



Groundwater Replenishment System

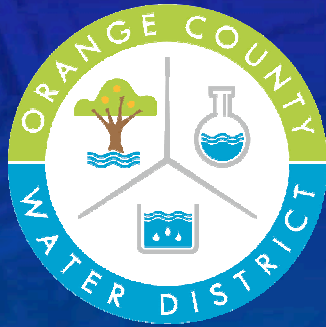
A Pure Solution to Orange County's Water Needs



Jim Herberg

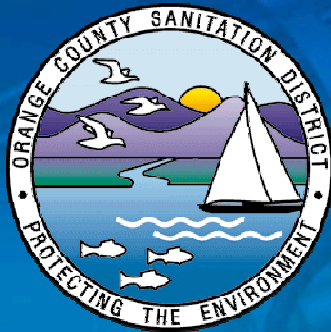
OCSD, Assistant General Manager

The GWRS is a Joint Project Between



SINCE 1933

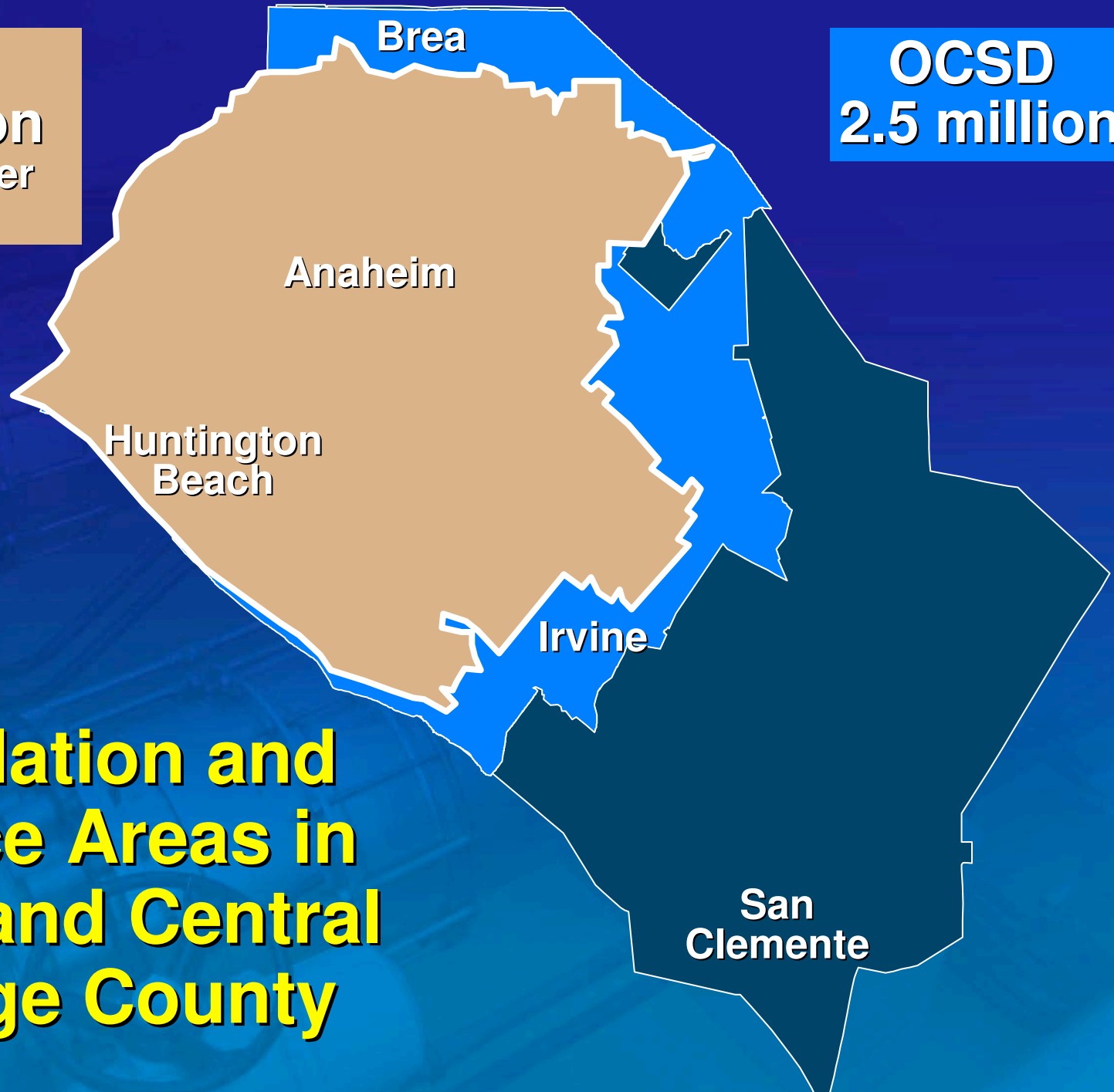
- 💧 **OCWD** – To provide local water retailers with a reliable, adequate, high quality water supply at the lowest reasonable cost in an environmentally responsible manner



- 💧 **OCSD** – We protect public health and the environment by providing effective wastewater collection, treatment, and recycling

OCWD
2.3 million
(groundwater
basin)

OCSD
2.5 million



Population and Service Areas in North and Central Orange County

Sources of Water for Orange County

- Groundwater is pumped from wells by producers (cities and water districts)
 - 65% of the water used in North and Central OC
 - Groundwater basin recharged by Santa Ana River, rainwater, imported and recycled water



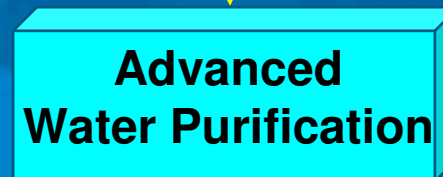
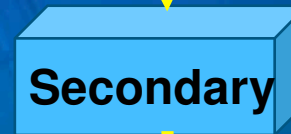
Wastewater Reclamation Partnership Since 1972



