ORANGE COUNTY WATER DISTRICT

Sustainable Management Criteria and GSP Preparation

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DWR/GRA
GSP Preparation Workshop
June 5, 2018

SINCE 1933

Where are we going?

- Hydrogeologic setting
- Evolution of groundwater management and management tools
- “Alternative to GSP” for Basin 8-1

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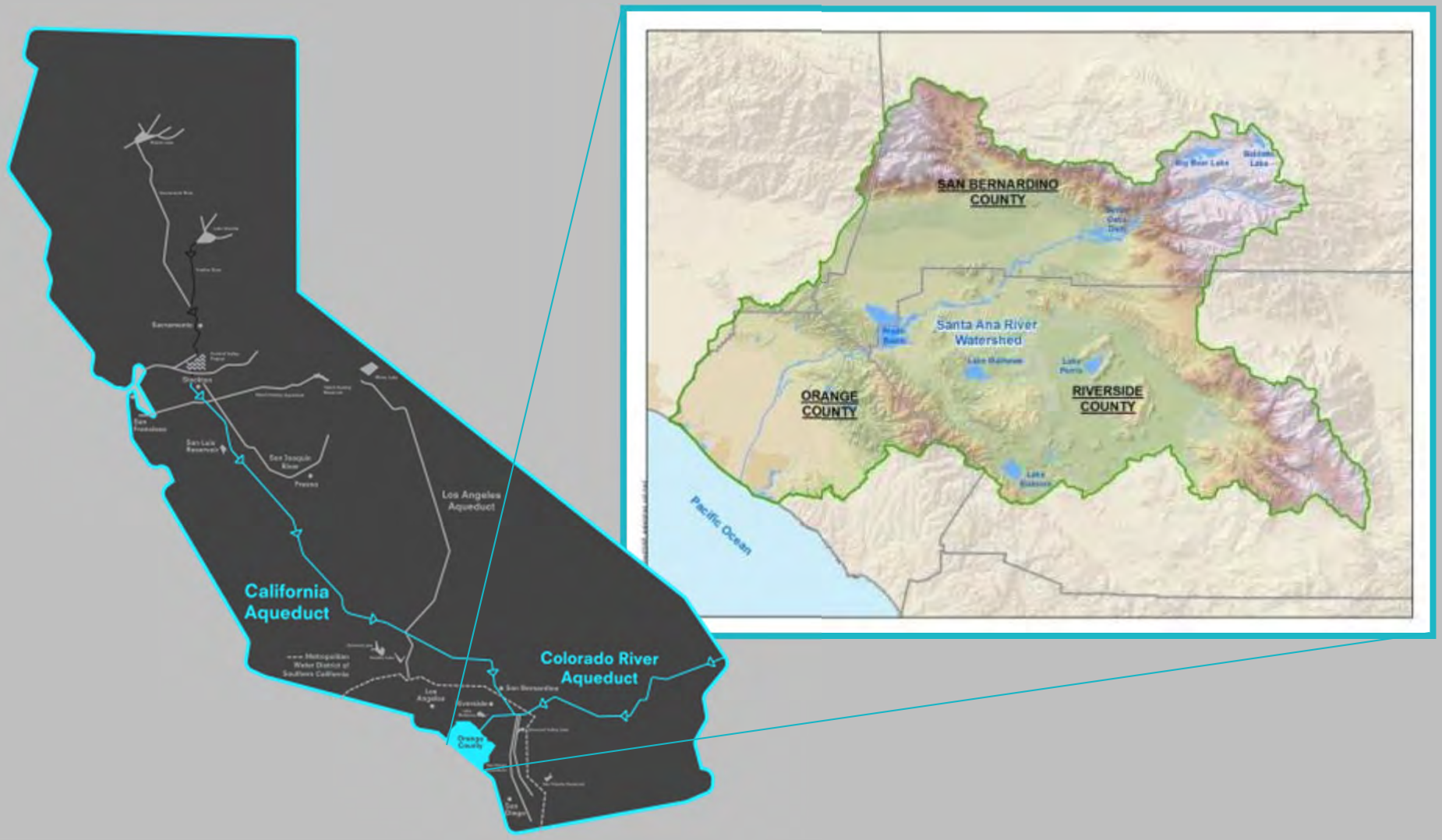
The Orange County groundwater basin lies at the base of the Santa Ana River watershed.



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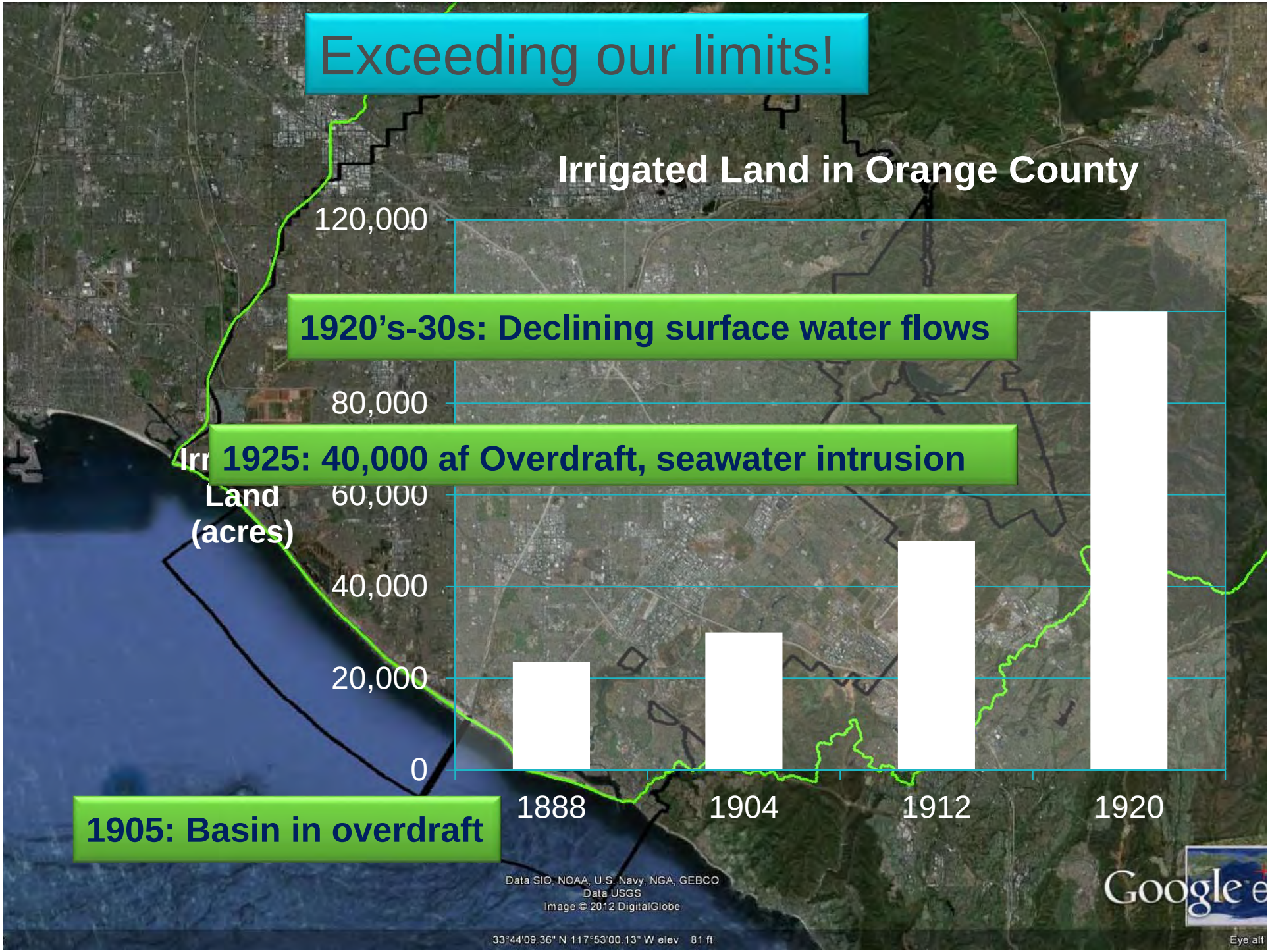
The Orange County Water District was formed by the State in 1933 to protect and manage Orange County's groundwater supplies.

First Board of Directors

Why?

- **Declining flow of Santa Ana River**
- **Basin overdraft**
- **Seawater intrusion**
- **Attempts by LA County to obtain water rights in Orange County**

Exceeding our limits!



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In the 1930s, there were multiple "undesirable results" in Orange County.

Lowering GW Levels

Yes

Degraded Quality

Shallow aquifer impacted by agricultural activity

Reduction of Storage

Basin in overdraft in 1905

Land Subsidence

No data

Seawater Intrusion

Noticed in 1925

Surface Water Depletion

No data

1930 Population: Approximately 120,000

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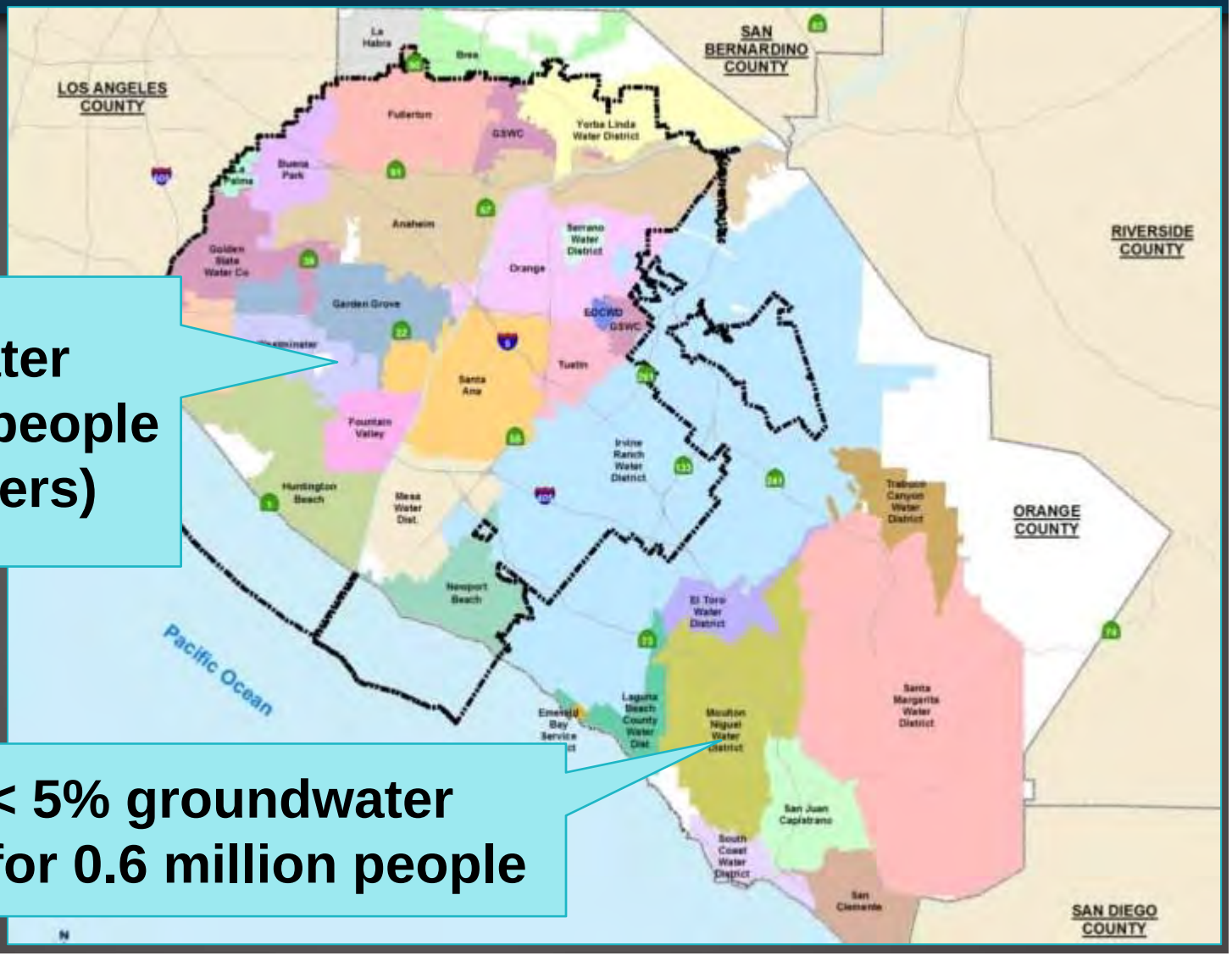
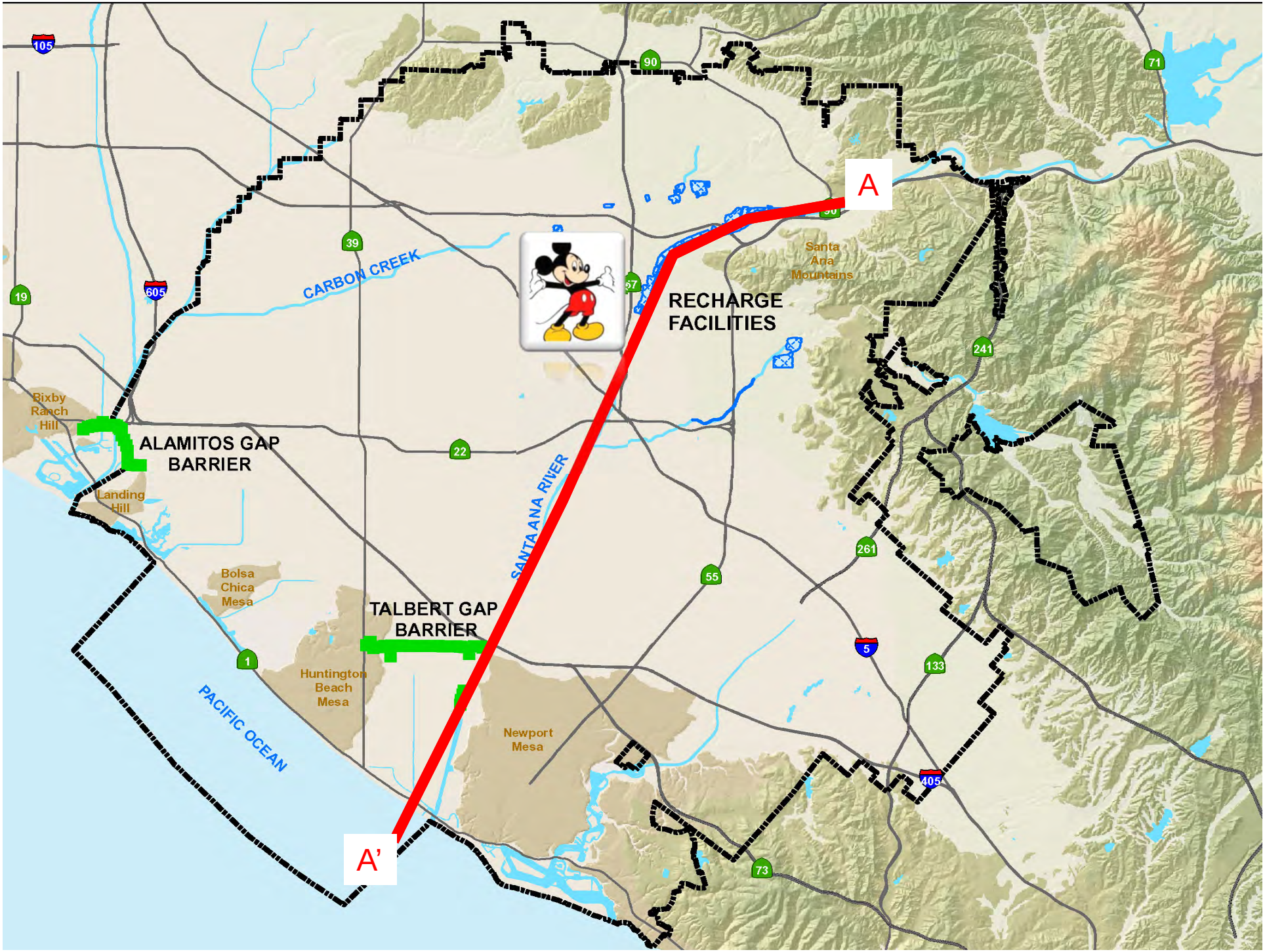
OCWD overlies the groundwater basin in the north and central portion of Orange County.

