Water availability and MAR opportunities in the Lower Mississippi River Basin

by

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ASR-MAR Workgoup
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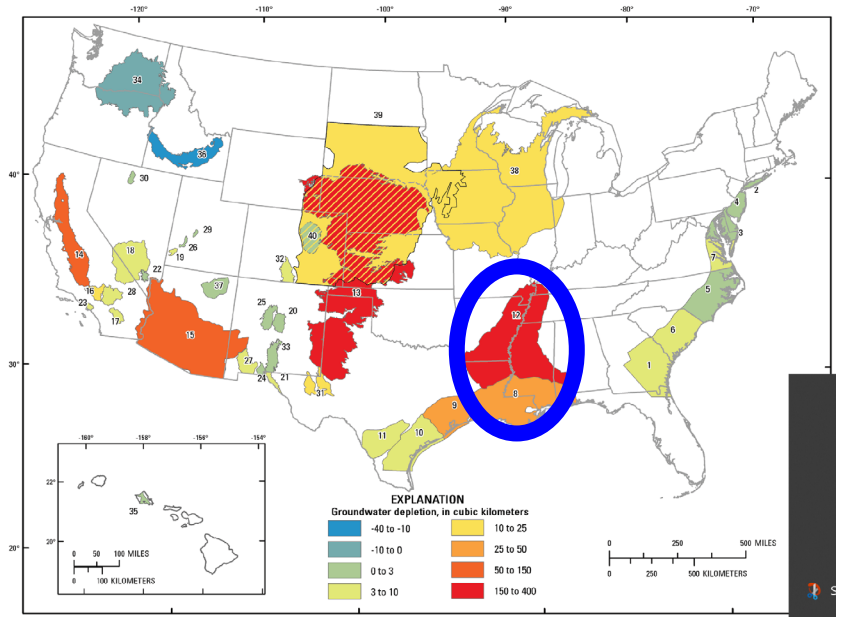
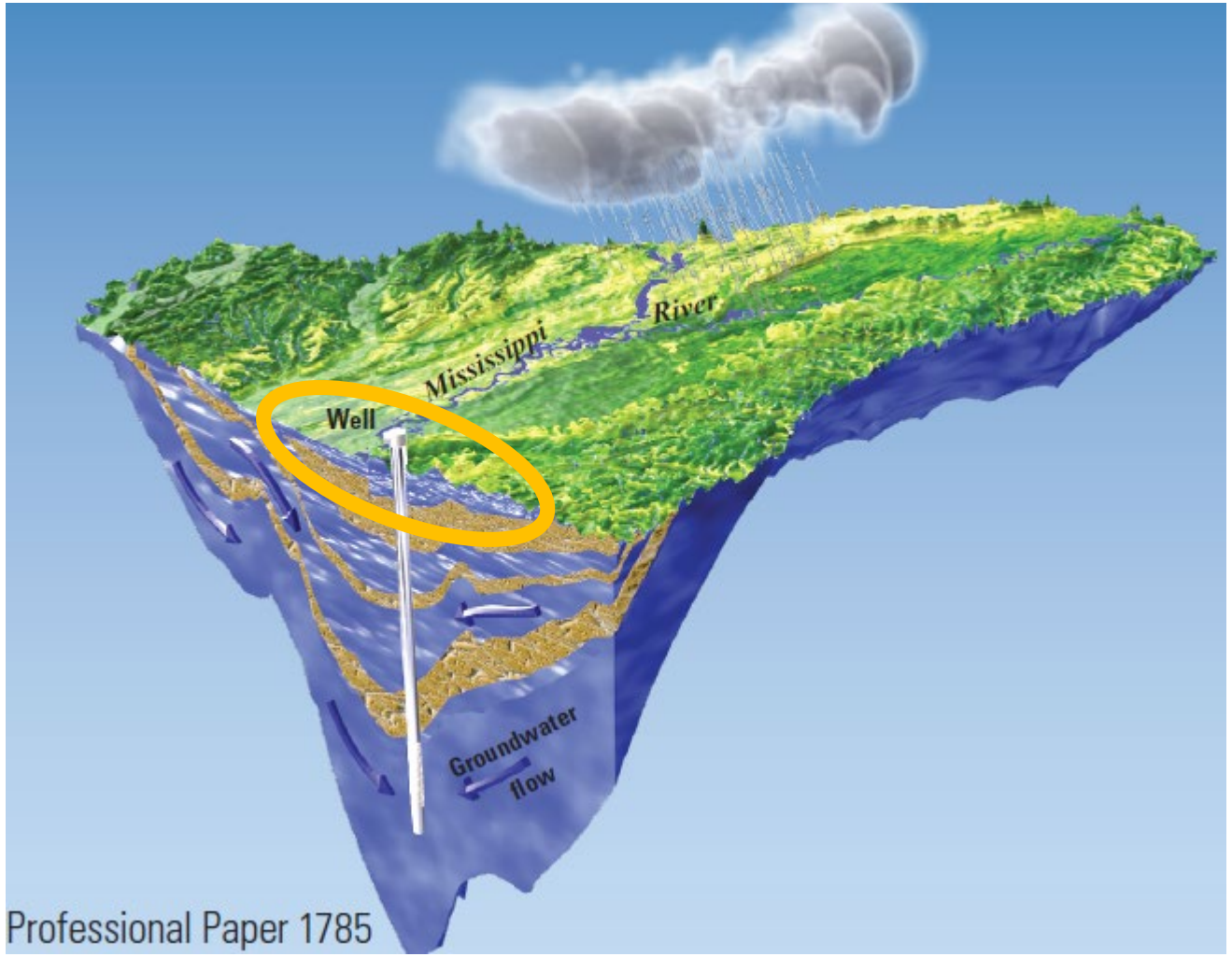
Hydrogeology of Mississippi Embayment