Enhanced
Source Control
in collections system



Sanitation
District



Water District

Reuse





Why Did We Partner? Planning in the 1990's

- 💧 **OCSD:**
Defer the need for
a new ocean outfall

Why Did We Partner? Planning in the 1990's

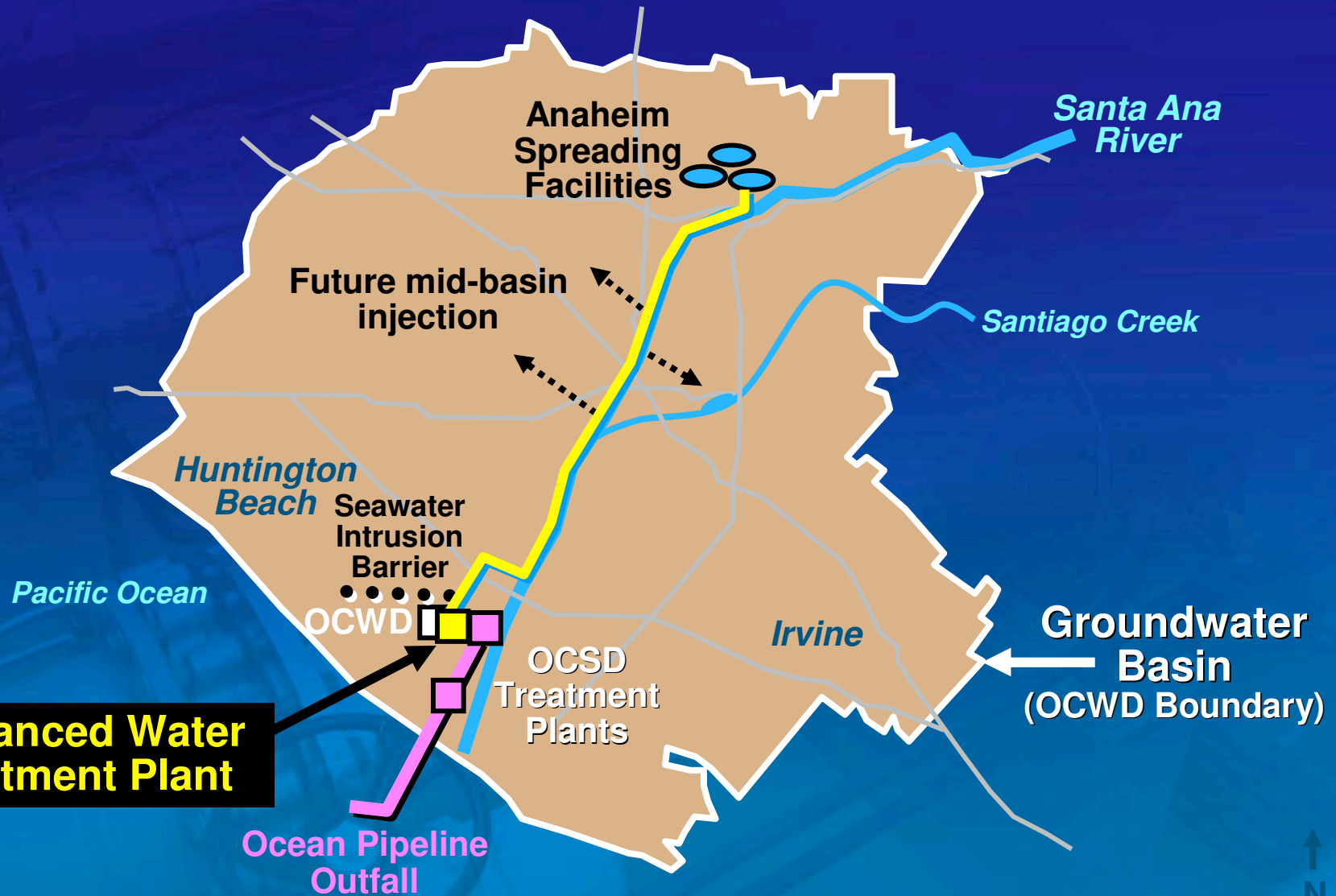
💧 **OCWD:**

Need more water:

- larger intrusion barrier
- 5-year drought 1987–92
- population steadily increasing
- imported water supply challenges
- improve groundwater quality



GWRS Project Components



Joint Governance Established for GWRS



Key Decisions



- 💧 100% Reverse osmosis
- 💧 NWRRI appointed advisory panel of expert scientists and engineers
- 💧 Extensive, proactive public outreach
- 💧 Close coordination at all levels

OCWD and OCSD Joint Campus



OCSD Focuses on Wastewater as a Resource

Master Planning:

- Collection system configuration maximizes flow to Reclamation Plant No. 1
- New capacity constructed at Reclamation Plant No. 1
- Hydraulic design for GWR System
- Accommodation of GWR System return flows

Treatment Plant No. 1 Secondary Projects

OCSD Reclamation Plant No. 1 Boundary

Orange County
Water District

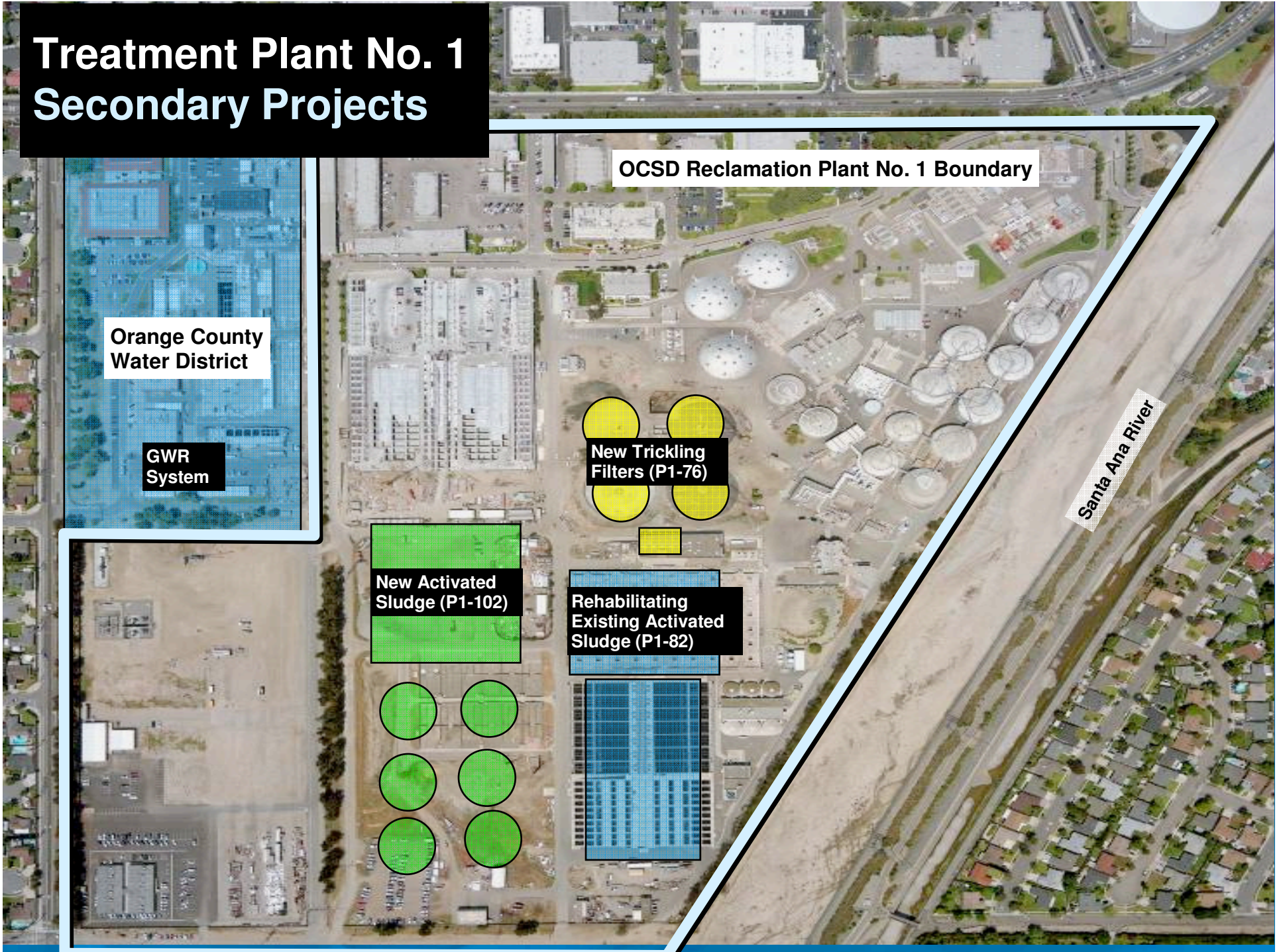
GWR
System

New Trickling
Filters (P1-76)

New Activated
Sludge (P1-102)

Rehabilitating
Existing Activated
Sludge (P1-82)

Santa Ana River



OCSD Focuses on Wastewater as a Resource

System Operations:

- 💧 Flow diversions
 - Good sewage to Plant No. 1
 - Brine waste out of Plant No.1
 - Storage in standby basins
- 💧 NDN conversion
 - Improved MF production
 - Lower effluent ammonia to ocean
 - Lower Nitrogen to GWRS
- 💧 Communication