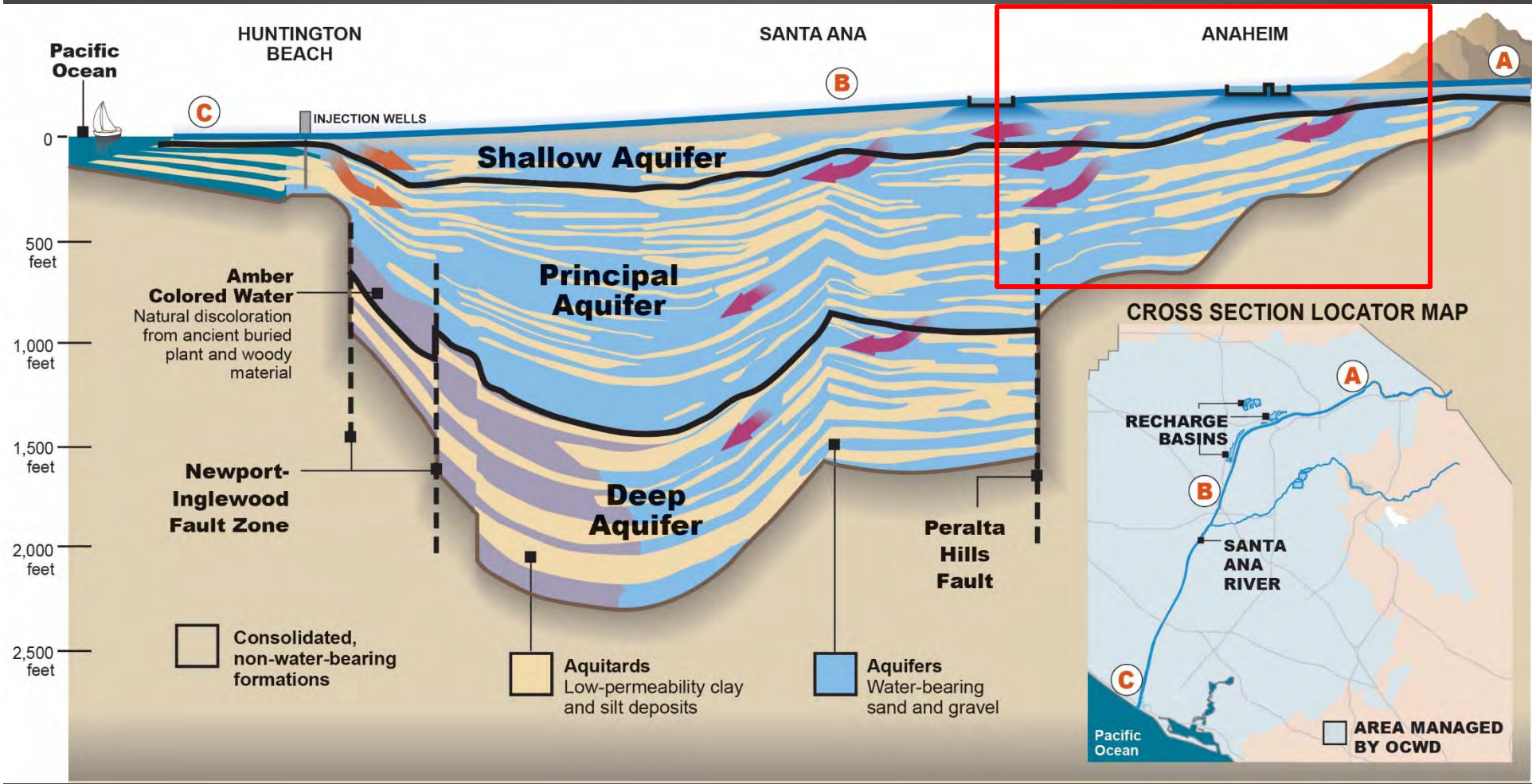


75% groundwater for 2.4 million people (19 water retailers)

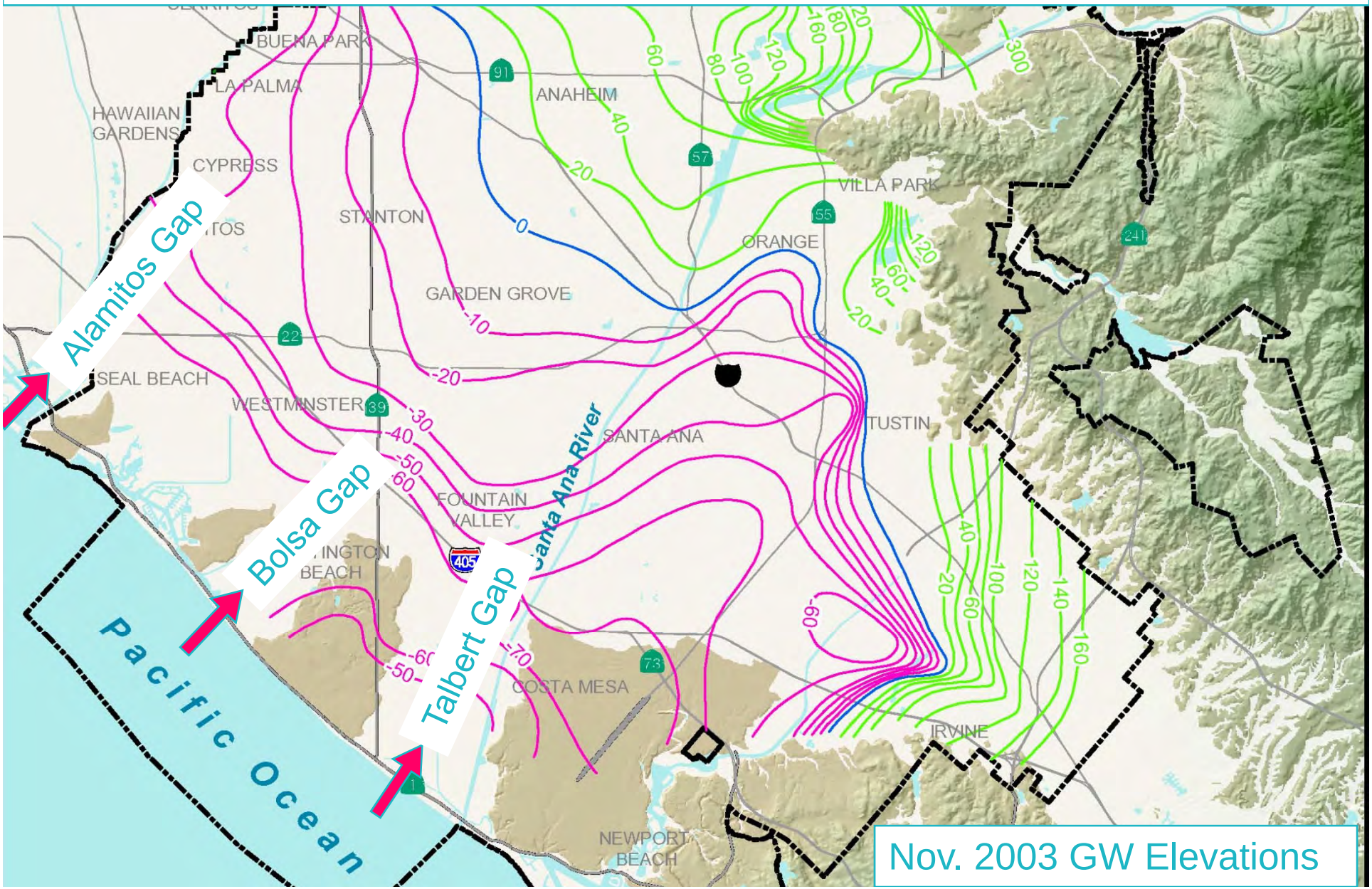
< 5% groundwater for 0.6 million people


A
A'
RECHARGE FACILITIES
CARBON CREEK
SANTA ANA RIVER
ALAMITOS GAP BARRIER
TALBERT GAP BARRIER
PACIFIC OCEAN
Santa Ana Mountains
Bixby Ranch Hill
Landing Hill
Bolsa Chica Mesa
Huntington Beach Mesa
Newport Mesa
105
90
71
39
605
19
57
241
22
261
55
5
133
1
405
73

The basin is comprised of three major aquifer systems that are hydraulically interconnected.



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



OCWD has always taken a “supply-side” approach to groundwater management.

- Aggressively pursue opportunities to increase supply.
  - Early leaders were farmers and knew that land values were tied to abundant water supply
- Rejected adjudication as “philosophy of scarcity” and needless expense.

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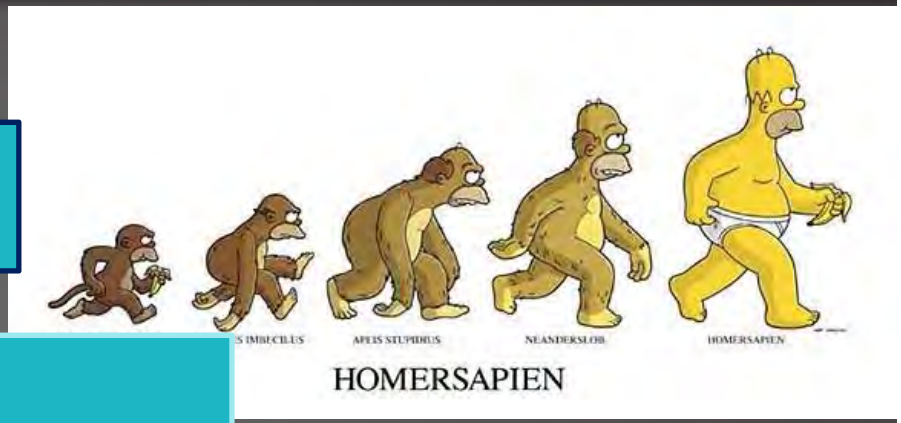
OCWD's approach to basin management has evolved over time.

