

Exploring Water Management Concepts, PrAMA Model - Draft

Regional Hydrology Model Revisions

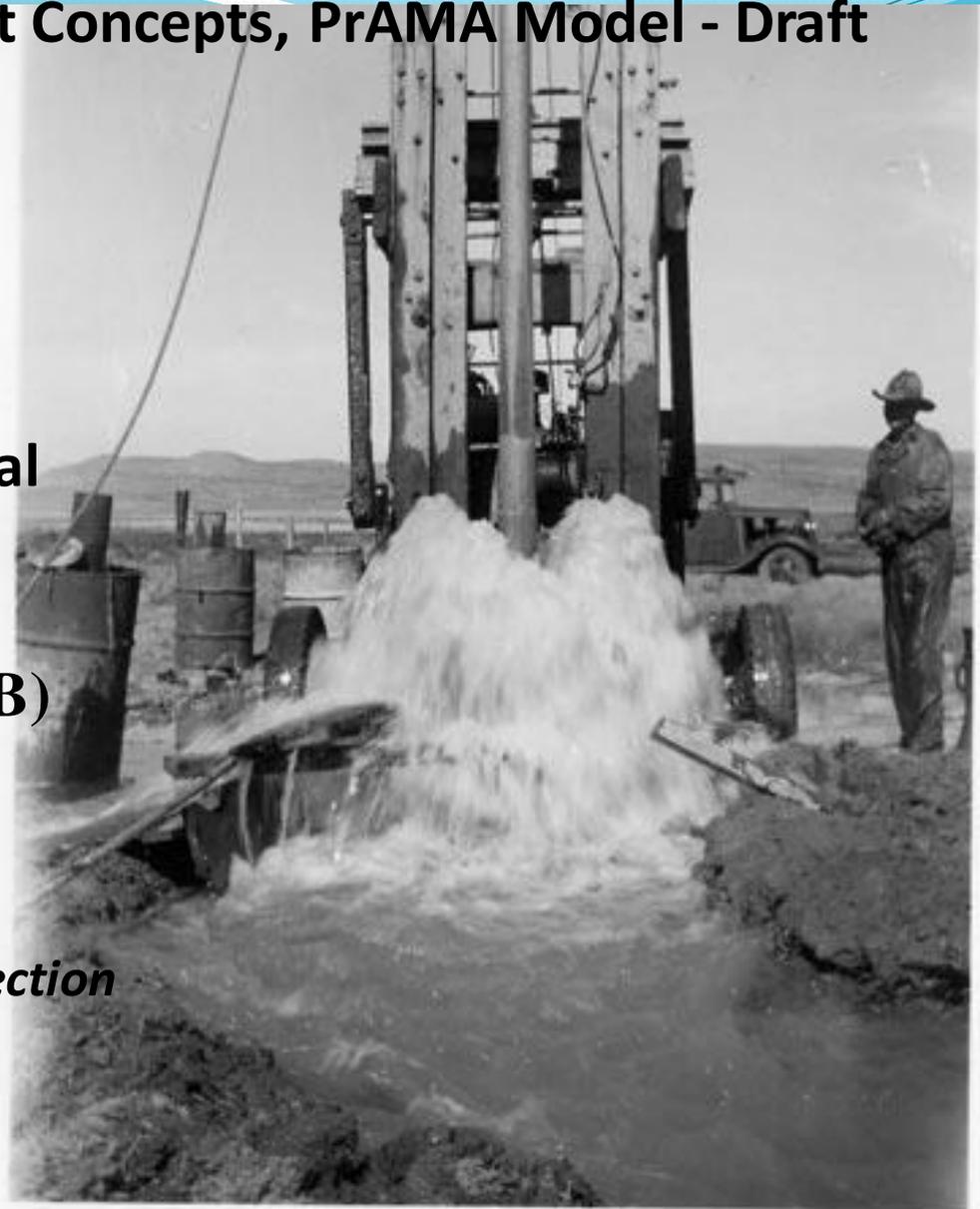
Recharge Distribution
Aquitard Extension

Compare Base vs. Hypothetical Pumping Distributions

- Δ Storage
- Streamflow Depletion (HDB)
- Capture & Induced Recharge*

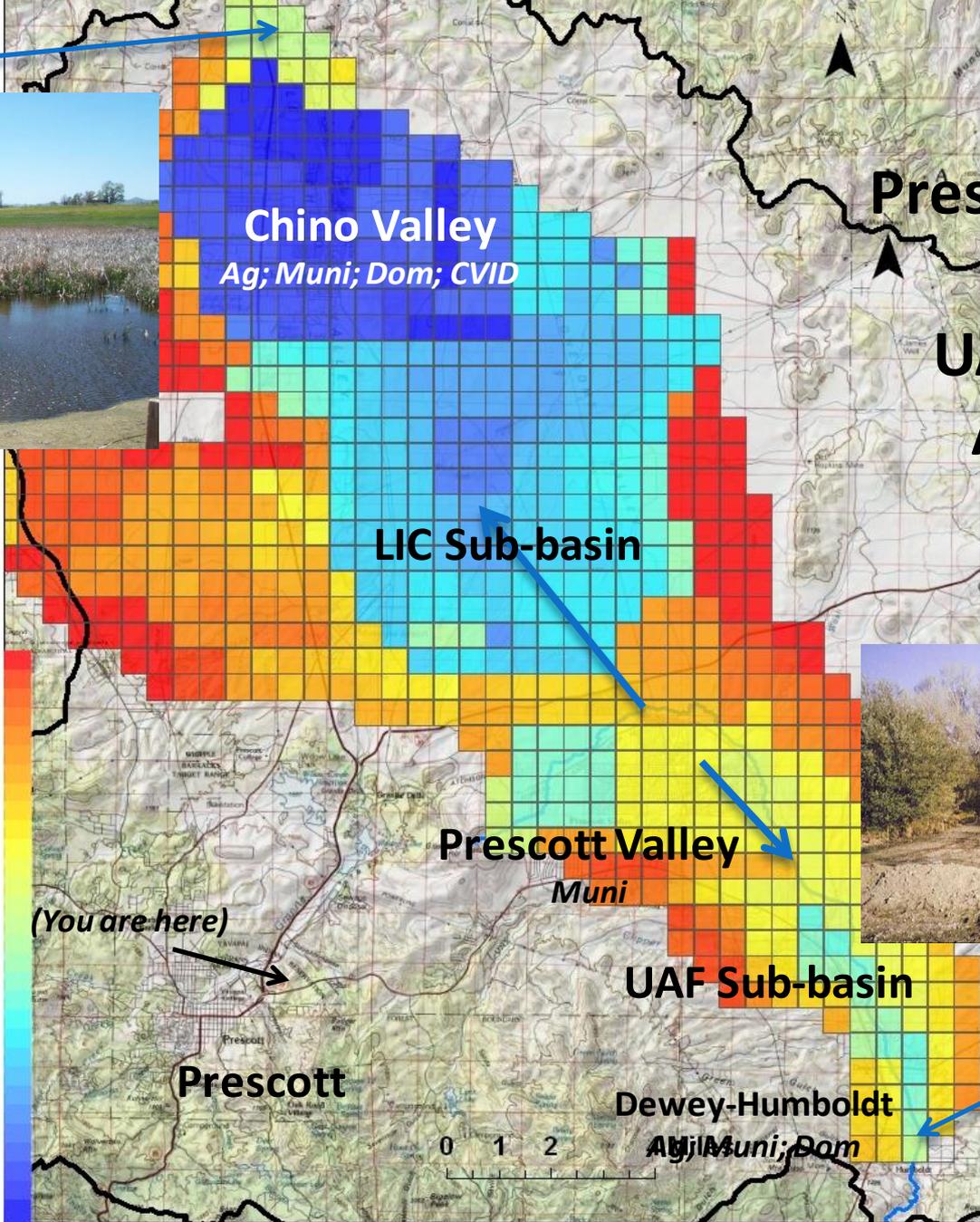
Acknowledgments

*ADWR Field Services & Modeling Section
USGS; Drillers, Hydro/geo,
Geotechnical Studies
Stakeholders, Citizens*



Contact: kmnelson@azwater.gov

Del Rio Springs



Prescott AMA ,
 485 mi²
 UAU & LVU
 Aquifers

Simulated
 Total
 Transmissivity
 Low T

Modest T

High T



Agua Fria
 River
 Baseflow

(You are here)

Prescott

Prescott Valley
 Muni

UAF Sub-basin

Dewey-Humboldt
 Ag; Muni; Dom

0 1 2

Plausible Range of Natural Recharge
Based on available data (1939-2011):
7,500 – 12,000 AF/yr (95% CI, 5K-15K)
Long-Term Natural $\sim 2/3$ Variable Streams
Recharge Rate $\sim 1/3$ Uniform MFR

