



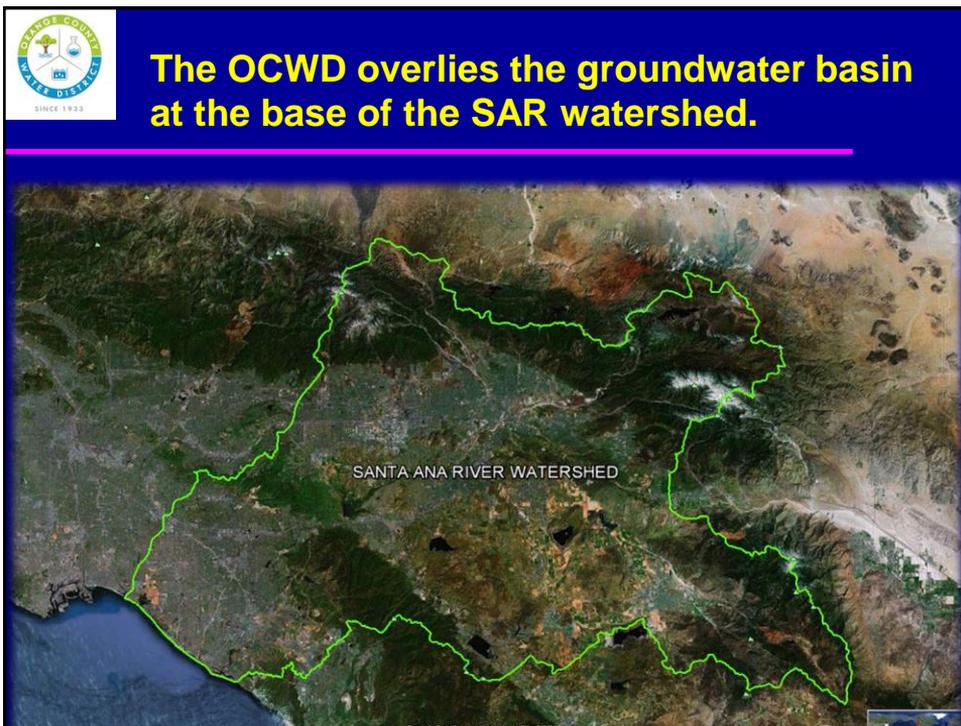
# Beyond Sustainability: Increasing the Yield of the Orange County Groundwater Basin

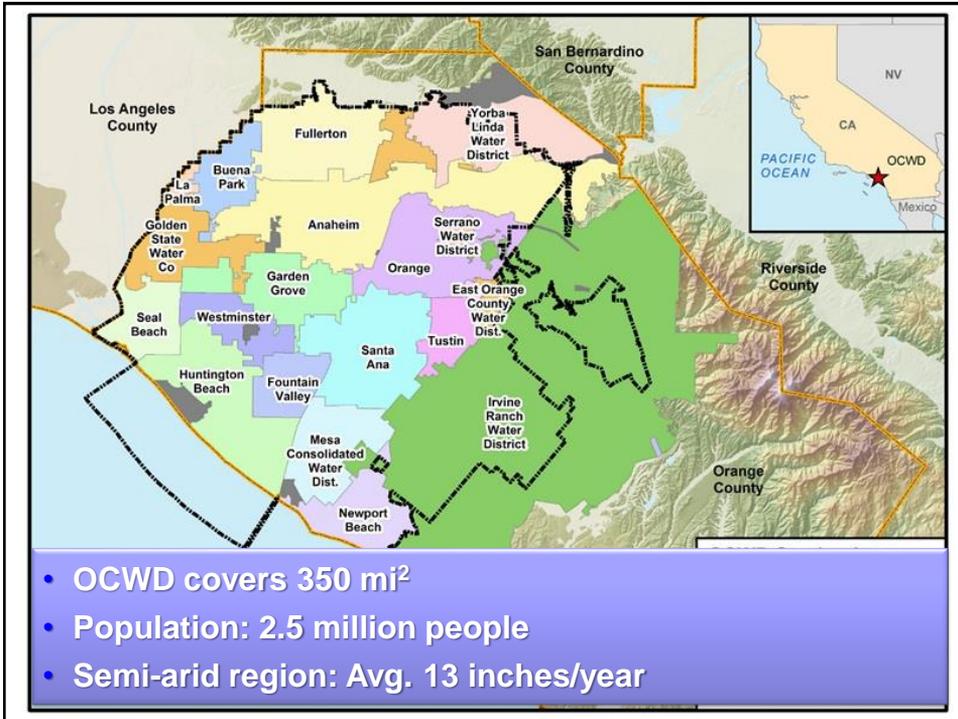
Adam Hutchinson  
Recharge Planning Manager  
Orange County Water District



The Orange County groundwater basin lies at the base of the Santa Ana River watershed.









## Orange County took a different, more difficult path.

- Adjudication (Mine)
  - Adversarial
  - Individualistic
  - Limited view of resource
- OCWD (Ours)
  - Supportive
  - Community
  - Expansive view of resource
- Took political courage
  - Adjudication was dominant model
  - Stakeholders had to be convinced it was in their best interest

A chalkboard with handwritten text in white chalk. The text reads: "MINE" with a checked box to its left, "YOURS" with an unchecked box to its left, and "OURS" with an unchecked box to its left.