Enhanced Source Control

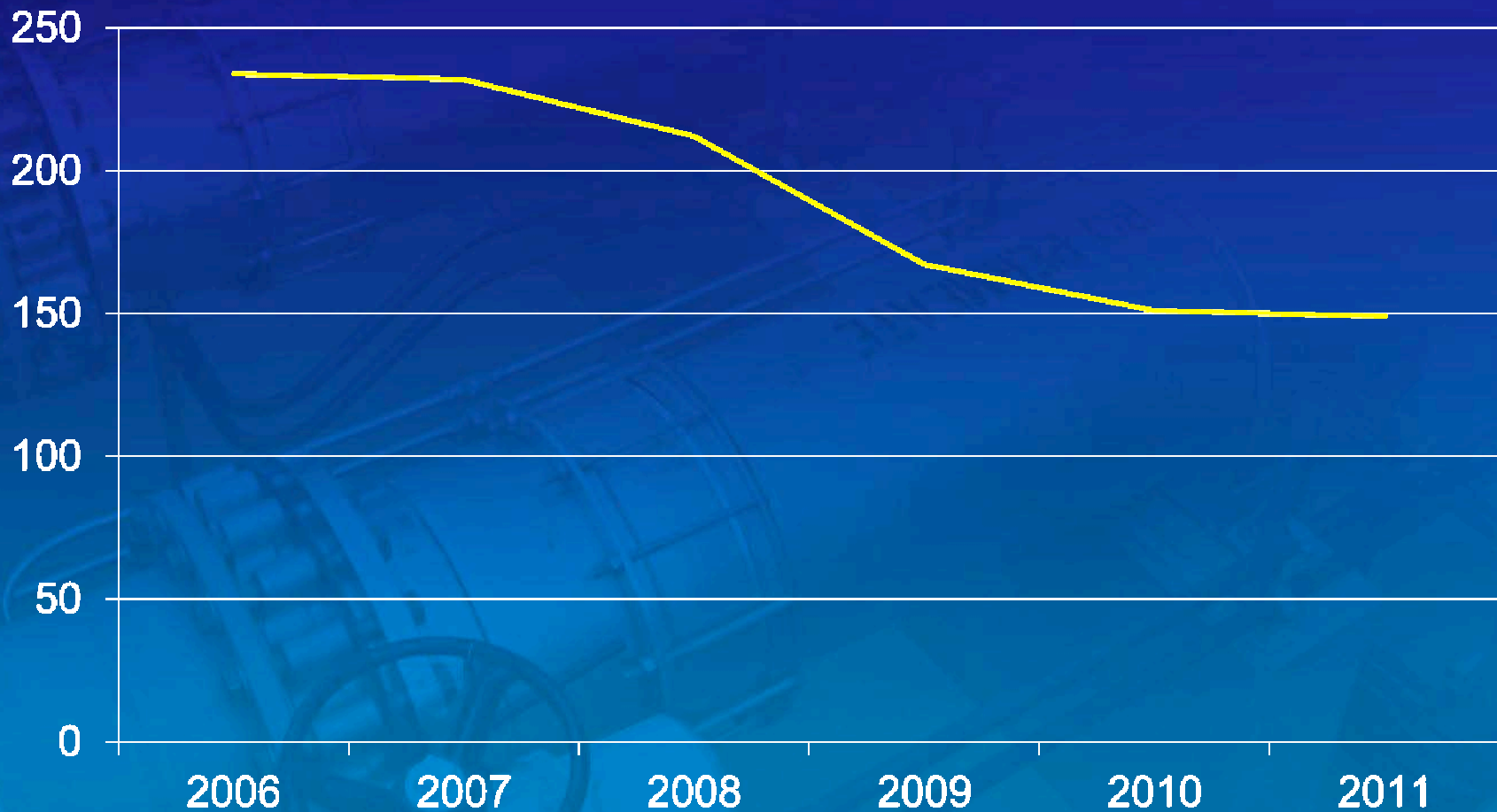
- Title 22
 - Drinking and Recycled Water
- Pollutant Prioritization
 - Constituents of Emerging concern
- Chemical Inventory Program
 - Fire Department/CDPH/Toxic Release Inventories
- Geographic Information System
 - Flow Trace from Treatment Plant to Source
- Public Outreach

Enhanced Source Control

- 💧 Pharmaceutical Program
 - No Drugs Down the Drain
 - Pilot Project
 - Health Service Facilities
- 💧 Countywide Pollution Prevention Partnership Program
 - 22 Cities
 - Public Outreach
- 💧 Commercial Sector Program
 - Cleaners and Degreasers
 - Coatings
 - Coloring Agents and Dyes

Ramping Up Water Reclamation: Less Water to Ocean Outfall

Million Gallons per Day to Ocean

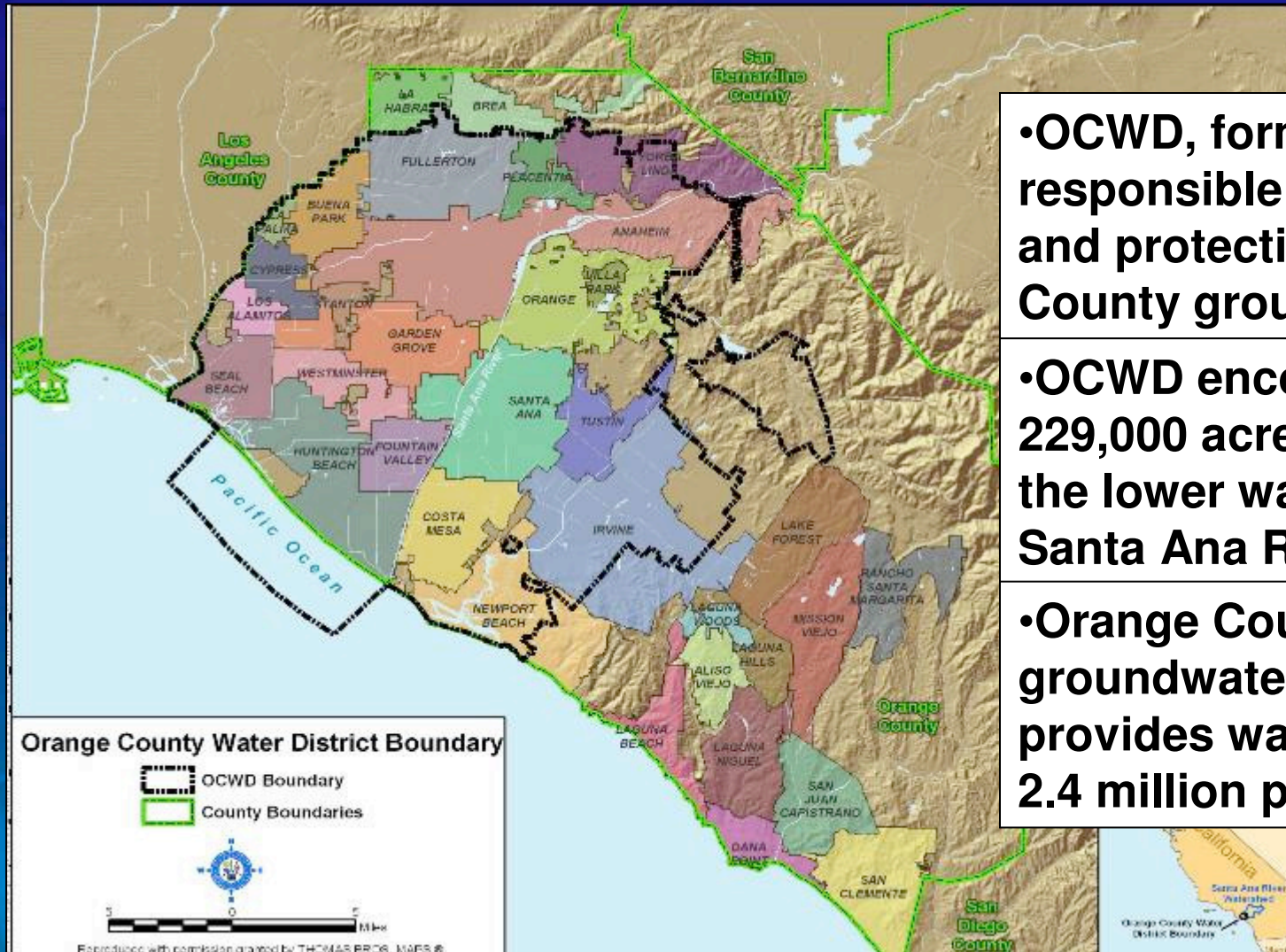




Mike Markus

OCWD, General Manager

Orange County Water District



•OCWD, formed in 1933, is responsible for managing and protecting the Orange County groundwater basin

•OCWD encompasses 229,000 acres (925 km²) in the lower watershed of the Santa Ana River (SAR)

