



Role of Aquifers and Aquitards in Stream Depletion and Recharge: Cosumnes River Case Study

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Stream Depletion Through the SGMA Lens:
Practical Solutions for a Complex Problem

Sacramento, August 29, 2017

Key Points

- Aquifers are commonly, mostly *not* comprised of aquifer materials.
- Heterogeneity results in spatial complexity, but connectivity simplifies matters at the GSA scale.
- Models can capture large scale interaction through appropriate calibration and data.
- But be mindful of local variability.

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Beloved Layer-Cake

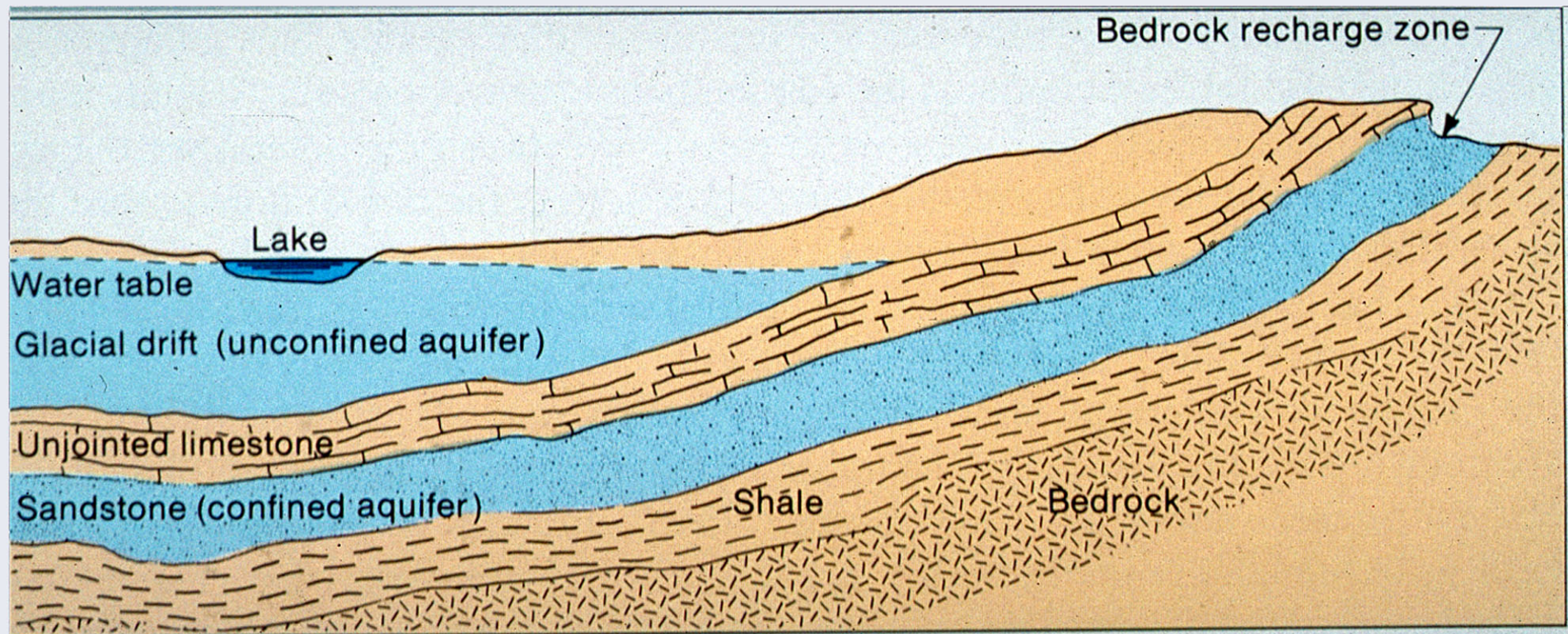


Figure 5.2. Groundwater exists in the underground in two major environments: unconfined and confined.



