Thank You For Joining Us!
The Webinar Will Begin Shortly

While we wait… take a moment to connect with OCWD

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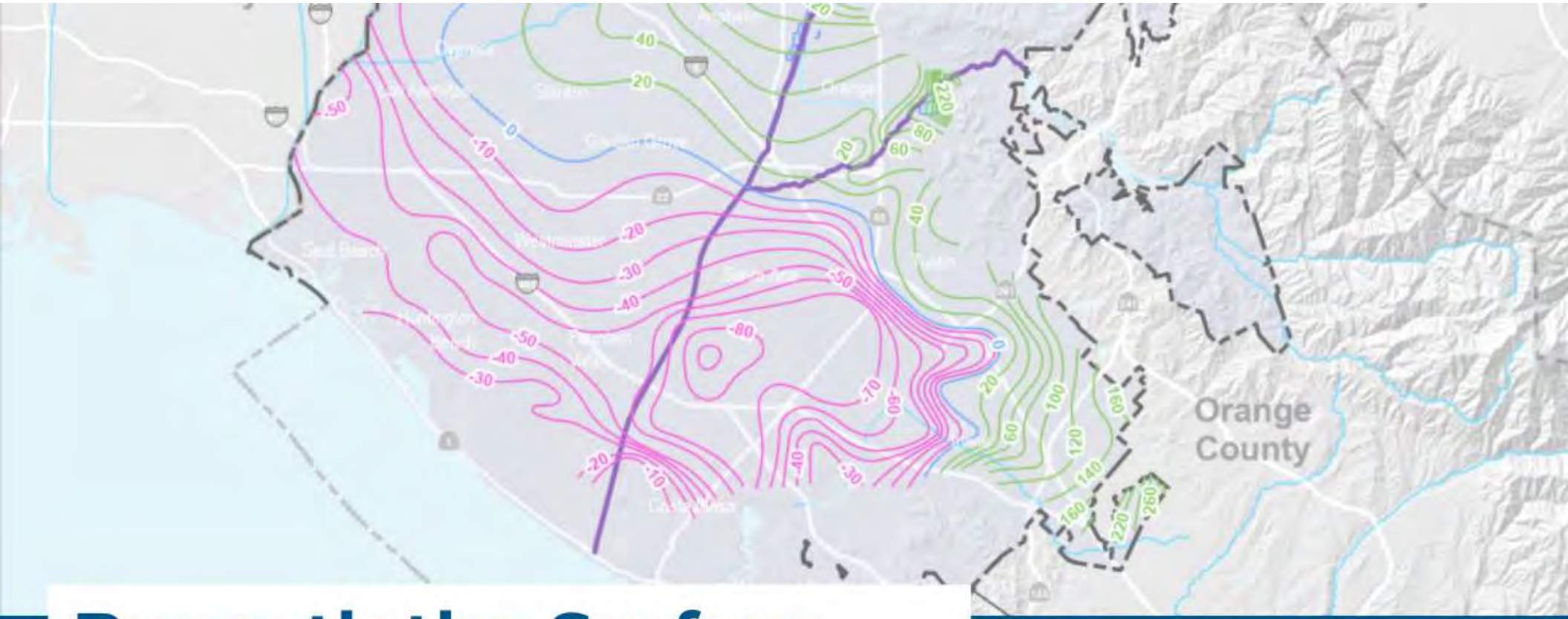

Beneath the Surface

Understanding OCWD's Groundwater Monitoring Network

Tuesday, October 28, 2025

Before We Get Started

- Attendees are muted to reduce background noise
- Webinar is being recorded and will be published on OCWD's YouTube Channel
- Use the Q&A box to submit questions on today's topic
- Email info@ocwd.com for any follow-up questions

Meet Our Speakers

Roy Herndon, P.G., C.HG
Chief Hydrogeologist
Orange County Water District

Tim Sovich, P.E.
Principal Engineer
Orange County Water District

Brendan Neel
Hydrogeologist
Orange County Water District

Beneath the Surface

Understanding OCWD's Groundwater Monitoring Network

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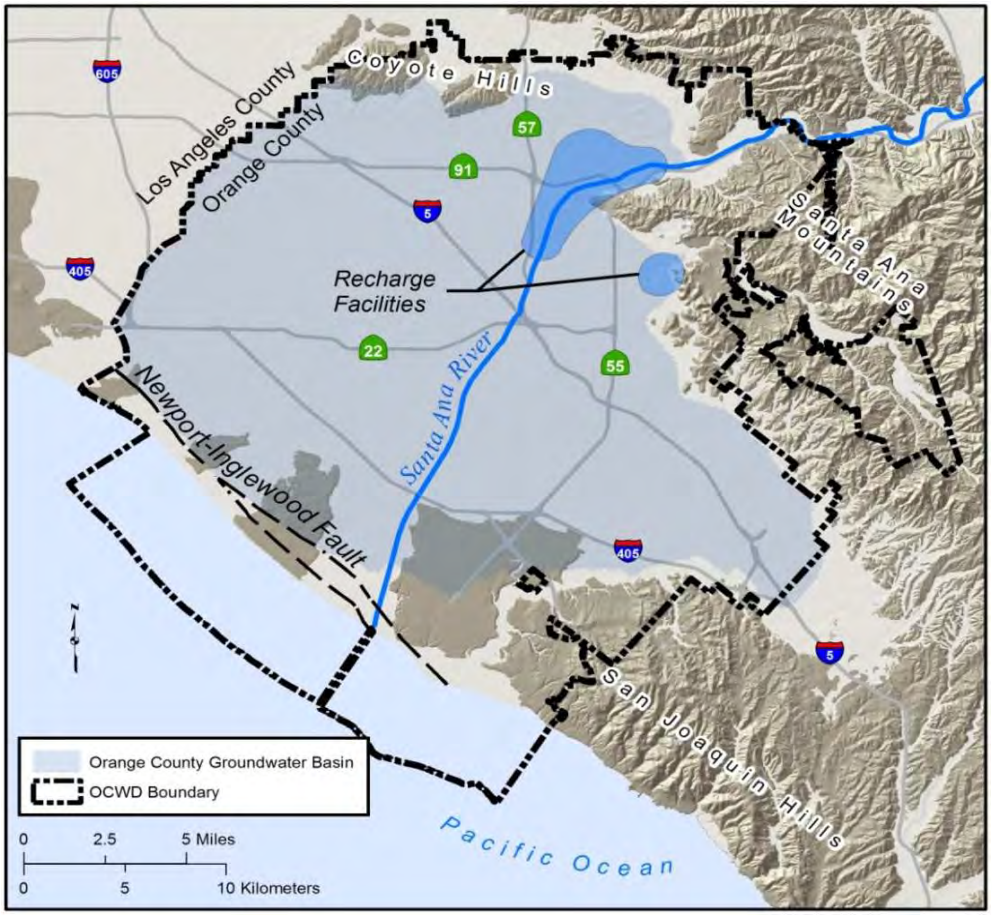
Today's Topics

1. Overview: OCWD responsibilities and basin importance
2. OCWD monitoring well network and why it is needed
3. Description of OCWD monitoring well types
4. How OCWD uses monitoring well data
5. Monitoring well drilling and construction

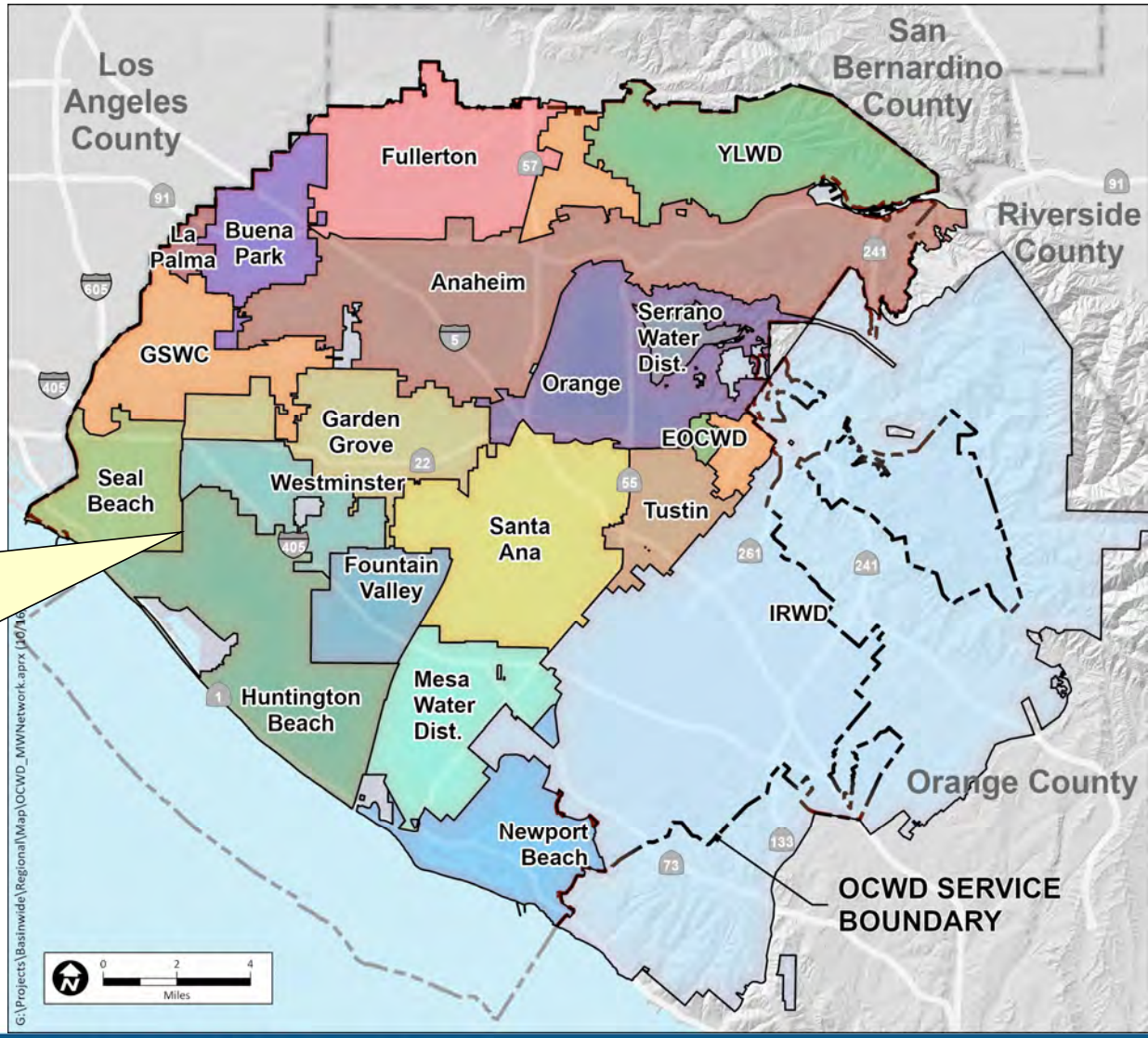
Who is Orange County Water District?



- **Local government agency formed in 1933**
- **Manage groundwater basin under North-Central OC**
- **Replenish aquifers**
- **Control seawater intrusion**
- **Protect and improve water quality**

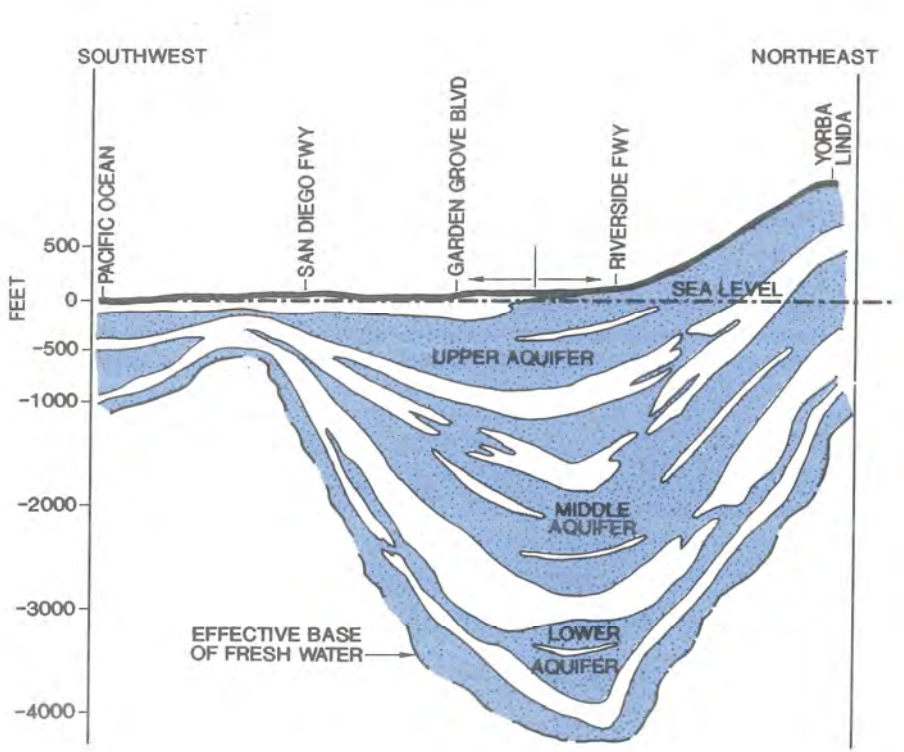
In OCWD:

- 19 retail water agencies
- 2.5 million people
- 85% groundwater
- 200 drinking water wells

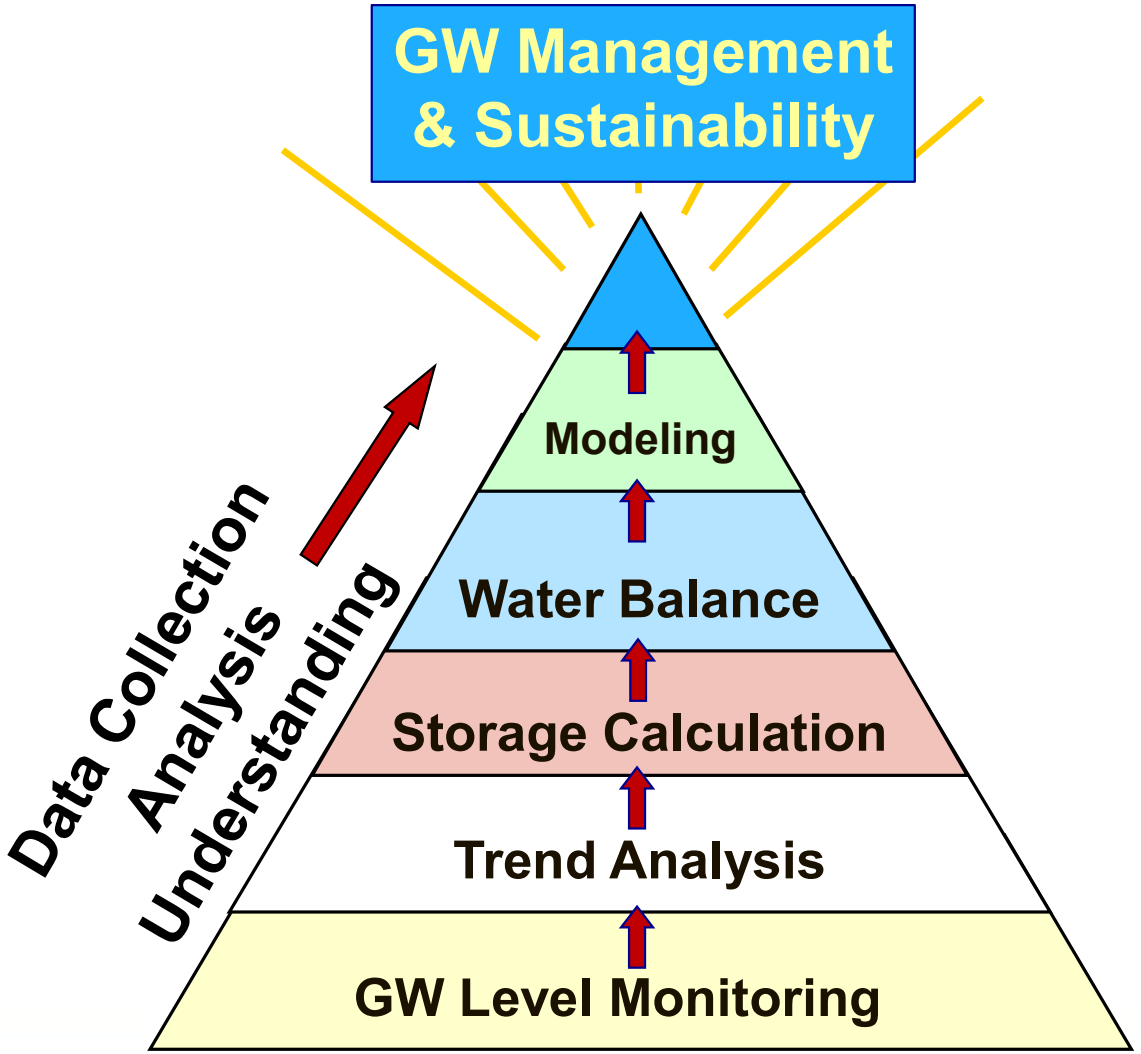


1987-89: Proposed Monitoring Well Network

- **Develop better understanding of basin aquifers**
- **Evaluate effectiveness of recharge program**
- **Assess baseline groundwater quality for future trend analysis**
- **Identify areas vulnerable to contamination**