MINE  
 YOURS  
 OURS



## Local Supply Focus

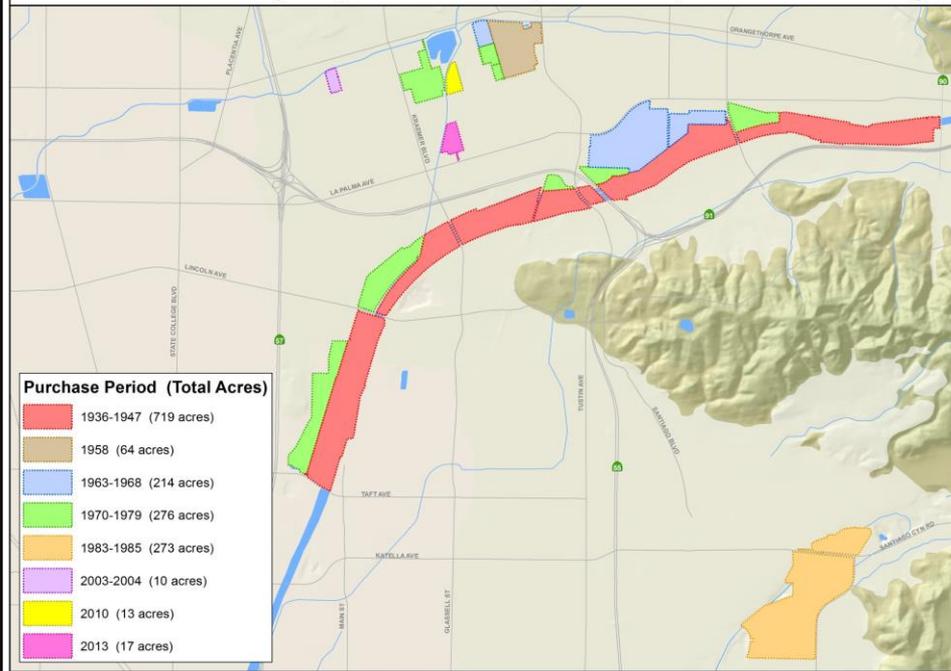
- ◆ Capture and recharge local flows
  - Santa Ana River base flow
  - Storm flow
- ◆ Produce and recharge recycled water
  - Water Factory 21 (1975-2007)
  - Groundwater Replenishment System
    - » 100,000 afy
- ◆ Desalination
  - Being considered, but very expensive



# Surface recharge operations started in early 1930s.

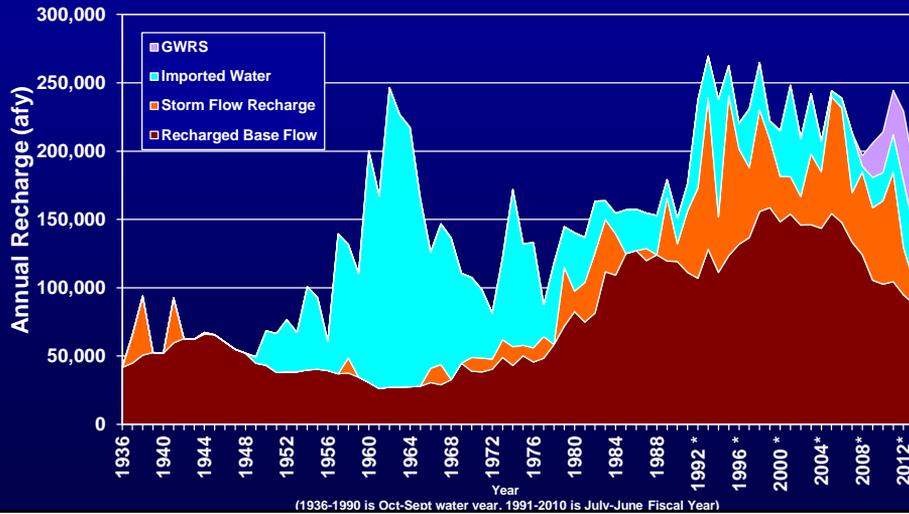


Over the course of 77 years, the District has purchased 1,590 acres for recharge.

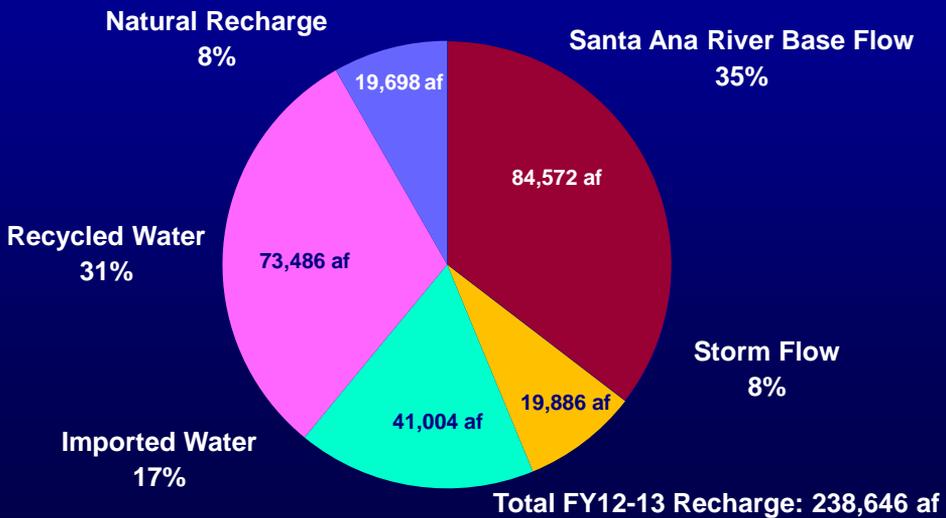




## The sources of recharge water have changed over the years.



## With GWRS, recycled water is now a critical component of recharge to the basin.





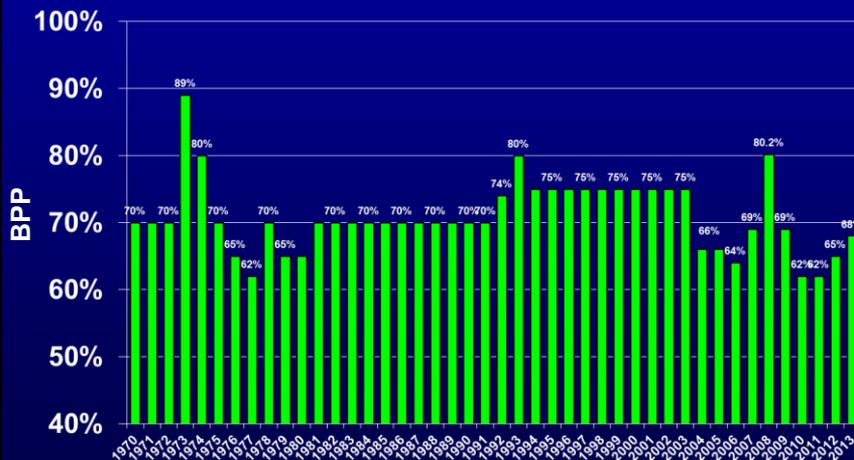
## OCWD uses financial incentives to control pumping.

