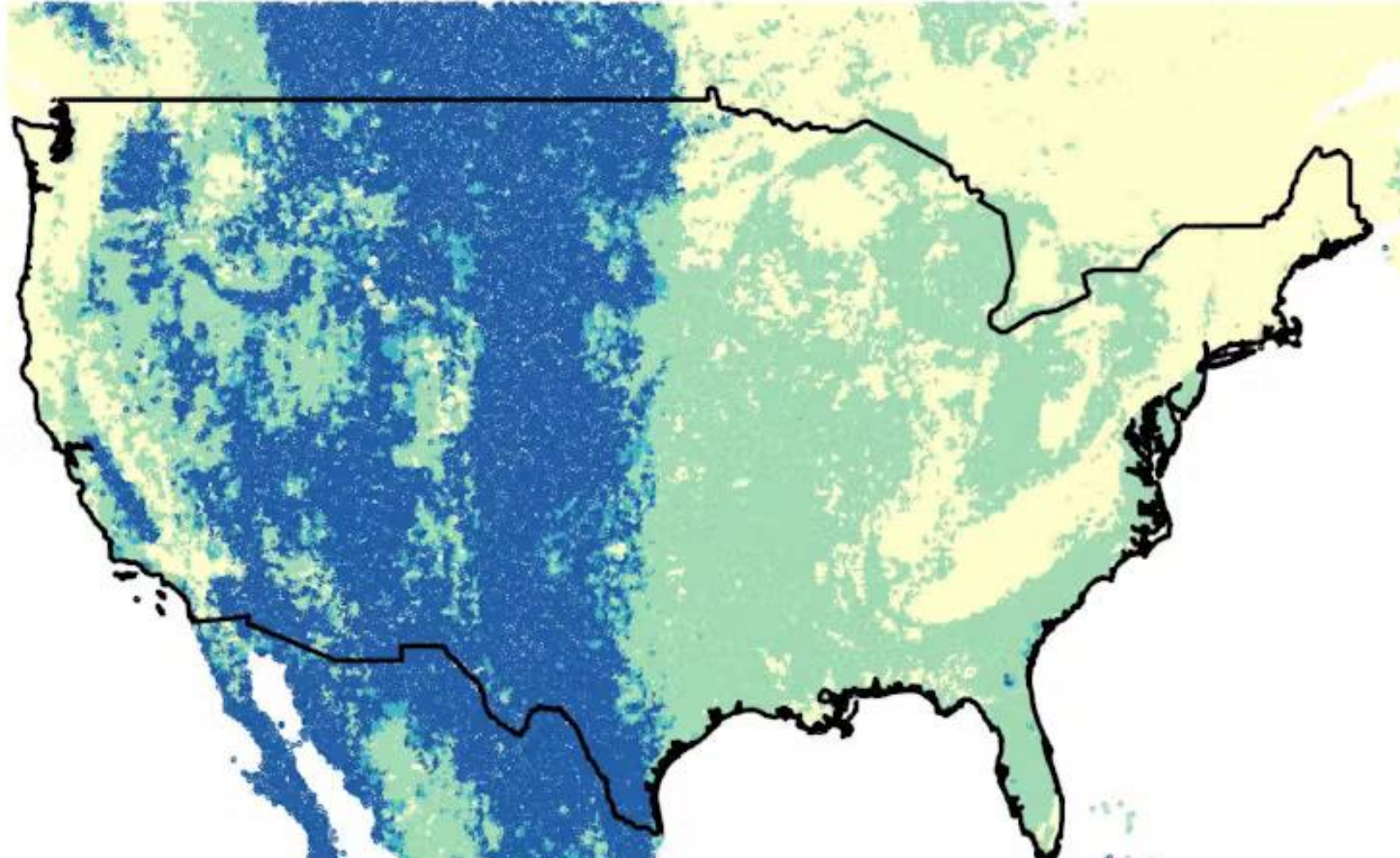


# What Colorado River Shortage Means for Groundwater in Arizona

# The oldest water in the U.S.

The West's aquifers have some of the longest turnover times in the country. Turnover time is the amount of time required for groundwater to be replenished naturally.