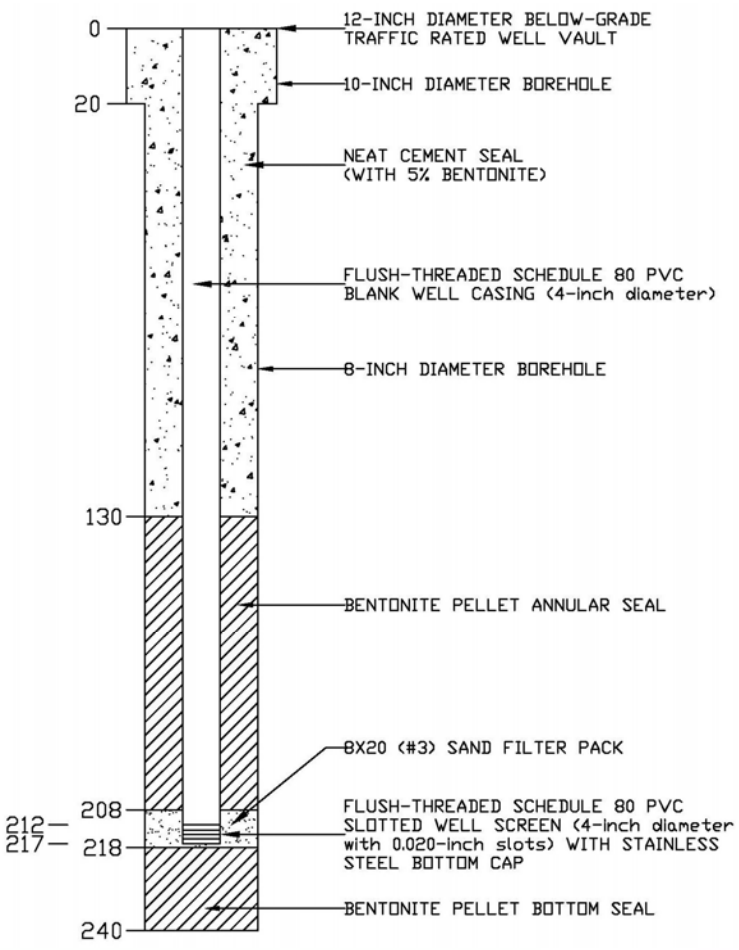


Source: OCWD 1989 Groundwater Management Plan

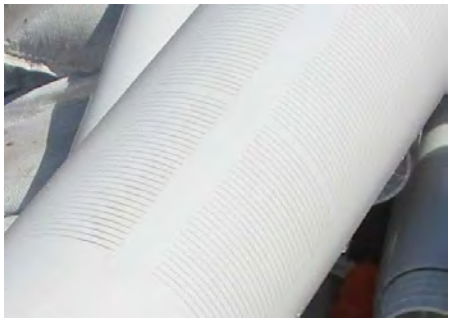

GW Management & Sustainability
Modeling
Water Balance
Storage Calculation
Trend Analysis
GW Level Monitoring
Data Collection
Analysis
Understanding

OCWD Monitoring Well Network

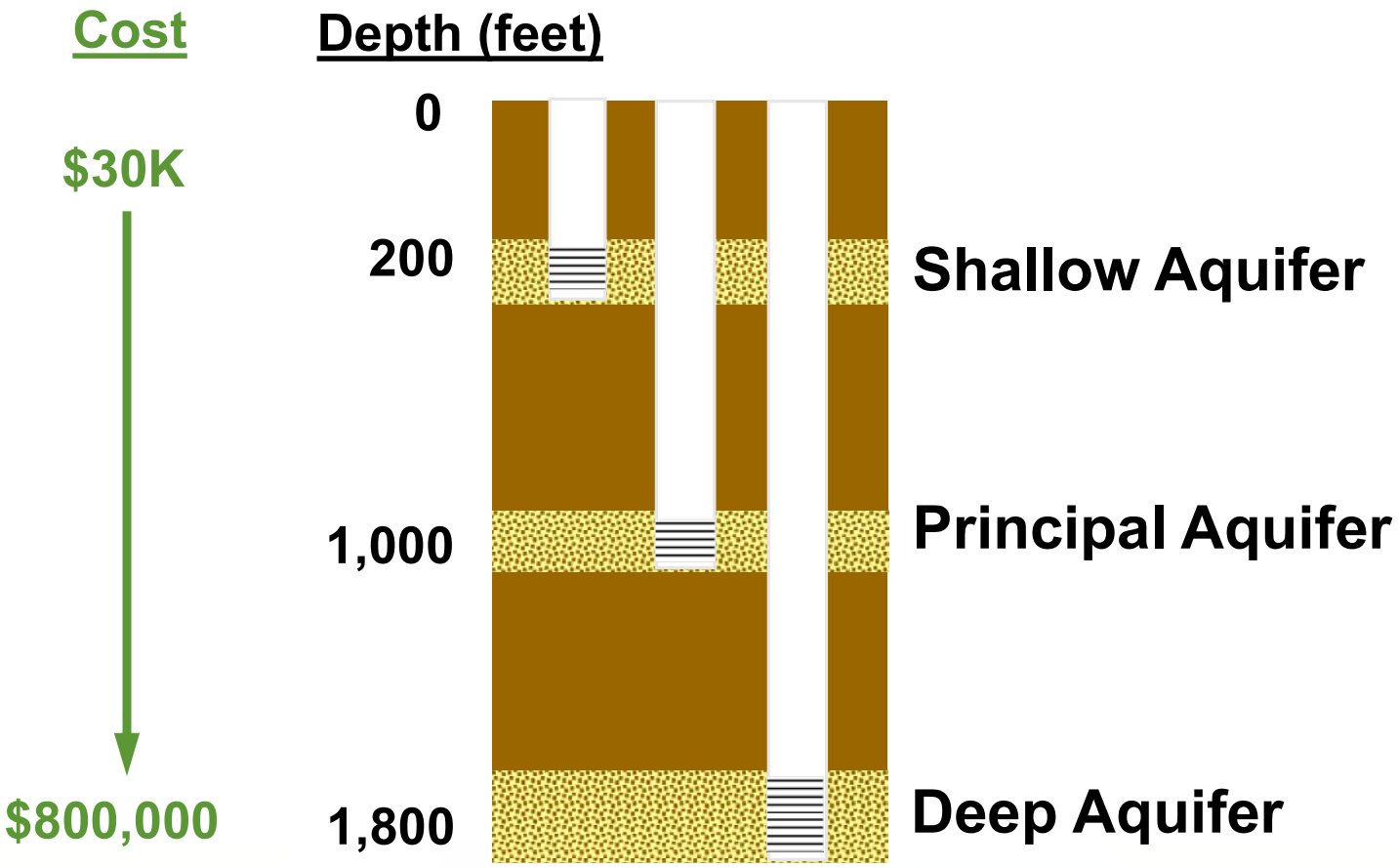
What is a monitoring or “observation” well?



- Vertically drilled hole
- Cased with PVC or steel pipe
- Pipe perforated or slotted in targeted aquifer zone
- Gravel/sand in annular space around screen
- Bentonite clay & cement seals in remainder of annular space
- Monitor GW levels & quality
- Gain geologic information



Monitoring wells collect groundwater level and quality data at targeted aquifer depths. Cost increases with depth and number of casings.



Monitoring well data helps answer many questions

Drill cuttings and logs:

- Define aquifer depths & thickness
- Define low-permeability aquitards
- Determine geologic structure
- Develop geologic cross-sections

Groundwater level monitoring:

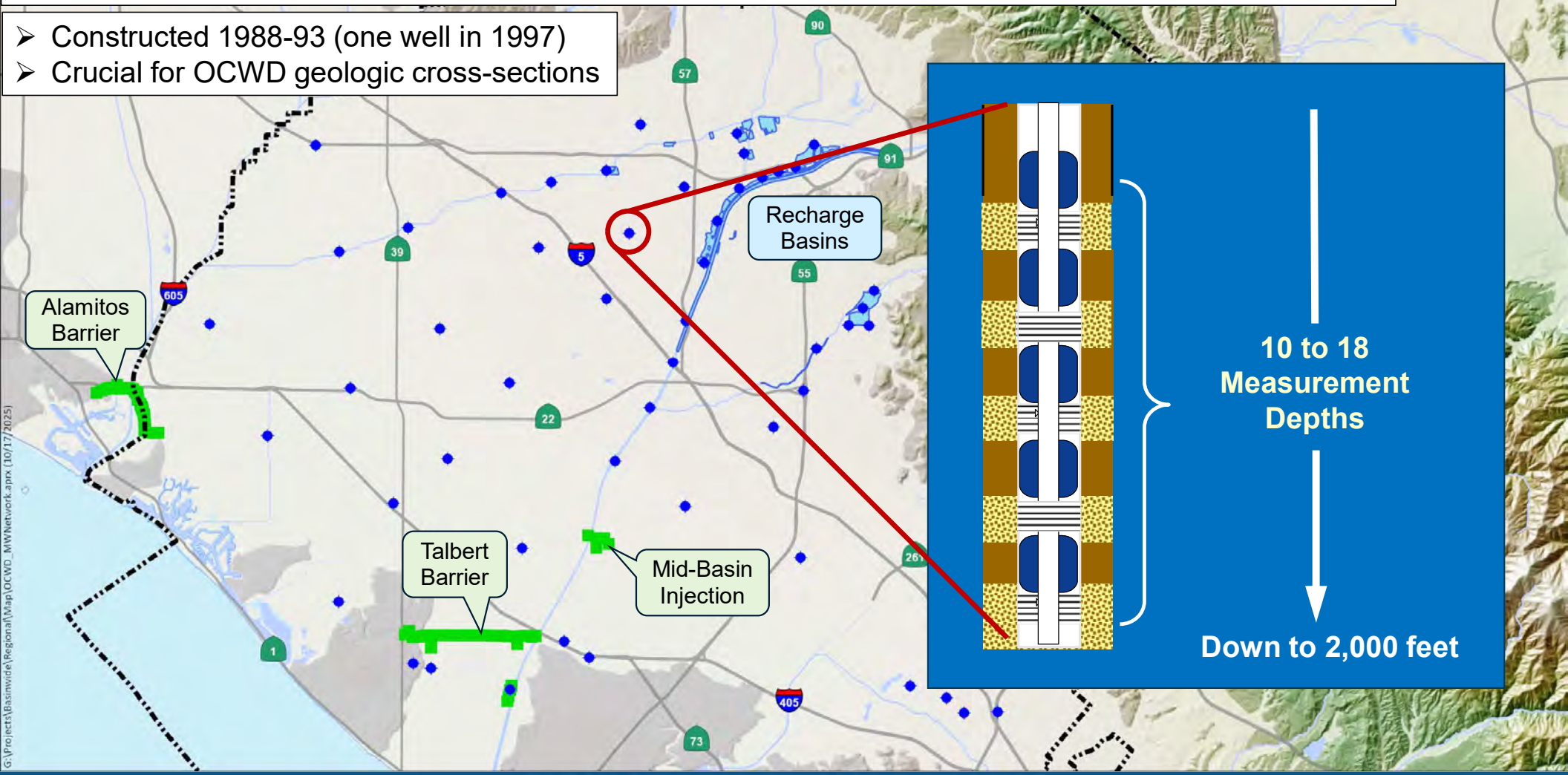
- Define groundwater flow directions
- Vertical connection between aquifers
- Identify pumping & recharge effects
- Track basin storage changes

Groundwater quality sampling:

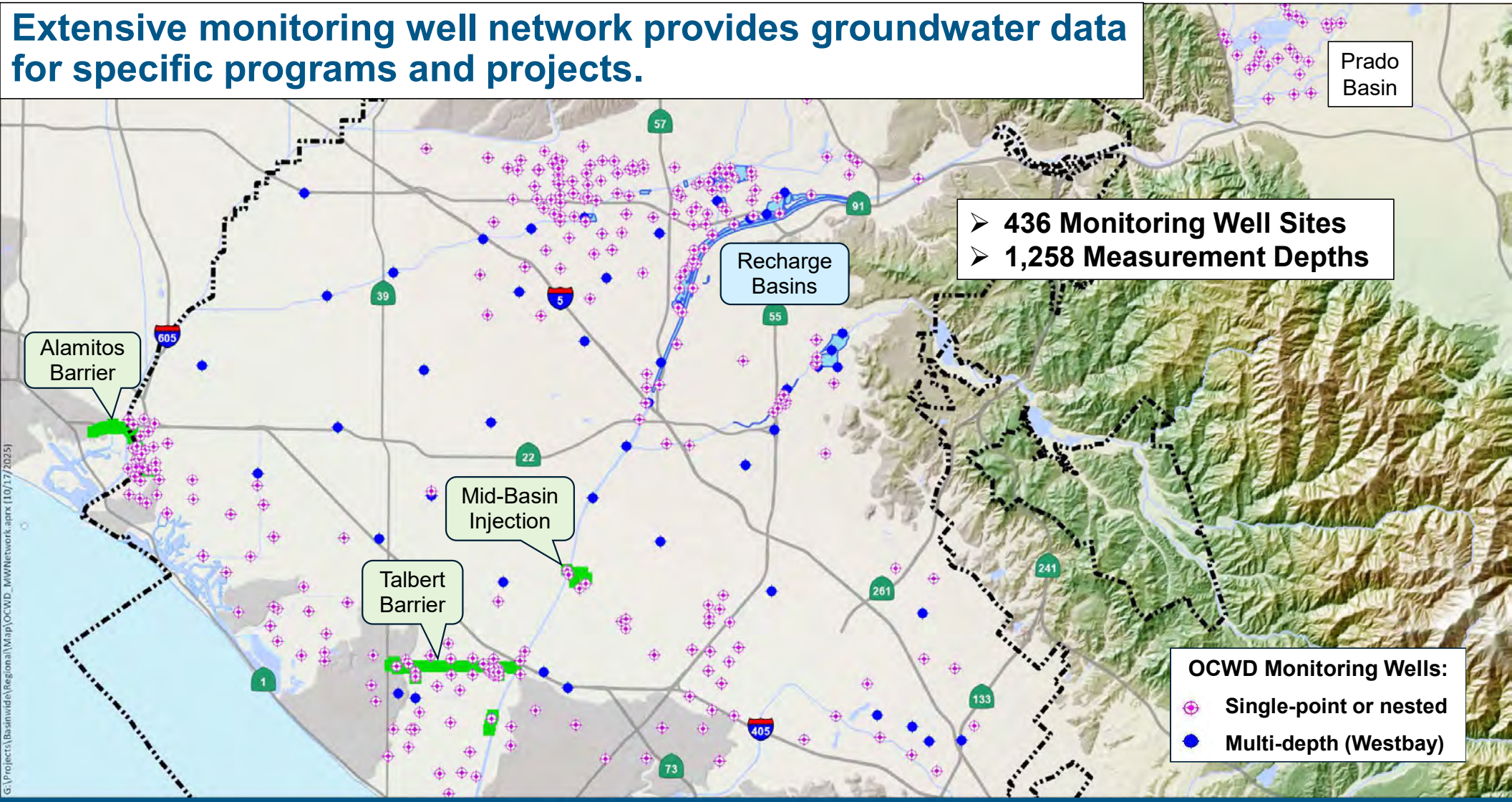
- Investigate seawater intrusion
- Delineate contaminant plumes
- GWRS compliance monitoring
- Estimate GW velocity (travel time)

52 multi-depth “Westbay” wells form the backbone of OCWD’s monitoring well network.