•Orange County groundwater basin provides water for over 2.4 million people

Operational Recharge Facilities

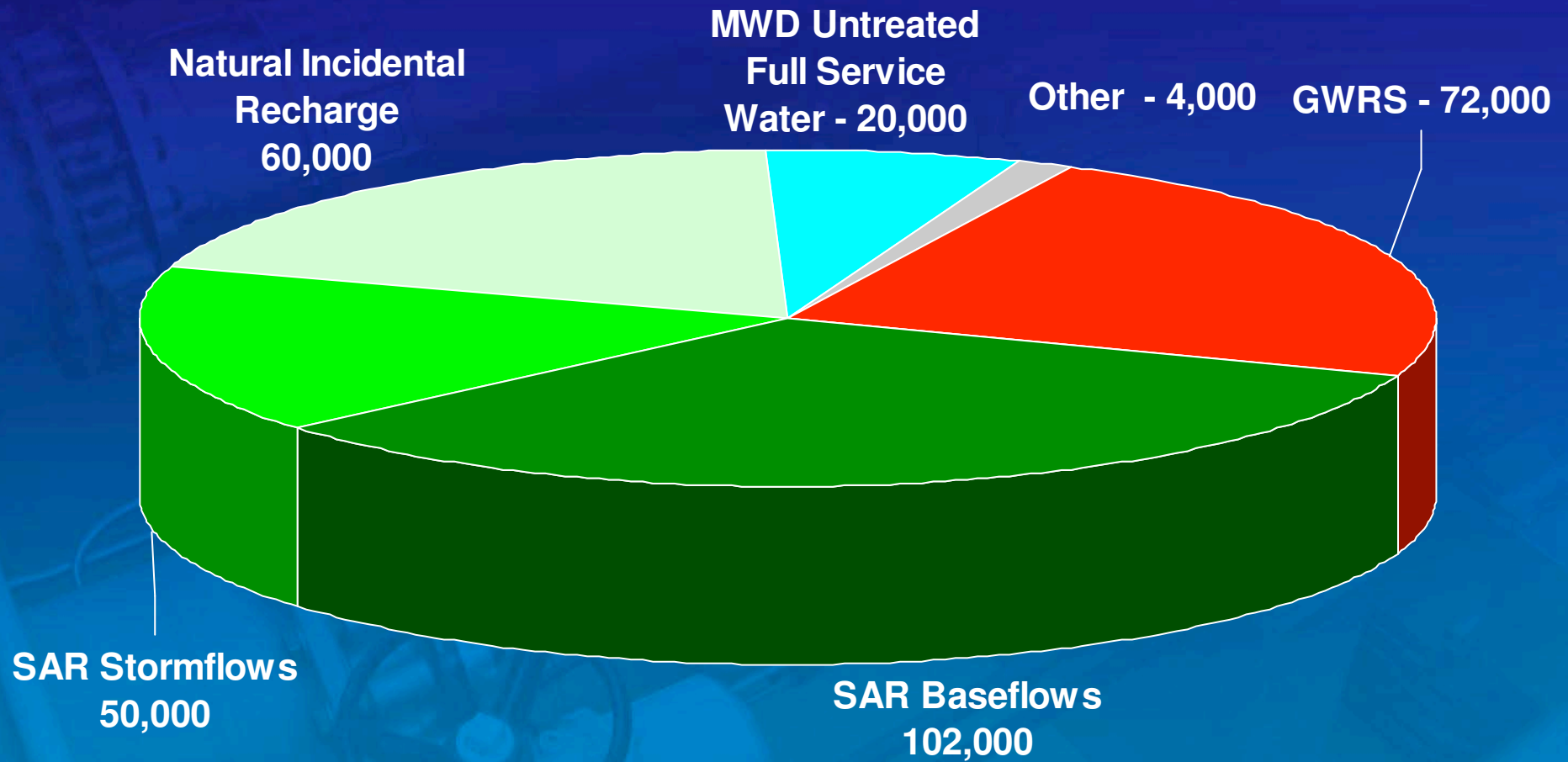
Groundwater Replenishment System

Prado Dam

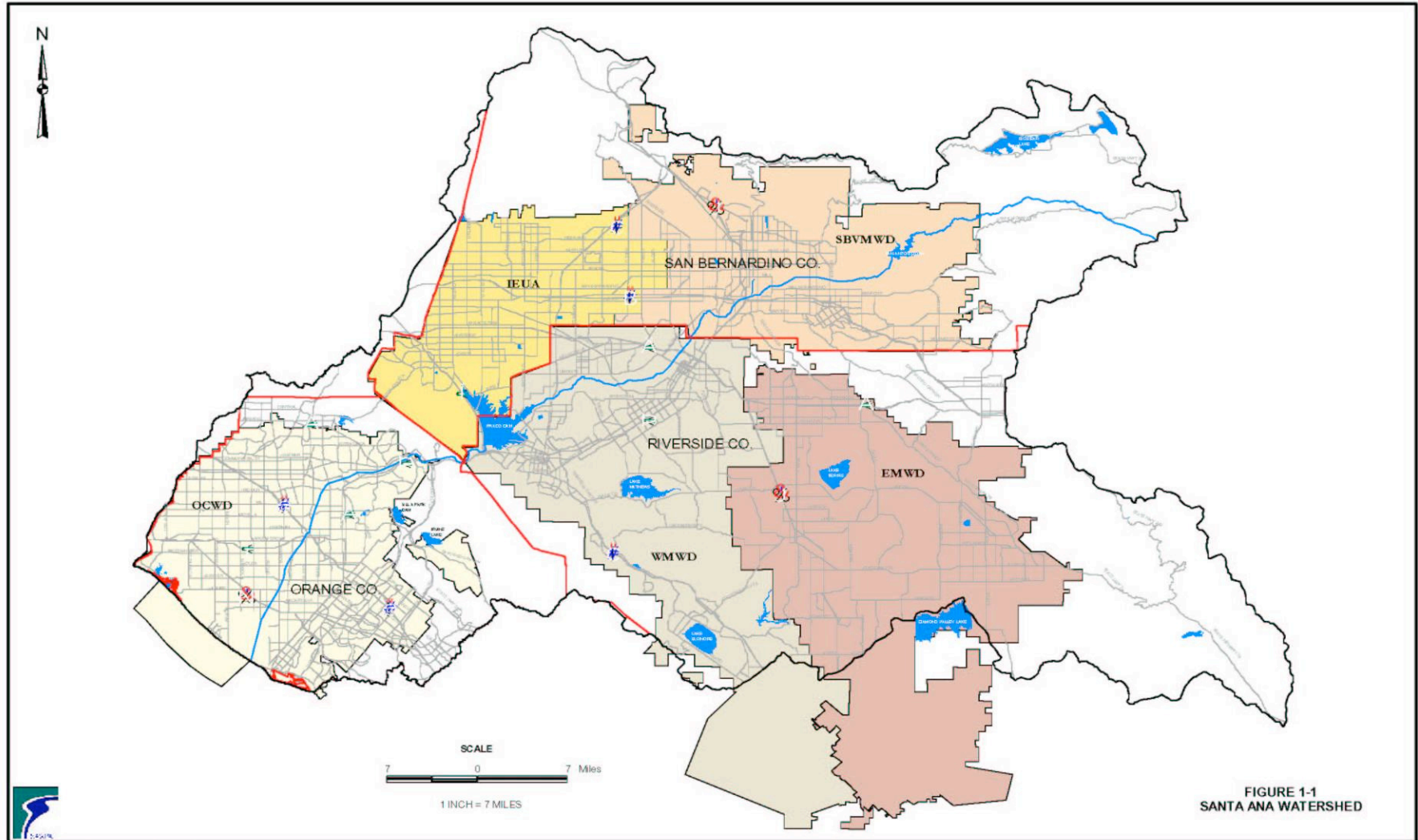


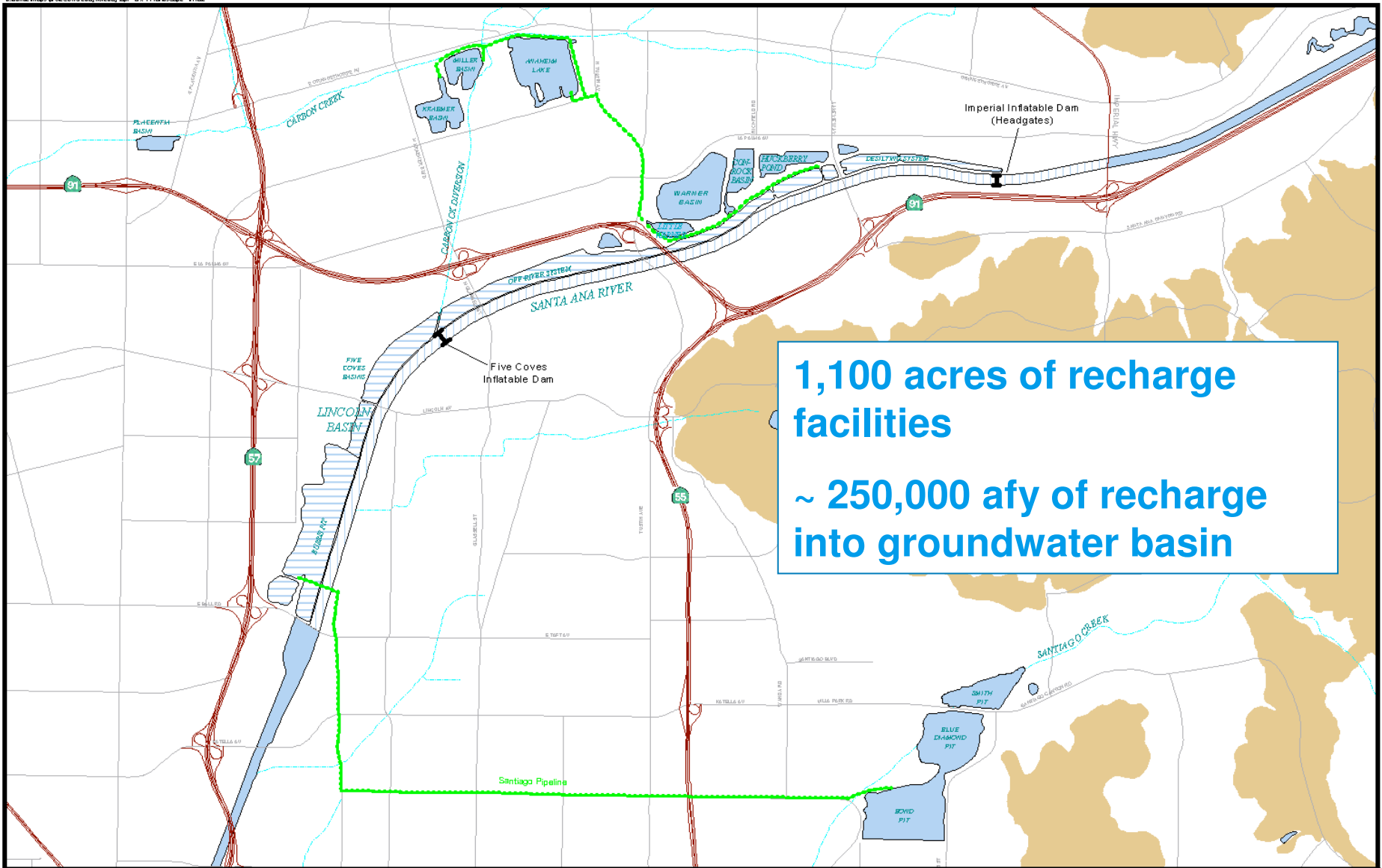
Santa Ana River Facilities







Water Supply Sources to Recharge the Groundwater Basin (308,000 afy)