**Average turnover time for groundwater**

wentynine

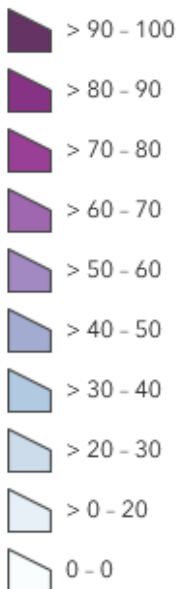


### Central\_Arizona\_Project

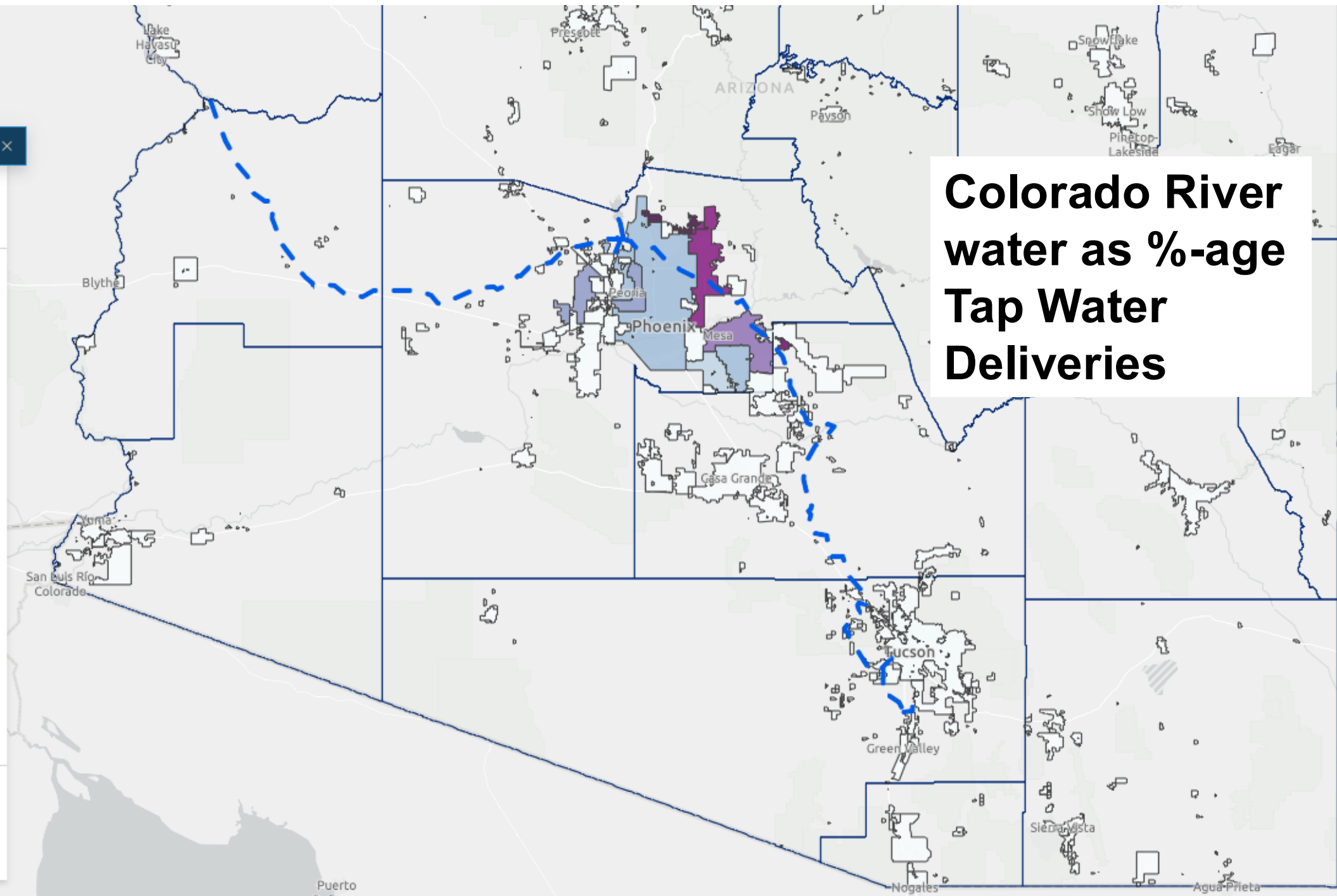


### CWS\_Service\_Area

CR\_TapWater\_Percentage

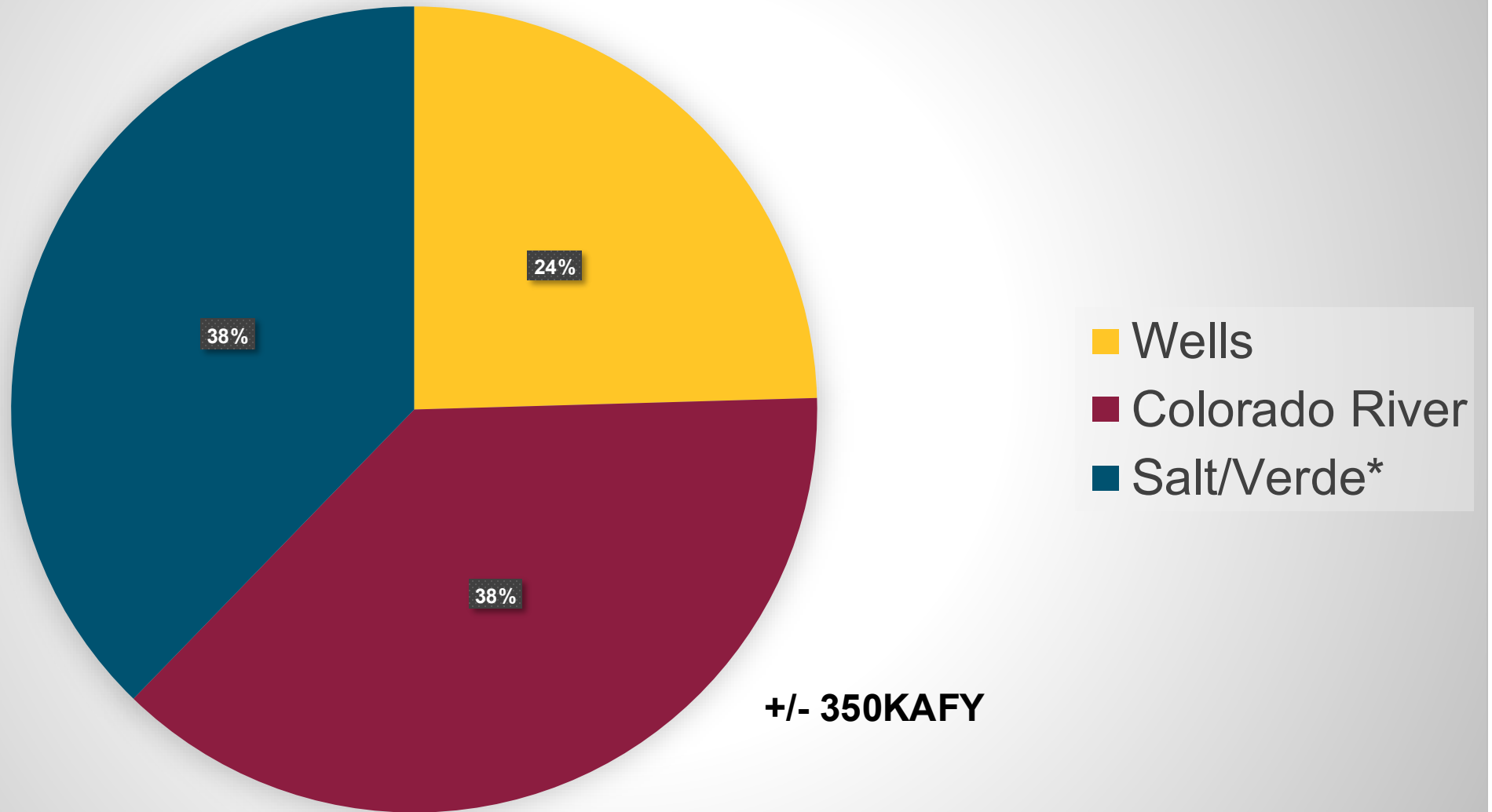