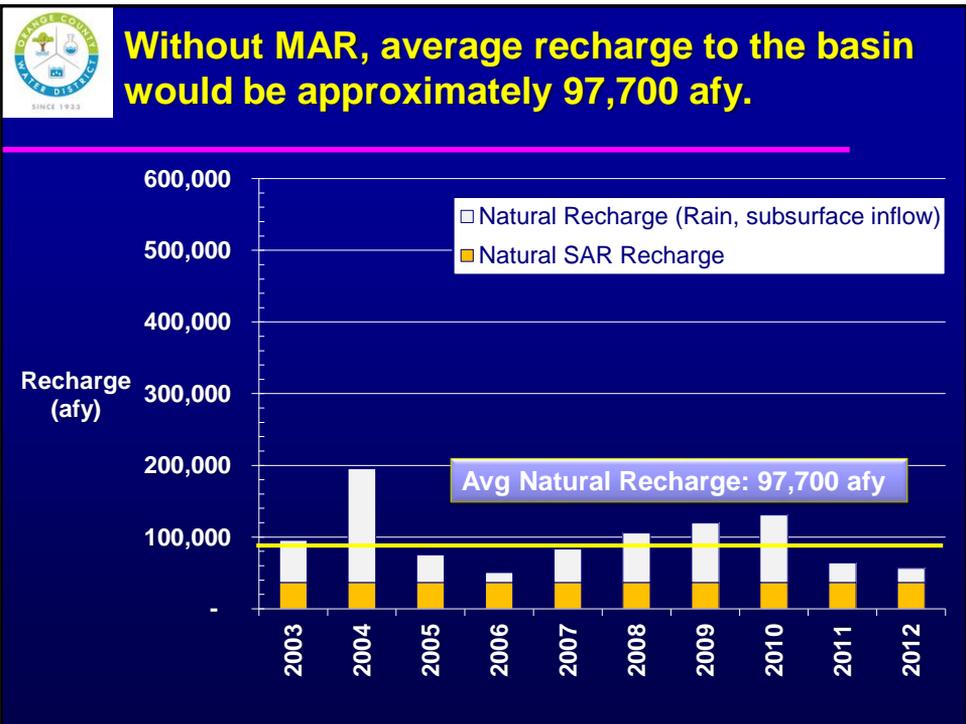
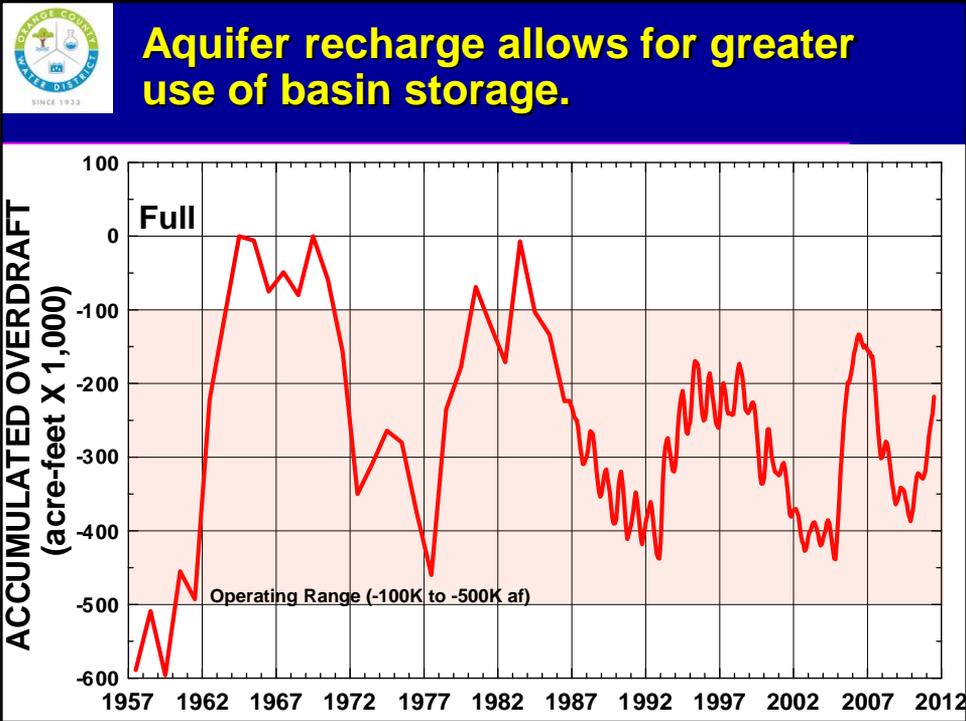
- ◆ All wells metered and required to report usage 2x's per year.
- ◆ OCWD annually establishes Basin Production Percentage (BPP) for each producer
  - Percentage of total water demand that can be met with groundwater
- ◆ Pumping over BPP subject to additional charges



## Over the last 33 years, the BPP has averaged 71 percent.

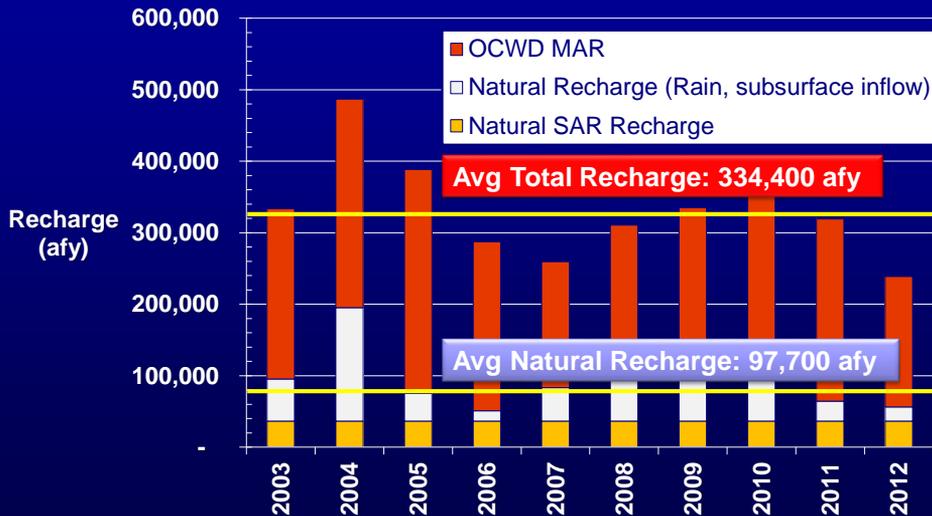
Remainder of water demand met with imported water.