- Plunging syncline sedimentary basin with layered aquifer system
- Shallow alluvial aquifer experiencing greatest long-term GW depletion



Konikow, L.F., 2013, Groundwater depletion in the United States (1900–2008): U.S. Geological Survey Scientific Investigations Report 2013–5079, 63 p., http://pubs.usgs.gov/sir/2013/5079.



Source: Clark, B.R., Hart, R.M., and Gurdak, J.J., 2011, Groundwater availability of the Mississippi embayment: U.S. Geological Survey Professional Paper 1785, 62 p.

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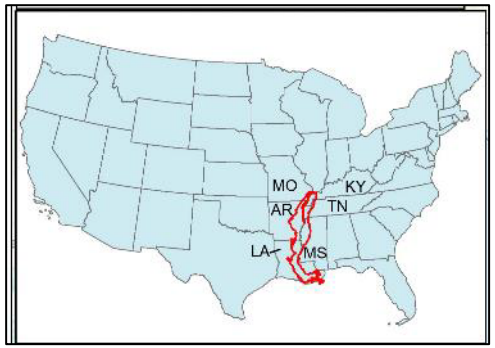
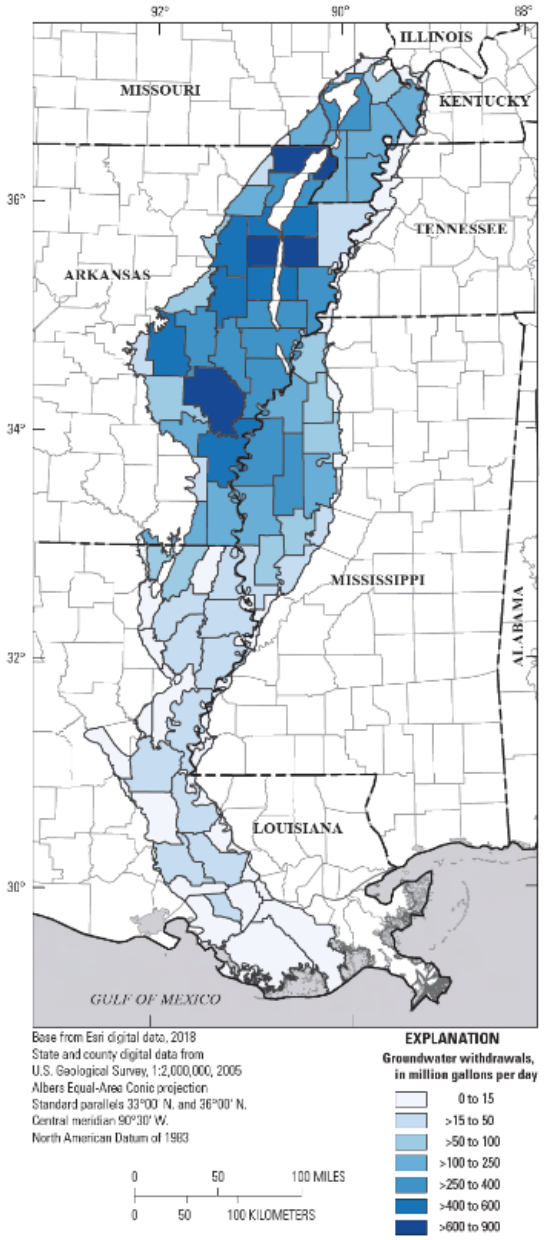
Second highest GW withdrawals in the United States

