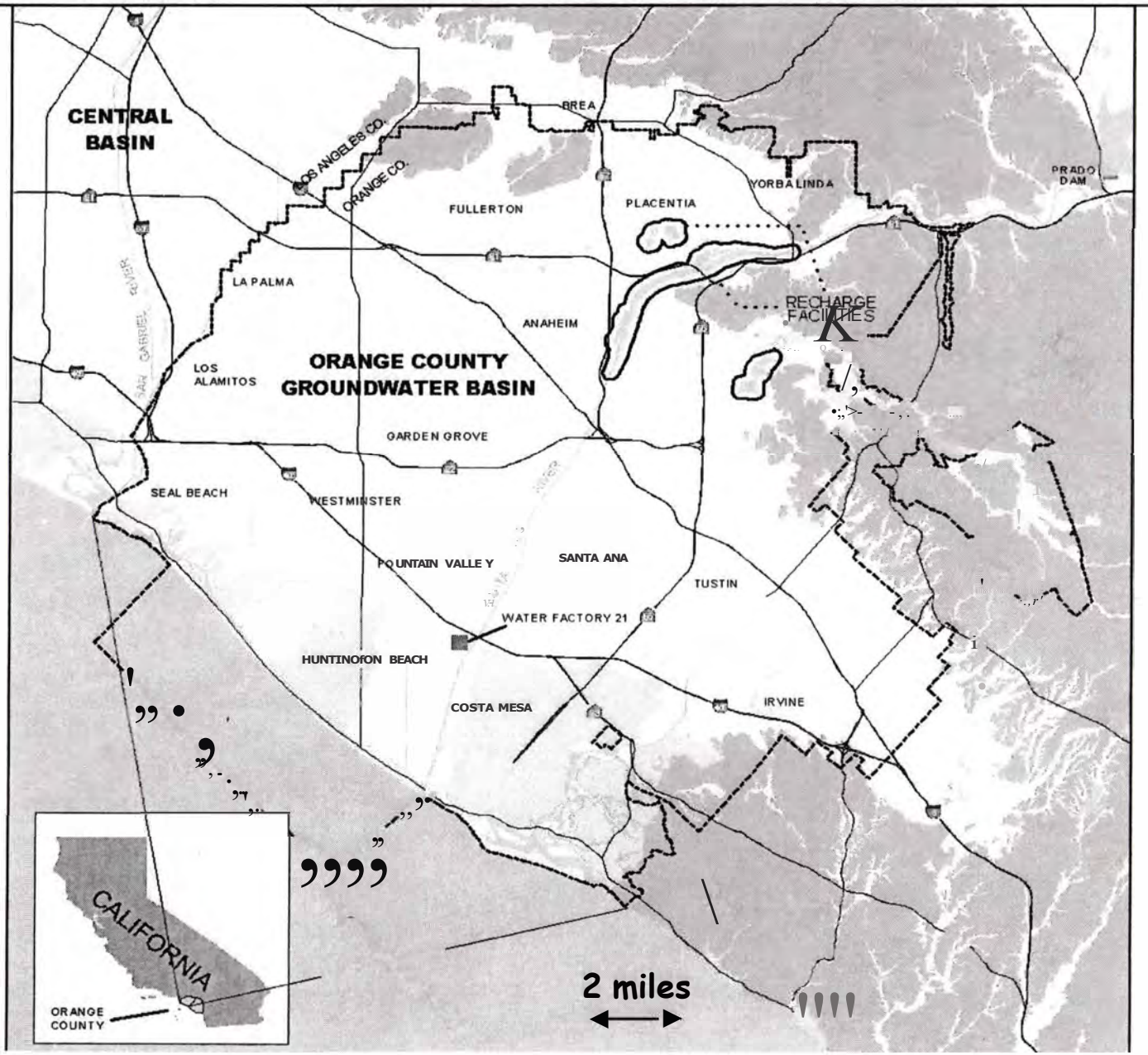
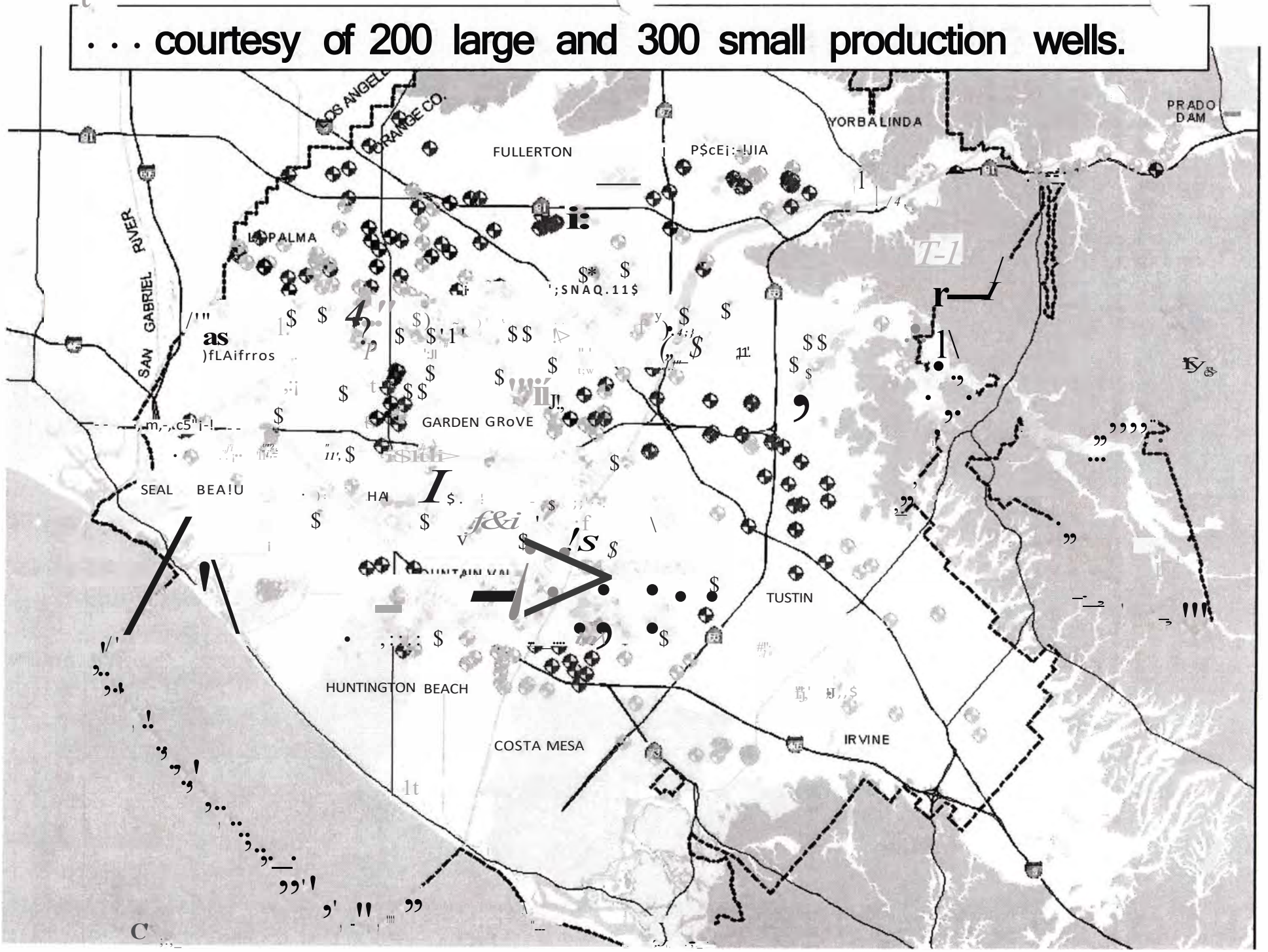
35 Years of Controlling Seawater Intrusion in Orange County, California