Capture/Recharge Native Water

- **Refill basin with Imported Water**
- **Replenishment Assessment**



- **Meter pumping**
- **Establish basin production percentage**
- **Seawater Barrier**

- **In-lieu recharge with imported water**
- **Expand capture/recharge of SAR Base/Storm Flow**
- **Basin Equity Assessment**

Groundwater Replenishment System (Recycled Water)
Multi-Basin Conjunctive Use

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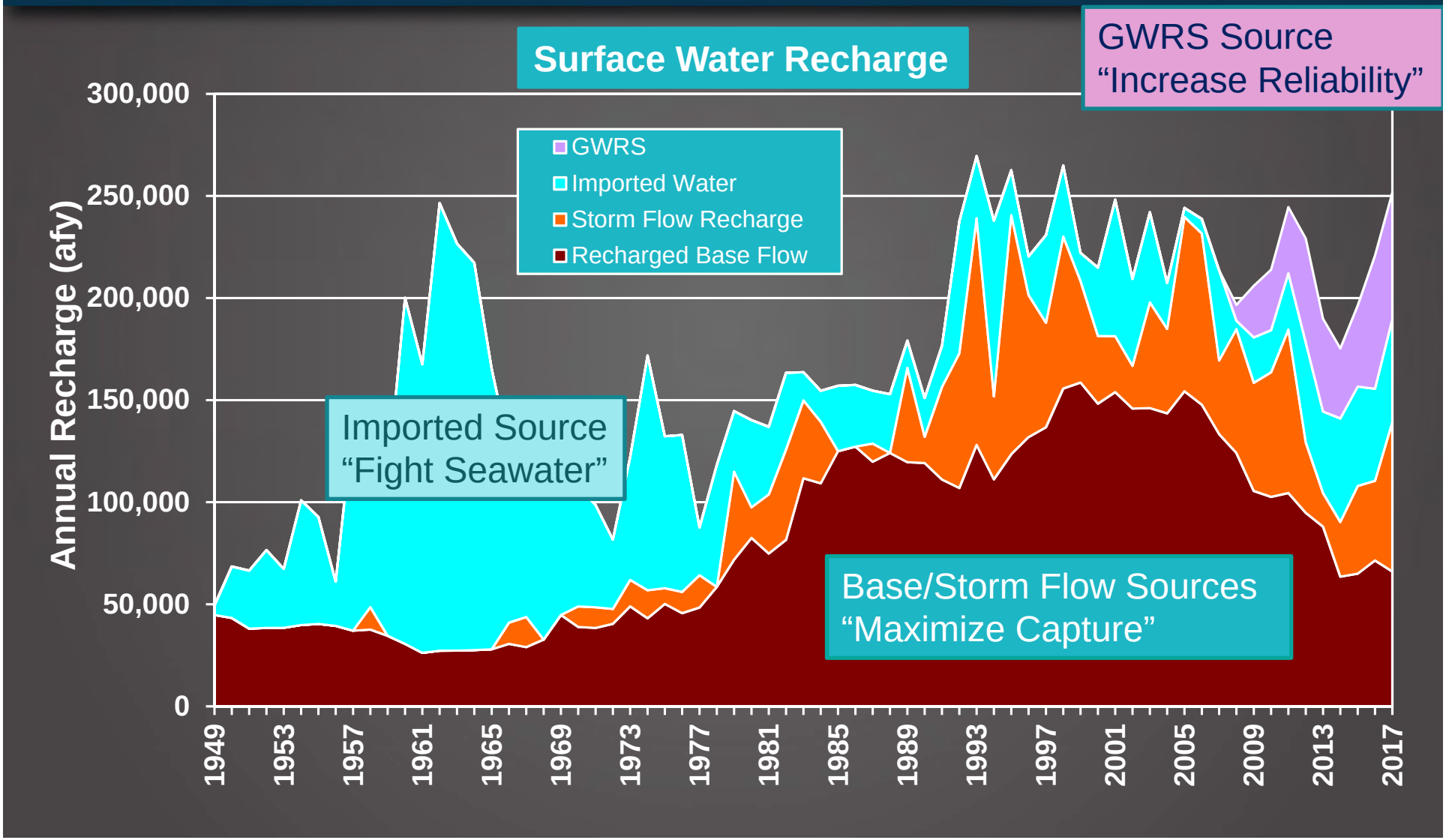
OCWD's Managed Aquifer Recharge reflects changing approaches and opportunities in basin management..



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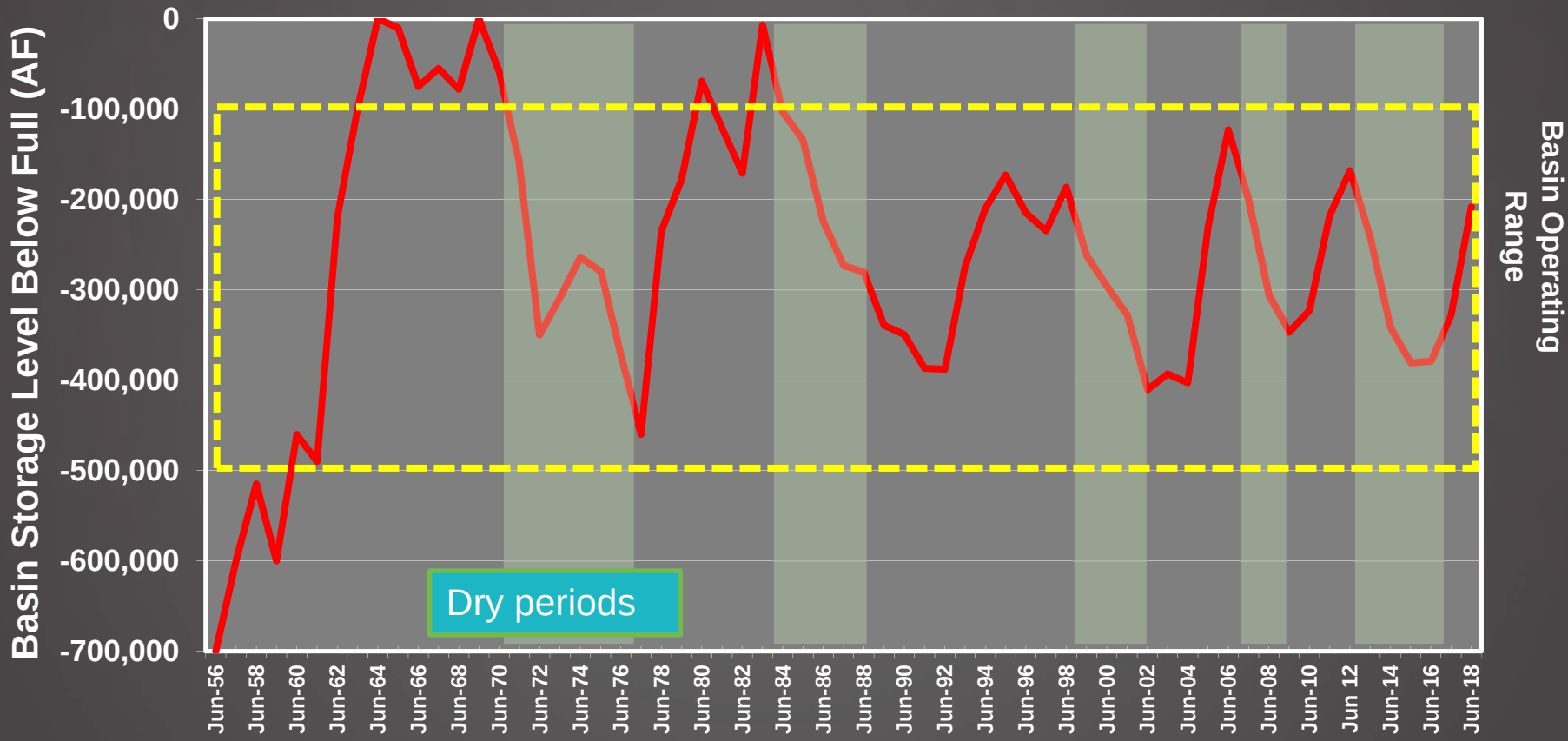
OCWD manages basin storage within a specific operating range.



Total basin storage is 66MAF. Operating storage is <1% of total storage.

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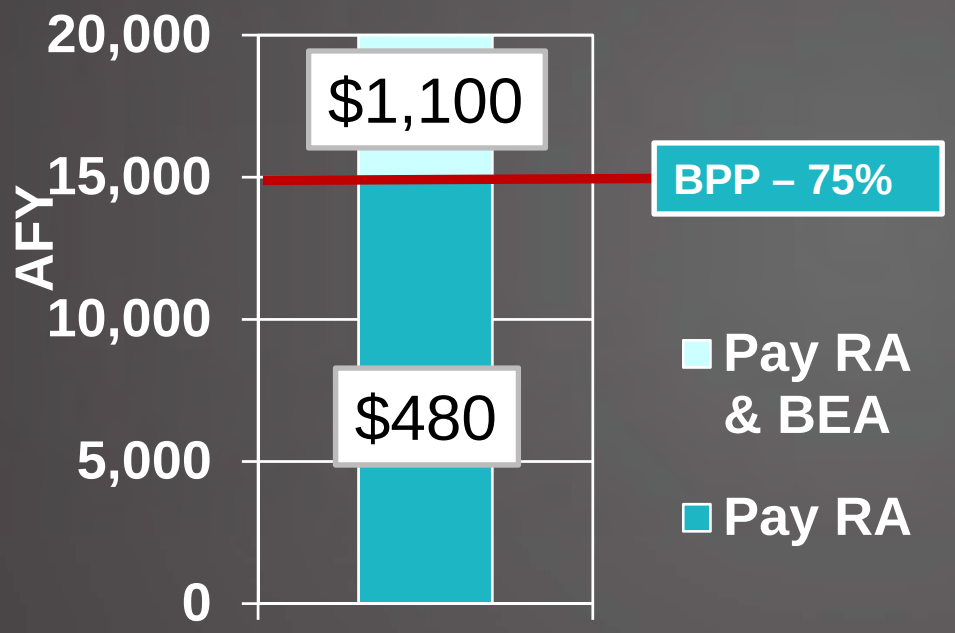
OCWD uses economic incentives to manage pumping.

Example Water Utility with 20,000 afy of Total Water Demands



RA+BEA = Imported water cost

- **Basin production percentage (BPP)** = amount of total demand that can be met with groundwater
- **Replenishment assessment (RA)** = charge for groundwater below BPP
- **Basin equity assessment (BEA)** = additional charge for water pumped above BPP

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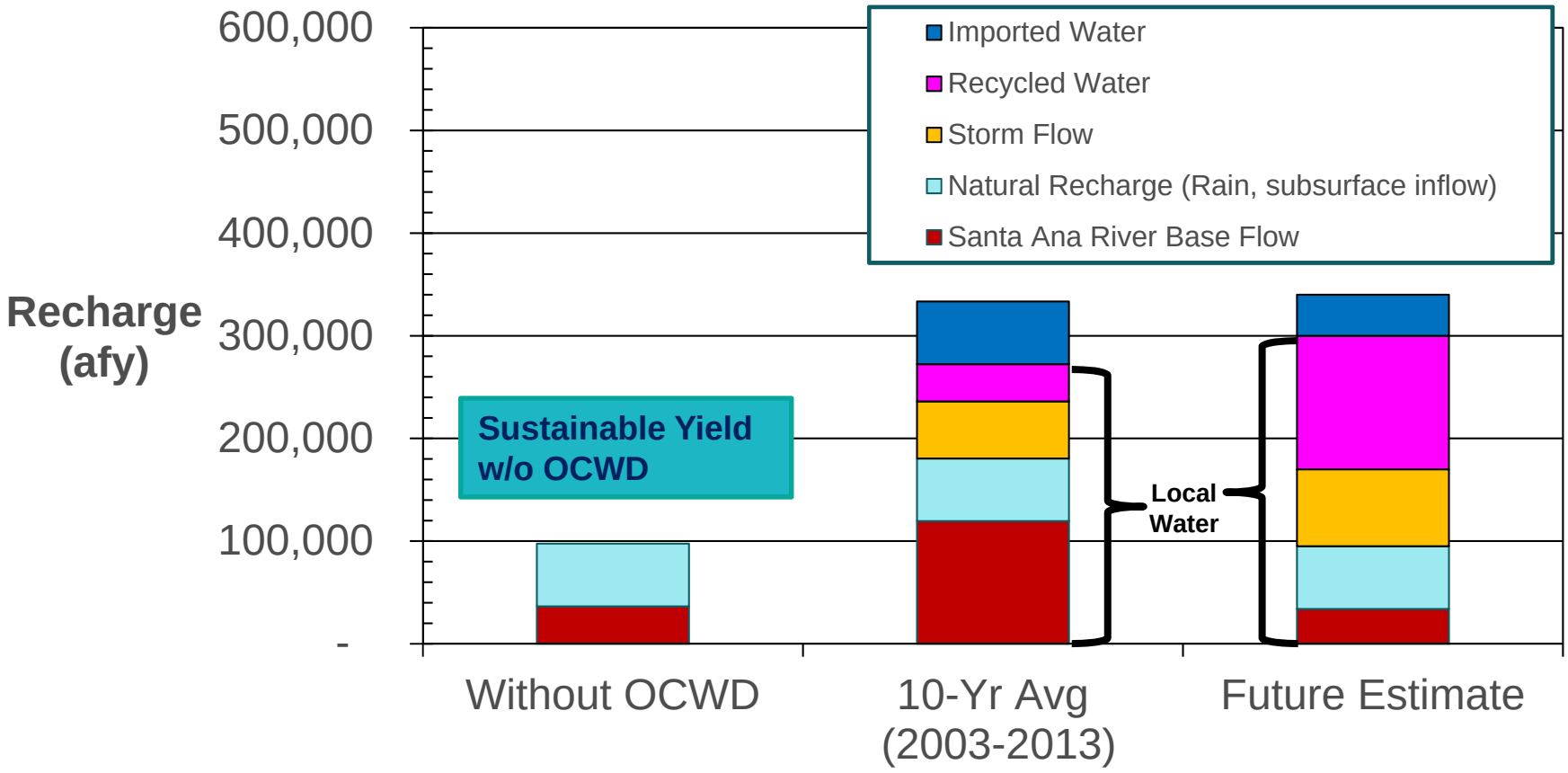
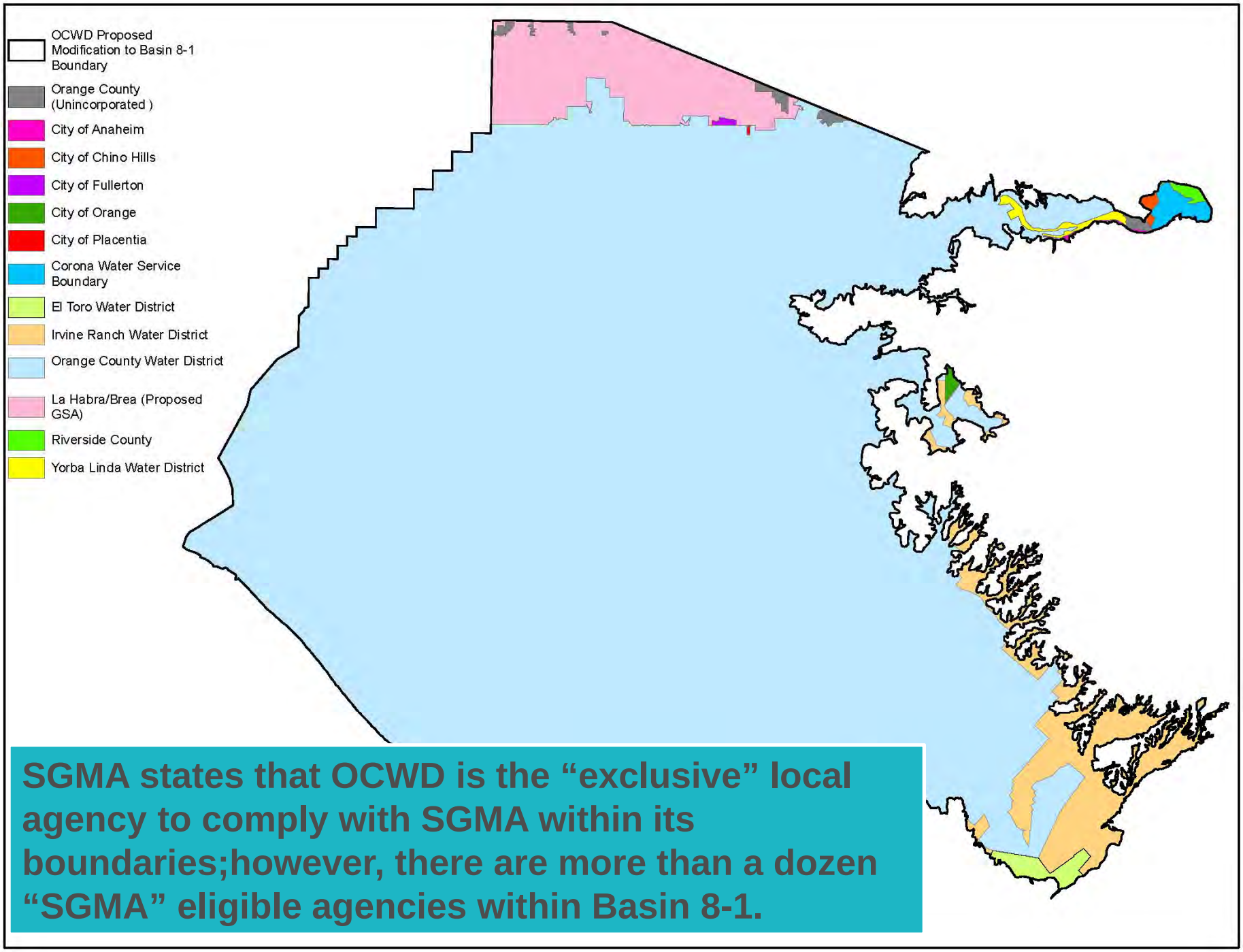
The recharge of local water sources has more than doubled the yield of the basin.