- The *Mississippi River Valley alluvial aquifer (MRVAA)* had the second highest groundwater withdrawals of any principal aquifer in the U.S. of *12.1 Bgal/day*
- In this humid region, we get a lot of rain – still can have *imbalances* between aquifer inflows (recharge) and natural outflows and pumpage



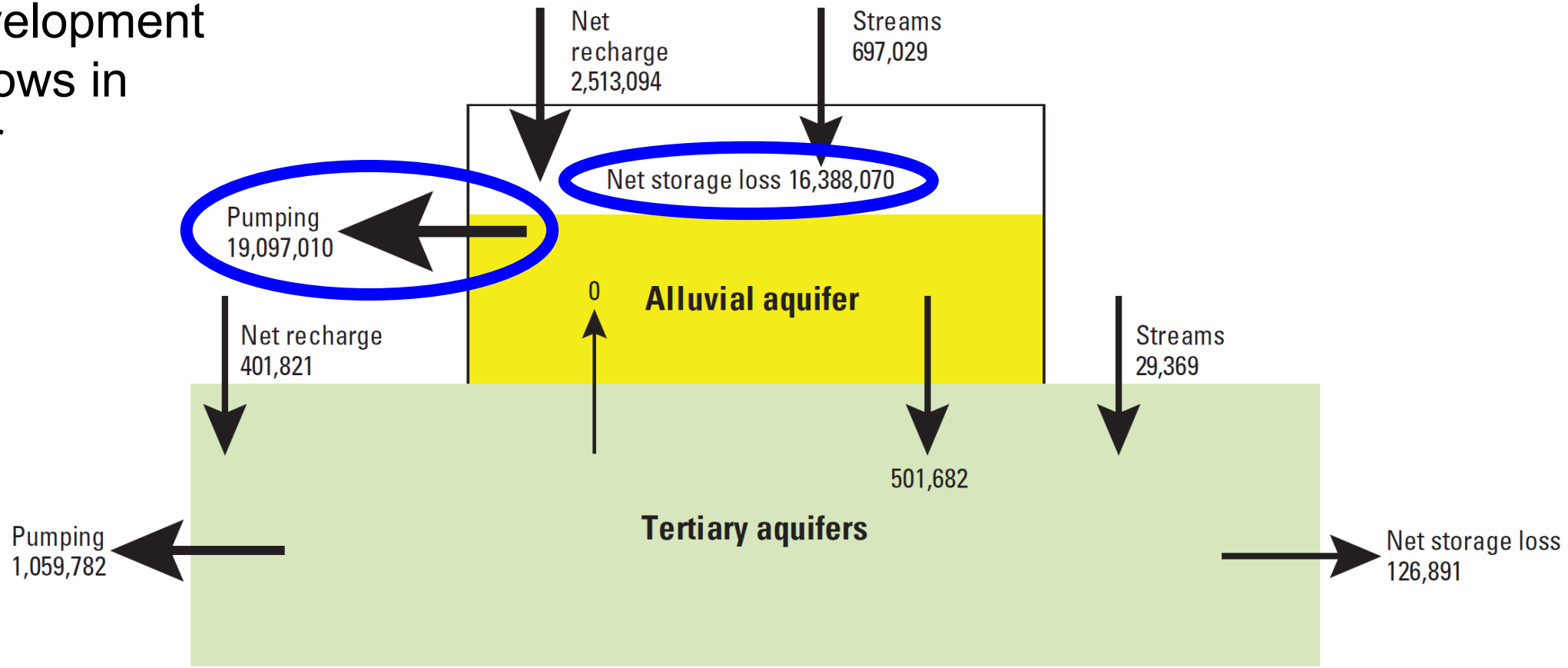
Groundwater withdrawals for the year 2015