SPLAY
SANDS



CHANNEL
SANDS



PEAT

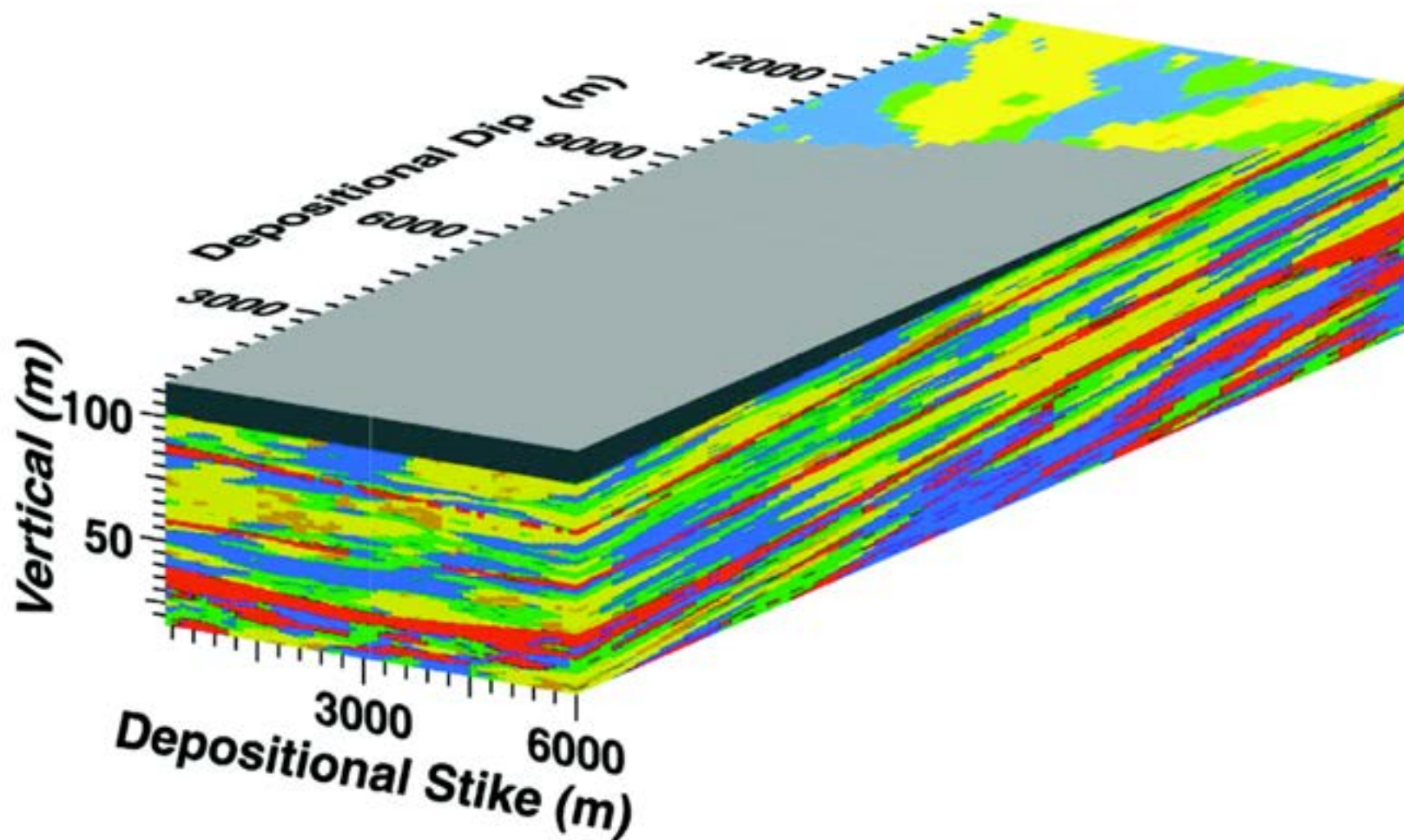



INTERCHANNEL
SILT/CLAY

MIXED-LOAD CHANNEL SYSTEM


Kings River Alluvial Fan

Realization 5



 *gravel*