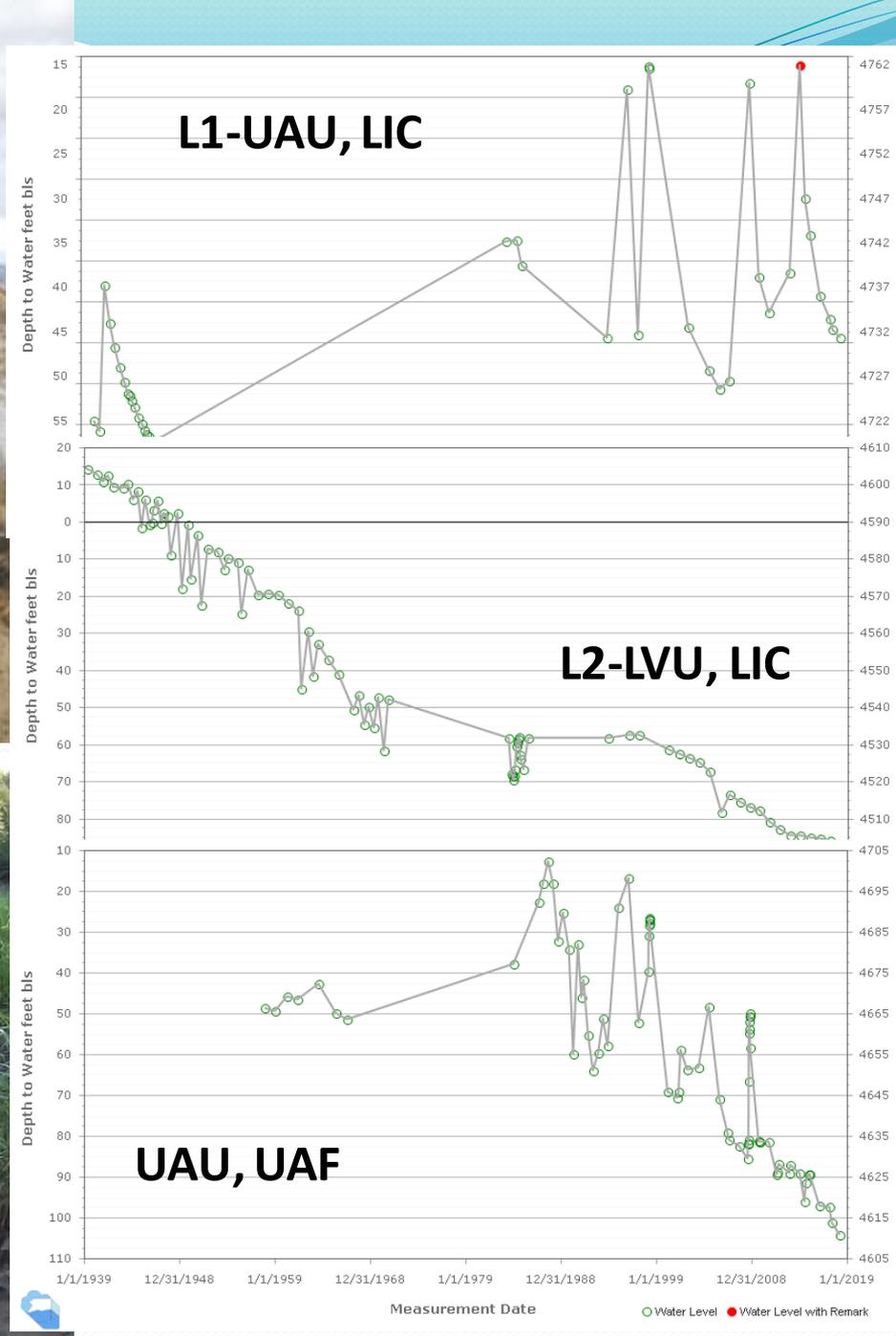


Greater model bias resulted when recharge was forced upon areas outside major tributaries & MFR zones

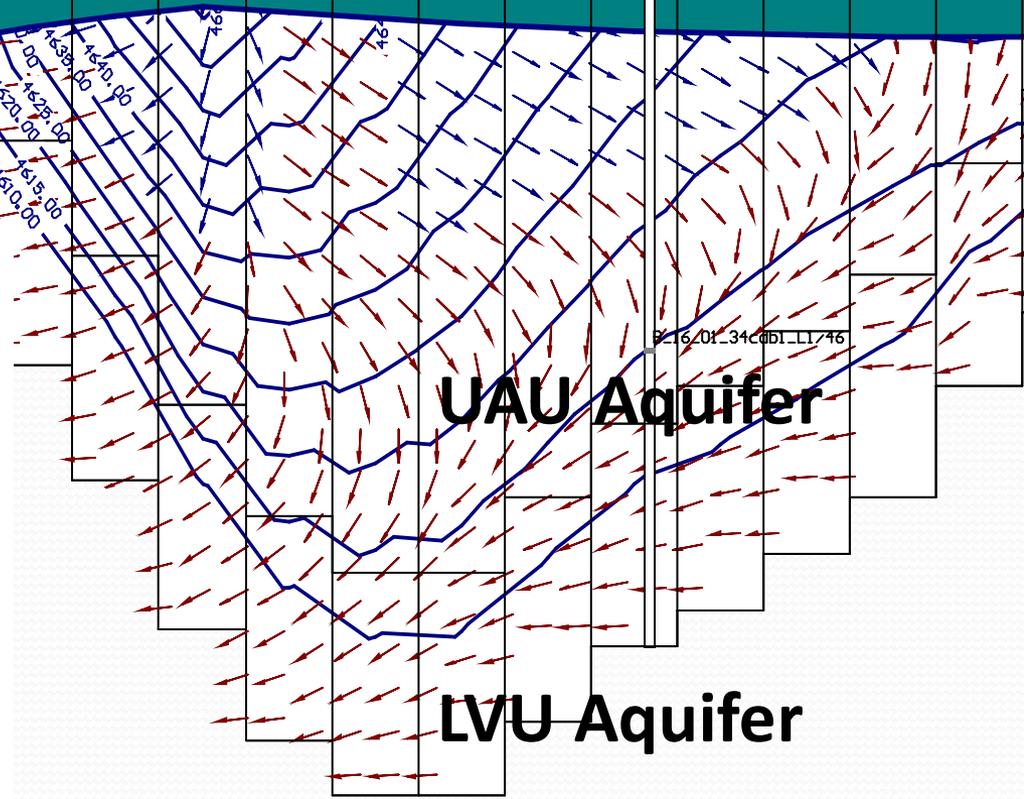
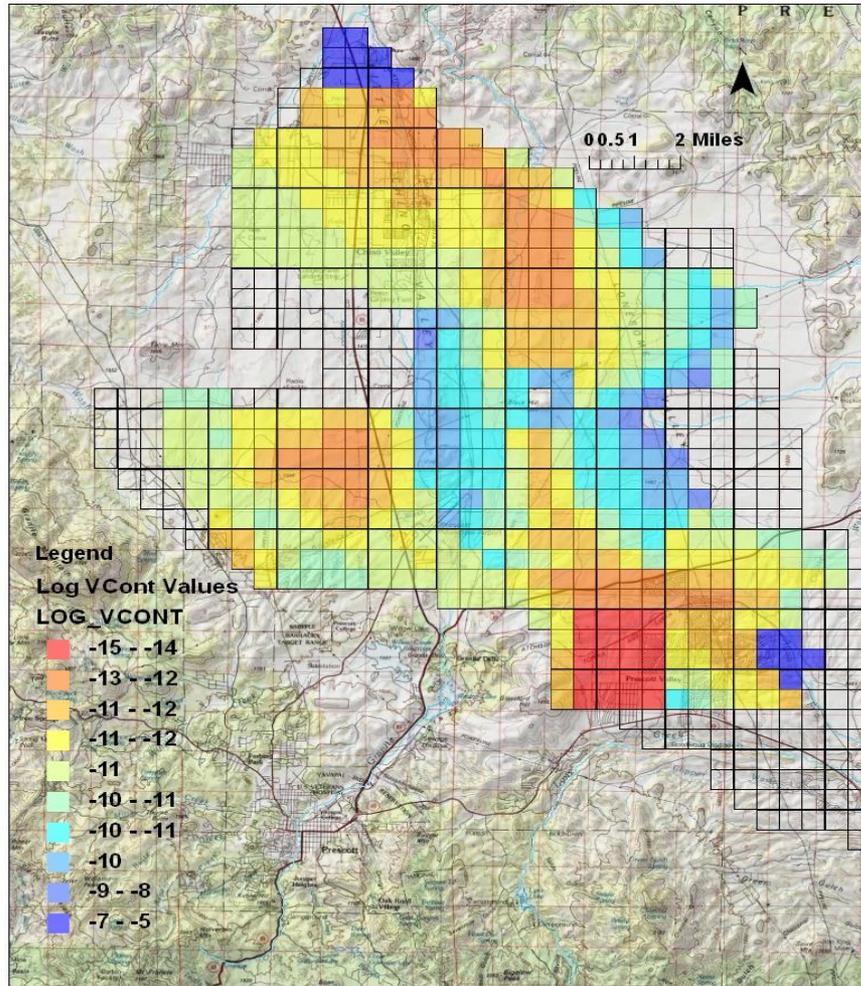
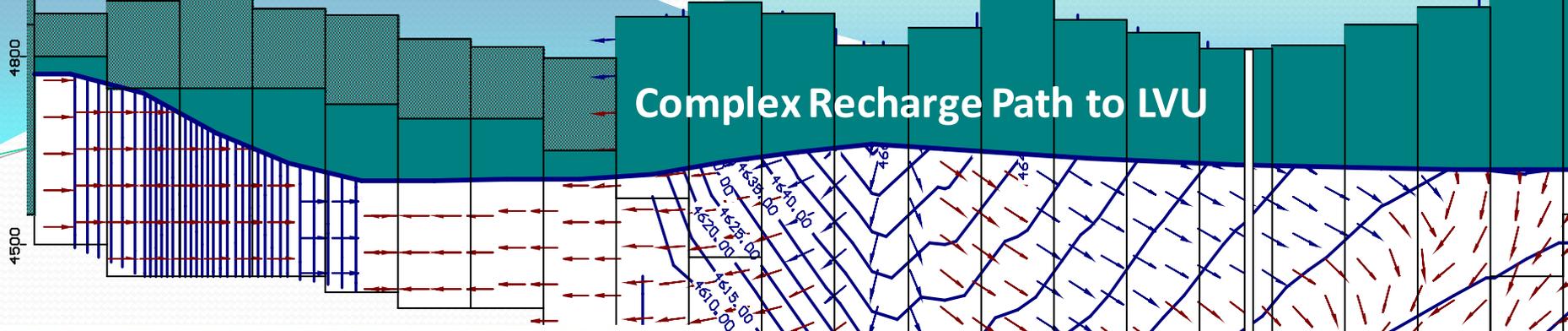
Simulated Natural Recharge

-  MFR (recharge cells - constant)
-  Bradshaw Foothills (variable recharge cells)
-  Lynx Creek/Agua Fria River (variable stream cells)
-  Granite Creek (variable stream cells)