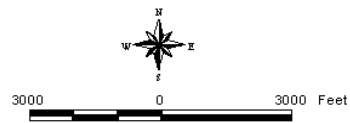


Santa Ana River Watershed





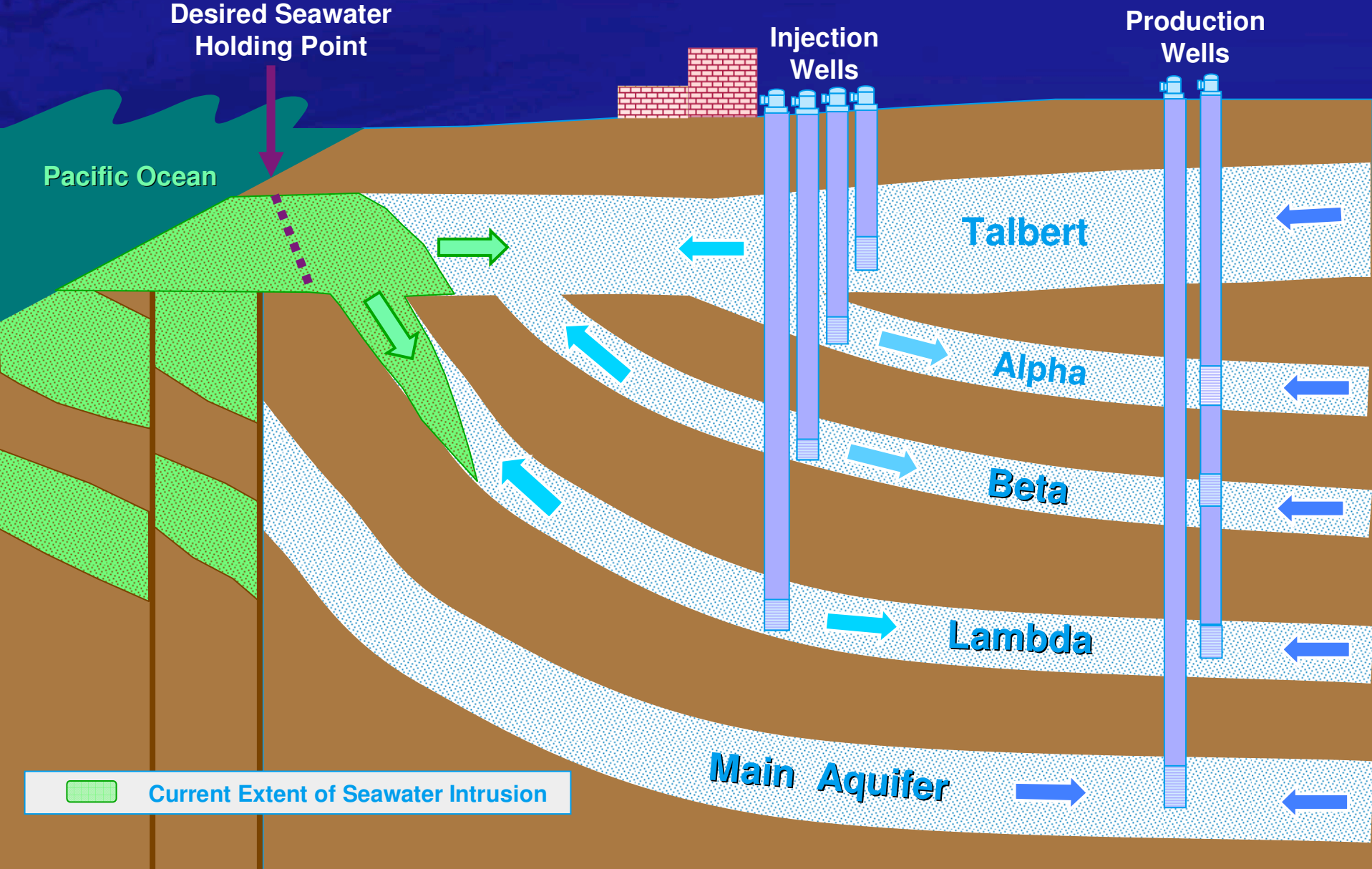
-  On River Recharge Area
-  Off River Recharge Area
-  Deep Basin Recharge Area
-  Diversion Pipeline
-  Infiltrable Rubber Dam
-  Non-Waterbearing Formation



OCWD Recharge Facilities



Seawater Intrusion



Why Do We Need The GWRS?