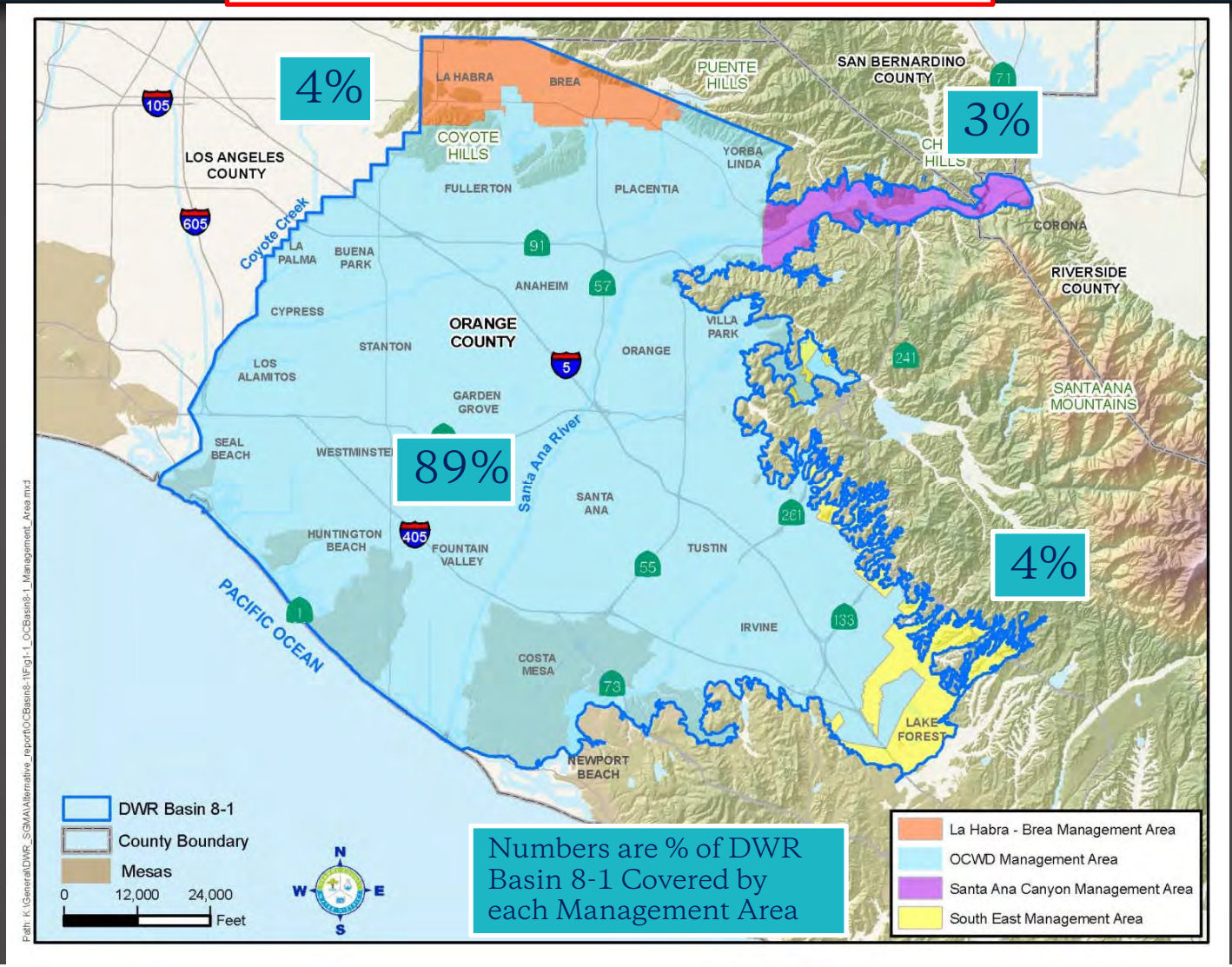




SGMA states that OCWD is the “exclusive” local agency to comply with SGMA within its boundaries;however, there are more than a dozen “SGMA” eligible agencies within Basin 8-1.

OCWD collaborated with multiple agencies to define four Management Areas in its “Alternative Plan”.

Alterative Plan is currently under review by DWR.



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The OC Basin has been operated sustainably since the mid-1970s.

Lowering GW Levels

No

Degraded Quality

No. OCWD is cleaning up contamination.

Reduction of Storage

Storage maintained in operating range.

Land Subsidence

No

Seawater Intrusion

Halted in 1975 with Talbert Barrier

Surface Water Depletion

Not applicable

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Lowering GW Levels

Managing GW Levels

- Extensive monitoring well network
  - 1,000 measuring points monitored monthly to bi-monthly
- Basin-wide water levels obtained every June (end of fiscal year)
  - Includes production wells
  - Contour maps of 3 aquifers generated annually
- Shift groundwater production away from coast as needed
  - Assists with Seawater Intrusion Barrier

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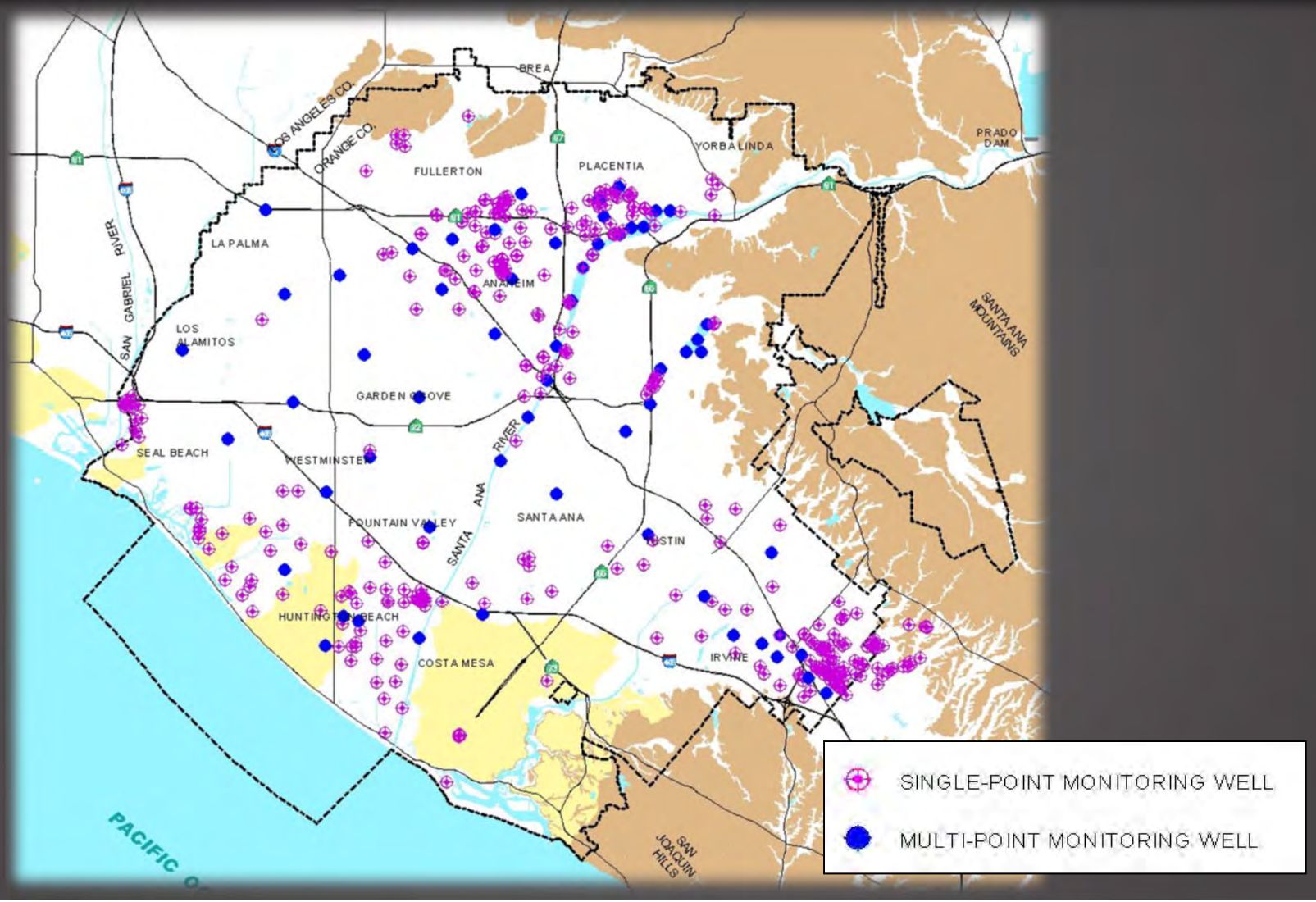
OCWD has constructed over 100 single- and multi-depth monitoring wells.