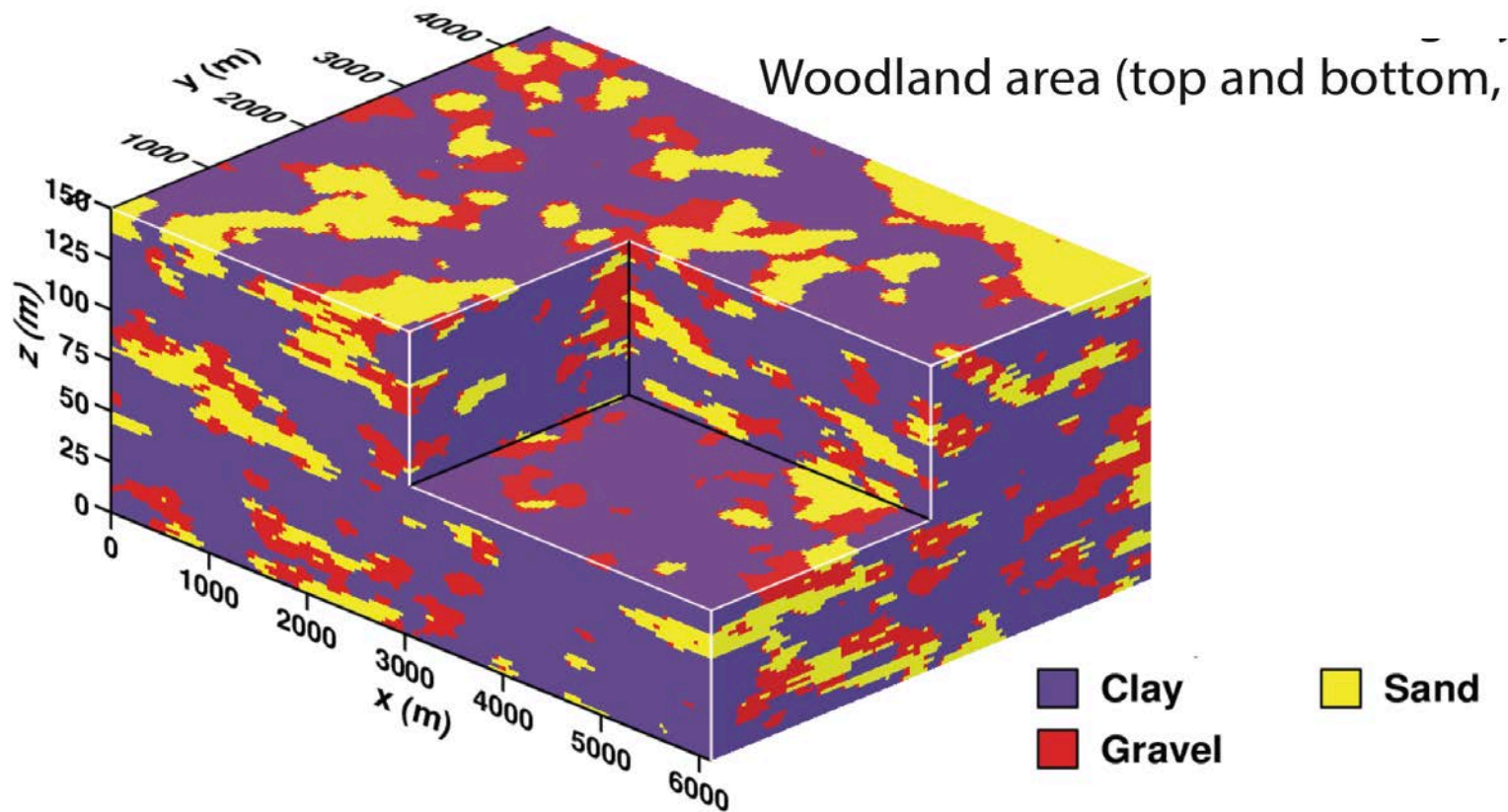
 *sand*

 *muddy sand*

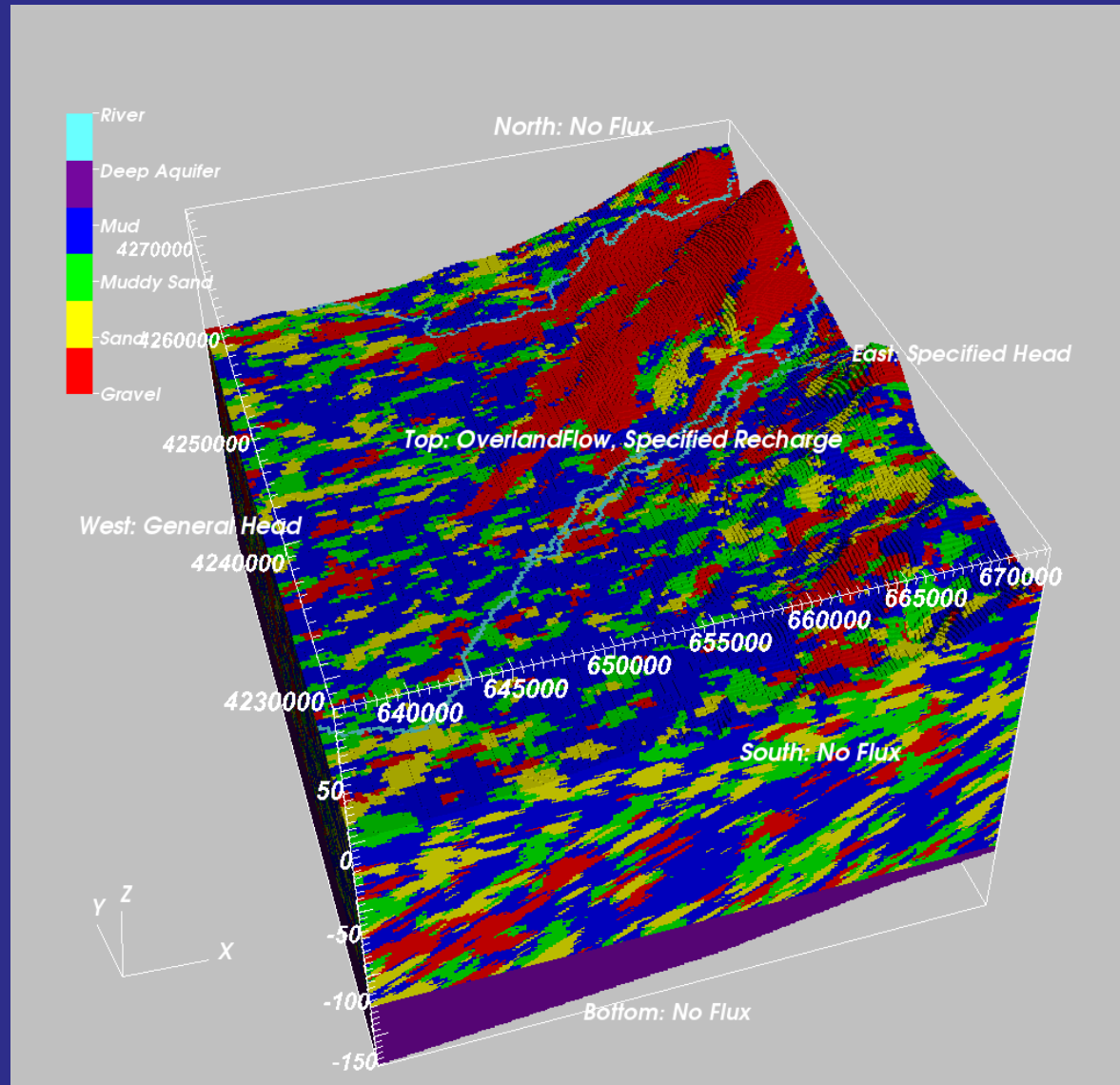
 *mud*

 *paleosol*

Woodland Area Aquifer System Network (Stephen Maples, HYD 2'