## OCWD's MAR activities has more than doubled the yield of the groundwater basin.



## It pays to work together.

- ◆ Cooperative approach works
- ◆ All need to participate
  - Meter pumping
  - Accept higher cost water if exceed limits
- ◆ Work to maximize recharge of locally controlled supplies
- ◆ Look for win-win opportunities with neighboring groundwater users



## ◆ Extra Slides



**Managed aquifer recharge (MAR) describes man's attempt to supplement natural recharge.**

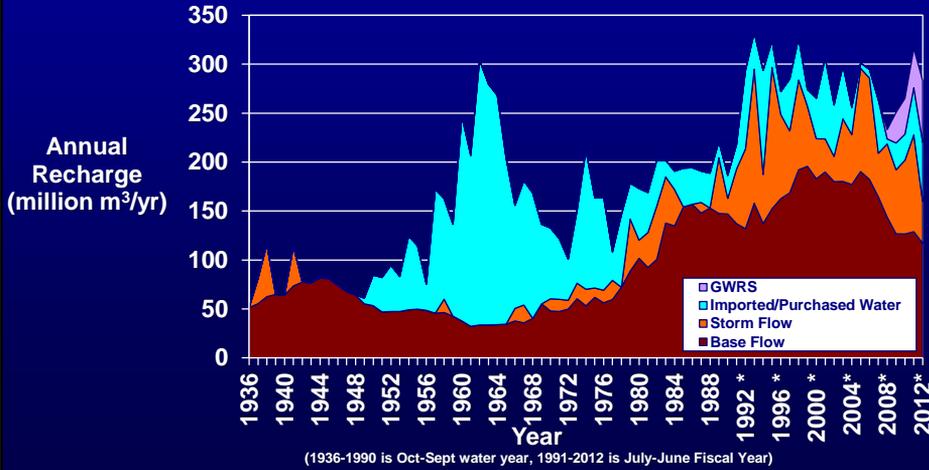
- ◆ Enhanced river/creek recharge
- ◆ Spreading basins
- ◆ Injection wells
- ◆ Subsurface recharge galleries

There are many advantages to MAR:

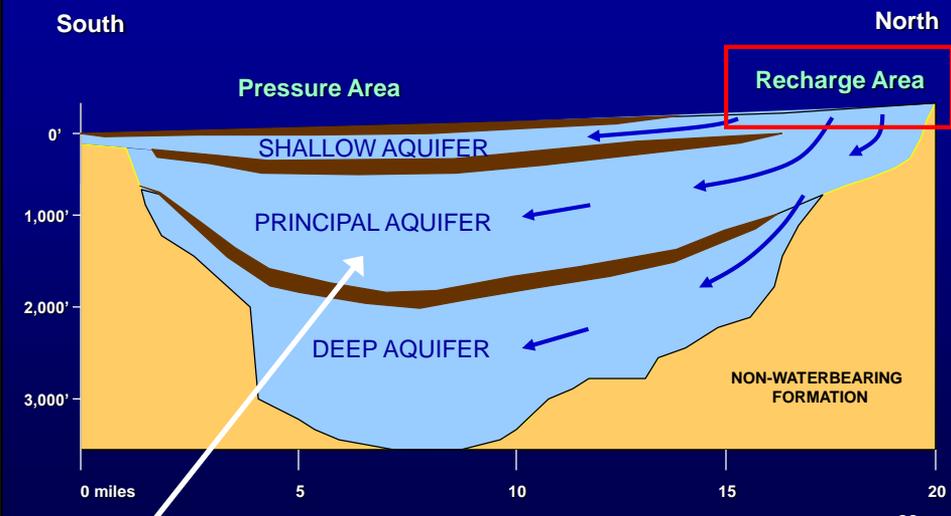
- Storage in aquifer is better than surface storage
- Makes better use of local water supplies
- Allows for increased use of groundwater basin storage
- Can improve water quality



Over the past decade, surface water recharge has averaged 274 million m<sup>3</sup> per year from a variety of sources.



Basin geology limits the area where surface MAR can be used.



Most groundwater production is from the Principal Aquifer.



## Older recharge basins are 50 to 60 feet deep.



Anaheim Lake



## New recharge basins are shallow for ease of draining and cleaning.



### River View Basin

- 2-7 ft deep
- Gravity drains
- Clean in 1 day

JAN 10 2006



## Miraloma Basin is our newest basin and went on-line in July 2012.

- ◆ Former LASCO site
- ◆ 3-7 ft deep
- ◆ 10 wetted acres
- ◆ Dedicated to GWRs water
  - ◆ High percolation rate: 10 ft/day



Prior to the early 1990s, a large sand dike had to be constructed to divert water from the SAR.



**In 1992, the Imperial Rubber Dam was installed at a cost of \$3M.**



Increased capture of storm water paid for the cost of the dam and control structure in the first year of operation.