### Counties - GWLC

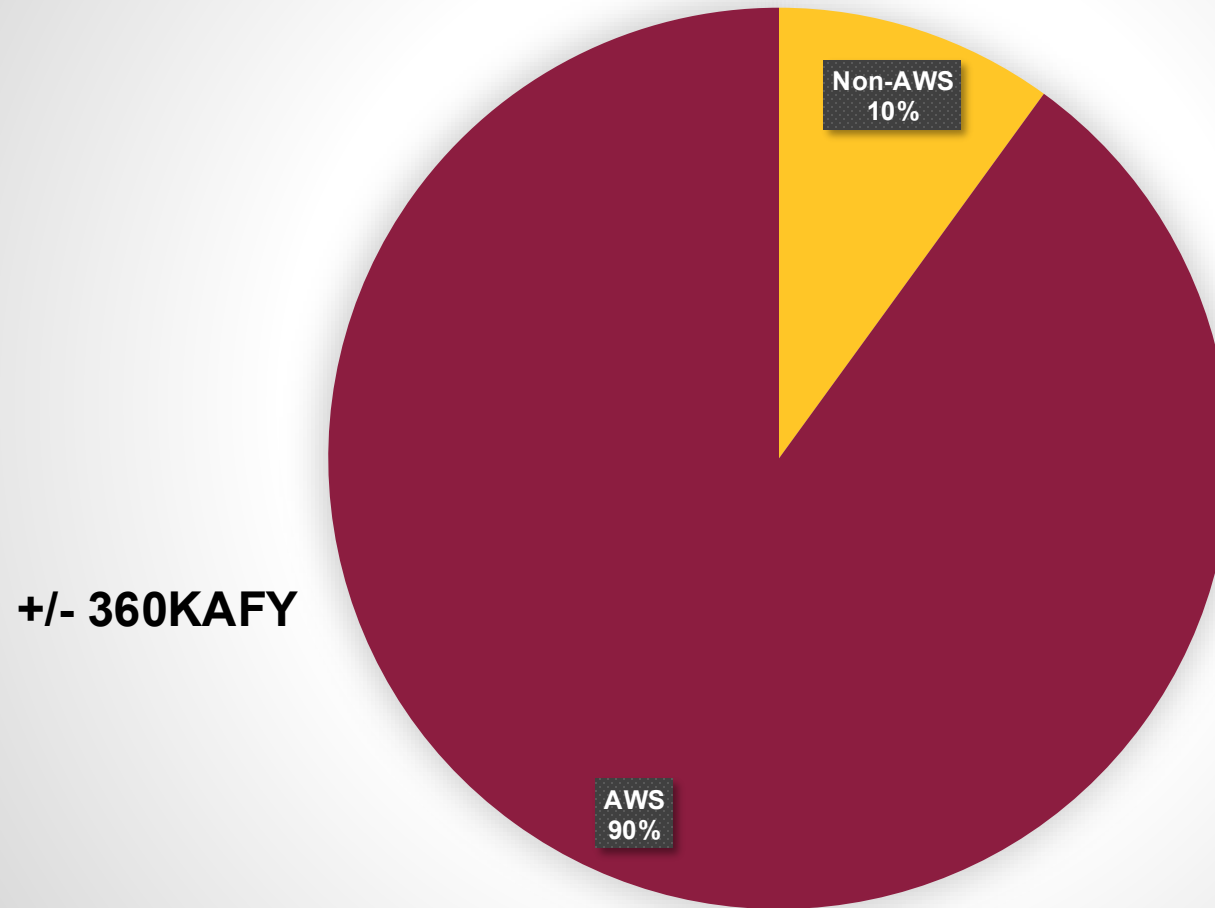


**Colorado River  
water as %-age  
Tap Water  
Deliveries**

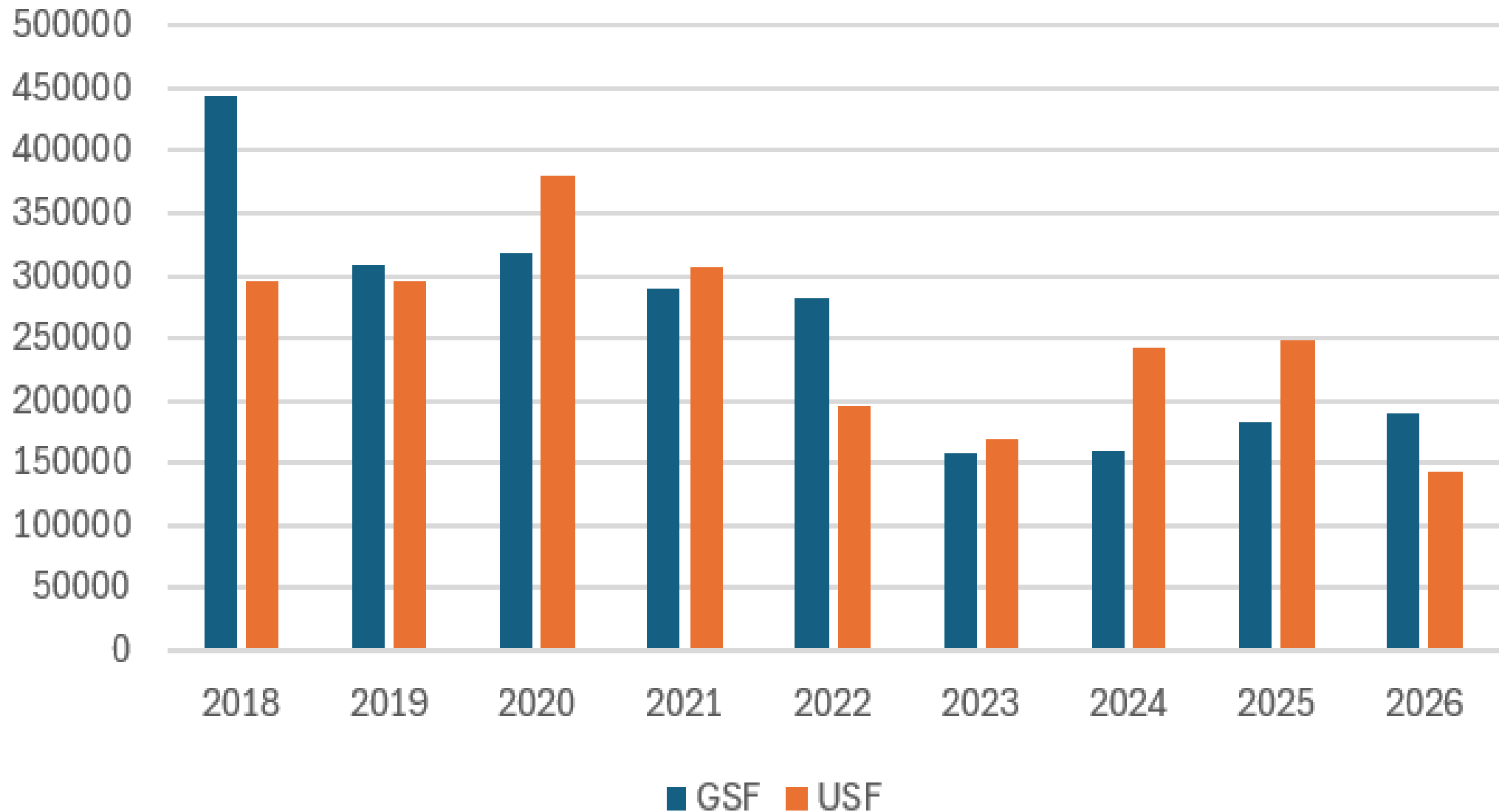
# Valley of the Sun Tap Water Sources



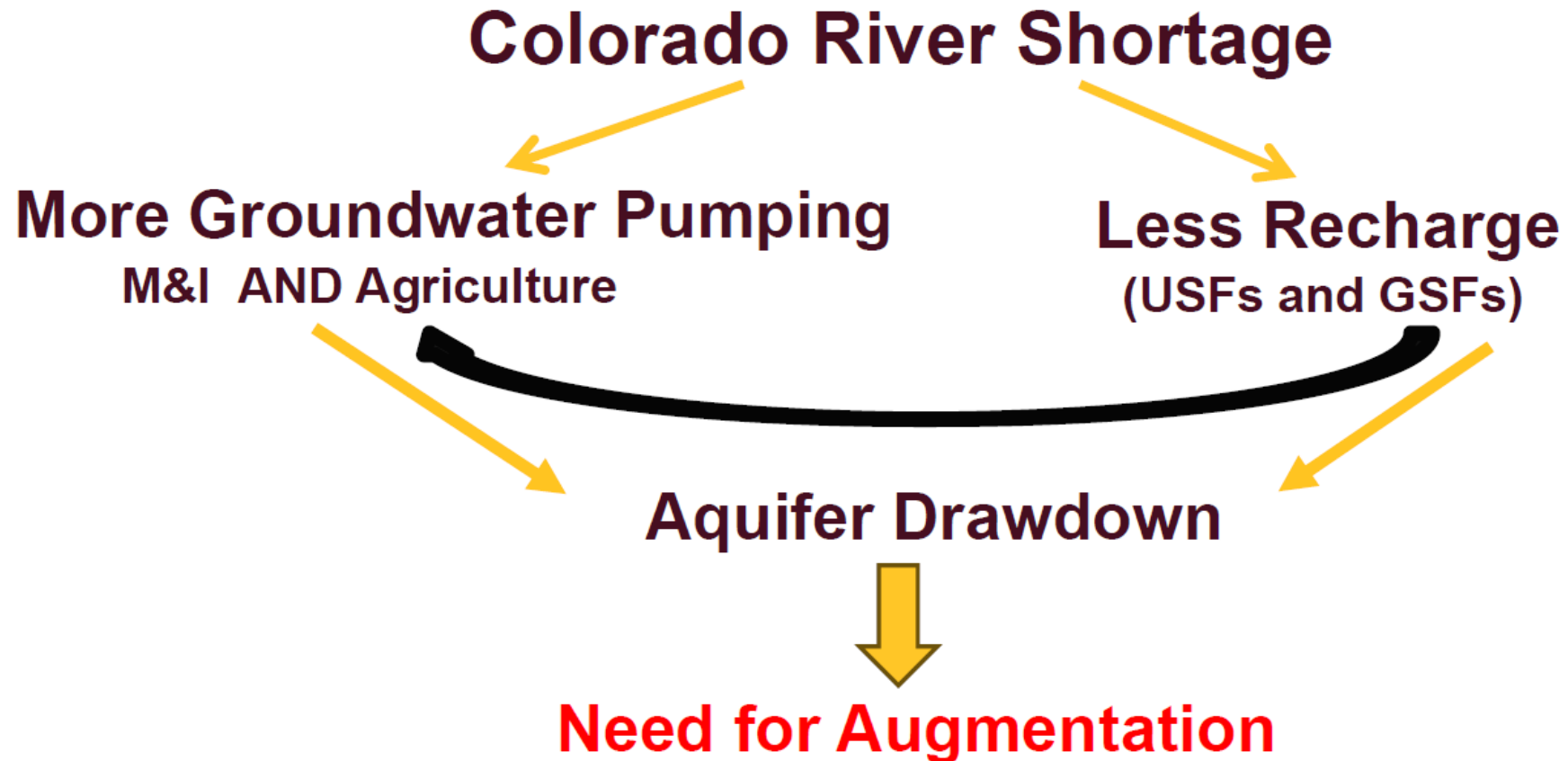
# Well Pumping for Tap Water in CAP Service Area