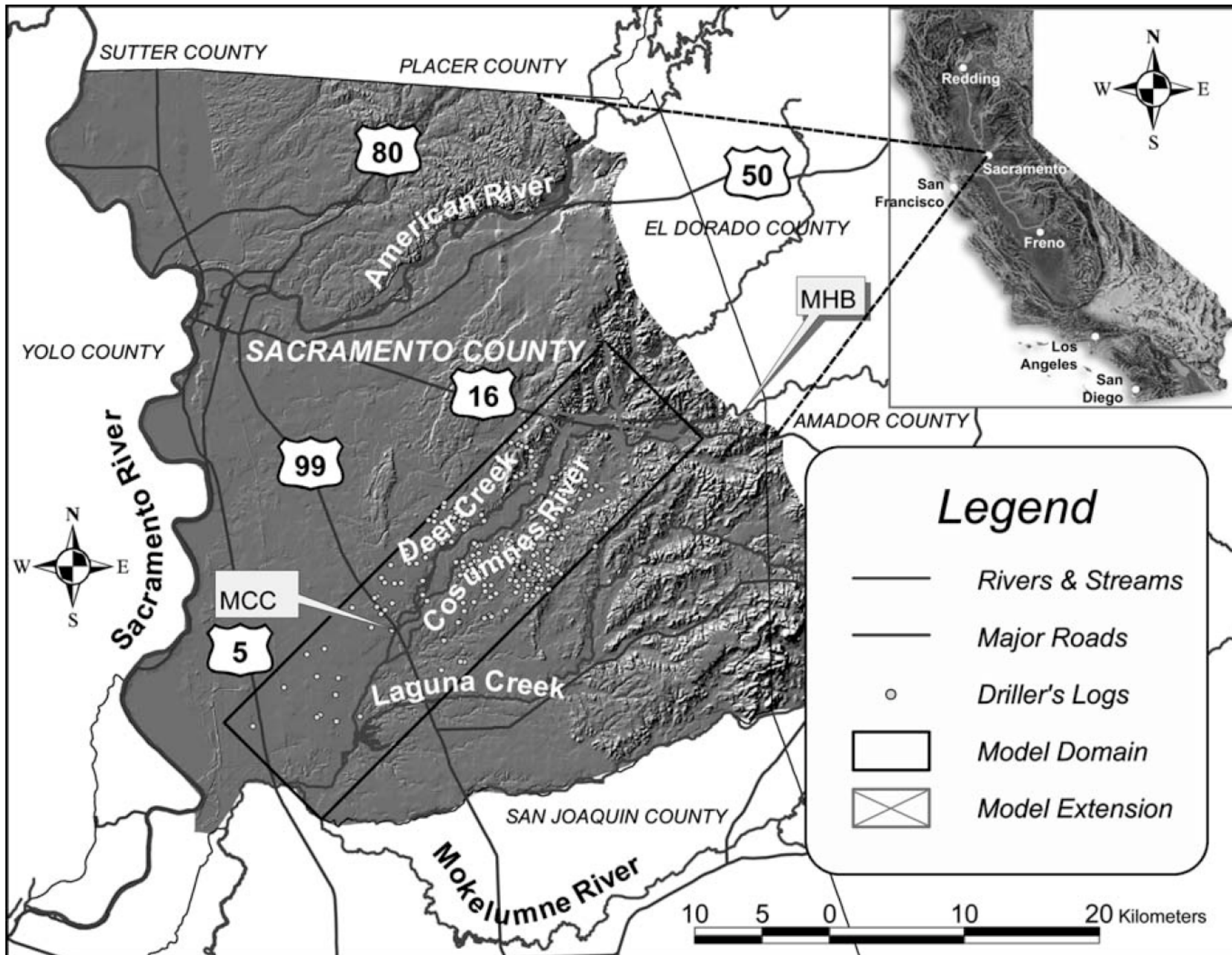


Sacramento County Subsurface, UC Water Security and Sustainability Research Initiative

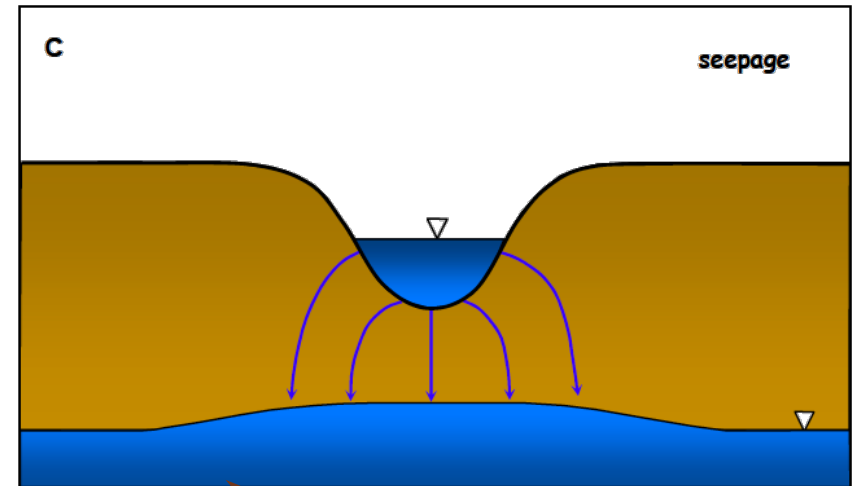
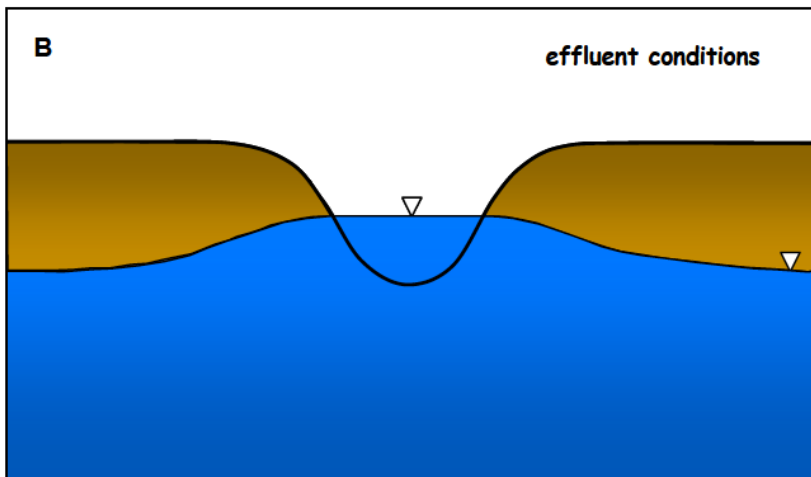
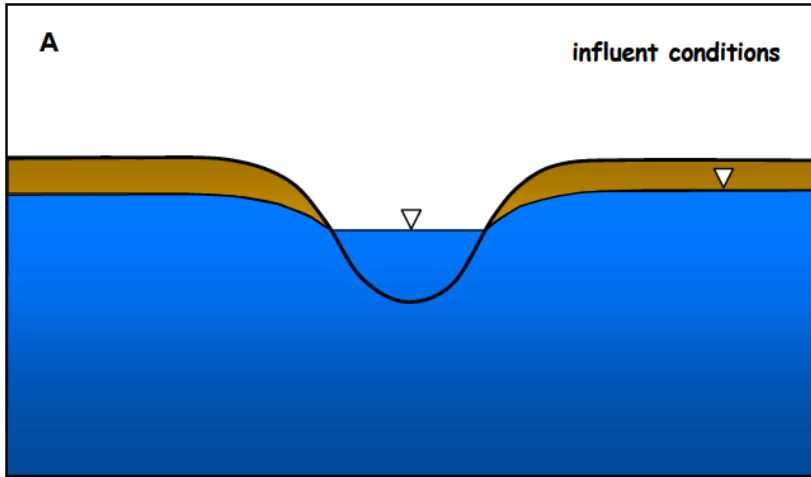