San Luis Reservoir before and now. Gov. Schwarzenegger declares emergency

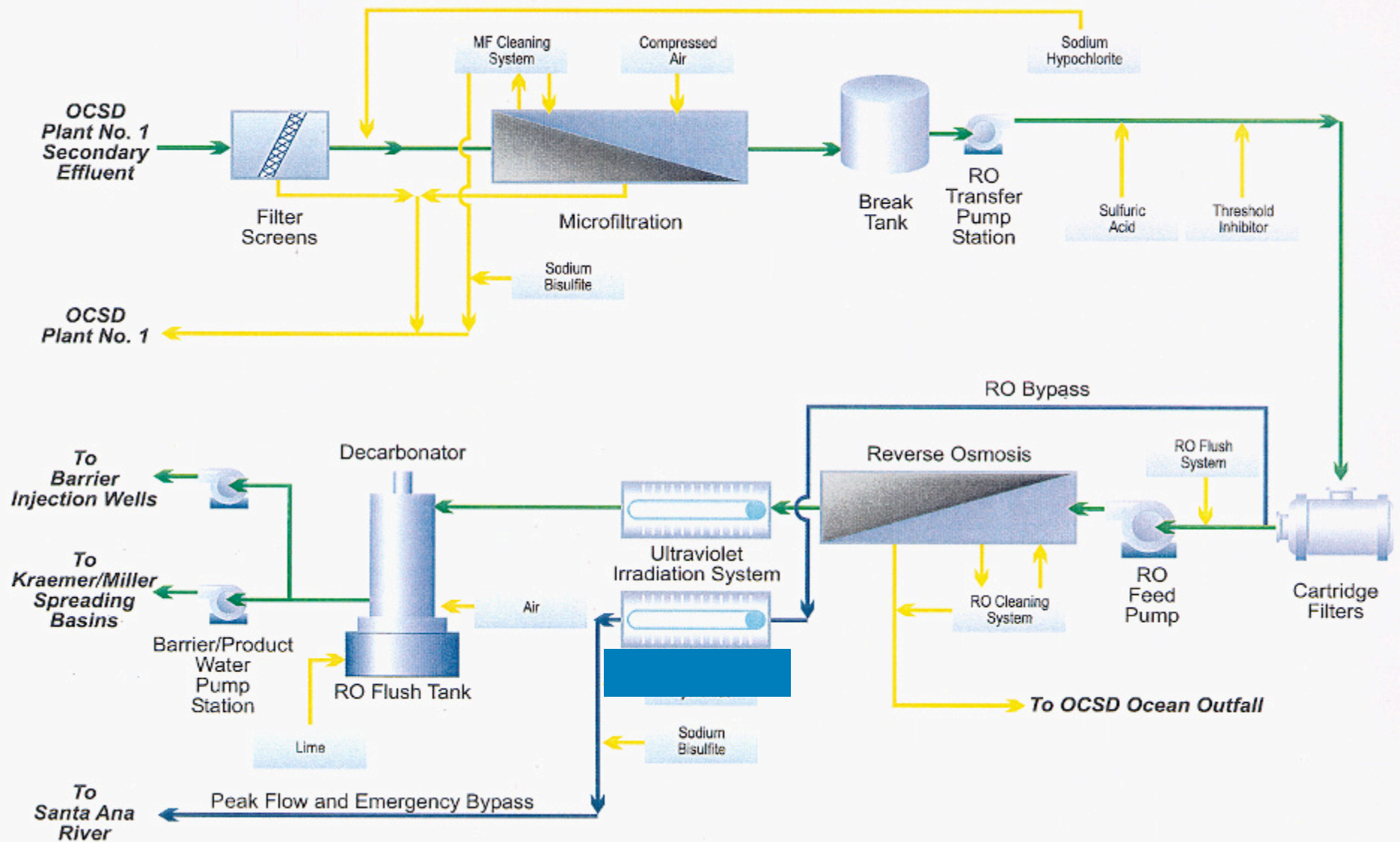
- Extended drought
- Imported water shortages
 - Colorado River losses
 - State Water Project losses
 - Environmental restrictions
 - Potential levee failures
- Local Projects lessen dependency on outside sources

What Is The GWRS?

- ◆ New 70 MGD (265,000 m³/day) advanced water purification facility
- ◆ Takes sewer water that otherwise would be wasted to the ocean, purifies it to near distilled quality and then recharges it into the groundwater basin
- ◆ Provides a new 72,000 acre-feet (88,000,000 m³) per year source of water, which is enough water for over 500,000 people
- ◆ Operational since January 2008



GWRS Advanced Purification Process



Microfiltration System



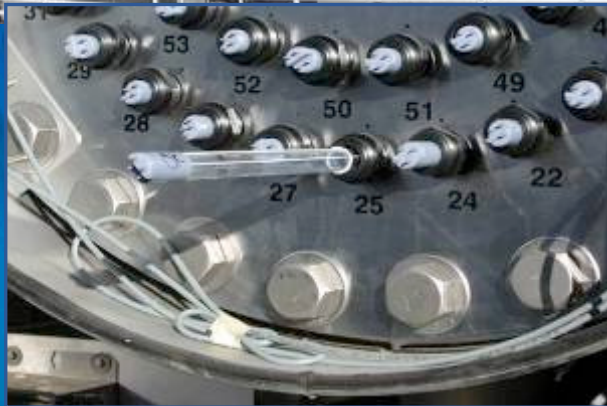
- 86 MGD (325,500 m³/day) Siemens CMF-S Microfiltration System
- Tiny, straw like hollow fiber polypropylene membrane
- Removes bacteria, protozoa, and suspended solids
- 0.2 micron pore size
- In basin submersible system

Reverse Osmosis System



- 70 MGD (265,000 m³/day) Reverse Osmosis System
- 3 stage: 78-48-24 array
- Hydranautics ESPA-2 Membranes
- Recovery Rate: 85%
- Removes dissolved minerals, viruses, and organic compounds (incl. pharmaceuticals)
- Pressure range: 150 – 200 psi

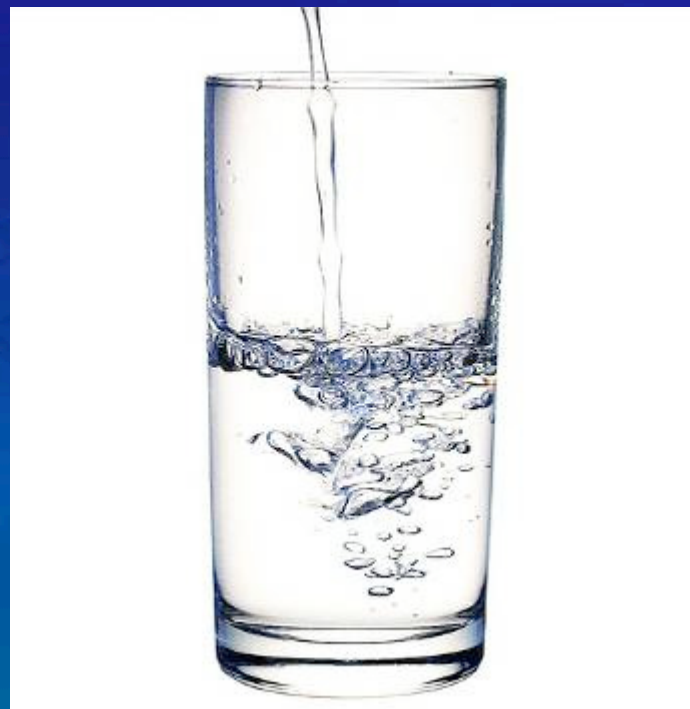
Direct Photolysis/Advanced Oxidation



- 70 MGD (265,000 m³/day) Trojan UVPhox System
- Low Pressure – High Output lamp system
- Destroys trace organics
- Uses Hydrogen Peroxide to create an Advanced Oxidation Process
- After treatment, water is so pure we need to add minerals back - lime

Regulatory Oversight

- Regional Water Quality Control Board issues permits for recycling
- CA Department of Public Health regulates drinking water and establishes reclamation criteria
 - Treatment
 - TOC limit
 - Travel time
 - Blending
- No federal role regulating reuse
- CDPH hearing findings and recommendations incorporated into permit by Regional Board



Independent Advisory Panel

- ◆ Appointed by National Water Research Institute
- ◆ Leading experts in hydrogeology, chemistry, toxicology, microbiology, engineering, public health, public communications and environmental protection
- ◆ Review operations, monitoring and water quality
- ◆ Panel makes recommendations to OCWD and regulatory agencies to assure quality and reliability



GWRS Proven Reliability

- California Department of Public Health developed permit requirements
- Test for over 400 compounds with all results well below permit levels or at non-detection (ND) levels
 - 28 Volatile Organic Compounds – All ND
 - 39 Non-Volatile Synthetic Organic Compounds – All ND
 - 8 Disinfection By-Products – All ND
 - 10 Unregulated Chemicals – All but one ND, all below permit levels
 - 51 Priority Pollutants – All ND
 - 16 Endocrine Disrupting Chemicals and Pharmaceuticals – All ND

Project Funding and Timing

- ◆ Capital Cost: approximately \$481 million
 - Split equally between OCWD and OCSD
- ◆ Expandable to 130 mgd
- ◆ Costs comparable to imported water
 - Project received \$92 million in state and federal grants, and \$4 million per year (21 year) operation and maintenance subsidy from Metropolitan Water District
 - Costs \$480 per acre-ft (\$850 per acre-ft without subsidies)
- ◆ Operational since January 2008