## GSF & USF Deliveries Over Time



# How Shortages Cause Aquifer Decline



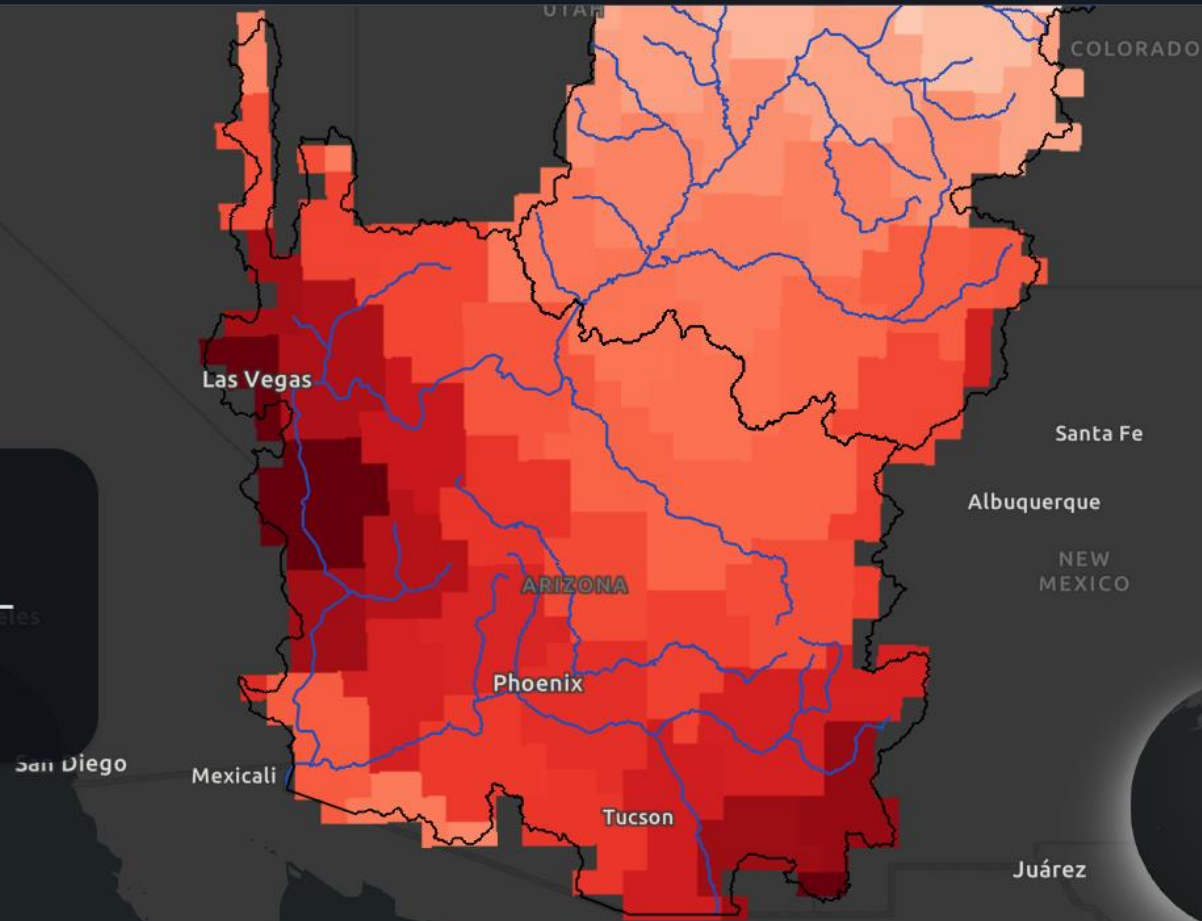
The Colorado River Basin

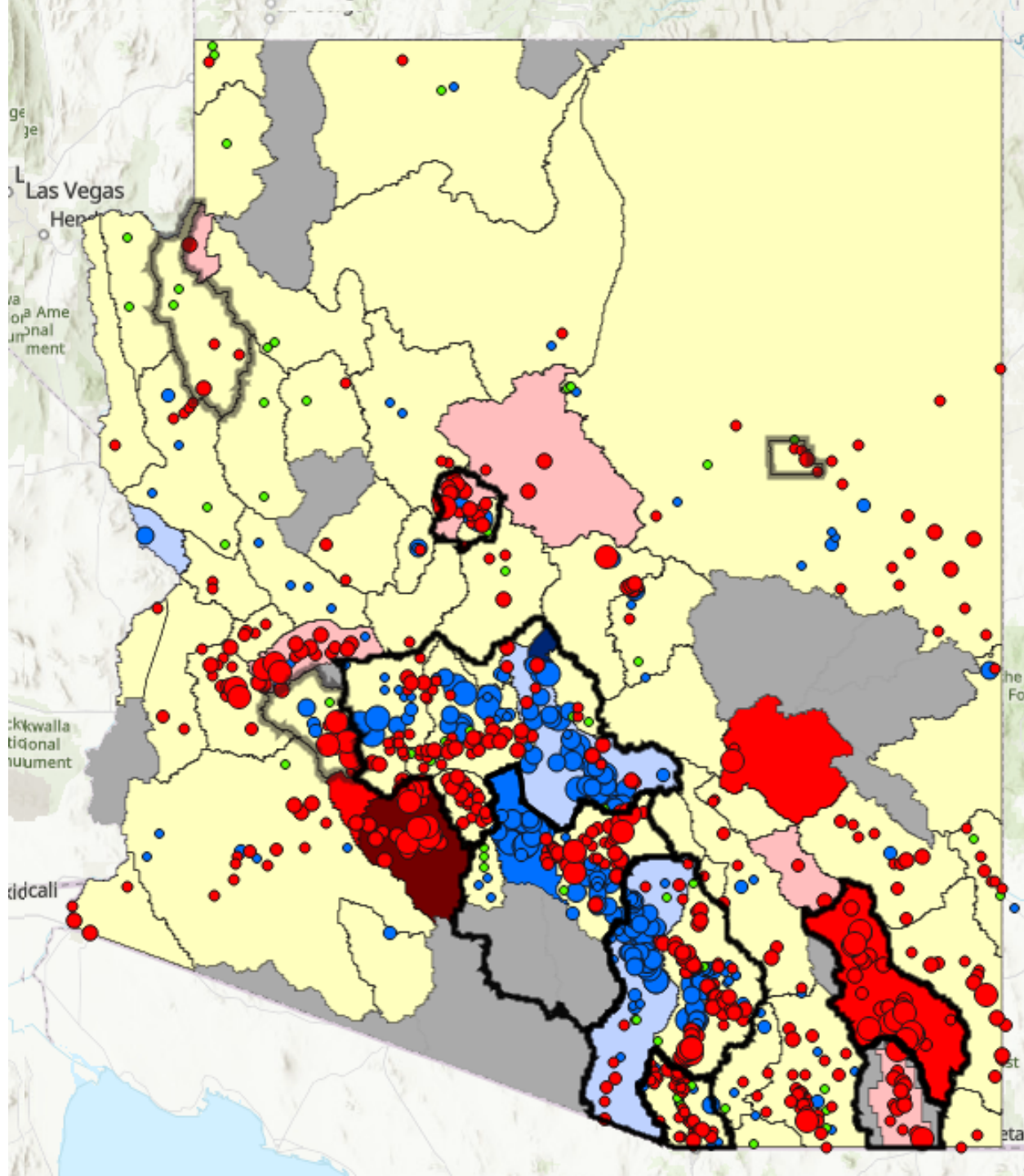
How Can Satellites Track Water...

Groundwater Is Disappearing in...

Groundwater decline in Arizona

In the Lower Basin,  $20.69 \pm 6.00$  million acre-feet (MAF) disappeared—71% of total stored water loss.





## Most Recent Water Year (2020)

### Layers

- ☐ Wells: 1-YR Water Level Change (2019-2020) ...
- ☐ Sub-basins: 1-YR Rate of Change (2019-2020) ...
- ☐ Wells: 10-YR Water Level Change (2010-2020) ...
- ☐ Sub-basins: 10-YR Rate of Change (2010-2020) ...
- ☒ Wells: 20-YR Water Level Change (2000-2020) ...

### 20-YR Water Level Change (ft)

- ☒ Sub-basins: 20-YR Rate of Change (2000-2020) ...
  - ☐ Sub-basins: 20-YR Rate of Change (2000-2020) ...
- 20-YR Water Level Change (ft)
- ☐ > 60
  - ☐ 40 to 60
  - ☐ 20 to 40
  - ☐ 10 to 20
  - ☐ > 1 - 10
  - ☐ < 1 foot change
  - ☐ -1 to -10
  - ☐ -10 to -20
  - ☐ -20 to -60
  - ☐ < -60

**Arizona  
Aquifers**

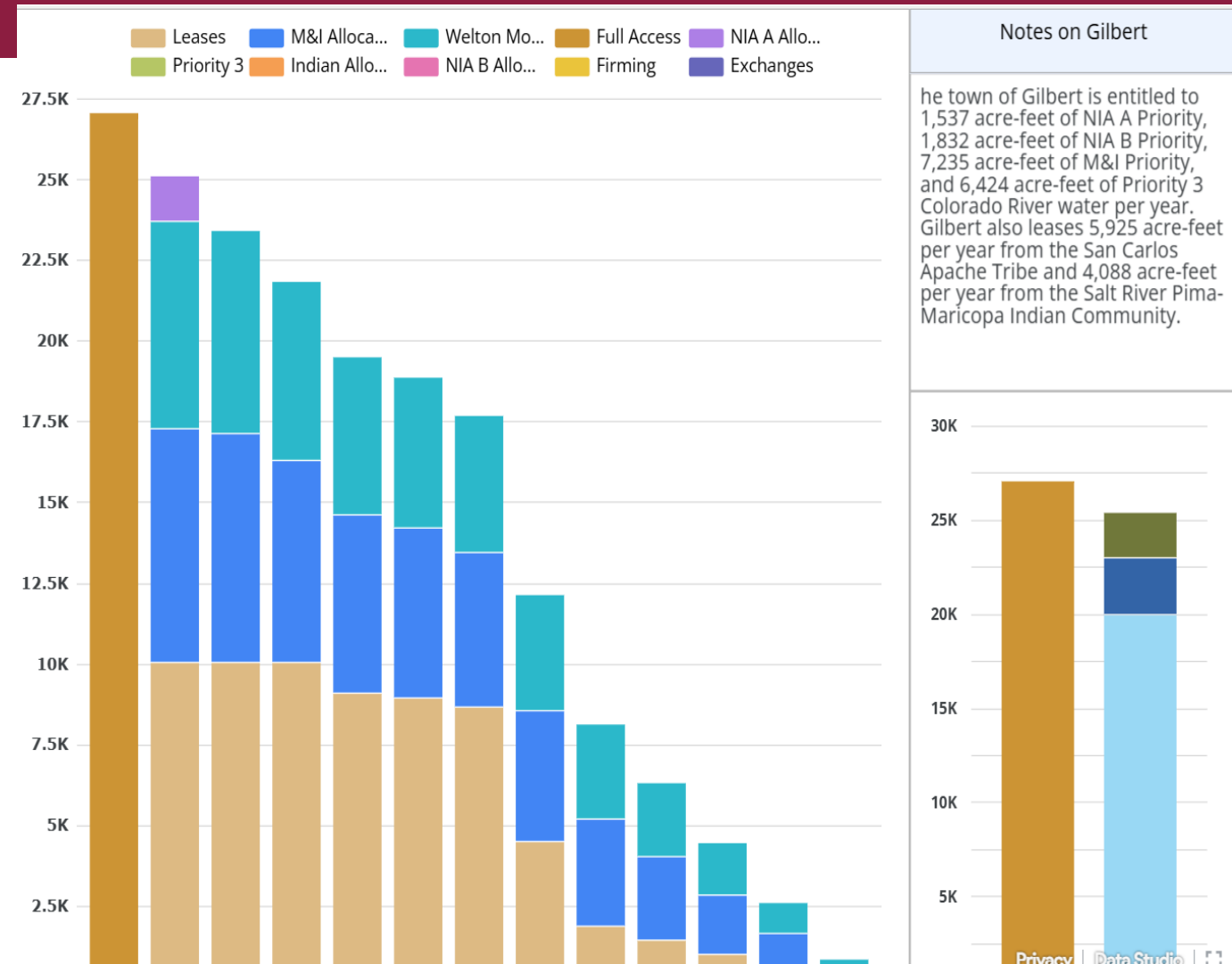


**Colorado  
River  
shortage**

# Groundwater CuRVE

## Colorado River Visualization Enterprise

- Colorado River water used to meet **tap water** demands must be replaced during shortage.
- Much of the replacement will come from well pumping.
- Groundwater CuRVE models the 50-year impact of that pumping on aquifer levels in the Phoenix AMA.



# Shortage Model

Based on current CAP usage patterns

- Amount of CAP water available to each entity fills uses in priority order
  - Surface water treatment plants (if the entity has one)
  - Exchanges with SRP for Salt & Verde River water (if the entity exchanges)
  - Direct delivery for industrial uses (if any)
  - Direct delivery for turf facilities (if any)
  - Tribes– Direct delivery for agriculture
- Leftover CAP water is available for USF/GSF and is assigned based on historic pattern of USF/GSF usage.