Aquifer Recharge Distribution

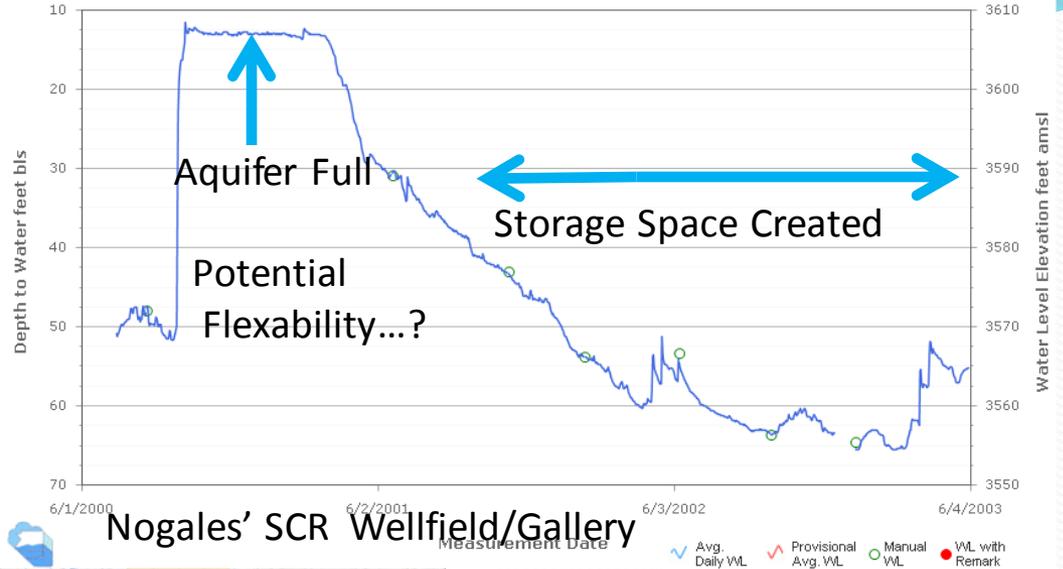
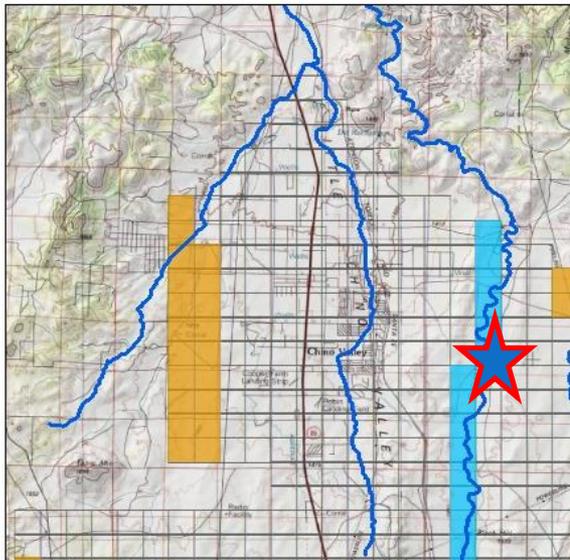


Photo, Chino Valley Review; D. McMillian

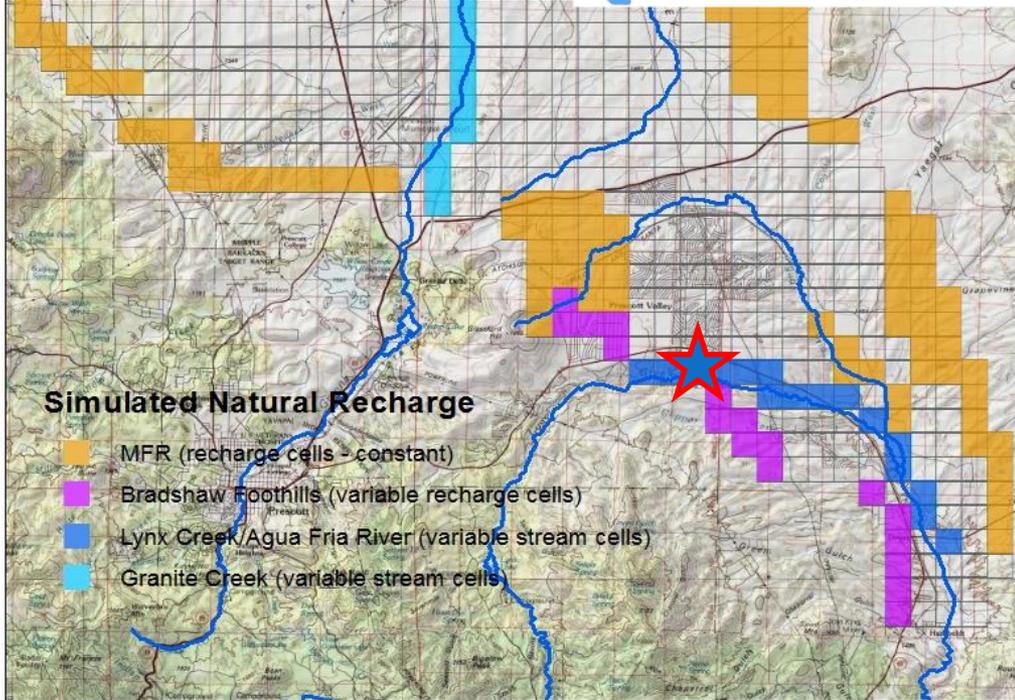


Primary Aquitard, Sensitive
 48000 56000 64000 72000
Kz3 95% CI: $\approx 0.0007 - 0.003$ feet/day

Kz26 $\approx 1E-6$ ft/d, very strong hydraulic isolation between UAU and LVU



Nogales' SCR Wellfield/Gallery



Simulated Natural Recharge

- MFR (recharge cells - constant)
- Bradshaw Foothills (variable recharge cells)
- Lynx Creek/Agua Fria River (variable stream cells)
- Granite Creek (variable stream cells)

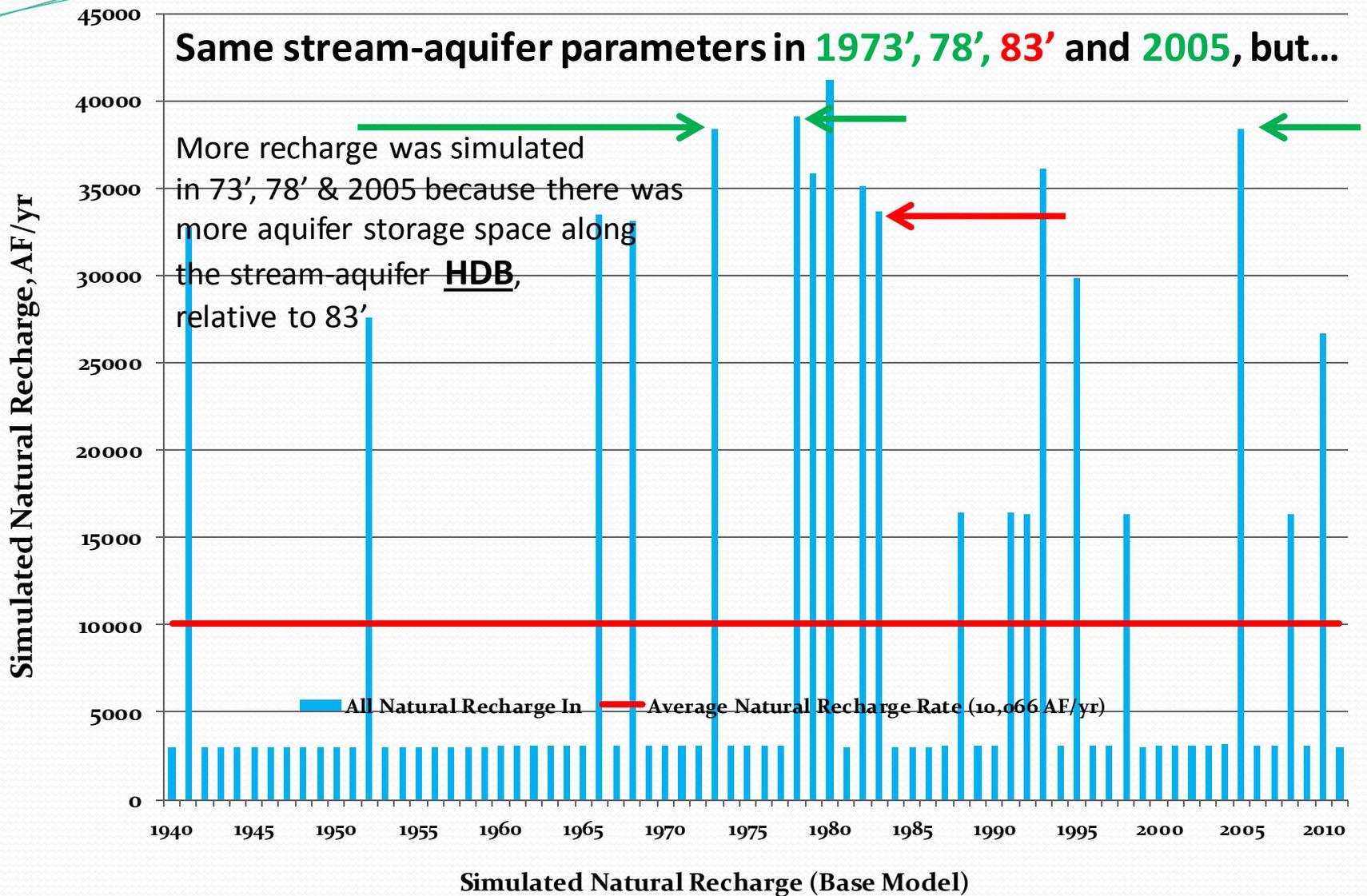


**Hypothetical
Withdrawal
Pumpage and/or
infiltration gallery**

1978-1984 (5.6 years)

North Granite Creek
5X -100,000 ft³/day
23,360 AF

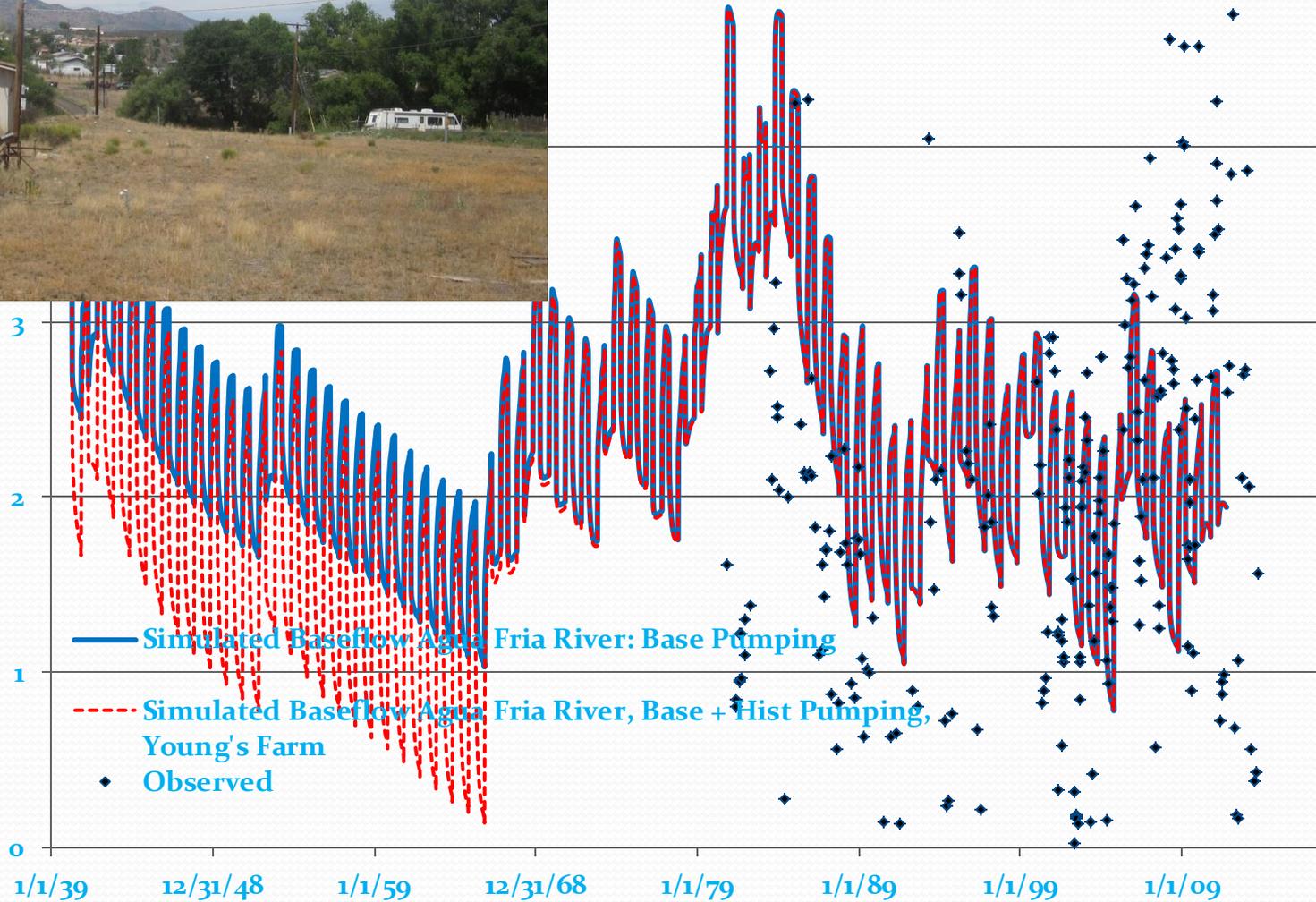
Upper Lynx Creek
5X(-100,000 ft³/day)
23,360 AF