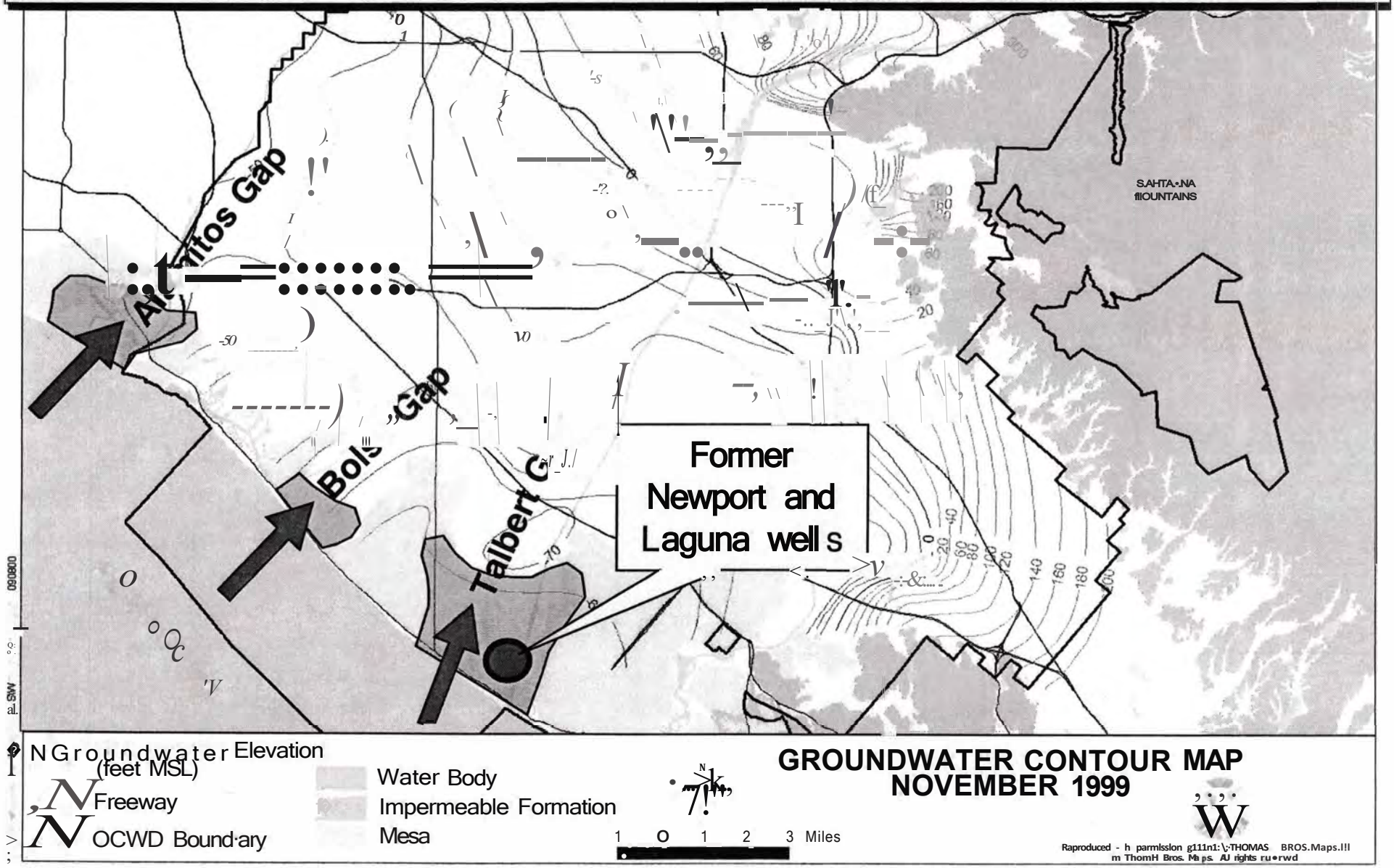
September 2001

The 350-sq. mi. Orange County groundwater basin supplies 350,000 af/yr (75% of demand) to 2.2 million people …

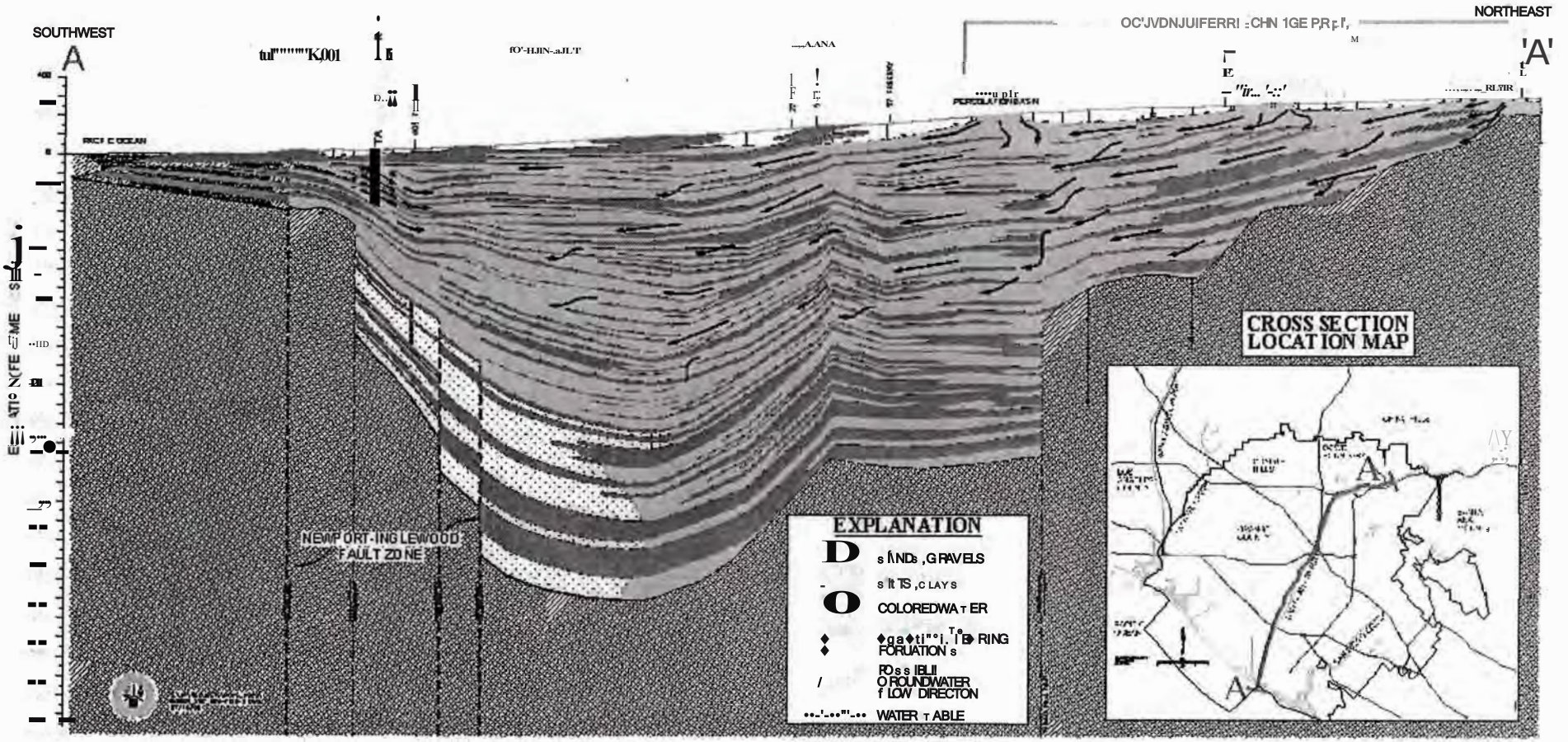



. . . courtesy of 200 large and 300 small production wells.
FULLERTON
YORBA LINDA
PRADO DAM
LA PALMA
SAN GABRIEL RIVER
GARDEN GROVE
SEAL BEACH
HUNTINGTON BEACH
TUSTIN
COSTA MESA
IRVINE