# Scenario Development

## Parameters

- Shortage Levels (**volumes in CAP** including P3):
  - 765 KAF (tentative 2027 volumes)
  - 600 KAF
  - 400 KAF
  - 200 KAF
- Demand Adjustments – for each shortage level, applied two demands
  - 6% increase over 50 years (assumes significant demand management & slowed growth)
  - 50% increase over 50 years (assumes higher rate of growth)
- Shortage levels are constant over 50-year run. Model is not time sequence, but represents beginning and end conditions (aquifer levels in 2025 and 2076)

# 765 KAF Available in CAP

## Roughly what was delivered in 2023

- Additional groundwater pumping over baseline: **200K AFY**
- Reduction in USF recharge: **-80K AFY**
- Increase in GSF pumping due to reduced recharge: **190K AFY**
- Range of Aquifer Drawdown by Year 50: **0-50 ft**

**NOT AWESOME BUT WE CAN HOLD**



# 600 KAF Available in CAP

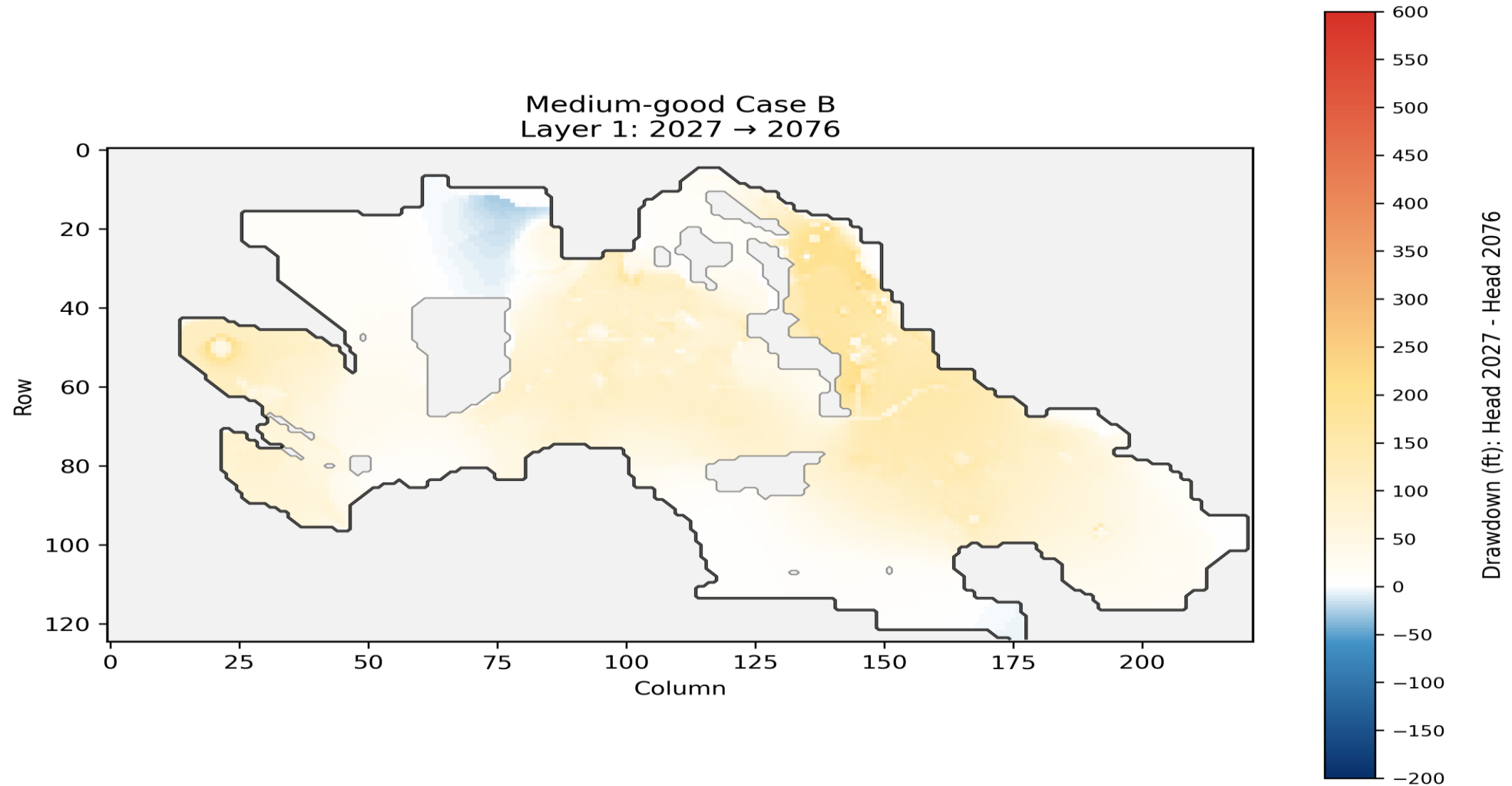
50% Demand Increase Over 50 Years

- Additional groundwater pumping over baseline: 250K AFY
- Reduction in USF recharge: -115K AFY
- Increase in GSF pumping due to reduced recharge: 230K AFY
- Range of Aquifer Drawdown by Year 50: 0-250 ft

COACH IS GETTING MAD



# 50-Year Drawdown (600 KAF CAP/50% Demand Increase)



# 400 KAF Available in CAP

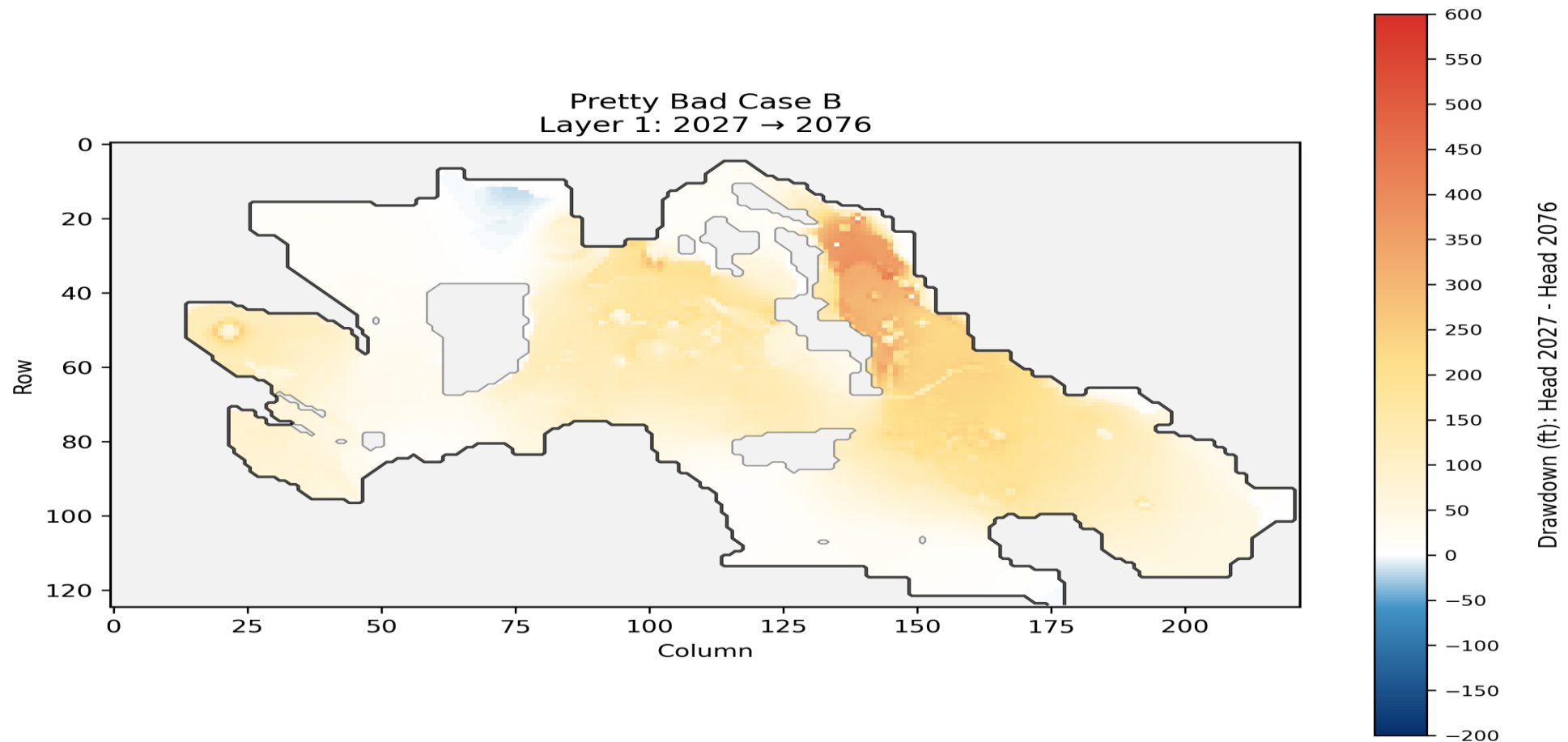
50% Demand Increase Over 50 Years

- AGP over baseline: 340K AFY
- Reduction in USF recharge: -140K AFY
- Increase in GSF pumping due to reduced recharge: 260K AFY
- Range of Aquifer Drawdown by Year 50: 0-450 ft

