



TACIR

The Tennessee Advisory Commission
on Intergovernmental Relations



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MEMORANDUM

TO: TACIR Commission Members

FROM: Harry A. Green
Executive Director

DATE: September 9, 2010

SUBJECT: Regional Water Supply Planning

When the 2007 drought hit the state and many communities' water systems were stressed as their sources of supply were almost exhausted, the idea of a regional approach to planning for future supplies arose. Due to the very real fears that some water systems would run out of water (one small community did), many utility systems worked together in meeting the needs of the regions in which they were located. By the use of interconnections between systems the overall effects of the drought were somewhat mitigated, and some shortages were avoided. The importance of this type cooperation across a region cannot be over emphasized.

Regional water supply planning that takes into account all of the sources of water supply and the means to deliver drinking water to the consumers simply makes good sense. The Tennessee Department of Environment and Conservation (TDEC) convened the Water Resources Technical Advisory Committee in 2008 to address the issue of future water supplies. The concept of developing a pilot project for regional planning was developed, and two pilot areas were selected, both of which had severe problems in meeting the consumers' needs in 2007 and 2008. A multi-disciplinary team was established to develop the plans, and work began in 2008.

The TACIR participation in the pilot water supply plans began in 2008 as a result of being appointed as a member of the Water Resources Technical Advisory Committee and a request from Paul Sloan, Deputy Commissioner of TDEC, for

TACIR to assist in writing and assembling the final reports. The TACIR role on the committee and in the preparation of the plans has already been presented to the Commission.

In addition to participation on the planning team TACIR executed a contract with the University of Tennessee to prepare a study on different approaches to water supply planning in various other states. This report, *Statewide Water Resources Planning: A Nine State Study*, is complete. The report's summary and overview are attached.

During the last Advisory Commission meeting in June, the Commission requested an update on the pilot reports to be presented at the September meeting of the Commission. The project team is now nearing completion of the plans. Several chapters have been written, and these include

- the description of the regions,
- analysis of water usage and sources of supply,
- projections of future demand,
- the financial capacity of water systems to meet future demands,
- potential sources of future supplies to meet demands.

The plans will also discuss advantages and disadvantages of the different alternatives and a cost estimate.

In order to brief commissioners about the plans and the planning process some members of the project team will be making reports to the Advisory Commission. These presenters include

- Paul Sloan, Deputy Commissioner, TDEC

As Deputy Commissioner at the Tennessee Department of Environment and Conservation (TDEC) Paul Sloan heads the department's Bureau of Environment and leads the senior management team responsible for safeguarding human health and protecting the quality of Tennessee's land, air and water.

Paul holds a law degree from Vanderbilt University and came to TDEC following a career that includes success in education, law, business and conservation. He was a founding board member of Cumberland Region Tomorrow, a former trustee of The Nature Conservancy and board member of the Cumberland River Compact.

- Ben Rohrbach, Chief, Hydrology and Hydraulics, U. S. Army Corps of Engineers

Ben Rohrbach began his career with the U.S. Army Corps of Engineers as a co-op student in the Nashville District in 1995. He holds a Bachelor's

Degree in Engineering from TN Technological University in 1997. Mr. Rohrbach is a registered professional engineer in the State of TN, and has 15 years of experience working as a hydraulic engineer on flood risk management, ecosystem restoration, navigation lock replacement, and water supply projects across the Cumberland and Tennessee River Basins. He currently serves as the Chief of the Hydrology and Hydraulics Branch in the Nashville District.

- Bob Freudenthal, Executive Director, Tennessee Association of Utility Districts

Bob Freudenthal has been serving as the Executive Director of the Tennessee Association of Utility Districts since June, 2008. TAUD is concerned with the promotion and advancement of utility operation in the State of Tennessee including water, sewer, sewage disposal, and natural gas. Primary achievement of this mission is through education, advocacy, operations, and financial assistance.

Bob began his public service career as a Building Inspector for the City of Hendersonville, eventually becoming the Public Works Director in 1988. In 2001 he became the Director of Public Works for the City of Paducah, Kentucky, serving three years before accepting the position of Deputy General Manager for the Hendersonville Utility District in 2004.

Bob has been an active member of many professional associations including the American Public Works Association serving as Region III Director on the APWA Board of Directors and as APWA President for 2005-2006. Bob has a BS in Business Management from Mid-Continent University.

- Doug Murphy, Executive Director, Tennessee Duck River Development Association

Doug Murphy's biographical information includes 27 years with TVA in Natural Resource Management in the following programs: Air Quality Research and Management, Vector Control, Aquatic Plant Management, Water and Land Management, and Watershed Management. Since August 2006 Doug has been the Executive Director of the TN Duck River Agency. Doug has a B.S. Degree in Biology from the University of North Alabama.

- Lynnisse Roehrich-Patrick, Associate Executive Director, TACIR

Statewide Water Resources Planning: A Nine-State Study

April 2010

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Prepared under contract with the
Tennessee Advisory Commission on Intergovernmental Relations

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Summary

This report provides an analysis of statewide water resources planning in Tennessee and eight other states. The term “water resources” can and should encompass both water quality and water supply concerns. In this report, water supply planning – a much more recent concern in southeastern states such as Tennessee – is emphasized. But water quality and water supply are tightly coupled. Ultimately, their planning must be closely coordinated.

Tennessee has a long and strong history of water quality planning. It only recently has embarked on water supply planning. Two pilot water-planning studies are underway; one in the north central region and the other in the southern Cumberland Plateau region. Both regions were selected largely because of their drought vulnerability, and in both, the study areas have been based largely on utility districts. If the two pilot studies are an indication, it appears that Tennessee’s interpretation of water supply planning is water *system* planning – in other words, a focus on system supply, infrastructure, and interconnections – with planning regions drawn accordingly.

The eight other states discussed in this report include Florida, Georgia, North Carolina, Pennsylvania, South Carolina, Virginia, and West Virginia. These states were selected for analysis because they provide a variety of approaches to statewide water supply planning. Some, for example, focus their efforts on planning by state agencies, while others focus on planning by regional or local agencies. Virtually all, however, use watersheds (*the natural hydrological system*), not utility districts (*the water delivery system*), as the basis for their water supply planning. This enables them to link water supply planning with water quality planning into integrated water resources planning. Other common features of the other states studied include planning for both the short term and the long term, planning for both surface water and groundwater, and addressing water allocation strategies only after statewide water resources planning is underway.

Tennessee needs to tailor its own approach, but much can be learned from other states that are further along in the process of integrated water resources planning:

- First, if Tennessee is to plan for the long-term adequacy of its water resources, it should link water supply planning with water quality planning. To do so, it should reconsider its emphasis on delivery systems as the basis for water supply planning. With its 55 watershed management units for water quality planning, Tennessee is well positioned to pursue an integrated approach to water resources planning.
- Second, while Tennessee appears to have embraced long-term as well as short-term water supply planning, it may be advisable to link surface water planning with groundwater planning, especially in critical hydrological areas.

- Third, while Tennessee may decide not to embark on extensive integrated water resources planning simultaneously throughout the state, a preliminary statewide survey of water supply and demand is needed to decide which areas should be addressed first.
- Finally, while ways to allocate water efficiently can be explored, their implementation should be done within the context of a good understanding of present and future water supply and demand.

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Overview

I. Genesis and Focus of this Report

The study at hand has been conducted under contract with the Tennessee Advisory Commission on Intergovernmental Relations (TACIR). TACIR has a mandate to assess and facilitate intergovernmental coordination within Tennessee. One important issue facing the state as a whole, as well as state agencies, municipal and county governments, and public and private utilities, is the need for adequate water supply. This study examines efforts that other states and their internal water management networks are taking to develop water supply and allocation plans and processes. In the report, we often use the term “water resources planning.” Water resources planning can and should encompass both water quality and water quantity concerns. Here, however, water supply planning is emphasized.

The study focuses on case studies of water supply planning in nine states. The nine states include Tennessee and eight other states: Florida, Georgia, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, and West Virginia. These eight states were selected for the following reasons:

1. We sought a range of examples along the following dimensions:
 - recent v. long-standing water supply planning
 - state v. regional v. local locus for planning
 - reliance on groundwater v. surface water
 - rural v. urban
2. Given Tennessee’s riparian tradition, we mainly considered states east of the Mississippi River. Texas was added in part because of its experience with groundwater.
3. We emphasized states in the Southeast, because this may be useful to Tennessee for future inter-state water supply planning.

In conducting the case studies, we focused on the structure of water resources planning (in particular, water supply planning) in each of the states considered. We did not, however, attempt a systematic catalogue comparing the features of various states’ water supply planning (e.g., the statutes enacted and regulations adopted, the policies expressed in statutes, the responsible agencies, and so forth). This has been done by others (e.g.,

Christy, Myszewski, and Kundell 2005; Myszewski, Christy, and Kundell 2005; Moreau and Hatch 2008). Instead, in each case we delved most deeply into the features, including innovative approaches, that may be informative for Tennessee.

II. Why Is Statewide Water Resources Planning Needed?

With the pressures of economic and population growth, water shortages can occur even in states that traditionally have had abundant water supplies. Now, with the prospect of protracted droughts, especially given global climate change, states in the Southeast and elsewhere are embarking on state-wide long-term planning for their water resources. All of the states adjacent to Tennessee except Alabama are at least nominally pursuing statewide water resources planning (Viessman and Feather 2005; Moreau and Hatch 2008).

Tennessee, like other states in the Southeast, is experiencing water shortages from the pressures of growth as well as droughts. For Tennessee, as with other states, a complicating factor is land use – in particular, rural water needs and rural sprawl. While rural sprawl occurs for many reasons, it is enabled in part by the advent of in-situ package treatment plants for wastewater, replacing the need for individual septic systems (Curtis 2008). . In-situ package treatment plants enable pockets of residential density in areas that are sparsely populated, leading to scattered development that does not necessarily have ready access to public services (schools; police and fire protection; paved, well-graded roads; etc.) or adequate water supplies. Because these areas typically have limited land use controls and planning resources, these scattered developments often are able to proceed with little oversight.

According to the *Tennessee Rural Needs Report* (Tennessee Department of Environment and Conservation 2005), approximately 6 percent of the state’s population relies on private wells and springs. Many of these people are in sparsely populated areas. Some are content with their water supplies; others have quantity or quality problems. Yet their needs may not be addressed by water utilities, even as water lines penetrate rural areas to serve new developments. As Daniel Carter has noted, “[for many] rural residents in counties supplied by a myriad of small municipal water districts, the only chance in many cases to receive a public water supply is if they happen to live on the way to a new development” (Carter 2008, p. 49).

Tennessee’s 1998 Growth Policy Act (commonly called “Public Chapter 1101”) was intended partly to promote compact, contiguous development and to address the coordination of development with the provision of public services. Nevertheless, disconnects continue to occur between coherent land use planning, local development patterns, and the extension of utility services. Apart from the phenomenon of rural

sprawl, there are other reasons to undertake water resources planning that addresses water supply as well as water quality. Three are listed below.

1. **Areas with high population growth.** According to a study conducted for the Tennessee Advisory Commission on Intergovernmental Relations (Middleton and Murray 2009), the state's population is predicted to increase from 6.2 million people in 2010 to 7.3 million in 2030. The population of the eight-county region including and surrounding metropolitan Nashville is expected to increase the most dramatically. The collective population of those eight counties (Davidson County, surrounded by Williamson, Rutherford, Wilson, Sumner, Robertson, Cheatham, and Dickson counties) is predicted to grow from an estimated 1,485,820 in 2010 to an estimated 2,074,206 in 2030 – an increase of nearly 590,000. This increase accounts for half of that expected for the state as a whole between 2010 and 2030.
2. **Areas of ecological importance that have limited water availability.** Areas in the state with limited water availability such as the Cumberland Plateau and the Duck River Basin may be severely affected by droughts, from the standpoint of the water needs of both humans and aquatic species. The Duck River, with its headwaters in Coffee County, is one of thirteen rivers that have received a State Scenic River designation from the Tennessee Department of Environment and Conservation. It contains highly diverse populations of mussels and fish and is facing both commercial and residential growth pressures. The Collins River in the southern Cumberland Plateau area also has been designated a State Scenic River; it is vulnerable to protracted drought. The Obed river system on the Cumberland Plateau is the only river in Tennessee that has been designated a National Wild and Scenic River. The plateau is a popular retirement and vacation destination, and continued growth is expected.
3. **Prospective competition among essential uses.** As of 2005, Tennessee was among the top eight states in the United States in the quantity of water withdrawn for thermoelectric power generation (Kenny et al. 2009). Approximately four-fifths of Tennessee's water withdrawals are used to generate electricity; the remainder is used mainly by industry and mining and for public water supplies. In general, Tennessee has adequate water available for these uses at present, but population growth combined with protracted drought could strain the state's ability to satisfy these needs while meeting in-stream needs and maintaining good water quality.

These are just three examples of the water supply issues that Tennessee is facing or may encounter in the coming years. Long-term comprehensive statewide planning for both water quantity and water quality will be needed to address not only these issues but also others as yet unforeseen.

III. Statewide Water Resources Planning:

Widely Shared Features

All of the states studied except Tennessee have conducted or embarked on statewide water resources planning. Statewide planning for water resources has been done in Florida and Texas for several decades. In the other states, it is a recent phenomenon.

The planning efforts were triggered by persistent drought or concerns about water shortages in light of growing populations and economies. Other shared characteristics of the states' water resources planning include the following:

1. Planning for both the short term and the long term

The planning horizons used by the states studied vary, but typically they include long-term as well as shorter-term planning – e.g., 20- or 30-year horizons as well as 5- or 10-year horizons. In Georgia, for example, each regional planning council will develop 10, 20, 30, and 40-year forecasts of water supply demands and assimilative capacity demands using estimates of future population and employment as well as land-use surface types and distribution. In several of the states studied, data for forecasts are generated by or in consultation with state agencies.

2. Planning based on hydrologic units

Although the scale of planning units used by the states varies, virtually all are based on watersheds. The most common unit for planning is the eight-digit level of the Hydrologic Unit Code established by the U.S. Geological Survey. Called HUC 8 for short, there are 2,264 of these units in the United States; they are sub-areas of the 21 two-digit regions in the United States (<http://water.usgs.gov/GIS/huc.html>).

Tennessee has all or parts of 55 HUC 8 units (<http://www.tennessee.gov/environment/watersheds/>).

3. Planning for both surface water and groundwater

Virtually all of the states studied include plans for water supply from groundwater as well as surface water. Although groundwater supplies can be much more difficult to quantify, they are recognized in the planning processes even of states such as West Virginia, which relies on surface water for virtually all of its large-quantity water withdrawals.

4. Developing water allocation strategies only after statewide water resources planning is underway

Water allocation is a feature of water resources planning in the arid and semi-arid states of the West and in some northeastern states (e.g., New Jersey, Pennsylvania, Rhode Island), but the term “water allocation” appears to be largely avoided in the Southeast. Florida is an exception: Florida’s five regional water management districts (WMDs) have the power to control water allocation through water use permits, and a 2005 state act linked growth to water supplies, requiring that communities plan their growth around WMD determinations of water availability. Most of the southeastern states studied, however, have moved very cautiously (if at all) toward water allocation strategies, and then only after extensive water resources planning.

Apart from these four commonalities, the basic features of the states’ comprehensive water resources planning have differed significantly, as briefly discussed below.

IV. Statewide Water Resources Planning:

Other Basic Features

Each state that has undertaken statewide water resources planning has had to decide – tacitly or explicitly – what roles will be played by whom, and how they will be sequenced. Below, four key features are discussed. These include the roles of

- state legislation,
- the local, regional, and state levels,
- participation, and
- data gathering.

The Role of State Legislation

In most of the states studied, state legislation mandated planning. In some cases (e.g., West Virginia), the initial impetus came from one or more state legislators; in other instances (e.g., Pennsylvania), the impetus came from the state agency responsible for water resources. In a number of states, legislation was preceded by studies, data gathering, and participation by experts and interested parties to sketch out the approach to be used.

Roles at the Local, Regional, and State Levels

The states studied vary in where the central responsibility for water resources planning is located. At one extreme, West Virginia has to date taken a strong state lead with only nominal involvement at the regional or local level. At the other extreme, North Carolina's state plan is largely a compilation of local plans. In conducting statewide planning, several of the states studied – in particular, Florida, Georgia, Pennsylvania, and Texas – emphasize the importance of regional water resources planning with significant involvement by regional councils.

The Role of Participation

In developing their statewide water resources planning efforts, many of the states studied have used state or regional committees representing various interests, together with committees of technical experts. However, two states stand out for their use of systematic, inclusive participatory methods. In Pennsylvania, the Department of Environmental Protection conducted 16 public meetings across the state to solicit public opinion on water resources management. The results convinced the legislature to take action. In Virginia, a stalemate among various competing interests was resolved by using a facilitated consensus-building process involving more than 30 representatives of different interests. The result was a recommended set of regulations for a statewide water supply planning process that was then approved and adopted by the State Water Control Board.

The Role of Data Gathering

Several of the states – e.g., North Carolina, Pennsylvania, and West Virginia – have undertaken intensive data-gathering efforts before launching their planning efforts, in part to help guide those efforts. Who has gathered the data differs. North Carolina's data gathering has been done mainly by local governments; Pennsylvania's has been done mainly by regional committees in conjunction with the state Department of Environmental Protection; West Virginia's has been done mainly by the state Department of Environmental Protection.

Other states – e.g., Georgia, South Carolina, and Virginia – have begun gathering their data as part of their planning efforts. In effect, the framework for the plan is established first; then data gathering commences.

A few of the states studied (e.g., Florida, Georgia, Pennsylvania, West Virginia) make a point of distinguishing consumptive and non-consumptive uses in gathering their data. This distinction is important: it estimates the net amount returned to the water system. In Georgia's 2008 plan (p. 10), consumptive use is defined as:

the difference between the total amount of water withdrawn from a defined hydrologic system of surface water or groundwater and the total amount of

withdrawn water that is returned to that same hydrologic system over a specified period of time.

For example, a transfer of water out of a basin is considered to be a 100 percent consumptive use, whereas a domestic or commercial use of water is thought to be about 20 percent consumptive (Draper 2002). In contrast, in stream uses such as hydroelectric power generation are considered to be non-consumptive.

V. Statewide Water Resources Planning: Additional New Features

In addition to making decisions about the basic features of statewide water resources planning, several of the states studied have embraced one or more relatively new, forward-thinking features. As discussed below, these include

- critical areas planning,
- conjunctive management,
- tightly coupling water quantity and water quality, and
- planning for conservation and efficiency.

Critical Areas Planning

In several of the states studied, identifying critical areas has been a key component of planning – especially in recently initiated planning efforts (e.g., North Carolina, South Carolina, Virginia, Pennsylvania, and West Virginia). North Carolina and South Carolina have adopted the approach of identifying “capacity use areas” where water sources are threatened; similarly, Virginia has identified “ground water management areas.” Pennsylvania and West Virginia have included as part of their formal planning processes identifying and preparing plans for “critical planning areas.” In Pennsylvania, the areas are nominated through a regional planning process; in West Virginia, through a state-led process. In addition to identifying critical planning areas, West Virginia – after gathering extensive data statewide – has prioritized its state-led planning efforts according to which watersheds are likely to experience the fastest increases in water demand.

Conjunctive Management

Conjunctive management – i.e., the integrated management of rivers, reservoirs, and confined and unconfined aquifers – is becoming a feature of water resources planning in

some of the states studied (e.g., Georgia, North Carolina, and South Carolina), especially for areas that rely on both groundwater and surface water. Conjunctive management includes but goes beyond conjunctive use: it entails monitoring and often complex modeling. Although conjunctive management can be analytically demanding because of numerous variables, large uncertainties, nonlinearities, and multiple objectives (Abu Rumman 2005), it can be used to both recharge aquifers and substitute groundwater for surface water (Dudley and Fulton 2005).

Linking Water Quantity and Water Quality

With federal legislation in the 1970s – the 1972 Clean Water Act and the 1974 Safe Drinking Water Act – the national interest in water quality was clearly articulated, and state governments as well as the federal government assumed responsibility for setting water quality standards, monitoring, and enforcement. (At the federal level, the U.S. Environmental Protection Agency takes the lead in water quality regulation.) In contrast, water quantity issues have remained largely a matter left up to the individual states. The link between water quality and quantity has been recognized, however (e.g., through minimum flow standards), and that link is now becoming central to some states' water resources planning. Georgia's 2008 plan, for example, comments (p. 9) that “[w]ater quality and quantity and surface and groundwater are interrelated and require planning as well as reasonable and efficient use.”

Planning for Conservation and Efficiency

In states such as Texas and Florida that have considerable experience with water shortage, planning for conservation and efficiency has become an essential part of statewide water resources planning. In other states such as North Carolina and South Carolina, calls for conservation and efficiency are being incorporated into statewide planning. In Georgia, a state Water Conservation Implementation Plan was mandated by executive order.

Conservation and efficiency planning includes but goes beyond enumerating best practices for various user sectors and helping to establish leak detection programs. To meet expected future water demand in Texas, for example, regional water supply plans rely heavily on reduction in demand through planned conservation and efficiency measures with specific targets.

VI. Cousins of Statewide Water Resources Planning

Two state programs that have become increasingly popular – registering large water withdrawals and regulating inter-basin water transfers – are worthwhile in themselves;

they also can help support statewide water resources planning and water allocation strategies.

Registering (and Permitting) Large Water Withdrawals

Several of the states studied, Tennessee included, have programs for registering large water withdrawals. Tennessee's program requires reporting and registering all water withdrawals of 10,000 gallons per day (gpd) or more. Pennsylvania has a similar program. West Virginia requires registration of large quantity users, defined as those withdrawing more than 750,000 gallons per month (gpm). North Carolina requires registration of water withdrawals of 100,000 gpd or more; similarly, South Carolina requires registration of water withdrawals exceeding 3 million gpm.

A few of the states studied add permitting requirements to registration requirements for large withdrawals in specific areas. In North Carolina, all groundwater withdrawals of 100,000 gpd or more within a designated "capacity use area" require permits. Similarly, South Carolina requires permits for groundwater withdrawals over 3 million gpm in designated capacity use areas. Virginia requires permits for groundwater withdrawals of 300,000 gpm or more in designated "ground water management areas."

Regulating Inter-basin Water Transfers

Several of the states studied, Tennessee included, regulate inter-basin transfers of water. Tennessee requires permits for transfers of surface water between 10 designated basins; a permit for an inter-basin transfer of groundwater is required only if it would adversely affect the flow of a Tennessee surface water. Tennessee's inter-basin permit requirement applies to "all persons or entities (1) that have been granted powers by the state to acquire water, water rights and associated property by eminent domain or condemnation; or (2) that acquire or supply water for the use or benefit of public water supply systems..." (Tennessee Code Annotated § 69-7-204(a)).

In Florida, inter-basin transfers between the state's five water management districts require the approval of all districts involved. South Carolina's 1977 Interbasin Transfer of Water Act enabled regulating the transfer of water from one river basin to another, if the transfer involves five percent of the seven-day, ten-year low flow or 1 million gpd, whichever is less. In North Carolina, large inter-basin transfers (i.e., 2 million gpd or more) are regulated.

VII. Complicating Factors

Two factors – the federal role in managing some state waters and the refusal of water to respect state boundaries – complicate statewide water resources planning. These factors are not a reason to abjure statewide planning; they simply need to be taken into account.

The Federal Role in Managing Some State Waters

A federal presence in managing some state waters can complicate a state's water resource planning. The Tennessee Valley Authority (TVA) has dominated affairs regarding the Tennessee River and its major tributaries for more than seven decades. Although TVA's presence looms largest in Tennessee, it is felt in parts of some of Tennessee's surrounding states as well.

Apart from TVA, however, all of the states studied must take into account the actions and decisions of federal agencies, especially the U.S. Army Corps of Engineers (COE). Among other things, the COE constructs and operates dams. In the Southeast, it has 33 major projects with multiple purposes such as flood control, hydroelectric power, water supply, recreation, navigation, and wildlife enhancement. Some of these projects, such as Lake Lanier reservoir on the Chattahoochee River, have become a source of interstate controversy.

Eastern and middle Tennessee are in the COE's Great Lakes and Ohio Division; western Tennessee is in its Mississippi Valley Division. According to the COE's website (<http://outreach.lrh.usace.army.mil/States/TN/Default.htm>), Tennessee contains over 600 miles of navigable waterways in the Ohio River basin. The major waterways are the Tennessee River and the Cumberland River. The Tennessee-Tombigbee Waterway linking the Tennessee River with the Gulf of Mexico is one well-known COE project.

Interstate Water Resources Issues

Interstate water resources issues also complicate an individual state's water resources planning, yet they are virtually inevitable. Water is not always contained within state boundaries; cooperation among states becomes necessary to avoid controversies. For example, of South Carolina's four major river basins, two are shared with North Carolina and one is shared with Georgia; only the Ace basin near Charleston is located entirely within the state.

In Tennessee at present, the two largest interstate water resources issues concern the use of the Memphis Aquifer and the prospect of diverting water from the Tennessee River to help supply the metro Atlanta region. In other states studied, interstate issues include, for example, tensions between Virginia and Maryland regarding the Potomac River; Virginia

and North Carolina regarding the Roanoke River; Texas and seven other states regarding the Ogalalla Aquifer; and Georgia, Alabama, and Florida regarding the Chattahoochee River and, to a lesser extent, the Etowah River.

Pennsylvania provides an example of formal, federally endorsed solutions to interstate water issues. It is a member state, with New York and Maryland, of the Susquehanna River Basin Commission and, with New York, New Jersey, and Delaware, of the Delaware River Basin Commission. In each case, the commission has responsibility for overseeing the protection and use of the basin's waters.

VIII. Water Rights Law

Water rights law is an important backdrop for water resources planning. Below are brief summaries of traditions of surface water law and groundwater law in the United States, and their interpretations in Tennessee and the other states studied.

Surface Water

In the United States, there are two distinct legal traditions regarding the allocation of surface water:

- Riparian rights, a doctrine prevalent in the humid eastern states. Grounded in English common law, this doctrine holds that landowners abutting a watercourse have use rights but not property rights to the water; instead, water is a common property.
- Appropriative rights, a doctrine prevalent in the arid western states. Grounded in nineteenth-century case law in the western states, this doctrine treats water as private property and does not make owning land abutting a watercourse a requisite.

Increasingly, the two traditions – especially the riparian rights tradition – have been modified to meet changing demands. During the last half of the twentieth century, about half of the eastern states legislatively adopted regulatory permit systems for allocating the diversion of water from some or all sources (Dellapenna 2007, 2009). Called “regulated riparianism,” this approach – which in effect shifts from treating water as common property to treating it as public property – also has been adopted more or less loosely by other eastern states. No state now adheres strictly to the traditional “natural flow” version of riparian rights; all have incorporated concepts such as “reasonable use” or “beneficial use” in their statutory or case-based law.

Groundwater

The law for allocating groundwater has evolved somewhat differently. Because of a lack of knowledge about the location or movement of groundwater, case-based law in the nineteenth century gave rise to a doctrine variously called the “absolute dominion rule,” the “absolute ownership rule,” or the “rule of capture” (Dellapenna 2003, 2009). This doctrine allows a landowner over an underground water source to withdraw an unlimited quantity of water regardless of injury to another landowner. The doctrine, or a modified version of it, has been applied to groundwater unless it can be proved to be part of an underground stream, in which case it is treated for legal purposes as surface water.

To temper the potential abuses of the absolute dominion rule, the statutory or case-based law regarding groundwater in some states has been modified to require that the groundwater use be “reasonable” – i.e., restricted to use on the overlying land and non-injurious to other landowners.

With a shift to a “reasonable use rule,” groundwater is treated less like private property and more like common property (Myszewski, Christy, and Kundell 2005).

States Studied

Texas is the only state studied that, for its surface water law, has abandoned its riparian tradition in favor of an appropriative rights approach. The remaining states studied could be called “regulated riparian” states, although the nature and extent of their regulation varies. Driven by water use disputes or concerns about water quality or water shortage, they have adopted selective or comprehensive statutory approaches to address water supply issues.

Texas, Florida, and Pennsylvania have the most elaborate statewide systems for water supply regulation. North Carolina, South Carolina, and Virginia have targeted areas of current or potential water shortage. Georgia, with the statutory creation of the 15-county Metropolitan North Georgia Water Planning District in 2001, targeted this area of water shortage. West Virginia has not forayed far into the arena of water supply regulation. Tennessee’s water rights law is very briefly summarized below.

Tennessee

Like those in most of the other states in the Southeast, Tennessee courts recognize the “reasonable use” interpretation of the riparian doctrine (Christy, Myszewski, and Kundell 2005). Tennessee has modified its common law doctrine (1) by provisions in the 1977 Water Quality Control Act stating 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...” (Tennessee Code Annotated § 69-3-102) and mandating regulations requiring an Aquatic Resource Alteration Permit (ARAP) for activities such as water withdrawals, (2) by the 2000 Inter-basin Water Transfer Act, and (3) by the 2002 Water Resources Information Act.

Regarding its groundwater law, Tennessee traditionally relied mainly on common law (Feldman and Elmendorf 2000). Nevertheless, as statutorily defined (Tennessee Code Annotated § 69-3-103(33)), the ARAP requirement applies to groundwater as well as to surface water; so do the requirements under the Inter-basin Water Transfer Act and the Water Resources Information Act.

IX. Implications for Tennessee

Tennessee is well positioned to begin statewide water resources planning. With its water withdrawal registration program, its regulation of inter-basin transfers, and its strengths in water quality monitoring and regulation (particularly its ARAP program), Tennessee has some of the essential underpinnings for integrated, statewide water resources planning. Its position in this regard is improved by the recent formation of the Water Resources Technical Advisory Committee (WRTAC) and by the recent updating of the state's Drought Management Plan.

In the state's 2002 Water Resources Information Act, the statutory groundwork was laid for taking a regional approach to water planning. This approach was affirmed by Paul Sloan, deputy commissioner of the Tennessee Department of Environment and Conservation, in a March 13, 2008, presentation to the WRTAC entitled "Tennessee's Approach to Regional Water Resource Planning"

(http://www.tennessee.gov/environment/boards/wrtac/pdf/TN_ApproachRegionalWater%20ResourcePlanning031408.pdf). There, Commissioner Sloan noted that the elements of regional planning include delineating regions and matching current and projected sources and uses.

Delineating regions is an important first step for Tennessee. A one-page list titled "TDEC's Approach to Prioritizing the Need for Planning Regional Water Systems" (n.d.) is posted on the WRTAC's website

(<http://www.tennessee.gov/environment/boards/wrtac/pdf/PrioritizingNeedRegionalization031408.pdf> retrieved December 4, 2009) and is quoted below:

The Department would propose to assign priority for regional planning on the basis of the following criteria:

- *Do the area systems have a history of inadequate sources of supply or lack hydraulic capacity that resulted in shortages or low pressures during the drought?*
- *Has there been inadequate planning or response at the local level to address the shortage or lack of hydraulic capacity?*

- *Do existing water system withdrawals interfere with sustaining aquatic biota or assimilative capacity of the area's streams?*
- *Is there duplication of existing water supply infrastructure in the region?*
- *Will the expected population growth and water supply demand of area water systems exceed the sustainable capacity of the source?*
- *Will the energy and financial impact of piping big waters to the region exceed the customer's ability to pay for the project or result in more harm to the environment than constructing headwater impoundments for a source of water supply?*
- *Does the system(s) have a source(s) of sufficient capacity to last another 50 years?*
- *Have the water systems in the area maximized interconnections with adjacent systems to mitigate possible service interruptions due to emergencies?*
- *Has there been a history of noncooperation among nearby systems?*

The two pilot water-planning studies that are underway in Tennessee – the North Central Study and the Southern Cumberland Plateau Study – apparently were selected because of their drought vulnerability, and the study areas have been based largely on utility districts. Their selection and defined study areas thus are consonant with TDEC's criteria. If the two pilot studies are an indication, it appears that Tennessee's interpretation of water supply planning is water *system* planning with planning regions accordingly delineated.

The other states discussed in this study are taking a rather different approach. Virtually all are integrating water supply with water quality considerations in their water resources planning, and virtually all use watersheds (*the natural hydrological system*), not utility districts (*the water delivery system*), as the geographic basis for their planning.

Watersheds are used by Tennessee for its water quality planning: It has 55 watershed management areas, which are based on 8-digit Hydrologic Unit Codes of the US Geological Survey. While Tennessee's strategy of focusing water supply planning at the regional level seems appropriate for the state, if water supply planning is to be linked with water quality planning, it may be wise to use the state's watershed management areas as the primary basis for both.

Tennessee has a strong background in water quality planning on which it can and should build. Its pilot regional water-planning studies are, appropriately, using long-term (20- to 50-year) demand forecasts. Its 1977 Water Quality Control Act helped to establish the legal basis for the state's interest in not only water quality planning and regulation but

also water supply planning and regulation, with its broad declaration 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..." (Tennessee Code Annotated § 69-3-102).

The Water Quality Control Act's § 69-3-102 declaration, which falls under the "public trust" doctrine adopted by many states in various ways regarding their waters (Walston 1989), can be interpreted as establishing the state's proprietary right to and regulatory interest in its waters. However, to better understand how this declaration might serve as the underpinning for prospective state involvement in water supply issues, legal clarification likely will be needed. Similarly, clarification may be needed of the force of a 1957 statute establishing a water resources division within what has become TDEC. This statute is still part of Tennessee law (Tennessee Code Annotated § 69-7-101 et seq.), but – as discussed in the Tennessee case study – the division is long defunct. A 2002 report by the Office of Research within the state's Comptroller of the Treasury pointed out that although TDEC's Division of Water Supply carries out some of the provisions of the 1957 act, it does not, for example, define and propose water control districts or implement the basic water resource policy of the state (Cohen-Vogel and Spradley 2002). There appears to have been no case law on this point.

At this juncture in Tennessee, the future direction of statewide water resources planning is not yet fully set. Tennessee needs to tailor its own approach, mindful of its own laws, water resources, and water needs. Much can be learned, however, from other states that are further underway with integrated water resources planning.

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