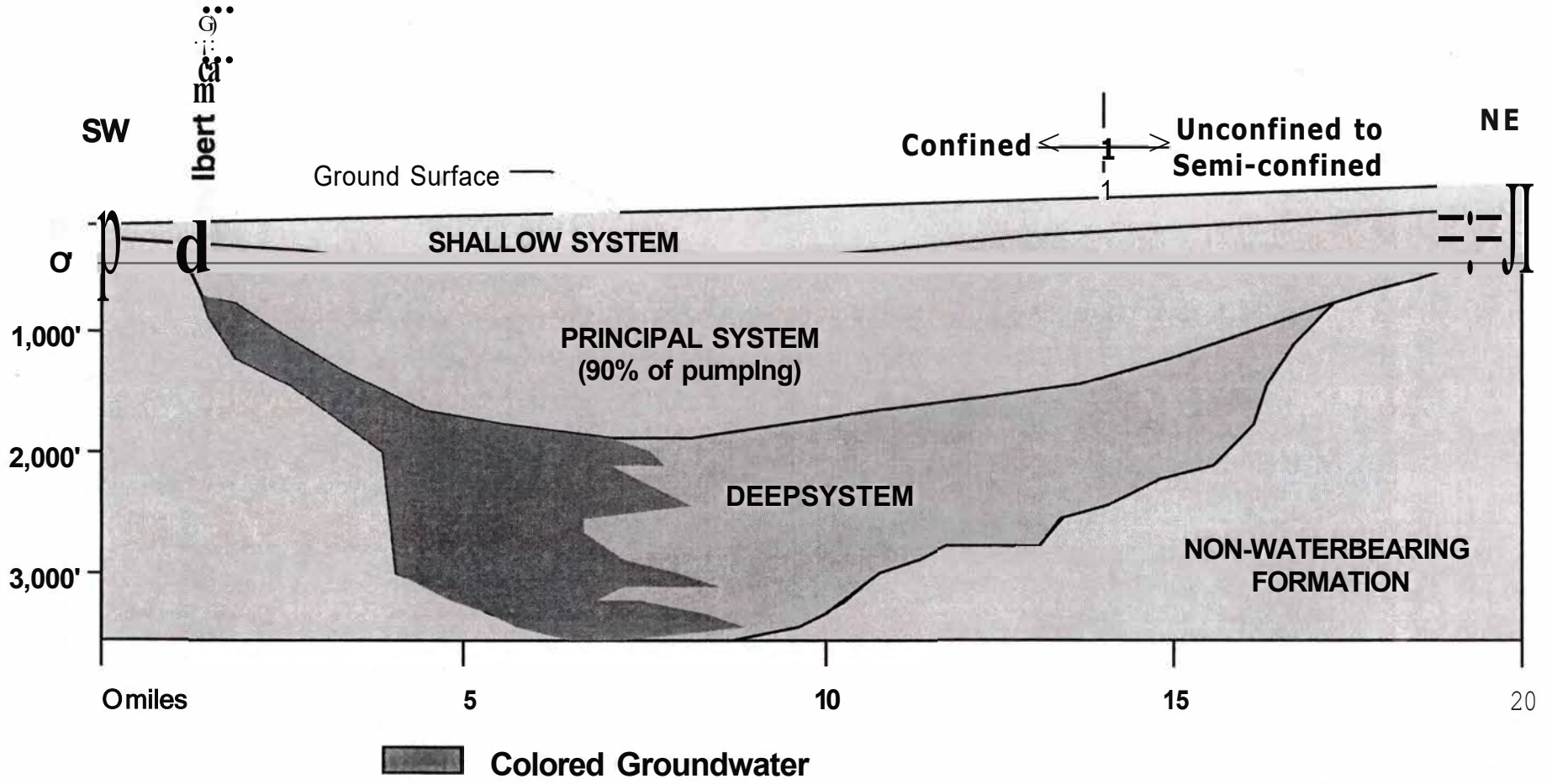
In the early 1900s, groundwater pumping began to cause seawater intrusion through geologic "gaps," eventually destroying the local water supply of Newport Beach and Laguna Beach_.



2,000+ feet of unconsolidated sands, gravels, silts, and c·lays from marine and alluvial deposition concurrent with folding and faulting comprise the basin aquifers.



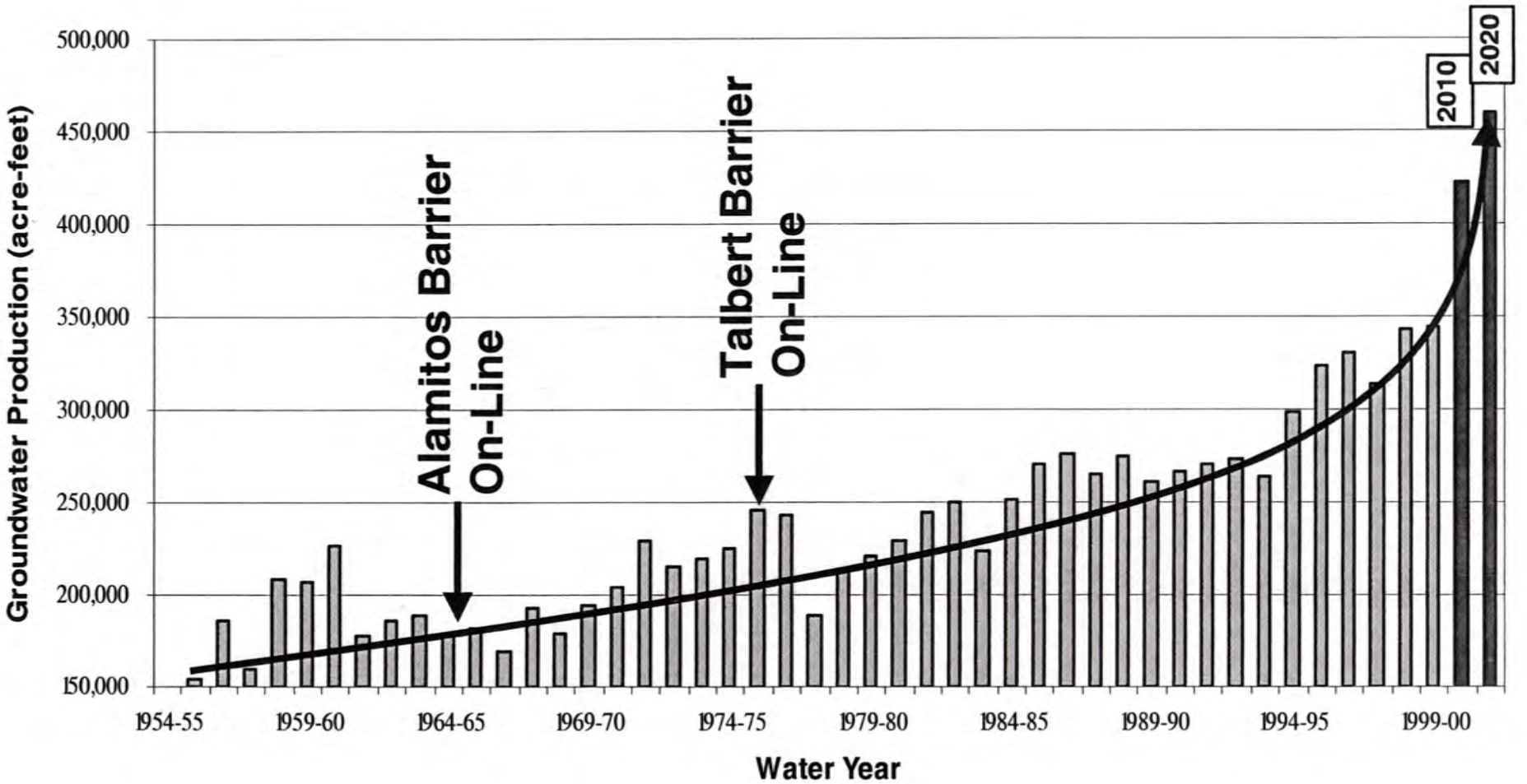
Three major aquifer systems are differentiated by their potentiometric. and water chemistry characteristics.