**In 1993, the Five Coves Rubber Dam was installed.**



**The Imperial Rubber Dam was replaced in 2011.**



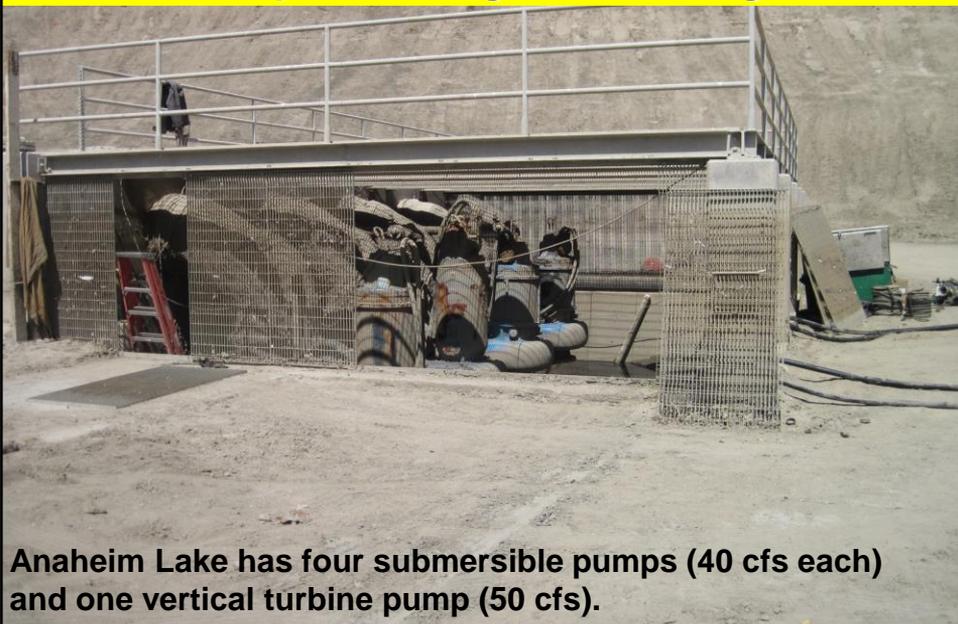
**Sand “T and L” levees are constructed in the Santa Ana River channel to spread the water in the channel.**



**The Burris Basin pump station was installed in 1990. It has a pumping capacity of 105,000 gpm.**



**All of the larger basins have dewatering pumps to allow for rapid draining and cleaning.**



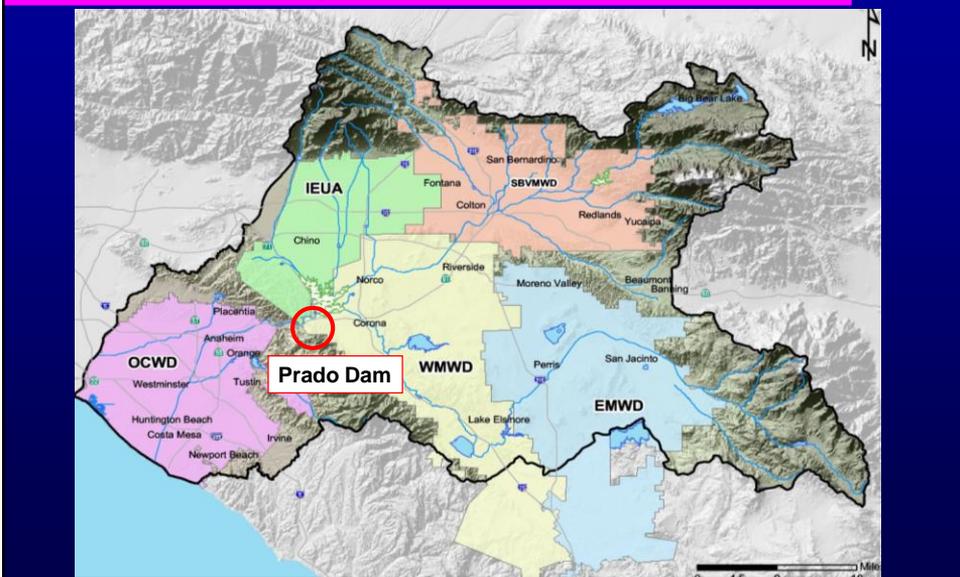
**Anaheim Lake has four submersible pumps (40 cfs each) and one vertical turbine pump (50 cfs).**



## A fleet of heavy equipment is used to clean and maintain the recharge facilities.



## The Santa Ana River is Orange County's main water source.





The US Army Corps of Engineers constructed Prado Dam in 1941 for flood control and water conservation.



Dec. 30, 2010  
Pool Elev. 527.3 ft msl  
Discharge: 5,000 cfs

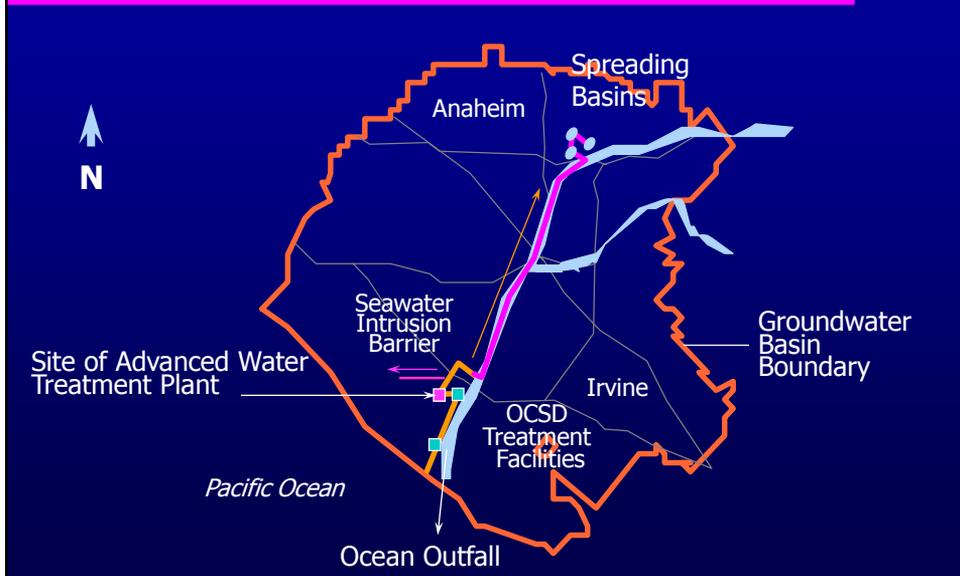


The storm water conservation program at Prado Dam is a good example of cooperation between two governmental agencies.