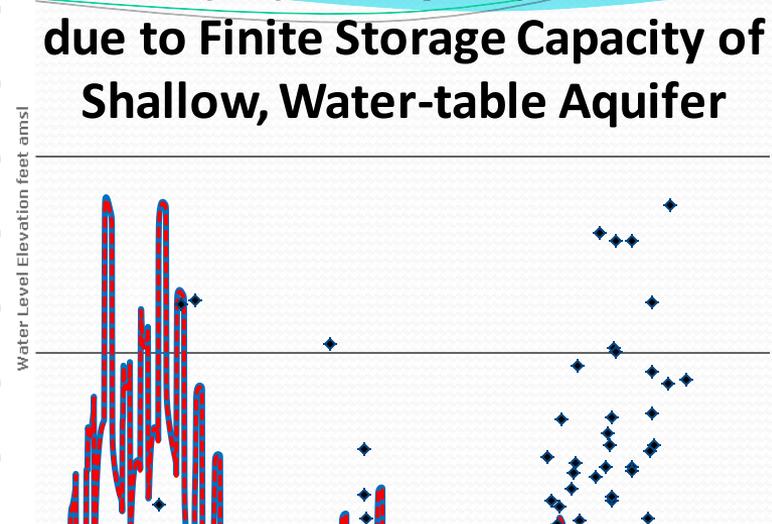
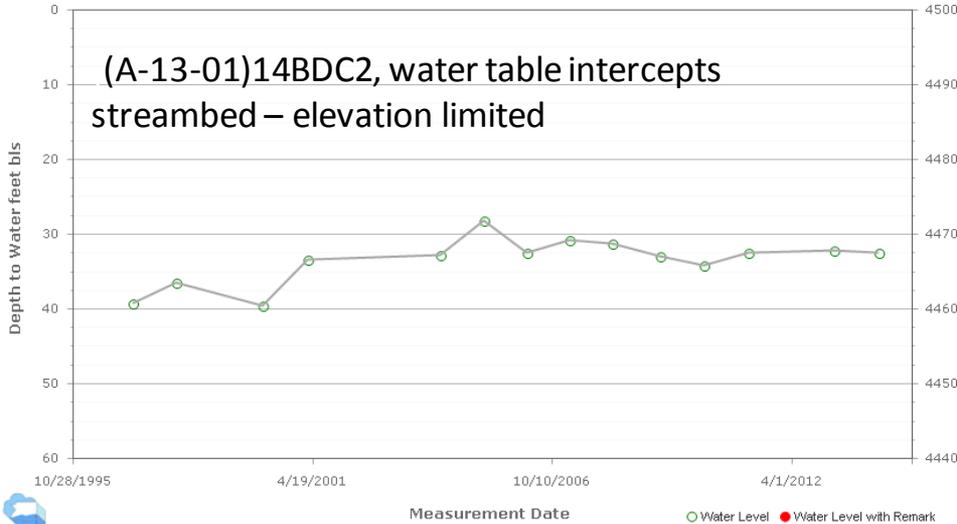
Inner Valley Hydrologic System “Resets” due to Finite Storage Capacity of Shallow, Water-table Aquifer