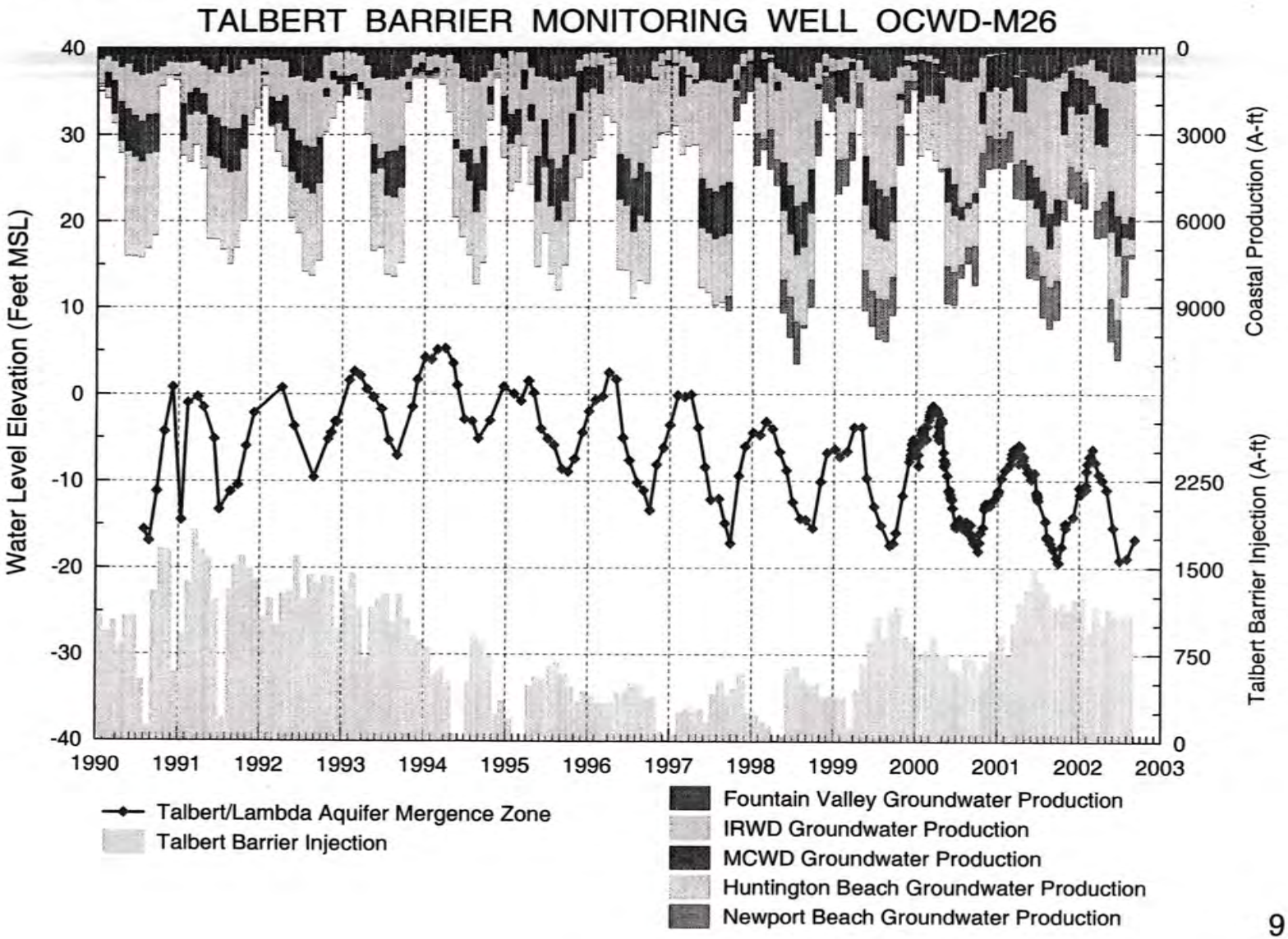
By the 1950s, seeing that coastal portions of the basin were. at risk of permanent damage and potential costly litigation, the basin groundwater pumpers (cities and farmers) agreed to:

- Treat the basin as a whole.
- Empower and finance the OCWD to manage *their* basin.
- OCWD's initial objectives:
  - Refill the basin with $13/af surplus Colo. River water (npw $260 - $450/af, if available), as an interim measure.
  - Determine how to prevent further intrusion while maximizing basin production.

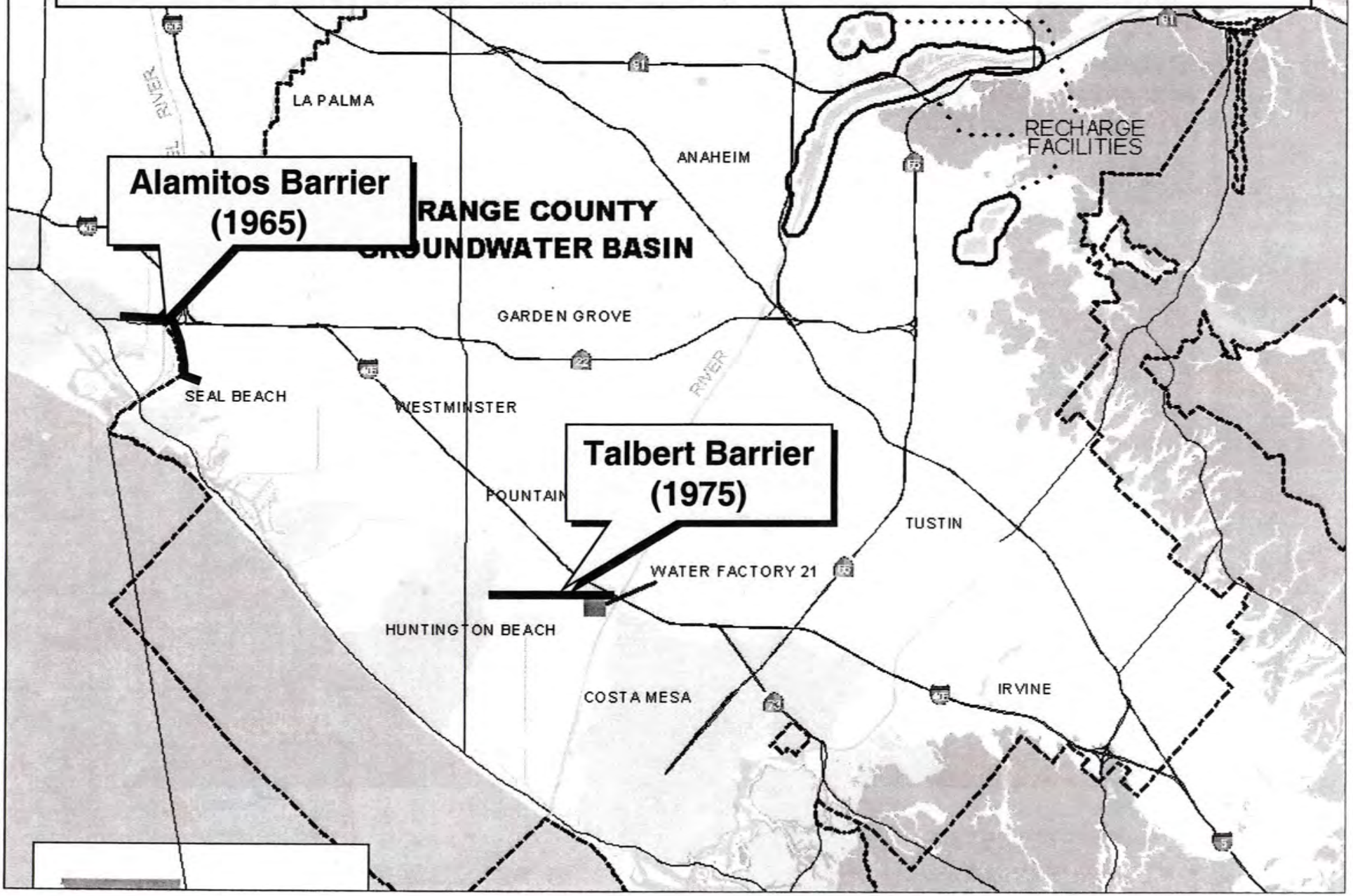
Groundwater production has increased 125% in the last 45 yrs and is projected to increase by 30% by 2020.



