

RECHARGE



BUILDING GROUNDWATER
RESERVES



As much as 300 acre-feet of water can percolate through the walls of Santiago Basin in one day's time. The newest of OCWD's recharge basins, this site was formerly a gravel pit.

The **Orange County Water District** is responsible for managing the underground water reserves that supply about 500 wells within district boundaries. At the present time about 270,000 acre-feet of this water is pumped for use each year. That quantity grows steadily, and projections indicate the demand may reach 450,000 acre-feet a year in the next quarter century. (One acre-foot of water, which would cover a football field to a depth of twelve inches, would supply two average families for a full year.)

Groundwater reserves are maintained by a **recharge system**, which replaces water that is pumped from wells. OCWD's facilities have a recharge capacity of approximately 300,000 acre-feet per year. About two million people depend on this source for more than three-quarters of their water. **Groundwater producers** (city water departments and other local agencies) pump water from the **groundwater basin** and deliver it by pipeline to consumers.

G R O U N D W A T E R

Along a six-mile section of the Santa Ana River that belongs to OCWD, a system of diversion structures and **recharge basins** captures most of the water that would otherwise flow into the Pacific Ocean. The district has 1500 acres of land for use in its recharge program.

The current average annual base flow of the Santa Ana River is approximately 140,000 acre-feet. Storm flows add an average of 60,000 acre-feet per year, ranging from 10,000 to 500,000 acre-feet. The base flow may increase by 100,000 acre-feet over the next 20 years due to urban development in upstream areas. More buildings and paved areas mean greater quantities of storm runoff, and growth in population and industry causes a proportional increase in wastewater discharges into the river channel.

Water that flows down the **Santa Ana River**, together with supplies imported from the Colorado River and from the State Water Project, is channeled into nine recharge basins. These lakes and ponds, with depths ranging from 50 to 150 feet, were formed in years past by sand and gravel mining operations.

The soil along this stretch of the Santa Ana River is coarse-grained and sandy. Therefore, water readily seeps into natural storage spaces below ground surface, a process called **percolation**. A pattern of interlaced **levees** built of sand helps to slow the river's flow so that more of the water can percolate through the bottom of the river channel.

Groundwater is stored in porous underground layers of sand and gravel called **aquifers**. Certain aquifers reach the surface in this area of Orange County (the **forebay**) and can be easily recharged, while in other areas a layer of dense clay overlies the aquifer and prevents efficient percolation.

R E C H A R G E



District crews clean the recharge basins twice yearly in order to improve percolation rates. The water that seeps through the bottom of these lakes and ponds replenishes aquifers that supply about 500 wells.

The district's deep recharge basins, such as **Anaheim Lake, Warner Basin and Kraemer Basin**, gradually accumulate a thin layer of fine sediments and biological material that slows and can even stop percolation. Although the percolation rate in a newly cleaned deep basin can reach 10 feet per day, the rate can drop to nearly zero after six to eight months.

Each of these deep basins is periodically emptied by means of submersible pumps, and the clogging layer is removed by scrapers or by a sand-washing device. Clogging affects only the upper two to three inches of soil.

When one basin is being cleaned, the supply to other basins is maintained by means of bypass pipelines. A twice-yearly **cleaning cycle**, which has replaced a single annual cleaning, increases percolation by as much as 40 percent.

Water diverted to **Burris Pit** during heavy rains is pumped through 4.5 miles of pipeline to the district's **Santiago Creek** recharge facility for storage and percolation. Up to 90,000 gallons per minute can be transferred via this pumping system. The Santiago Creek recharge basin, the district's newest, has a capacity of 25,000 acre-feet.

