

# Regional Management of Water Resources: --- **River Authorities In Texas**

**REGIONAL MANAGEMENT OF WATER RESOURCES:  
RIVER AUTHORITIES IN TEXAS**

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This research was funded by the Texas Agricultural Experiment Station (Project 6447) and by the Texas Rice Research Foundation (Econo-Rice Project). The authors wish to acknowledge constructive input by Judon Fambrough, Lonnie Jones, and Bruce McCarl. A special thanks is due to Steve Stagner for both his interest and insights.

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## **Regional Management Of Water Resources:**

### **River Authorities In Texas**

The nation contains an estimated 1,000 special water districts (Lesly), and Texas holds more than its fair share of these. Texas Water Commission information suggests that more than one thousand water districts have been authorized in Texas, but the number of active districts is unknown (Smerdon and Gronouski, p. 111). Most water districts have decidedly local purviews, but some have enlarged responsibilities as a result of regionally defined service areas. Regional water management organizations are found across the United States. Several of these are located in Texas where they are usually called "river authorities." The river authority concept is attractive, in part, because many of Texas' rivers are intrastate streams. Eight major Texas rivers flow from their sources in West Texas to the Gulf of Mexico, making it possible to create a basin-wide district (McNeely and Lacewell)<sup>1</sup>

River authorities are an example of resource management institutions created by the Texas Legislature to develop, control, and protect the state's water resources at the regional level. The study of the institutional structure, powers, and accomplishments of Texas river authorities provides insight into the present and future roles of these organizations. This report addresses the following two objectives:

1. To identify the extent and manner of river authority control over the state's water resource base.
2. To isolate trends and forces which may be shaping the future of these organizations and, consequently, the allocation of state water among competing uses and users.

Progress toward satisfying these objectives is accomplished through the following activities:

1. Reviewing the historical development of river authority powers from inception to present.
2. Quantitatively examining the changing control of water resources since the 1930s by comparing water use annually reported by river authorities to that of all other water users.
3. Employing concepts from resource and institutional economics to provide insights regarding the role of river authorities as resource management organizations.

Before discussing the origins and roles of Texas river authorities, we summarize some possible rationalizations for erecting such entities.

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<sup>1</sup> The Brazos and Colorado Rivers are included, although small (generally noncontributing) portions of their watersheds are located within the State of New Mexico.

## Regional Organization

A region can be defined as "a territory which possesses enough of the measure of sameness to distinguish it fundamentally from its neighbors" (Dahir, p. 8). This "sameness" depends on the characteristics on which the division is based. Six common regional divisions are those based on: 1) climate, 2) commodities, 3) metropolitan areas, 4) river basins, 5) culture, and 6) jurisdictions (Dahir, p. 8). Rivers "invite regional organization since they make their way to the ocean without regard to man-made boundaries of government" (Derthick, p. 6). Current political boundaries have tended to make rivers the frontier rather than the center of practical units for the planning, development, and administration of water resources. Essentially, regional organization is a response to the problems of *scale*, *coordination*, and *centralization* within either state or local governments.

The problem of *scale* arises due "to a lack of fit between the areal jurisdictions of government and the demands of governmental function" (Derthick, p. 8). This problem occurs when actions in one jurisdiction adversely affect the welfare of neighboring jurisdictions. Superseding these jurisdictional boundaries with coherent, regionally oriented units provides a way to encompass these intergovernmental externalities<sup>2</sup> and to capture economies of scale in planning and administration (Derthick, p. 6).

The *coordination* problem exists when the functions of governments, agencies, or organizations that perform similar functions (but for different purposes) overlap, resulting in competing programs and projects, wasted funds, and conflict. Failure to coordinate may mean the activity of these units is inefficient. The argument for a regional authority to coordinate disparate interests is especially applicable to the river basin. With a multitude of local, state, and federal agencies and organizations involved in the planning, development, and administration of water resources within a particular river basin, the need for a coordinating organization can be paramount.

The *centralization* problem implies that federal or state government has become too centralized, and is losing its ability to respond to variable local conditions or needs, as it moves slowly through a tangle of red tape. The establishment of regional organizations represents a dispersion of federal or state authority to provincial jurisdictions, providing a presumably more flexible and adaptive government presence. The effectiveness of regional organizations as agents of decentralization depends upon two criteria: 1) the amount of "authority" given the regional organization, and 2) the "accessibility" of that organization to outside (nonfederal/nonstate) interests (Derthick, p. 13).

### Texas Law and the Creation of River Authorities

The formation of "conservation and reclamation" districts is authorized under the 1917 Conservation Amendment to the Texas Constitution (Article XVI, § 59), which has provided the constitutional basis for the creation of all surface water-related districts

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<sup>2</sup> Intergovernmental "externalities" are the external effects on one unit of government by its neighboring jurisdictions. Resource management by nonmarket institutions (such as governments) can frequently result in negative intergovernmental interdependencies (also called "derived externalities") (Wolf).

since that time<sup>3</sup>. This amendment declares that the State of Texas has the "rights and duties" for the

. . . conservation and development of all of the natural resources of the State, including the control, storing, preservation, and distribution of its storm and flood waters, the waters of its rivers and streams, for irrigation, power and all useful purposes, the reclamation and irrigation of its arid, semi-arid and other lands needing irrigation, the reclamation and drainage of its overflowed lands, and other lands needing drainage, the conservation and development of its forests, water and hydro-electric power, the navigation of its inland and coastal waters, and the preservation and conservation of all such natural resources of the State. . . (*Texas Legislative Manual*, p. 110).

One of the most significant aspects of this amendment is that districts formed under it are free from state-imposed tax and debt limitations. This results in a unique situation in which the state, the counties, and the cities of Texas are subject to constitutional and/or statutory debt and tax limitations, while water districts are not (Thompson, pp. 26-27).

Hundreds of special purpose districts<sup>4</sup> have been created throughout the State of Texas to handle one or more of the duties and functions prescribed under the Conservation Amendment on a "local" basis. Districts range in size from small "neighborhood" units to county and multiple county units. They are created in response to local concerns and are responsible to a local electorate (directors are elected to two-year terms). Districts either can be created under the general laws of the state at the local level (with the approval of the Texas Water Commission) or by special act of the state legislature<sup>5</sup> (Thrombley 1959, p. 44). The principal justification for the formation of a special purpose district is to provide an essential service which regular governments are unable to supply. Charges have been made, however, that this type of district is simply a convenient and politically expedient method of circumventing the tax and debt limitations imposed on local governments (Thrombley 1966, pp. 299-300).

River authorities are the exclusive creations of the state legislature and are initiated by individual, special act. As originally conceived, "conservation districts"

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<sup>3</sup> An earlier amendment (Article III, § 52), adopted in 1904, was the first to authorize the formation of special districts to develop the surface waters of the State of Texas. Districts for flood control, irrigation, drainage, and navigation could be created under this amendment (Thrombley 1959, p. 43). Underground water conservation districts were first authorized in 1949 and are subject to the same administrative and procedural provisions as water control and improvement districts (Thrombley 1959, p. 66).

<sup>4</sup> A partial list of water-related special purpose districts includes: drainage districts, irrigation districts, levee improvement districts, flood control districts, navigation districts, water control and improvement districts, water(shed) districts (or authorities), conservation and reclamation districts, municipal water districts (or authorities), water and sanitation districts, water recreational districts, watershed improvement districts, conservation districts, and underground water conservation districts (Texas Water Resources Institute).

<sup>5</sup> A "special" act is a law which specifically governs particular places or subjects. In contrast, a "general" law is one drafted in general terms that applies to a class of subjects or places and does not omit any subject or place naturally belonging to that class (Thrombley 1959, p. 44).

were an attempt by the state to create governmental units with the basin-wide perspective and legal authority to develop and conserve the water and soil resources of the state's river basins (Thompson, p. 27). The first river authority, which was created by the legislature in 1929, was the Brazos River Conservation and Reclamation District. This district was later renamed the Brazos River Authority (BRA), predating the creation of the Tennessee Valley Authority (TVA) and the next Texas "river authority" by four years. The act creating the Brazos River Conservation and Reclamation District was used by later Texas legislatures as the model for subsequent river authorities<sup>6</sup> (Hendrickson, p. 15; Thompson, p. 28). River authorities are recognized as governmental entities of the State of Texas, but do not receive any direct state appropriations.

Since the creation of the Brazos River Conservation and Reclamation District in 1929, many water districts and river authorities have been established. The formation of these institutions not only was considered to be a practical method for the coordinated management of river basins but also was a means of funneling grants and loans from federal relief programs into the State of Texas (Thompson, p. 28). Since 1941, only three totally new river authorities have been created.<sup>7</sup> Also, one of the early conservation and reclamation districts was divided into two river authorities, and the names of several districts were changed to "river authority" in recognition of their similar powers and purposes.

### **Defining River Authorities**

The number of ways in which water districts in the United States differ from one another has led one author to liken them to snowflakes (Leshy). The situation is no different in Texas. The customized nature of enabling legislation for individual river authorities implies that no two are exactly alike. Furthermore, no particular set of criteria has ever been applied to determine which Texas water districts are to be labeled river authorities.

The term "river authority" by its very nature implies an institution that possesses authority over a river, that by its nature imparts a regional character to the organization. "Authority" also implies the existence of broad powers and expertise which enable the institution to accomplish a wide array of mandated duties. Some authors and organizations (i.e., Thompson, Texas Department of Water Resources Library, and Texas Advisory Commission on Intergovernmental Relations) have suggested that the name of a particular water management institution alone does not preclude its classification as a river authority. Conversely, "river authority" attached to an organization's name does not automatically qualify it as a river authority. Such institutions must also possess the regional character and the broad powers of a river authority.

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<sup>6</sup> Hendrickson and Thompson also suggest that the act creating the Brazos River Conservation and Reclamation District has been used by the Federal government and other states as a model for regional water resource management institutions.

<sup>7</sup> The latest, the Sulphur River Basin Authority created, in 1985, evidently replaces the legislation which organized the Sulphur River Conservation and Reclamation District in 1935.

The remainder of this section is devoted to applying this criterion to districts which are commonly considered by different groups to possess river authority stature. This criterion provides the basis for the selection of the river authorities treated in this study.

Some special regional water districts that have been submitted as river authority candidates are the following: Lower Nueces River Water Supply District, Colorado River Municipal Water District, North Texas Municipal Water District, Northeast Texas Municipal Water District, Canadian River Municipal Water District, Upper Neches River Municipal Water Authority, West Central Texas Municipal Water District, Gulf Coast Waste Disposal Authority, and Chambers-Liberty Counties Navigation District. However, these districts fail to achieve river authority status because they are endowed with only a limited range of powers and duties and are generally involved in only one or two specific activities.

Another group of candidates are often considered river authorities simply because they were so named. These include the Central Colorado River Authority, Upper Guadalupe River Authority, Lavaca-Navidad River Authority, Bandera County River Authority, Mason County River Authority, Kimble County River Authority, and Palo Duro River Authority. Some of these have a broad range of powers, while others possess a more limited set. Nevertheless, all lack the regional orientation of a true river authority because their jurisdictional areas comprise one county or less.

Two other districts which merit discussion for river authority status are the Red Bluff Water Power Control District and the Lower Concho River Water and Soil Conservation Authority. A water power control district is a "master district" created by the federation of two or more water improvement districts. The Red Bluff Water Power Control District was created in 1928 to facilitate and support the operations of seven member districts in the Pecos River Valley. This district operates Red Bluff Reservoir and its 2,350 kilowatt hydroelectric facility and releases water to its constituent districts (Thrombley 1959, p. 61). Although it is a powerful innovation, the master district concept does not organize a given region under a single authority because each of the member districts retain separate identities, as well as their powers and obligations (Thrombley 1959, p. 60). For this reason, the Red Bluff Water Power Control District is not considered as a river authority.