Groundwater levels must be maintained above Mean Sea Level to prevent seawater intrusion

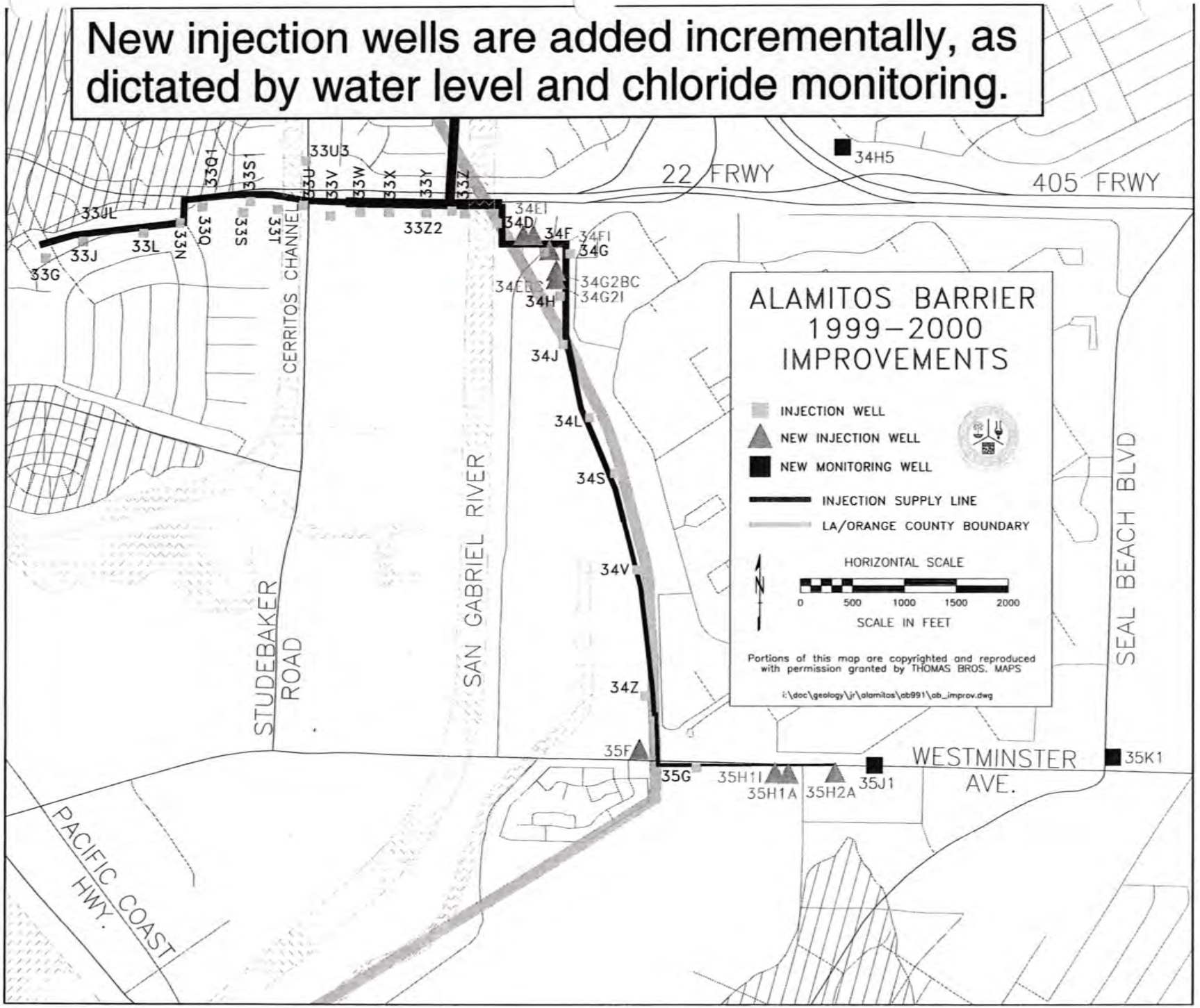


Two seawater barriers using injection and extraction wells were constructed by OCWD and jointly with L.A. County.