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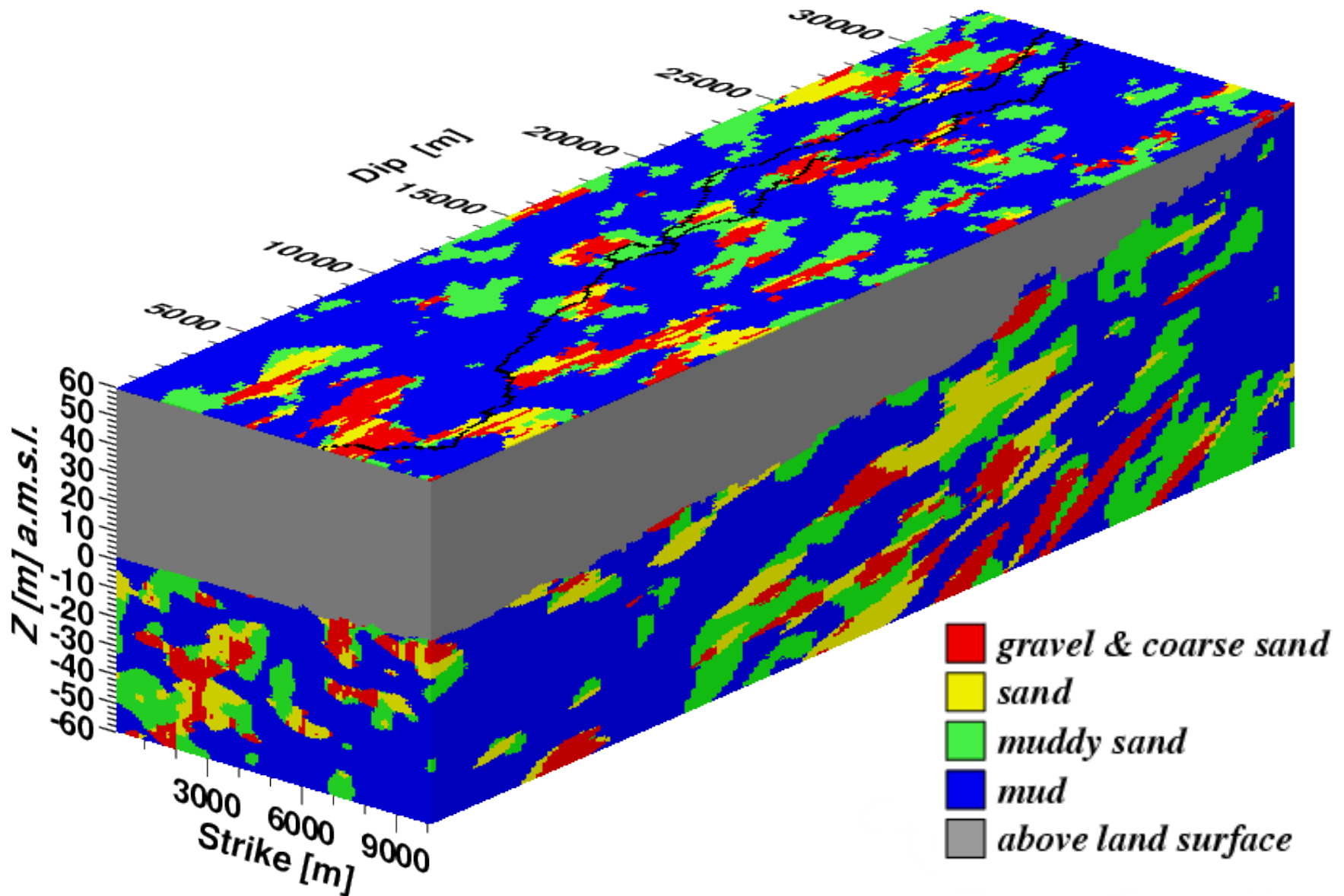


River-Aquifer Interaction Basics



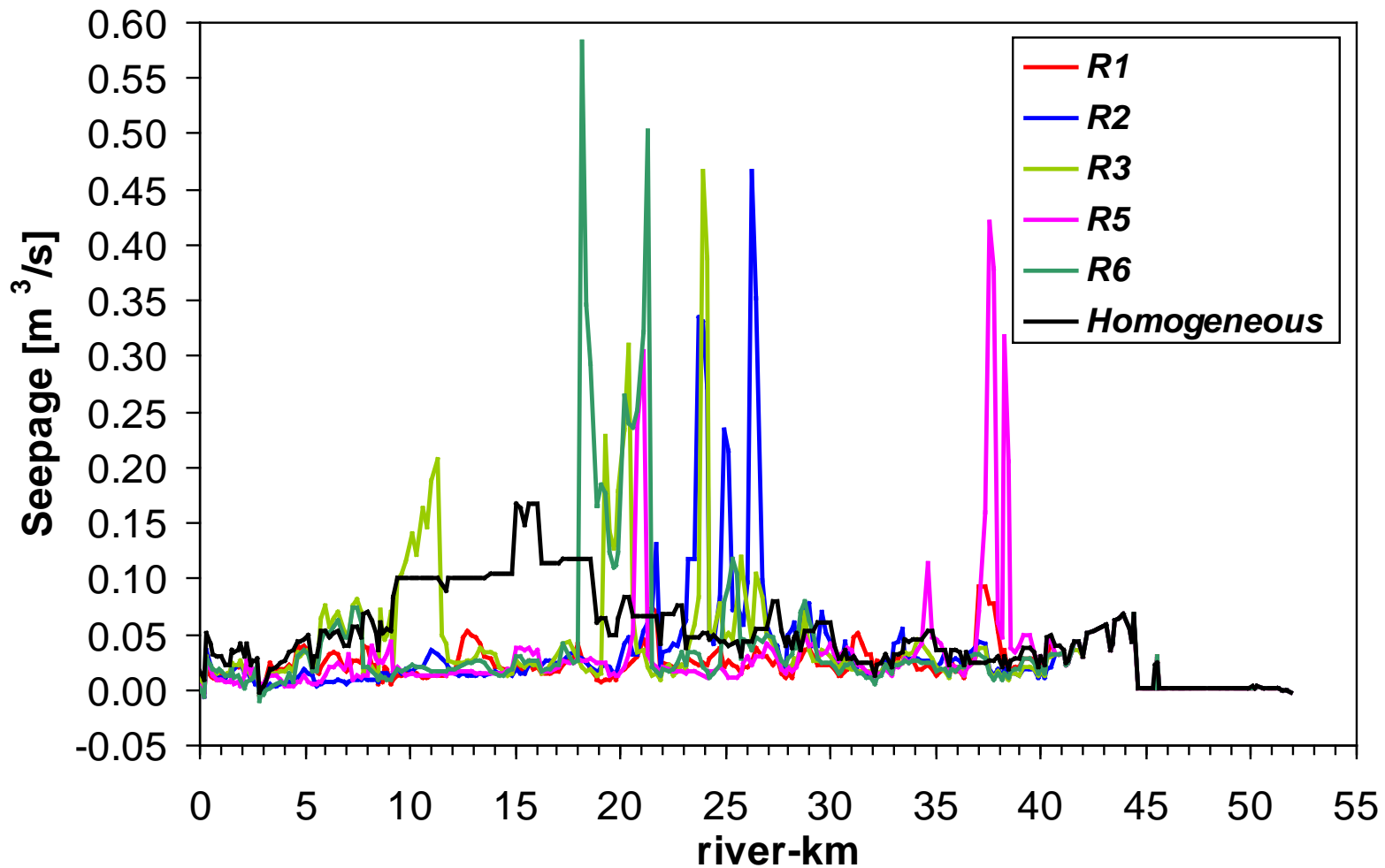
Aquifer said to be
"disconnected" from
stream