## A 13-mile pipeline was constructed to link the treatment plant with the spreading basins.



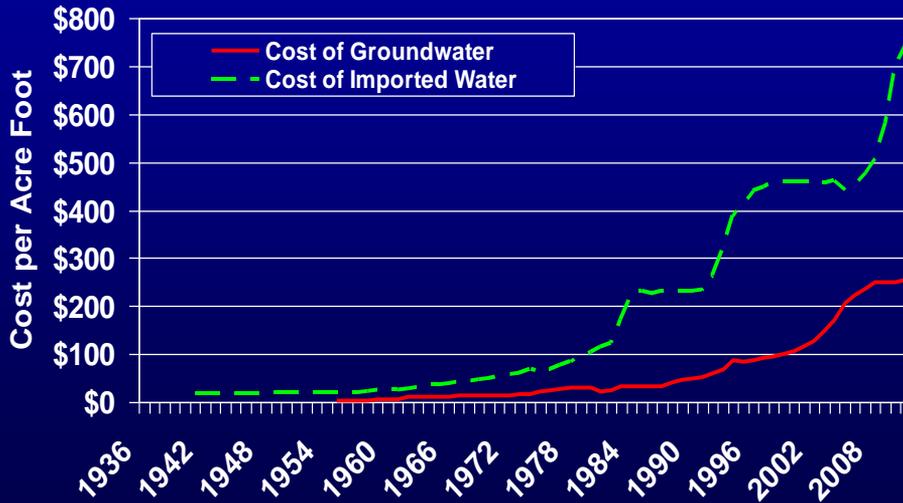
## Water quality is improved during recharge.

- ◆ Process is technically referred to as “Soil Aquifer Treatment” (SAT)
- ◆ Suspended sediment and other floating materials are filtered out.
- ◆ Bacteria and viruses are removed.
- ◆ The concentrations of nitrate, total organic carbon and other dissolved constituents are reduced.
- ◆ Even the concentrations of caffeine and ibuprofen are reduced during recharge!

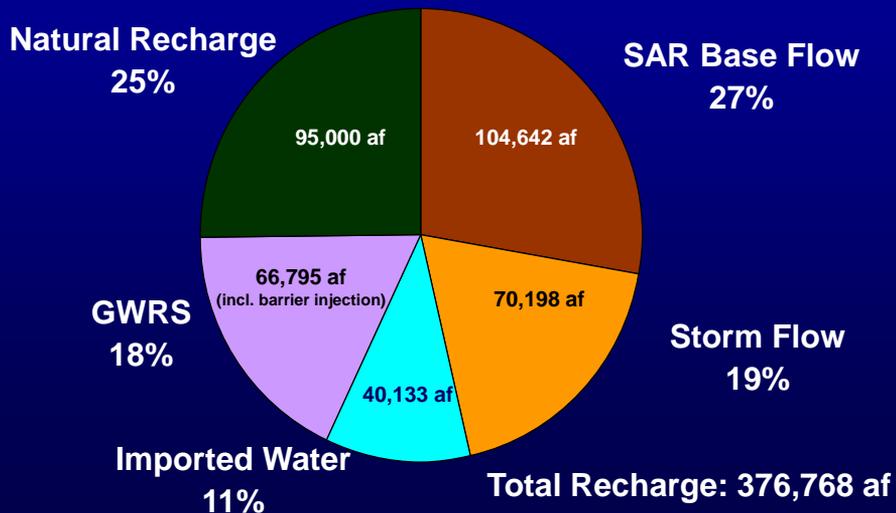




## Recharge has allowed the producers to benefit from low priced groundwater.

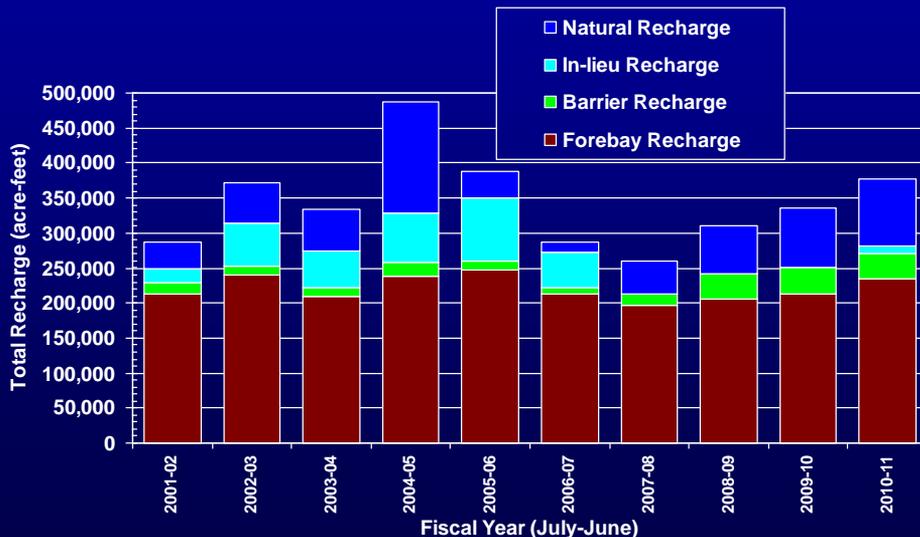


## The GWR System provided 18 percent of OCWD recharge in FY10-11.





**Over the past 10 years, MAR has provided an average of 80 percent of total recharge.**



**Managed aquifer recharge plays a critical role in management of the Orange County groundwater basin.**

- ◆ Provides groundwater replenishment
  - Average 80% of basin recharge
- ◆ Prevents seawater intrusion
  - Yes, and provides recharge (80% of injected water)
- ◆ Maximizes basin storage
  - Can use 400,000 af of storage volume
- ◆ Maximizes available water supplies
  - Can take advantage of storms, imported surpluses, etc.
  - Producers can use groundwater to meet 62 -75% of demand
- ◆ Provides drought insurance
  - Yes!
- ◆ Provides financial benefits to groundwater producers
  - Groundwater is much less expensive than imported water
  - Tremendous benefits to producers and citizens of Orange County



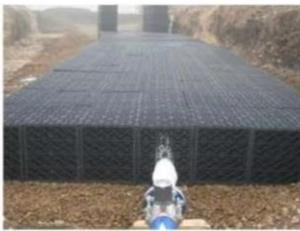
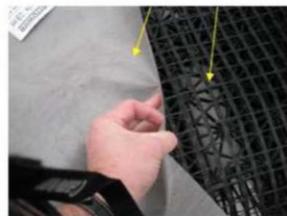
**Enjoy your time at the river!**

Atlantis brand rain tanks were used to test subsurface recharge in Walla Walla, WA.