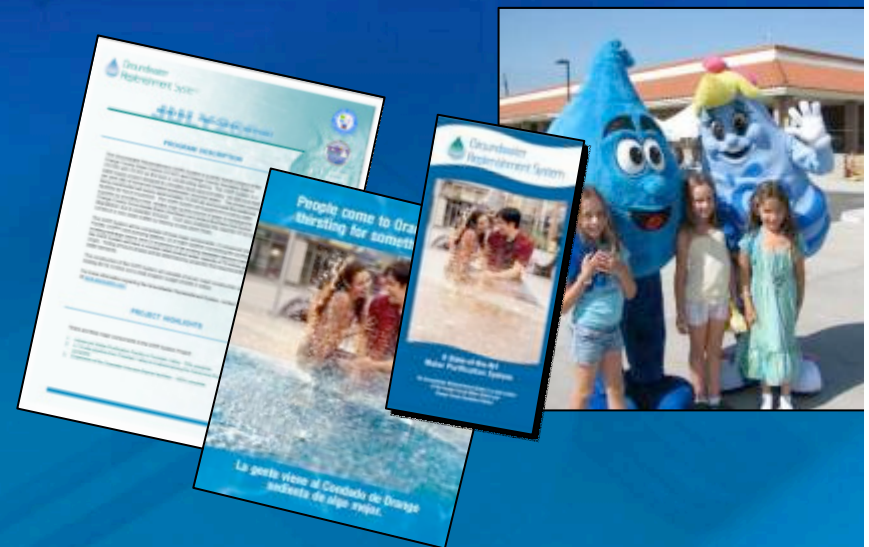
Benefits Of GWRS



- ◆ Creates a new water supply
- ◆ Reuses a wasted resource
- ◆ Expands the seawater barrier
- ◆ Increases water supply reliability
- ◆ Offsets imported water cutbacks
- ◆ Costs comparable to imported water
- ◆ Saves half the energy over imported water or desalinated seawater
- ◆ Improves quality of water in the basin

Public Outreach

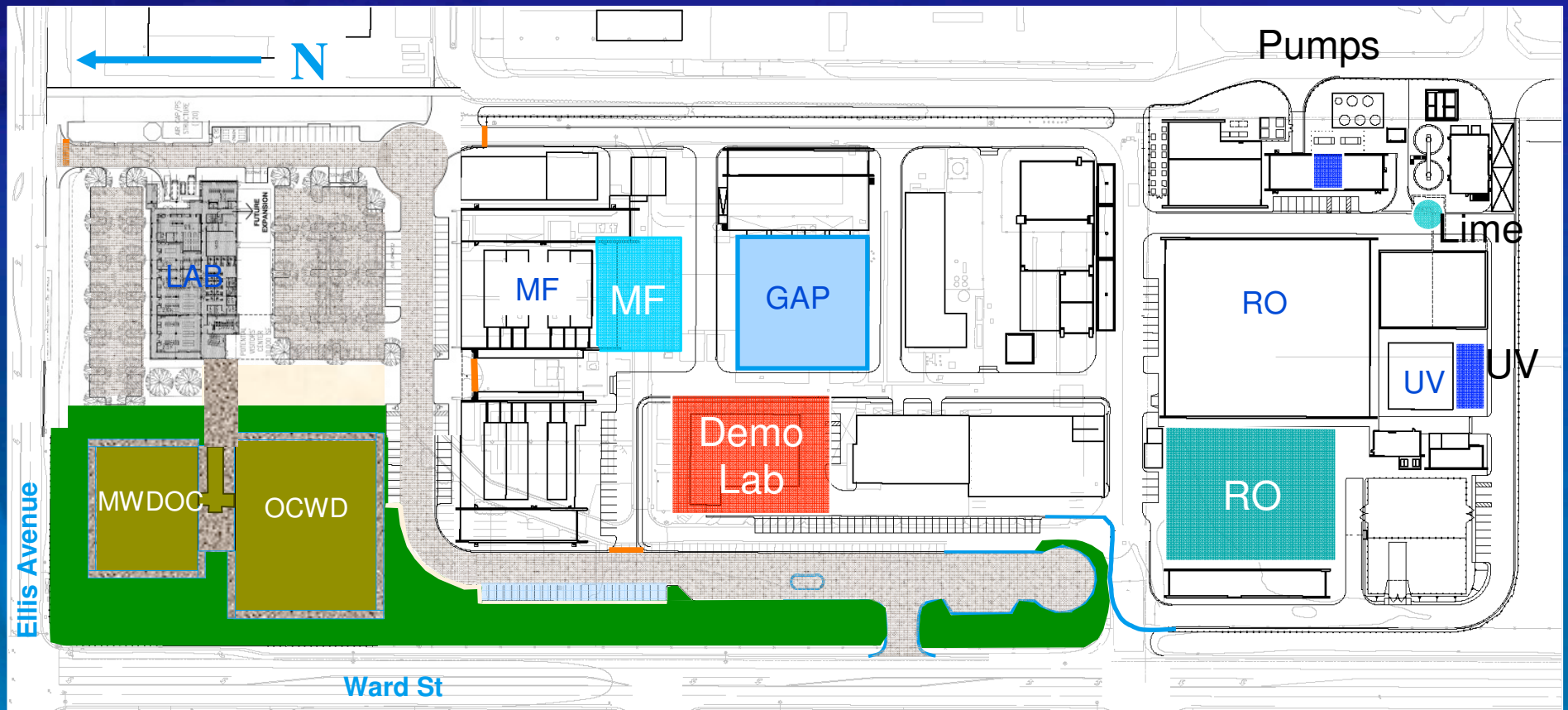
- Many projects stopped by public and political opposition
- Outreach began early, over 10 years prior to start up
- Researched public concerns
- Face to face presentations
- Community leaders
- Measured effects of outreach
- Community support
- Outreach continues today, assisted by media interest



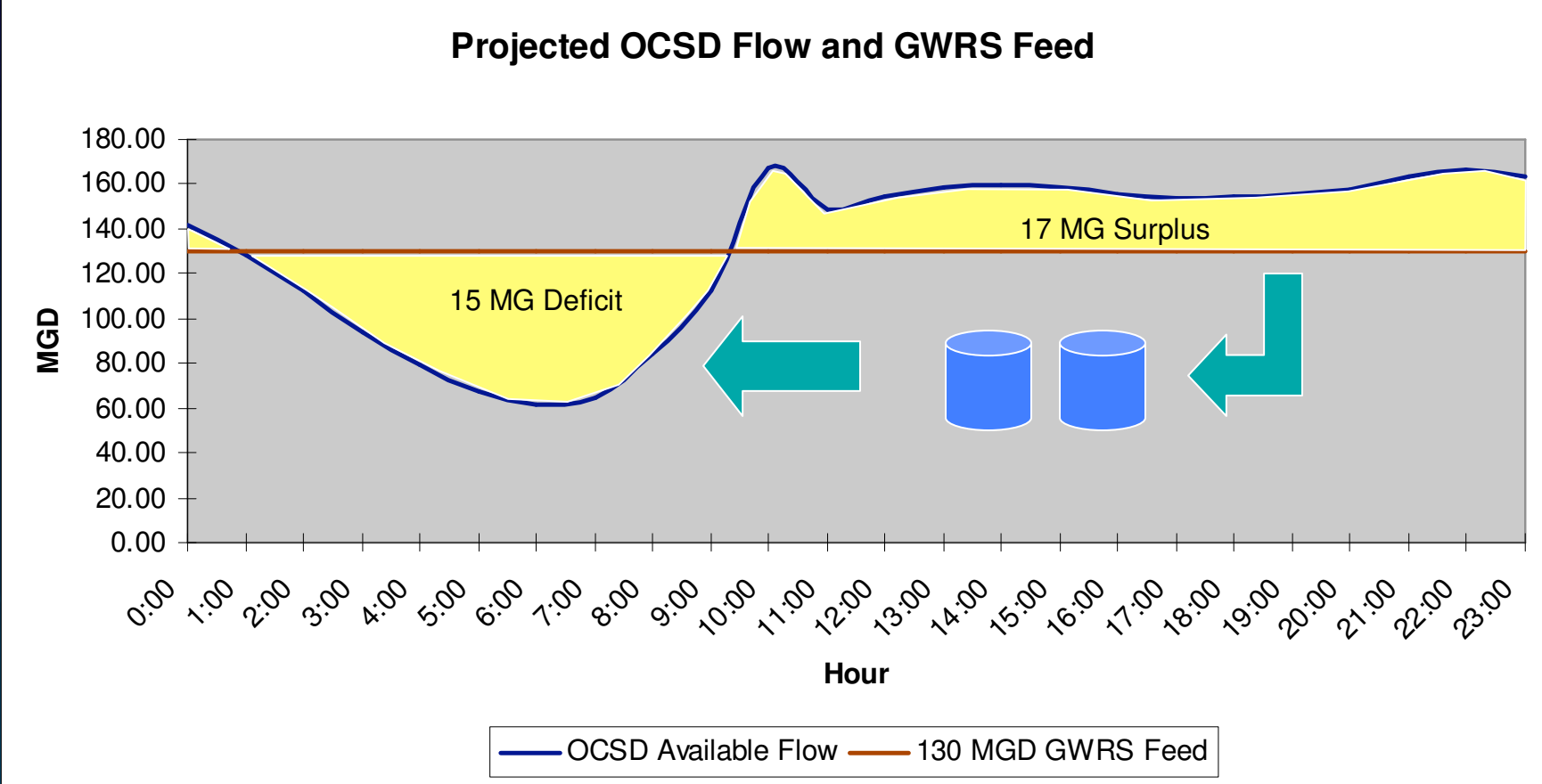
What's Next?