Things are coming apart



# 50-Year Drawdown (400 KAF CAP/50% Demand Increase)



# 200 KAF Available in CAP

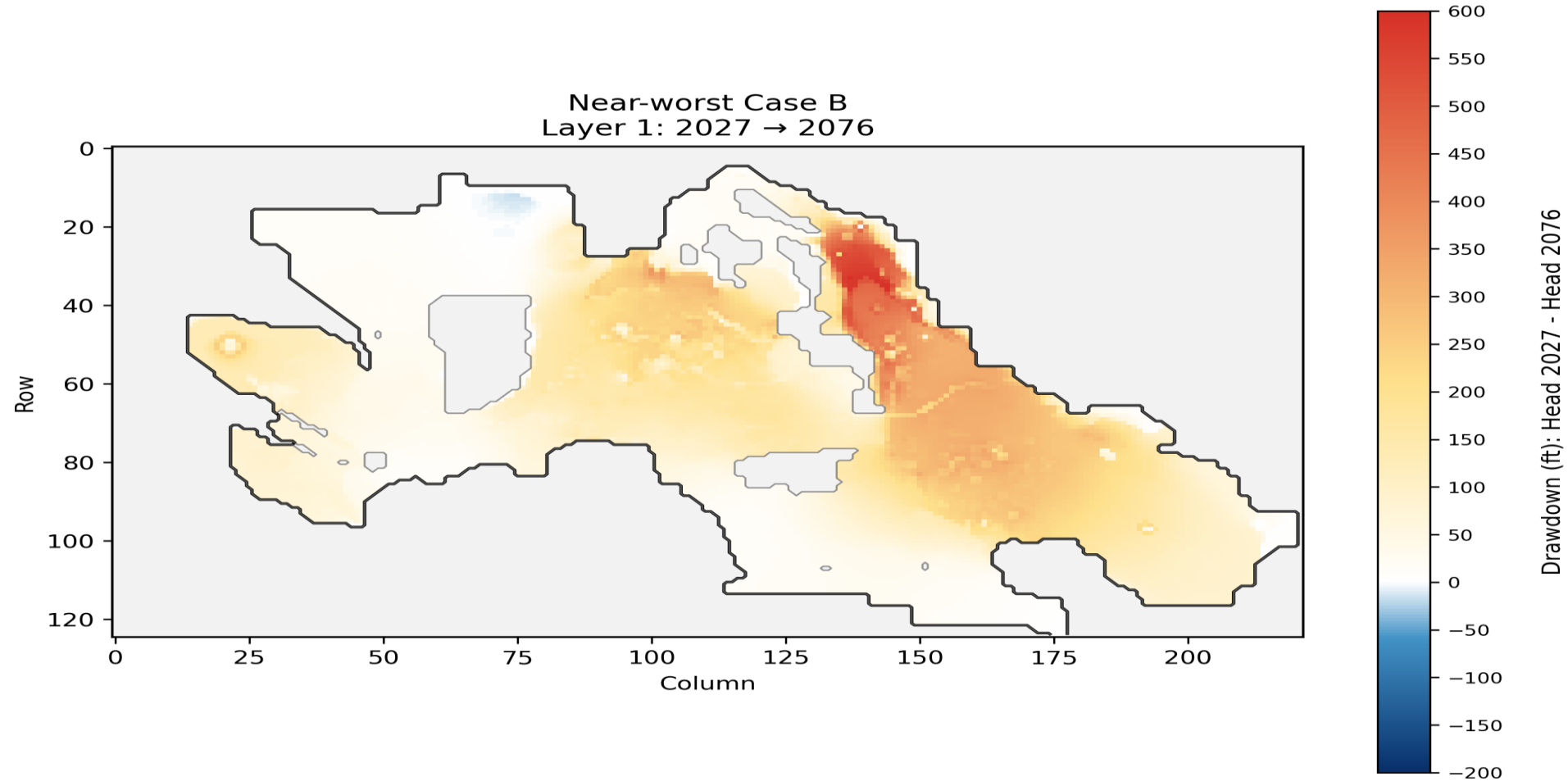
50% Demand Increase Over 50 Years

- Additional groundwater pumping over baseline: **440K AFY**
- Reduction in USF recharge: **-160K AFY**
- Increase in GSF pumping due to reduced recharge: **270K AFY**
- Range of Aquifer Drawdown by Year 50:  
**50-600 ft**