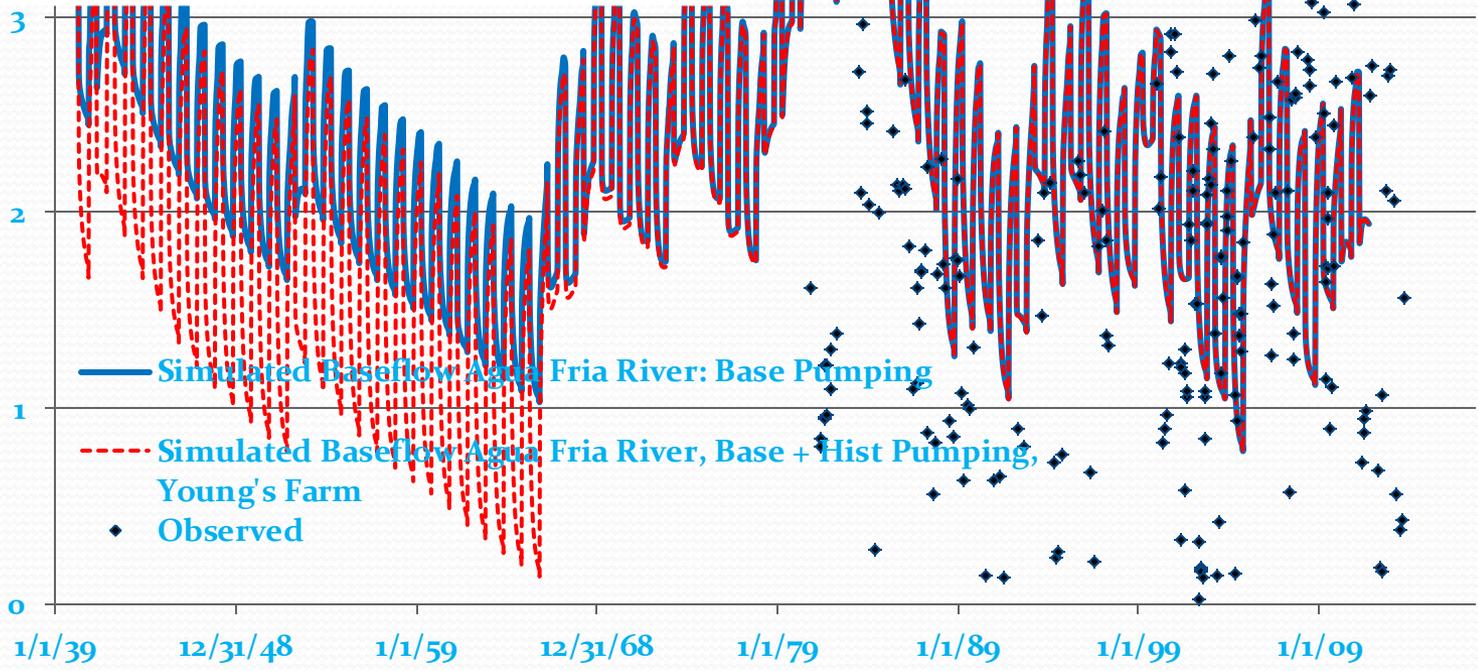
Simulated Baseflow Agua Fria

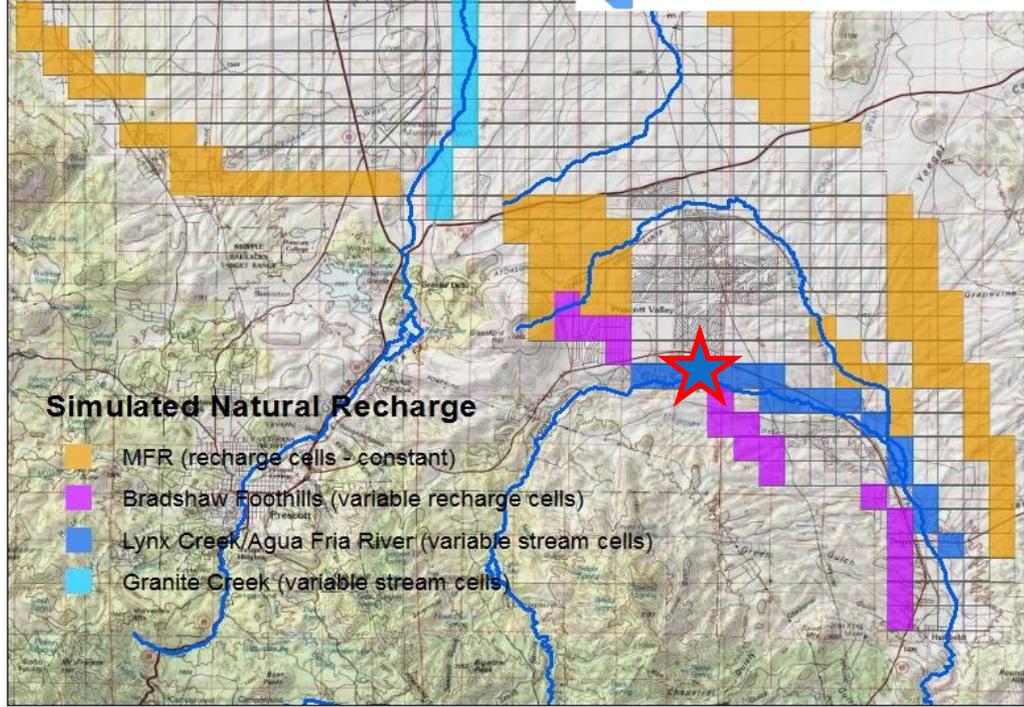
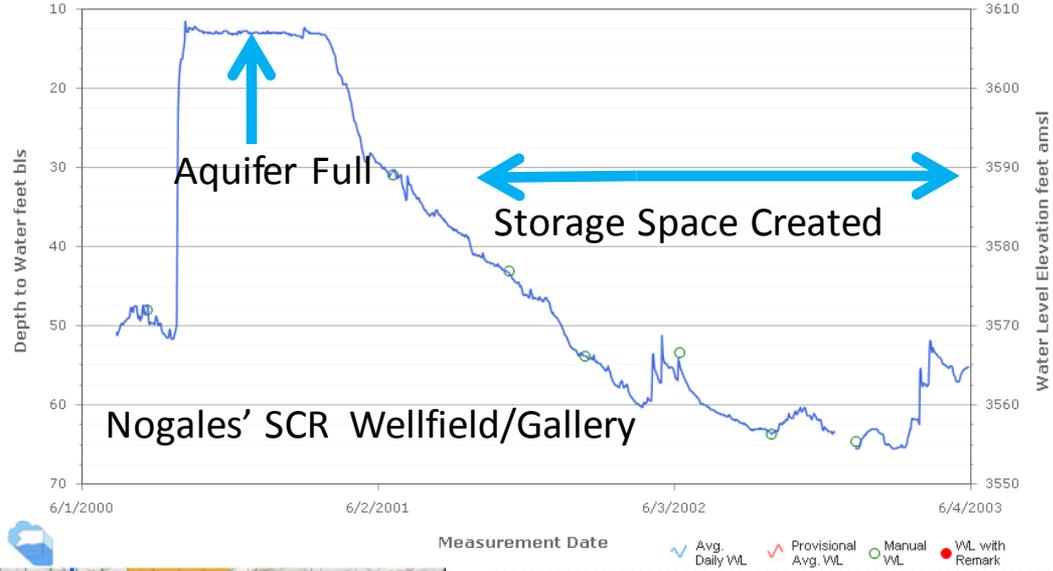
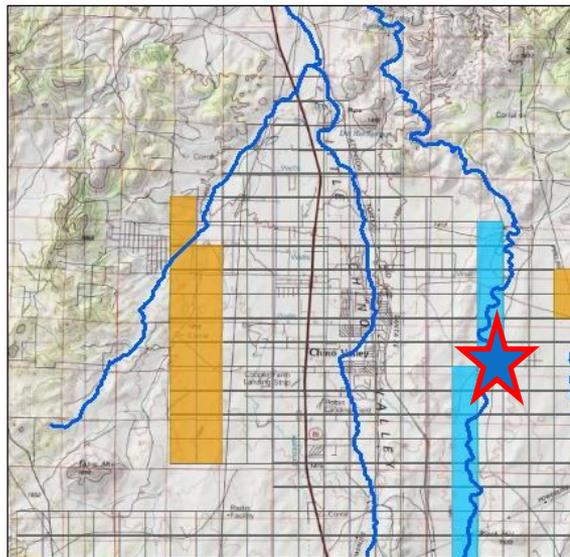


Inner Valley Hydrologic System “Resets” due to Finite Storage Capacity of Shallow, Water-table Aquifer



Simulated Baseflow Agua Fria





Base & Alternative Scenario: Same Long-term pumping rate, different distribution

1978-1984 (5.6 years)

North Granite Creek
 5X -100,000 ft³/day
 23,360 AF

Upper Lynx Creek
 5X(-100,000 ft³/day)
 23,360 AF

Same Long-term Pumping Rate, Different Distribution (UAF)

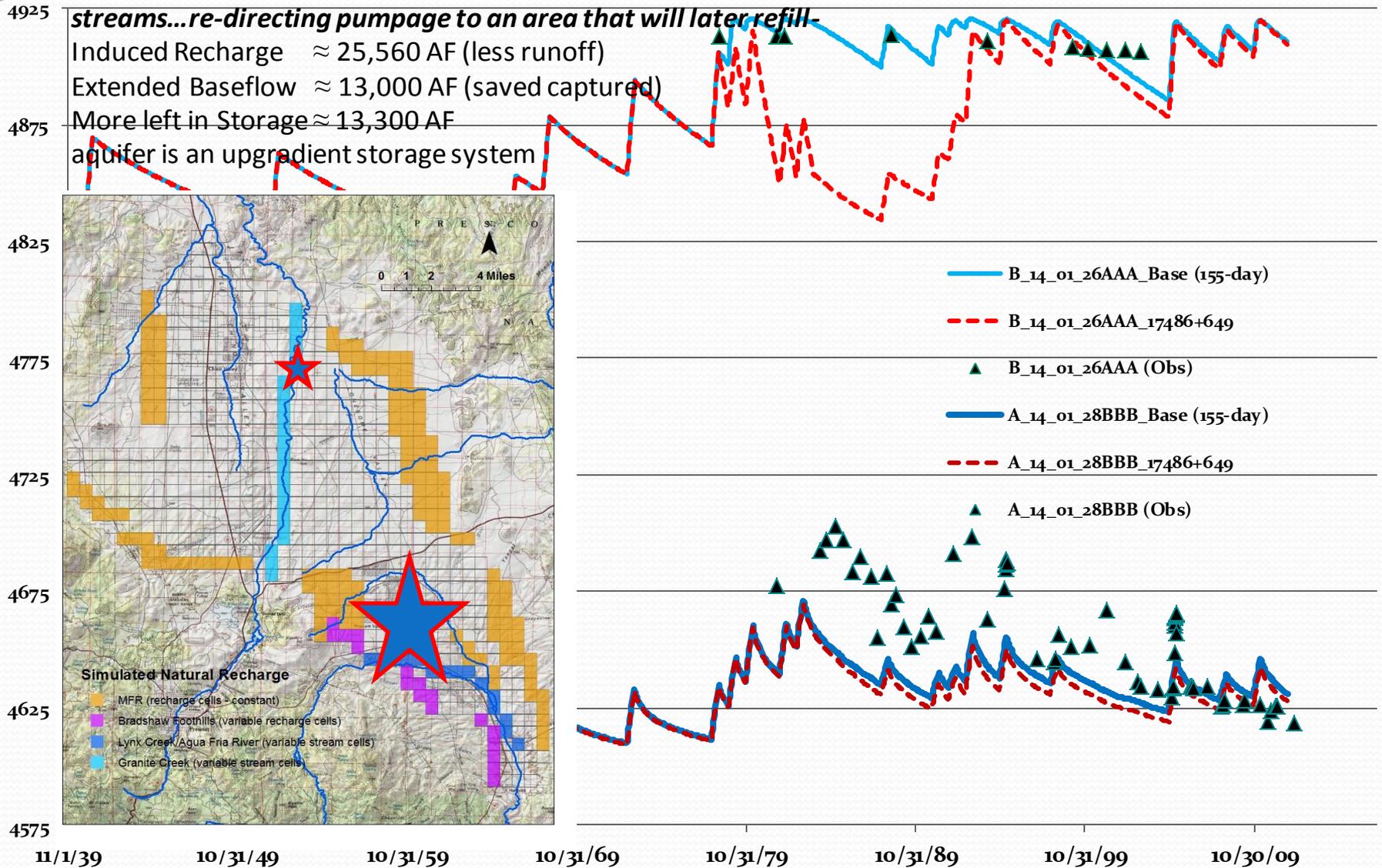
Decreased base pumpage by amount equal to hypothetical concentrated pumpage distributed along streams...re-directing pumpage to an area that will later refill-

Induced Recharge $\approx 25,560$ AF (less runoff)

Extended Baseflow $\approx 13,000$ AF (saved captured)

More left in Storage $\approx 13,300$ AF

aquifer is an upgradient storage system



Same long-term Pumping Rate, Different Distribution (LIC)

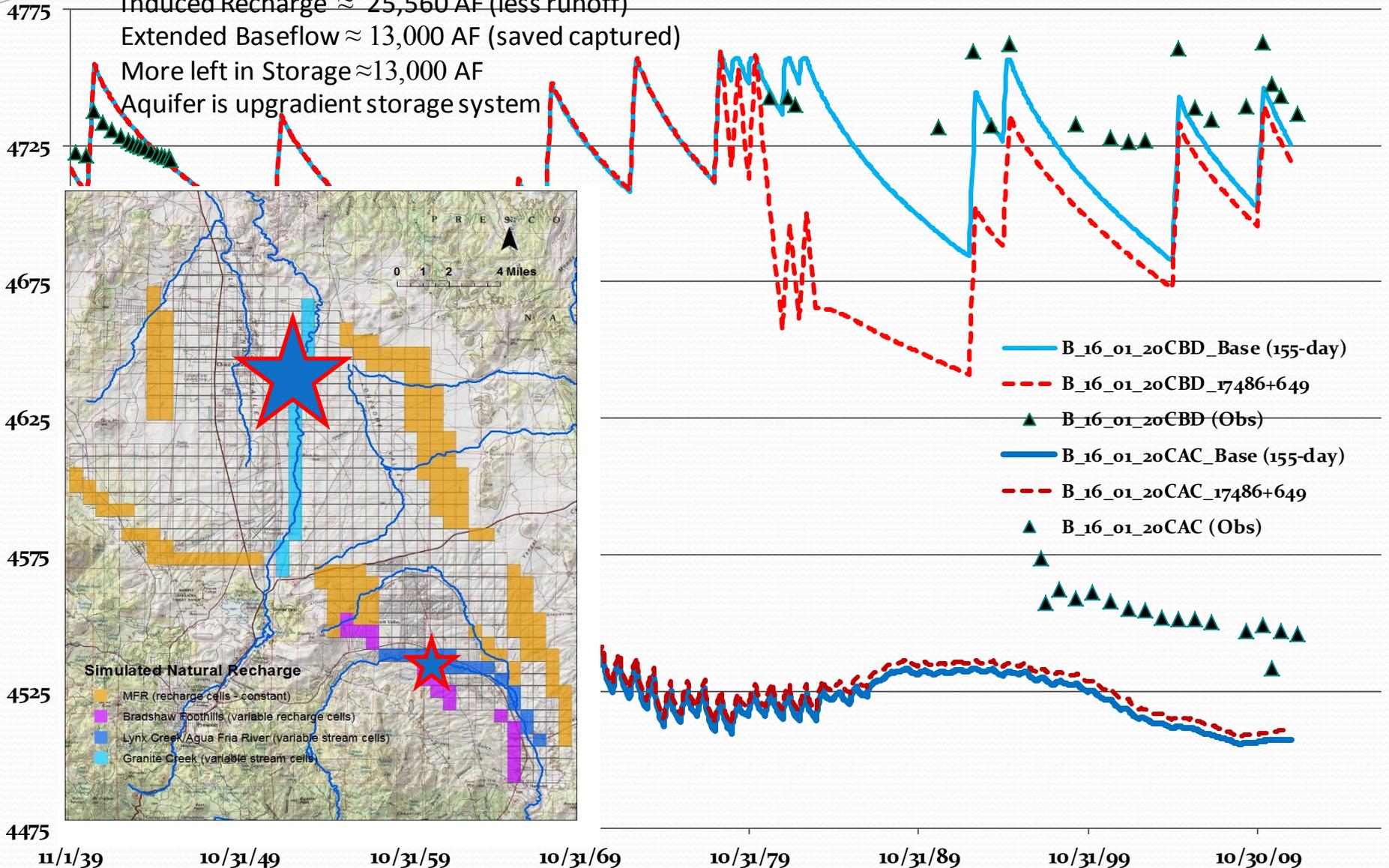
Decreased base pumping by rate equal to hypothetical pumping along stream

