
The Curious Case of the Memphis Sand Aquifer

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Presentation Outline

• Definitions
• Memphis Background
• Memphis Sand
• The Issues
• The Lawsuit
• The Appeal
• The Supreme Court
• Observations
• Implications for Groundwater Management; Speculation
• Current Situation
• References
Definitions

• **Expert:** “Someone who travels more than 500 miles to a meeting and uses multi-colored presentations.”
  -- Source unknown (1970s)

• **Expert:** “Someone who *blogs and/or tweets on a topic.*” – Source unknown (early 2000s)

• **What These Mean:** By one definition, and sometimes two, I am an **expert** on the Memphis Sand aquifer.

  *shameless plugs* for WaterWired blog
  
  http://www.waterwired.org
  
  Twitter (http://twitter.com/waterwired)
Memphis Background - 1

- Memphis, Tennessee, on the Mississippi River, is a major southern USA city (population c. 700,000)
- Memphis metropolitan area encompasses surrounding Shelby County and parts of other counties in Tennessee, Arkansas, and Mississippi (c. 1.3M people)
- Has world’s second largest (in tonnage, as of 2010) cargo airport (MEM); FedEx headquarters and its major hub.
- Great musical heritage: Jazz; Blues; Rock and Roll; Rhythm & Blues; Country & Western. Elvis Presley!
Location of Memphis, Shelby County, and Tennessee
Memphis Background - 2

- City-owned utility, Memphis Light, Gas, and Water (MLGW) provides water to about 1.1M people. Started pumping groundwater c. 1924.
- MLGW pumps high-quality groundwater, primarily from Memphis Sand and Fort Pillow Sand aquifers.
- Daily pumpage: 160 – 200 million gallons per day (MGD).
- Cameron (2009) claims Memphis is the largest city in the world relying solely on groundwater.
Memphis Sand

- Underlies 10 000 mi$^2$ of AR, TN, MS, KY; up to 900 feet thick
- Very coarse sand with interbedded lenses of clay and silt
- Good water storage & transmissive properties
- High quality, low total dissolved solids (TDS) water (19 – 333 mg/L)
- Recharged via precipitation (average annual precipitation ~ 55 inches) on outcrop belt in western TN, and downward percolation of water from overlying units
- Part of MS Embayment Aquifer System
Mississippi Embayment Aquifer System

(RENKEN 1998)
NW-SE Hydrostratigraphic Cross Section beneath Memphis, Tennessee (TN) and Adjacent States of Arkansas (AR) and Mississippi (MS) (note vertical exaggeration – strata dip more like 1%)

[Courtesy of the Department of Geosciences, Mississippi State University, Starkville, MS; modified from Brahana et al. (1987)]
The Issues

• MLGW pumping from 10 well fields (as of 2009) has caused pumping effects to expand into Mississippi

• Mississippi claims that MLGW is ‘stealing’ its groundwater: currently ~24 MGD and 365 billion gallons since 1965

• Mississippi lists Memphis as its biggest user of its groundwater!
Groundwater Rights in the 50 USA States
(courtesy Ken Rainwater, Texas Tech University)
### Summary – State Groundwater Allocation Laws
*(courtesy Ken Rainwater, Texas Tech University)*

<table>
<thead>
<tr>
<th>Groundwater Allocation</th>
<th>No. of States</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Ownership</td>
<td>7</td>
<td>Connecticut, Indiana, Louisiana, Maine, Massachusetts, Rhode Island, Texas</td>
</tr>
<tr>
<td>Reasonable Use</td>
<td>16</td>
<td>Alabama, Florida, Illinois, Kentucky, Maryland, Missouri, Nebraska, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia</td>
</tr>
<tr>
<td>Prior Appropriation</td>
<td>14</td>
<td>New Jersey, South Dakota</td>
</tr>
<tr>
<td>Correlative Rights</td>
<td>5</td>
<td>Delaware, Hawaii, Iowa, Minnesota, Vermont</td>
</tr>
<tr>
<td>Beneficial Purpose Doctrine (Restatement of Torts § 858)</td>
<td>3</td>
<td>Michigan, Ohio, Wisconsin</td>
</tr>
<tr>
<td>Reasonable Use / Correlative Rights</td>
<td>4</td>
<td>New Hampshire, Oklahoma</td>
</tr>
<tr>
<td>Absolute Ownership / Reasonable Use</td>
<td>1</td>
<td>Georgia</td>
</tr>
</tbody>
</table>
State Groundwater Law: Reasonable Use
(courtesy Ken Rainwater, Texas Tech University)

- **American Rule**
  - Groundwater may be owned by landowner or state
  - Rights of adjacent landowner are recognized
  - Reasonable use – any non-wasteful use on overlying land
    - Economic, social values may be considered

- **Advantage**
  - Overlying users are protected

- **Disadvantages**
  - Reasonable use can be debated
  - May not prevent overdraft
MLGW Well Fields
(Cameron 2009)
Pumping Well Cone of Depression
(Cameron 2009)
What Happens When A Well Pumps from a Confined Aquifer
(Alley et al. 1999)
Memphis Sand Aquifer Flow Net showing Groundwater Movement from Mississippi to MLGW Well Fields

Note: Natural Flow is Generally East to West

[Cameron 2009]
Three-Dimensional Representation of the Cones of Depression Created by MLGW’s Memphis Sand Aquifer Pumping

[Cameron 2009]
The Lawsuit

• In February 2005 Mississippi filed suit against the City of Memphis and MLGW, seeking over $1B in damages for diversion of water belonging to MS.

• Suit was filed in U.S. District Court, Northern District of Mississippi in Oxford, and went to trial in February 2008.