SOURCE: Lovelace, J.K., Nielsen, M.G., Read, A.L., Murphy, C.J., and Maupin, M.A., 2020, Estimated groundwater withdrawals from principal aquifers in the United States, 2015 (ver. 1.2, October 2020): U.S. Geological Survey Circular 1464

MRVAA – Pumpage met by storage loss

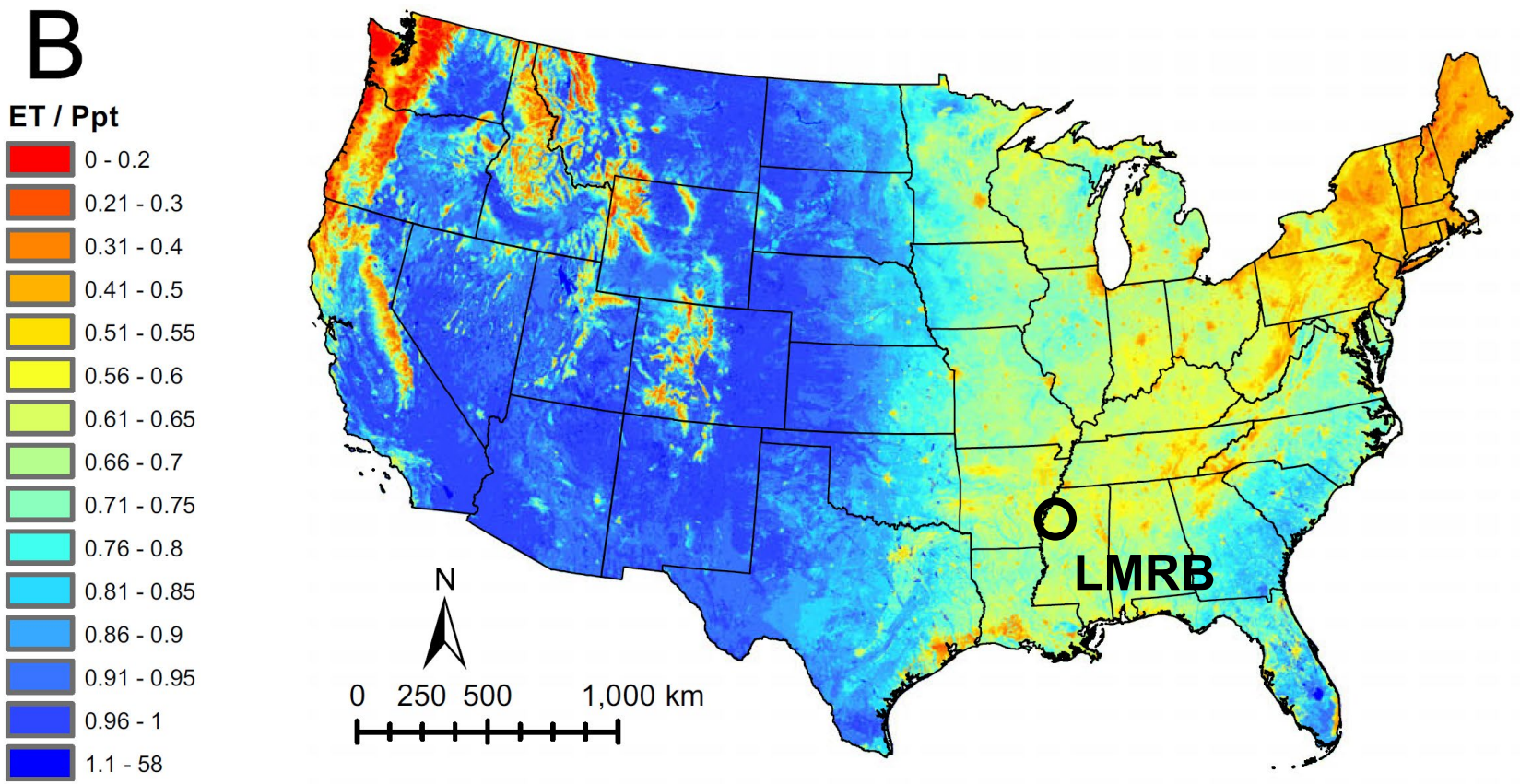
- Post-development (2007) flows in acre-ft/yr



Source: Clark, B.R., Hart, R.M., and Gurdak, J.J., 2011, Groundwater availability of the Mississippi embayment: U.S. Geological Survey Professional Paper 1785, 62 p.