Alamitos Barrier Factoids

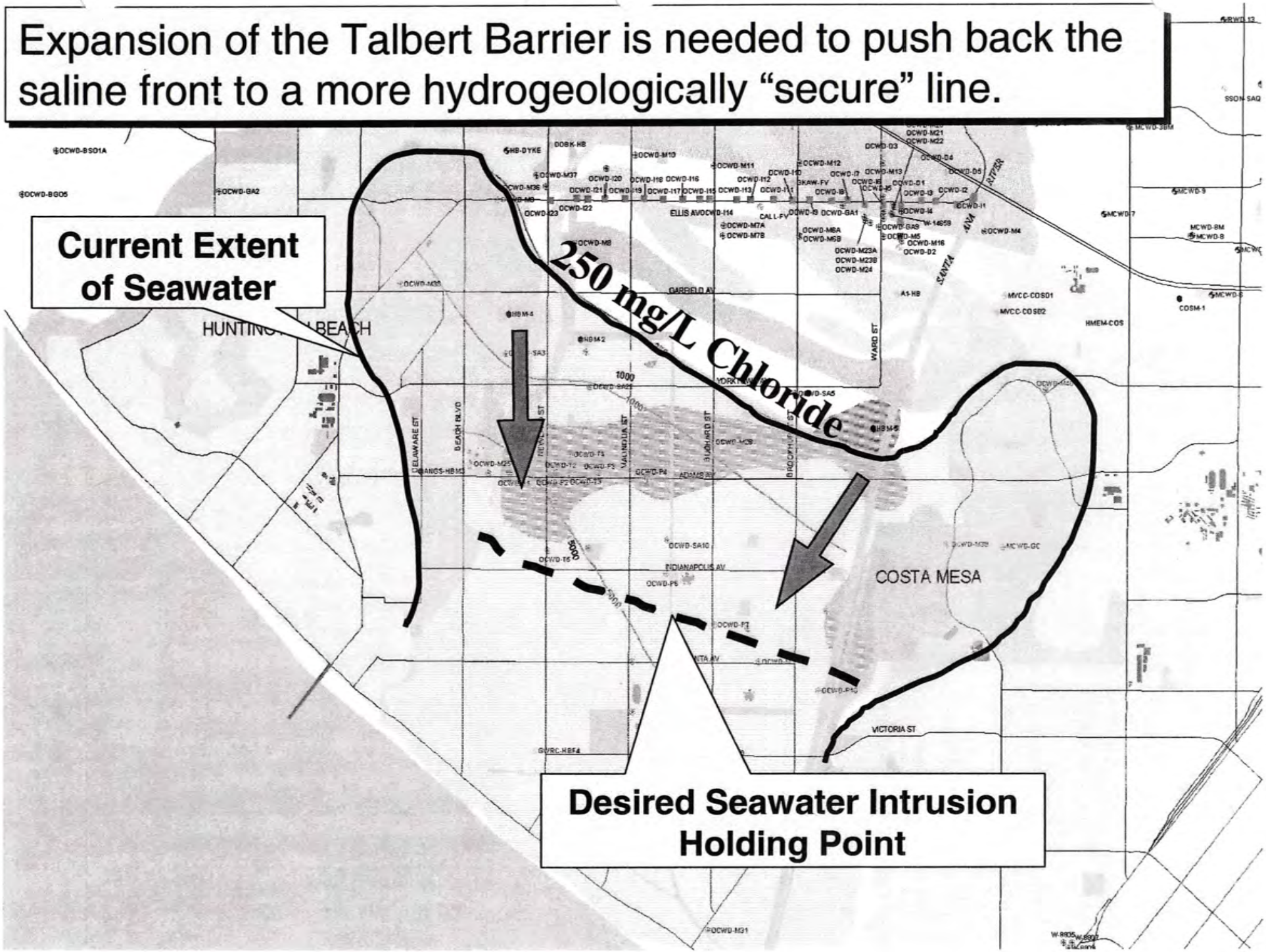
- 6,000 af/yr (3-5 mgd) potable imported water injected at a cost of $450/af.
- O&M costs approx. $850,000/yr
- 44 injection wells (9 new)
- 178 monitoring wells (3 new)
- 4 extraction wells (not particularly effective)
- Managed by multi-agency committee
- Plans to convert 50% of water supply to reclaimed

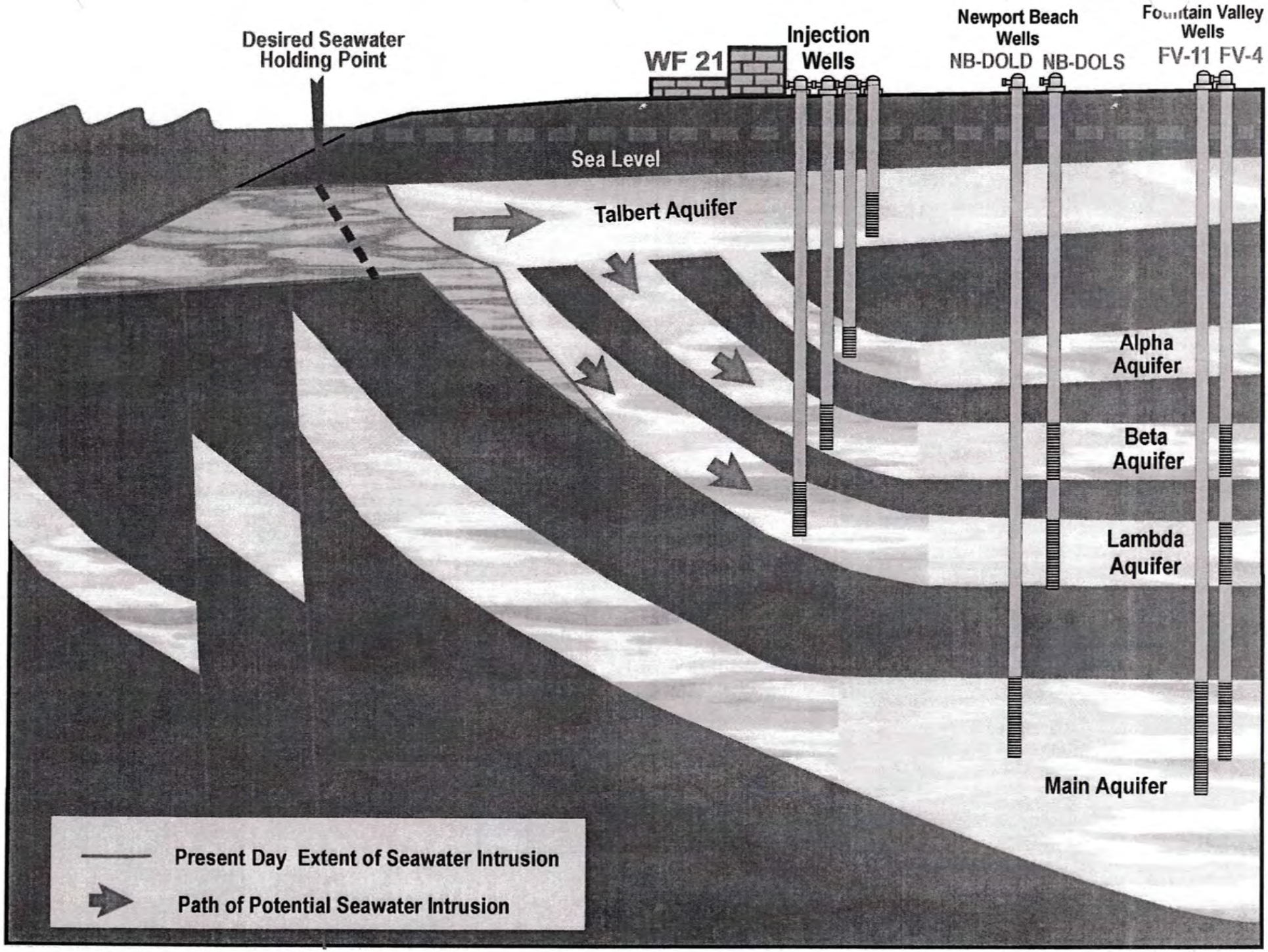

New injection wells are added incrementally, as dictated by water level and chloride monitoring.
ALAMITOS BARRIER
1999–2000
IMPROVEMENTS
INJECTION WELL
NEW INJECTION WELL
NEW MONITORING WELL
INJECTION SUPPLY LINE
LA/ORANGE COUNTY BOUNDARY
HORIZONTAL SCALE
0 500 1000 1500 2000
SCALE IN FEET
Portions of this map are copyrighted and reproduced with permission granted by THOMAS BROS. MAPS
i:\doc\geology\jr\alamitos\ab991\ab_improv.dwg
22 FRWY
405 FRWY
CERRITOS CHANNEL
SAN GABRIEL RIVER
STUDEBAKER ROAD
SEAL BEACH BLVD
WESTMINSTER AVE.
PACIFIC COAST HWY.
33G
33J
33L
33JL
33N
33Q
33S
33T
33Q1
33S1
33U
33U3
33V
33W
33X
33Y
33Z
33Z2
34D
34E1
34F
34FI
34G
34G2BC
34G2I
34H
34H5
34J
34L
34S
34V
34Z
35F
35G
35H1I
35H1A
35H2A
35J1
35K1