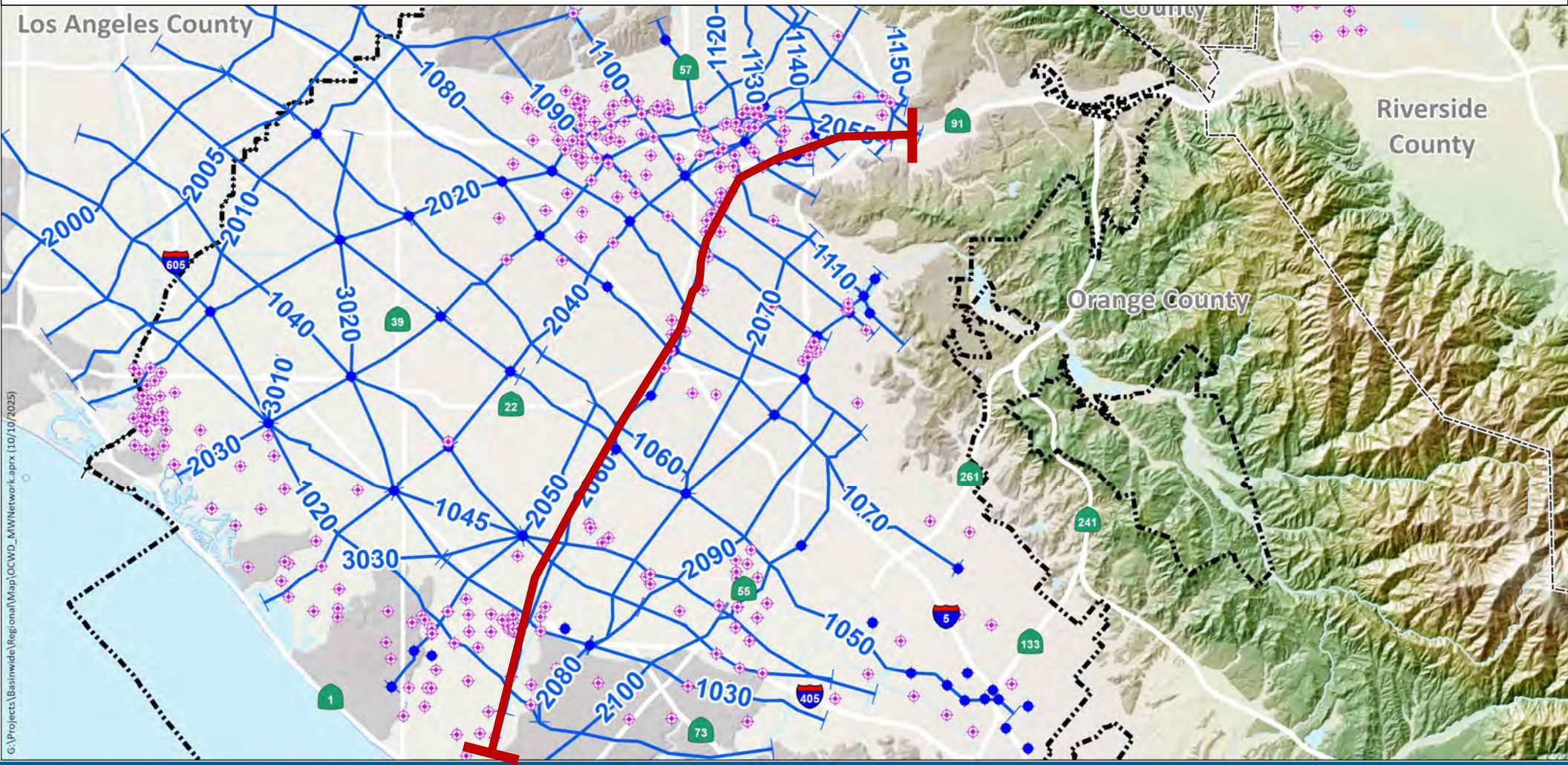
- Constructed 1988-93 (one well in 1997)
- Crucial for OCWD geologic cross-sections



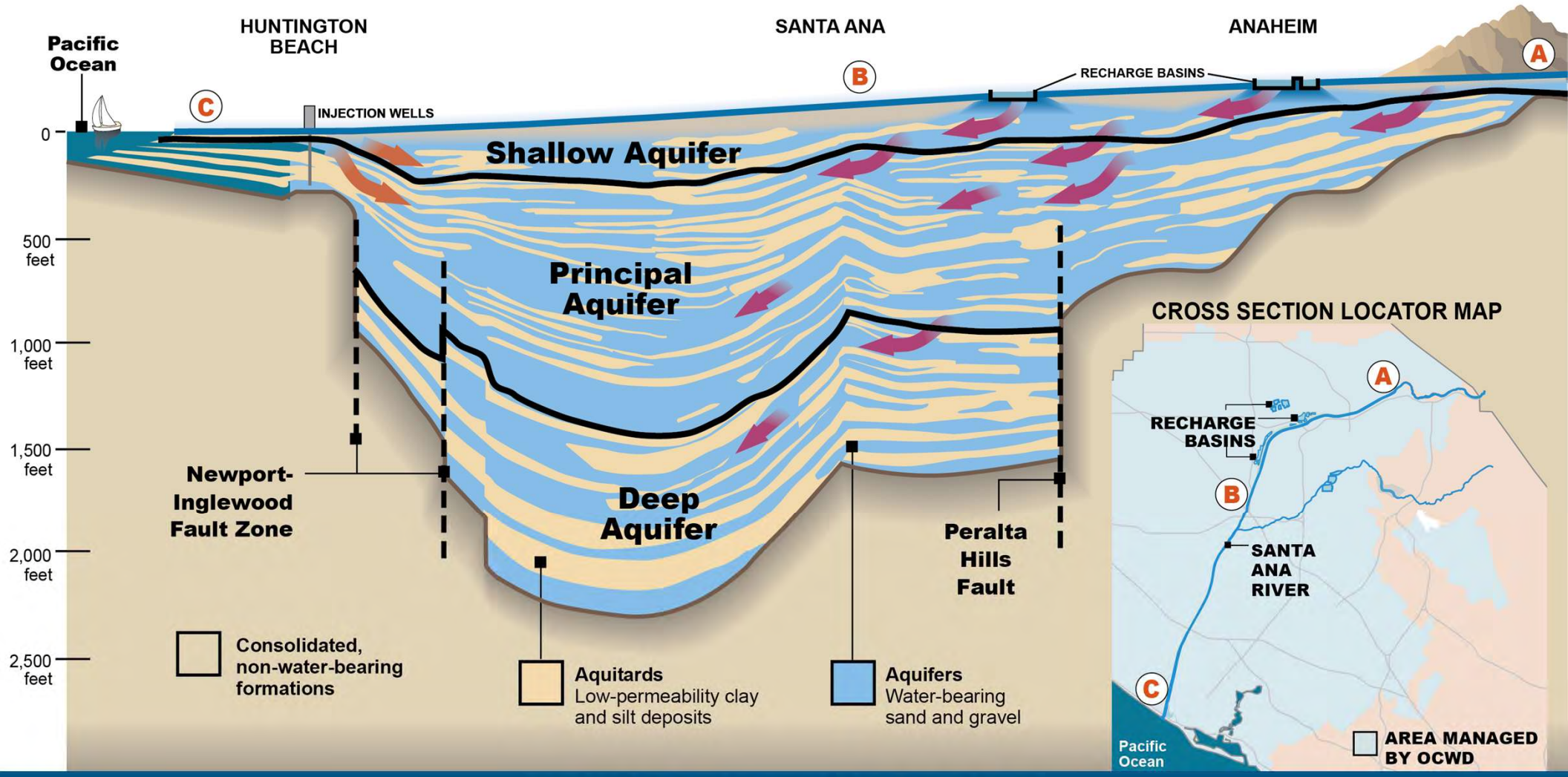
Extensive monitoring well network provides groundwater data for specific programs and projects.



OCWD developed over 30 geologic cross-sections defining the Basin's structure.

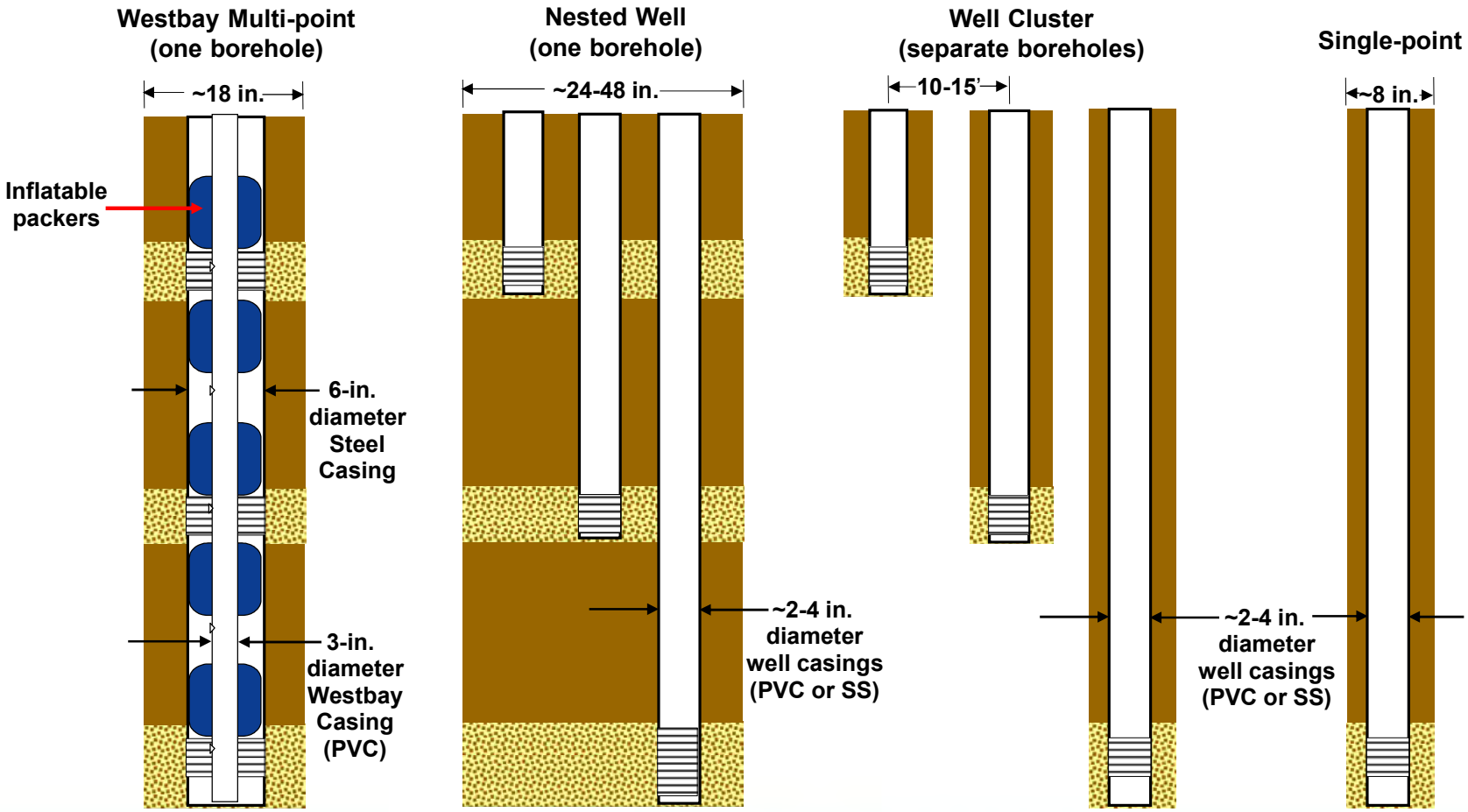


Basin grouped into three major aquifer systems. Over 90% of pumping from Principal aquifer.