**We're going to need a Hail Mary AND an extra second on the game clock**



# 50-Year Drawdown (200 KAF CAP/50% Demand Increase)



# How do you solve a water problem in the West?

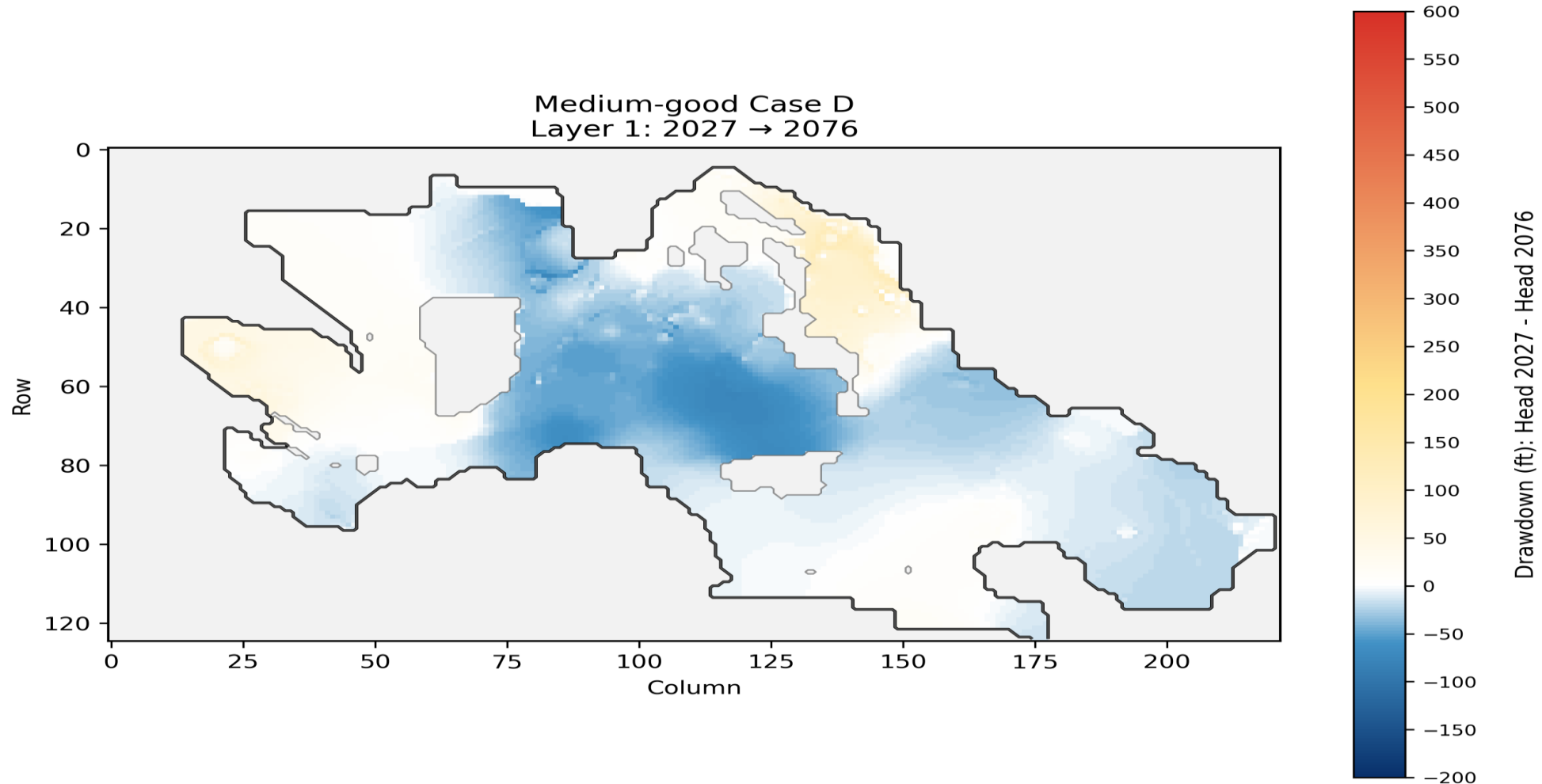
By conserving

By augmenting supplies

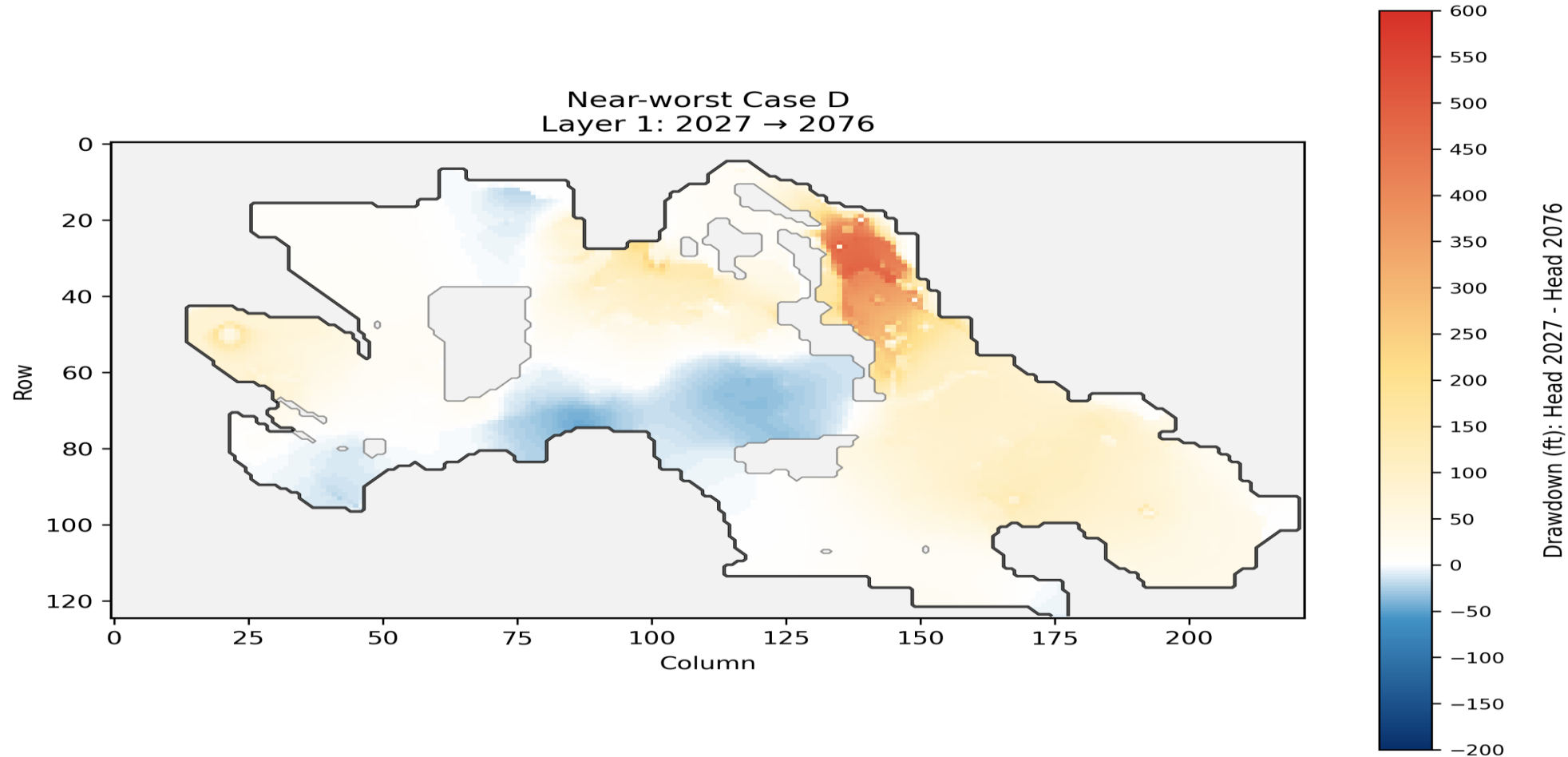
By increasing the price of water to signal the scarcity of the resource

By taking someone else's water

# No Ag GW pumping (600 KAF CAP/50% Demand Increase)



# No Ag GW pumping (200 KAF CAP/50% Demand Increase)



# What Did We Learn from all this?

- Loss of Colorado River water creates a deficit in volumes necessary to meet tap water deliveries
- Loss of Colorado River water significantly reduces artificial recharge in USFs and results in more agricultural pumping from loss of GSF recharge.
- This negative result will be exacerbated if entities use their available water for system conservation in Lake Mead rather than at USFs and GSFs.
- To meet demands, transfer of pumping locations is necessary, which requires collaboration in infrastructure improvements.

# What about all that banked water?

## Long Term Storage Credits Dashboard

| AMA     | LTSA_HOLDER     | LTSC_VOLUME  |
|---------|-----------------|--------------|
| Phoenix | ARIZONA WA...   | 4,382,318.3  |
|         | CENTRAL ARI...  | 1,836,303.3  |
| Pinal   | GILA RIVER ...  | 756,810.5    |
|         | CITY OF PHO...  | 638,775.9    |
| Tucson  | CITY OF TUC...  | 586,634.8    |
|         | CITY OF MESA    | 560,797.5    |
|         | TOWN OF GI...   | 558,127.3    |
|         | CENTRAL ARI...  | 499,692.4    |
|         | CITY OF CHA...  | 471,960.1    |
|         | BUREAU OF ...   | 421,479.8    |
|         | GILA RIVER I... | 363,838.2    |
|         | TOHONO O'...    | 345,419.9    |
|         | FREEPORT M...   | 312,981.3    |
|         | RESOLUTION...   | 276,857      |
|         | CITY OF SCO...  | 276,211.9    |
|         | CITY OF PEO...  | 229,117.4    |
|         | VIDLER WAT...   | 214,584.4    |
|         | CITY OF GLE...  | 203,072.7    |
|         | CITY OF SUR...  | 142,036.6    |
|         | ASARCO          | 137,716.5    |
|         | CITY OF AVO...  | 134,539.8    |
|         |                 | 14,506,537.9 |

| GSF               |             |
|-------------------|-------------|
| FACILITY_N...     | LTSC_VOLUME |
| New Magma...      | 1,459,932   |
| Maricopa-St...    | 1,286,814   |
| Roosevelt W...    | 1,219,077   |
| Hohokam Irri...   | 968,740     |
| Salt River Val... | 859,830     |
| Central Arizo...  | 838,432     |
| Queen Cree...     | 422,559     |
|                   | 8,119,031   |

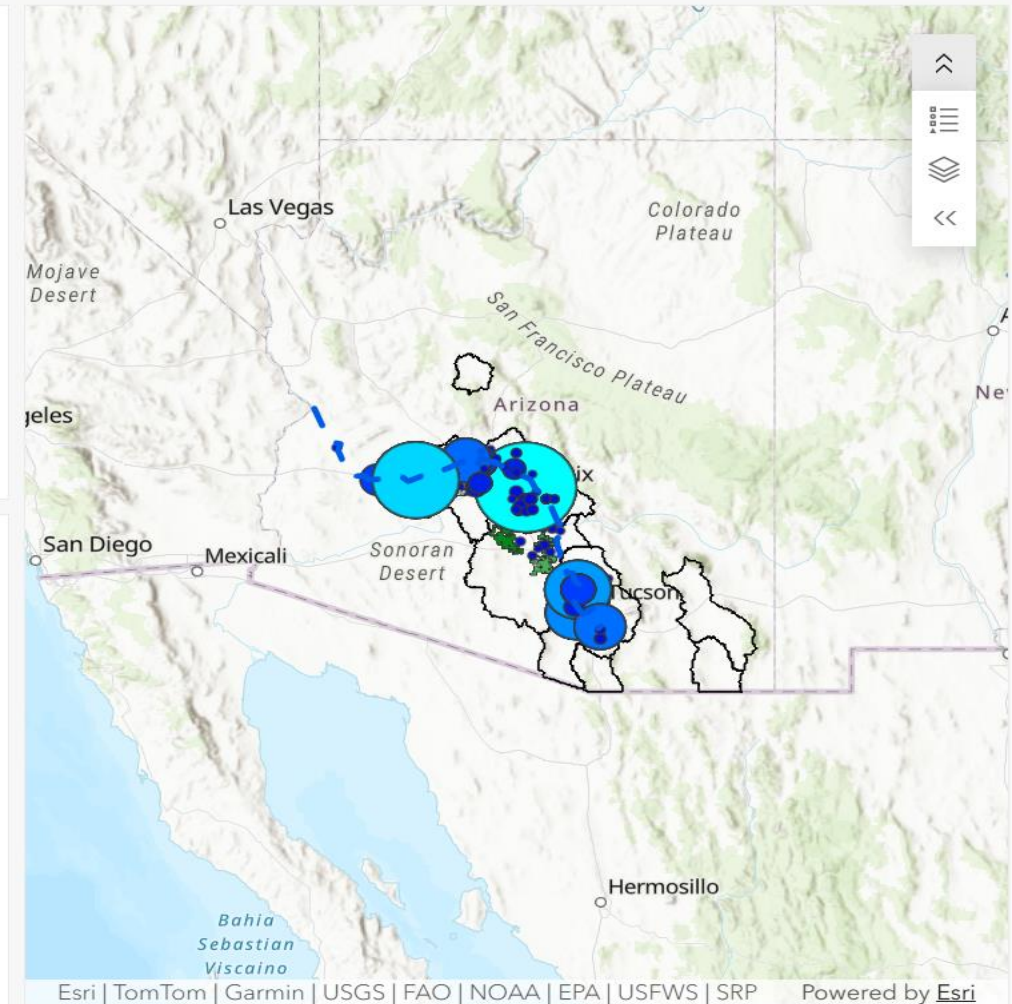
| USF              |             |
|------------------|-------------|
| FACILITY_N...    | LTSC_VOLUME |
| Granite Reef ... | 863,890     |
| Tonopah De...    | 722,756     |
| Lower Santa ...  | 536,971     |
| Southern Avr...  | 485,062     |
| Pima Mine R...   | 399,408     |
| Hieroglyphic...  | 382,341     |
| Santa Cruz Ri... | 285,157     |
|                  | 6,387,506   |