Induced Recharge $\approx 25,560$ AF (less runoff)

Extended Baseflow $\approx 13,000$ AF (saved captured)

More left in Storage $\approx 13,000$ AF

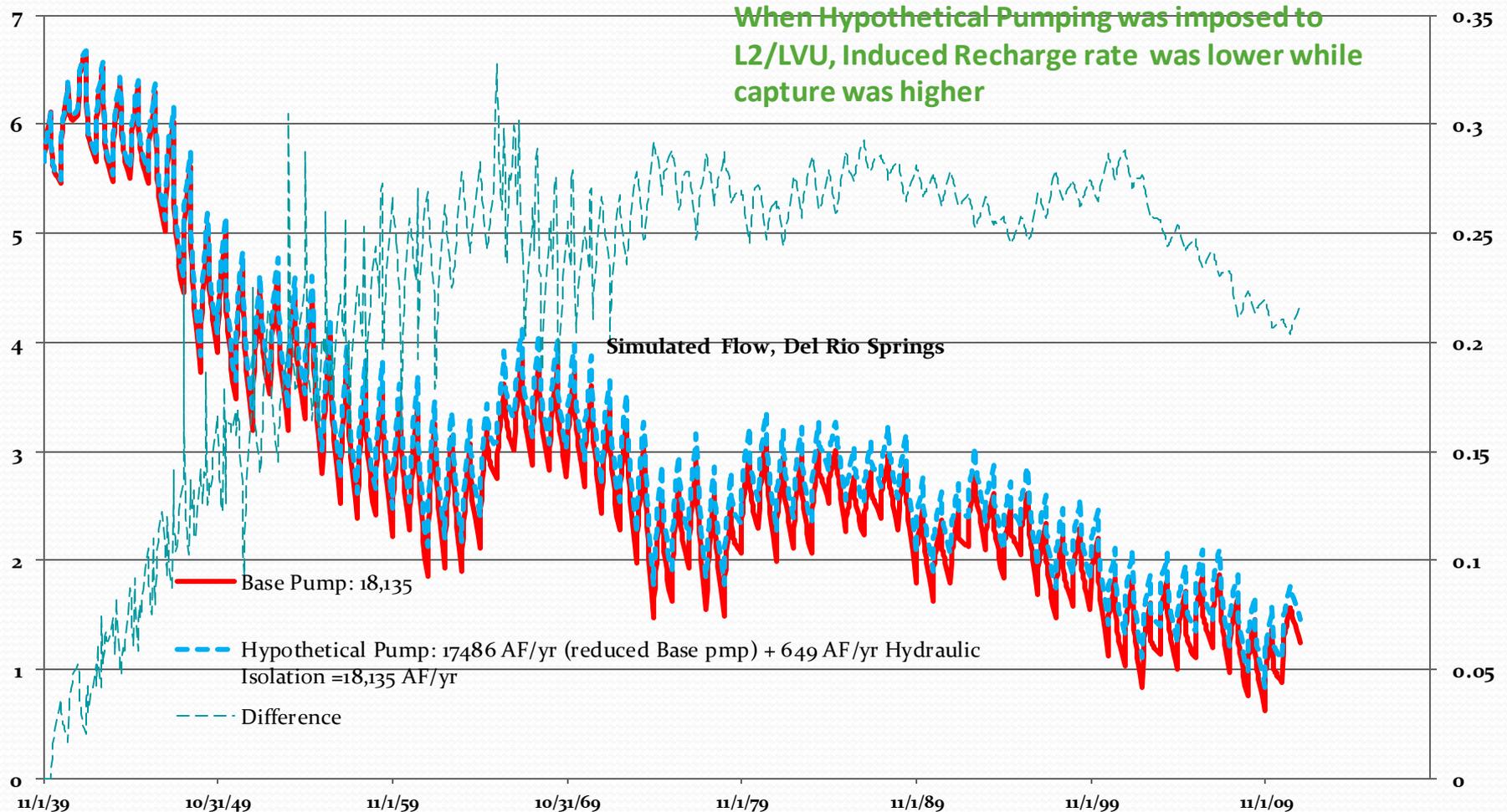
Aquifer is upgradient storage system



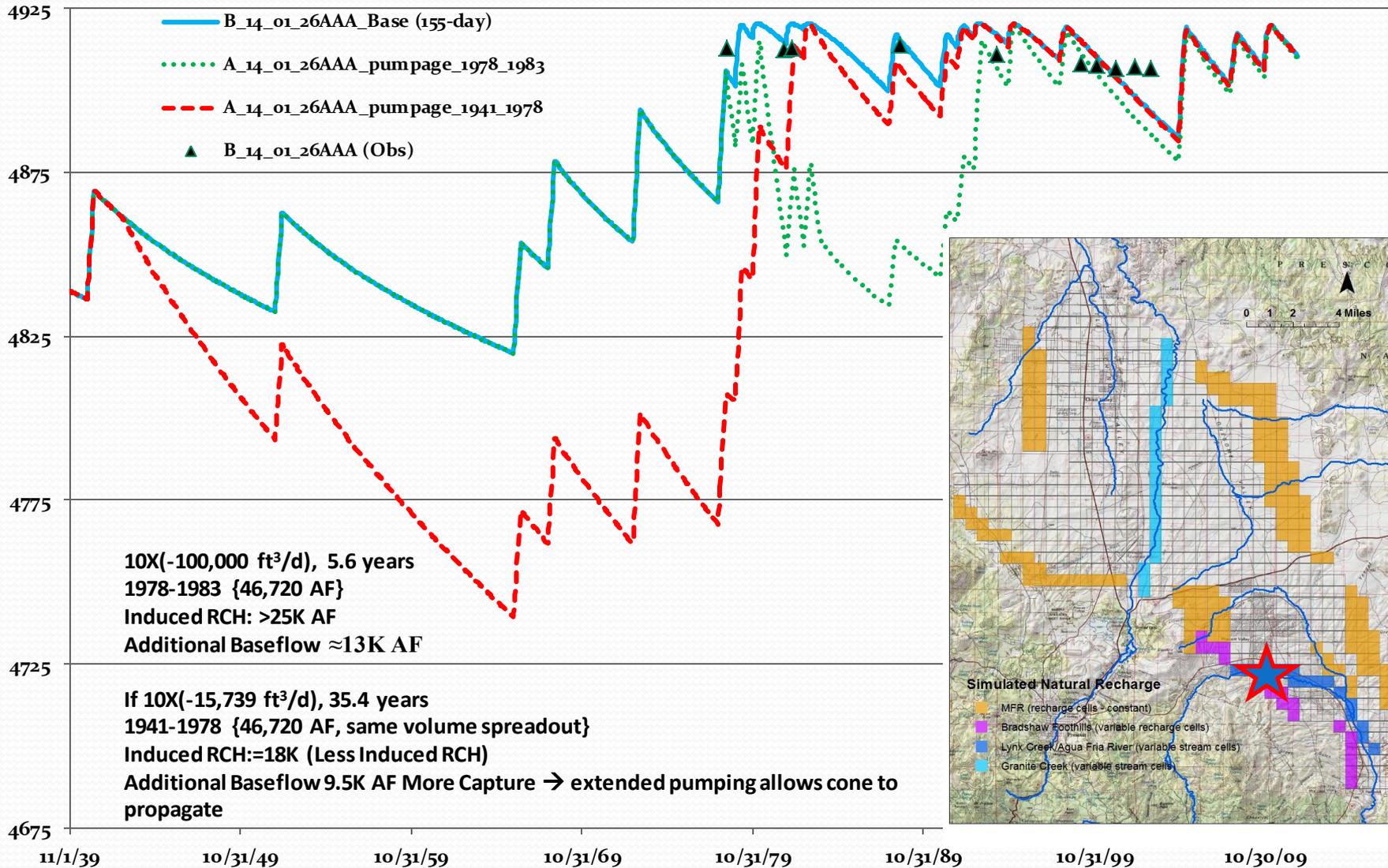
Simulated Groundwater Discharge, Del Rio Springs:
Hypothetical, Displaced Pumpage to Hydraulically-Buffered Areas Resulted in
Less Capture At Del Rio Springs {nearly 13,000 AF/(1939-2011)}