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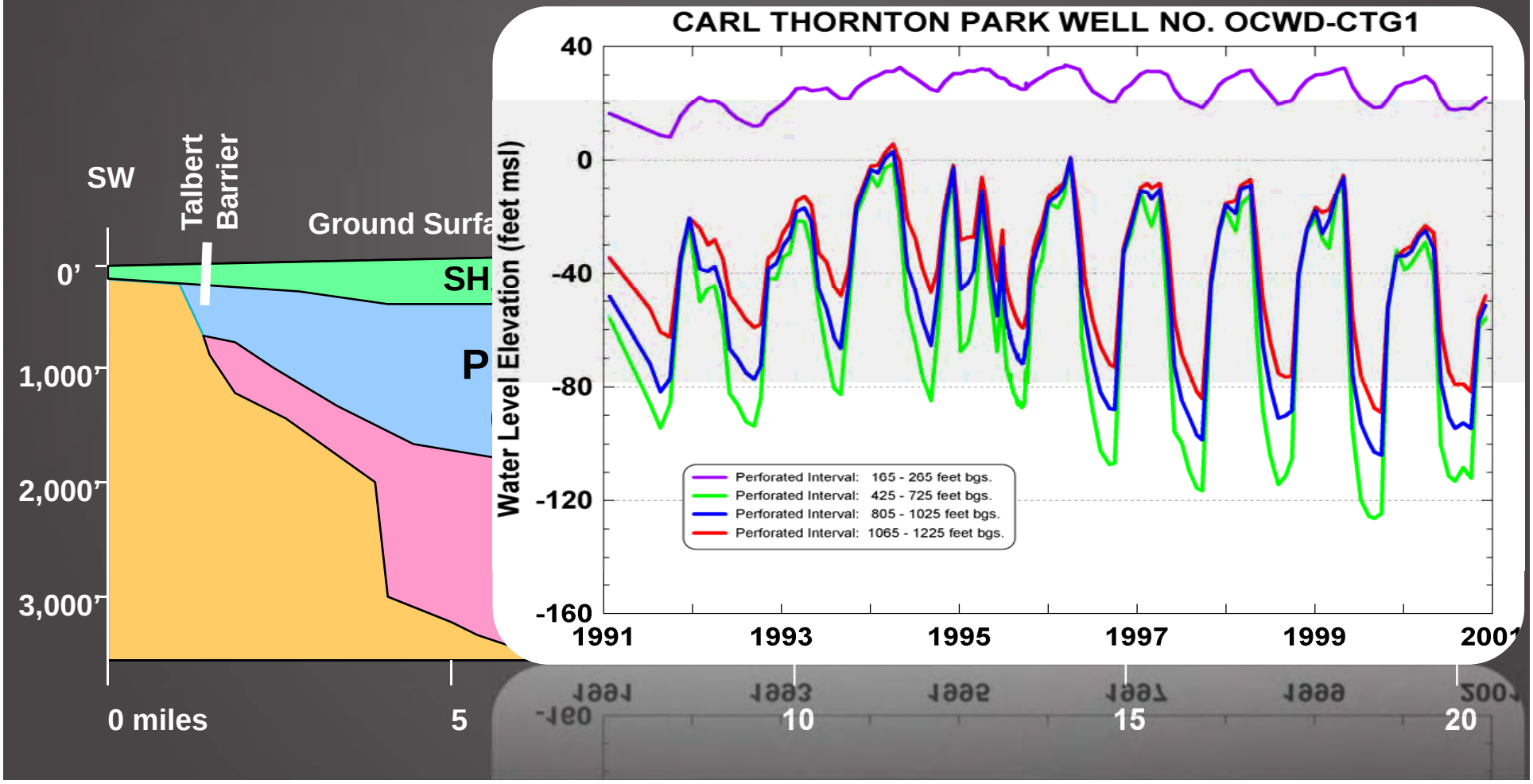
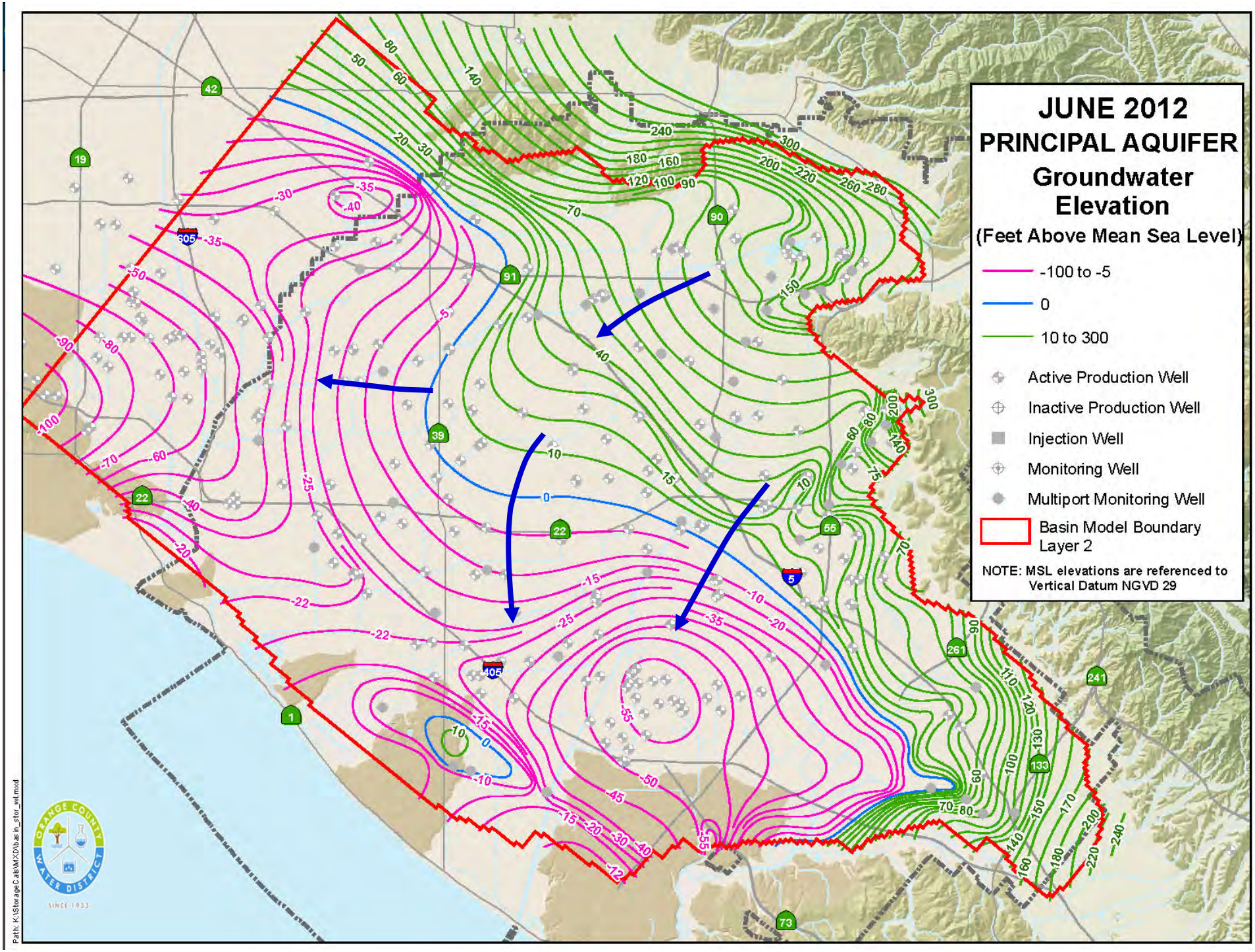
Multi-depth wells were crucial to defining the three aquifer systems in the basin.

- Multi-level monitoring wells




JUNE 2012
PRINCIPAL AQUIFER
Groundwater Elevation
(Feet Above Mean Sea Level)
-100 to -5
0
10 to 300
Active Production Well
Inactive Production Well
Injection Well
Monitoring Well
Multiport Monitoring Well
Basin Model Boundary Layer 2
NOTE: MSL elevations are referenced to Vertical Datum NGVD 29
ORANGE COUNTY WATER DISTRICT
SINCE 1933
Path: K:\StorageCalc\MXD\basin_stor_wl.mxd

What is significant and unreasonable?

- Lowering of groundwater levels is significant and unreasonable if it results in basin storage to fall below the operating range for an extended period of time.
- Minimum Threshold: When basin storage falls below the operating range for an extended period of time.

Reduction of Storage

Managing GW Storage

- Calculate storage monthly using water budget approach
- Calculate storage annually for all 3 aquifers
  - Use June contour maps
- Two approaches generally agree
- Increase recharge or reduce pumping to maintain storage within operating range

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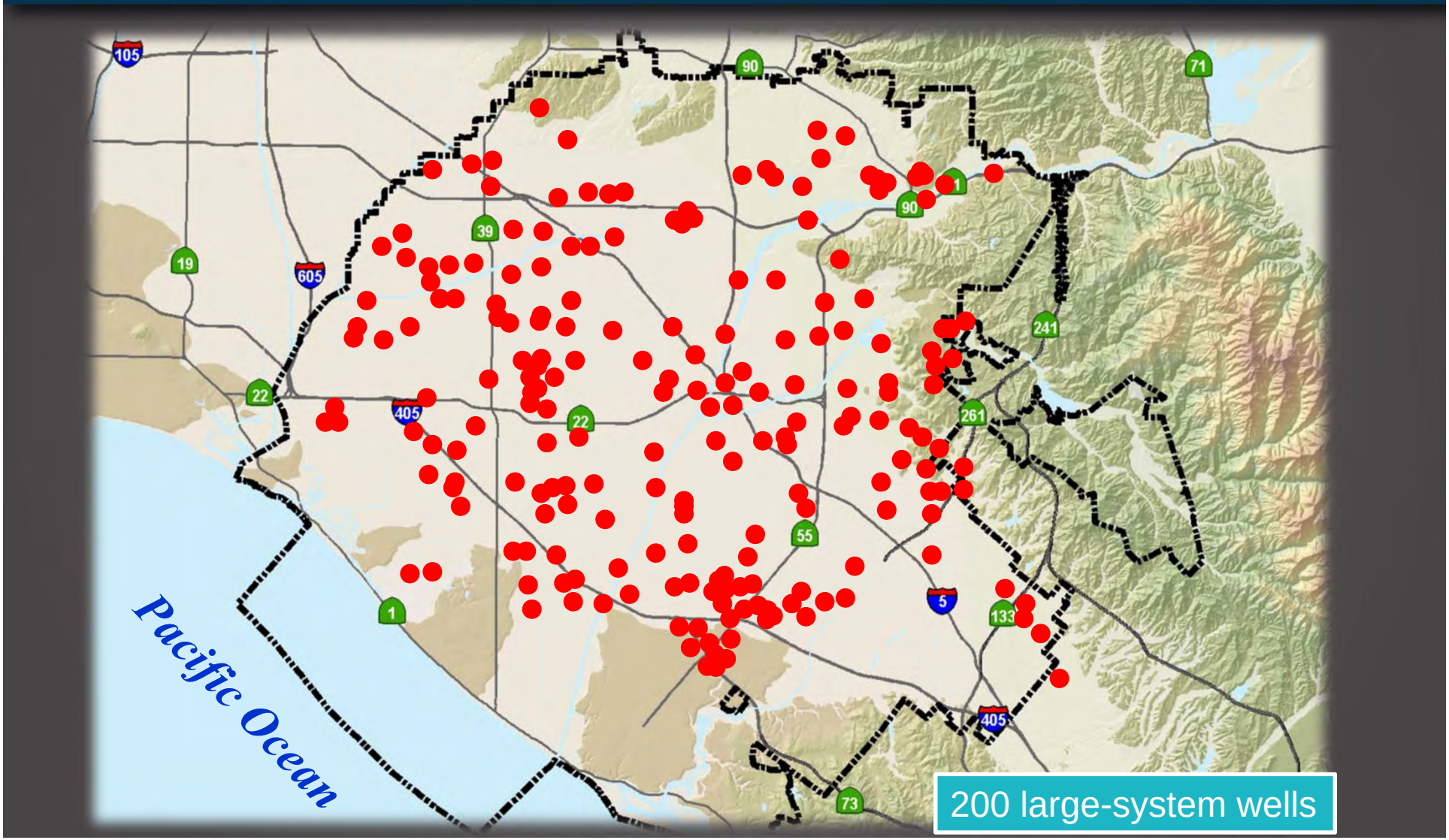
Groundwater production from 407 wells is metered and reported.



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WY2012-13 Groundwater Budget

Inflows & Outflows (acre-feet)	Projected Avg Rain 13.66”	Actual Rain 5.85”
SAR Base Flow Recharge	105,000	93,200
SAR Storm Flow Recharge	50,000	19,100
Incidental Recharge	60,000	19,700
GWR System (Forebay & Barrier)	72,000	72,600
MWD Supplies	13,000	40,000
Other (Alamitos Barrier)	3,000	1,700
Total Water Into Basin	301,000	246,300
Basin Pumping @ 68% BPP	-300,000	-309,300
Storage Change	+1,000	-63,000
Basin Storage (af below full)	178,000	242,000

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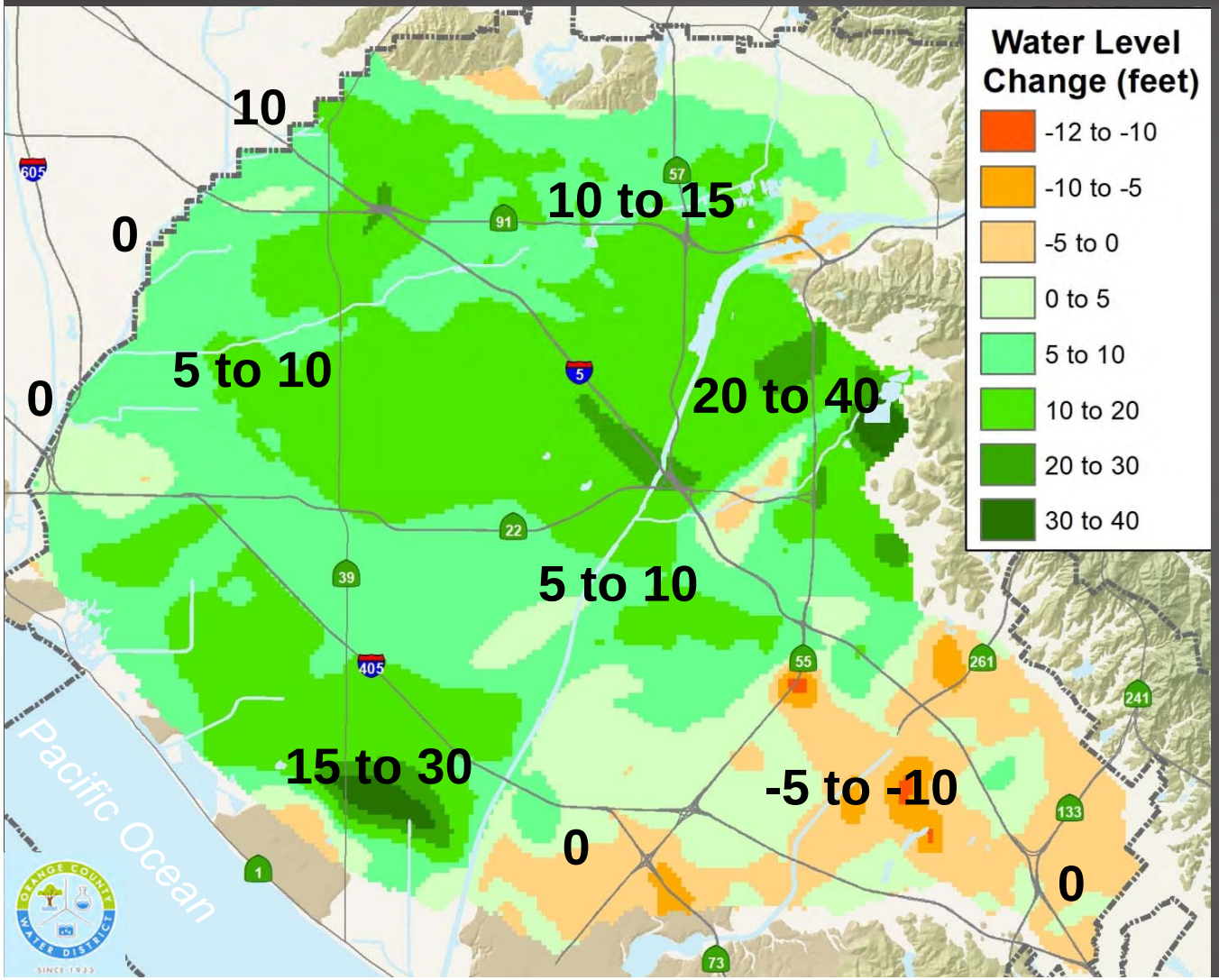
The difference in water levels in each aquifer is calculated annually.