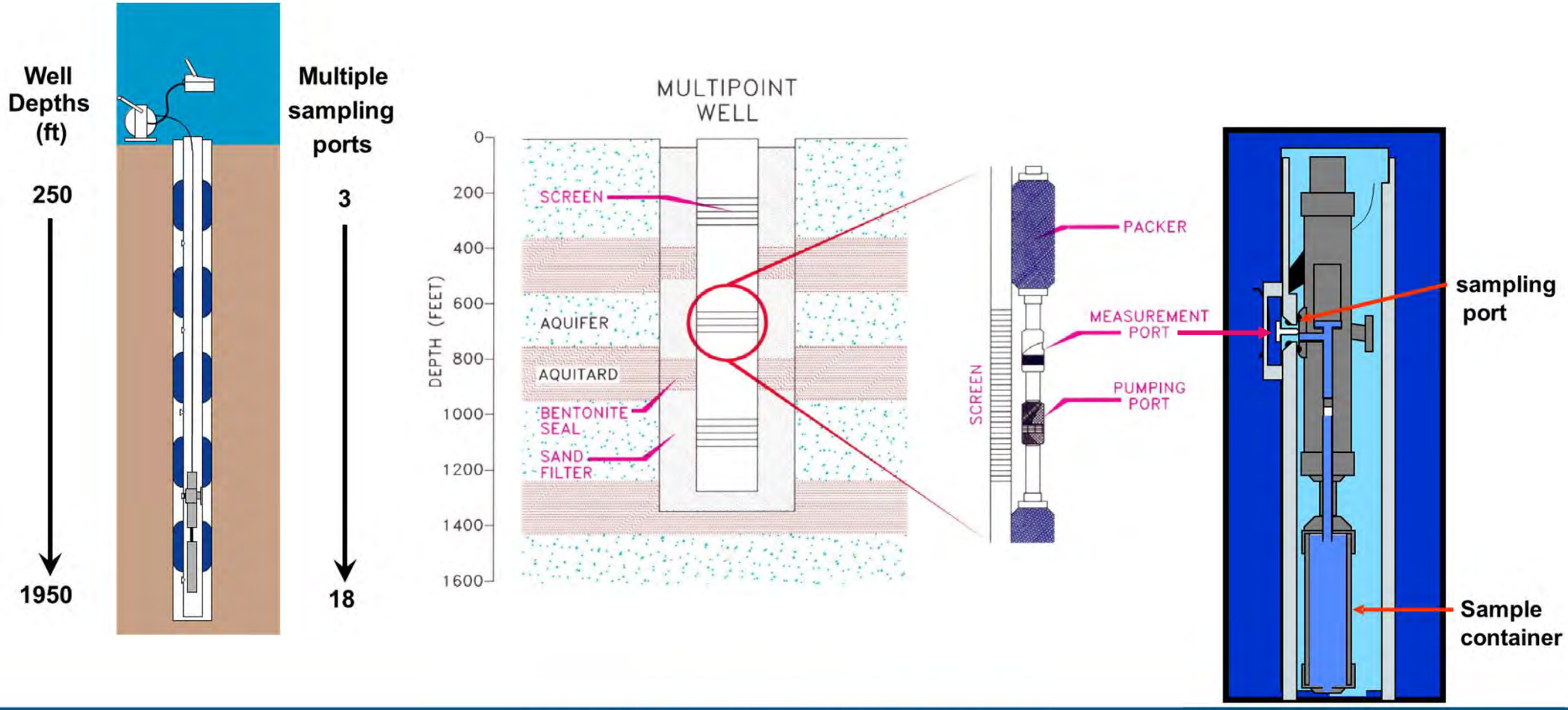


OCWD Monitoring Well Types

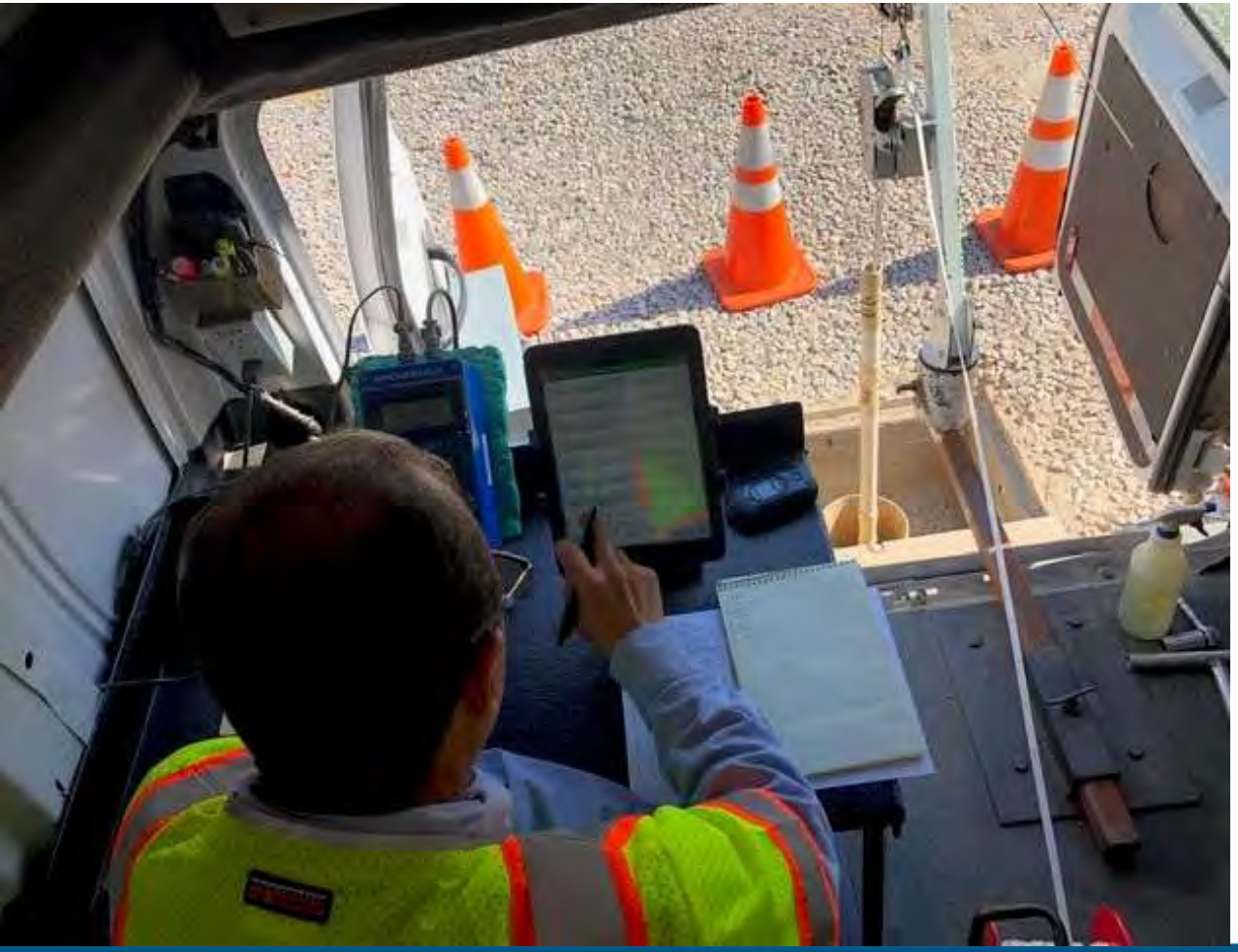
OCWD Monitoring Well Types



Westbay-type Multi-Depth Monitoring Well Details

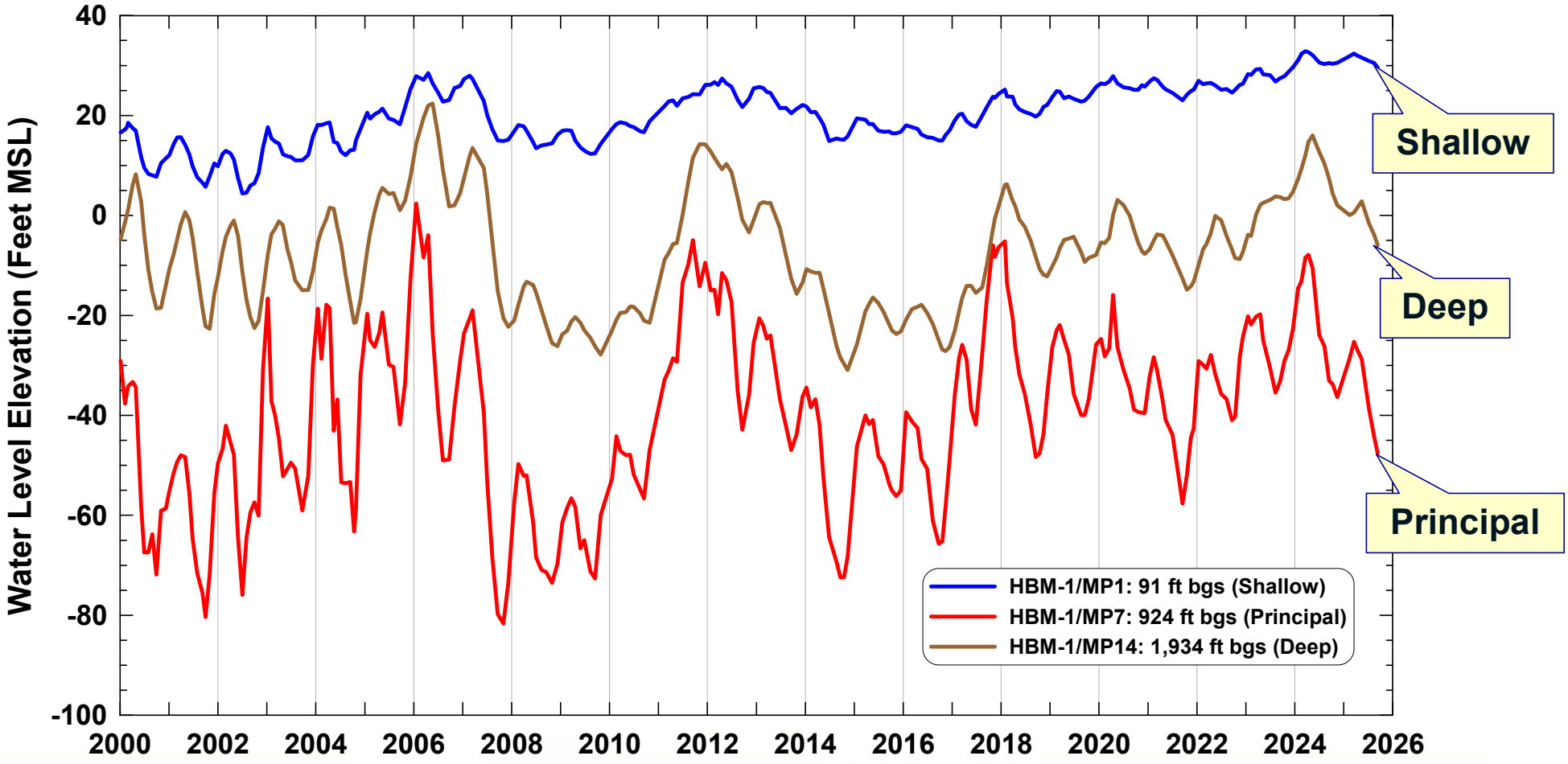


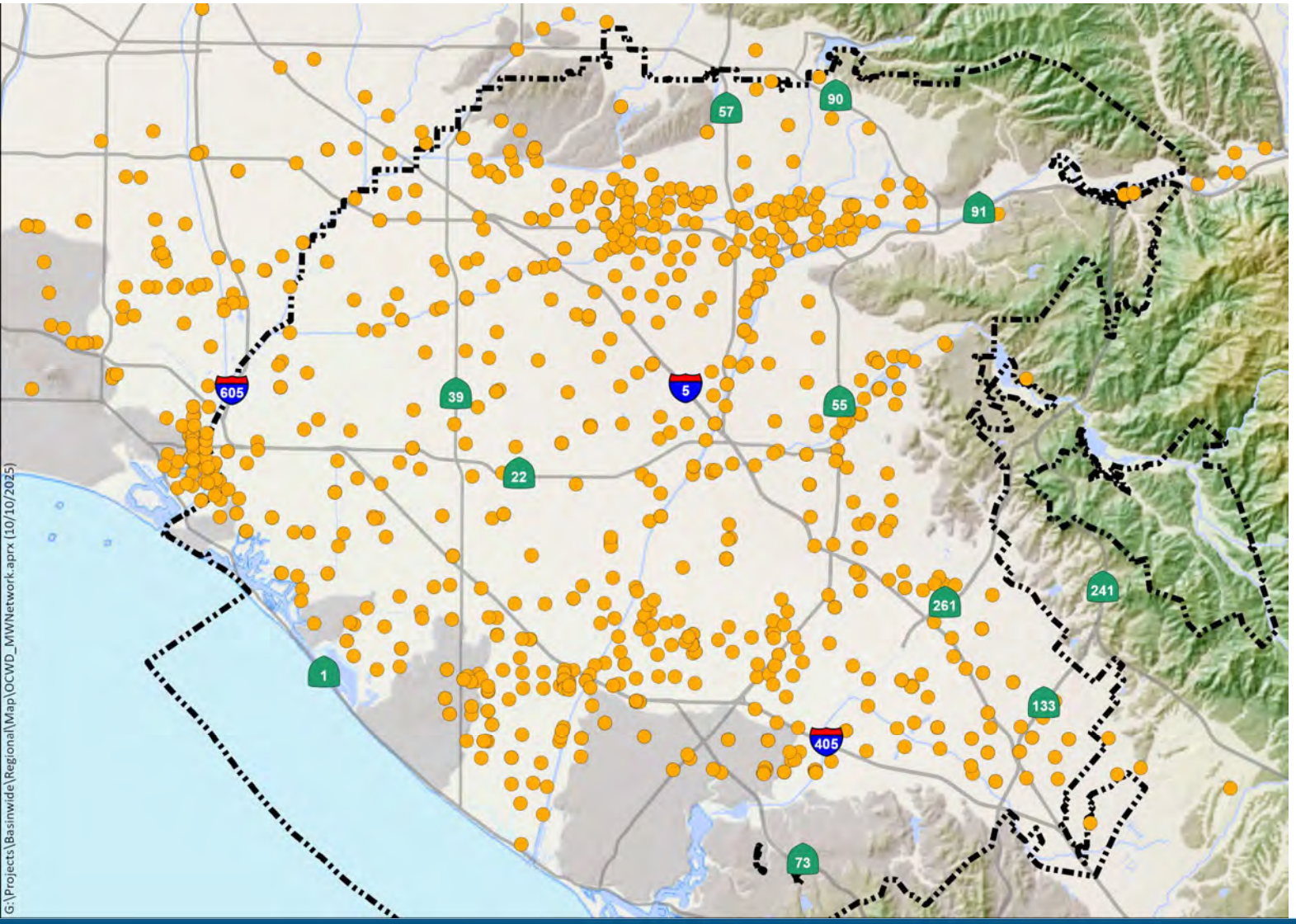
Westbay Van used to monitor water levels (“pressure profiles”)



How OCWD Uses Monitoring Well Data

Groundwater level hydrographs tell us about basin dynamics.

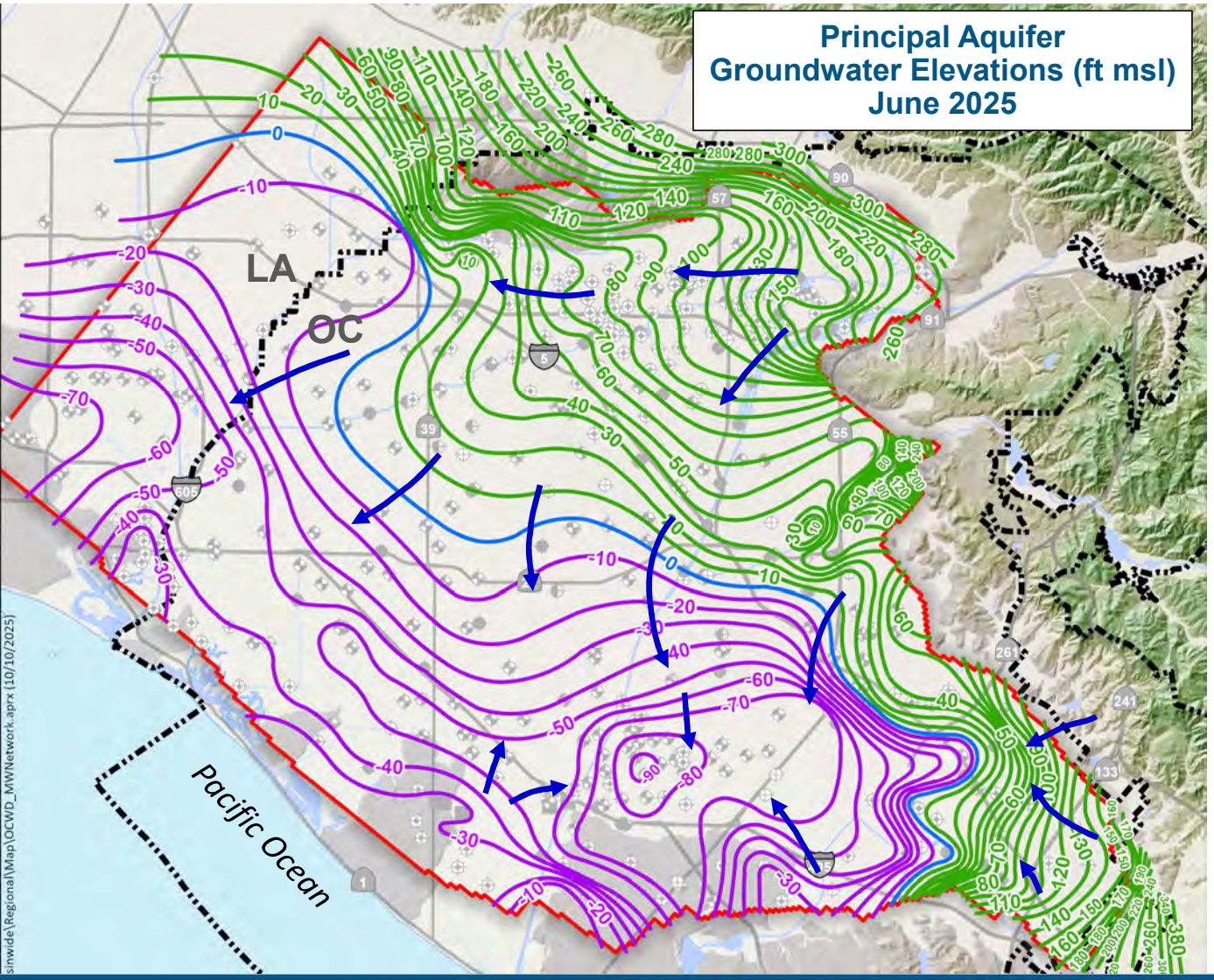




Several hundred water levels used for constructing groundwater contour maps…

Collaboratively measured near June 30:

- OCWD staff
- OC Producers
- LA Producers
- WRD



Groundwater elevation data contoured every year to assess storage conditions

Groundwater flows from inland Forebay towards the coast and LA County

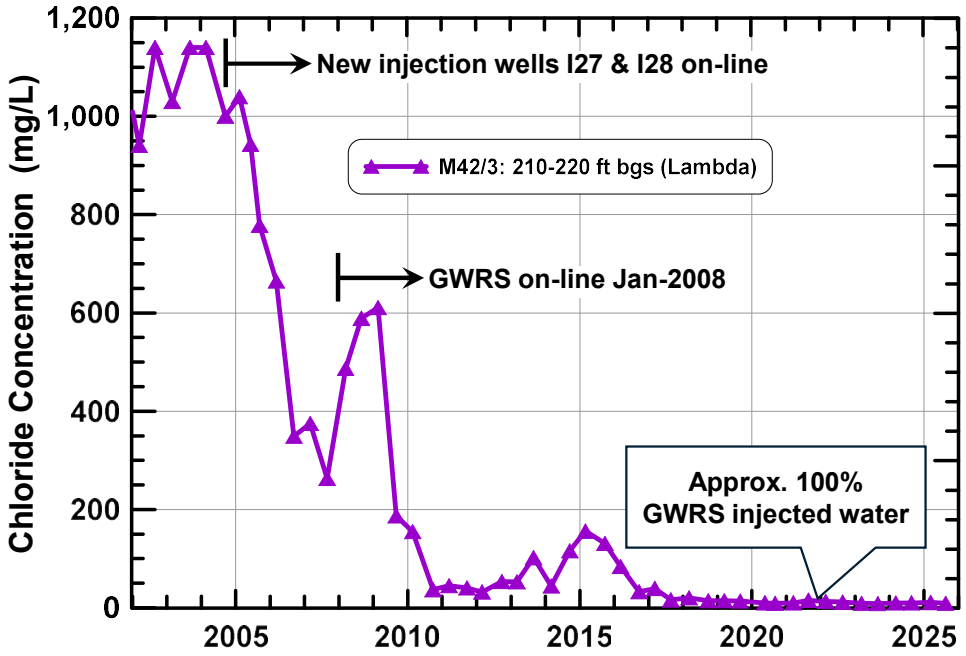
Steep hydraulic gradients and depressions below sea level due to pumping

Lowest point typically in the Santa Ana and Costa Mesa area due to more pumping.

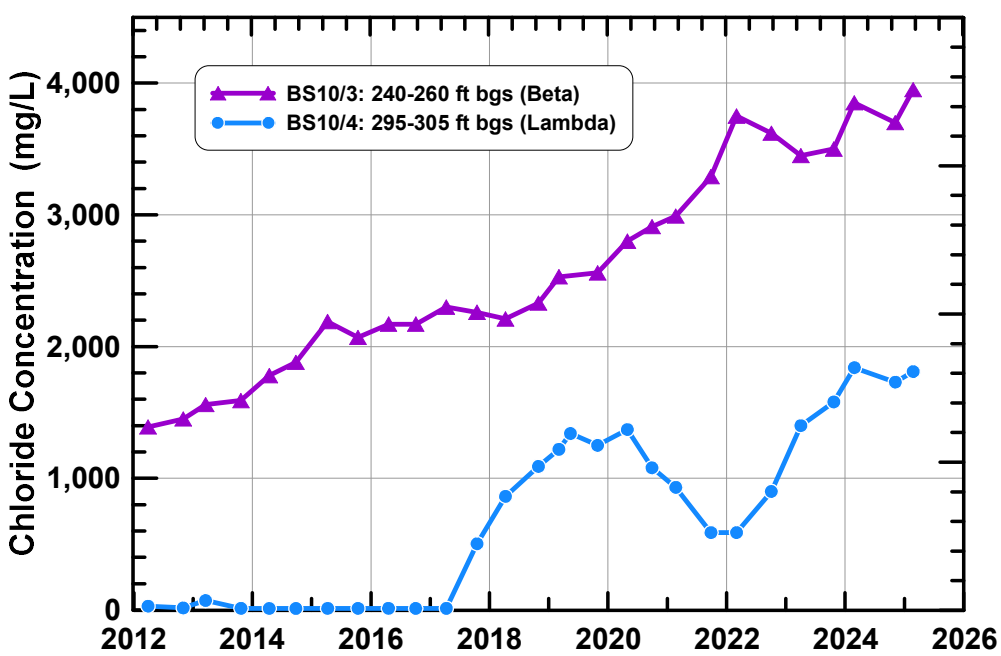
Chloride is a common water quality parameter for evaluating seawater intrusion and the extent of recharged GWRS purified recycled water.

Monitoring well example chloride time series graphs show various trends:

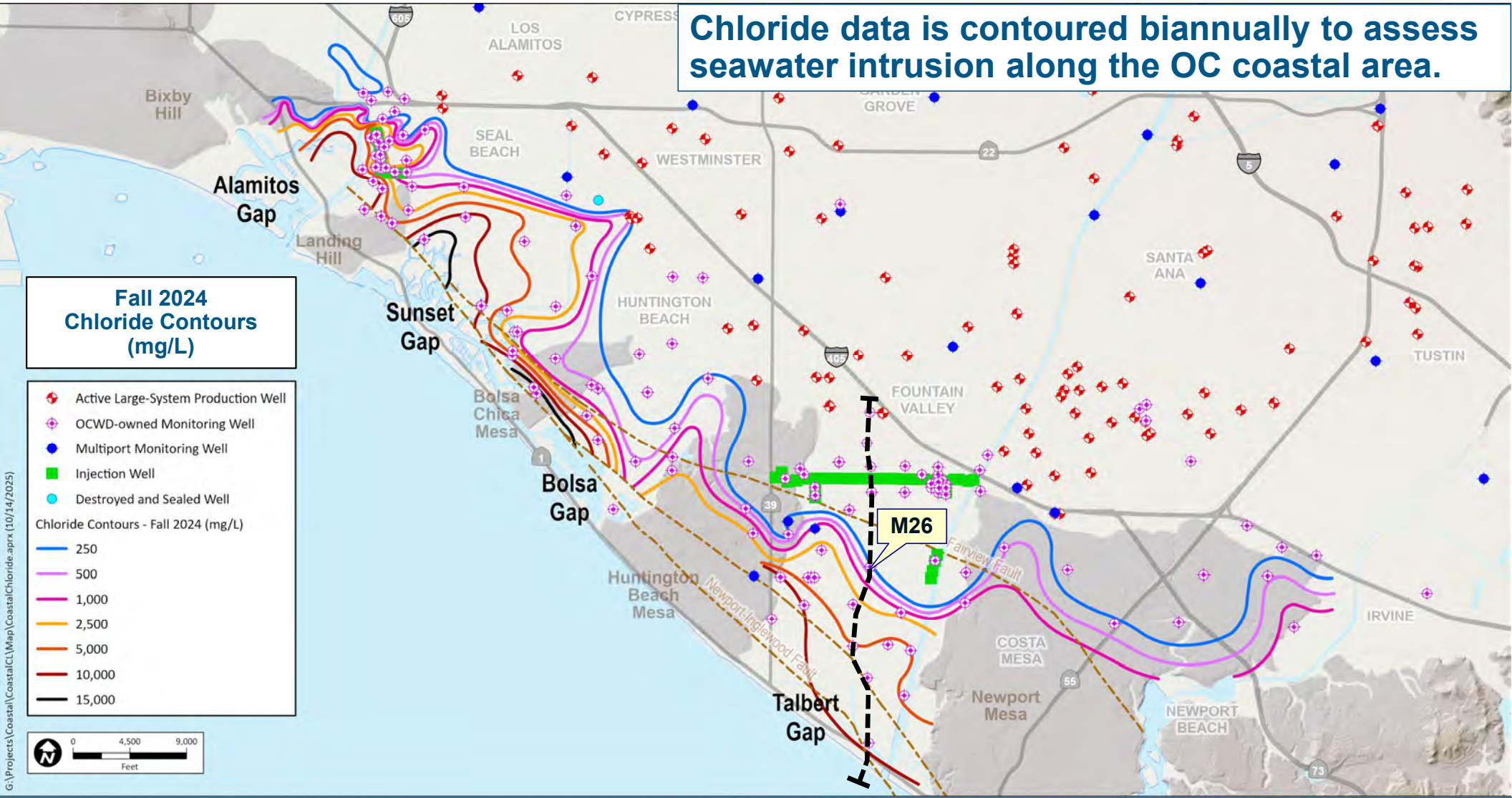
Talbert Gap
Intrusion alleviated due to injection barrier

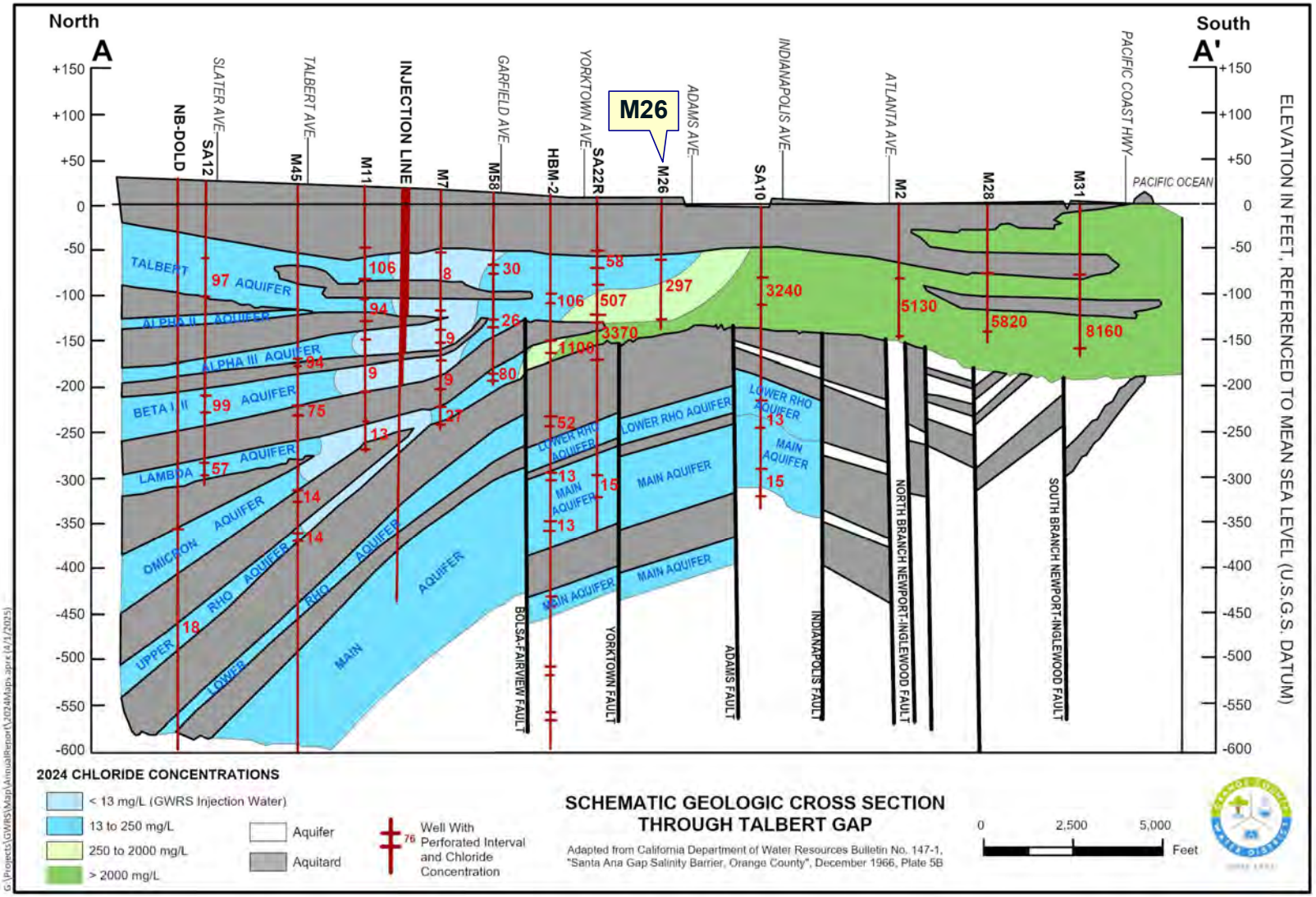


Sunset Gap
Intrusion gradually worsening; new barrier?



Chloride data is contoured biannually to assess seawater intrusion along the OC coastal area.