Aquifer System Beneath Cosumnes River



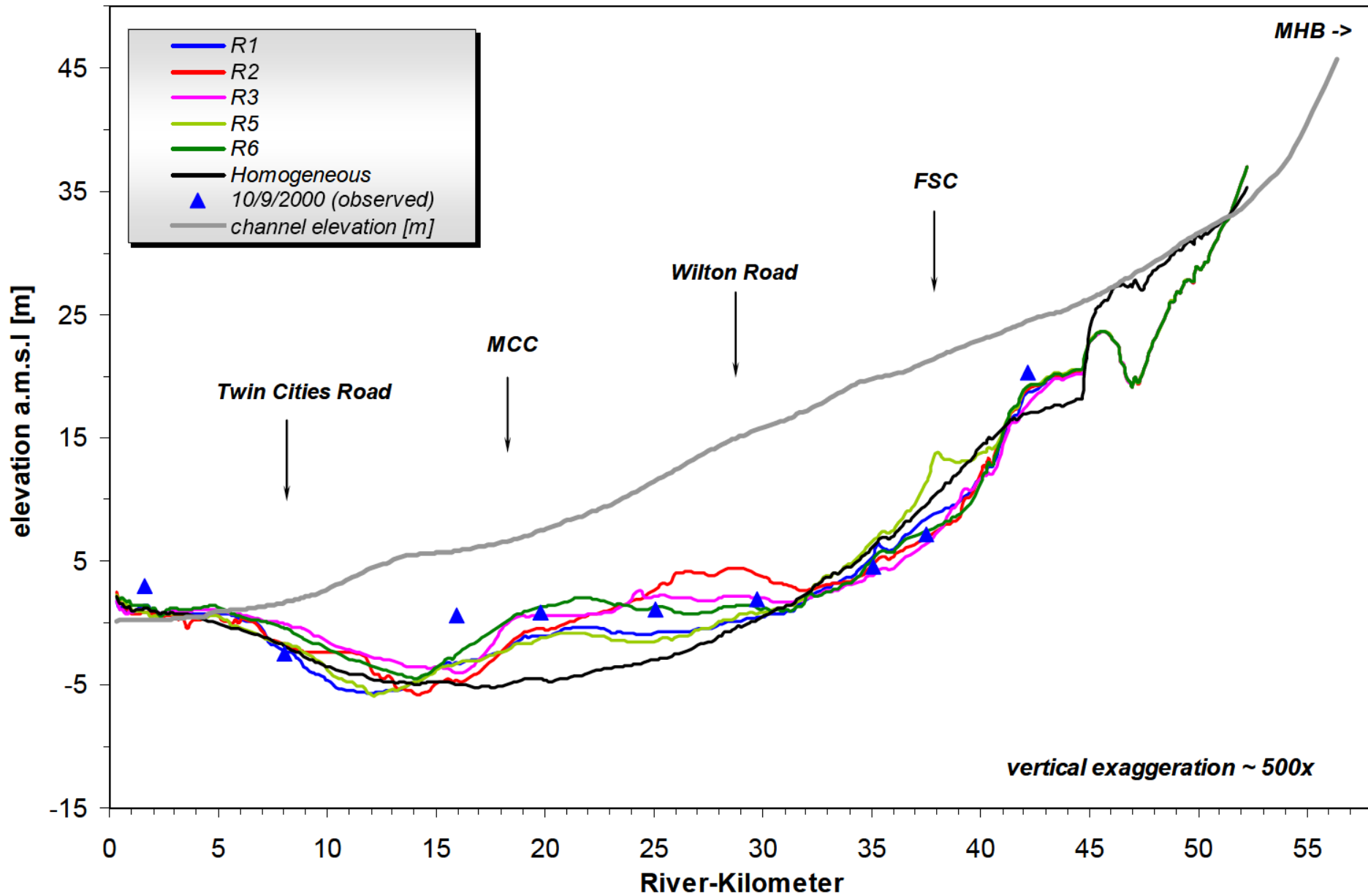
River model – simulated seepage

R = realization

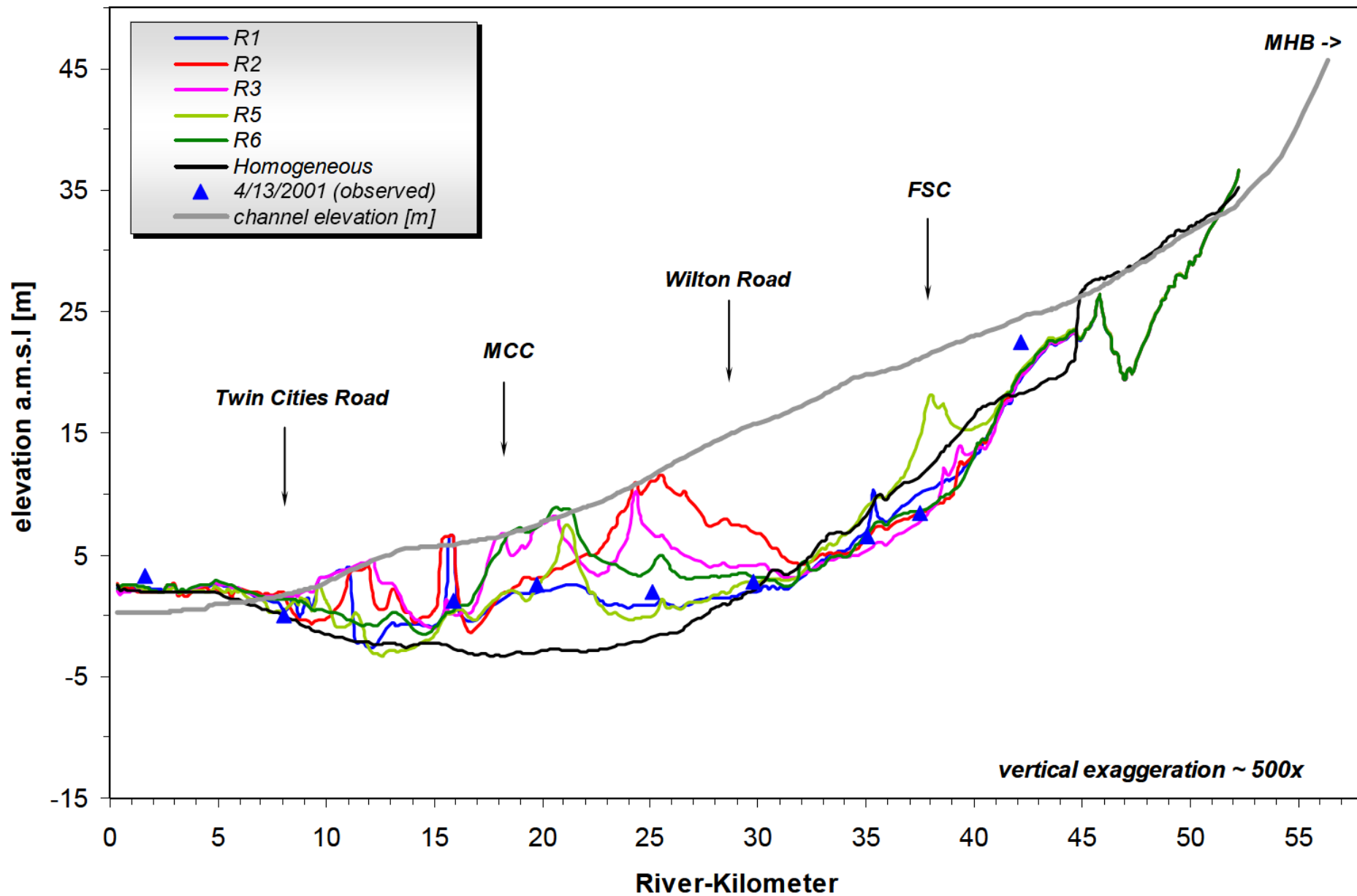


Fleckenstein, J.H., Niswonger R.G., & Fogg, G.E., *Ground Water*, 44(6), 2006

Simulated Groundwater levels, September 28th, 2000



Simulated Groundwater levels, April 14th, 2001

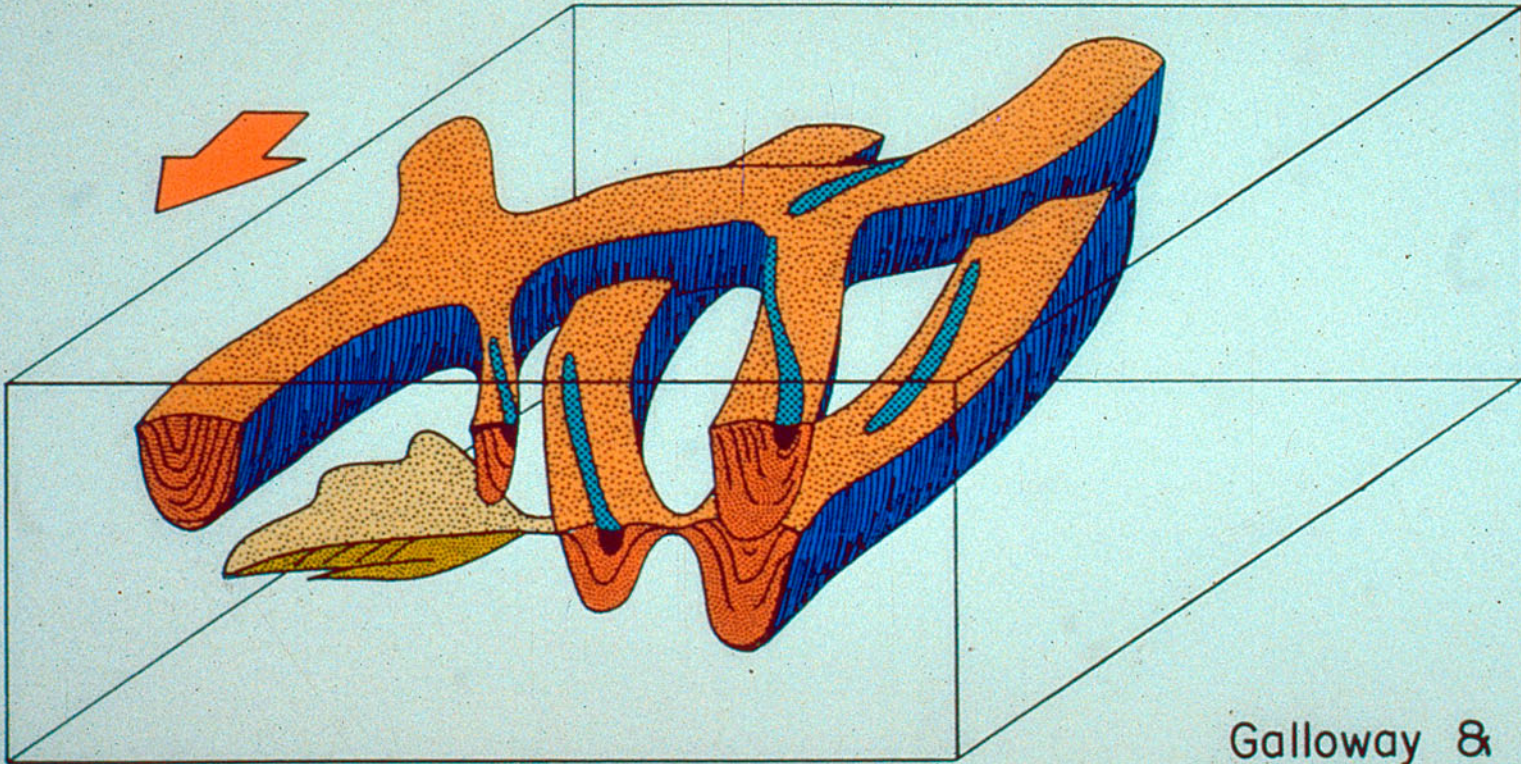