• Judge Glen H. Davidson said that TN was a “necessary and indispensable party” in the case and must be brought in as a defendant.

• Judge Davidson dismissed the case, saying that his court did not have jurisdiction since the case involved two states, MS and TN, and such cases must be heard by the U.S. Supreme Court.
• Mississippi chose to appeal Judge Davidson’s decision to the Fifth Circuit Court of Appeals in New Orleans.

• Court upheld lower court’s ruling, saying that Tennessee must be brought into the case as its exclusion would be enormously prejudicial to “Tennessee’s sovereign interests in its water rights.”

• Circuit Court also noted that since the aquifer is an interstate resource, its water must be formally allocated among the states before one state could sue another for “invading its share.”
• The Fifth Circuit Court also said the aquifer is "indistinguishable from a lake bordered by multiple states or from a river bordering several states depending on it for water."

• The Court continued: “The aquifer must be allocated like other interstate water resources in which different states have competing sovereign interests.“

• Mississippi contended that the groundwater had been allocated to it when it became a state in 1817.

• Mississippi chose to take the case to the U.S. Supreme Court.
The Supreme Court declined to hear the case, denying the motion *without prejudice*; Mississippi could refile the case at a later date if it believed it could prove damages.

Nelson (2010) reported:

“The Supreme Court today rejected two legal actions by Mississippi, ending for now the state's quest to stop Memphis, Tenn., from using aquifer water that Mississippi claims as its own.”

“Today, in *Mississippi v. Memphis*, the Supreme Court refused to examine Mississippi's appeal of a lower court ruling that only the Supreme Court could consider the dispute. The justices also denied Mississippi's motion to file a complaint in a separate case, titled 139 Original, which would have brought the merits of the dispute before the Supreme Court.”
Observations - 1

- Prior to the 2005 lawsuit, the states of TN, MS, and AR were in discussions about developing a plan to manage the aquifer. MS withdrew from the discussions right before it filed suit.

- Lawsuit seemed more appropriate to the arid Western USA, not to an area that receives about 55 inches of annual precipitation and abuts one of the world’s largest rivers. Shape of things to come?

- Does the ‘public trust’ doctrine apply to groundwater? Mississippi invoked it, claiming it was protecting groundwater for its citizens (Cameron 2009; Baxtresser 2010).
Observations - 2

• Institutional asymmetry is interesting: state v. city in a dispute over water resources. Are new approaches for resolution of such disputes needed?
• Should we establish regional interstate agencies to manage transboundary groundwater? USA has such agencies for river basins (e.g., Delaware River Basin Commission)
• Harder to prove groundwater is being diverted (compared to surface water)
• Does MLGW have right to pump so much groundwater? (Feldman and Elmendorf 2000)
Implications for Groundwater Management

- Groundwater ownership versus use
- Resolution of transboundary groundwater disputes that do not involve state versus state
- Value of groundwater and possible groundwater marketing
- Public trust doctrine as applied to groundwater
- Need to allocate transboundary GW among states and/or other political subdivisions
- Need for compacts/institutions designed specifically for transboundary groundwater (e.g., Bellagio Draft Treaty)
More Implications for USA Groundwater Management

Eckstein (2009) commented:
“Ground water resources, for too many years, have been treated as the neglected stepchild of water law. This is especially true in a transboundary context but also in the domestic laws of many nations, including the US. The adage ‘out of sight, out of mind’ comes to mind.”

Cameron (2009, p. 14) added:
“At the opening of the twenty-first century, hydrogeology and law are still not wholly integrated. However, lawyers and jurists have increasingly developed knowledge of hydrogeology and are drawing on that knowledge in litigation, in the administrative processes and in drafting of statutory enactments. Undoubtedly, the intertwined relationship between law and hydrogeology, that has had a long-established history, will become even more intimate in the future.”

Perhaps Mississippi v. Memphis will provide the impetus for transboundary aquifer riparians to develop joint management plans and avoid litigation.
Eckstein (2009) speculated on what might have happened had the case had been heard before the U.S. Supreme Court:

“Will the same occur for the law of transboundary ground waters? There is scant little precedence in US law on which the Court might base its decision other than cases on transboundary surface waters. While the analogy between the two water resources is certainly applicable and appropriate, this is new and unsettled ground for the Court to plow.”

Eckstein also speculated on international implications – many look to SCOTUS for leadership.
Let’s Be Friends!

From the Memphis Commercial Appeal, 25 January 2010:

• Mayor A.C. Wharton said the litigation hasn't changed the city's commitment to "good stewardship" of the abundant, high-quality aquifer hundreds of feet below most of the city. He said Memphis remains ready to "sit down and discuss" ways to protect and enhance the aquifer with Mississippi officials.

• "We simply would do nothing to jeopardize God's greatest treasure, and that's the water." – Mayor A.C. Wharton

• “Don’t be cruel.” – Elvis Presley
What’s Happening Now?

- Study by U. of Memphis professors Brian Waldron and Daniel Larsen: MS GW flowed into TN before MLGW pumping; refuted argument that TN is ‘stealing’ MS groundwater. In fact, pumping in DeSoto County may have ‘stolen’ TN’s groundwater. Study is being submitted as a journal article. See more at http://bit.ly/IqPKpu

- Will MS Attorney General refile the suit? "We are still evaluating our options with this." – Jan Schaefer, MS AG office (email to reporter Tom Charlier)


- Water attorney friend of mine not involved in the case stated that Memphis has no reason to negotiate with MS; they won.
Mississippi and Memphis Representatives Discuss Water Allocation Without Their Lawyers
(courtesy: www.duckboy.com)
Email: aquadoc@oregonstate.edu

Thank You!
References