40% of rainfall available as runoff or recharge

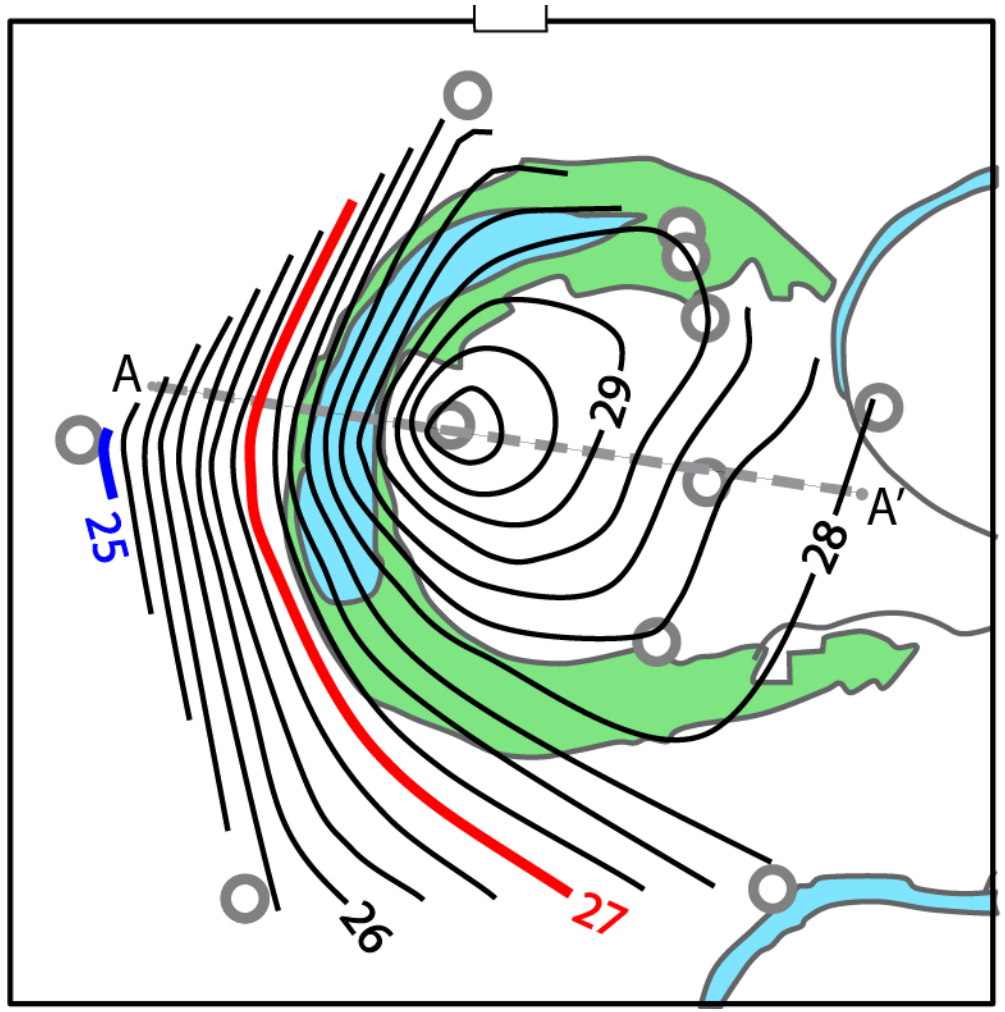
- ET/Precipitation ratio
  - LMRB ~0.6
- Average annual available water (P – ET)
  - ~22 inches



SOURCE: Reitz, M., Sanford, W.E., Senay, G.B., and Cazenas, J., 2017, Annual estimates of recharge, quick-flow runoff and evapotranspiration for the contiguous U.S. using empirical regression equations. JAWRA 53(4): 961–983

MAR opportunities

- Low permeability surficial soil and intensive cultivation
  - Limits surface infiltration and land availability
- Subsurface infiltration
  - *Infiltration galleries*; vadose zone wells
- Direct injection
  - *Aquifer recharge wells*
- Enhancing natural recharge
  - Oxbow lakes
  - Overbank flooding



SOURCE: Gratzer, M.C., Davidson, G.R., O'Reilly, A.M., and Rigby, J.R., 2020. Groundwater recharge from an oxbow lake-wetland system in the Lower Mississippi River Valley: Hydrological Processes 34: 1359–1370.