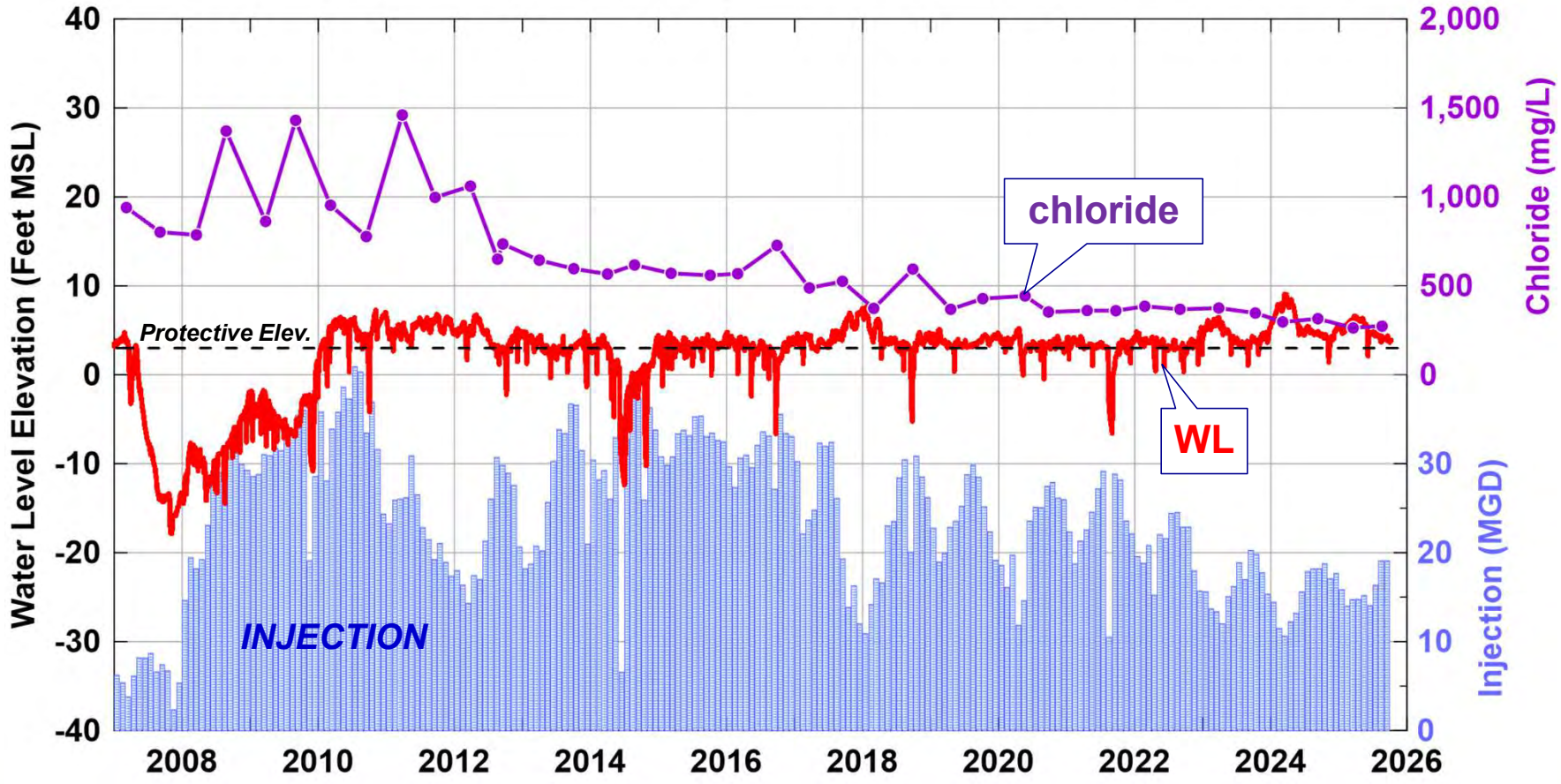


Schematic Geologic Cross-Section through Talbert Gap

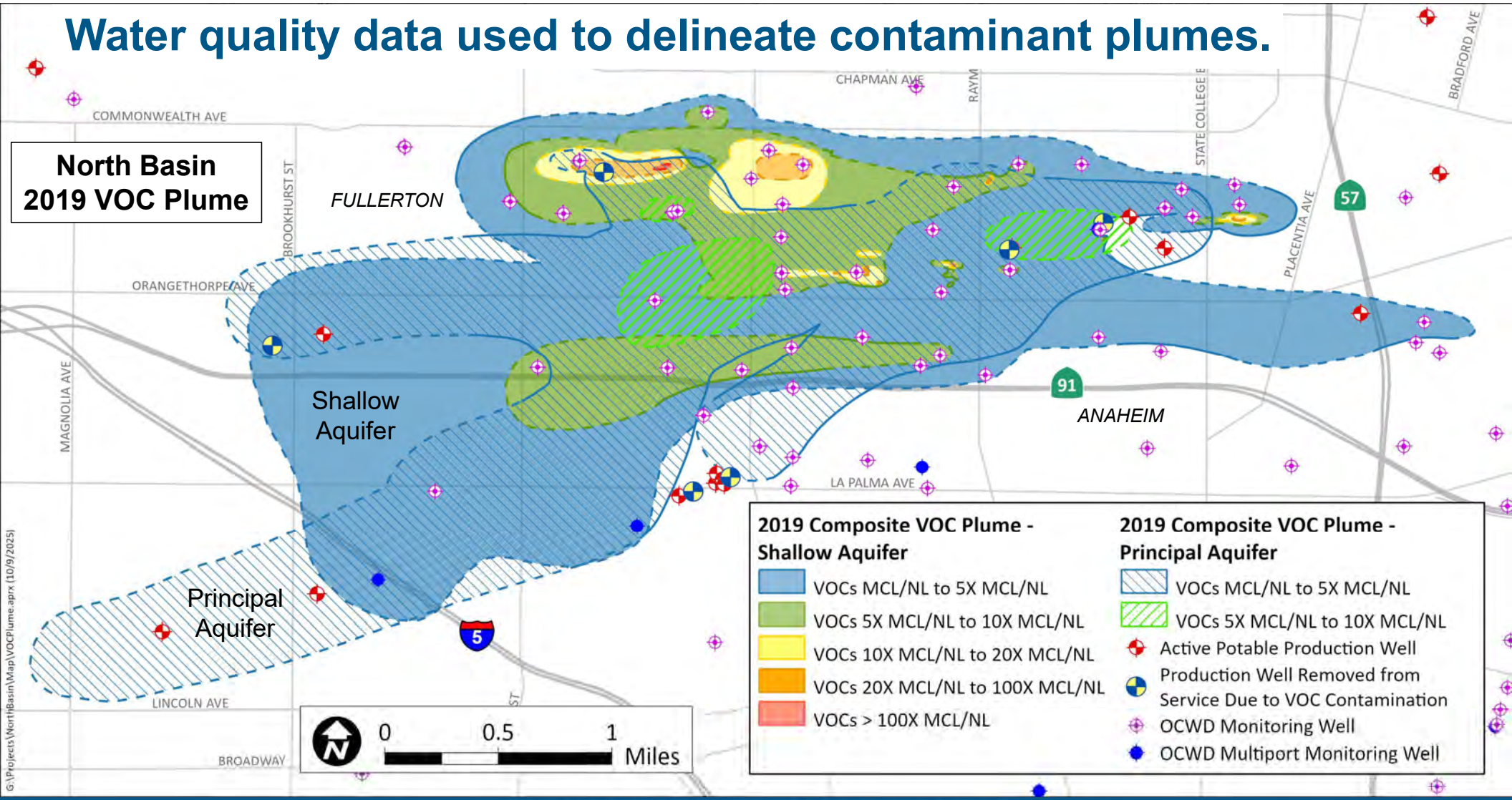
Depth-specific monitoring well chloride data used to define the vertical/lateral extent of:

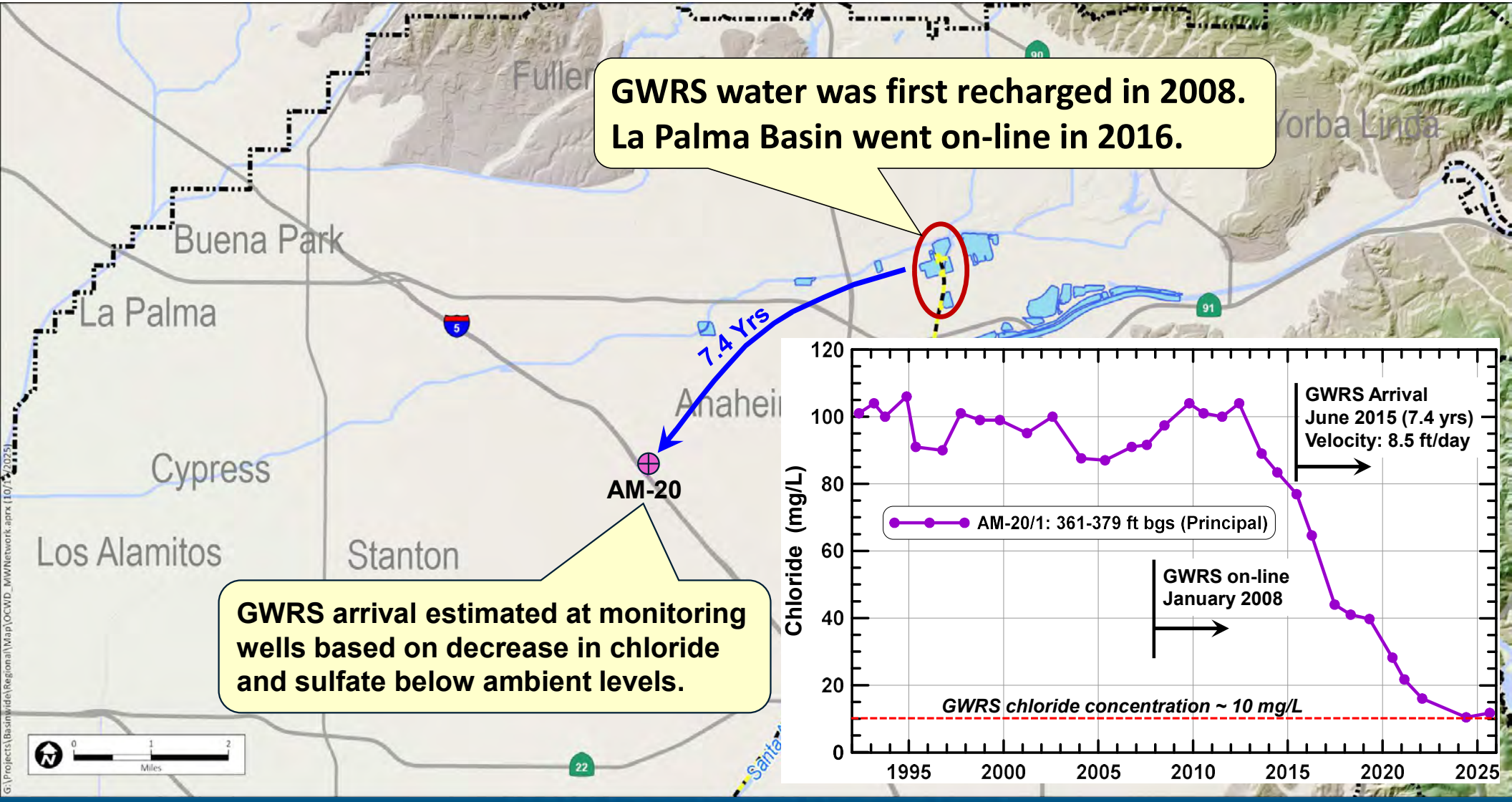
- Seawater intrusion
- GWRS water injected at Talbert Barrier
- Rate of annual GW movement

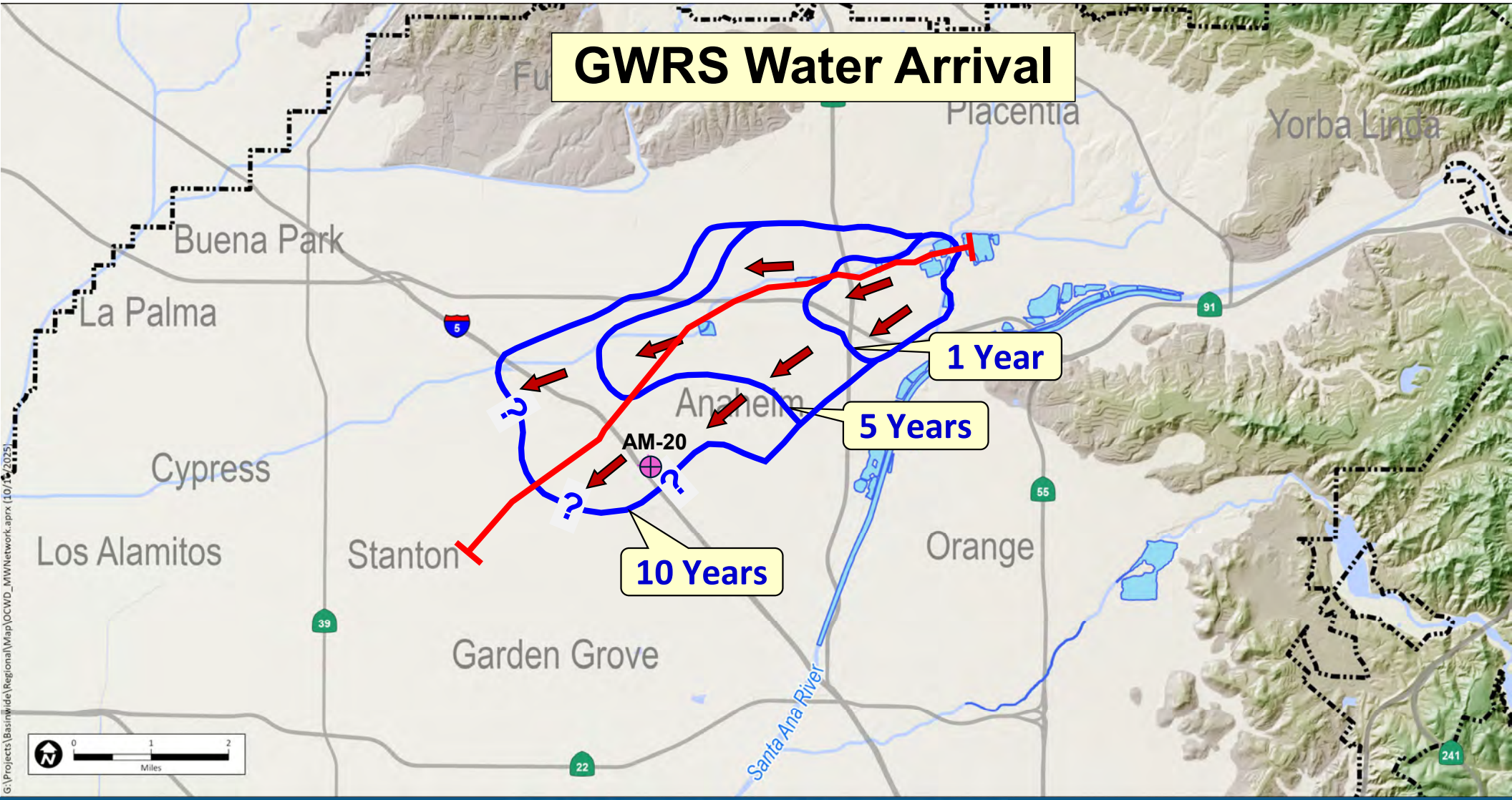
At key well M26, water level and chloride data help us maintain protective elevations at the Talbert Barrier and push back seawater intrusion.



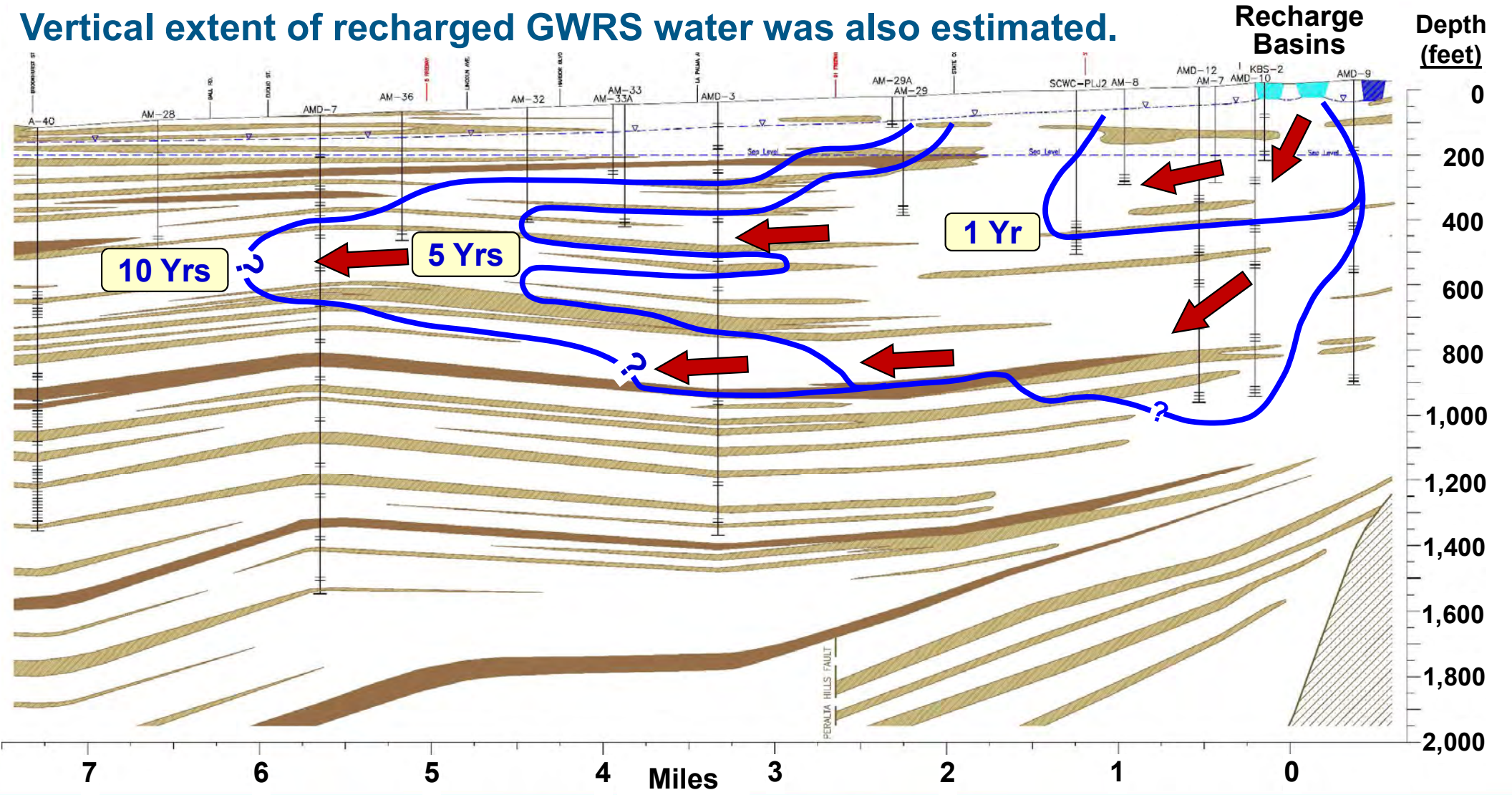
Water quality data used to delineate contaminant plumes.