wrt Base Pumping Distribution: **Tradeoff between**

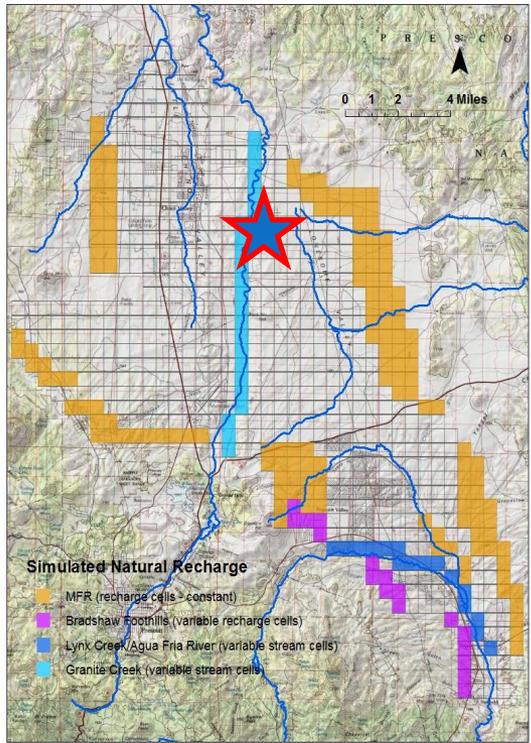
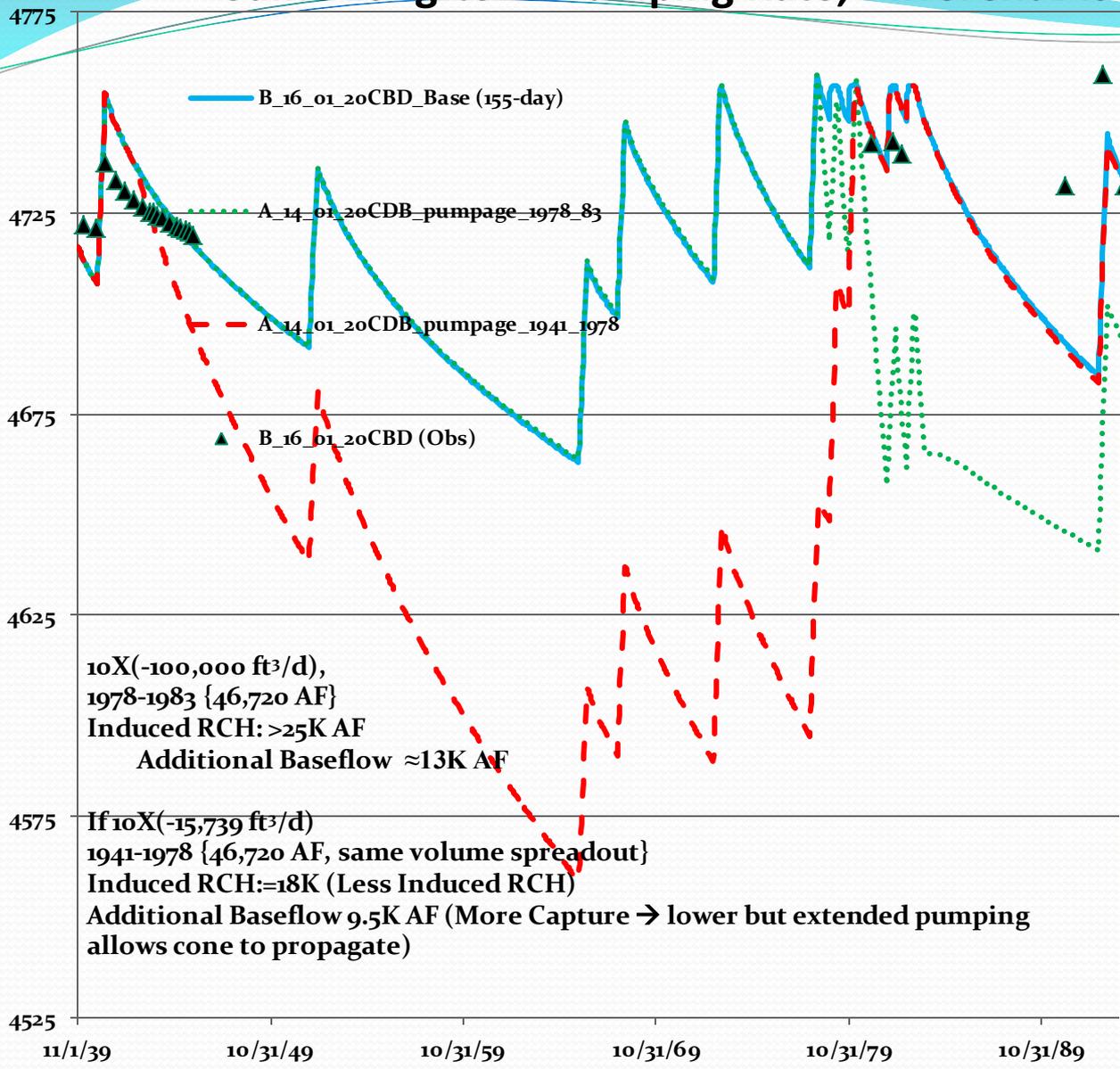
1) reduction in runoff vs. 2) more storage & higher rate of sustained baseflow



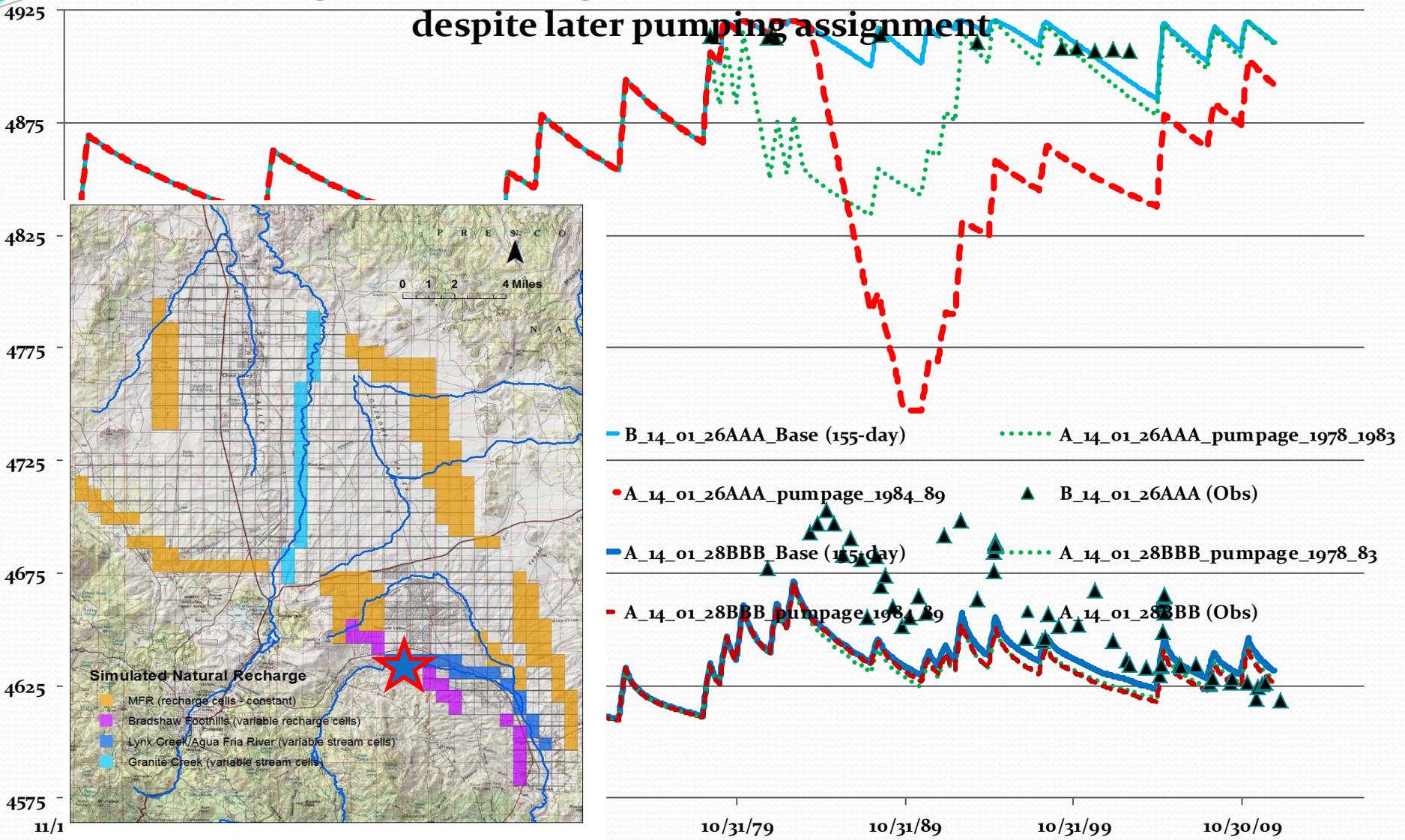
Same long-term Pumping Rate, Different Distribution



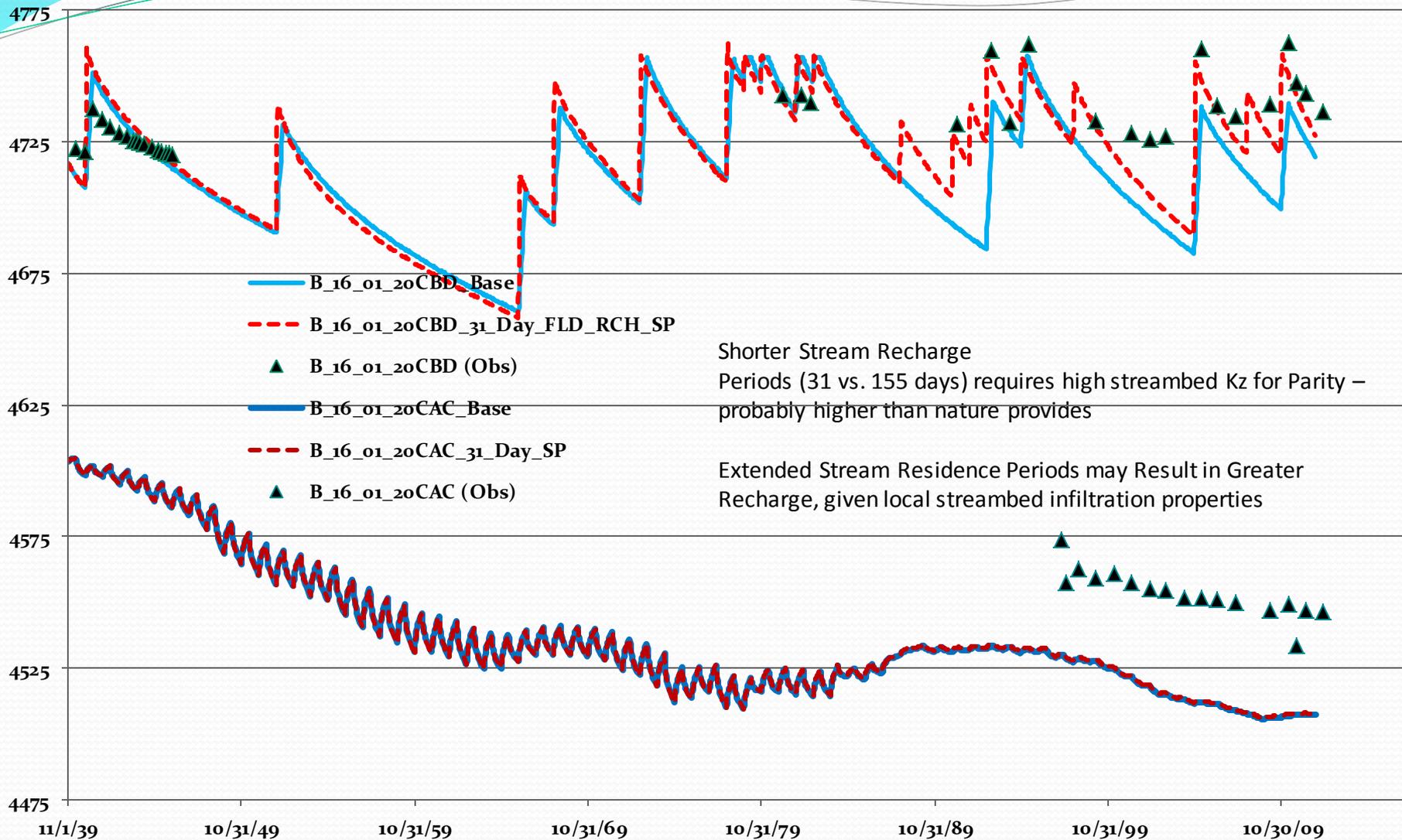
Same Long-term Pumping Rate, Different Distribution