**Raintanks being deployed**

**Gallery top: filter fabric and mesh**



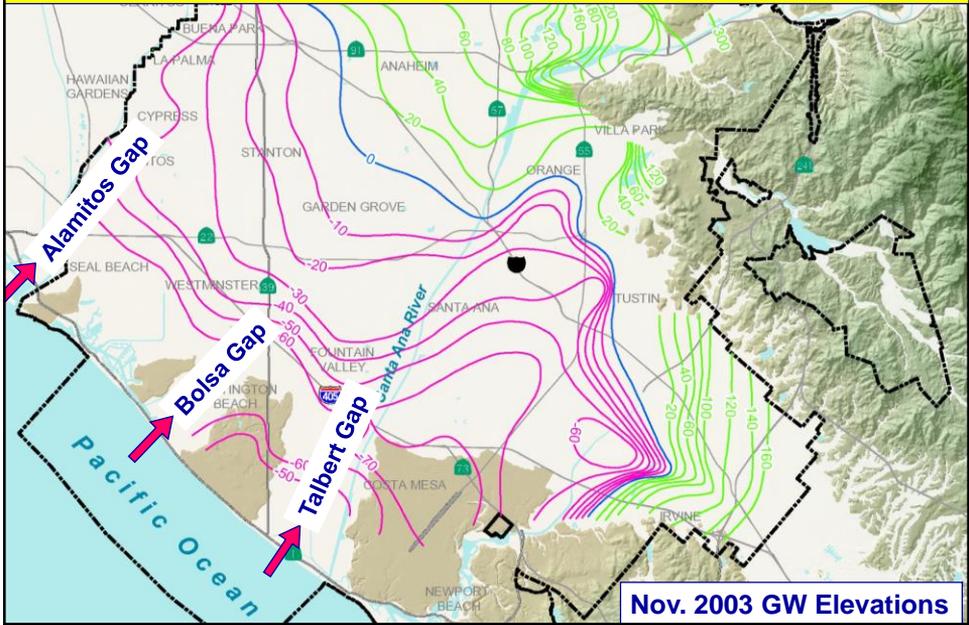
**Intake: Valve and metered**



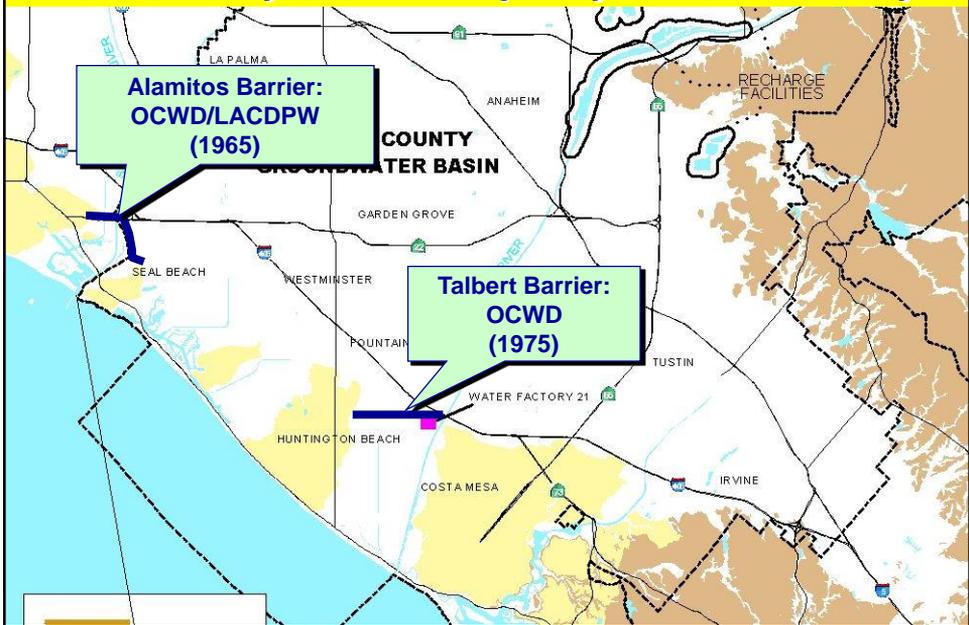
**HBDIC Testing Site: 1000 feet<sup>2</sup> infiltration area**