Principal Aquifer Water Level Change

June 2016 to June 2017

Rise throughout most of basin: 10-15 ft

Max rise near Santiago Basins: 40 ft

Decline in most of Irvine area: 5-10 ft

Smaller rise in west OC and LA County

Steeper gradient towards Long Beach

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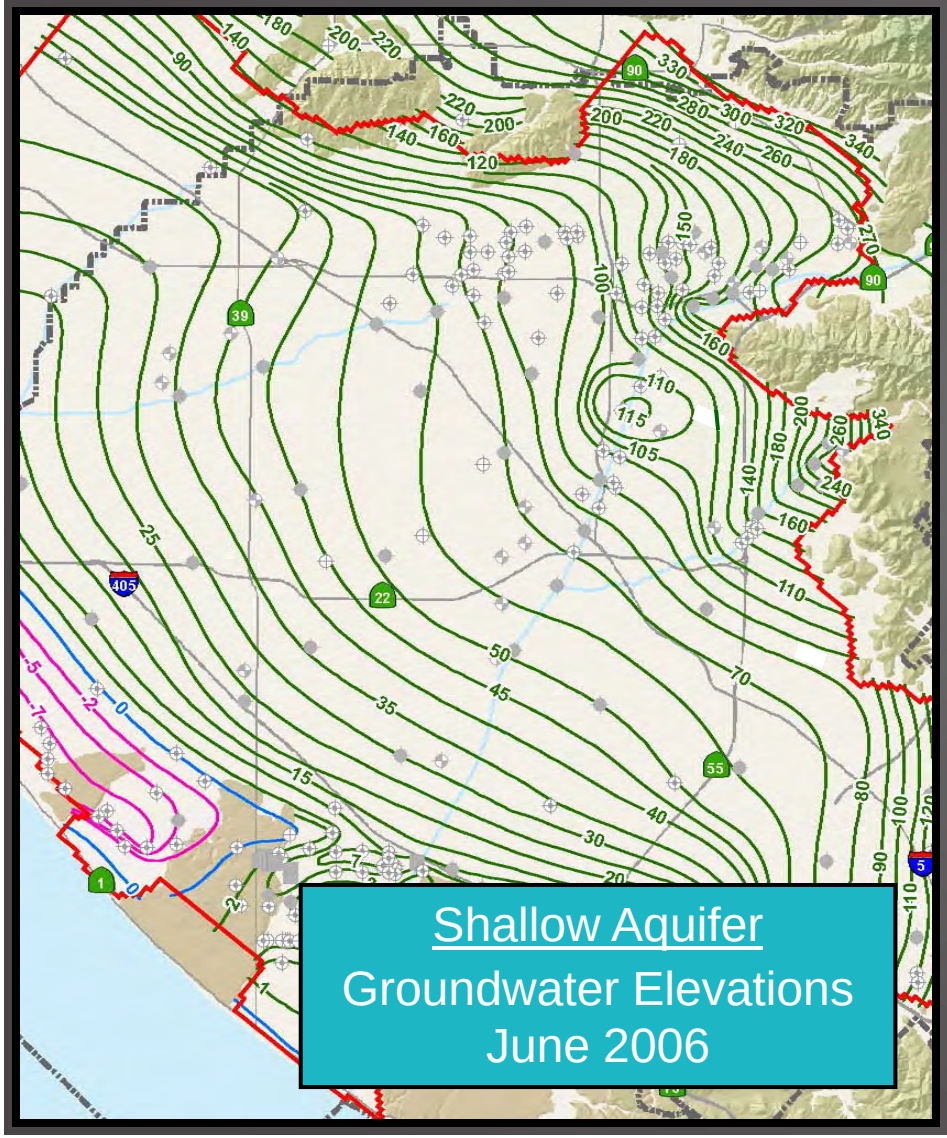
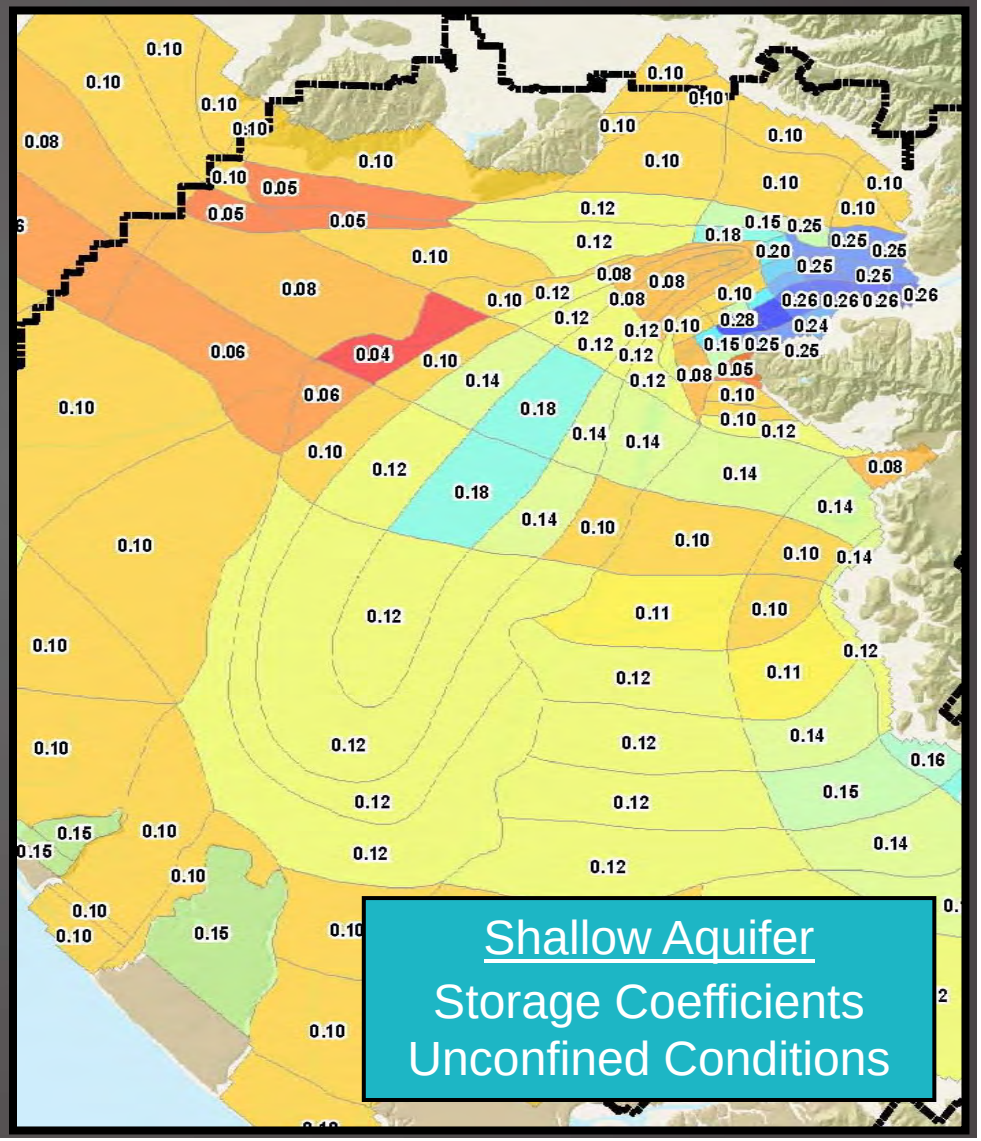
Accuracy of contoured water level data and storage coefficients is critical.





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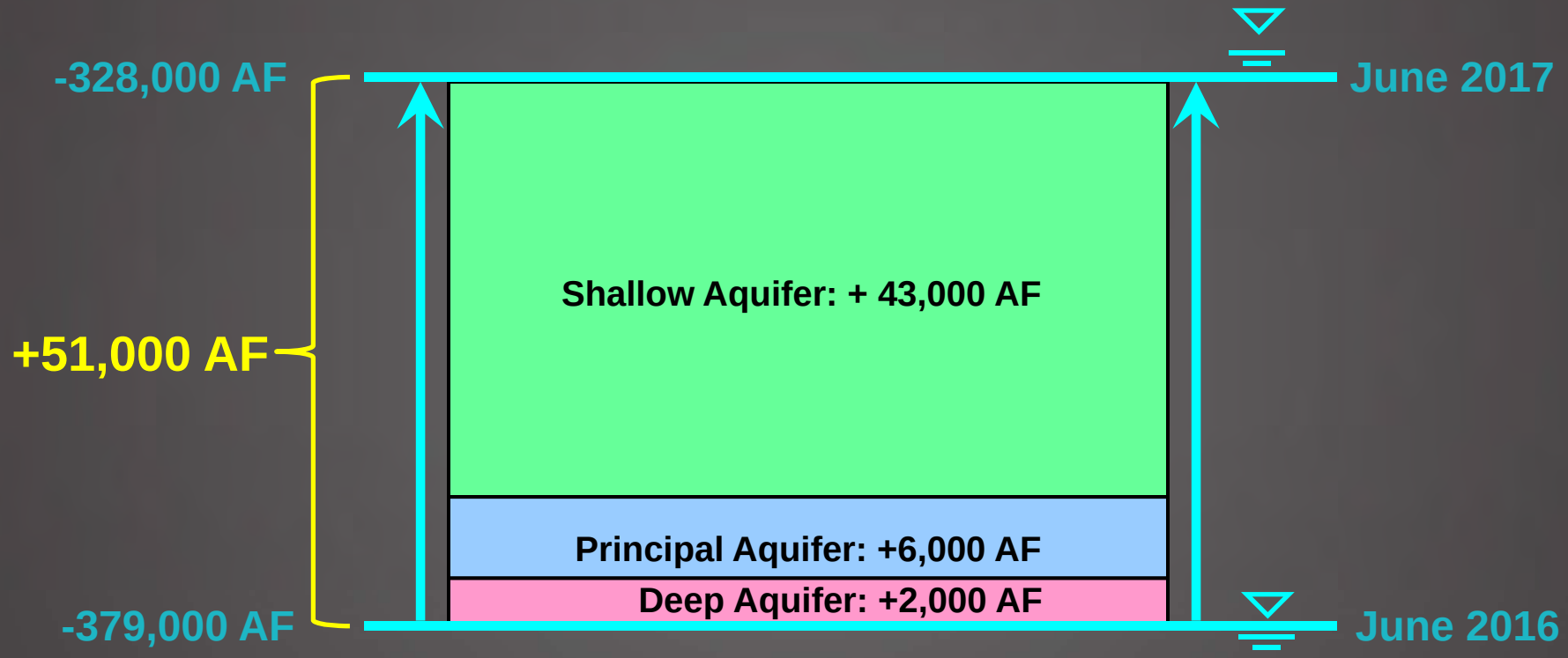
In WY 2016-17, there was in increase in 51,000 af of storage in the basin.



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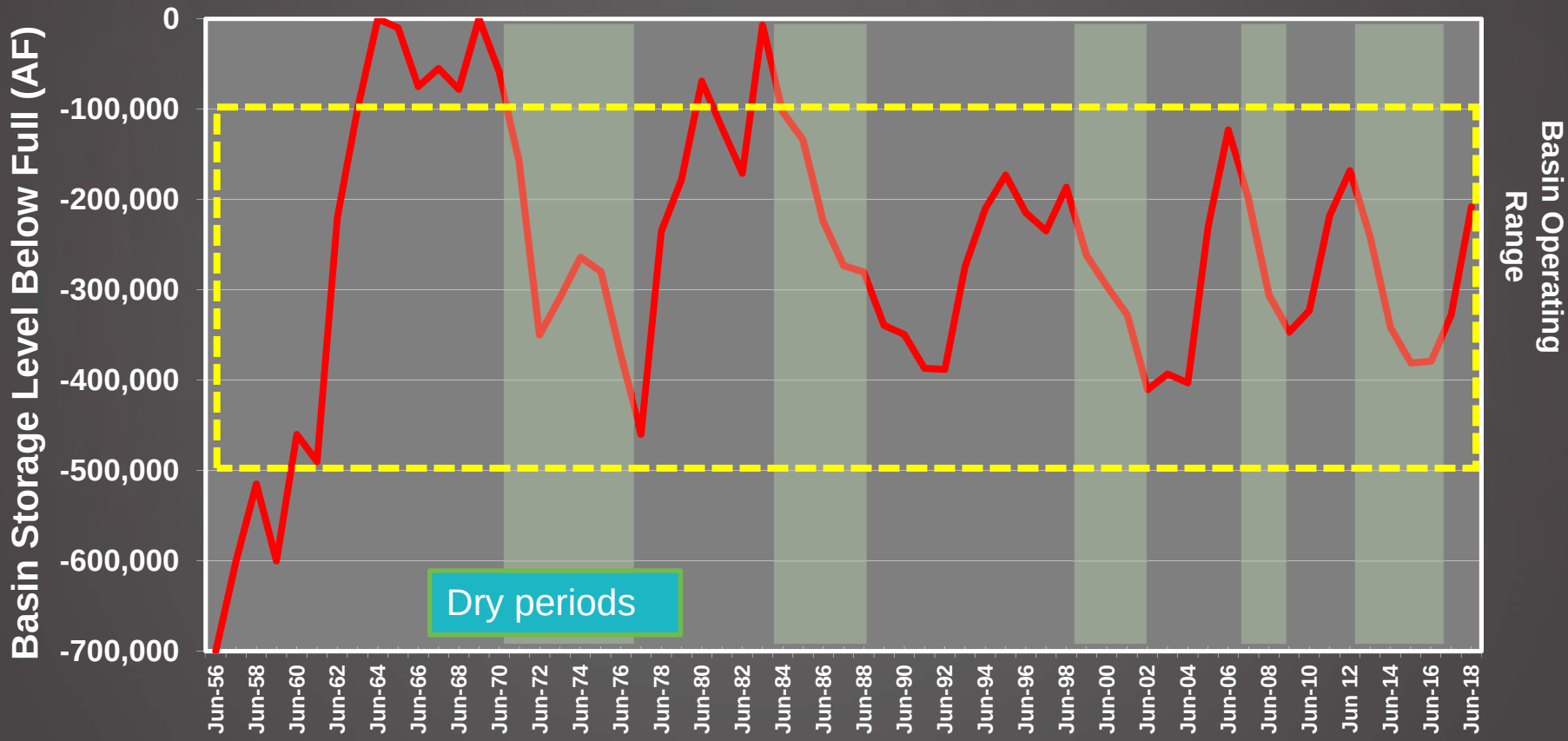
OCWD manages basin storage within a specific operating range.