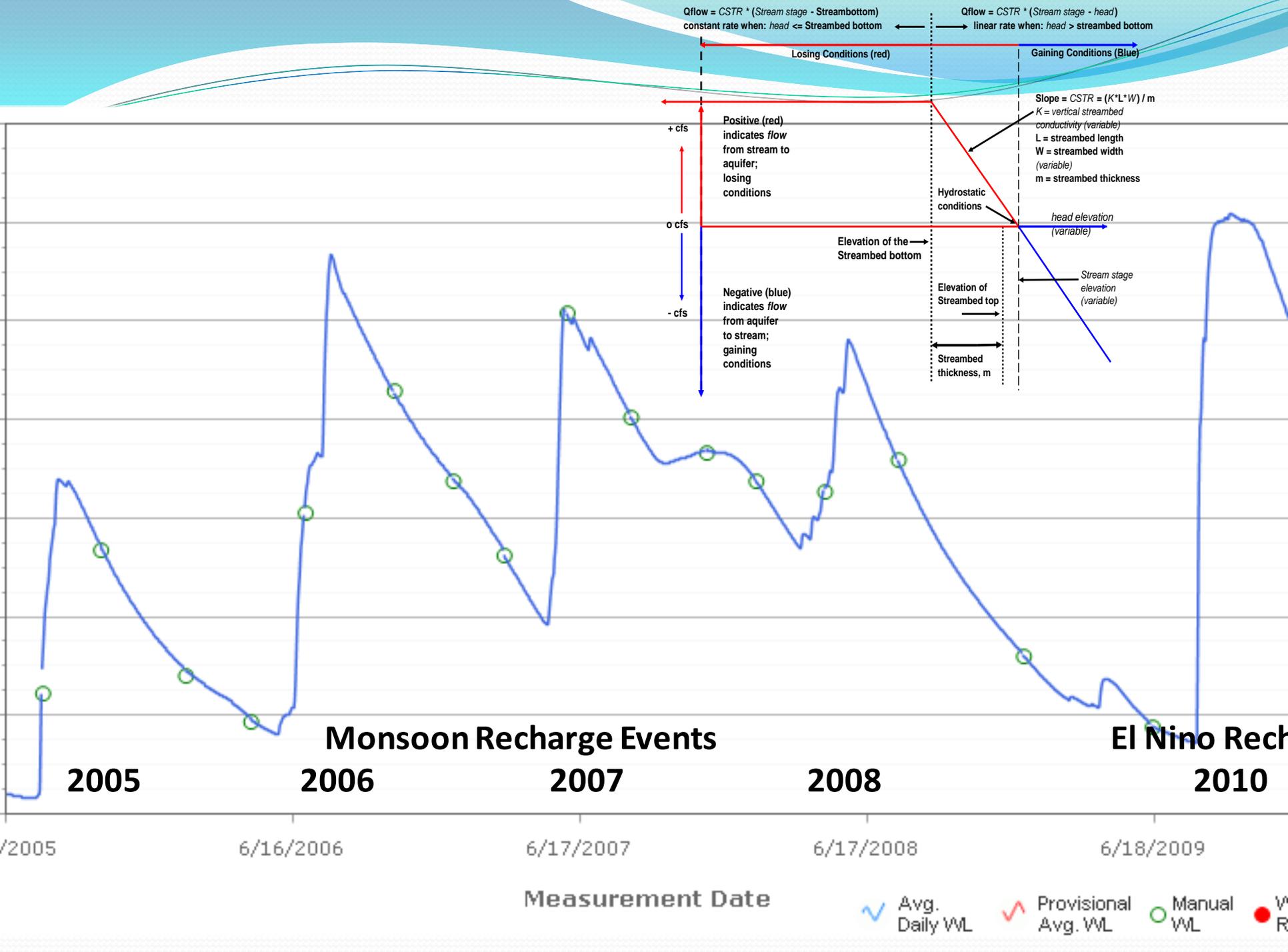


Same Long-term Pumping Rates, Later Distribution (1984-89) during Dry Period Results in greater Loss of Storage, less Induced Recharge and even a higher rate of capture rate than 1978-83, despite later pumping assignment



11/1



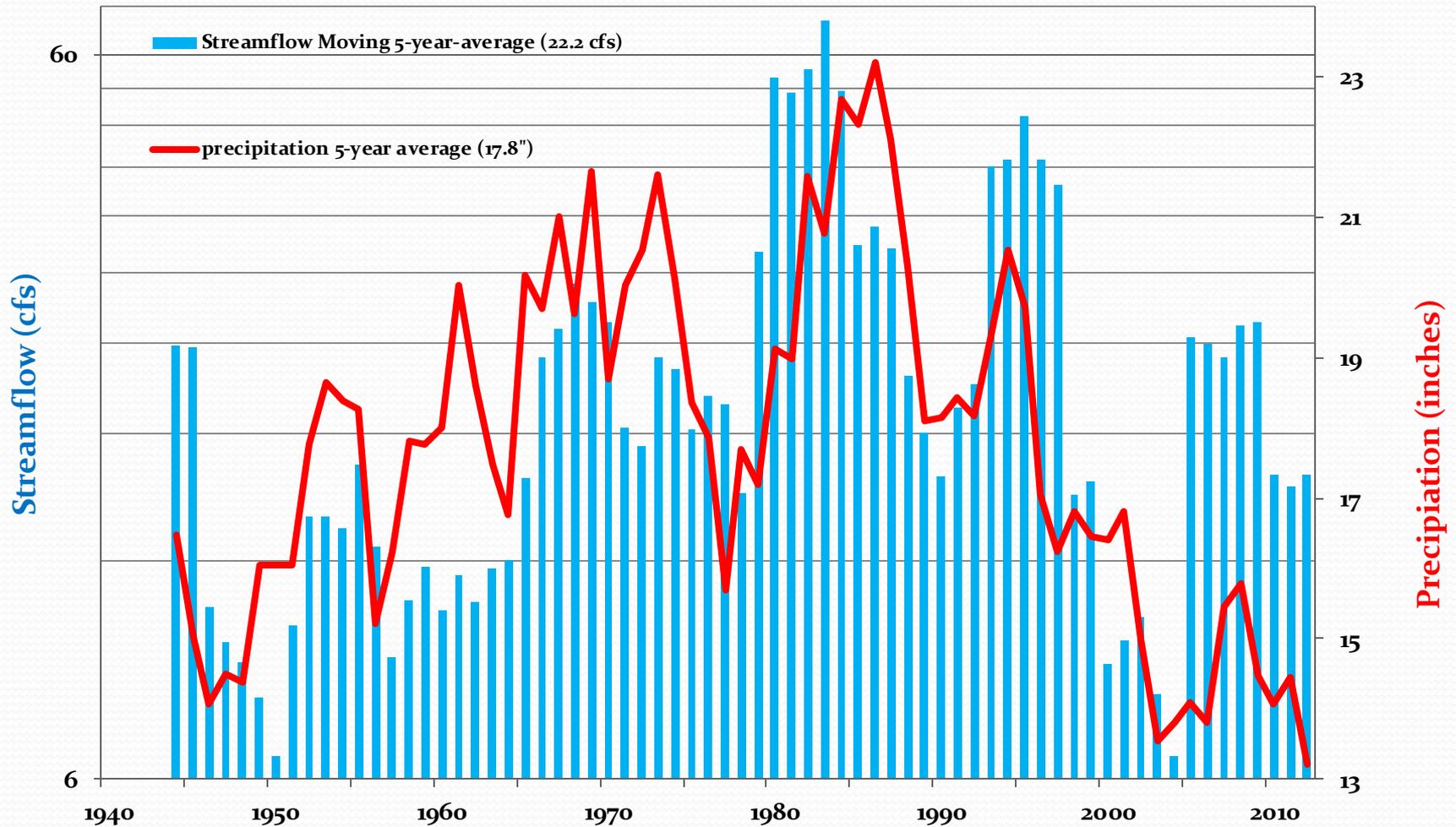


**Gravity-fed Infiltration Gallery
Santa Cruz River, Sonora Mexico**



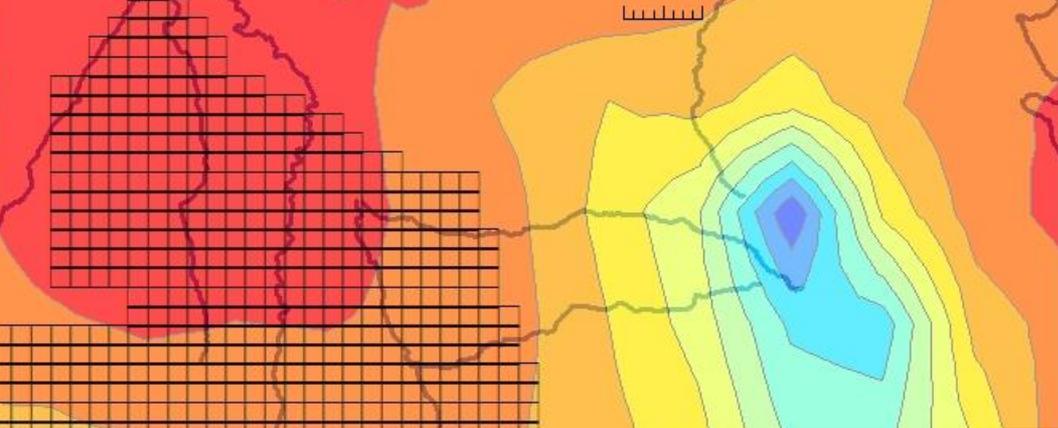
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5-Year Moving Average Streamflow along Agua Fria River near Mayer AZ (1940-2012) and Precipitation in Prescott AZ (1940-2012)



Questions?

Contact: kmnelson@azwater.gov



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- 15.0
- 17.0
- 19.0
- 21.0
- 23.0
- 25.0
- 27.0
- 29.0
- 31.0
- 33.0