- Expand the capacity of the plant to 100 mgd.
 - Bids were received July 18, 2011
 - Low bidder McCarthy - \$115.1 million
 - Contract was awarded on September 7, 2011
 - Project completion scheduled for October 2014
- Project will produce 31,000 afy, which is enough water for nearly 250,000 people.

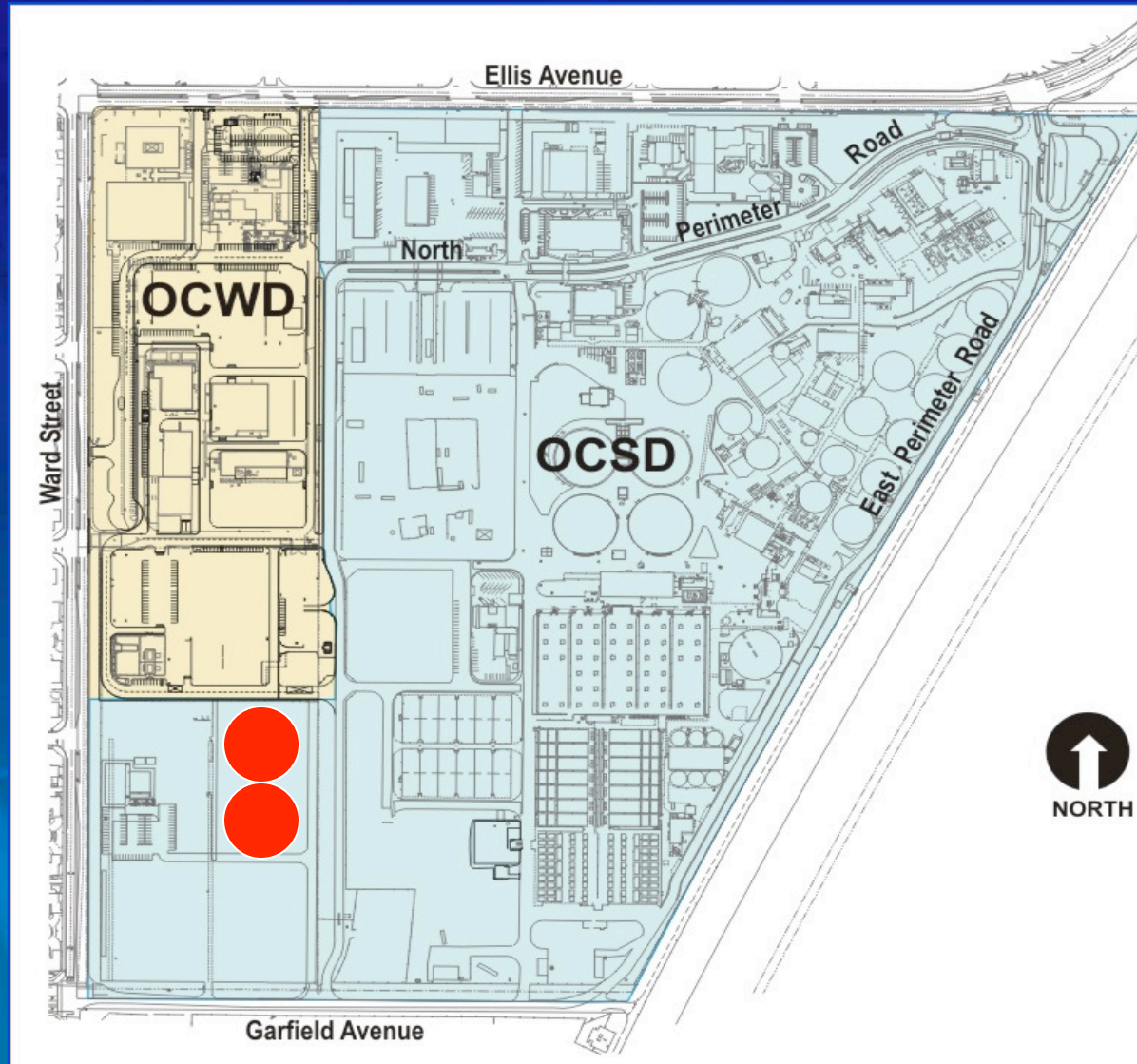
GWR System Site Expansion



Expansion with Flow Equalization



Flow Equalization Tanks



- ▶ Two – 7.5 million gallon tanks
- ▶ Diameter – 216 ft
- ▶ Height – 35 ft

Estimated Unit Cost of Existing GWRS with GWRS Expansion Project

“Melded Rate”

Existing
GWRS
FY10-11

\$480/af

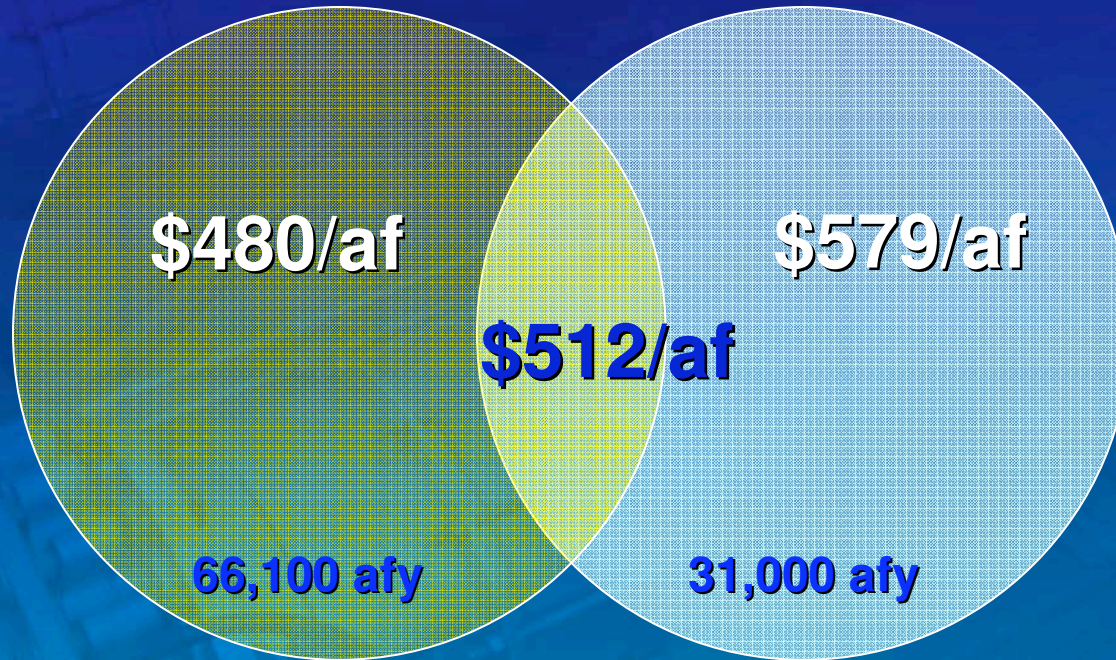
66,100 afy

GWRS
Expansion
(\$142.7 M)

\$579/af

31,000 afy

\$512/af



GWRS Aerial View





Groundwater Replenishment System

A Pure Solution to Orange County's Water Needs

www.gwrssystem.com