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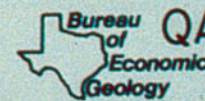
Connectivity of High-K (Aquifer)
Facies Generally Good

FACIES ARCHITECTURE



Suspended-load channel

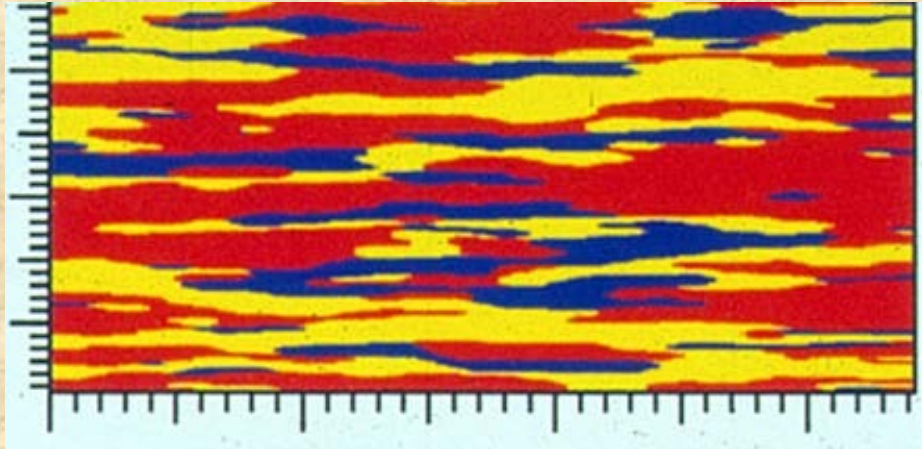
Galloway &
Hobday 1983



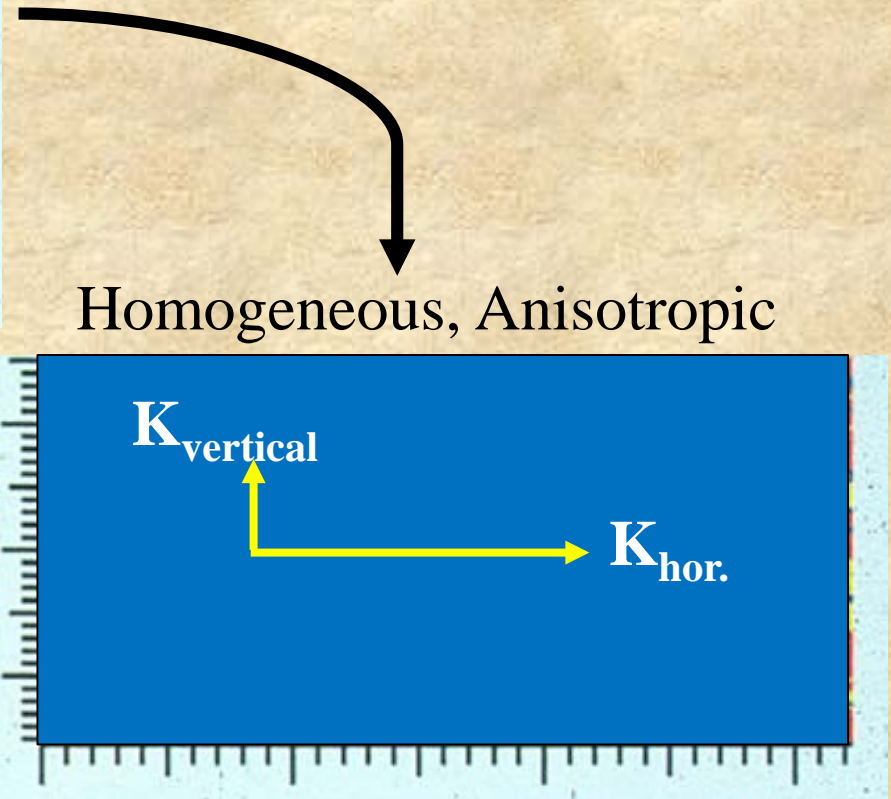
QA-2480

Representing Heterogeneity With Homogeneous, Anisotropic Equivalent

Heterogeneous



- $K_{\text{hor.}}$ from well tests and conventional model calibration.
- $K_{\text{vert.}}$ from vertical h gradient data and calibration (Fogg, 1986)



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Key Data for Modeling Groundwater-Stream Systems

- Streamflow
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- Streamflow diversions and returns
- Water levels near and far from the stream(s)
- Vertical head gradients (3D head mapping)
- Stream channel morphology