The Lower Concho River Water and Soil Conservation Authority was also created under Article XVI, § 59 of the Texas Constitution, and it is endowed with broad powers similar to those of many of the river authorities created during the Depression. The wording of its enabling legislation is somewhat different, however, and stresses the role of the district in assisting farmers and ranchers with soil conservation and irrigation. This, in addition to the fact that its jurisdictional area is limited to one county, removes this entity from consideration as a river authority.

The organizations which meet the criteria of having a regional perspective and broad powers are listed in Table 1. Eleven of these thirteen organizations have "river authority" explicit in their current names. The other two names evolved as a product of their times rather than from any actual institutional differences. The Lower Neches Valley Authority was created shortly after the TVA in 1933, and basin was added to the name of the Sulphur River Basin Authority to emphasize the basin-wide nature of the organization. These 13 organizations constitute the river authorities highlighted in this study.



**Table 1. Texas River Authorities**

River Authority	Original Name	Year Created	Service Area (Sq. Miles)	Majority of Watershed	Entire Watershed †
Angelina-Neches River Authority	Sabine-Neches Conservation and Reclamation District	1935	5,000*	✓	
Brazos River Authority	Brazos River Conservation and Reclamation District	1929	42,840		✓
Guadalupe-Blanco River Authority	Guadalupe River Authority	1933	7,250	✓	
Lower Colorado River Authority	Lower Colorado River Authority	1934	9,718		
Lower Neches Valley Authority	Lower Neches Valley Authority	1933	3,300*		
Nueces River Authority	Nueces River Conservation and Reclamation District	1935	17,796	✓	
Red River Authority	Red River Authority	1959	24,500*		✓
Sabine River Authority	Sabine-Neches Conservation and Reclamation District	1935	7,426		✓
San Antonio River Authority	San Antonio River Canal and Conservancy District	1937	3,677	✓	
San Jacinto River Authority	San Jacinto River Conservation and Reclamation District	1937	2,627	✓	
Sulphur River Basin Authority	Sulphur River Basin Authority	1985	3,300*	✓	
Trinity River Authority	Trinity River Authority	1955	11,000*	✓	
Upper Colorado River Authority	Upper Colorado River Authority	1935	2,411		

\*Estimated

†Entire watershed within Texas.

## Jurisdictional Characteristics of River Authorities

The river authority was originally conceived as "an agency with the power to manage the waters of an entire river basin" (Hendrickson, p. 15). The first, and by far the largest of the river authorities, was the authority created in the Brazos watershed.<sup>8</sup> However, the creation of river authorities during the Depression led to the formation of many river authorities without basin-wide control (Table 1). In three of the Texas river basins, more than one "river authority" was created, each having jurisdiction over only a portion of the river basin.<sup>9</sup> The creation of the Lower Colorado River Authority (LCRA), which services the lower 10 counties in the Colorado River basin, required the political compromise that upstream river authorities would be created to protect the rights and interests of the people living in the upper sections of the river (Williams, p. 5). Some river authority boundaries are defined by watershed boundaries and some by county boundaries. This has led to overlapping service areas between the following: the Nueces River Authority and the San Antonio River Authority; the LCRA and the BRA; the BRA and the Red River Authority; and the Lower Neches Valley Authority and the Trinity River Authority. In some enabling legislation, the river authority is also given the power to "develop, conserve, distribute, and protect the waters" of a given river basin both "within and without its boundaries" (Lower Neches Valley Authority). Clearly, major deviations from the basin-wide concept were authorized in the creation of most of the river authorities in Texas, and jurisdictional boundaries are not at all certain in some cases. Only seven of the thirteen river authorities in Texas have control over a majority of their watersheds and are the sole "river authority" operating in their particular basin. Known service areas for the thirteen river authorities are shown in Figure 1.

## The Powers and Progress of Texas River Authorities

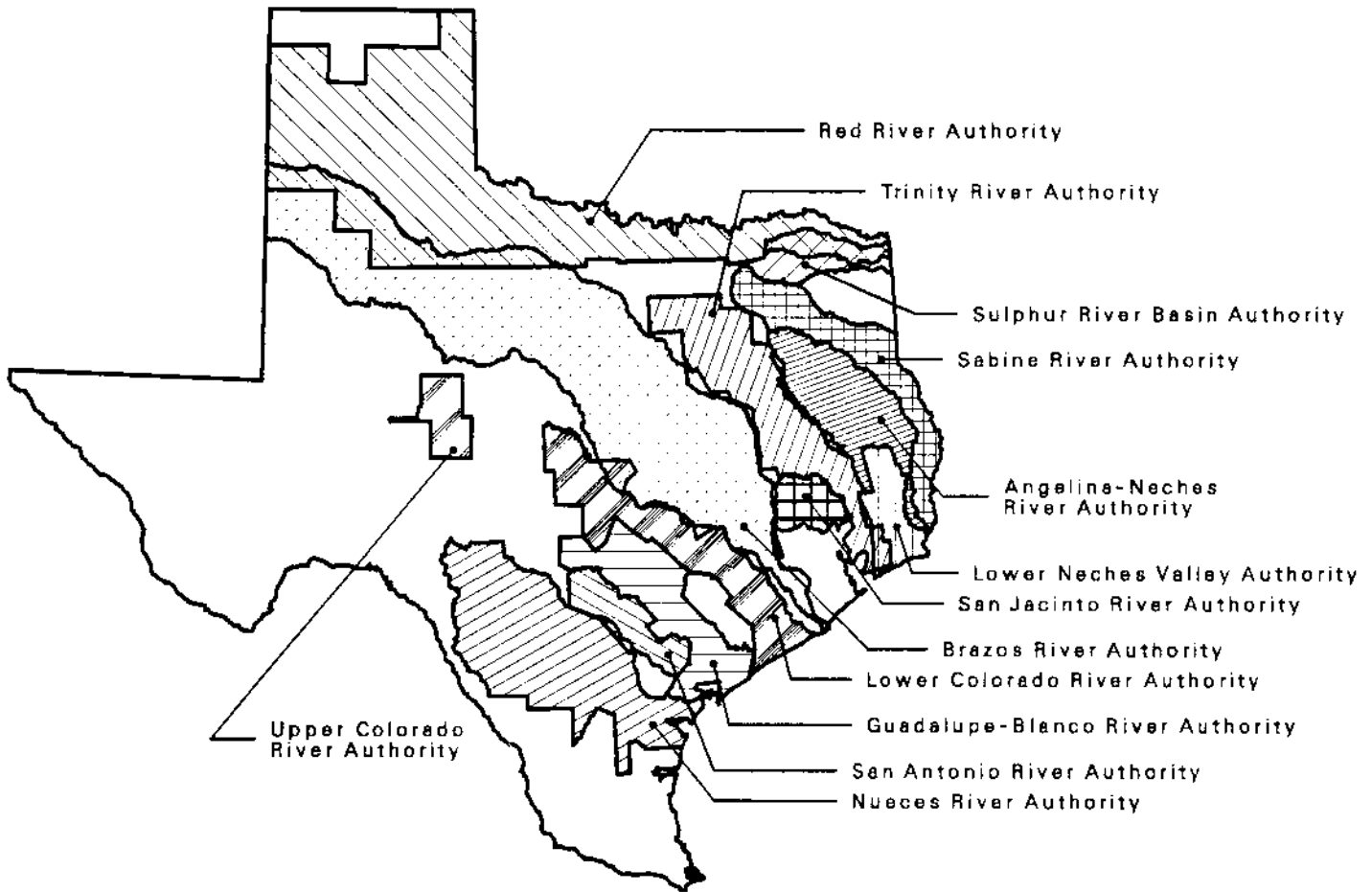
When comparing the expectations for the TVA as outlined in its enabling legislation with present day reality, it is easy to see that in many aspects it has had an enormous impact on the management of water resources in the Tennessee Valley region. Texas river authorities were created essentially with the same high expectations as the TVA. Although each river authority is endowed with similar water development powers, they have not progressed equally. Opportunity and able management certainly have been benefits to many of the river authorities and have allowed them to progress more rapidly than others. The age of the river authority is not a good indicator of whether or not it has been active. For example, the BRA and the LCRA are two of the most active, but the BRA was nearly 12 years old before its first dam was finished in 1941. The LCRA, on the other hand, had completed four dam projects by 1941 when it was only seven years old (Williams, p. 6). The Nueces River Authority (created in 1935) did not

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<sup>8</sup> The BRA has a jurisdictional area of more than 42,000 square miles, which includes 23 entire counties and portions of 42 others (Hendrickson, p. 15). In comparison, the TVA's operations are conducted in the Tennessee Basin which covers an area of 41,000 square miles in the states of Tennessee, Kentucky, Mississippi, Alabama, Georgia, North Carolina, and Virginia (Derthick, p. 18).

<sup>9</sup> The Guadalupe River basin has two: the Guadalupe-Blanco and the Upper Guadalupe River Authorities; the Colorado has three: the Upper, the Central, and the Lower Colorado River Authorities; and the Neches has two: the Lower Neches Valley Authority and the Angelina-Neches River Authority.

Figure 1. Texas River Authorities.



play a major role until the construction of the Choke Canyon project (completed in 1983). Several of the districts formed during the Depression have been dormant or have undertaken only small-scale projects and/or provided limited services.

River authorities were granted broad powers for the development and management of the water resources of the State of Texas.<sup>10</sup> The duties and powers of the river authorities can be divided into those pertaining to: 1) watershed management, 2) water supply management, 3) pollution control and groundwater management, 4) appurtenant development, and 5) governmental or administrative authority.

### *Watershed Management*

River authorities have been given a variety of powers and duties regarding the management of their watersheds including those involving: 1) the storage, preservation, and conservation of water, 2) flood control, 3) soil conservation, 4) forestation and reforestation, and 5) drainage (Table 2). Prior to the construction of multipurpose reservoirs to regulate the rivers and streams of Texas, extended periods of drought could be interspersed with devastating floods. In December 1913, for example, the Guadalupe, Colorado, Trinity, and Brazos Rivers were out of their banks at the same time, flooding approximately 3,000 square miles and causing extensive damage and loss of life (Hendrickson, p. 13). Downstream water users also wanted to secure additional water supplies and improve existing water rights by reducing supply uncertainty. These forces provided much of the impetus for organizing river authorities.

Flood control and water supply are two of the most important functions of the river authorities. Although the Federal Flood Control Act of 1936 assigned much of the responsibility for flood control to the Corps of Engineers, some river authorities have played a significant role in flood control. In relation to water supply, the river authorities have been instrumental in apportioning available water storage and meeting demands for additional storage.

Reservoir development has been the major response of river authorities to solving the water supply and flood control problems. Reservoir development has been accomplished in basically two ways: 1) constructing and maintaining projects of their own design, financed through some combination of federal loans and grants, the sale of bonds, and cooperating ventures and contracts with water retailers (mainly cities), or 2) by acting as the local sponsor for Corps of Engineers or Bureau of Reclamation projects by contributing toward the construction cost or purchasing conservation storage space in the reservoirs.<sup>11</sup> Construction of reservoirs during the Depression was possible through grants and loans provided by the Public Works Administration, the Works Progress

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<sup>10</sup> The powers and the structure of the "river authorities" have undergone varying degrees of change throughout the years. In the legislative sessions through 1985, nearly 100 laws had been enacted to clarify, amend, and/or add new sections to the 12 original acts (Harper). River authorities possess only those powers which are expressly delegated by the legislature or which exist by clear implication (Thrombley 1959, p. 49).

<sup>11</sup> River authorities have also obtained dams and reservoirs by purchase. The Guadalupe-Blanco River Authority purchased six small hydroelectric reservoirs constructed in the late 1920s and early 1930s from the Texas Hydroelectric Corporation and others in 1963 for \$3.75 million (Guadalupe-Blanco River Authority of Texas, p. 11). The LCRA purchased the partially completed Hamilton Dam (now Buchanan Dam) in 1935 for \$2.6 million (Clay, pp. 145-146).