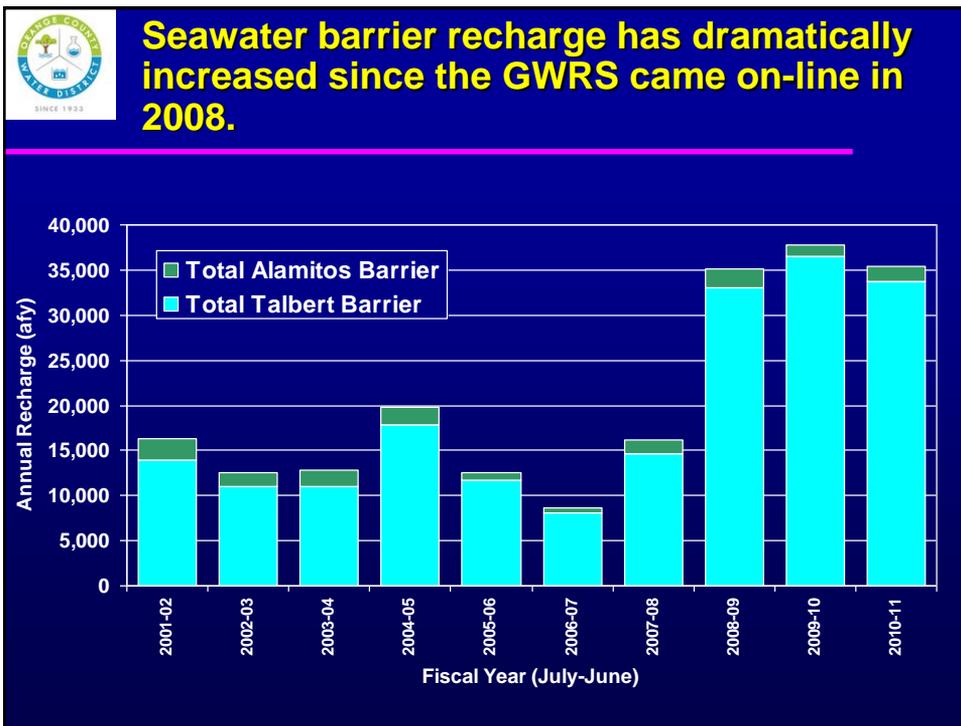
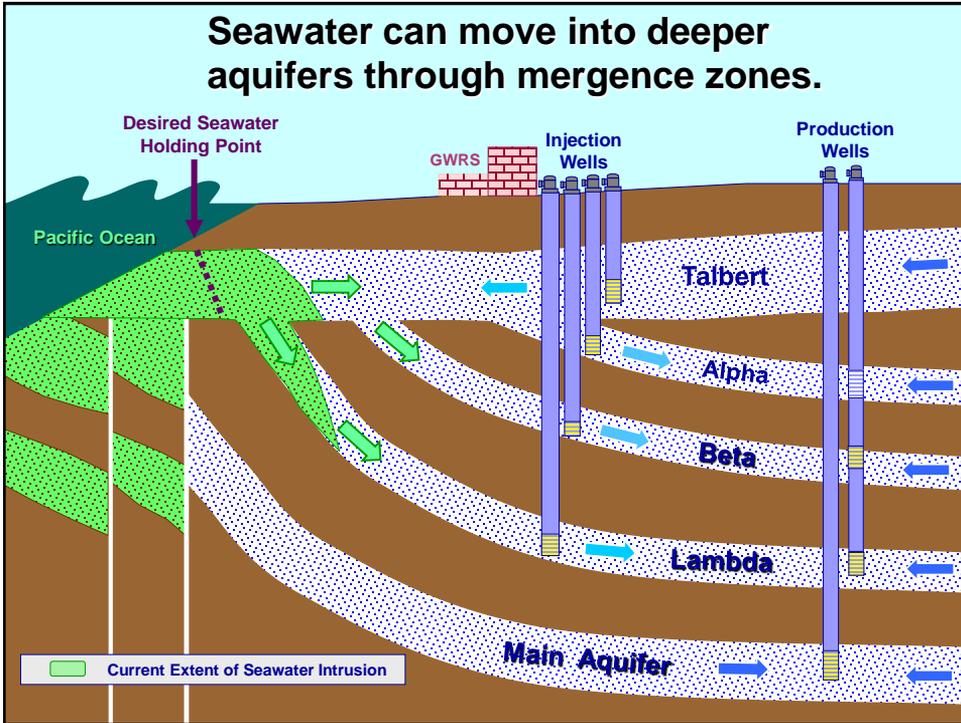


**Seawater intrusion along the coast presents a continuing basin management challenge to OCWD.**



**The basin is protected by two seawater barriers constructed by OCWD and jointly with L.A. County.**

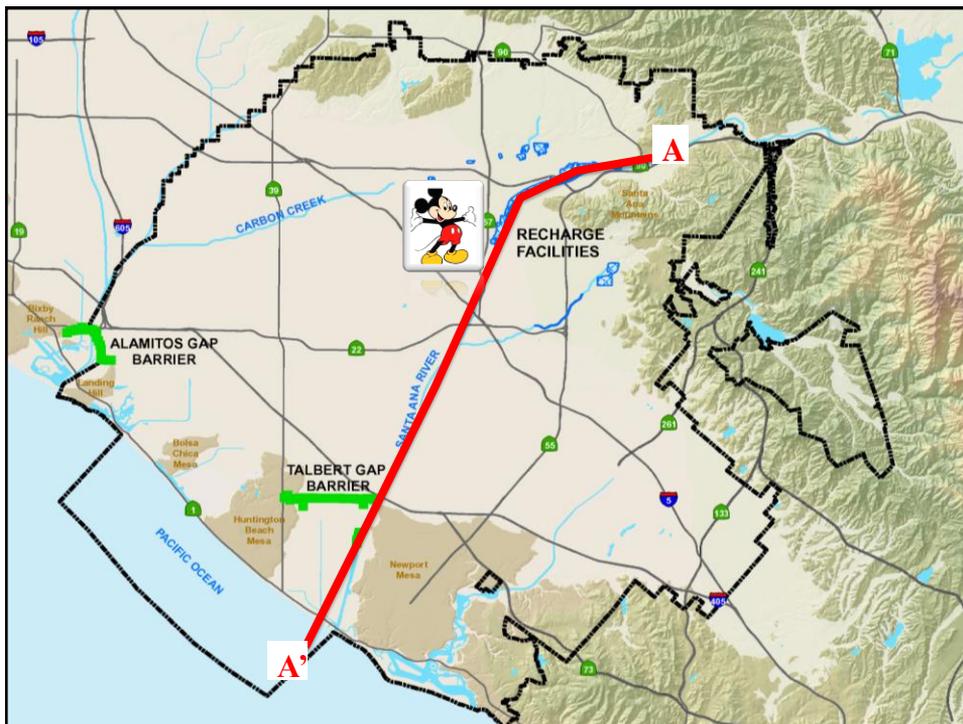






## The State of California formed the OCWD in 1933.

1. Manage the groundwater basin in Orange County
2. Conserve Groundwater Supplies, Both Quality and Quantity
3. Protect Orange County Rights to Santa Ana River Flows





Over 600 meters of unconsolidated sediments from marine and alluvial deposition, concurrent with folding and faulting, comprise the basin aquifers.

The basin contains approximately 74 billion m<sup>3</sup> of groundwater, but only 600 million m<sup>3</sup> is utilized (<1%).

### CROSS SECTION OF ORANGE COUNTY GROUNDWATER BASIN