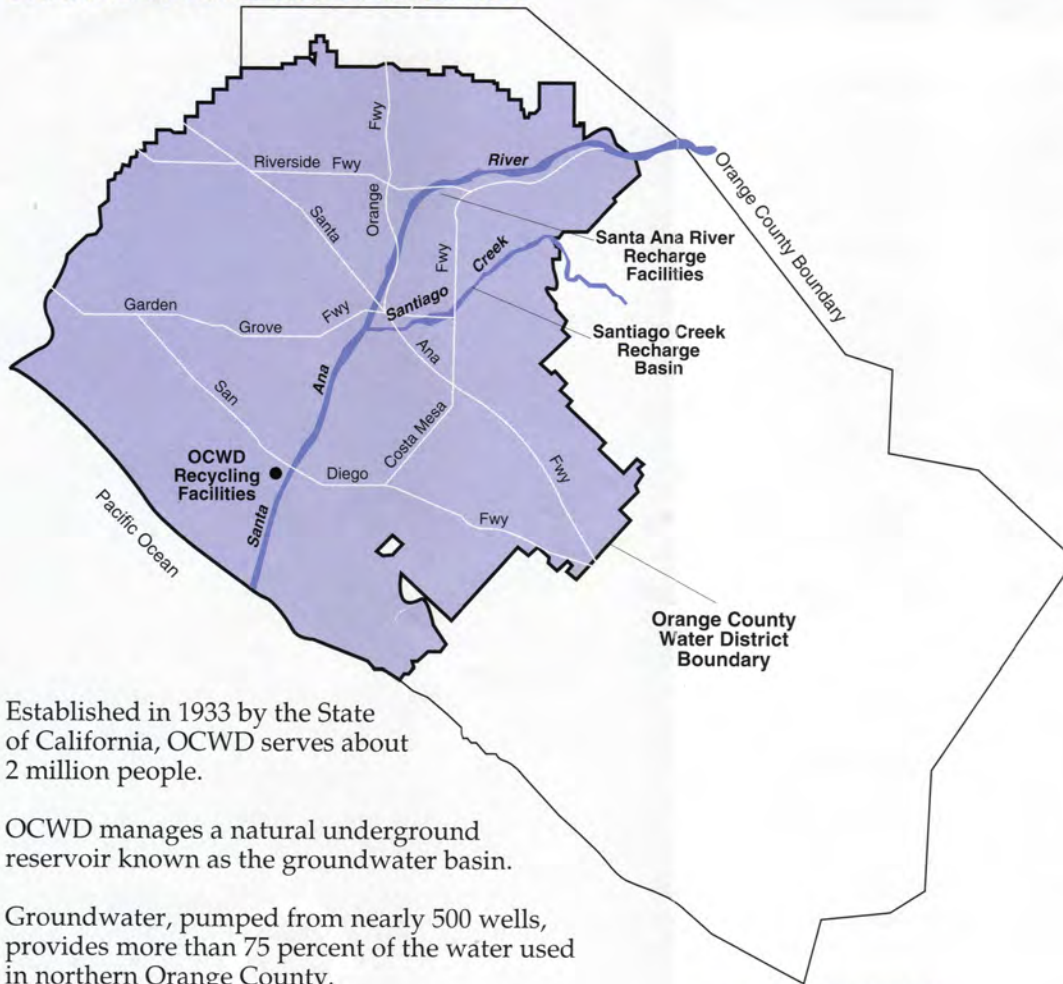
Prevention plays an important role in solving the problem of clogging. A **flocculation** system at the Imperial headgates helps to coagulate suspended solid particles so that they will settle out of the water as it passes through a series of **desilting ponds**. Three of these ponds between Imperial Highway and Lakeview Avenue help reduce the sediment load in water that is diverted to the recharge basins. This slows the formation of a clogging layer and thereby helps to maintain efficient percolation.

OCWD's **hydrogeologists** are carrying out extensive explorations in order to determine the structures and mechanisms that affect the district's natural subterranean reservoir. Special wells drilled to depths as great as 2,000 feet are equipped with monitoring devices that reveal the pathways of groundwater migration, the dynamics of the recharge process, and potential new sources of water. By analyzing the data obtained from these wells, the district is able to modify its recharge operations and to expand the usage of the groundwater basin to meet anticipated demand.

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.

Recreational opportunities include river trails for horseback riding, bicycling and jogging; and several of the recharge basins are stocked for sport fishing.

ORANGE COUNTY WATER DISTRICT



Established in 1933 by the State of California, OCWD serves about 2 million people.

OCWD manages a natural underground reservoir known as the groundwater basin.

Groundwater, pumped from nearly 500 wells, provides more than 75 percent of the water used in northern Orange County.

SANTA ANA RIVER

OCWD manages the entire flow of the Santa Ana River below Prado Dam and owns 6 miles of the riverbed in Anaheim.

The river's average yearly flow of 60 billion gallons is 1/3 storm water and 2/3 treated wastewater and surface runoff.

GROUNDWATER RECHARGE

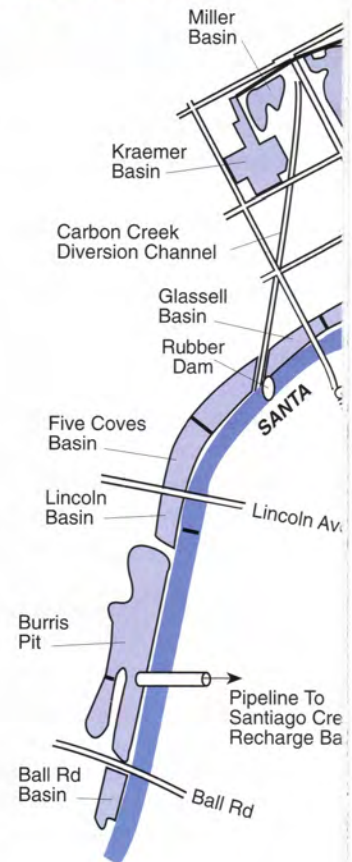
Water pumped from underground aquifers is recharged by a recharge process.