Talbert Barrier Factoids

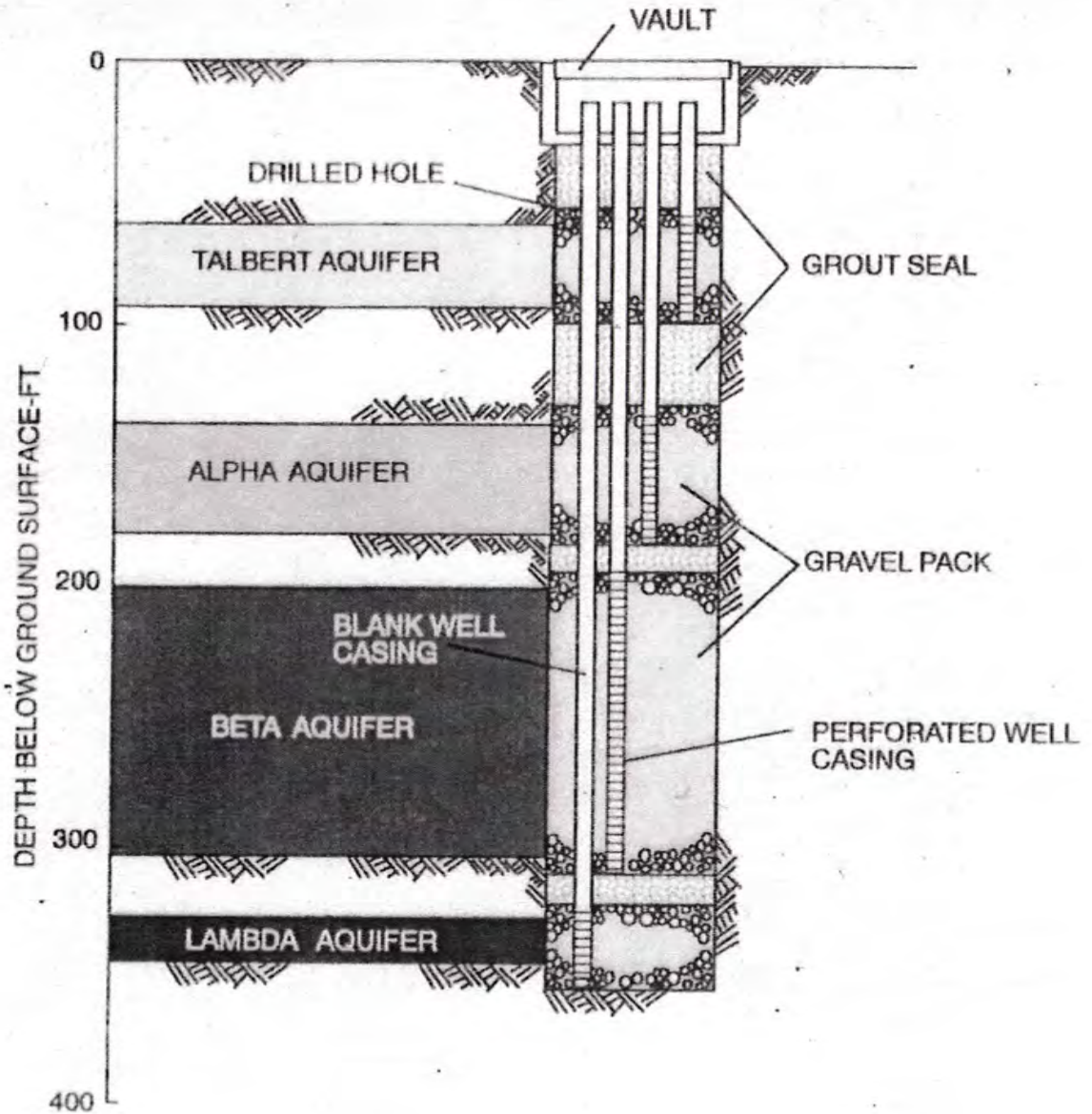
- 13,000 af/yr (10-17 mgd) potable-quality reclaimed water (Water Factory 21) and deep aquifer water injected at a cost of approx. $500/af.
- 26 multi-depth injection wells (3 new)
- 120+ monitoring wells
- Extraction wells deactivated in '80s
- Operated by OCWD
- 42 mgd expansion reclamation project in design, to be operational in 2006.

Expansion of the Talbert Barrier is needed to push back the saline front to a more hydrogeologically "secure" line.

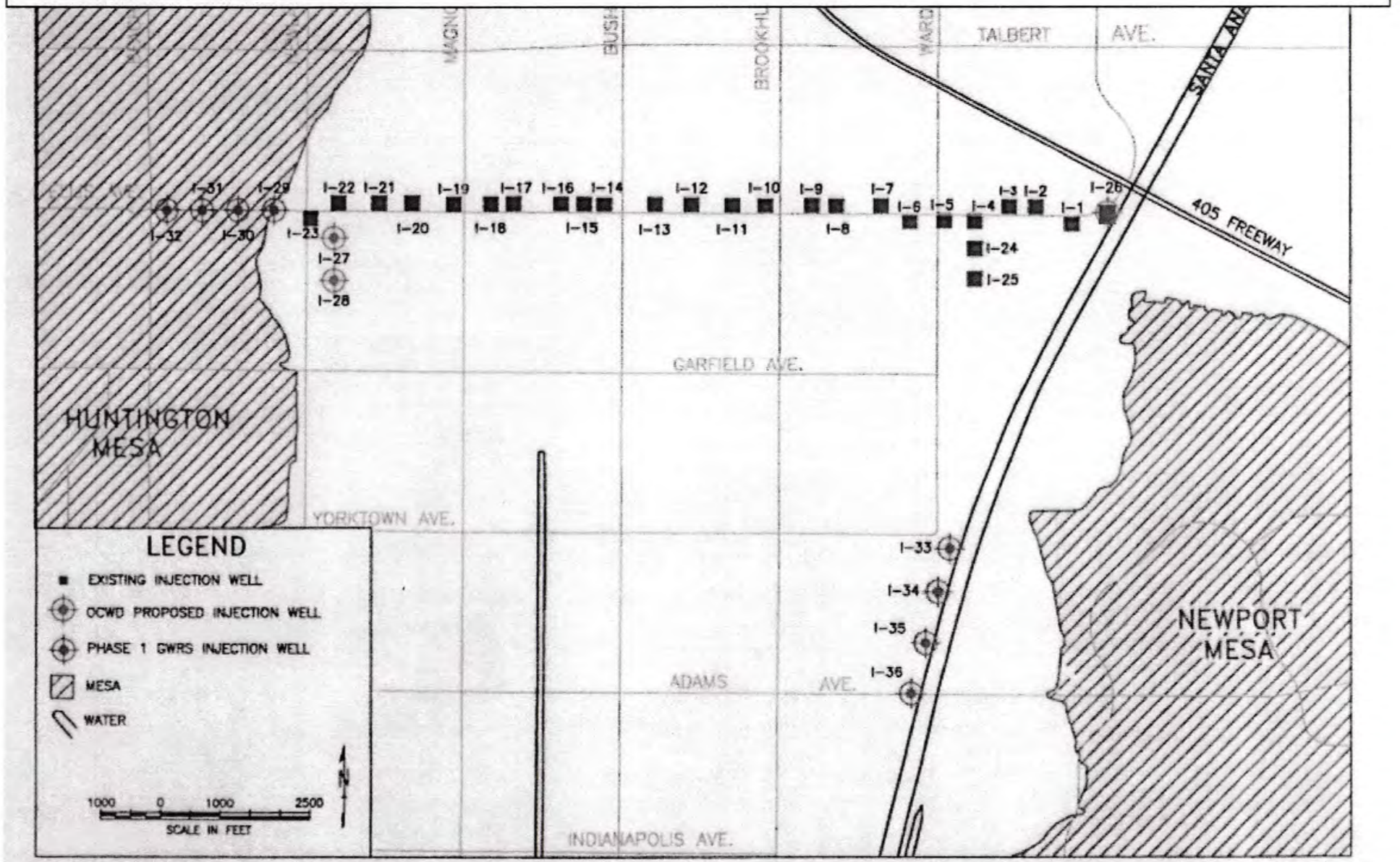



Desired Seawater Holding Point
WF 21
Injection Wells
Newport Beach Wells
NB-DOLD NB-DOLS
Fountain Valley Wells
FV-11 FV-4
Sea Level
Talbert Aquifer
Alpha Aquifer
Beta Aquifer
Lambda Aquifer
Main Aquifer
Present Day Extent of Seawater Intrusion
Path of Potential Seawater Intrusion

The original 23 Talbert Barrier wells were constructed with 4 casings within each borehole. Because of water leakage, new wells will be constructed as single-cased wells.