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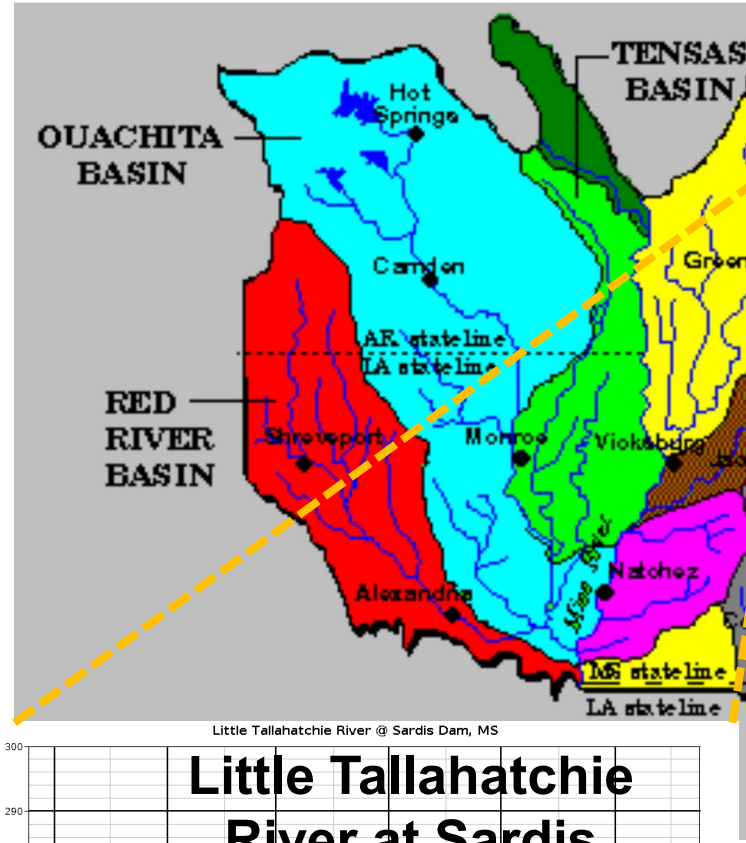
MAR source water

- Predominantly rural region
- Surface water sources
  - On-farm reservoirs
  - Rivers / riverbank filtration
- Opportunities for *conjunctive management* of GW and SW, e.g., Yazoo River
  - 4 reservoirs in upper basin above major agricultural area



Mississippi River

Upper Yazoo River Basin

Yazoo River Backwater Area

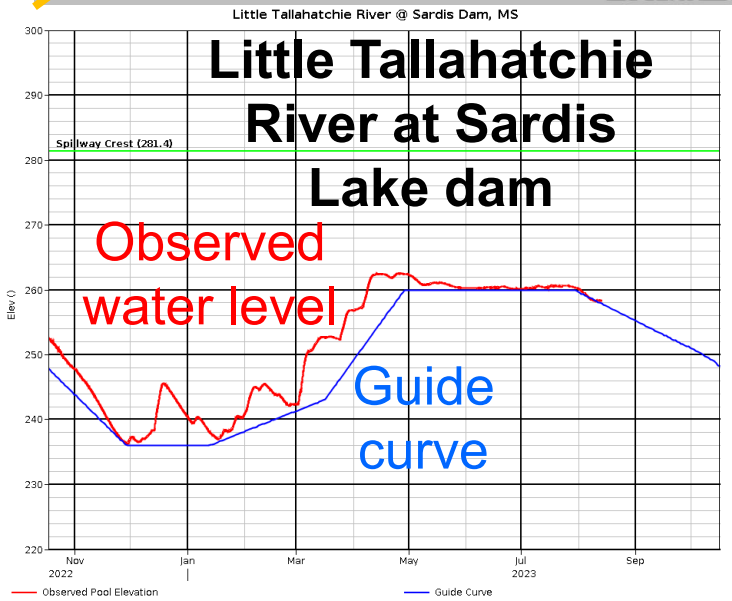
Boeuf-Tensas Basin

Ouachita River Basin

Red River Basin

Pearl River Basin

Arkansas River Basin



SOURCE: https://www.mvk.usace.army.mil/Missions/Engineering-and-Construction-Division/Hydraulics-Branch/Water-Control-Management/

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