Total basin storage is 66MAF. Operating storage is <1% of total storage.

OCWD has basin management triggers tied to basin storage conditions.

Basin Storage Conditions (acre-feet below full)	Basin Management Actions to Consider
Less than 100,000 af	Raise BPP
100,000 to 300,000 af	Maintain and/or raise BPP
300,000 to 350,000 af	Seek additional supplies to refill the basin and/or lower the BPP
Greater than 350,000 af	Seek additional supplies to refill the basin and lower the BPP

What is significant and unreasonable?

- A significant and unreasonable reduction in groundwater storage would occur if storage fell below 500,000 acre-feet for an extended period of time.
- Minimum Threshold: When the storage volume of the groundwater basin falls below 500,000 acre-feet for an extended period of time.

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Seawater Intrusion

Managing Seawater Intrusion

- Monitor groundwater quality in “gaps” and other areas susceptible to intrusion
- Maintain groundwater levels in “gaps” at or above “protective” elevations
- Install additional monitoring and injection wells as needed
- Development of focused hydrogeologic models to optimize barrier performance

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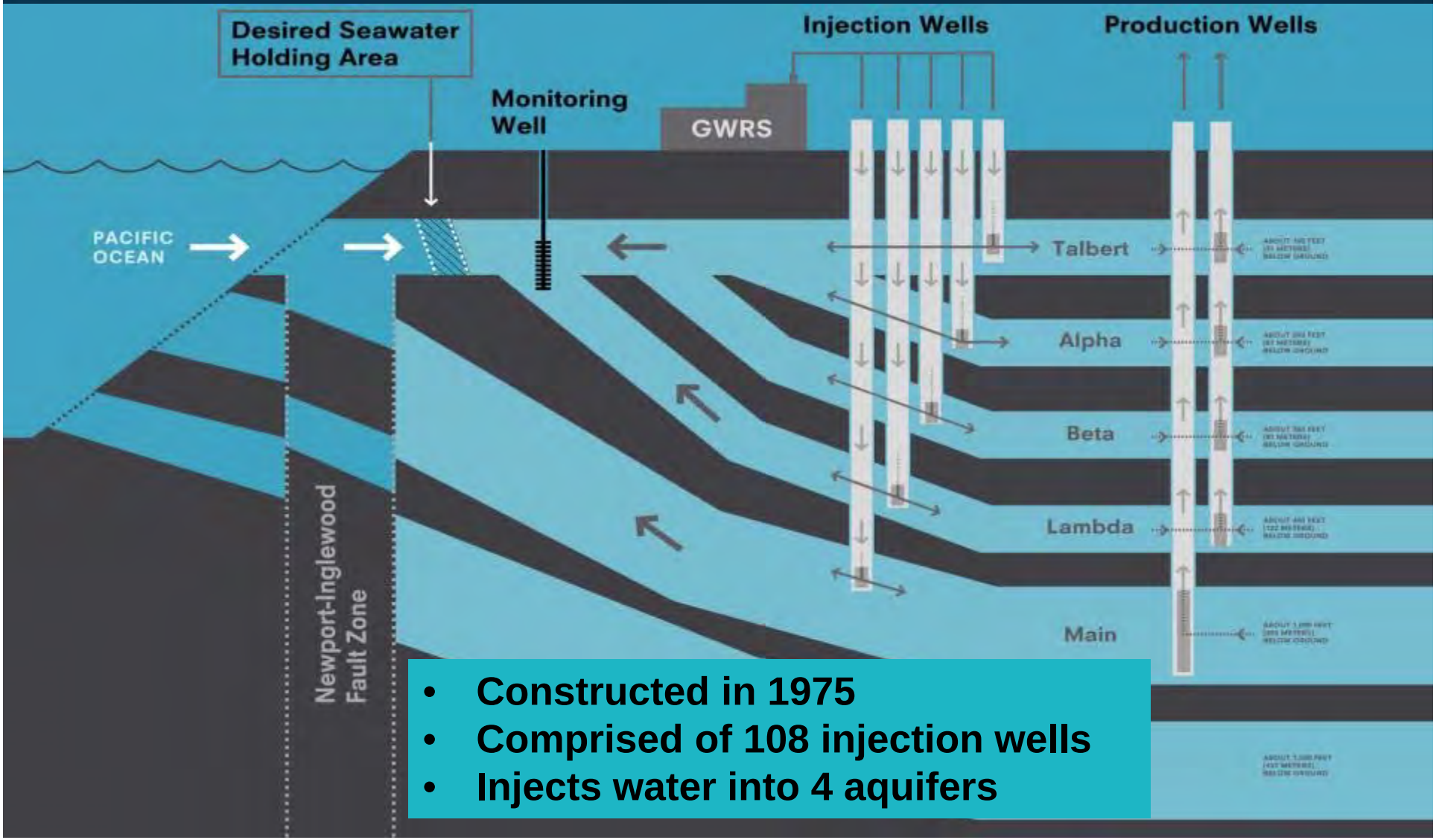
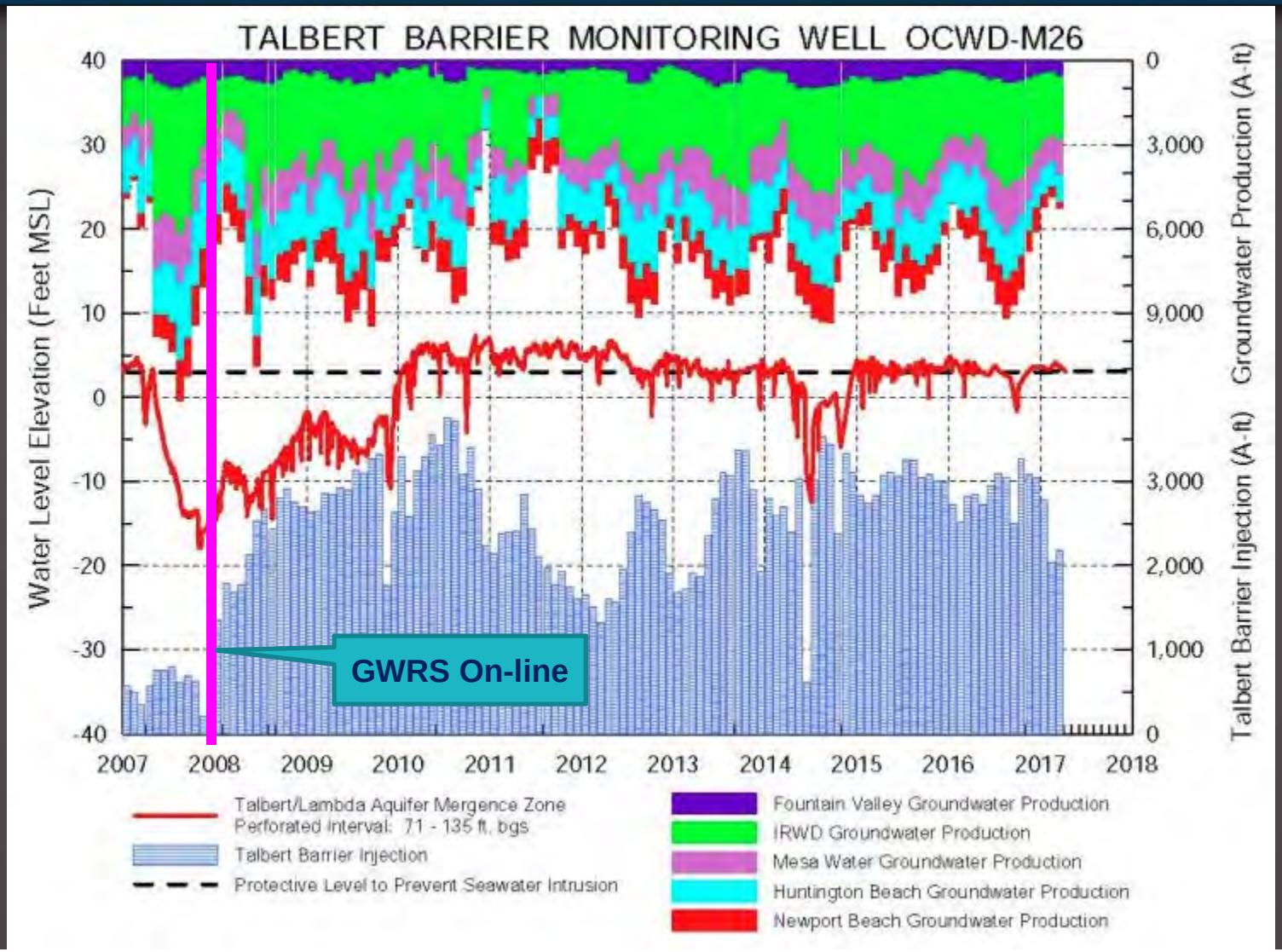
The Talbert Gap Seawater Intrusion Barrier was constructed to protect and maximize the use of basin storage.

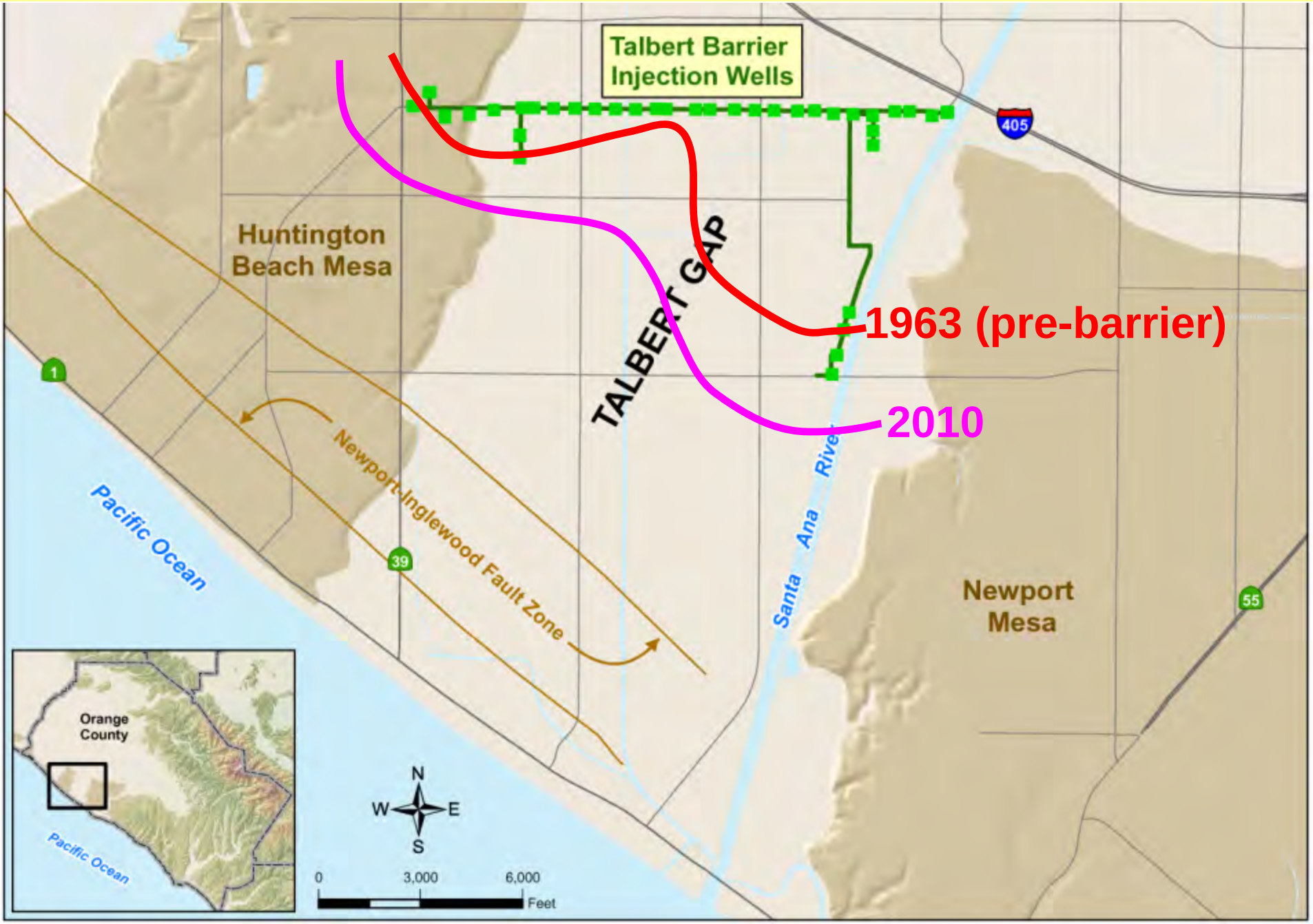


- Constructed in 1975
- Comprised of 108 injection wells
- Injects water into 4 aquifers

About 30,000 acre-feet per year of recharge is needed to maintain protective elevations.