To control seawater on the west and southeast portions of the Talbert Gap, ten new injection well sets are planned for construction.



Seawater barriers are crucial to Southern California's water reliability, but they are expensive to operate and maintain.

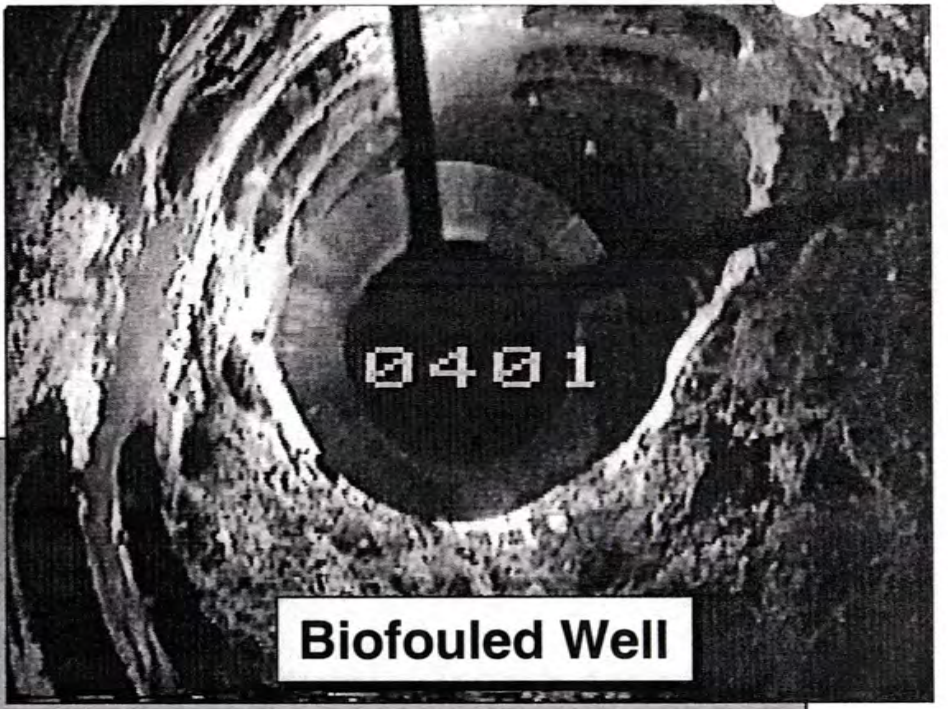
Pros

- Most economical alternative that allows optimal basin use
- Provides high-quality recharge to coastal areas
- Generally not land-intensive (environmentally friendly)
- Educated public and political bodies fully supportive, including impacts on their water bills

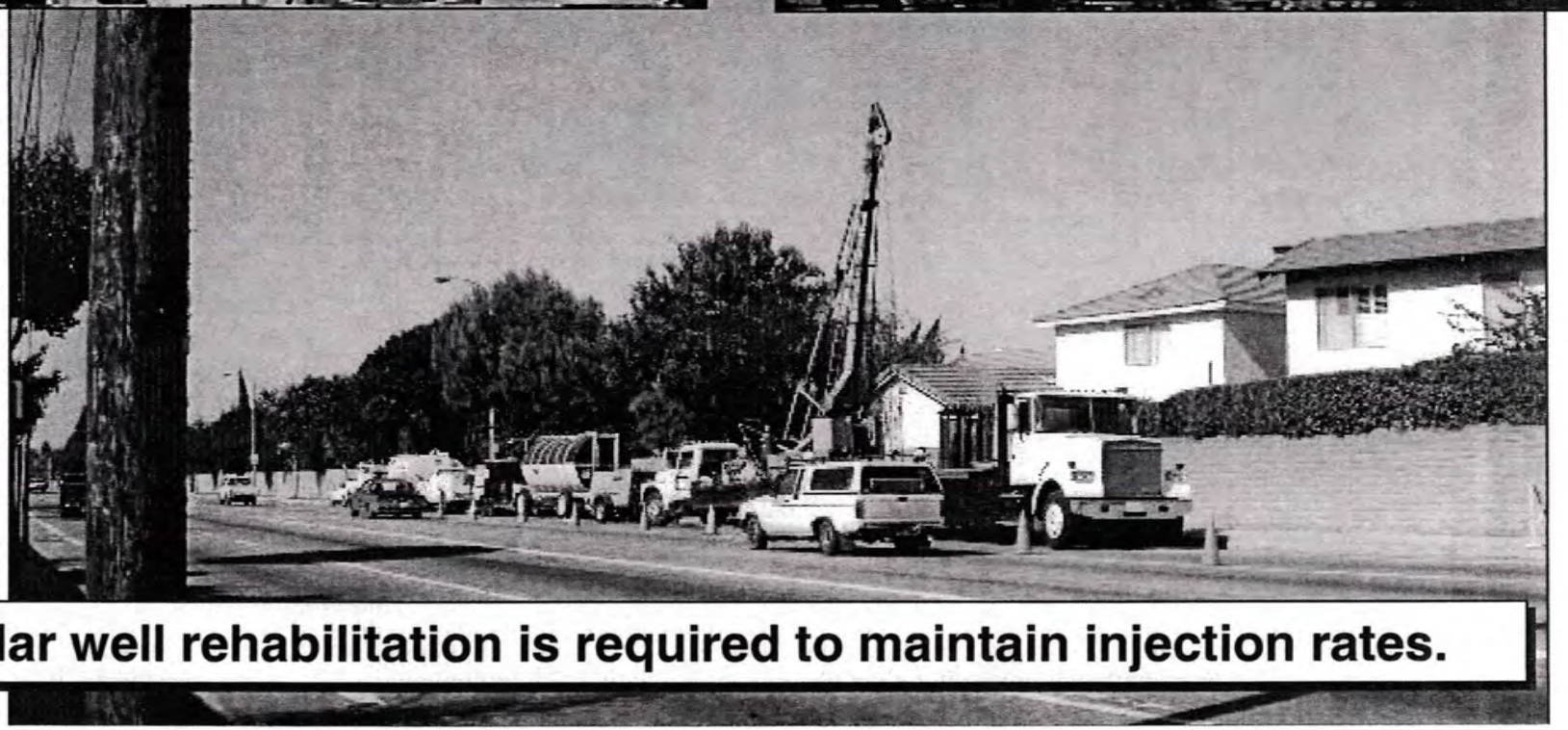
Cons

- High-quality water supply needed
- Substantial public education for acceptance of reclaimed water projects
- Regulatory approval for reclaimed water projects
- Specialized multi-disciplinary staff to operate and evaluate
- Long-term well maintenance

Clean Well



Biofouled Well



Regular well rehabilitation is required to maintain injection rates.

OCWD has employed or is investigating other methods to control seawater intrusion.

- Balance long-term pumping with recharge
- Purchase imported water for coastal pumpers in lieu of groundwater
- Shift pumping inland
- Economic incentives for conservation
- Reclaimed water for non-potable use
- Seawater desalting still too costly

End of Presentation