**Table 2. Watershed Management Powers of Texas River Authorities**

Authority	Water Storage Preservation and Conservation	Flood Control	Soil Conservation	Forestation and River Reforestation	Drainage
Angelina-Neches River Authority	✓	✓	✓		✓
Brazos River Authority	✓	✓	✓		✓
Guadalupe-Blanco River Authority	✓	✓	✓	✓	✓
Lower Colorado River Authority	✓	✓	✓	✓	
Lower Neches Valley Authority	✓	✓	✓		✓
Nueces River Authority	✓	✓	✓	✓	✓
Red River Authority	✓	✓	✓		✓
Sabine River Authority	✓	✓	✓		✓
San Antonio River Authority	✓	✓	✓	✓	
San Jacinto River Authority	✓	✓	✓	✓	✓
Sulphur River Basin Authority	✓	✓	✓	✓	✓
Trinity River Authority	✓	✓	✓		
Upper Colorado River Authority	✓	✓	✓	✓	

Administration, and the Reconstruction Finance Corporation. Most of the financing for the four dams constructed by the LCRA during this period<sup>12</sup> was provided through loans and grants from the Public Works Administration and the Bureau of Reclamation, with some aid from the Reconstruction Finance Corporation and the Works Progress Administration (Clay, pp. 275-276). The BRA obtained the funding for its Possum Kingdom Project from a combination of the sale of revenue bonds to the Reconstruction Finance Corporation, a Works Progress Administration grant, and state tax remissions (BRA, *Water Resource Conservation and Development*). Construction of reservoirs since that time has depended primarily upon the sale of revenue bonds backed by the sale of water and/or electricity generated from the project. Reservoir construction has been encouraged by the river authorities through contributions to the construction cost<sup>13</sup> and the purchase of storage in proposed or existing Corps of Engineers or Bureau of Reclamation reservoirs.<sup>14</sup>

The list of reservoirs used by river authorities is impressive and includes seven of the ten largest reservoirs in Texas (Table 3).<sup>15</sup> Many are multipurpose projects with water storage functions (for municipal, industrial, irrigation, and mining use), flood control functions, and hydroelectric power generation functions. Others are designed for only one or two purposes. Recreational use is a prominent feature of most of the reservoirs and certainly a factor for the others.

The San Antonio River Authority, although it has not developed reservoirs for water storage and conservation, is actively involved in flood control on the San Antonio River and its tributaries. Acting as local sponsor for the Corps of Engineers, the San Antonio River Authority has been involved in extensive channel improvement projects (the widening, deepening, and straightening of more than 33 miles of stream channels in the City of San Antonio (San Antonio River Authority 1980, p. A-2)) and the development of small flood control dams on tributary streams.<sup>16</sup> In addition, the San Antonio River Authority is planning and sponsoring two reservoir projects in the San Antonio River Basin. Both are slated to provide municipal and industrial water, one for San Antonio, Kenedy, and Karnes City and the other for Corpus Christi and the lower Guadalupe River Basin (San Antonio River Authority 1984, p. 9).

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<sup>12</sup> Buchanan Dam (Lake Buchanan) was completed in 1937, Roy Inks Dam (Lake Inks) in 1938, Tom Miller Dam (Lake Austin) in 1940, and the Mansfield Dam (Lake Travis) in 1941.

<sup>13</sup> The Guadalupe-Blanco River Authority made an initial contribution of \$1.4 million toward the completion of Canyon Reservoir, with additional payments of \$308,980 per year for 60 years (1966-2026) (Guadalupe-Blanco River Authority of Texas, p. 13). The Lower Neches Valley Authority made an initial contribution of \$5 million toward the completion of B. A. Steinhagen and Sam Rayburn Reservoirs with annual payments of \$200,000 per year for 50 years (1966-2016) (Lower Neches Valley Authority).

<sup>14</sup> The most active has been the BRA which has contracted for the conservation storage in nine Corps of Engineers reservoirs in the Brazos basin for a total of \$53.8 million (BRA 1984, p. 16).

<sup>15</sup> The other three are International Amistad (second place, 3.5 million acre-feet) and International Falcon (fifth place, 2.7 million acre-feet) on the Rio Grande River, and Lake Meredith (tenth place, 0.8 million acre-feet) on the Canadian River.

<sup>16</sup> The San Antonio River Authority currently operates and maintains 41 flood control structures (San Antonio River Authority 1984, p. 8).

**Table 3. Reservoirs Used by River Authorities in Texas†**

Reservoir	Year Completed	Owner	Conservation Storage	Uses‡
<i>Brazos River Authority</i>				
Aquilla	1983	Corps of Engineers	52,400	1,2,3,7,8
Belton	1954	Corps of Engineers	457,300	1,2,3,8
Georgetown	1980	Corps of Engineers	37,050	1,2,8
Granbury	1969	Brazos River Authority	151,300	1,2,3,5
Granger	1980	Corps of Engineers	64,540	1,2,8
Limestone	1978	Brazos River Authority	225,400	1,2,3
Possum Kingdom	1941	Brazos River Authority	569,380	1,2,3,4,5,7
Proctor	1964	Corps of Engineers	59,300	1,2,3,8
Somerville	1967	Corps of Engineers	160,100	1,2,3,8
Stillhouse Hollow	1968	Corps of Engineers	234,900	1,2,3,8
Waco <sup>a</sup>	1965	Corps of Engineers	151,900	1,7,8
Whitney <sup>b</sup>	1951	Corps of Engineers	622,800	5,8
<i>Lower Neches Valley Authority</i>				
Sam Rayburn <sup>c</sup>	1965	Corps of Engineers	2,876,300	1,2,3,5,7,8
E.A. Steinhagen	1951	Corps of Engineers	94,200	7,8
<i>Guadalupe-Blanco River Authority</i>				
Canyon	1964	Corps of Engineers	386,210	1,2,5,8
Coleto Creek	1980	Guadalupe-Blanco River Authority	35,080	2
Dunlap	1928	Guadalupe-Blanco River Authority	5,310	5
H-4	1931	Guadalupe-Blanco River Authority	4,620	5
McQueeney	1928	Guadalupe-Blanco River Authority	4,950	5
H-5	1931	Guadalupe-Blanco River Authority	3,720	5
Nolte	1928	Guadalupe-Blanco River Authority	1,460	5
TP-4	1932	Guadalupe-Blanco River Authority	2,260	5
<i>Lower Colorado River Authority</i>				
Austin	1939	City of Austin	21,000	1,2,5
Bastrop	1964	Lower Colorado River Authority	16,590	2
Buchanan	1938	Lower Colorado River Authority	955,200	1,3,4,5
Cedar Creek	1977	Lower Colorado River Authority	71,400	2
Eagle <sup>d</sup>	1900	Lower Colorado River Authority	9,600	3
Inks	1938	Lower Colorado River Authority	17,540	1,3,4,5
Lyndon B. Johnson	1951	Lower Colorado River Authority	138,500	5
Marble Falls	1951	Lower Colorado River Authority	8,760	5
Travis	1942	Lower Colorado River Authority	1,144,100	1,2,3,4,5,7,8
<i>Sabine River Authority</i>				
Lake Fork	1980	Sabine River Authority	635,200	1,2
Tawakoni	1960	Sabine River Authority	936,200	1,2,3,7
Toledo Bend <sup>e</sup>	1969	Sabine River Authorities of Louisiana and Texas	4,472,900	1,2,3,5,7

Administration, and the Reconstruction Finance Corporation. Most of the financing for the four dams constructed by the LCRA during this period<sup>12</sup> was provided through loans and grants from the Public Works Administration and the Bureau of Reclamation, with some aid from the Reconstruction Finance Corporation and the Works Progress Administration (Clay, pp. 275-276). The BRA obtained the funding for its Possum Kingdom Project from a combination of the sale of revenue bonds to the Reconstruction Finance Corporation, a Works Progress Administration grant, and state tax remissions (BRA, *Water Resource Conservation and Development*). Construction of reservoirs since that time has depended primarily upon the sale of revenue bonds backed by the sale of water and/or electricity generated from the project. Reservoir construction has been encouraged by the river authorities through contributions to the construction cost<sup>13</sup> and the purchase of storage in proposed or existing Corps of Engineers or Bureau of Reclamation reservoirs.<sup>14</sup>

The list of reservoirs used by river authorities is impressive and includes seven of the ten largest reservoirs in Texas (Table 3).<sup>15</sup> Many are multipurpose projects with water storage functions (for municipal, industrial, irrigation, and mining use), flood control functions, and hydroelectric power generation functions. Others are designed for only one or two purposes. Recreational use is a prominent feature of most of the reservoirs and certainly a factor for the others.

The San Antonio River Authority, although it has not developed reservoirs for water storage and conservation, is actively involved in flood control on the San Antonio River and its tributaries. Acting as local sponsor for the Corps of Engineers, the San Antonio River Authority has been involved in extensive channel improvement projects (the widening, deepening, and straightening of more than 33 miles of stream channels in the City of San Antonio (San Antonio River Authority 1980, p. A-2)) and the development of small flood control dams on tributary streams.<sup>16</sup> In addition, the San Antonio River Authority is planning and sponsoring two reservoir projects in the San Antonio River Basin. Both are slated to provide municipal and industrial water, one for San Antonio, Kenedy, and Karnes City and the other for Corpus Christi and the lower Guadalupe River Basin (San Antonio River Authority 1984, p. 9).

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<sup>12</sup> Buchanan Dam (Lake Buchanan) was completed in 1937, Roy Inks Dam (Lake Inks) in 1938, Tom Miller Dam (Lake Austin) in 1940, and the Mansfield Dam (Lake Travis) in 1941.

<sup>13</sup> The Guadalupe-Blanco River Authority made an initial contribution of \$1.4 million toward the completion of Canyon Reservoir, with additional payments of \$308,980 per year for 60 years (1966-2026) (Guadalupe-Blanco River Authority of Texas, p. 13). The Lower Neches Valley Authority made an initial contribution of \$5 million toward the completion of B. A. Steinhagen and Sam Rayburn Reservoirs with annual payments of \$200,000 per year for 50 years (1966-2016) (Lower Neches Valley Authority).

<sup>14</sup> The most active has been the BRA which has contracted for the conservation storage in nine Corps of Engineers reservoirs in the Brazos basin for a total of \$53.8 million (BRA 1984, p. 16).

<sup>15</sup> The other three are International Amistad (second place, 3.5 million acre-feet) and International Falcon (fifth place, 2.7 million acre-feet) on the Rio Grande River, and Lake Meredith (tenth place, 0.8 million acre-feet) on the Canadian River.

<sup>16</sup> The San Antonio River Authority currently operates and maintains 41 flood control structures (San Antonio River Authority 1984, p. 8).



**Table 3. Reservoirs Used by River Authorities in Texas†**

Reservoir	Year Completed	Owner	Conservation Storage	Uses‡
<i>Brazos River Authority</i>				
Aquilla	1983	Corps of Engineers	52,400	1,2,3,7,8
Belton	1954	Corps of Engineers	457,300	1,2,3,8
Georgetown	1980	Corps of Engineers	37,050	1,2,8
Granbury	1969	Brazos River Authority	151,300	1,2,3,5
Granger	1980	Corps of Engineers	64,540	1,2,8
Limestone	1978	Brazos River Authority	225,400	1,2,3
Possum Kingdom	1941	Brazos River Authority	569,380	1,2,3,4,5,7
Proctor	1964	Corps of Engineers	59,300	1,2,3,8
Somerville	1967	Corps of Engineers	160,100	1,2,3,8
Stillhouse Hollow	1968	Corps of Engineers	234,900	1,2,3,8
Waco <sup>a</sup>	1965	Corps of Engineers	151,900	1,7,8
Whitney <sup>b</sup>	1951	Corps of Engineers	622,800	5,8
<i>Lower Neches Valley Authority</i>				
Sam Rayburn <sup>c</sup>	1965	Corps of Engineers	2,876,300	1,2,3,5,7,8
E.A. Steinhagen	1951	Corps of Engineers	94,200	7,8
<i>Guadalupe-Blanco River Authority</i>				
Canyon	1964	Corps of Engineers	386,210	1,2,5,8
Coloto Creek	1980	Guadalupe-Blanco River Authority	35,080	2
Dunlap	1928	Guadalupe-Blanco River Authority	5,310	5
H-4	1931	Guadalupe-Blanco River Authority	4,620	5
McQueeney	1928	Guadalupe-Blanco River Authority	4,950	5
H-5	1931	Guadalupe-Blanco River Authority	3,720	5
Nolte	1928	Guadalupe-Blanco River Authority	1,460	5
TP-4	1932	Guadalupe-Blanco River Authority	2,260	5
<i>Lower Colorado River Authority</i>				
Austin	1939	City of Austin	21,000	1,2,5
Bastrop	1964	Lower Colorado River Authority	16,590	2
Buchanan	1938	Lower Colorado River Authority	955,200	1,3,4,5
Cedar Creek	1977	Lower Colorado River Authority	71,400	2
Eagle <sup>d</sup>	1900	Lower Colorado River Authority	9,600	3
Inks	1938	Lower Colorado River Authority	17,540	1,3,4,5
Lyndon B. Johnson	1951	Lower Colorado River Authority	138,500	5
Marble Falls	1951	Lower Colorado River Authority	8,760	5
Travis	1942	Lower Colorado River Authority	1,144,100	1,2,3,4,5,7,8
<i>Sabine River Authority</i>				
Lake Fork	1980	Sabine River Authority	635,200	1,2
Tawakoni	1960	Sabine River Authority	936,200	1,2,3,7
Toledo Bend <sup>e</sup>	1969	Sabine River Authorities of Louisiana and Texas	4,472,900	1,2,3,5,7

**Table 3. (Continued)**

Reservoir	Year Completed	Owner	Conservation Storage	Uses <sup>1</sup>
<i>Upper Colorado River Authority</i>				
O.C. Fisher	1951	Corps of Engineers	119,200	1,2,3,4,7,8
<i>Nueces River Authority</i>				
Choke Canyon <sup>f</sup>	1983	The City of Corpus Christi and the Nueces River Authority	690,400	1,2,7,8
<i>San Antonio River Authority</i>				
Calaveras <sup>g</sup>	1969	City Public Service	--	7
Victor Braunig <sup>g</sup>	1962	Board of San Antonio	--	7
<i>San Jacinto River Authority</i>				
Conroe <sup>h</sup>	1973	San Jacinto River Authority	429,900	1,2,4
Houston <sup>i</sup>	1954	City of Houston	140,500	1,2,3,4,7
Highlands <sup>j</sup>		San Jacinto River Authority	--	--
<i>Trinity River Authority</i>				
Livingston <sup>k</sup>	1969	The City of Houston and the Trinity River Authority	1,750,000	1,2,3
Bardwell	1966	Corps of Engineers	53,580	7,8
Navarro Mills	1963	Corps of Engineers	60,900	1,8
Joe Pool	1986	Corps of Engineers	176,900	1,7,8
Wallisville <sup>l</sup>	*	Corps of Engineers	58,000	1,2,3
<i>Red River Authority</i>				
Texoma <sup>m</sup>	1943	Corps of Engineers	2,722,000	5,7,8
Truscott <sup>n</sup>		Red River Authority	107,000	--

† The Angelina-Neches River Authority and the Sulphur River Basin Authority have neither developed reservoirs of their own nor contracted for or purchased conservation storage in existing reservoirs.

‡ Use Codes (Texas Department of Water Resources)

- |                          |                         |                  |
|--------------------------|-------------------------|------------------|
| 1- municipal or domestic | 4- mining               | 7- recreation    |
| 2- industrial            | 5- hydro-electric power | 8- flood control |
| 3- irrigation            | 6- navigation           | 9- recharge      |

\* Under construction

### Table 3. (Continued)

#### Footnotes:

- <sup>a</sup> Conservation storage assigned to the City of Waco by the BRA
- <sup>b</sup> In 1957, the State Board of Water Engineers decreed that only the BRA has the right to purchase the conservation storage in Lake Whitney.
- <sup>c</sup> Permits held by the Lower Neches Valley Authority authorize it to appropriate water (for municipal, industrial, and irrigation uses) from Sam Rayburn Reservoir. This water is to be impounded and reregulated in B.A. Steinhagen Lake.
- <sup>d</sup> Eagle Lake is used as off-channel storage for the Lakeside canal system. Rights obtained in 1983 in the Lakeside Irrigation purchase.
- <sup>e</sup> Half of the conservation storage (2,236,450 AF) is allocated to Louisiana.
- <sup>f</sup> The City of Corpus Christi owns an 80% interest in this project.
- <sup>g</sup> City Public Service Board of San Antonio steam-electric power plant cooling reservoirs. The San Antonio River Authority, through long-term leases, has developed fee-supported recreational projects on these reservoirs. The San Antonio River Authority presently does not own any conservation storage rights in existing reservoirs or possess any water permits.
- <sup>h</sup> Two-thirds of the conservation storage (286,600 AF) belongs to the City of Houston.
- <sup>i</sup> The San Jacinto River Authority, through an agreement with the City of Houston, diverts water directly from Lake Houston for industrial plants and rice irrigation in the Baytown area
- <sup>j</sup> This is a regulating reservoir used in connection with the diversions from Lake Houston (See footnote i.).
- <sup>k</sup> The Trinity River Authority has 30% of the conservation storage (525,000 AF) and the City of Houston has 70% (1,225,000 AF).
- <sup>l</sup> Construction on the Wallisville Project has been halted since 1973 by a federal injunction prompted by environmental concerns.
- <sup>m</sup> The conservation storage of Lake Texoma is contracted from the Corps of Engineers by the City of Denison, Texas Power and Light Company, Atlantic Richfield Company, Texaco, Inc., and the Red River Authority.
- <sup>n</sup> This is a chloride control project and has no water supply function.

River authorities have accomplished little in the soil conservation and forestation/reforestation area.<sup>17</sup> Some effort has been directed toward support for the creation of soil conservation districts and county conservation councils.<sup>18</sup> The Brazos River Authority, for example, has engaged in some promotional activities in connection with soil conservation, including an annual reward of \$1,000 for the group or individual judged most effective in soil conservation work each year (Hendrickson, p. 59). In the late 1940s the directors of the LCRA decided to: 1) use LCRA-owned lands adjoining its reservoirs for soil conservation experiments and demonstration projects, 2) purchase terracing and other conservation equipment that would in turn be rented to farmers on a cost basis, and 3) study the need for check dams on the tributaries of the Colorado River (Clay, p. 230).

As originally conceived, river authorities were given broad powers regarding land drainage within their jurisdictions. River authorities are empowered to develop and maintain drainage systems for lands requiring drainage for profitable agricultural production or to develop such lands to their most advantageous use. Based on historical actions by river authorities, drainage has never become an important function, probably because of the lack of revenue-generating potential from drainage systems. In addition, with growing public concern about maintaining wetlands for fish and wildlife habitat, it is probably not politically expedient to be engaged in their destruction.

#### *Water Supply Management*

Maintaining an adequate supply of water is one of the most important functions of the river authority (Table 4). River authorities are empowered to provide water for any and all beneficial uses; municipal,<sup>19</sup> industrial, agricultural, and electrical generation (both hydro and thermal) purposes are by far the most important. To study the relative influence of river authorities, a dataset containing annual, individual water reports by all Texas surface water right holders was obtained from the Texas Department of Water Resources (TDWR) during 1984. A listing of permits owned by river authorities was used to distinguish between river authority water diversions and all others. The amount of water supplied by the 13 river authorities is significant (Figures 2 and 3). Since 1970, river authorities have supplied between 30 percent and 50 percent of combined consumptive and nonconsumptive<sup>20</sup> surface water use (Figure 4) and about 25 percent of the consumptive surface water use (Figure 5) reported in the State of Texas. Figure 5, which excludes hydropower water use, illustrates the growing influence of river authorities on water supply.

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<sup>17</sup> It can be argued, however, that by controlling floods through the operation of reservoirs, the river authorities have contributed to the prevention of soil erosion in the lands below the dams.

<sup>18</sup> The Trinity River Authority and the LCRA are specifically charged with cooperating with and furnishing assistance to soil conservation districts (Thrombley 1959, p. 50).

<sup>19</sup> Protection of the rights of cities to obtain water for municipal purposes is specifically mentioned in the acts creating the LCRA, the Upper Colorado River Authority, and the Trinity River Authority (Thrombley 1959, p. 49).

<sup>20</sup> Consumptive use implies that the water is "consumed" (i.e., depleted) and is unavailable for *immediate* reuse. Nonconsumptive means that the water is available for reuse, either by the same user or by downstream users. For example, hydroelectric power generation is a nonconsumptive use of water.

**Table 4. Water Supply Powers of Texas River Authorities**

River Authority	For Any and All Beneficial Uses	Within and Without Territory	Acquire Water Transportation and Supply Facilities	Water Importation	Water Purification and Treatment	Provide Standby Service
Angelina-Neches River Authority	✓	✓	✓			
Brazos River Authority	✓		✓		✓	
Guadalupe-Blanco River Authority	✓	✓	✓			
Lower Colorado River Authority	✓		✓			
Lower Neches Valley Authority	✓	✓	✓			
Nueces River Authority	✓	✓	✓	✓	✓	
Red River Authority	✓	✓	✓			
Sabine River Authority	✓	✓	✓			
San Antonio River Authority	✓	✓	✓	✓	✓	✓
San Jacinto River Authority	✓	✓	✓		✓	
Sulphur River Basin Authority	✓	✓	✓		✓	
Trinity River Authority	✓	✓	✓	✓	✓	✓
Upper Colorado River Authority	✓	✓	✓			

Figure 2. Reported Surface Water Use in Texas, 1906-1982.

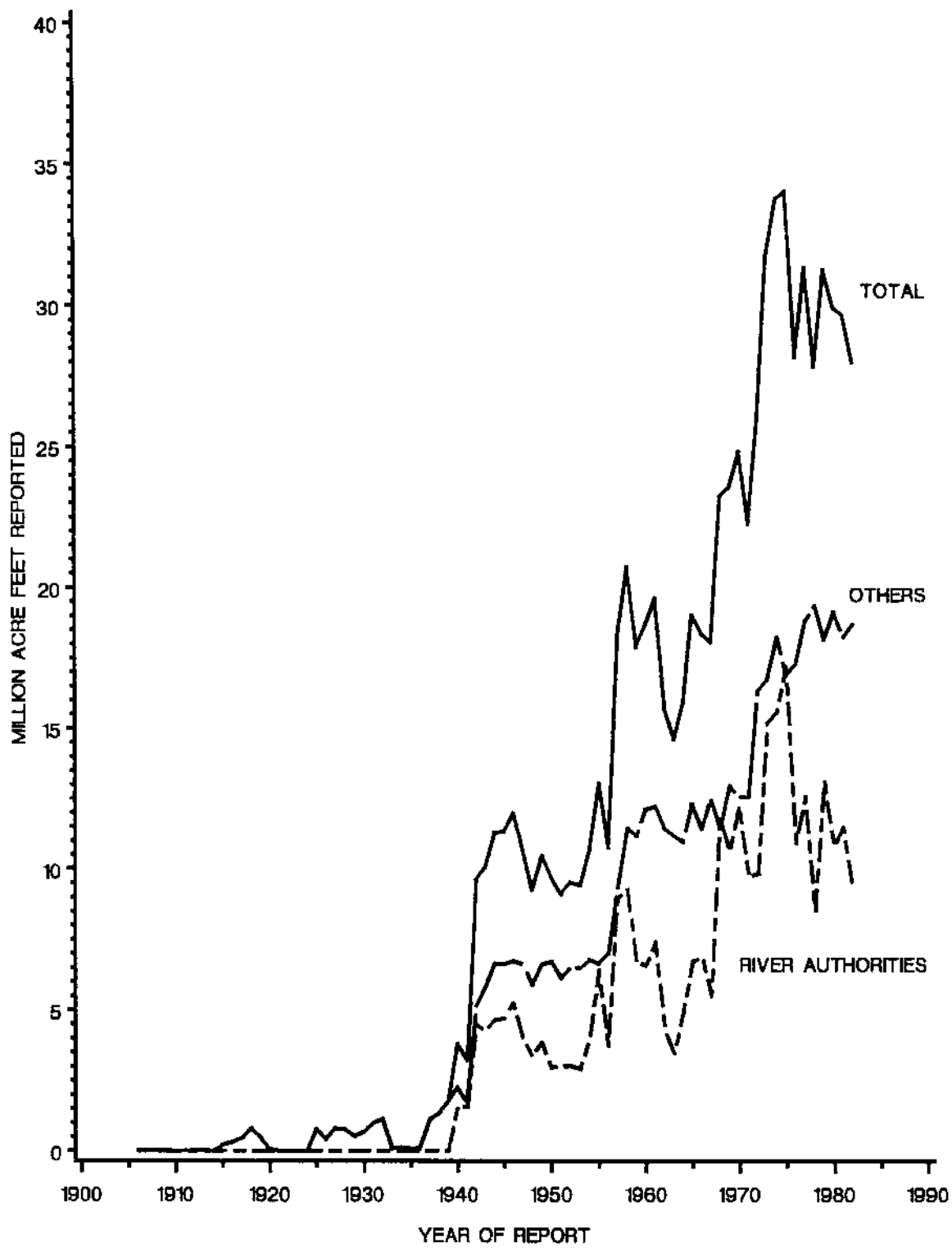


Figure 3. Consumptive Surface Water Use in Texas, 1906-1982.

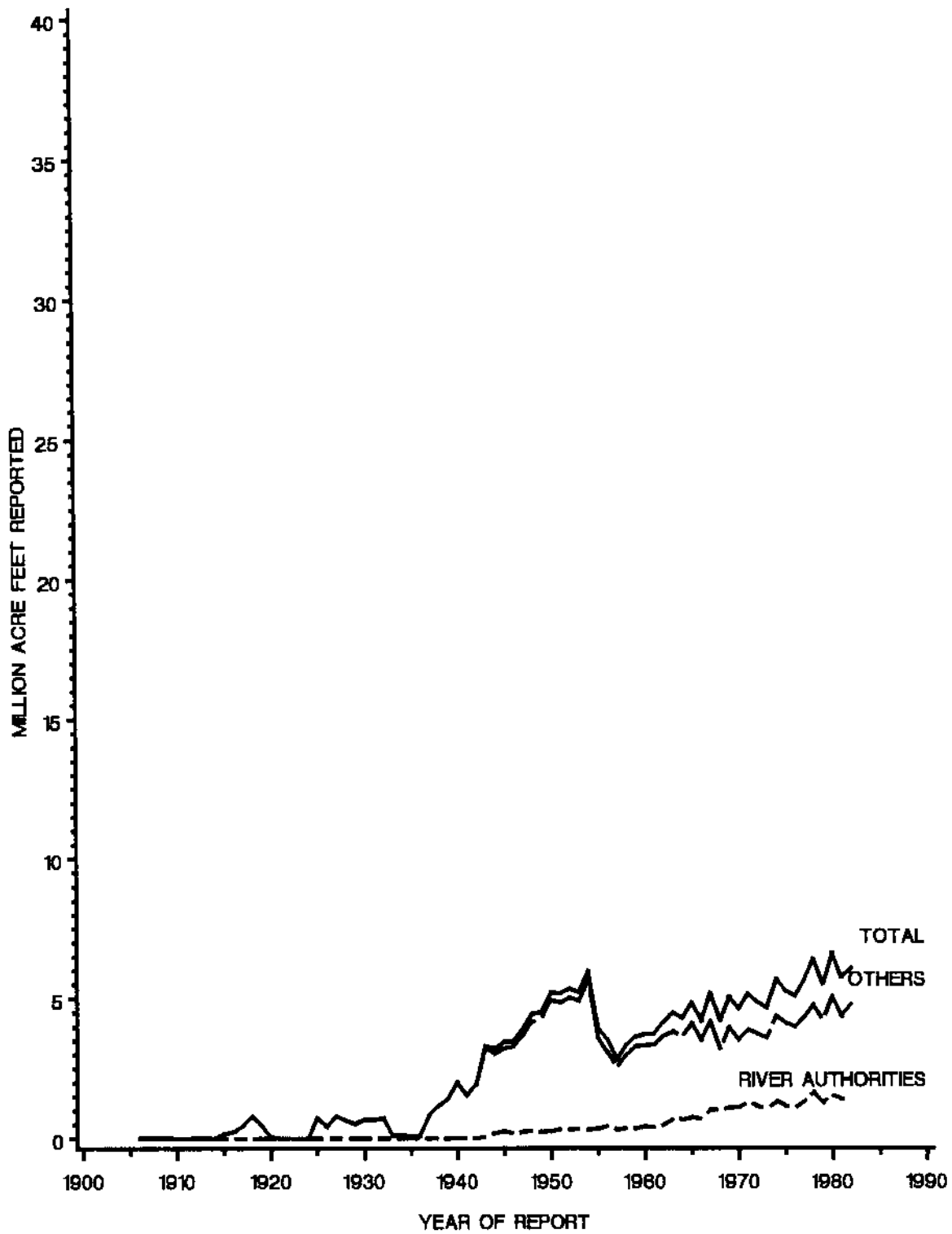


Figure 4. Percent of Surface Water Use Attributed to River Authorities, 1906-1982.

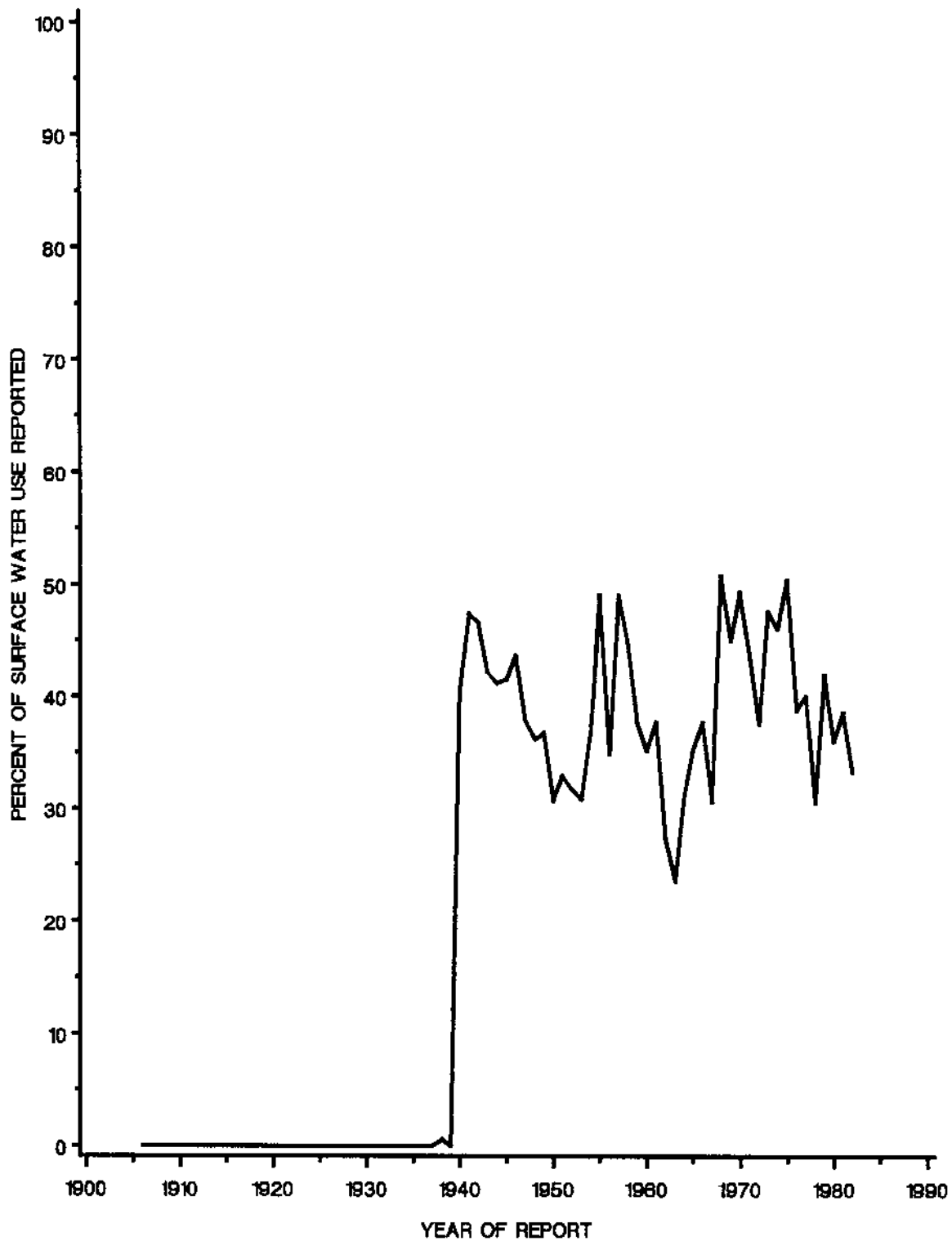
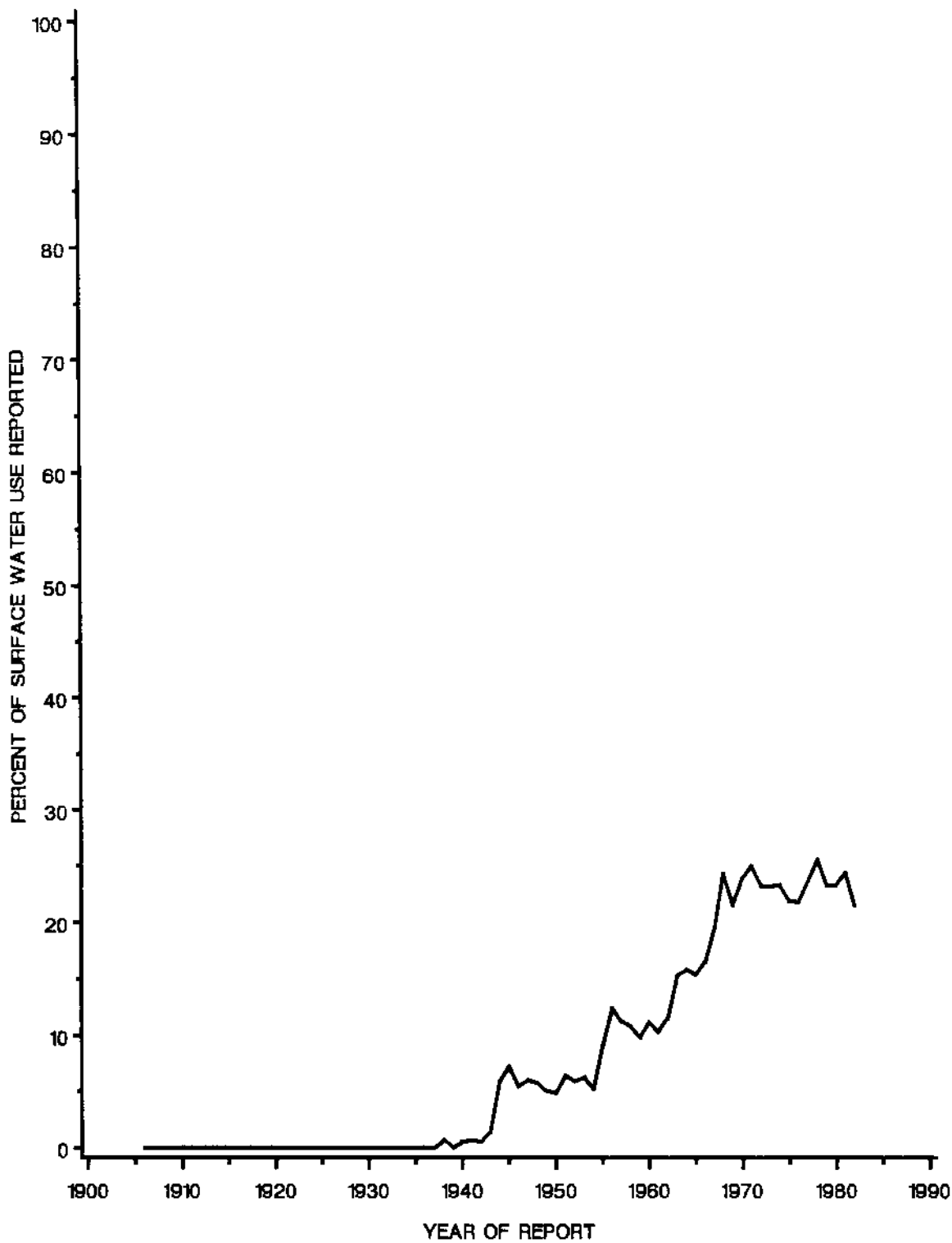




Figure 5. Percent of Consumptive Surface Water Use Attributed to River Authorities, 1906-1982.



River authorities are, in the majority of cases, given the power to supply water both within and without their jurisdictional areas and to acquire the necessary transportation and supply facilities required to deliver the water. The provision to supply water both within and without jurisdictions has been withheld in only three cases, the most notable of which involves the LCRA.<sup>21</sup>

In order to supply water, the river authorities have acquired numerous irrigation canal companies, assisted in the construction of water supply pipelines, constructed water purification and treatment systems, and in some cases built the associated local distribution systems. The acquisition of canal systems began in 1944 when the Lower Neches Valley Authority purchased the water permits, pumping plants, and more than 300 miles of canals owned by the Texas Public Service Company (Lower Neches Valley Authority). Most of the larger canal systems have been acquired by the river authorities throughout the years (Table 5).<sup>22</sup> All of these river authorities currently supply water for agricultural uses (primarily rice irrigation)<sup>23</sup> through their canal systems and seven of the ten systems provide water for industrial uses (for four of these seven, industrial water supply is the predominant current use) (Table 5).

In some instances, water is drawn directly from the reservoirs and transported by pipeline to the user. On the Sabine River Authority's Lake Tawakoni, for example, there are eight separate municipal pumping facilities. In other situations, water is released by a dam upstream, with the industry or municipality pumping directly from the watercourse. The canal systems are all operated in this manner.

In some cases, water purification, treatment, and distribution is also performed by river authorities. The Guadalupe-Blanco River Authority operates rural water treatment and distribution facilities in three counties and water treatment plants for two municipalities. The Trinity River Authority operates four separate domestic water supply systems.

Water importation by river authorities has been allowed in three basins: the Nueces, the Trinity, and the San Antonio. The Trinity River Authority has endeavored to alleviate some of the problems of the City of Houston through the development of Lake Livingston and the Wallisville project, and the Nueces River Authority has attempted to improve conditions for the City of Corpus Christi by cooperating in the Choke Canyon project. The future needs of Corpus Christi, San Antonio, and Houston are becoming serious concerns, however, and the possible need to import water into these areas was recognized by the State legislature when granting powers to these river

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<sup>21</sup> A water rights amendment was required to appease West Texans in the Colorado watershed who felt that such a restriction was needed to prevent the LCRA from exporting "their" water out of the basin and to safeguard future water rights for domestic, municipal, and irrigation uses (Clay, pp. 112-117).

<sup>22</sup> Due to declining rice acreage and the tremendous expense of court-imposed water metering, the Trinity River Authority was unable to repay its loan for this purchase, and the system was sold to the previous owners in December 1986. It is notable that the Trinity River Authority operates its separate water supply and treatment projects as financially distinct entities. The Trinity River Authority was unwilling to subsidize the Devers system with revenues from other operations, and therefore released ownership of Devers canals and water after determining that this system could not be self-sufficient.

<sup>23</sup> For additional descriptions of the use of the canal systems for agricultural uses by river authorities see Griffin, Perry, and McCauley; Griffin and Perry; and Harper and Mjelde.

**Table 5. Canal Systems Purchased by River Authorities**

River Authority	Canal System Purchased From	Year Purchased	Average Water Diversions (1977-1982) (thousands of acre-feet)		
			Agricultural	Industrial	Municipal
Lower Neches Valley Authority	Texas Public Service Company	1944	261.7	138.5	16.6
San Jacinto River Authority	federal government	1951	3.0	47.5	--
Sabine River Authority	Orange Canal Company	1954	7.5	37.6	*
Lower Colorado River Authority	Gulf Coast Canal Company	1960	276.6	3.0	--
Guadalupe-Blanco River Authority	West Side Calhoun Navigation District	1963	52.3	29.0	3.6
Brazos River Authority	American Canal Company	1966	41.9	15.1	--
Brazos River Authority	Briscoe Canal Company	1967	36.9	53.3	--
Trinity River Authority	Devers Canal Company**	1969	77.0	*	--
Brazos River Authority	Industrial Water Company of Galveston County	1971	--	†	--
Lower Colorado River Authority	Lakeside Irrigation Company	1983	122.8	--	--

\* Less than one thousand acre-feet.

\*\* This canal system reverted to private ownership in December 1986.

† Redistributes water from the other canal systems owned by the Brazos River Authority.

authorities.

### *Pollution Control and Groundwater Management*

Many of the river authorities were given specific powers regarding pollution control (Table 6). The most outstanding response to this authorization has been the construction and operation of wastewater treatment facilities by some of the river authorities. The BRA, the Guadalupe Blanco River Authority, the Trinity River Authority, and the San Antonio River Authority have been active in the construction of wastewater treatment facilities. The BRA has constructed three large regional sewage systems, the Guadalupe-Blanco River Authority operates one large municipal sewage plant and four small wastewater reclamation systems and the Trinity River Authority operates three regional wastewater treatment systems (one of the Trinity River Authority systems is a 100-million-gallon-per-day facility located in west Dallas County; another is a pretreatment system for runoff water from the Dallas-Fort Worth Airport). In addition, the San Antonio River Authority operates two sewage treatment plants in the San Antonio vicinity. All of the sewage treatment services are provided through negotiated contracts with cities and industrial firms.

Part of the impetus for river authorities to become involved in wastewater treatment results from the enactment of the Federal Water Pollution Control Act of 1972 and the Clean Water Act of 1977. This legislation raised the maximum federal cost share from 55 percent to 85 percent<sup>24</sup> in the municipal sewage treatment grant program. All of these river authorities have received grants from the EPA for eligible construction costs in their various wastewater treatment projects.

Some of the river authorities are also empowered to provide for solid waste disposal and to control surface water pollution.<sup>25</sup> Many river authorities monitor water quality, wastewater disposal, septic tank placement and use, hazardous waste disposal, and discharge permit applications. The LCRA requires that water customers along its lakes agree to a "zero discharge" to prevent pollution and has approved ordinances designed to control pollution generated by boat marinas operating on its reservoirs (Williams, p. 11).

River authorities are also empowered under state law to prepare regional plans for water quality management. This includes the recommendation of where systems should be sited and which type of system should be constructed and the methods to be employed to finance such facilities. River authorities are also empowered by the state to make applications and enter into contracts for financial assistance under § 3(c) of the Federal Water Pollution Control Act. In addition, several of the river authorities are involved in water quality planning under § 208 of Federal Water Pollution Control Act and the Clean Water Act. § 208 applies to area-wide waste treatment management planning and emphasizes the control of non-point pollution sources.

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<sup>24</sup> The Federal Water Pollution Control Act of 1956 allowed for a federal matching share of 30 percent of the project costs. The 1965 Water Quality Act raised the federal share to 55 percent (Lieber and Rosinoff, p. 12).

<sup>25</sup> Several of the river authorities are involved in water quality planning under § 208 of the Federal Water Pollution Control Act and the Clean Water Act. § 208 applies to area-wide waste treatment management planning and emphasizes the control of non-point pollution sources such as agricultural and urban runoff.

**Table 6. Pollution Control and Groundwater Management Powers of Texas River Authorities**

River Authority	Sewage Treatment and Disposal	Solid Waste Disposal	Monitor and/or Control Surface Quality	Monitor and/or Control Groundwater Quality	Groundwater Recharge	Groundwater Control, Development, and Use
Angelina-Neches River Authority						
Brazos River Authority						
Guadalupe-Blanco River Authority	✓					✓
Lower Colorado River Authority	✓		✓	✓		
Lower Neches Valley Authority						
Nueces River Authority	✓	✓	✓		✓	✓
Red River Authority	✓	✓	✓			
Sabine River Authority	✓	✓	✓			
San Antonio River Authority	✓	✓	✓	✓		
San Jacinto River Authority	✓					
Sulphur River Basin Authority	✓	✓	✓	✓	✓	
Trinity River Authority	✓					
Upper Colorado River Authority						

The LCRA and the San Antonio River Authority are empowered to protect groundwater supplies from pollution, and the Guadalupe-Blanco and Nueces River Authorities are empowered to control, develop, and use groundwater resources. The Nueces River Authority is also empowered to recharge the groundwater aquifer within its basin. However, this power is also possessed by the Edwards Aquifer Underground Water District.<sup>26</sup>

### *Appurtenant Development*

All but one of the river authorities are empowered to develop the hydroelectric potential of their basins (Table 7). However, only four currently operate hydroelectric generating facilities. The most successful has been the LCRA which currently operates six reservoirs with a total generating capacity of 230,000 kilowatts (LCRA 1984, p. 3).

The development of hydroelectric power helped the LCRA, the BRA, and the Sabine River Authority generate the needed income to back their revenue bonds and to support other operations and projects. The BRA operates only one reservoir with hydroelectric facilities: Possum Kingdom Reservoir (22,500 kilowatts of capacity) which was the authority's first project and the primary source of income during its early years. The Sabine River Authority is proud that its Toledo Bend Reservoir (81,000 kilowatts of capacity) operated jointly with the Sabine River Authority of Louisiana "is the only major dam and reservoir project with hydroelectric capacity in the nation to be constructed without federal assistance in the permanent financing" (Sabine River Authority, undated). The potential revenues from the project facilitated the sale of the bonds which removed the need for government assistance. The Guadalupe-Blanco River Authority, on the other hand, used revenue bonds to purchase an existing hydroelectric system consisting of six small reservoirs (16,080 kilowatts of capacity) for which revenue potential was already known.

The electricity generated by LCRA projects is sold directly to municipalities and to rural electrical cooperatives and reflects the New Deal mistrust of the private utility companies as espoused by the TVA. The BRA sells the power from its Possum Kingdom project to an electrical cooperative, as does the Guadalupe-Blanco River Authority. The Sabine River Authority has taken a different approach and sells the power output from its Toledo Bend project to the Gulf States Utilities Company, the Central Louisiana Electric Company, Inc., and the Louisiana Power and Light Company.

The LCRA has been called "Texas' Little TVA" and in terms of electric power has followed a similar course. In addition to the hydroelectric capacity of its reservoirs, the LCRA has developed six steam electric generating plants (1.6 million kilowatts of capacity) to meet the rapidly growing power demands of a 31,000-square-mile electric service area. The LCRA currently operates four units fired by natural gas and two by western coal. Reservoirs such as Lake Bastrop and Cedar Creek were created as cooling reservoirs for these electric generating plants. In 1988, the LCRA plans to bring a unit online powered by locally available lignite and has another in the planning stage. The LCRA provides electricity for 11 electrical cooperatives, 30 wholesale cities, and 3 retail cities in a 41 county area. Approximately 90 percent of the revenue generated by LCRA results from the sale of electricity. Recently, hydropower supplied an average of 7 percent of its customers electrical needs (LCRA 1982, p. 10).

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<sup>26</sup> In order to avoid creation of another entity, the State legislature has recently discussed allowing surface water districts to assume the powers of groundwater conservation districts in some areas (Stagner).

**Table 7. Appurtenant Development Powers of Texas River Authorities**

River Authority	Hydroelectric Power Generation	Thermal Electric Power Generation	Protect, Develop, and Aid Navigation	Construct and/or Operate Navigation Facilities	Right to Bed and Banks of River	Parks and Recreational Development	Oil and Gas Leases
Angelina-Neches River Authority	✓						
Brazos River Authority	✓		✓		✓	✓	
Guadalupe-Blanco River Authority	✓		✓		✓	✓	
Lower Colorado River Authority	✓	✓				✓	
Lower Neches Valley Authority	✓					✓	
Nueces River Authority	✓				✓	✓	
Red River Authority	✓		✓	✓		✓	
Sabine River Authority	✓		✓	✓		✓	
San Antonio River Authority			✓	✓	✓	✓	
San Jacinto River Authority	✓		✓			✓	✓
Sulphur River Basin Authority	✓				✓	✓	
Trinity River Authority	✓		✓	✓		✓	
Upper Colorado River Authority	✓					✓	

Protecting, developing, and aiding the navigation of Texas' rivers is authorized for eight of the river authorities. Four of these are given the additional power to construct and/or operate navigation facilities. In the nineteenth century, attempts were made to open many of Texas' major rivers to steamboat navigation. The Colorado, Brazos, and Trinity are noteworthy examples. However, opening these rivers to large-scale barge traffic has been frustrated because of a combination of the high cost of clearing and deepening the channels and building navigation locks, as well as the general lack of bulk commodities which lend themselves to barge transportation. The channelization of the Trinity River to Dallas has been the subject of much debate throughout the years with large regional economic benefits estimated (Durham), but, in 1982, the Corps of Engineers determined that navigation, except from the mouth of the river to Liberty, is not economically feasible at the present time (Trinity River Authority of Texas 1984b, p. F-1). Due to circumstances like these, river authorities have not become as active in navigation as the TVA. The operation of dams on the rivers, however, positively affected navigation downstream by increasing low water flows and appreciably decreasing the flood flows of the river (Clay, p. 226).

The development of park and recreational facilities by river authorities has been a natural outgrowth of the demand for water-based recreation in Texas. Originally, the public was allowed free access to lands adjacent to reservoirs, except cases when such access would interfere with the operations of the river authority. As this demand increased, fee-supported facilities for camping, picnicking, boating, and swimming were developed, often in conjunction with the Texas Parks and Wildlife Department or local organizations. Most river authorities have developed parks and recreation facilities on their major reservoirs. Recreational development has not always been a byproduct of the construction of reservoirs, however. The Lower Neches Valley Authority, for example, has developed public boat ramps at various points on the Neches River and its tributaries. The San Antonio River Authority has been active in the creation of small-scale neighborhood parks on surplus lands abutting their urban flood control projects and the development of fee-supported recreational facilities on two cooling reservoirs leased from the City Public Service Board of San Antonio.

#### *Governmental and Administrative Powers and Characteristics*

The Board of Directors of river authorities are composed of between six and twenty-four members who serve six-year staggered terms (Table 8). River authorities possess, in varying degrees, the right to adopt an official seal, the right to sue and be sued, the power of eminent domain, the right to adopt and enforce rules, lease, purchase, and dispose of property, accept grants, employ peace officers, and enter into contracts (Thrombley 1959, p. 48). River authorities have the right to issue bonds for land acquisition and project construction, to enter into agreements with companies to issue tax-exempt debt for the construction of pollution control and waste disposal facilities for the companies under the Texas Clean Air Financing Act of 1973<sup>27</sup> and to issue industrial development bonds on behalf of companies under the Development Corporation Act of 1979<sup>28</sup>. Five of the thirteen river authorities have the right to levy

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<sup>27</sup> This is the manner in which many of the river authorities have become involved in the reduction of pollution in their basins.

<sup>28</sup> The river authority has no liability for repayment of the later two types of bonds; the payments from the companies and the property itself represents the only security for the bondholders (BRA 1984, p. 17).



**Table 8. Administrative Characteristics and Powers of Texas River Authorities**

River Authority	Board of Directors* (number)	Power of Eminent Domain	Right to Adopt and Enforce Rules	Right to Issue Bonds	Right to Levy Taxes	Must Prepare a Master Plan
Angelina-Neches River Authority	9 †	✓		✓		✓
Brazos River Authority	21 †	✓	✓	✓	✓	✓
Guadalupe-Blanco River Authority	9 †	✓	✓	✓		✓
Lower Colorado River Authority	15 †	✓	✓	✓		
Lower Neches Valley Authority	9 ‡	✓		✓		✓
Nueces River Authority	21 †	✓	✓	✓	✓	✓
Red River Authority	9 †	✓	✓	✓		✓
Sabine River Authority	9 †	✓	✓	✓		✓
San Antonio River Authority	12 *	✓	✓	✓	✓	✓
San Jacinto River Authority	6 ‡	✓		✓	✓	✓
Sulphur River Basin Authority	6 †	✓	✓	✓		✓
Trinity River Authority	24 †	✓	✓	✓	✓	✓
Upper Colorado River Authority	9 †	✓	✓	✓		

†Appointed by the Governor, with Senate confirmation.

‡Appointed by the Texas Water Commission.

\*Elected locally.

taxes, but none currently do so.<sup>29</sup>

River authorities are the comprehensive water resources planning and coordinating agencies within their jurisdictional areas. In the enabling legislation for most river authorities, the State Board of Water Engineers (or its successor agency) is required to approve the master plan for development of the water resources of the basin before the plan can be implemented.<sup>30</sup> This obligation now falls to the Texas Water Commission. The LCRA, however, does not recognize any authority of the Texas Water Commission to determine the adequacy of its plans and projects for the Colorado basin. The LCRA's enabling legislation does not assign oversight authority to this or any state agency; therefore, the LCRA has never filed a master plan.<sup>31</sup>

### Water Permits

Like other surface water users, river authorities are required to have water permits before diversions and allocations can be made. In the period from 1936 to 1983, over 90 permits for various uses were obtained by river authorities.<sup>32</sup> The majority of these permits, as alluded to earlier, have come from two sources: purchase from canal companies and original filings in reservoir projects. All of the river authorities hold water permits except the Angelina-Neches River Authority, the San Antonio River Authority, and the Sulphur River Basin Authority. The relative importance of the purchase of water permits compared to original filings<sup>33</sup> is illustrated in Figure 5. As of 1983, purchased water permits accounted for 30 percent of the acre-feet of water permits held by river authorities. The only time in which purchased permits exceeded original filings was from 1936 to 1946. In 1962, purchased permits accounted for 42 percent after LCRA's purchase of the Gulf Coast canal system. Since that time,

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<sup>29</sup> The San Antonio River Authority obtained most of the funding for its flood control projects from an ad valorem tax of fifteen cents per one hundred dollars valuation that was approved by the voters of Bexar County in 1951 (San Antonio River Authority 1980, p. 3). The San Antonio River Authority levied a tax of two cents per one hundred dollar valuation during the period 1961 to 1977 to provide operating income for the district. This tax was decreased to one cent per one hundred dollars valuation by 1980 and is not levied at present (San Antonio River Authority 1984, p. 24).

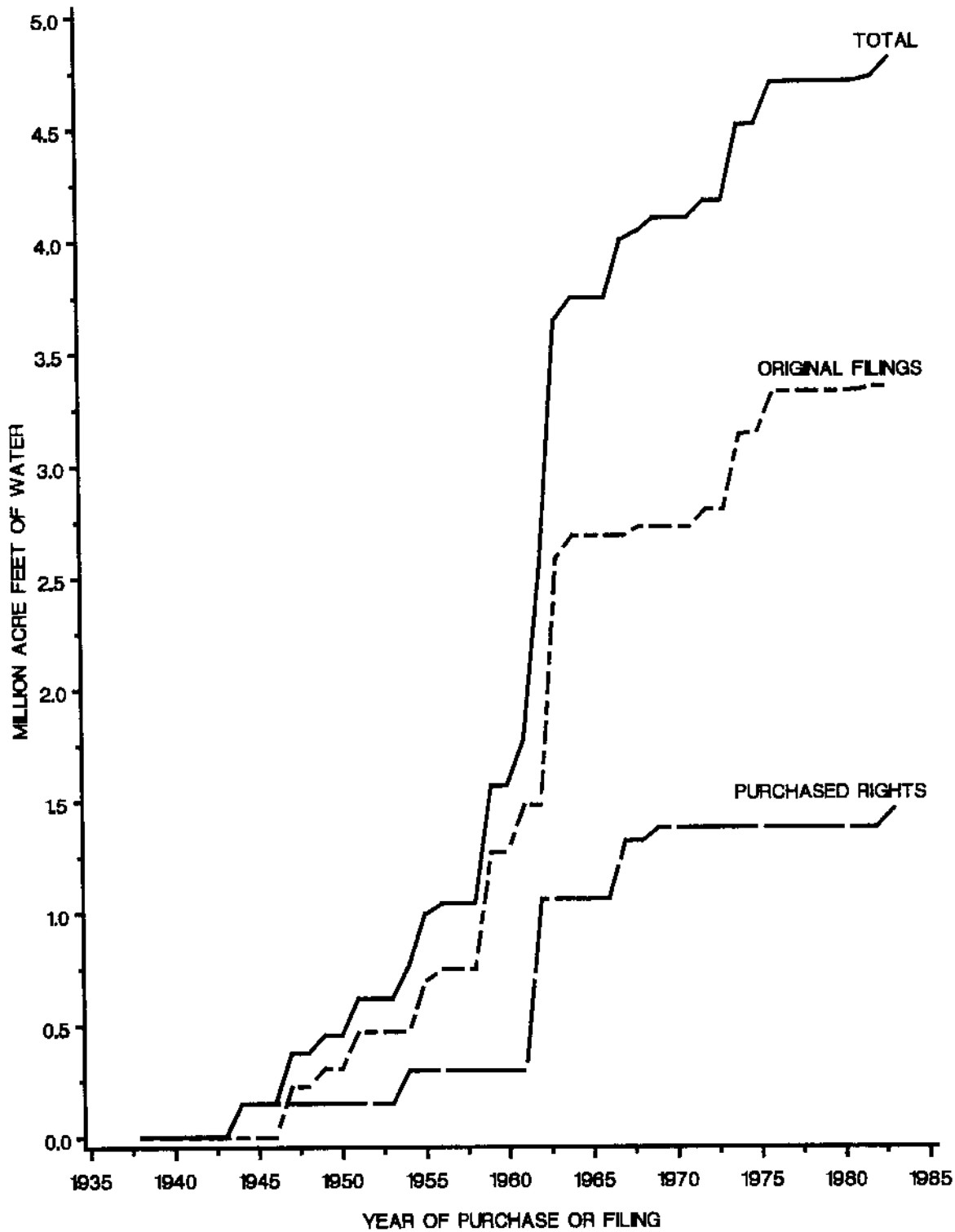
<sup>30</sup> The legislation creating the BRA, Trinity River Authority, Lower Neches Valley Authority, Guadalupe Blanco River Authority, Angelina-Neches River Authority, Nueces River Authority, San Jacinto River Authority, and Sabine River Authority place these river authorities under the "continuing supervision of the Board of Water Engineers" (Thrombley 1959, p. 49).

<sup>31</sup> § 12.081 of the Texas Water Code extends the continuing right of supervision throughout all districts created under Article III, § 52 and Article XVI, § 59. However, the provisions of this section do not apply to any river authority encompassing 10 or more counties which was not subject to the continuing right of supervision on June 10, 1969 (i.e., the LCRA).

<sup>32</sup> A listing of all water permits held by river authorities and their authorized diversions was provided to the authors in the Fall of 1984 by the TDWR. Dates of transfer or filing were determined by checking the original permits on file in the archives of the TDWR.

<sup>33</sup> Original filings are for water which has not been previously allocated. Most of the filings by river authorities are for conservation storage in reservoirs.

Figure 6. Source of Nonhydroelectric Water Permits Held by River Authorities, 1936-1983.



however, river authorities have widened the gap by filing for permits in such reservoir projects as Proctor, Belton, Stillhouse Hollow, Somerville, Granbury, Granger, Georgetown, Limestone, and Aquilla in the Brazos River Basin; Sam Rayburn in the Neches; Lake Fork in the Sabine; Cedar Creek in the Colorado; Joe Pool in the Trinity; and Choke Canyon in the Nueces. Applications for these permits are filed years in advance of actual completion of the reservoir and establish an early priority date for the water permit.

No hydroelectric water permits are included in Figure 6 because hydroelectric power generation is a nonconsumptive use of water, and allowed diversions are not always specified in these permits. As of 1983, use of water for hydroelectric power generation is authorized under seventeen different permits for four river authorities: The LCRA alone holds thirteen permits, the Guadalupe-Blanco River Authority two, and the BRA and the Sabine River Authority one each. The LCRA purchased five of its permits from the Central Texas Hydroelectric Company in the 1930s, and the Guadalupe-Blanco River Authority obtained its permits from the purchase of six small hydroelectric reservoirs from the Texas Hydroelectric Corporation and others in 1963.

The expansion of authorities' water permits through purchases is evidence of the entrepreneurial abilities of these organizations. Because river authorities are not supported by state appropriations, water permit acquisitions are typically financed through bond issuance or a note to the seller with repayment to come from expected revenues. Some authorities are better positioned than others for future water permit acquisitions as a result of their revenue-generating potential. This advantage often applies to authorities with power generation activities or heavy involvement in municipal or industrial water supplies (as opposed to agricultural water supplies). Conceivably, high revenues may become a perplexing policy issue. River authorities are nonprofit organizations and cannot disseminate profits to shareholders. Rates can be reduced, but reduction may create excess demand and undervalue the resource (water or electricity) with negative implications for resource allocation and conservation. Operating costs can be increased by intensifying management activities, but this practice could become wasteful. Excess revenues can be used to fund further expansion (such as water permit acquisitions), but expansion opportunities may become limited and, again, this approach may not be optimal.

### **Recent Legislation Affecting River Authorities**

Several pieces of legislation affecting river authorities have been passed by the Texas Legislature in recent years. This legislation includes the application of the Sunset Act to river authorities and the establishment of the "Water District and River Authority Study Committee" in 1985. These actions and other legislation attempt to subject river authorities to more state supervision. Proposed policies seem to be consistent with a national trend to establish greater accountability by water management districts (DeYoung).

The Sunset Act provides for review of the activities and duties of state agencies. The Sunset Advisory Commission, established under this act, has the responsibility to determine if a public need exists for the continuation of a specific state agency. The Commission can recommend that a particular agency be abolished, continued, or reorganized, or that programs of state agencies be consolidated, transferred, or reorganized. The application of this act to river authorities was passed in an amendment to the Sunset Act and was effective as of August 26, 1985. The amendment

lists 19 "river authorities" who are all due for review September 1, 1991.<sup>34</sup> A bill to exempt river authorities from Sunset review failed during the 1987 Legislative Session.

The Water District and River Authority Committee was created to determine if the power and duties of the districts created under Article XVI, § 59 of the Texas Constitution are appropriate for the management of Texas' water resources. They were also charged with determining whether the state's role relative to the creation and operation of such authorities should be changed. The Committee found that "the existing water resource management structure should be changed to establish State supervisory authority over all districts and authorities ..." (Water District and River Authority Study Committee, p. 2). The Committee issued a set of recommendations regarding water districts and river authorities including that (Water District and River Authority Study Committee, pp. 13-22):

- all applicants for water permits or financial assistance from the State to submit water conservation plans and implement reasonable conservation measures,
- all non-exempt surface water diversions be metered,
- conservation-oriented water rate structures be employed,
- educational programs to promote water conservation be implemented,
- agricultural water conservation be encouraged, including usage of acceptable measuring devices at the point of diversion,
- all districts and authorities be subject to uniform rules and regulations by the State which take into consideration regional resources and uses,
- the continuing right of supervision over districts and authorities delegated to the Texas Water Commission be revised to apply to all districts and authorities,
- regional advisory committees be appointed to examine the problems in regions of the state where appropriate,
- an appropriate legislative oversight body be created to oversee the water resource management, development, and regulation process in the State, and
- clearer and more thorough financial reporting be required.

These recommendations were generally embodied in a set of bills which failed during the 1987 legislative Session as a result of their relationship to Sunset exemption.

The 1983, 1985, and 1987 Legislative Sessions have not found river authorities to be docile or apathetic. Rather, these organizations have attempted to influence legislation, both collectively and independently. River authority opposition to bay and

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<sup>34</sup> This list includes the Bandera County River Authority, Central Colorado River Authority, Kimble County River Authority, Lavaca-Navidad River Authority, Mason County River Authority, Palo Duro River Authority, and Upper Guadalupe River Authority, but excludes the Lower Neches Valley Authority.

estuary protection measures in 1983 is particularly well acknowledged (Holley).

## Conclusions

The use of river authorities by the State of Texas as an organization to manage water resources has been a successful innovation if one measures success in units of water. More worthy measures of success are unavailable. Similar in concept to the TVA, river authorities are endowed with broad powers for the development of the water resources within their jurisdictions. However, unlike the TVA, the river authorities of Texas have not had the benefit of an annual appropriation to rely upon, and, *as a direct result*, have developed somewhat differently. Some river authorities have been very active in their particular basins, while others have been largely dormant. Many operate large reservoir systems for flood control and water supply. Some are involved in the generation of electricity and the treatment of sewage for cities and towns. Others are somewhat inert agencies and provide only very limited services. River authorities have been granted broad powers with respect to soil conservation, forestation, drainage, and navigation, but these powers have gone largely unused.

Some of the river authorities in Texas have attained a TVA-like stature within their basins. The LCRA is the best example, because it has become a major supplier of electricity to a large section of central Texas. However, its scale of operations is much smaller: In 1984, the LCRA generated 6,972 million kilowatt hours of electricity (LCRA 1984, p. 18) compared to 113,978 million kilowatt hours for the TVA (TVA, p. 54).

What began as a funnel to expedite the flow of federal dollars into the state has become an important water management organization in several regions. This importance was, in nearly all cases, initiated by federal support, although several river authorities have complemented their water permit holdings through water permit purchases. Opportunities to create new river authorities have probably dried up along with federal subsidies. As a related point, the drastic reduction in reservoir construction caused by the virtual elimination of federal participation may usher in an era when purchased permits become the dominant source of river authority water permits. While no data exists to support or refute this stance, experience and contacts with river authority personnel suggest that they are very positive about opportunities for effecting water reallocation to higher-valued uses. The reason is obvious: authority revenue is enhanced. Governing board composition can act as a deterrent to actively reallocating water. For example, board members who are sensitive to the desires of the farming community may rail against reallocating irrigation water to other use designations. Casual observation does suggest, however, that agricultural representation on boards of directors tends to decline over time.

Among future forces shaping river authorities are further population increases and commercial and industrial development. These changes will encourage greater reallocations of water from traditional irrigation to residential/commercial/industrial water use. Water purveyors, such as river authorities, have a comparative advantage in water allocation because their water specialization (with attendant engineering and legal expertise) lowers transaction costs. While permanent sales of water permits by

river authorities will be a very uncommon occurrence,<sup>35</sup> authorities can excel in buying water permits and leasing them to users, or entering into long-term contracts to deliver water (often to cities). Thus, market transfers of water in which river authorities act as a sort of possessory intermediary may increase river authority water permit holdings.

The importance of river authorities in some regions and the insignificance in others is a sign of strength rather than weakness in the river authority concept. This variability demonstrates the flexibility of the institution to adapt to areal conditions. Similar variability in the functions pursued by river authorities illustrates another useful dimension of flexibility. But flexibility can be a disadvantage, too. Recent legislation impacting river authorities has highlighted the accountability issue. A growing public and political attitude maintains that river authorities have too much discretionary latitude—too much flexibility and independence. The state’s response has been to attempt to subjugate river authorities to a more homogeneous set of restrictions and procedures. It is, unfortunate, perhaps, that the increased pressure of the state’s regulatory biases tends to force conspicuous organizations, such as river authorities, into defensive postures as they seek lower profiles and focus upon newfound responsibilities to unfamiliar overseers. These changes act to constrain modifications within management practices and activities chosen by river authorities, thereby reducing the flexibility to address new circumstances in the future. Perhaps state efforts, especially those of the Texas Water Commission, will recognize the desirability of adequate economic incentives for encouraging river authorities to conduct appropriate water management activities. All too often, bureaucratic actions to enforce resource management result in the installation of inflexible “command-and-control” systems rather than economic incentives (Schultze, p. 6). Policy-makers should remain mindful that river authorities have been effective in developing projects that satisfy economic demands. Because they do not receive state appropriations, river authorities are naturally attracted to efforts in which rewards equal or exceed costs. If the activities of river authorities appear to be deficient, the appropriate solution may be to revise their economic incentives to achieve desired goals rather than to impose regulatory restrictions.

On the other hand, if left alone, aggressive river authorities could conceivably increase their water permit holding to monopoly status within a region. Whether this is good or bad clearly depends on the authority’s actions in water allocation, development, and rate establishment. One very clear and demonstrated problem is the tendency of river authorities to neglect public water uses. By definition, a public water use (a) is relatively nonconsumptive and (b) cannot be easily denied to consumers who do not pay for the use (nonexclusion). Public water uses include recreational activities to various degrees (i.e., fishing and boating), scenic and aesthetic uses, and freshwater flows to support estuaries.

The dichotomy separating public and private uses is significant because the nonexclusion characteristic of public uses implies that opportunities for generating revenue are slight in comparison to private uses. This is not to say that public uses are without social value, only that public uses are not sufficiently valuable (in a monetary sense) to river authorities. As a result, uncorrected water management by river authorities underallocates water to public uses from the perspective of relative social values. Reservoir construction by river authorities supplies private and public uses jointly, so some public water uses have been a necessary byproduct of water development. However, whenever private and public uses compete, river authorities are inclined to favor private uses because they have more profit potential.

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<sup>35</sup> Job security and remuneration for river authority employees depends on keeping water permits—not selling them.

According to Derthick, regional organization is a response to the scale, coordination, and centralization problems of state and local governments. Likewise, the design of Texas river authorities is not entirely without problems. Also, coordination remains an unsolved issue because conflict is still present and mandated self-sufficiency causes public water uses to be underprovided. The outcome of recent legislative action illustrates that the structure of the river authority concept is a dynamic structure which is undergoing change to meet current and future water resource needs.



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