The 250 mg/L chloride line has been pushed further seaward.



What is significant and unreasonable?

- A significant and continuing reduction in usable storage volume in the groundwater basin as a result of seawater intrusion.
- Minimum Threshold: When (1) active large system production wells are shutdown due to seawater-derived salinity and (2) continuing loss of a significant amount of basin storage due to seawater-derived salinity.

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Managing Groundwater Quality

- Monitor groundwater quality
- Salinity management
- Work closely with and support existing agencies (e.g, DTSC, RWQCB)
- Groundwater quality improvement projects
  - TDS/Nitrate removal
  - VOC cleanup
- Provide financial incentives to producers

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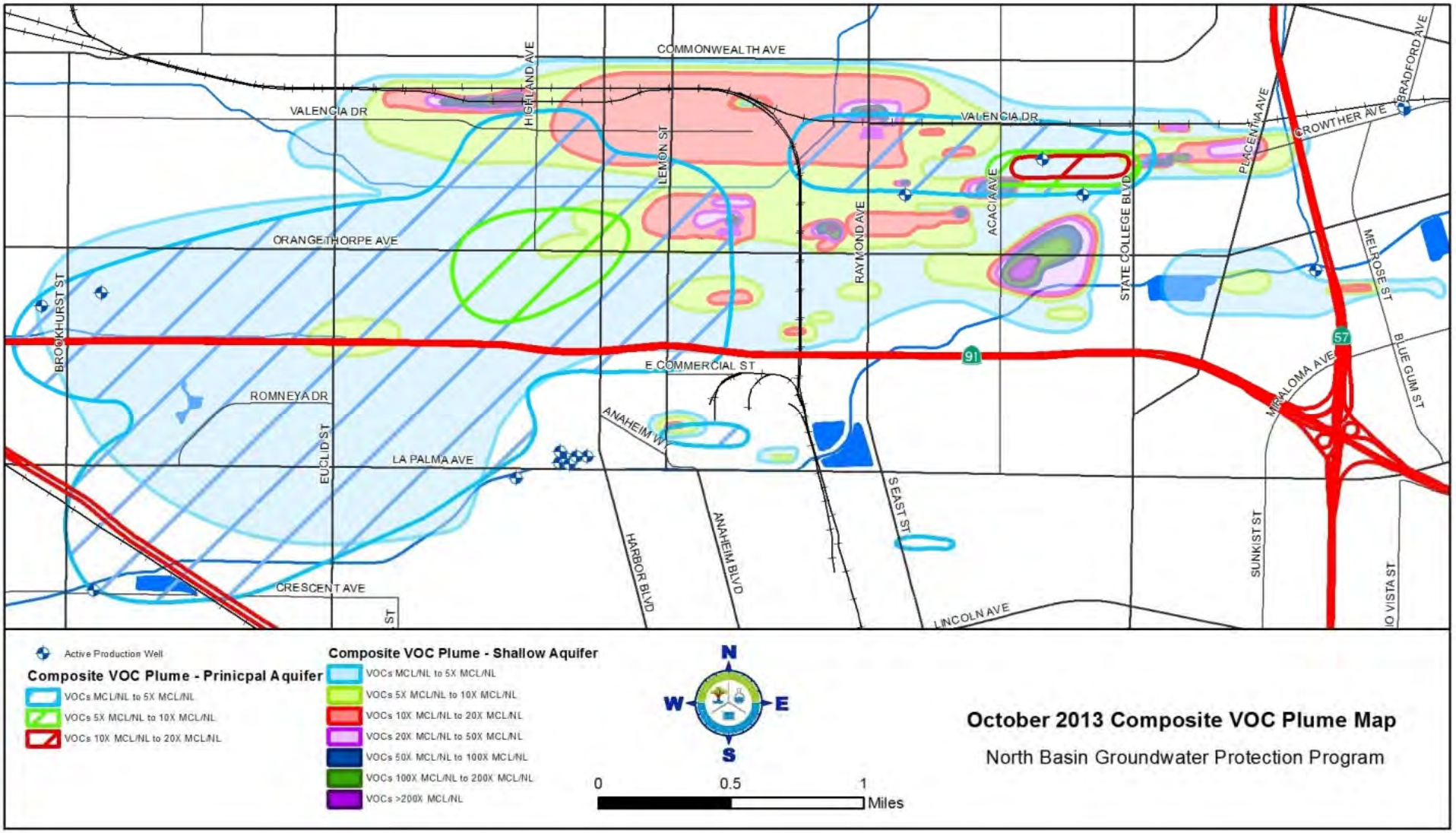
OCWD has been working to clean up a large, shallow VOC plume to protect deeper groundwater supplies.



What is significant and unreasonable?

- Three key elements:
  - Causal nexus between groundwater management activities and groundwater quality
  - Beneficial uses and groundwater and water quality regulations (e.g., MCLs)
  - Volume of usable groundwater impacted
- Minimum Threshold: Exceedances of MCLs or other applicable regulatory limits that are directly attributable to groundwater management actions that prevents the use of groundwater for its designated beneficial uses.

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Managing Subsidence

- Maintain groundwater storage within target operating range
- Monitor ground surface elevations
  - Orange County surveyor

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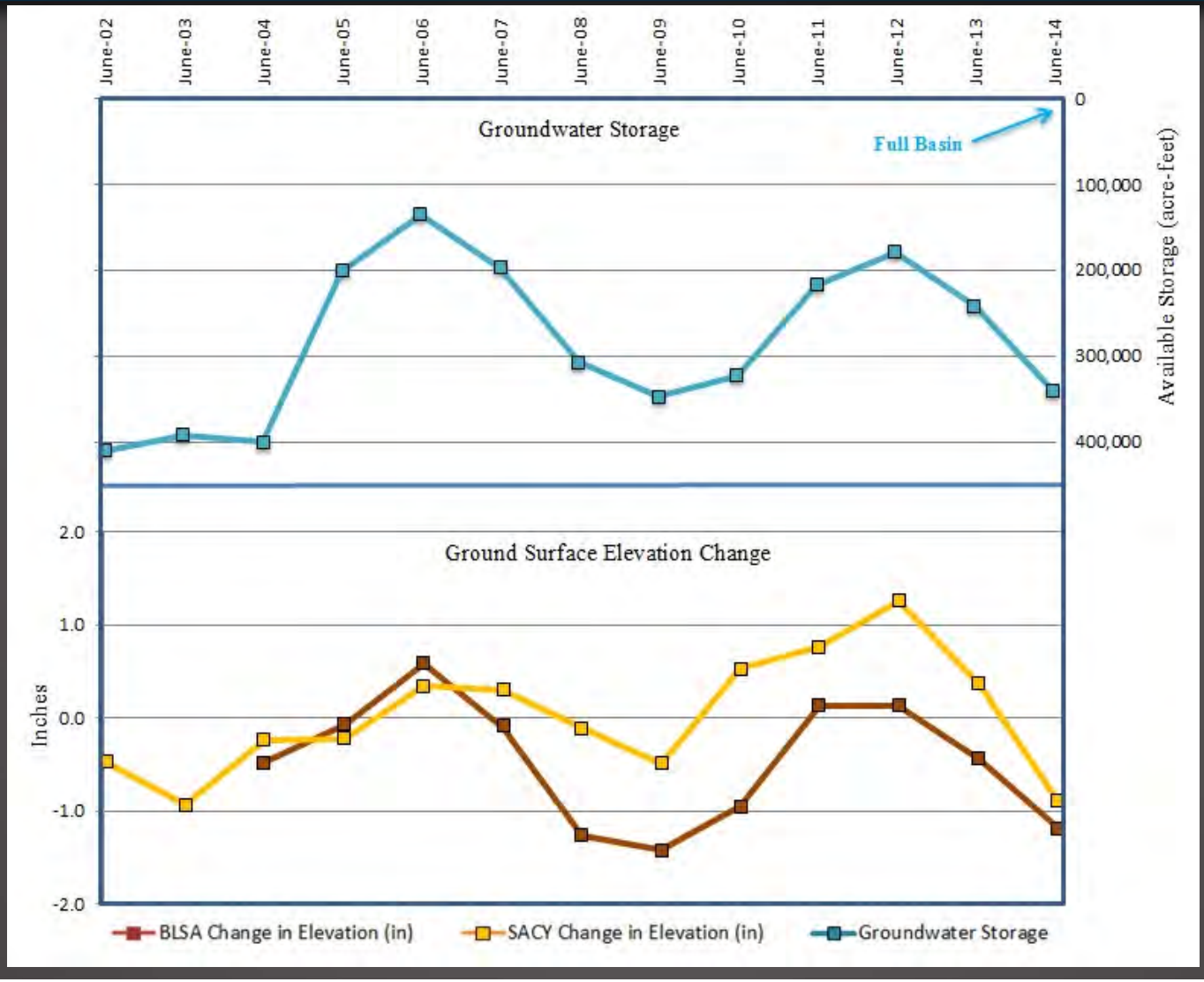
Ground surface elevations rise and fall based on groundwater storage levels.



What is significant and unreasonable?

- Significant and unreasonable subsidence would be occur if ground surface elevation changes are determined to be inelastic over a significant period of time, caused by declines in groundwater storage and impact surface uses.
- Minimum Threshold: Sustained lowering of ground surface elevation that is attributable to lowering of groundwater storage and is likely to interfere with surface uses.

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Managing Surface Water Depletion

- Only Santa Ana Canyon Management Area has surface water
- Santa Ana River flows in and over “full” alluvial canyon aquifer
  - Water levels are flat
  - Surface flow through canyon is orders of magnitude higher than groundwater pumping
- Once Santa Ana River exits canyon, it percolates into the river channel and becomes concrete lined to ocean

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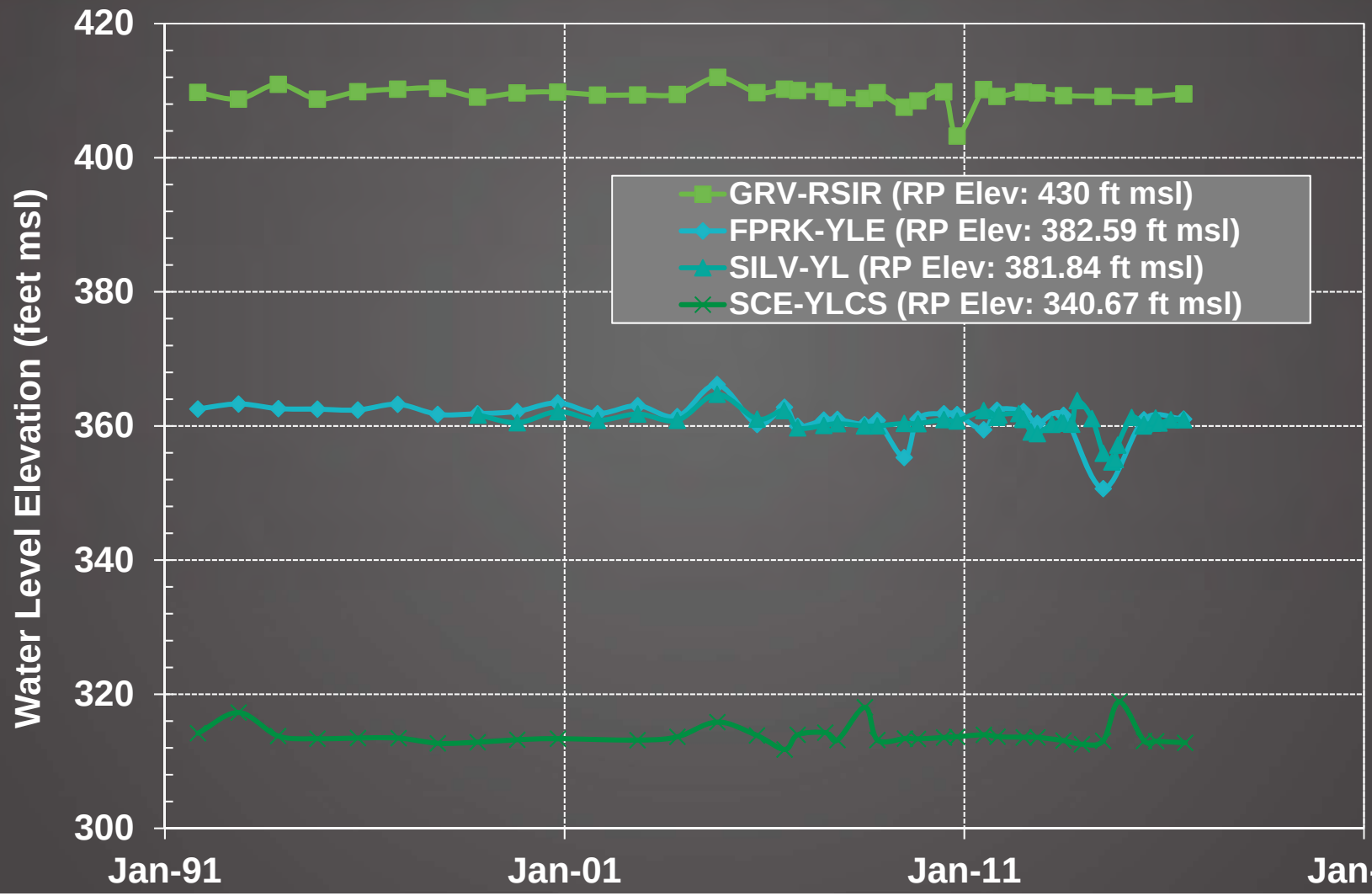
Groundwater in the Santa Ana Canyon are “disconnected” from the main basin.



What is significant and unreasonable?

- No foreseeable significant and unreasonable impact to groundwater depletions impacting surface water.


Thank You!
Contact:
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714-378-3214