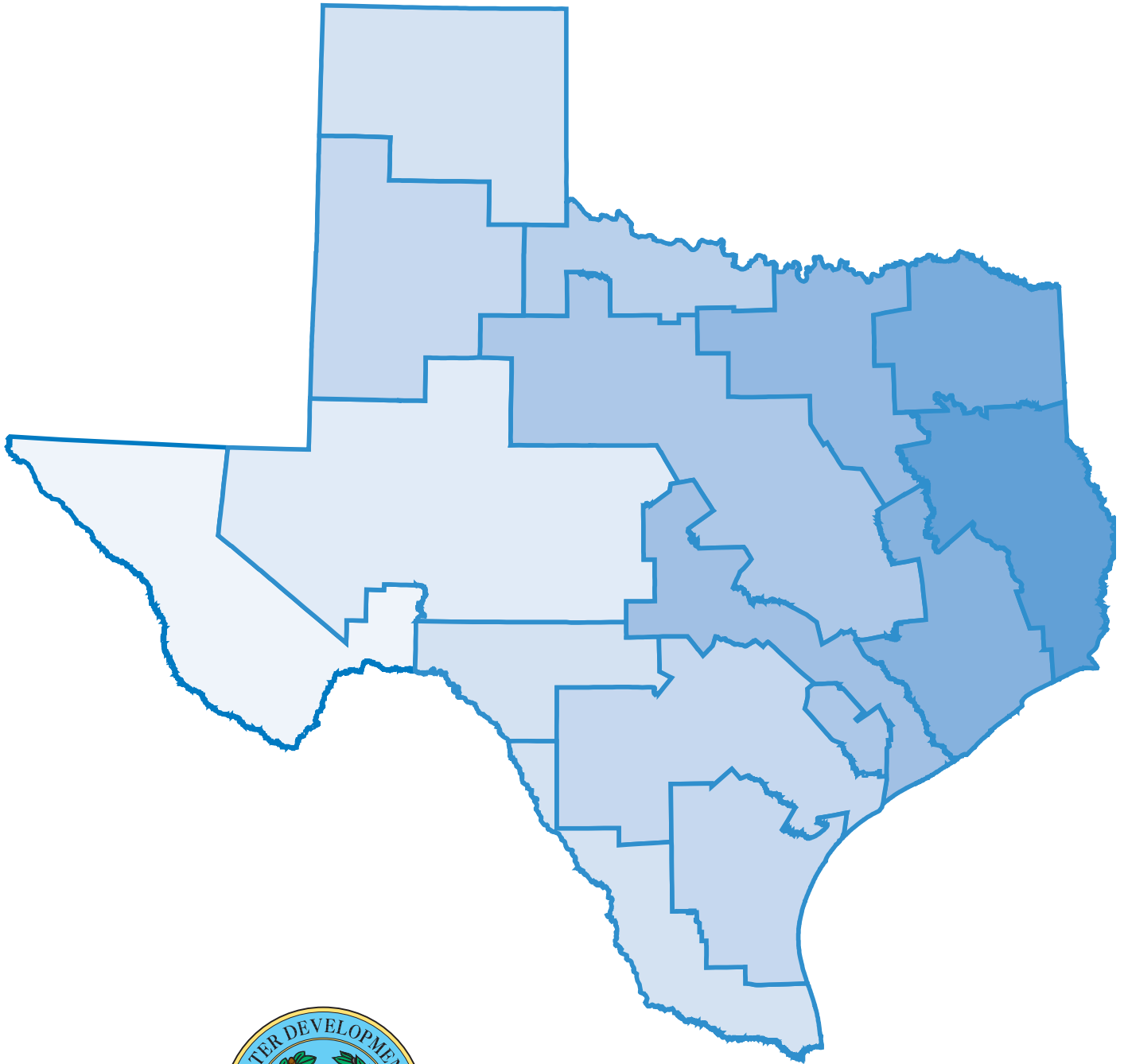


Water for Texas – 2002



Texas Water Development Board
January 2002



TEXAS WATER DEVELOPMENT BOARD



William B. Madden, *Chairman*
Jack Hunt, *Member*
Noé Fernández, *Member*

Craig D. Pedersen
Executive Administrator

Wales H. Madden, Jr., *Vice-Chairman*
William W. Meadows, *Member*

December 31, 2001

To: The People of the State of Texas
The Honorable Rick Perry, Governor of Texas
The Honorable Bill Ratliff, Lieutenant Governor of Texas
The Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives
The Honorable J. E. "Buster" Brown, Chair, Natural Resources Committee, Texas Senate
The Honorable David Counts, Chair, Natural Resources Committee, Texas House of Representatives

Transmitted herewith is the first State Water Plan, Water for Texas – 2002, adopted pursuant to Senate Bill 1, 75th Texas Legislature. The Texas Water Development Board adopted this plan unanimously on December 12, 2001.

This plan realizes Senate Bill 1's vision for an open and participatory process with specific decisions made at the regional level. It identifies actions to be used to meet local water needs during a drought of record and over the next 50 years. By incorporating the 16 approved regional water plans, this plan reflects the combined penmanship of over 450 regional water planning group members. In addition to incorporating the approved regional water plans, the Board also sought the input of an advisory stakeholder group and the general public in preparing the policy recommendations contained in this plan.

Volume I contains statewide water resource information, results of the regional water planning process, lists of recommended unique reservoir sites and river and stream segments of unique ecological value for the Legislature to consider, and policy recommendations. Volume II provides detailed water supply strategies for each city, town and area in the State. Volume III includes electronic copies of the 16 approved regional water plans.

The regional and state water planning process is dynamic in nature. Already, the next round of regional water planning is underway. These plans will be subject to ongoing revisions as the Planning Groups respond to changed conditions and new information. In addition, the formally revised regional water plans will be submitted by January 5, 2006 with a revised State Water Plan following one year later.

This planning must recognize that rapid growth will continue to exert great pressure on the capabilities of many local governments to implement and finance the strategies included in the regional water plans. Without implementation, Texas will not be able to keep pace with this growth and related environmental, health, and public safety concerns.

William B. Madden
Chairman

Craig D. Pedersen
Executive Administrator

Our Mission

Provide leadership, technical services and financial assistance to support planning, conservation, and responsible development of water for Texas.

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Fax (512) 475-2053 • 1-800-RELAYTX (for the hearing impaired)
Web Address: www.twdb.state.tx.us • E-Mail Address: info@twdb.state.tx.us
TNRIS - The Texas Information Gateway • www.tnris.state.tx.us
A Member of the Texas Geographic Information Council (TGIC)



Water for Texas – 2002

Volumes I - III

Texas Water Development Board

William B. Madden, Chairman, Dallas
Jack Hunt, Member, Houston
Noé Fernández, Member, McAllen

Wales H. Madden, Jr., Vice-Chairman, Amarillo
William W. Meadows, Member, Fort Worth

Craig D. Pedersen, Executive Administrator

Section 16.051 of the Texas Water Code directs the Texas Water Development Board to prepare, develop, formulate, and adopt a comprehensive State Water Plan that incorporates the regional water plans approved under Section 16.053. The State Water Plan shall provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions, in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of the entire State.

Authorization for use or reproduction of any original material contained in this publication, i.e., not obtained from other sources, is freely granted. The Board would appreciate acknowledgment.

Published and Distributed
by the
Texas Water Development Board
P.O. Box 1323, Capitol Station
Austin, Texas 78711-3231

January 2002
Document No. GP-7-1
(Printed on Recycled Paper)

Table of Contents

VOLUME I

1.0	Highlights and Major Policy Recommendations of the 2002 State Water Plan.....	1
2.0	Introduction.....	13
2.1	Organization of the Plan	14
3.0	History of Water Planning in Texas.....	17
4.0	Water Planning Process	21
4.1	Regional Water Planning Areas.....	21
4.2	Regional Water Planning Groups (Planning Groups)	22
4.3	Regional Water Planning.....	23
4.4	Coordination between Planning Groups, States, and Mexico	24
5.0	Methodology and Results.....	25
5.1	Population Projections	25
5.1.1	TWDB Projections and the 2000 Census.....	27
5.2	Water Demand Projections.....	27
5.2.1	Municipal Water Demand	31
5.2.1.1	Per Capita Water Use	31
5.2.1.2	Conservation	34
5.2.1.3	Projections	34
5.2.2	Manufacturing Water Demand	34
5.2.3	Irrigation Water Demand.....	35
5.2.4	Steam-Electric Power Water Demand.....	36
5.2.5	Mining Water Demand	36
5.2.6	Livestock Water Demand	37
5.2.7	Criteria for Revision of Water Demand Projections.....	37
5.3	Water Supply Projections	37
5.3.1	Groundwater.....	38
5.3.1.1	Aquifers of Texas	38
5.3.1.2	Groundwater Availability	43
5.3.1.3	Groundwater Supplies.....	43
5.3.2	Surface Water	47
5.3.2.1	River Basins.....	47
5.3.2.2	Reservoirs.....	48
5.3.2.3	Surface Water Availability and Supplies	48
5.3.3	Wastewater Reuse.....	56
5.3.4	Total Supplies for the Planning Areas	58
6.0	Environmental Planning.....	59
6.1	Environmental Flow Needs and Unique Stream Segments.....	59
6.2	New Environmental Assessment Tools.....	61
7.0	Identification of Needs.....	63
7.1	Water User Groups and Major Water Providers with Needs.....	63
7.2	Needs by River Basin.....	64
8.0	Recommended Water Management Strategies	69
8.1	Water Conservation.....	71

Table of Contents *(continued)*

8.2	Groundwater.....	72
8.3	Surface Water.....	73
8.4	Reuse.....	73
8.5	Desalination.....	74
8.6	Brush Control.....	74
8.7	Major Conveyances.....	74
9.0	Implementation Cost Estimates 2001–2050	79
10.0	Alternative Strategies.....	83
10.1	Voluntary East Texas Surface Water Transfers	83
10.2	Playa Modification	84
10.3	Additional Desalination	84
11.0	Regional Summaries.....	86
12.0	Socioeconomic Impacts.....	119
12.1	Estimating Socioeconomic Impacts	119
12.2	Impacts of Not Meeting Water Needs	121
13.0	Status of Water Availability Modeling.....	123
13.1	Groundwater Availability Modeling.....	123
13.2	Surface Water Availability Modeling.....	124
14.0	Policy Recommendations	127
14.1	Policy Recommendations from the Planning Groups.....	127
14.2	Recommendations for Designation of Stream Segments of Unique Ecological Value.....	135
14.3	Recommendations for Unique Reservoir Sites	136

List of Figures

3-1	History and projected future of reservoir development in Texas.....	18
4-1	Location of the 16 regional water planning areas in Texas.....	22
5-1	Projected population growth in Texas.....	26
5-2	Numerical difference between TWDB’s projection for 2000 and the 2000 Census.....	28
5-3	Percent difference between TWDB’s projection for 2000 and the 2000 Census.....	28
5-4	Projected water demand for irrigation, municipal, and manufacturing water uses during drought.....	30
5-5	Projected water demand for steam-electric, livestock, and mining water uses during drought	30
5-6	Regional per capita water demand projections for 2000-2050	32
5-7	Analysis of total 1999 water use by county in Texas, illustrating dominant supply source....	39
5-8	The major aquifers of Texas.....	40
5-9	The minor aquifers of Texas	41
5-10	Location of the Yegua-Jackson aquifer in Texas.....	42
5-11	Groundwater availability for aquifers of Texas under drought conditions, as reported by Planning Groups	44
5-12	Percent of available groundwater remaining for the Carrizo-Wilcox, Gulf Coast, Ogallala, Edwards-Trinity High Plains, and Hueco-Mesilla Bolson aquifers through 2050.....	45
5-13	Current groundwater, surface water, and wastewater reuse supplies from existing sources through 2050 under drought conditions	46

Table of Contents *(continued)*

5-14	Major river basins of Texas	49
5-15	Surface water availability index.....	50
5-16	Surface water supply index	51
5-17	Surface water availability for the different river basins in 2000 under drought conditions....	52
5-18	Existing interbasin transfers in the State	56
6-1	Environmental flow criteria for regional and State water planning	60
7-1	Number of water user groups with projected needs Statewide.....	64
7-2	Number of water user groups with projected needs in regional water planning areas in 2050	65
7-3	Volume of needs in regions in 2050.....	65
7-4	Volume of needs Statewide in 2050.....	66
7-5	Counties in Texas with unmet needs in 2050	67
8-1	Statewide comparison of demands versus supplies with and without implementation of the regional water plans.....	69
8-2	Volumetric comparison of the various sources of water utilized by recommended water management strategies to meet needs in the regional water plans.....	71
8-3	Major and minor reservoirs recommended in the regional water plans to meet needs	75
8-4	Major water conveyances proposed by Planning Groups	77
9-1	Relative proportion of estimated capital costs to meet water-related needs for Texas through 2050	81
9-2	Through 2050, capital costs of (1) water supply, (2) drinking water (infrastructure), (3) wastewater, and (4) total capital costs, for the 16 planning areas	81
9-3	Capital costs on a per capita basis comparing projected population in 2050 and total capital costs through 2050.....	82
13-1	Locations and expected completion dates of groundwater availability models of the major aquifers of Texas	125
14-1	Reservoir sites and unique stream segments recommended by Region H	137
14-2	Unique reservoir sites proposed by Planning Groups	140

List of Tables

4-1	List of Planning Groups	21
5-1	Projected population through 2050 for different planning areas	26
5-2	Population and water use in 1990, with projections of future population and annual water demand for 2000-2050	29
5-3	Projected demand for water for each planning area under drought conditions	29
5-4	Projected per capita water use for 40 largest cities of Texas under drought conditions, grouped and ordered by 2000 value.....	33
5-5	Groundwater supplies from existing sources under drought conditions for the different aquifers, as reported by Planning Groups	46
5-6	Surface water supplies from existing sources under drought conditions for the different river basins, as reported by Planning Groups	52
5-7	Existing interbasin transfers.....	53
5-8	Groundwater, surface water, wastewater reuse, and total supplies from existing sources under drought conditions for different planning areas	57

Table of Contents *(continued)*

6-1	Environmental checklist	61
7-1	Number of major water providers with projected needs in regional water planning areas	63
7-2	Volume of needs for different water use categories (AFY)	64
7-3	Volume of needs for water user groups in river basins (AFY)	68
8-1	Major water conveyances proposed by Planning Groups	76
9-1	Capital costs of water-related services included in the 1997 State Water Plan	80
9-2	Capital costs of water-related services included in the 2002 State Water Plan	80
12-1	Direct economic benefit per acre-foot of water for different water uses in the regions.....	120
12-2	Direct economic benefit per acre-foot of water for different manufacturing water uses in the State	120
12-3	Economic output, income, and employment multipliers	121

Appendix I

Policy Recommendations from Stakeholders		141
--	--	-----

Plate

Existing major water supply and permitted reservoirs (see insert)		
---	--	--

VOLUME II

1. Water User Group Summaries

1.1	Water User Group Name	
1.2	Water User Group Region	
1.3	Water User Group County	
1.4	Water User Group Basin	
1.5	Projected Population	
1.6	Projected Water Demand	
1.7	Sources and Supply Amounts	
1.8	Needs Analysis	
1.9	Recommended Water Management Strategies	
1.10	Overall Water Balance including Strategies	

2. Major Water Provider Summaries

2.1	Major Water Provider Name	
2.2	Major Water Provider Region	
2.3	Contracts and Demands	
2.4	Sources and Supply Amounts	
2.5	Needs Analysis	
2.6	Recommended Water Management Strategies	

VOLUME III

1.	Electronic Version of Volume I	
2.	The 16 Approved Regional Water Plans	
3.	Stakeholders Report	

1.0 Highlights and Major Policy Recommendations of the 2002 State Water Plan

The Texas Water Development Board (TWDB) is proud to present *Water for Texas—2002*, the seventh State Water Plan adopted since the drought of the 1950's. As the title states, the goal of *Water for Texas—2002* is to provide a grassroots water plan that, if implemented, will meet the needs of all Texans, even during conditions of drought. While some needs may remain unmet, the degree to which this plan achieves that goal is unprecedented, both for the State of Texas and for any other water resource planning effort.

Water for Texas—2002 is the first State Water Plan to be adopted by the TWDB since the passage of Senate Bill 1 during the 1997 Texas Legislature. One of the primary elements of Senate Bill 1 changed the planning process to one based on public participation at each step of the process and local and regional decisions to produce regional water plans—plans that then form the basis of the State Water Plan. The process focused on local and regional decisions to help achieve the goal of increasing the chance of plan implementation over that of previous, more centralized plans. There is no question about the benefits resulting from local decision making and the increase in public participation, public education, and public awareness. The Planning Groups, initially appointed by the TWDB under the authority of Senate Bill 1, eventually included approximately 450 representatives having a broad array of interests, including 11 interest group categories specifically required by statute. They worked for more than 3 years to develop their 16 regional plans. Nearly 900 public meetings across the State were held by the Planning Groups as they developed the 16 regional water plans. The Planning Group members spent thousands of hours and traveled as many miles as they created these plans. Clearly, public education and understanding of water resource issues will continue to grow as a result of such efforts.

A great wealth of information has been provided by the Planning Groups on water demands, supplies, actions needed, and a host of other issues and policy recommendations. The Legislature enacted changes during the 77th Session on four of the six recommendations common to all of the regional plans (See Section 14.1). The changes were to continue the planning process, provide adequate funding for regional water planning, provide adequate funding for implementing water plan recommendations, and clarify Senate Bill 1 provisions on unique stream segments. The Legislature and TWDB also followed the Planning Groups' recommendation to make certain administrative activities eligible for funding. However, the Legislature did not enact changes to address the last common requirement that the Planning Groups wished to change—allowing alternative strategies rather than specific water management strategies for water user groups with needs.

To further maximize public input in the development of policy recommendations in the 2002 State Water Plan, TWDB drew on the input of a stakeholder advisory group. Eighty-three persons from across the State represented a broad array of those interested in water, including Planning Group members, cities and other political subdivisions, agriculture, environmental and other interest groups, and State agencies. This group met in a public forum 5 times as a large body and approximately 15 times in smaller roundtables with other persons interested in specific policy issues.¹

¹ See Appendix I to Volume I for a discussion of the stakeholder process and a list of recommendations and Volume III for the complete text of the stakeholders' report to the TWDB.

The Texas Water Code §16.051 (b) states that the State Water Plan “*shall be a guide to State water policy*” in Texas. **The 2002 State Water Plan incorporates the approved regional water plans. But to meet this statutory charge of being a policy guide, the TWDB believes that it is necessary to highlight broad conclusions from the regional water plans, tie them together with some common threads, and link them to key policy issues. For the regional water plans and, by inference, the 2002 State Water Plan to be successfully implemented, these recommendations will require legislative or regulatory action.**

TWDB presents the following discussions and recommendations to meet these goals. **Data, water management strategies, key policy recommendations from regional water plans, key stakeholder-process policy recommendations (which have built on this earlier work), and ideas from the TWDB have been integrated into the narrative that follows.** The regional water plan recommendations and stakeholder policy recommendations are included in Section 14.1 and Appendix I, respectively, and should be reviewed for a more thorough exploration of the policy issues facing Texas. Owing to the wide diversity in Texas, not all of the recommendations, both from the Planning Groups and the stakeholder process, represent consensus. So many recommendations have been made that not all could be included in this section. Their absence should not be construed as a lack of support or appreciation of any of these recommendations.

Water: The Driving Influence

The regional planning process focused on identifying actions necessary to meet water needs during drought-of-record conditions. Droughts in Texas are a recurring phenomenon, and the regional water plans have identified ways for most, but not all, water users to address their water needs. However, it should be noted that future climatic conditions may induce droughts more severe than those experienced during the historical period of record. Thus, planning for drought-of-record should not be viewed as planning for the “worst-case scenario” because future droughts may be worse than those for which we have historical data. In some cases, drought will require painful choices because the Planning Groups were unable to identify solutions for all users to meet their needs. As a result, some needs during drought will be unmet and shortages will occur.

By 2050, almost 900 cities (representing 38 percent of the projected population) and other water users will need either to reduce demand (through conservation and/or drought management) or develop additional sources of water beyond those currently available to meet their needs during droughts.

Total inability of current water sources to meet demands increases from 2.4 million acre-feet per year (AFY) in 2000 to 7.5 million AFY in 2050. This includes water users that cannot rely on current sources because contracts expire during the planning period. Twenty percent of irrigation demand cannot be met by existing sources were a drought-of-record to occur today. Seven percent of municipal demand would not be met by existing sources if a drought were to occur now. **However, if a drought occurs in 2050, almost half (43 percent) of the municipal demand could not be satisfied by current sources.** Similar percentages of manufacturing and steam-electric power generation demands could not be met in 2050. While the exact consequences are impossible to specify, failure to meet these demands would have an unacceptable impact on the people and economy of the State. **The best response to this situation is a thoughtful, feasible, long-term plan for water supply acquisition and demand reduction.**

The regional water plans developed over the past few years are an excellent first step in that process, but the work must continue. These plans, by law and by necessity, are works in progress. Many Planning Groups identified areas on which they wanted to refocus or add to even as they were finalizing the first regional

water plans. It will be especially important for all interest groups to participate throughout the next round of planning to ensure that all aspects are considered. **This important planning and educational process must be allowed to continue its good work.**

The success of the regional water planning process is highlighted by the cooperative agreements that were reached. Growth throughout the State may occur in areas where water resources are not available, creating either conflict or the opportunity for regional cooperation. **One of the great successes of the Senate Bill 1 planning process has been the work of Planning Groups who have turned previous conflicts into opportunities for win-win outcomes.** An example of this regional cooperation occurred when Region C and the North East Texas Region together developed a proposal for a major project to benefit both regions. The Lower Colorado Region and South Central Texas Region also worked together on solving a major water supply need of the San Antonio area in a cooperative sharing of water resources. Entities in the Dallas-Fort Worth area are working together on possibly using water from Oklahoma. The South Central Planning Group created numerous water-sharing initiatives within their region. The planning process created a forum that fostered cooperation, which in turn encouraged solutions involving interbasin transfers of water. This forum reduced distrust and allowed creation of win-win solutions of problems that only a few years ago appeared to be intractable. More of this activity needs to occur.

TWDB makes the following major policy recommendations:

1. The regional water planning process should continue.
2. Planning Groups should continue exploring the potential for voluntary, cooperative agreements that can meet water supply, quality, management, and financing needs of all parties while protecting critical instream flows and freshwater inflows to our bays and estuaries. The Legislature should consider ways to encourage this process to continue, support the Planning Groups in their efforts, and find meaningful ways to back their proposed solutions, including passage of targeted legislation. Unless the Legislature encourages voluntary, cooperative agreements and provides the legal and regulatory flexibility for such agreements to continue to occur, this aspect of the planning process will likely fail.

Agricultural and Rural Water Issues

Texas is a growing State, with population expected almost to double by 2050. Rather than being uniformly distributed, growth will focus most heavily around urban centers. Although most rural communities and small cities are growing, they are not growing as fast as those near urban centers. This trend will create issues of resource sharing and competition between rural and urban areas.

The rural (nonmetropolitan) areas of Texas, based on Federal designations, contain 15 percent of the State's population. Five percent of rural income comes from farming. Geographically, rural areas cover approximately 80 percent of the State. Twelve of the State's counties are among the top 100 U.S. counties in farm product sales. In these counties, most of which are heavily dependent on irrigation, more than 30 percent of the income is from farming. In these and many more of the State's rural communities, the economy is heavily dependent on the continued viability of agriculture, from the farmers themselves to the businesses they patronize, to the businesses throughout the State that process and sell farm products.

Agriculture currently uses the majority of the freshwater in the State but will lose that distinction for the first time in the State's history before 2030. Two main factors will create major implications for rural Texas: decreased irrigation due to depletion of groundwater resources in some areas and increased use of all water resources by growing urban/suburban centers. This impact on water use will reverberate directly and indirectly through local institutions, from feed stores to banks, and through rural communities as a whole. The effects could be devastating to rural Texas.

TWDB makes the following major policy recommendations:

1. The Legislature should consider **protecting rural-community access to local water resources to ensure the continued economic viability of rural Texas.**
2. The Legislature should consider creating new financing mechanisms to support agricultural water conservation in general, but especially to support the voluntary conversion of a portion of the water saved to other uses when the water is not needed in the rural area.
3. The Legislature should consider requiring disclosure of information quantifying impacts on rural Texas. Applicants for surface water appropriations or groundwater withdrawal permits that remove water from rural areas could be required to provide the information to the regulatory body considering the application. Surface water aspects should be coordinated with the study recommended under Surface Water in this section.

Groundwater

Groundwater is and will continue to be a major source of water for Texas. Planning Groups estimate that 14.9 million AFY of groundwater is available, according to various management philosophies. For some aquifers, the management philosophy is driven by environmental constraints such as the Endangered Species Act. This philosophy has resulted in a plan based on a significant reduction in the withdrawals from the Edwards aquifer. However, 6.1 million AFY currently cannot be used because of the absence of infrastructure to connect to or treat the water. Many water management strategies focus on using this 6.1 million AFY and replacing the 1.5 million AFY of groundwater supply that is currently being used but that will not be available in 2050 because of depletion of aquifers. **Further, because of projected depletions of groundwater and because of water quality problems, due to naturally occurring constituents or as a result of man's activities, groundwater supplies will be insufficient to meet some irrigation needs and the needs of some small cities.** Another aspect of the plan is that there is a shift in some areas towards groundwater use, in part, due to new regulatory requirements on interbasin transfers of surface water. For many, the demand on groundwater has raised the question of management goals: **Should aquifers be managed on a sustainable basis or on the basis of eventual depletion?** Sustainability may be chosen as the appropriate management philosophy for some aquifers, but in all likelihood it will not be selected for areas such as El Paso and the High Plains where management at sustainable levels would have enormous economic dislocations.

TWDB makes the following major policy recommendations:

1. TWDB continues to maintain that **groundwater management in Texas is best accomplished through local groundwater conservation districts.** Further, **these districts should be constituted considering both hydrology and the availability of sufficient financial resources to accomplish**

key management tasks while recognizing existing local governmental entities and mutual local agreements.

2. Groundwater conservation districts and regional water planning groups in a common groundwater management area should strive to have **compatible groundwater management goals**.
3. The Legislature should consider requiring groundwater conservation districts to include in their groundwater management plans a **management goal quantifying the desired future condition of the aquifer**. The future condition could be described using water quantity and water quality parameters.
4. The goal of groundwater management in Texas should be to move toward sustainability, but, because aquifers and the social and economic needs of the State vary from place to place, **groundwater availability should be locally or regionally assessed**, balancing all interests. This is clearly a situation where one size does not fit all. **Groundwater conservation districts and regional water planning groups should determine whether sustainable management is appropriate for their area or whether another management scenario better fits the needs of their locality**. The TWDB, working cooperatively with groundwater conservation districts and regional water planning groups, should **evaluate, as data become available, the hydrologic, environmental, social, and economic impacts of withdrawal of groundwater at various rates on the basis of the identified management strategies, including the long-term sustainable level if appropriate, for the major and minor aquifers**.
5. The Legislature should consider both statutory provisions and financial incentives related to developing viable groundwater/surface water conjunctive use projects in order to use all water resources more efficiently and effectively.
6. Because safeguards for transporters included in Senate Bill 2 (77th Legislature) negated the need for Texas Water Code §36.121 and because of the unintended consequences of that section of law, the Legislature should consider repealing Texas Water Code §36.121, which exempts certain existing and planned municipal wells in certain countries from regulation.
7. The Legislature should consider requiring groundwater conservation districts to include in their groundwater management plans provisions to promote and implement programs, such as **conservation, recharge enhancements, rainwater harvesting, or brush control**, where appropriate and cost effective.
8. Regulatory programs to address abandoned oil and gas wells should be strengthened to minimize the contamination of groundwater supplies.

Surface Water

Surface water is and will continue to be a major source of water for Texas, especially for municipal and industrial purposes. This supply, generally reliable for cities, is renewable. Although approximately 14.9 million AFY of surface water is currently available, only 8.6 million AFY of that water can currently be accessed because of the absence of infrastructure and water rights. Some water management strategies are meant to utilize this unconnected water supply more fully. The regional water plans call for only eight new major reservoirs, each with more than 5,000 acre-feet of storage capacity, to be added to Texas' existing 211 major reservoirs during the next 50 years. These new major reservoirs would increase surface water

availability by 1.1 million AFY, supplying approximately 16 percent of the projected 7.5 million AFY shortage in 2050. New reservoir development is limited in this manner not only because existing reservoir capacity exceeds demands due to the investments made in earlier years but also because of increased reliance on groundwater. This shift to groundwater partly results from new regulatory requirements on interbasin transfers of surface water. This increased reliance on existing sources may also increase the possibility of conflicts between competing uses, such as between water supply and recreation.

The Planning Groups suggest voluntary redistribution of existing surface water resources as a significant solution. However, facilitating this and other surface water recommendations in the regional water plans requires a legal system and effective and efficient administration of water rights that addresses water marketing and sales, wastewater reuse, and interbasin transfers. Since the first statutory enactment of a water rights legal system beginning in the late 1800's, water rights law has developed and evolved in a somewhat piecemeal manner. A full examination of this legal system could strengthen the whole and allow a thorough balancing of issues, which have become more acute as the various needs for water put greater demands on the State's water resources and test the limits of the existing legal system. Water rights administration is the nexus that links these issues, and its effective implementation is essential to allowing the planned use of existing resources while protecting natural resources. The Legislature has provided a mechanism for increasing protection of surface water rights by watermasters. Where crucial local support exists, water rights holders may petition the Texas Natural Resource Conservation Commission (TNRCC) for creation of a watermaster. The effectiveness of water rights administration is based on closely linking appropriate laws, agency rules, and up-to-date analytical tools.

The TWDB makes the following major policy recommendation:

1. The Legislature, through an interim committee process or otherwise, should consider **continuing to examine the water resource regulatory structure of this State and look for opportunities to meet the water management needs of the 21st century**. TWDB recommends the following elements be included, at the minimum, in the Legislative study:
 - a. Consider changes needed in law relating to allocation and administration of flows resulting from wastewater discharges.
 - b. Consider any changes needed to continue crafting a policy that addresses the imbalance between the location of water resources and the location of water needs, while recognizing broad public interests and the need to weigh the interests of the basin of origin and the needs in the receiving basin.
 - c. Consider whether to require the implementation of watermaster programs in each river basin of the State, where appropriate.
 - d. Consider any changes needed to create more certainty in the water rights amendment process, thus facilitating water marketing transactions.
 - e. Consider allowing the TNRCC and TWDB jointly to develop a process that would link surface water availability models and groundwater availability models in areas where there is significant groundwater and surface water interaction, including major springs, as well as to recommend funding and statutory changes necessary to facilitate this linkage. The agencies should develop this process with significant involvement from major stakeholders.

- f. Consider, as part of the study, protection of environmental water needs, water rights, and broad public interests.

Conservation

Conservation is a very critical element to meeting the State's long-term water needs. Baseline conservation assumptions were used to develop water demand projections in the regional water plans. Some Planning Groups recommended additional conservation measures for selected water users. Conservation was an important factor in limiting total water demand in the State, with municipal demand increasing only 67 percent despite a projected 90 percent population increase by 2050. Although additional water conservation is possible and necessary, conservation alone will not meet all Texas' water needs, if Texans are to enjoy at least as good, if not better, standard of living than we enjoy today.

Water demands in cities are primarily a function of per capita water use. Conservation efforts can help reduce per capita uses at rates that are appropriate for each city. On a Statewide average, **baseline conservation assumptions (primarily more efficient plumbing fixture code requirements) are projected by 2050 to effect a 22-gallon per capita per day (GPCD) savings from current rates of municipal use.** This projection equates to **not having to supply an additional 976,000 AFY by 2050**, relative to current per capita demand projections. The Regional Plans further recommend water strategies that save more than 1 million AFY. A local approach to conservation allows local impacts of climate, economy, and availability of water supply to be considered. However, some areas of the State show high current and future projections for per capita use (see Table 5-4). Conservation should play a more aggressive part in future regional water planning, especially in areas with high per capita water use.

Conservation in irrigation also accounts for significant savings and should allow **declines of agricultural use that are slower** than would otherwise occur as groundwater resources are depleted. Because the **regional water plans contemplate very little "new" water being produced, a significant portion of the water currently used in agriculture will be voluntarily converted to municipal use.** Continued efforts to assure agricultural production using less water will help alleviate potential adverse effects of reduced water availability for agricultural use on rural areas that support agriculture. **Efforts to provide agricultural water savings generated through voluntary conservation can help provide new supplies to municipalities while simultaneously preserving agricultural production and mitigating negative impacts that a loss of production might produce.**

TWDB makes the following major policy recommendations:

1. The Legislature should support and finance increased educational and technical assistance to implement advanced conservation technologies.
2. Water suppliers at the local level should establish minimum levels of water conservation. TWDB should modify its rules to require that water conservation plans and TNRCC should modify their rules to require that drought contingency plans include locally set quantified goals, such as in GPCD. One goal should be a target amount for "unaccounted for" water. Goals set by specific entities should recognize past efforts and local circumstances. TNRCC and TWDB should jointly identify quantified target goals for water conservation and drought contingency results that water suppliers and other entities may use as guidelines in preparing water conservation or drought contingency

plans. These target goals should not be mandates. The Legislature should provide sufficient funding to assist entities in implementing plans that are consistent with quantified target goals.

3. TNRCC and TWDB should jointly develop model water conservation programs for different types of water suppliers that would suggest best management practices for achieving the highest practicable levels of water conservation and efficiency achievable for each specific type of water supplier.
4. TNRCC and TWDB should jointly develop model drought contingency programs for different types of water suppliers that would suggest best management practices for achieving the highest practicable levels of water use reductions achievable during drought situations for each specific type of water supplier.
5. The Legislature should consider creating new financing mechanisms to support agricultural water conservation in general, but especially to support the voluntary conversion of a portion of the water saved to provide water to other uses. (See discussion on Providing and Financing Water and Wastewater Service below).
6. The Legislature should encourage new public buildings to include alternative technologies such as rainwater harvesting systems and gray-water systems to provide water for secondary uses, such as cooling towers, toilets, and landscape irrigation.
7. The Legislature should support and finance implementation of efficient irrigation systems and research on crops and landscape plants that are drought and saline tolerant.

Innovative Strategies

The regional planning process helped Planning Groups recognize alternative methods of meeting needs besides building new lakes or drilling new wells. The Planning Groups evaluated and recommended many innovative water management strategies, including brush management, weather modification, desalination, reuse of wastewater flows, modification of existing projects, and changes in operational procedures. Although procedures such as weather modification and brush management were aimed at providing water during normal times and were not specifically used to meet drought needs, they were recognized as steps some regions should take.

Some of the innovative strategies will require continued research and improvements to be cost effective. