

**MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER AND SPARTA
AQUIFER COMPARISON REPORT FOR THE STATES OF
MISSISSIPPI, ARKANSAS, LOUISIANA, TENNESSEE, AND
MISSOURI**



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I. Introduction

The Mississippi River Valley Alluvial Aquifer (MRVA) is located in multiple states, including Arkansas, Louisiana, Mississippi, Missouri, and Tennessee.¹ The bulk of the aquifer is in Arkansas, Mississippi, and Tennessee.² The MRVA is colloquially referred to as the Delta and is made up of thick blanket sands, which water naturally filters through.³ The Sparta aquifer covers some of the same states as the MRVA. The Sparta aquifer extends from south Texas through Louisiana, Arkansas, Tennessee, Mississippi, and into Alabama.⁴ The aquifer is made up “of varying amounts of unconsolidated sand, inter-stratified with silt and clay lenses within the Sparta Sand of the Claiborne Group.”⁵

The primary uses of the water in the MRVA and Sparta aquifers vary by state. For example, in Arkansas the water is used mostly for public water supply and for supplementing crop irrigation.⁶ Texas utilizes water from the Sparta aquifer for domestic and livestock purposes.⁷ Louisiana primarily uses aquifer water for drinking water and industry purposes.⁸ The MRVA is the primary crop irrigation source for the Mississippi Delta region. Each state has its own uses for the water, but they are all threatened by depletion of the aquifers.

The aquifers are most critical between Arkansas and Louisiana. A cone of depression has formed between El Dorado, Arkansas, and Monroe, Louisiana, but this isn't the only location where a cone of depression has formed.⁹ A cone of depression forms by pumping wells too much so that it causes a depression, which alters the flow of the groundwater and leads to up-coning of brackish water from below.¹⁰ This increases the chloride levels in the water and threatens the aquifer.

To an extent, states in the region have addressed threats to water resources through special management programs. For instance, the Arkansas Soil and Water Conservation Commission has designated certain counties as “critical groundwater areas,” which encourages

¹ *Aquifer Basics*, U.S. GEOLOGICAL SURVEY, <https://water.usgs.gov/ogw/aquiferbasics/msrvaaq.html> (last visited Sept. 28, 2018).

² U.S. DEP'T OF THE INTERIOR, MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER, ALABAMA, ARKANSAS, ILLINOIS, KENTUCKY, LOUISIANA, MISSISSIPPI, TENNESSEE; 2006-2008, <https://catalog.data.gov/dataset/mississippi-river-valley-alluvial-aquifer-alabama-arkansas-illinois-kentucky-louisian-2006-2008> (last visited Sept. 26, 2018).

³ Claire Rose, *Determining Potential for Direct Recharge in the Mississippi River Valley Alluvial Aquifer Using Soil Core Analyses, Washington County, Northwestern Mississippi*, MISS. WATER RES. RESEARCH INST., <http://www.wrri.msstate.edu/pdf/rose07.pdf>; *Aquifer Basics*, U.S. GEOLOGICAL SURVEY, <https://water.usgs.gov/ogw/aquiferbasics/uncon.html> (both last visited Sept. 26, 2018).

⁴ U.S. GEOLOGICAL SURVEY, THE SPARTA AQUIFER: A SUSTAINABLE WATER RESOURCE <https://pubs.usgs.gov/fs/fs-111-02/> (last visited Sept. 26, 2018).

⁵ *Id.*

⁶ *Id.*

⁷ *Sparta Aquifer*, TEX. WATER DEV. BD., <http://www.twdb.texas.gov/groundwater/aquifer/minors/sparta.asp> (last visited Sept. 26, 2018).

⁸ *Aquifer Information*, LA. SPARTA GROUND WATER COMM'N, <https://www.spartaaquifer.com/aquifer-info.php> (last visited Sept. 26, 2018).

⁹ U.S. GEOLOGICAL SURVEY, *supra* note 4.

¹⁰ *Id.*

local authorities to address the problem and implement a plan to remedy the issue.¹¹ However, some states have taken different actions to address lower aquifer levels. Notably, the state of Mississippi has brought a lawsuit against the state of Tennessee for the use of the Sparta aquifer by the City of Memphis. Thus, much is still needed to be done and critical questions remain for states relying on the MRVA and Sparta aquifers.

This report will first provide an overview of the basics of water law, and will then examine the laws governing the allocation of surface water and groundwater in the following states- Mississippi, Arkansas, Louisiana, Tennessee, and Missouri. The report will then consider other aspects of water management in the region, including programs addressing water scarcity and water management districts.

II. Water Law Basics

Water Law provides the framework that guides our decisions about who gets to use freshwater. Water Law is generally state law - states get to determine their own rules on how to allocate the water within their borders. It is also a system that focuses on use, not conservation. What matters under the law is who is using water for what purpose, and some uses are more protected than others. For instance, domestic uses are more protected than industrial or agricultural uses.

Water Law is also an area of law that is split in a couple of fundamental ways, as surface water and groundwater are governed by two separate sets of legal principles. For groundwater, the rules vary by state under a handful of different legal doctrines. However, surface water has a stark regional difference, with the eastern and western United States following different doctrines. Finally, disputes over interstate water bodies are treated differently under the law.

a. Surface Water

The West has always had water supply issues, and a legal doctrine known as prior appropriation developed to deal with this scarcity. In the prior appropriation system, the state issues water rights to users on a time-based priority basis as certain amounts of each waterway are doled out to individual users. Thus, a water user's ability to draw water depends on how early or late your water right is in the priority system. Thus, if the stream dries up before it is a junior water rights holder's turn in the priority system, he or she is out of luck. Thus, water rights in the prior appropriation system is completely contingent on whether there is any water left in the stream to use.

In comparison, the East has traditionally been viewed as water rich, and the law recognizes this. Those who live on waterways are considered riparians, and they can use the water abutting their property however they like so long as the use is reasonable and doesn't affect other riparians. This means until there is a problem, there is very little monitoring or control over how much water a riparian owner is using. In addition, some states have adopted permit systems that requires some water withdrawals to be permitted. These systems vary by

¹¹ *Sparta Aquifer Recovery Study*, UNION COUNTY WATER CONSERVATION BD., <https://argis.ualr.edu/website/unionCoGraph/spartaHistory.asp> (last visited Sept. 26, 2018).

state, but are generally referred to as regulated riparianism. Further, as the eastern United States starts to face water scarcity issues, problems with the riparian system are emerging.

b. Groundwater

Groundwater has its own set of rules that are distinct from the rules governing surface water use. But there are a couple specific issues with groundwater that have affected how these rules have developed. With surface water, sources run out when we overuse- the stream or river simply goes dry. With groundwater, this usually isn't the case. In many aquifers, there is or was a lot of water to use for long periods of time. In addition, historically there was a lack of understanding of the science of aquifers. Since groundwater often could not be seen from above ground, there was an assumption that there would always be enough water to use. Both of these facts helped create the illusion that groundwater resources were limitless.

Because of this, groundwater doctrines often allowed water users to use vast amounts of groundwater, with no regard for the repercussions. However, over pumping groundwater can have serious consequences. Over pumping groundwater can cause subsidence, negatively affect ecosystems and habitats, and in coastal areas, can cause saltwater to intrude aquifers, which pollutes drinking water and harms crop lands. Further, when the water table is lowered, landowners are forced to drill deeper wells to access water. In addition, due to over pumping, most aquifers are being "mined." Mining is a term of art that means more water is being pumped out of the source than is being recharged. Aquifers are susceptible to mining because aquifer recharge happens at very low rates - often inches per year, while pumping often depletes aquifers at feet per year.

There are varying common law groundwater doctrines that states developed to regulate the use of groundwater. In addition, groundwater rules are not simply based on use rights. Since groundwater pumping can have negative effects on your neighbors, the common law rules often also include rules of liability. The groundwater doctrines include the rule of capture, American reasonable use, correlative rights, and prior appropriation.

The rule of capture is the oldest doctrine. The capture rule allows a landowner to pump groundwater from his or her property. The rule also insulates a landowner who withdraws groundwater from beneath the surface of his land from any liability to neighboring landowners for the injuries that those withdrawals cause.¹² The modern understanding of the connection between surface water and groundwater has decreased the capture rule's popularity, but it is still used in several jurisdictions, including Texas and Maine. This rule can be modified, however, in certain areas that have critical groundwater levels. For instance, the rule of capture does not apply to withdrawals from the Edwards Aquifer in Texas. In addition, if a landowner is willfully or negligently pumping in a way that harms a neighbor, such as by causing subsidence, the landowner can be liable.¹³

¹² See *Sipriano v. Great Spring Waters of America, Inc.*, 42 Tex. Sup. Ct. J. 629, 1 S.W.3d 75 (1999).

¹³ See *City of Corpus Christi v. City of Pleasanton*, 276 S.W.2d 798, 801 (Tex. 1955); *Friendswood Dev. Co. v. Smith-Southwest Indus., Inc.*, 576 S.W.2d 21, 30 (Tex. 1978).

The American Reasonable Use doctrine is a modification of the rule of capture. The doctrine began to replace the rule of capture in states beginning in the early 20th century. Most simply, the American Reasonable Use doctrine is essentially the same as the rule of capture, but the doctrine requires that the groundwater be used on the overlying tract of land for a reasonable use.¹⁴

Under a correlative rights approach, no person has a proprietary interest in ground water, only a usufructuary interest. Thus, being a landowner does not necessarily give you a right to pump up water beneath your land. Because of this, the rule requires that water be shared based on both the water's use and the rights of the landowners in the area.¹⁵

Finally, the prior appropriation doctrine for groundwater is very similar to the surface water doctrine. As with surface water, the senior users who first pumped the groundwater for a beneficial use gain priority over junior users and have superior rights to use the water.¹⁶ The doctrine does not function as well for groundwater, however. Unlike with surface water, when a groundwater well goes dry, there is usually still water left in the aquifer, meaning that the water could be accessed if the water user simply drills a deeper well.

c. Interstate Disputes

While Water Law is mostly a matter of state law, when two or more states disagree on how to share water resources between them, federal rules apply. Interstate water disputes are common, and sometimes states can negotiate agreements as to how to share water resources that cross state borders. But when states can't reach an agreement among themselves, the disputes can only be resolved by the Supreme Court of the United States (SCOTUS), as the Court has original jurisdiction in all cases in which a state is a party. In suits between states, SCOTUS serves as a trial court and appoints a special master to run a trial-like process. The special master hears the parties' initial motions and evaluates the evidence. The special master then makes findings of fact, conclusions of law, and recommends a decision for the Court. SCOTUS then decides whether or not to follow the special master's recommendation.

Currently, Mississippi and Tennessee are in a dispute concerning groundwater from the Memphis Sands Aquifer, which is fed mostly by the Sparta Sands Aquifer and underlies several states including Mississippi and Tennessee. Mississippi and Tennessee both pump water from this aquifer. The City of Memphis pumps its water very close to the Mississippi-Tennessee border. Mississippi has challenged this use before by suing the City of Memphis for monetary damages. In 2009, the 5th Circuit Court of Appeals dismissed Mississippi's lawsuit ruling that Mississippi had framed its case incorrectly.¹⁷ The court determined that the aquifer was an interstate resource, so Tennessee, which was not named in the suit, was a necessary party.¹⁸

¹⁴ See *Meecker v. City of East Orange*, 77 N.J.L. 623, 74 A. 379 (N.J. 1909).

¹⁵ See *Woodsum v. Pemberton Township*, 172 N.J. Super. 489, 412 A.2d 1064 (N.J. App. 1980).

¹⁶ See *Farmers Inv. Co. v. Bettwy*, 558 P.2d 14 (Ariz. 1976).

¹⁷ *Hood, ex rel. Mississippi v. City of Memphis*, 570 F.3d 625 (5th Cir. 2009), *cert. denied*, *Mississippi v. City of Memphis*, 559 U.S. 904 (2010).

¹⁸ *Id.*

Further, since it was an interstate dispute, original and exclusive jurisdiction belonged to SCOTUS.¹⁹

The Supreme Court agreed to hear Mississippi's case against Tennessee, along with the City of Memphis and the Memphis Light, Gas, and Water Division, regarding the use of the aquifer. The states of Mississippi and Tennessee have very different theories for the case. Tennessee, referring to the previous 5th Circuit decision, is claiming the water is an interstate resource, and thus, the Court needs to determine how much each state is entitled to.²⁰ However, Mississippi is claiming that Tennessee is actually pumping water from under Mississippi and that this water would never leave Mississippi but for Tennessee's pumping. Like its previous lawsuit, Mississippi is treating the water in the aquifer as Mississippi property, not as an interstate resource, and is asking for damages for the water Tennessee has taken.²¹ In early 2019, the Special Master will hold an initial hearing in the case to determine whether the aquifer is or is not an interstate resource.

III. State by State Analysis of Water Laws

Prompted by the *Mississippi v. Tennessee* lawsuit, the National Sea Grant Law Center (NSGLC) has undertaken a review of the water laws for several states that draw from the MRVA and Sparta Aquifers. This section summarizes the findings of that review.

a. Mississippi

In Mississippi, the law governing the use of water appears to be the same for both surface and groundwater. Mississippi works under a permit system that is similar to a modified version of the prior appropriation method that most Western States utilize.²² In order to use surface or groundwater you must first obtain a permit from the Mississippi Department of Environmental Quality's (MDEQ). Mississippi Code Annotated §51-3-5(1) states:

No person who is not specifically exempted by this chapter shall use water without having first obtained a permit as provided herein and without having otherwise complied with the provisions of this chapter, the regulations promulgated hereunder and any applicable permit conditions.

¹⁹ *Id.*

²⁰ Answer of Defendant State of Tennessee, *Mississippi v. Tennessee*, et al., No. 143, Orig. (U.S. filed Sept. 14, 2015) (Dkt. No. 15), http://www.ca6.uscourts.gov/sites/ca6/files/documents/special_master/DE%204%20Tennessee%20Brief%20in%20Opposition.pdf (last visited Sept. 26, 2018).

²¹ State of Mississippi's Brief in Support of Motion for Leave To File Bill of Complaint in Original Action, *Mississippi v. Tennessee*, et al., No. 143, Orig. (U.S. filed June 6, 2014) (Dkt. No. 1), http://www.ca6.uscourts.gov/sites/ca6/files/documents/special_master/DE%201%20Mississippi%20Motion%20for%20Leave%20to%20File%20Complaint.pdf (last visited Sept. 26, 2018).

²² DON R. CHRISTY ET AL, A COMPARISON OF SURFACE WATER LAWS AND REGULATIONS FROM SOUTHEASTERN STATES (2005), <https://athenaeum.libs.uga.edu/bitstream/handle/10724/19397/surfacewater.pdf?sequence=1> (last visited Sept. 26, 2018).

There are exemptions to this requirement in Mississippi Code Annotated §51-3-7, which specifies that anyone using water purely for domestic purposes does not need to obtain a permit. Also, if a user will pump water from a well that is less than six inches in diameter, no permit is required.

The MDEQ and its Office of Land and Water Resources (OLWR) list the beneficial uses for groundwater based on which has the highest priority of beneficial use. The top two uses for groundwater are public water supply and industrial/commercial uses.²³ Industrial and commercial uses are delineated into more specific categories that include agriculture, industrial, livestock, and commercial.²⁴ The OLWR also lists several limitations on uses of water for both surface and groundwater. The limitations for surface water are based on the established minimum flow for a given watercourse. The Permit Board may limit municipal users and industrial users based on criteria that would affect the established minimum flow. The limitations for groundwater are situation specific. For example, using a large volume of water for a once-through, non-contact cooling purpose is not considered a beneficial use, so using an amount of water in excess of 20,000 gallons per day is prohibited. While surface water and groundwater are generally treated the same, the OLWR under its Rule 1.4 spells out the regulations for groundwater withdrawals.²⁵

Drilling wells or boreholes to access groundwater requires a license with the Mississippi Commission on Environmental Quality.²⁶ The license required to drill a well or borehole is a contractor's license, and there are specific requirements that must be met in order to obtain a license to drill for groundwater.²⁷ Additionally, there are specific requirements for the MRVA Aquifer that are different from other groundwater in Mississippi. Due to the unique make-up of the MRVA, the MDEQ has distinct construction and disinfection standards for the MRVA. In addition to these standards the Delta Sustainable Water Resources Task Force states that the MRVA is used for irrigation, aquaculture, and wildlife management purposes.²⁸

b. Arkansas

The laws for allocation of water in Arkansas are similar for both surface and groundwater. Arkansas operates under a regulated riparianism system. A core concept of Arkansas' water laws is reasonable use. The reasonable use concept was introduced in Arkansas by *Harris v. Brooks* in 1955.²⁹ This case set out some basic principles for Riparianism and the reasonable use concept. The court stated, "The right to use water for strictly domestic

²³ *Administrative Procedures Act Rules, Chapter 1*, MISS. DEP'T OF ENVTL. QUALITY, <https://www.mdeq.ms.gov/wp-content/uploads/2017/06/11-Miss.-Admin.-Code-Pt.-7,-Ch.-1..pdf> (last visited Sept. 27, 2018).

²⁴ *Id.*

²⁵ *Id.*

²⁶ *Administrative Procedures Act Rules, Chapter 2*, MISS. DEP'T OF ENVTL. QUALITY <https://www.mdeq.ms.gov/wp-content/uploads/2017/06/11-Miss.-Admin.-Code-Pt.-7-Ch.-2..pdf> (last visited Sept. 27, 2018).

²⁷ MISS. CODE ANN. § 51-5-1.

²⁸ *Delta Sustainability Water Resources Task Force*, MISS. DEP'T OF ENVTL. QUALITY, <https://www.mdeq.ms.gov/water/water-availability-and-use/delta-sustainable-water-resources-task-force/> (last visited Sept. 27, 2018).

²⁹ *Harris v. Brooks*, 225 Ark. 436, (1955).

purposes...is superior to many other uses of water. Other than domestic use, all other lawful uses of water are equal.” The reasonable use concept applies to both surface and groundwater in Arkansas. The primary use of surface water is for public water supply.³⁰ The primary use of groundwater is for irrigation, with nearly 6.9 billion gallons used per day.³¹ The Arkansas Supreme Court has applied the correlative rights doctrine to groundwater within the state.³²

The Arkansas Natural Resource Commission (ANRC) requires annual reports of water usage. “Water users must annually report source of the water, point of diversion, purpose of the use of the water, quantity diverted, location of use, and times of the year when diversion is proposed.”³³ Persons in Arkansas “diverting less than 325,900 gallons of water in any water year,” or persons diverting surface water exclusively owned by one person are exempt from registration with the ANRC.³⁴ Additionally, there are certain wells that are exempt from registration. The ANRC states that household wells used exclusively for domestic use, as well as wells with potential flow rates less than 50,000 gallons a day are also exempt from reporting requirements.³⁵

c. Louisiana

The Louisiana *laissez faire* attitude applies to its water laws as well. Since Louisiana is generally a water-rich state, there are few regulations on water allocation.³⁶ While Louisiana’s can be broadly categorized as a riparian state, the state’s civil code differentiates it from other southeastern riparian common law states. Louisiana Civil Code Articles 657 and 658 provide the foundation and reasoning for riparianism in the state.³⁷ Apart from these Articles, there is little to no concrete water law for the state. Article 657 reads “[t]he Owner of an estate bordering on running water may use it as it runs for the purpose of watering his estate or for other purposes.”³⁸ The Article provides a clear reference to riparianism due to the reference to a property owner using water running through his property. Article 658 states “[t]he owner of an estate through which water runs, whether it originates there or passes from land above, may make use of it while it runs over his lands. He cannot stop it or give it another direction and is bound to return it to its ordinary channel where it leaves his estate.”³⁹ This Article indicates that if the water is not

³⁰ U.S. GEOLOGICAL SURVEY, ESTIMATED WATER USE IN ARKANSAS, 2010 (2015) <https://pubs.er.usgs.gov/publication/sir20155062> (last visited Sept. 27, 2018).

³¹ *Ground Water Use*, ARK. GEOLOGICAL SURVEY, http://www.geology.ar.gov/water/groundwater_use.htm (last visited Sept. 27, 2018).

³² ARK. NATURAL RES. COMM’N, WATER LAW IN ARKANSAS (2011), https://static.ark.org/eeuploads/anrc/arkansas_water_law_2011_draft-new.pdf (last visited Sept. 27, 2018).

³³ ARK. CODE ANN. § 15-22-215.

³⁴ ARK. ADMIN. CODE § 138.00.2-302.2.

³⁵ *Id.* at § 138.00.6-402.2.

³⁶ For an in-depth analysis of water rights in Louisiana, see LA. STATE LAW INST., REPORT IN RESPONSE TO SCR 53 OF THE 2012 REGULAR SESSION- THE USE OF SURFACE WATER VERSUS GROUNDWATER (2014), http://www.law.tulane.edu/uploadedFiles/Institutes_and_Centers/Water_Resources_Law_and_Policy/Content/4.04.14.%20Roberson,%20Water%20Law%20Report.pdf (last visited Sept. 28, 2018).

³⁷ MARK DAVIS, TULANE INST. ON WATER RES. LAW AND POLICY, A TOE IN THE WATER: A PRIMER ON LOUISIANA RIPARIAN LAW AND EMERGING ISSUES PREPARED FOR THE LOUISIANA MINERAL LAW INSTITUTE (2009), http://www.law.tulane.edu/uploadedFiles/Institutes_and_Centers/Water_Resources_Law_and_Policy/Content/A%20Toe%20in%20the%20Water,%20Davis%20,%20Mineral%20Law%20Inst.pdf (last visited Sept. 27, 2018).

³⁸ LA. CIV. CODE ANN. art. 657

³⁹ *Id.* at art. 658

running, no riparian rights apply. Further, stating that the water can be used as it runs over the riparian's land and that the water must return to its ordinary channel indicates that the water is meant to remain in the same water basin and introduces the reasonable use doctrine.

Louisiana Revised Statutes Section 9:1104 permits a riparian to assign his or her riparian rights in running surface water to a non-riparian for "agricultural or aquacultural purpose." The section states that neither agriculture or aquaculture are consumptive uses of water. In fact, these uses could actually enhance the hydrological cycle, such as by recharging aquifers with percolating water used for these purposes. The statute defines "agricultural or aquacultural purpose" as "any use by a riparian owner or an assignee of a riparian owner of running surface waters withdrawn and used for the purpose of directly sustaining life or providing habitat to sustain life of living organisms that are customarily or actually intended to be brought to market for sale."⁴⁰

There are a couple restrictions on the assignment of riparian rights to a non-riparian under this section. First, the water must stay within the state of Louisiana. Further, the withdrawal must be "environmentally and ecologically sound" and "consistent with the required balancing of environmental and ecological impacts with the economic and social benefits" in the Louisiana Constitution.⁴¹ The section also contains several other restrictions, including that the withdrawal cannot have an undue impact on navigation or public drinking water supplies.

There are currently no Civil Code provisions addressing groundwater, and courts in the state have not extended article 657 and 658 to groundwater.⁴² However, the Mineral Code in Louisiana states that its provisions are applicable to the removal of "subterranean water," but this is the only reference to water in the act's provisions.⁴³ Article 9 of the mineral code discusses correlative rights, stating that "[l]andowners and others with rights in a common reservoir or deposit of minerals have correlative rights and duties with respect to one another in the development and production of the common source of minerals."⁴⁴ However, the applicability of this provision to subterranean water has not been addressed by the courts.⁴⁵

The Sparta Aquifer is primarily utilized in northern Louisiana, specifically north-central Louisiana.⁴⁶ The two largest uses for the Sparta Aquifer are for public supply and for industrial use. Approximately 31.5 million gallons of Sparta Aquifer water is used each day for industrial purposes. The MRVA Aquifer is used statewide as a groundwater source. In northwestern Louisiana, it often represents the only source of water. The primary use of the MRVA is for irrigation with nearly 122 million gallons used per day within the state.

⁴⁰ LA. REV. STATUTES § 9:1104(C).

⁴¹ *Id.* at § 9:1104(B).

⁴² LA. STATE LAW INST., *supra* note 36, at 36-37.

⁴³ LA. REV. STATUTES § 31:4.

⁴⁴ *Id.* at § 31:9.

⁴⁵ LA. STATE LAW INST., *supra* note 36, at 43.

⁴⁶ C.G. STUART ET AL., U.S. GEOLOGICAL SURVEY, GUIDE TO LOUISIANA'S GROUND-WATER RESOURCES (1994), <https://pubs.usgs.gov/wri/1994/4085/report.pdf> (last visited Sept. 27, 2018).

d. Tennessee

Through its statutes, the state of Tennessee has declared that “the waters of the state are the property of the state and are held in public trust for the benefit of its citizens” and “the people of the state are beneficiaries of this trust and have a right to both an adequate quantity and quality of drinking water.”⁴⁷ Tennessee water laws can be generally categorized, like many other states in the southeast, as a system of regulated riparianism. Tennessee operates under a riparian permit system through the Tennessee Water Resources Information Act, the Inter-Basin Transfer Act, and the Water Quality Control Act. Tennessee is a riparian rights state and the doctrine of reasonable use applies to both surface and groundwater. Tennessee groundwater is more specifically governed by the correlative rights doctrine, like Arkansas.⁴⁸

The general assembly of Tennessee recognized that abusing water resources can have consequences. Thus, the Tennessee Water Resources Information Act (“Information Act”) was created to “institute a system of registration so that adequate information is obtained to document current demand for water and to project growth in that demand...”⁴⁹ The Information Act regulates withdrawals of surface and groundwater.⁵⁰ The Information Act requires that persons withdrawing 10,000 gallons or more of surface or groundwater per day must register with the commissioner of the Tennessee Department of Environment and Conservation (TDEC).⁵¹ The Information Act specifies certain exceptions to this requirement. For example, a person may withdraw water for agricultural purposes without first obtaining a permit and registering the withdrawal, regardless of the amount of water being withdrawn.

The Inter-Basin Transfer Act (IBT Act) also regulates water use in Tennessee. The IBT Act requires permits, issued by the Commissioner of the TDEC, for most water transfers between basins. The “basins” that are regulated by the IBT Act are the major rivers in Tennessee and their tributaries, including the Mississippi River. Tennessee Code Annotated § 69-7-204 specifies that the IBT Act requires “persons or entities that have been granted powers by the state to acquire water, water rights and associated property by eminent domain or condemnation or that acquire or supply water for the use or benefit of public water supply...” who intend to increase their use or plan on introducing a new use must obtain a permit. This Act applies primarily to surface water, but can also apply to groundwater. The IBT Act states that if a groundwater withdrawal

⁴⁷ TENN. CODE ANN. § 68-221-702. The state has made a similar statement in its Water Quality Control Act: “Recognizing that the waters of Tennessee are the property of the state and are held in public trust for the use of the people of the state, it is declared to be the public policy of Tennessee that the people of Tennessee, as beneficiaries of this trust, have a right to unpolluted waters. In the exercise of its public trust over the waters of the state, the government of Tennessee has an obligation to take all prudent steps to secure, protect, and preserve this right.” *Id.* at § 69-3-102(a). This section also creates a planning obligation on behalf of the state: “Recognizing that the waters of the state are the property of the state and are held in public trust for the benefit of its citizens, it is declared that the people of the state are beneficiaries of this trust and have a right to both an adequate quantity and quality of drinking water.” *Id.* at § 69-3-102(b).

⁴⁸ 4-TN WATERS AND WATER RIGHTS I (2018); *see also* Nashville, Chattanooga & St. Louis Railway v. Rickert, 89 S.W.2d 889, 896-98 (Tenn. Ct. App. 1935).

⁴⁹ TENN. CODE ANN. § 69-7-302.

⁵⁰ *Id.* at § 69-7-301 - § 69-7-309.

⁵¹ *Id.* at § 69-7-303 and 304.

“has a significant potential to adversely affect the flow of a Tennessee surface water,” then the person or entity withdrawing the water must first obtain a permit to do so.⁵²

Certain water diversions in the state of Tennessee may also require an Aquatic Resource Alteration Permit (ARAP), which is part of the water pollution control chapter of the Tennessee Code.⁵³ Section 69-3-108 enumerates on the specific situations that would require an ARAP, which include “the alteration of the physical, chemical, radiological, biological, or bacteriological properties of any waters of the state.”⁵⁴ Thus, groundwater withdrawals that alter surface waters may require an ARAP. Tennessee previously had regulations regarding ARAPs, but those rules have since been repealed.⁵⁵

The majority of water used in Tennessee is surface water and a small percentage of groundwater.⁵⁶ The primary uses for water in the state are (in order of highest use) thermoelectric, industrial, public supply, and irrigation. However, the highest demand is from public supply. The Tennessee Valley Authority states that even though thermoelectric is the largest use category, it is also the largest source of return flow. The majority of groundwater is used for public water supply with an estimated 22.8% of public supply use coming from groundwater in 2010.⁵⁷ The uses of groundwater in West Tennessee, where the MRVA and Sparta aquifers are located, include public water supply, industrial, and agriculture. In particular, Memphis, TN is one of a number of cities that primarily relies on groundwater for its drinking water supplies.⁵⁸

e. Missouri

Missouri is a riparian state with few water laws because Missouri is a uniformly water rich state. In fact, the Missouri Department of Natural Resources states “There are no state laws, regulations or policies that specify the quantity of water that any diverter may use.”⁵⁹ Most of Missouri’s laws regarding water allocation and use come from case law. The Missouri Department of Natural Resources says that there are no groundwater allocation rules in the state. *Higday v. Nickolaus* addressed groundwater allocation and use in its 1971 decision.⁶⁰ The court

⁵² *Id.* at §69-7-204.

⁵³ *Id.* at §69-3-108; Aquatic Resource Alteration Permit (ARAP), Tenn. Dep’t of Env’t and Conservation, <https://www.tn.gov/environment/permit-permits/water-permits1/aquatic-resource-alteration-permit--arap-.html> (last visited Sept. 27, 2018).

⁵⁴ *Id.* at §69-3-108(b)(1).

⁵⁵ See *Rules of the Tennessee Department of Environment and Conservation*, TENN. DEP’T OF ENV’T AND CONSERVATION, <https://publications.tnsosfiles.com/rules/0400/0400-40/0400-40.htm> (last visited Sept. 27, 2018).

⁵⁶ CHARLES E. BOHAC & AMANDA K. BOWEN, TENN. VALLEY AUTH., WATER USE IN THE TENNESSEE VALLEY FOR 2010 AND PROJECTED USE IN 2035 (2012), http://152.87.4.98/river/watersupply/water_use.pdf (last visited Sept. 27, 2018).

⁵⁷ *Id.*

⁵⁸ See Tom Charlier, *The Memphis Sand Aquifer: A Buried Treasure*, COMMERCIAL APPEAL, Dec. 16, 2016, <https://www.commercialappeal.com/story/news/environment/2016/12/16/memphis-sand-aquifer-buried-treasure/93814278/>.

⁵⁹ *Frequently Asked Missouri Water Resources*, MO. DEP’T OF NATURAL RES., <https://dnr.mo.gov/pubs/pub1350.htm> (last visited Sept. 27, 2018).

⁶⁰ MO. DEP’T OF NATURAL RES., A SUMMARY OF MISSOURI WATER LAWS 237 (2000) <https://dnr.mo.gov/pubs/WR51.pdf> at 237.

in *Higday* applied the reasonable use doctrine to groundwater and found that a riparian cannot own percolating groundwater or prevent other riparians from using groundwater.⁶¹ The riparian and reasonable use doctrines are applied strongly in Missouri to both surface and groundwater.

However, anyone using more than 70 gallons per minute or 100,000 gallons per day must register their water use with the Division of Geology and Land Survey of the Department of Natural Resources.⁶² These diverters are known as “major water users,” and the registration applies to withdrawals or diversions from “from any stream, river, lake, well, spring or other water source.”⁶³ In addition, the state’s Department of Natural Resources Water Resources Center “operates and maintains a groundwater level observation well network for monitoring Missouri’s aquifers” that “provides knowledge of available water quantity, aquifer response to water use, groundwater recharge and aquifer characteristics.”⁶⁴

The largest consumptive uses of water in the state are thermal electric generation, municipal, industrial, and agricultural.⁶⁵ Since the MRVA is very localized to be a small area in Missouri, overall it is not considered to be a major water source. However, the aquifer is a significant resource in locations where the aquifer’s water is available.⁶⁶ The MRVA is used primarily for agriculture and public water supply in the state.⁶⁷

IV. Management Programs Addressing Scarcity

Throughout the country, water resources are showing the stress of overuse. Perhaps this can best be shown by the current number of interstate disputes before the Supreme Court of the United States. For instance, in addition to the *Mississippi v. Tennessee* case, Florida is suing Georgia, claiming that the use of water in the Atlanta metro-area is affecting the amount of water flowing into the state of Florida, negatively affecting the state’s natural resources.⁶⁸ Thus, states are becoming increasingly active in adopting management programs to address water supply issues within their borders.

For instance, the Sustainable Groundwater Management Act (SGMA) was signed into California law in 2014 with the goal of providing a framework for groundwater management in the state. The Act requires high and medium priority basins to cease over drafting groundwater

⁶¹ *Higday v. Nickolaus*, 469 S.W.2d 859 (Mo. Ct. App. 1971).

⁶² MO. ANN. STAT. § 256.410.

⁶³ *Id.* at § 256.400.

⁶⁴ *Water Resources Center*, MO. DEP’T OF NATURAL RES., <https://dnr.mo.gov/geology/wrc/> (last visited Sept. 28, 2018).

⁶⁵ MO. DEP’T OF NATURAL RES., *supra* note 59, at 131.

⁶⁶ *Mississippi and Missouri River Alluvial Aquifer*, MO. DEP’T OF NATURAL RES., <https://dnr.mo.gov/geology/wrc/groundwater/education/provinces/riveralluviumprovince.htm> (last visited Sept. 27, 2018).

⁶⁷ *Missouri Groundwater Provinces and Aquifer Characteristics*, Univ. of Mo. Extension, <http://agebb.missouri.edu/drought/water/MissouriGroundwaterProvincesandAquiferCharacteristics.pdf> (last visited Sept. 27, 2018).

⁶⁸ *Florida v. Georgia*, 138 S. Ct. 2502 (2018).

basins and bring these basins to sustainable levels within 20 years or by a set date.⁶⁹ This is the first regulation in California aimed at conserving and sustaining groundwater sources.

The Edwards Aquifer in Texas “is one of the most abundant artesian aquifers in the world,” supplying “water to over two million people and thousands of farmers” in the San Antonio region of Texas.⁷⁰ However, this reliance by the people of South Central Texas has also led to the aquifer’s overuse, prompting the creation of the Edwards Aquifer Authority to better manage the aquifer’s resources and protect endangered and threatened species in the area. As discussed above, the rule of capture does not apply to withdrawals from the Edwards Aquifer in Texas. Rather, water users must first obtain a permit from the Edwards Aquifer Authority.⁷¹

A couple of the states in the South have also created groundwater management programs. Legislation enacted in 1957 created a dam permit system through the Arkansas Soil and Water Conservation Commission (ASWCC) and gave the Commission the authority to allocate water during periods of shortage.⁷² Even though the ASWCC has the authority to allocate water, as of 2011 no situation or request had occurred in which they allocated water.⁷³ In the event that water needs to be allocated, the Commission would allocate “subject to the following order of preference: (1) sustaining life, (2) maintaining health, and (3) increasing wealth.”⁷⁴ Water required for domestic use, federal water rights, and for minimum streamflow is supposed to be reserved when water is to be allocated.⁷⁵ After those three reserved uses, riparian uses for agriculture, industry, hydropower, and recreation take preference over other uses.⁷⁶

This allocation is primarily for surface water, but the Arkansas Natural Resource Commission also monitors and regulates groundwater through the Arkansas Groundwater Protection and Management Act. Through this act, the Commission designates critical groundwater areas and then is able to regulate specifically those designated areas. The Commission has designated at least three critical ground water areas in Arkansas, all of which are composed in part by the Sparta aquifer or the MRVA. Once an area is designated as a critical ground water area, the Commission must then determine whether regulation is necessary.⁷⁷ If regulation is necessary, then the ANRC can require users to obtain water rights in order to withdraw groundwater from the designated area.⁷⁸ These regulations on groundwater are based on the nearly identical criteria used for allocating surface water and reference the same priorities of use for sustaining life, maintaining health, and increasing wealth.

⁶⁹ *SGMA Groundwater Management*, CAL. DEP’T OF WATER RES., <https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management> (last visited Sept. 27, 2018).

⁷⁰ *History*, EDWARDS AQUIFER AUTH., <https://www.edwardsaquifer.org/eea/history> (last visited Sept. 28, 2018).

⁷¹ See *Edwards Aquifer Authority v. Day*, 369 S.W.3d 814 (Tex. 2012). The permit system has opened up the Edwards Aquifer Authority to takings claims, however.

⁷² ARK. CODE ANN. § 15-22-201.

⁷³ ARK. NATURAL RES. COMM’N, *supra* note 32, at 12.

⁷⁴ ARK. CODE ANN. § 15-22-217.

⁷⁵ *Id.*

⁷⁶ *Id.*

⁷⁷ *Id.* at § 15-22-909; ARK. ADMIN. CODE § 138.00.6-403.2.

⁷⁸ *Id.* § 15-22-909; ARK. ADMIN. CODE § 138.00.6-404.2

In Louisiana, a lot of the state's water comes from surface water. However, there is a growing concern for the amount of pollution that accumulates in surface water sources since Louisiana is essentially the end of the line for American waterways such as the Mississippi River.⁷⁹ Also, research from the Ground-Water Resources of the Greater New Orleans Area found that saltwater encroachment from the Gulf of Mexico is an additional threat to the Mississippi River and Louisiana's water resources. Even though Louisiana is considered a water rich state, the water in the state is not evenly distributed. Louisiana is experiencing considerable groundwater issues, especially in the Baton Rouge area. Groundwater in the state is not only at risk from the amount used in the state, but also from withdrawals in Arkansas, Texas, and Mississippi.

To combat the threats to groundwater in the Baton Rouge area, the Louisiana legislature created the Capital Area Ground Water Control Commission to regulate groundwater use in what is referred to as the "District."⁸⁰ The District is generally Baton Rouge and the surrounding area. The Commission requires registration of wells in the District with some exceptions for which wells need to be registered and which do not.⁸¹ The legislature also established a Ground Water Management Commission intended to regulate large wells throughout the state, as well as any new wells in what the Commission deems to be an area of groundwater concern.⁸² The Commission must go through a detailed process in order to designate an area as an area of groundwater concern.⁸³ These two commissions are recent progress within the state to monitor and regulate groundwater use.

V. Additional Factors Regarding the Use of Water

Water law is not the only factor influencing the use of the MRVA and Sparta Aquifers. Other policies and activities affect water use in the region. Those factors may include the role of water management districts, the use of drainage tiles, and other projects concerning aquifer storage and recovery. Each of these is discussed below.

a. Role of Water Management Districts

Water management districts could play a significant role in how water is used in an area. Water management has been defined as "the activity of planning, developing, distributing and managing the optimum use of water resources. In an ideal world, water management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all uses and demands."⁸⁴ The role of water management districts in Mississippi, Arkansas, Louisiana, Tennessee, and Missouri is discussed below.

⁷⁹ James M. Klebba, *Water Rights and Water Policy in Louisiana: Laissez Faire Riparianism, Market Based Approaches, or a New Managerialism?*, 53 LA. L. REV. 1779 (1993).

⁸⁰ LA. ADMIN CODE. tit. 56, § 125.

⁸¹ *Id.* at §§ 101, 105.

⁸² LA. REV. STAT. ANN. § 38:3097.6.

⁸³ *Id.*

⁸⁴ *Water Management*, MISS. WATER RES. ASS'N, <http://www.mswater.org/members/water-management/> (last visited Sept. 27, 2018).

i. Mississippi

Mississippi has five active water management districts. Each district has a particular mission, but their overall goal is to optimize the use of water while minimizing environmental impacts. The Pat Harrison Waterway District manages the rivers and their tributaries along the Pascagoula River Basin and focuses on flood control, water management, and recreation. The Pearl River Valley Water Supply District focuses on recreational uses. The Tombigbee River Valley Water Management District assists in federal water projects, flood control, and development of water-related resources. The Town Creek Master Water Management District manages Lee, Pontotoc, Prentiss, and Union counties. The Yazoo Mississippi Delta Joint Water Management District generally manages the Delta and was created to “provide local, non-regulatory solutions to the Delta’s growing water resource challenges.”⁸⁵ Mississippi statute dictates that these districts:

may be created for the purpose of establishing a water supply system, conserving water resources, developing additional water resources or any other water or wastewater management function not being performed by an existing water management district.⁸⁶

In addition to its water management districts, Mississippi has 82 soil and water conservation districts.⁸⁷

ii. Arkansas

There are approximately 75 soil and water conservation districts in Arkansas.⁸⁸ Soil and water conservation districts in Arkansas are considered political subdivisions of the state. Local resident landowners can vote to form a district for the purpose of managing soil and water resources at the local level.⁸⁹ Arkansas also has Irrigation, Drainage, and Watershed Improvement Districts that are meant to construct, operate, or maintain water management infrastructure like reservoirs and levees.⁹⁰ Landowners in Arkansas can also petition to form these districts for the purpose of coordinating irrigation, drainage improvement, and flood control in the area. Among other powers, these districts can acquire water rights to carry out the district’s purpose.⁹¹ Finally, Arkansas has also created Regional Water Distribution Districts.⁹² About 30 of these districts have been formed, and the districts have broad authority, including being used to supply water for agricultural purposes.⁹³

⁸⁵ YAZOO MISS. DELTA JOINT WATER MGMT. DIST., WATER MANAGEMENT PLAN (2006), <http://www.ymd.org/pdfs/Water%20Mgmt%20Plan%20to%20DEQ%20Jan06.pdf> (last visited Sept. 27, 2018).

⁸⁶ MISS. CODE ANN. § 51-8-3.

⁸⁷ District Assistance, Miss. Soil & Water Conservation Comm’n, <http://www.mswcc.ms.gov/Pages/District%20Assistance.aspx> (last visited Sept. 28, 2018).

⁸⁸ *Welcome to AACD!*, ARK. ASSOC. OF CONSERVATION DISTRICTS, <https://aracd.org/default.htm> (last visited Sept. 28, 2018).

⁸⁹ *Id.*

⁹⁰ ARK. CODE ANN. § 14-117-201.

⁹¹ *Id.* at § 14-117-304(a).

⁹² *Id.* at § 14-116-102.

⁹³ ARK. NATURAL RES. COMM’N, *supra* note 32, at 27.

iii. Louisiana

The Public Works and Water Resources Division of Louisiana provides assistance to eight non-coastal levee districts to help manage their levees, as well as statewide reservoir management.⁹⁴ In addition, the division has been directed to create a “reservoir development priority program” to be included in the state’s water plan.⁹⁵ Louisiana also has 44 soil and water conservation districts. Like other states, these districts are formed by local landowners and operate as a unit of local government.⁹⁶

iv. Tennessee

The Tennessee Department of Environment and Conservation’s Division of Water Resources has a watershed management approach that does not necessarily manage watersheds, rather it is a “decision-making process that reflects a strategy for information collection and analysis” to synchronize planning and monitoring of watersheds in the state.⁹⁷ Tennessee also has 95 soil and water conservation districts, which are split into the regions of East, Middle, and West Tennessee.⁹⁸

v. Missouri

Missouri has 114 soil and water conservation districts that were organized pursuant to state law in order to implement the state’s soil and water conservation programs. The districts work on the local level to provide landowners with information and technical support “to voluntarily implement soil and water conservation practices that decrease soil erosion and protect water resources.”⁹⁹

b. Drainage Tiles

In Missouri, drainage tiles are used to improve agricultural irrigation and drainage, especially during wet periods.¹⁰⁰ Increased technology has made this drainage system more affordable and more accurate. This method of drainage and irrigation is popular in Missouri,

⁹⁴ *Introduction- Public Works and Water Resources Division*, LA. DEP’T OF TRANSP. AND DEV., http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Public_Works/Pages/default.aspx (last visited Sept. 28, 2018).

⁹⁵ *Id.*

⁹⁶ *Soil and Water Conservation Districts*, LA. DEP’T OF AGRIC. AND FORESTRY, <http://www.ldaf.state.la.us/conservation/soil-water-conservation-districts/> (last visited Sept. 28, 2018).

⁹⁷ *Watershed Management Approach*, TENN. DEP’T OF ENV’T AND CONSERVATION, <https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/watershed-management-approach.html> (last visited Sept. 28, 2018).

⁹⁸ *Home Page*, TENN. ASSOC. OF CONSERVATION DISTRICTS, <http://tnacd.org/index.php> (last visited Sept. 28, 2018).

⁹⁹ *Soil and Water Conservation Districts*, MO. SOIL AND WATER CONSERVATION DIST., <https://mosoilandwater.land/> (last visited Sept. 28, 2018).

¹⁰⁰ David Bennett, *Field drainage/sub-irrigation systems in Missouri*, DELTA FARM PRESS, Oct. 27, 2006, <https://www.deltafarmpress.com/livestock/field-drainagesub-irrigation-systems-missouri> (last visited Sept. 28, 2018).

especially the Bootheel area.¹⁰¹ Due to the amount of time required for engineers to design each system, drainage tiles are being used and will be used primarily for problem fields that do not benefit from traditional irrigation and drainage methods.

c. Aquifer Storage and Recovery

The EPA has federal regulations governing aquifer storage and recovery that supersede any and all state regulations. Artificial recharge and aquifer storage and recovery wells are regulated by both the EPA and the states and must submit basic well information to one or both of these entities. The main federal regulation is that any artificial recharge or aquifer storage and recovery well does not endanger underground sources of drinking water. Some states require permits that are aimed at ensuring these groundwater sources are protected. The EPA states that there are about nine states that have stringent requirements on the quality of water used for injection into these types of wells. 40 CFR 14.12L is the federal regulation that clearly states that “the movement of fluid containing any contaminant into underground sources of drinking water” is prohibited.¹⁰²

The Underground Injection Control (UIC) program was created under Part C of the Safe Drinking Water Act.¹⁰³ Each state must meet federal UIC requirements set forth by 40 C.F.R. 144.¹⁰⁴ UIC programs regulate the injection of fluids underground for storage or disposal.¹⁰⁵ The State of Oregon’s UIC program is codified by Oregon Administrative Rules Chapter 340, Division 44.¹⁰⁶ The Oregon’s Department of Environmental Quality (DEQ) regulates UIC systems in order to prevent and protect groundwater from being contaminated. In order for the Oregon DEQ to regulate this program, they issue permits to UIC operators, enforces the systems, and revises the applicable rules when necessary.¹⁰⁷ The Oregon DEQ has specific rules regarding who is expressly authorized to operate a UIC system and for who must obtain a permit to do so.¹⁰⁸ Storm water and wastewater can easily get into the groundwater and pollute a state’s drinking water source, so regulation of UIC programs is necessary and crucial.¹⁰⁹

VI. Conclusion

The MRVA and Sparta Aquifers are vital water resources in the region. A review of the state laws and water management in Mississippi, Arkansas, Louisiana, Tennessee, and Missouri lead to the following conclusions:

¹⁰¹ *Id.*

¹⁰² *Underground Injection Control (UIC)*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/uic/aquifer-recharge-and-aquifer-storage-and-recovery#well_regs (last visited Sept. 28, 2018).

¹⁰³ *Overview- Water Quality Permits*, OREGON.GOV, <https://www.oregon.gov/deq/wq/wqpermits/Pages/UIC-Overview.aspx> (last visited Sept. 28, 2018).

¹⁰⁴ 40 C.F.R. § 144.1.

¹⁰⁵ *Underground Injection Control*, OREGON.GOV, <https://www.oregon.gov/deq/wq/wqpermits/Pages/UIC.aspx> (last visited Sept. 28, 2018).

¹⁰⁶ *Overview- Water Quality Permits*, *supra* note 103.

¹⁰⁷ *Id.*

¹⁰⁸ OR. ADMIN. R. 340-044-0018.

¹⁰⁹ STATE OF OR., DEP’T OF ENVTL. QUALITY, FACT SHEET- USE OF INJECTION CONTROL SYSTEMS AND GROUNDWATER PROTECTION (2017), <https://www.oregon.gov/deq/FilterDocs/uicsandgwprot.pdf> (last visited Sept. 28, 2018).

- Mississippi, Arkansas, and Tennessee operate under a regulated riparianism system. Permits are required for both surface and groundwater withdrawals.
- Both Louisiana and Missouri still see themselves as “water rich.” However, Louisiana’s resources are not evenly distributed throughout the state, and the state has taken many more regulatory steps to manage its water resources.
- Arkansas and Louisiana have developed some special groundwater management programs.
- Missouri uses drainage tiles, which could be concerning considering the lack of water law in the state.
- Mississippi has decided to use litigation against Tennessee rather than cooperatively manage the Sparta aquifer’s water resources.