Santa Ana River water is diverted into ponds that range from 50 to 100 acres.

Water in the ponds percolates into the porous soil and is stored in the groundwater basin.

Some water is imported from the Colorado River for augmentation.

THE FOREBAY



ENVIRONMENT

About 100 different kinds of birds, as well as many small land animals, are found in OCWD's recharge areas.

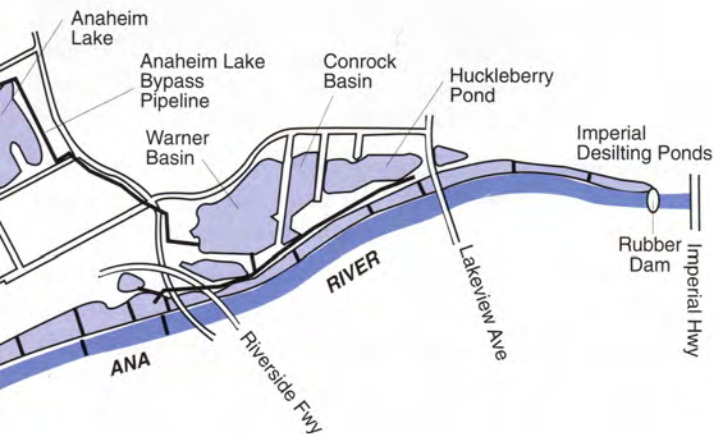
Wildlife habitats are protected by OCWD in cooperation with environmental agencies.

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CLEANING

Silt and organic matter settle on the floors of recharge ponds, clogging the spaces between sand particles.

Clogging gradually slows the percolation process.

The lakes and ponds are drained twice a year so that the clogging material can be removed.

Frequent cleaning restores high percolation rates of up to 10 feet per day.

Special monitoring wells, some as deep as 2,000 feet, help district geologists map the groundwater basin.

These specialists assess the effects of pumping and recharge and trace groundwater migration through the basin.

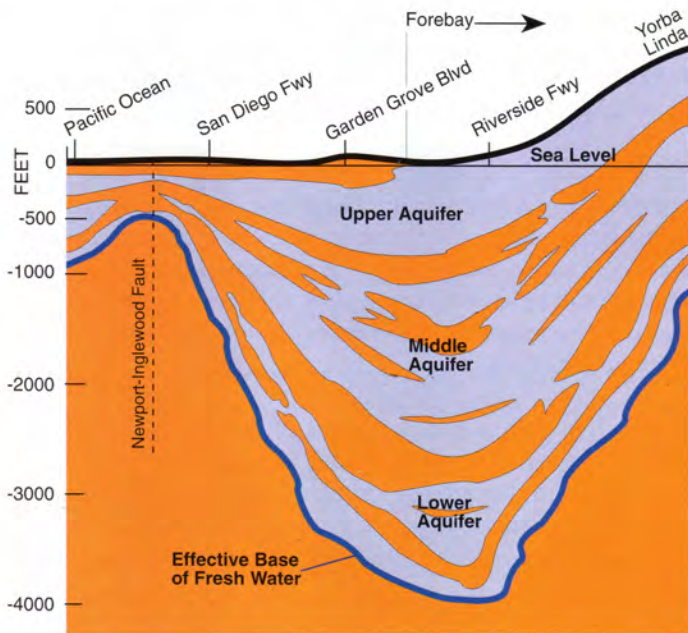
GROUNDWATER BASIN

Water is stored in porous underground layers called aquifers.

Orange County's aquifer system forms a vast underground reservoir that holds over 10 million acre-feet of water.

Effective percolation occurs only in areas where aquifers reach the surface, as they do in the forebay.

Water that enters the ground in the recharge area migrates toward the Pacific Ocean.



ABOUT THE COVER:

Orange County Water District builds sand levees in the Santa Ana River to slow its flow. The water seeps through the sandy bottom of the riverbed and replenishes supplies stored in a natural groundwater basin beneath the earth's surface.



**ORANGE COUNTY WATER DISTRICT
10500 ELLIS AVENUE
FOUNTAIN VALLEY, CALIFORNIA
(714) 378-3200**

**MAILING ADDRESS:
P.O. BOX 8300
FOUNTAIN VALLEY, CA 92728-8300**