### Groundwater Savings Facility (...)

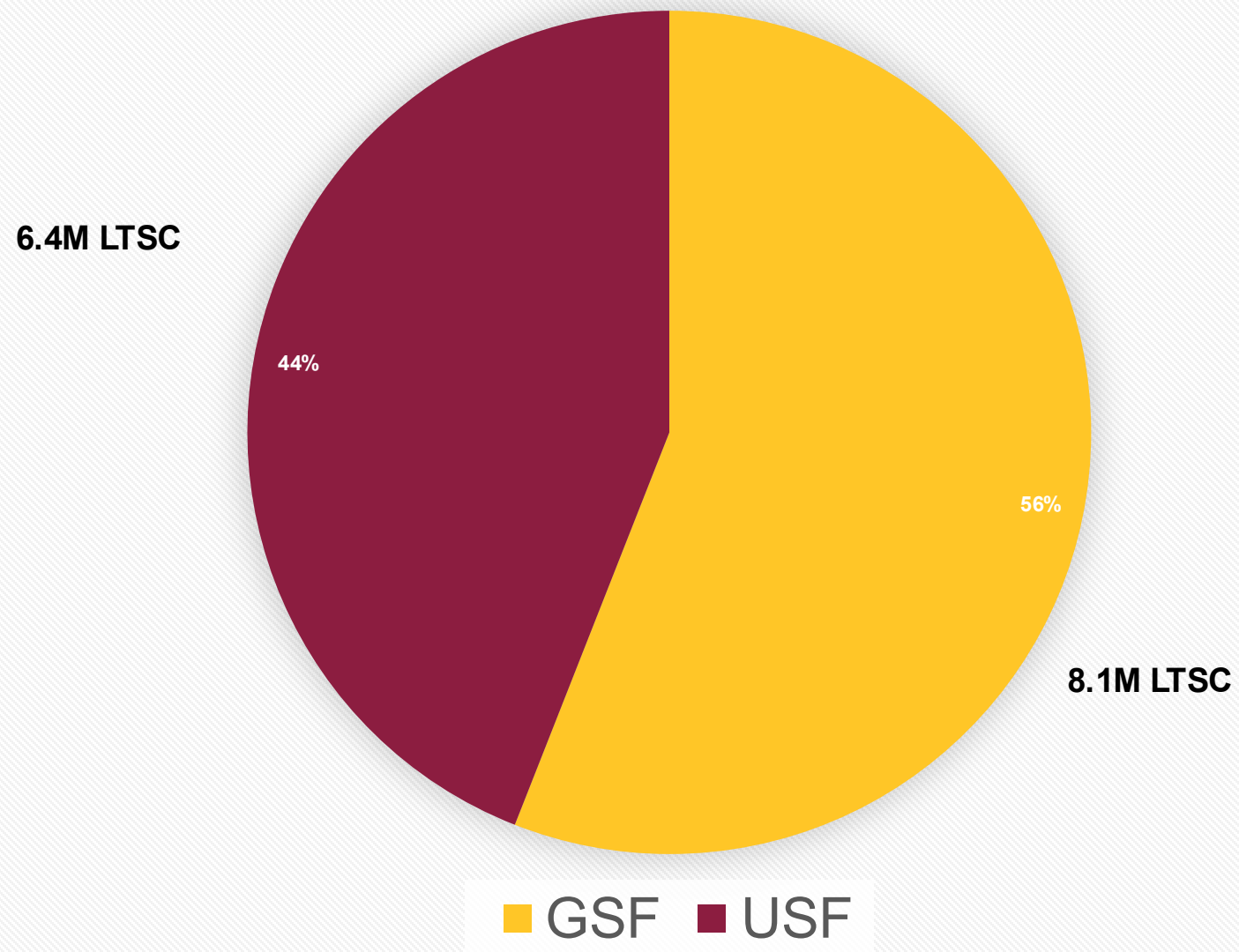
 Selection required from:  
 Table (6)

### Underground Storage Facility ...

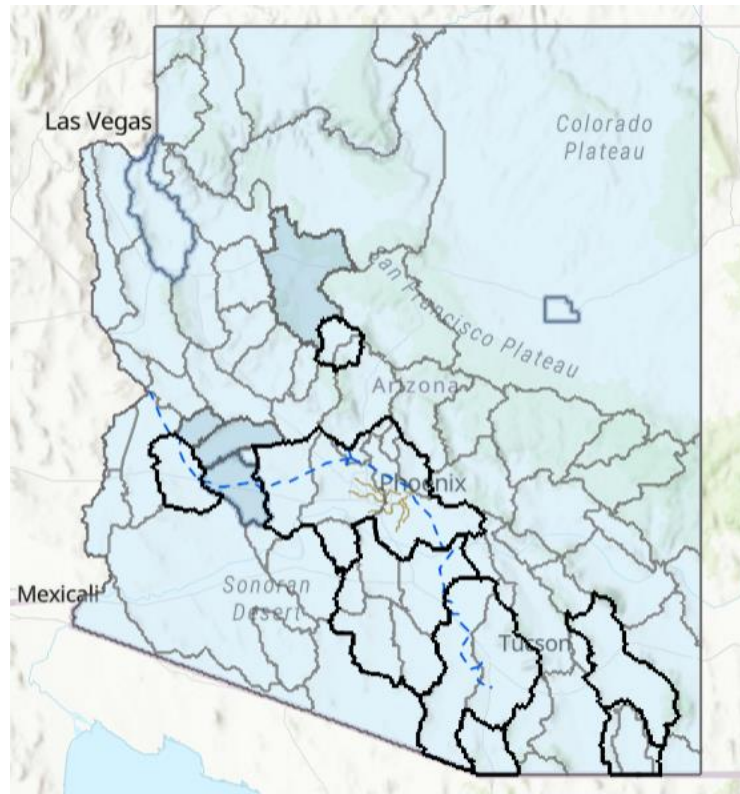
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 Table (6)

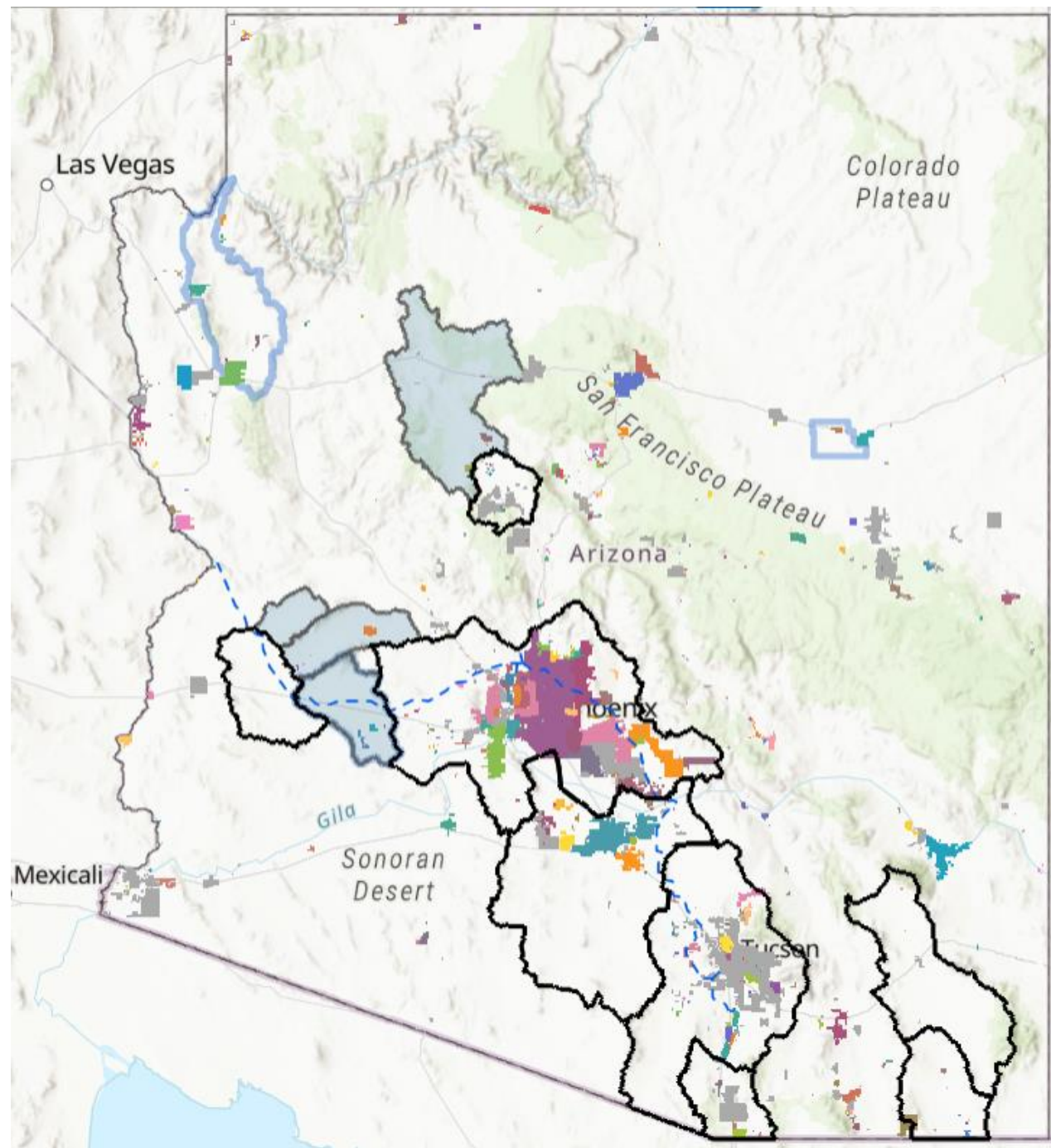


## Long-term Storage Credits in Tri-AMA Area



# OK, what about all the other aquifers?





# What cities are doing

- Tripling down on conservation
- Drilling more wells
- Entering into agreements for recovery of banked water and transportation
- Ensuring that recovery occurs closer to the area of hydrologic impact
  - Exchanging LTSCs
  - Gilbert Road pipeline
  - Phoenix's first call on SRP wells
- Investing in advanced water purification (pause)
- Helping each other through physical interconnects and voluntary transactions
- Investing in additional storage on the Verde
- Exchanging water with Tucson
- With SRP, developing the SCIF
- And yes, investing in transporting groundwater out of Harquahala

We will need to draw down our aquifers in the short term.

But we can collaborate to do it strategically to cause least harm to our aquifers

And we can team up to ensure that benefits and costs are distributed fairly.