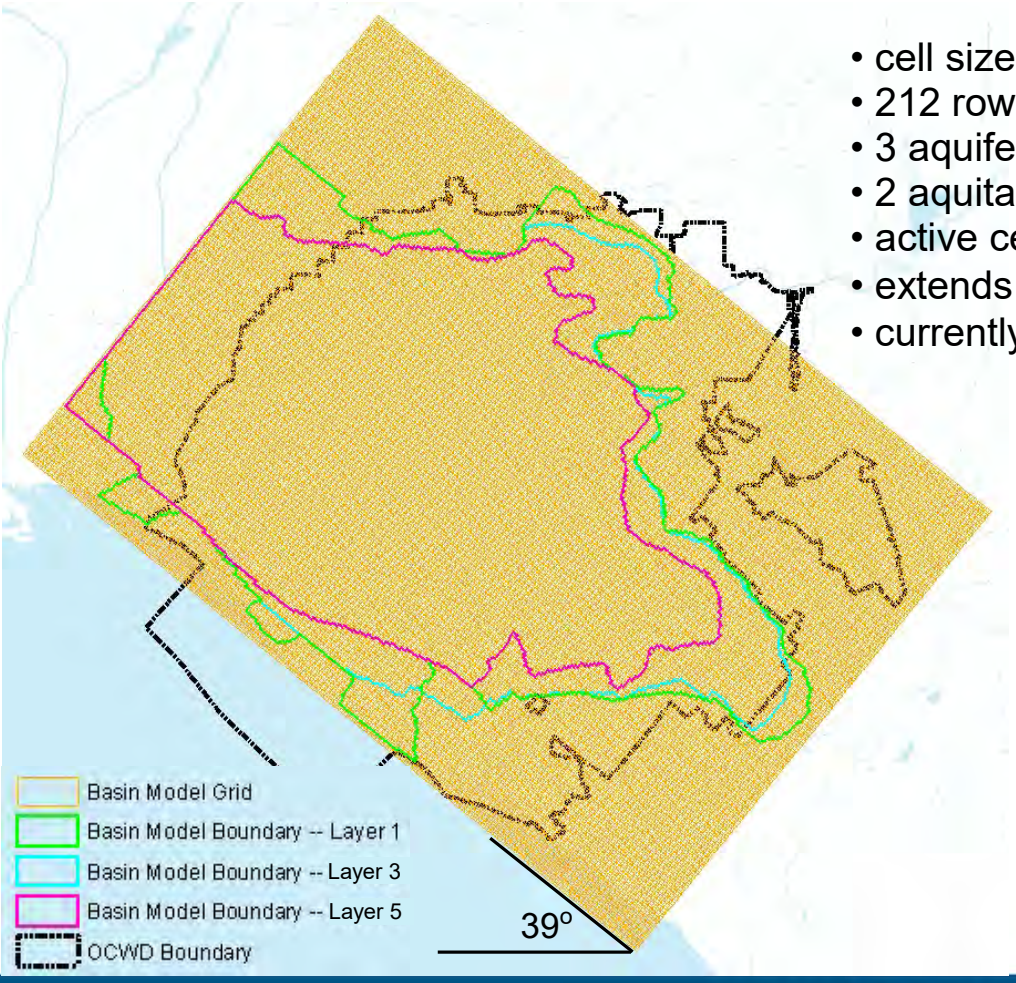

GWRS water was first recharged in 2008.
La Palma Basin went on-line in 2016.
Buena Park
La Palma
Cypress
Los Alamitos
Stanton
Yorba Linda
7.4 Yrs
AM-20
GWRS arrival estimated at monitoring wells based on decrease in chloride and sulfate below ambient levels.
Chloride (mg/L)
120
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
GWRS Arrival
June 2015 (7.4 yrs)
Velocity: 8.5 ft/day
AM-20/1: 361-379 ft bgs (Principal)
GWRS on-line
January 2008
GWRS chloride concentration ~ 10 mg/L
Miles


GWRS Water Arrival
Placentia
Yorba Linda
Buena Park
La Palma
Cypress
Los Alamitos
Stanton
Anaheim
Orange
Garden Grove
Santa Ana River
1 Year
5 Years
10 Years
AM-20
5
91
55
39
22
241
0
1
2
Miles
G:\Projects\Basinwide\Regional\Map\OCWD_MWNetwork.aprx (10/

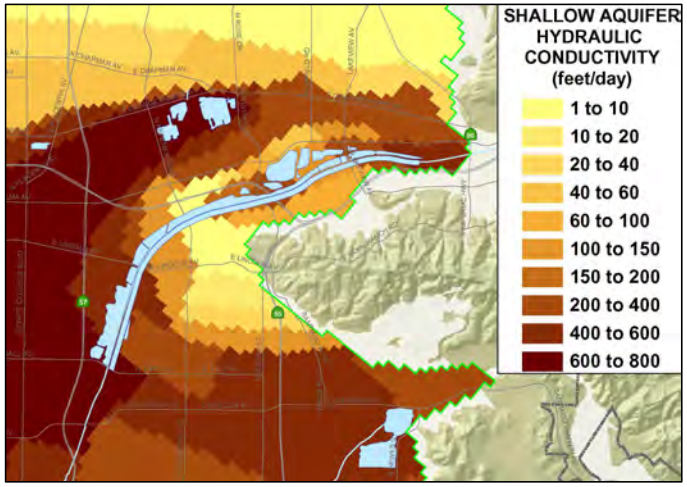
Vertical extent of recharged GWRS water was also estimated.

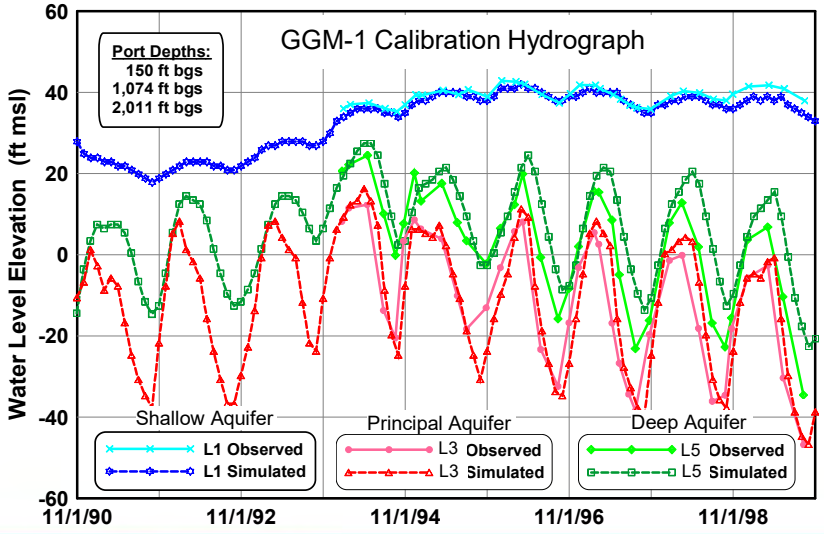


Wealth of monitoring well data enabled us to develop and calibrate a basin-wide numerical groundwater flow model ~ 25 years ago.



- cell size: 500’ x 500’
- 212 rows x 296 columns
- 3 aquifer layers
- 2 aquitard layers
- active cells: ~90,000
- extends 3 miles into LA
- currently being updated

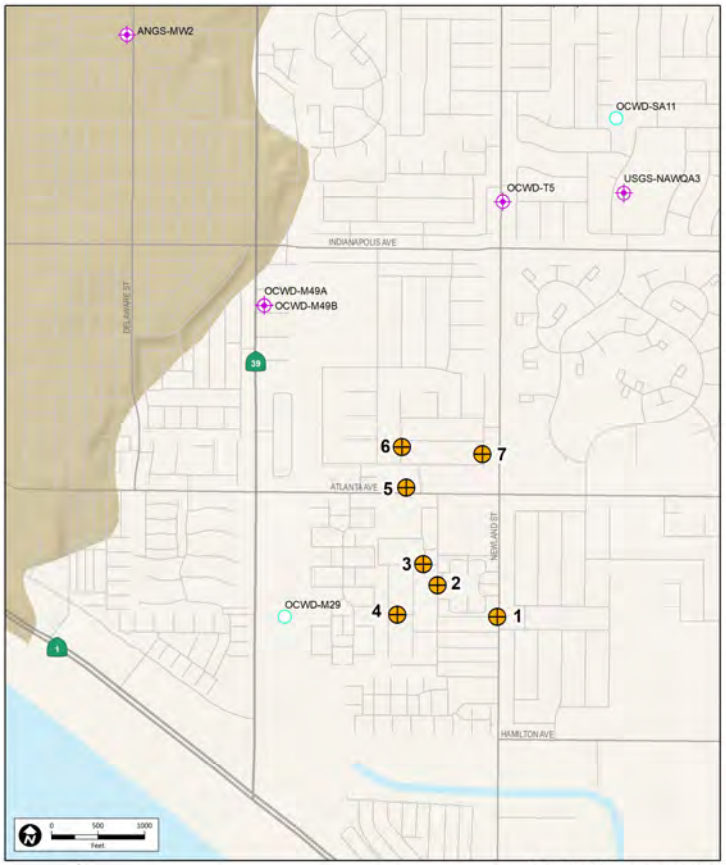




Monitoring Well Construction

- Siting and Logistics
- Drilling Methods
  - Auger
  - Sonic
  - Rotary
- Downhole Logging
- Design & Installation
- Costs & Life Expectancy

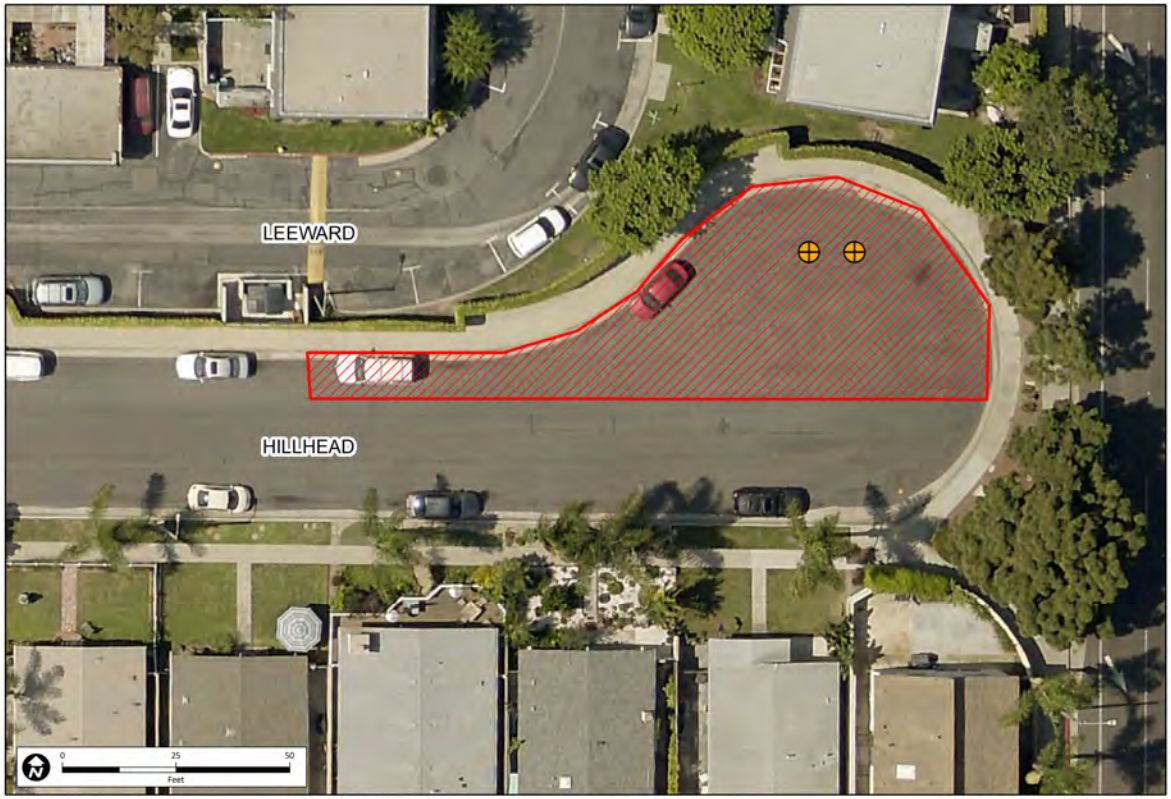
Siting & Logistics



OCWD-M29 Replacement Well
Potential Locations

Figure 1

SOURCE: OCWD (11/2023)



OCWD-M29 Monitoring Well Cluster
Proposed Locations & Construction Area

Figure 2

SOURCE: OCWD (11/2023)

Drilling Method 1 of 3:

Auger

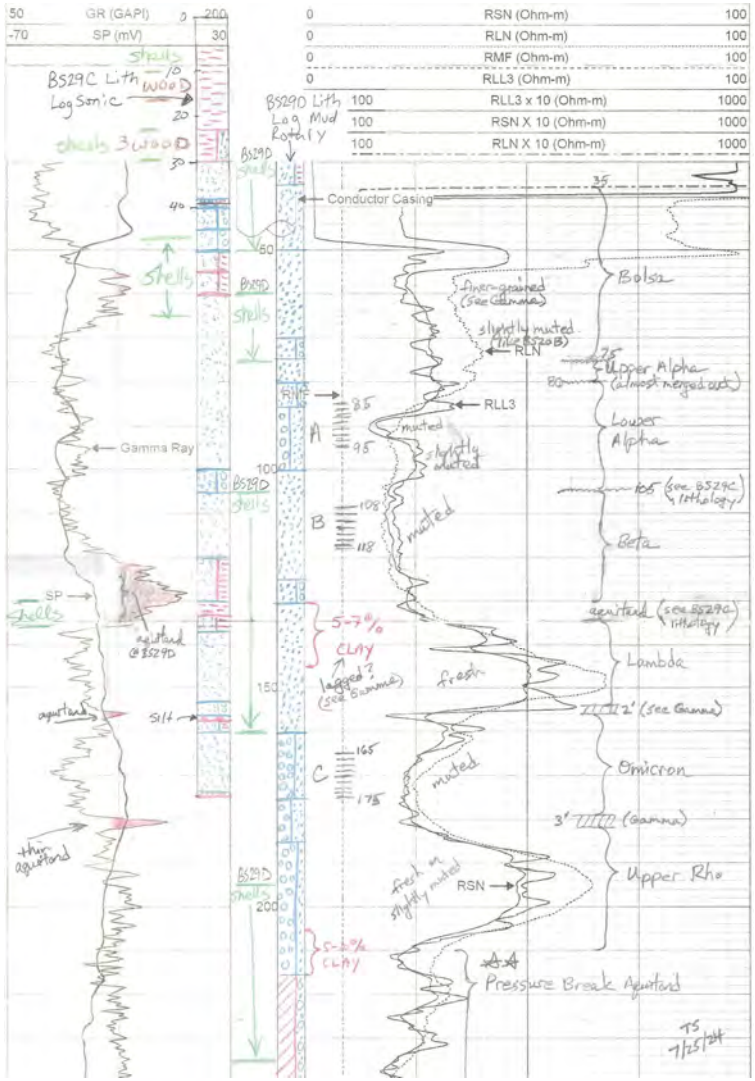
Drilling Method 2 of 3:

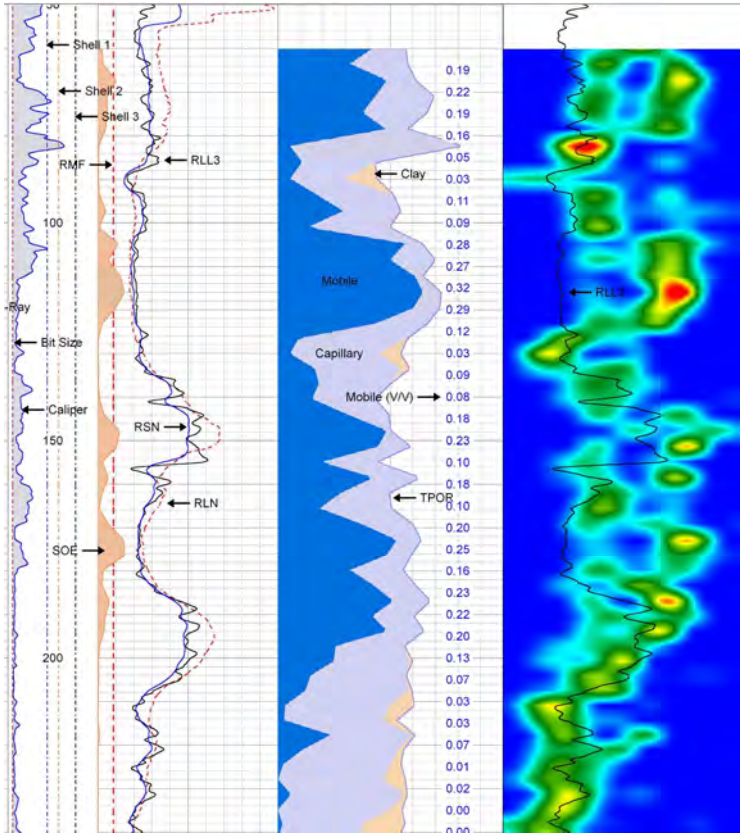
Sonic

Drilling Method 3 of 3:

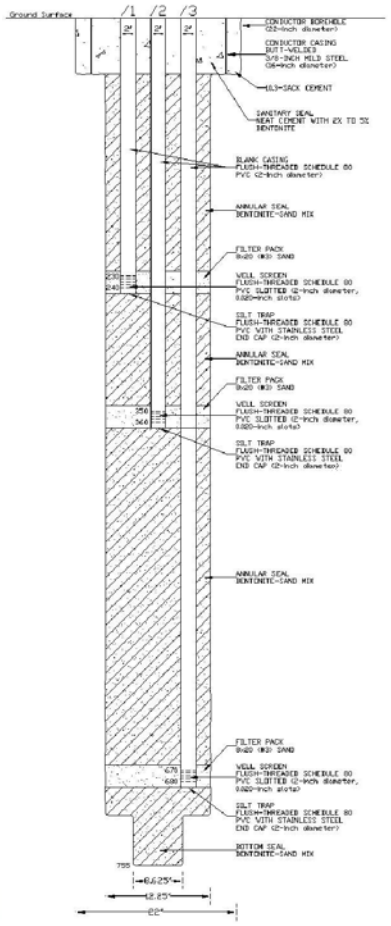
Rotary

Downhole Logging





Design & Installation



Costs & Life Expectancy

- Costs range from $30K to $800K
- Life Expectancy is 40+ years

Thank You

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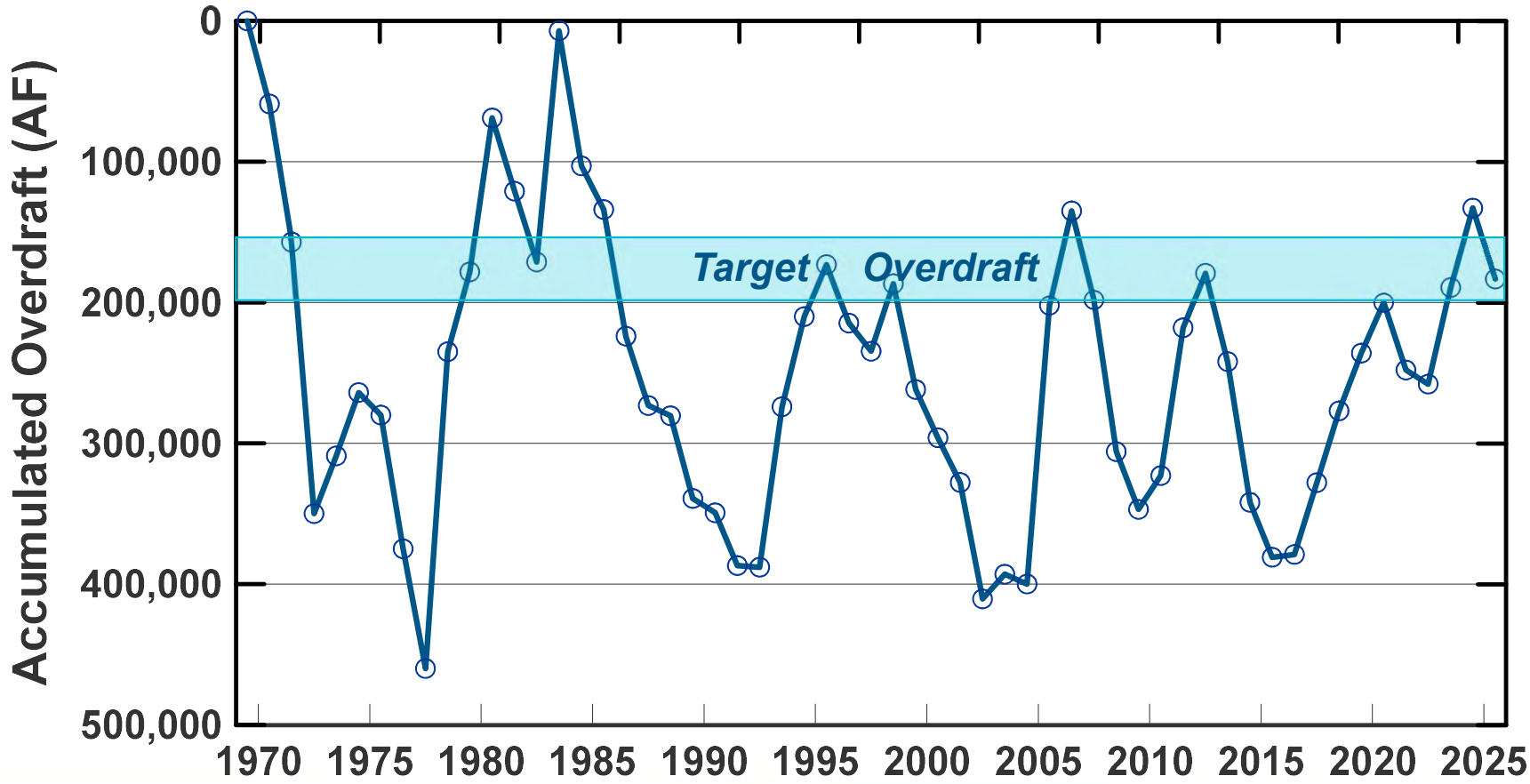
Orange County Water District
rherndon@ocwd.com

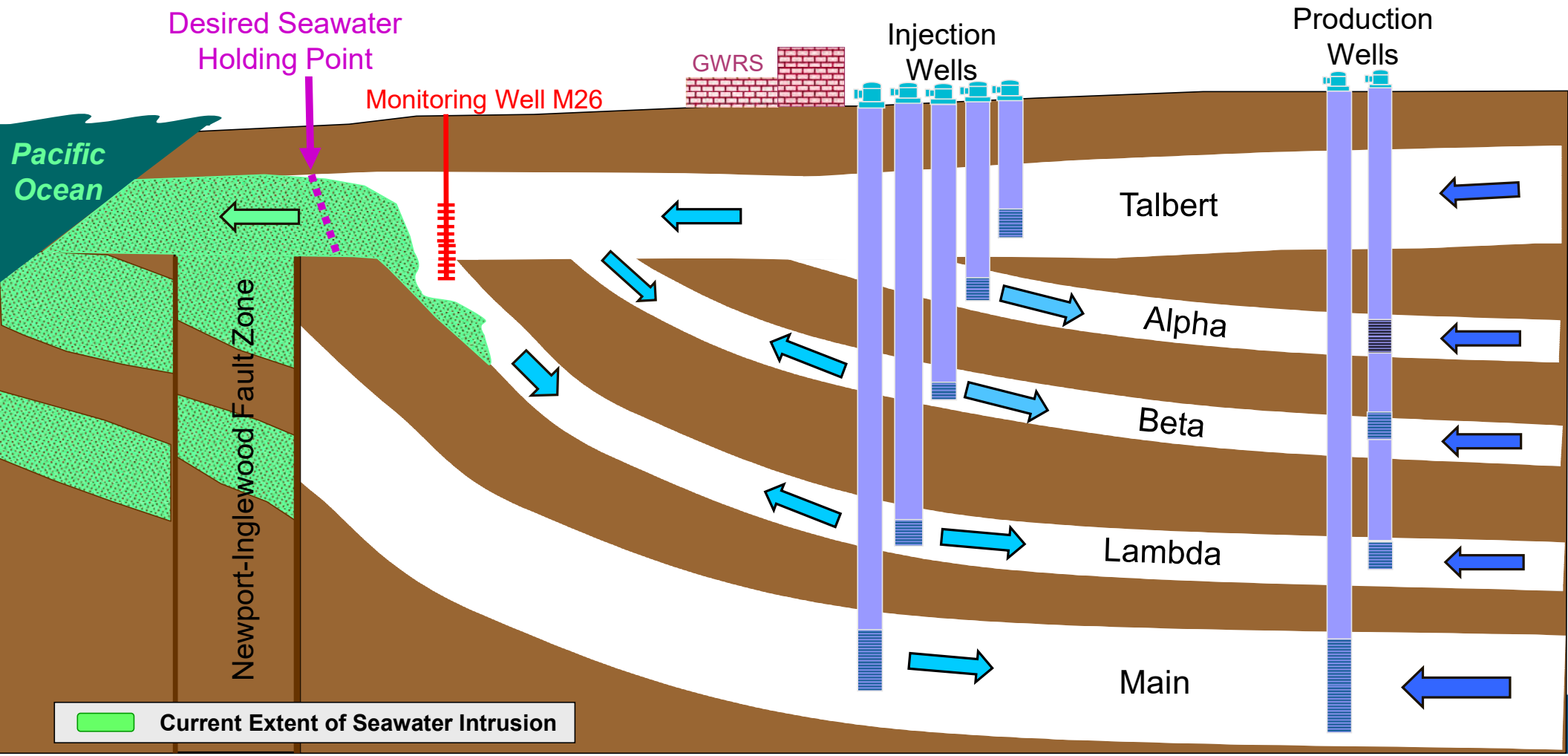
Questions?

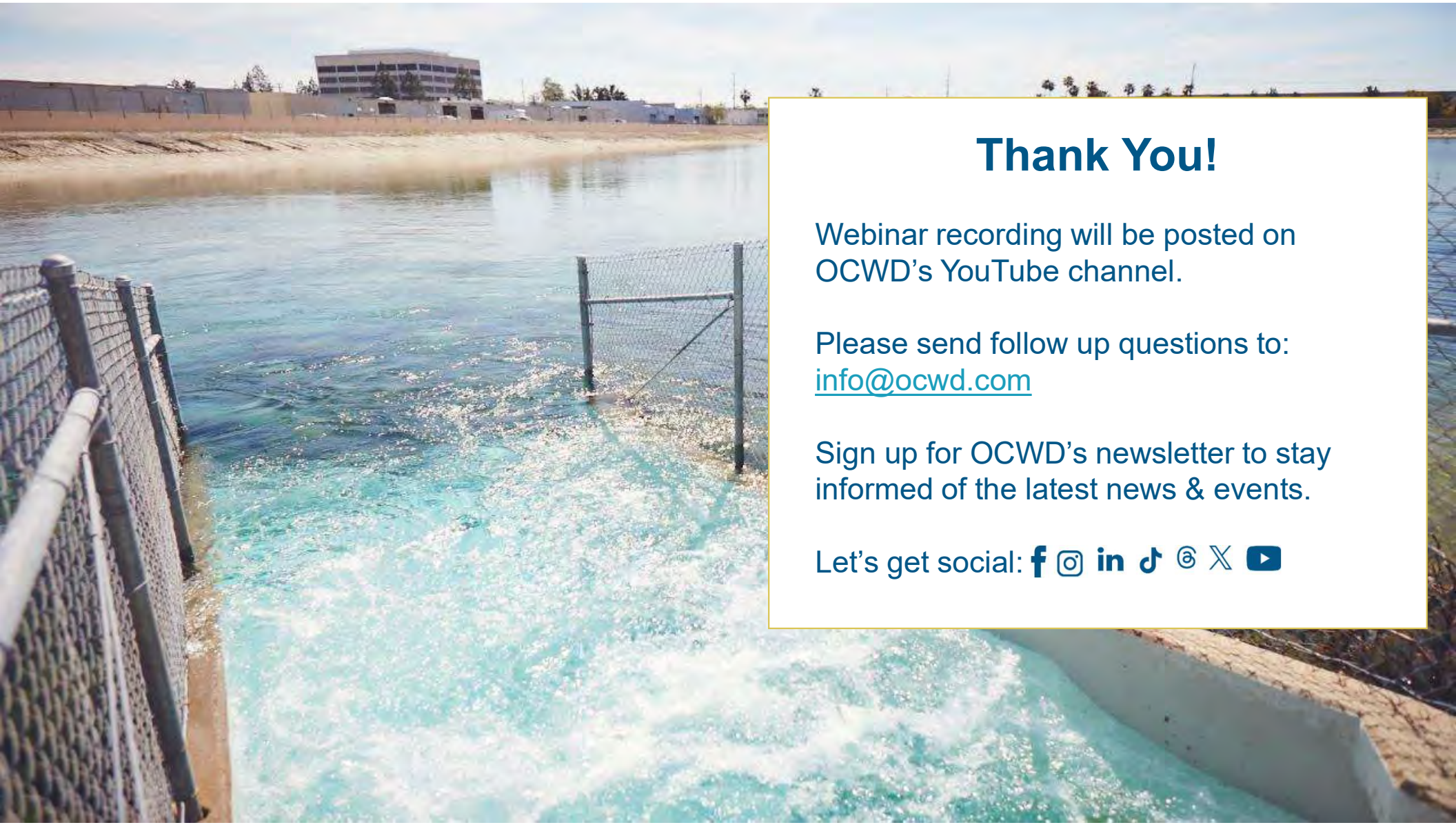
Use the Q&A box to submit your question

Since 1969, Basin has been sustainably managed within a 500,000 AF operating range.



Intrusion can enter the shallow Talbert aquifer and then flow into deeper aquifers via mergence zones.





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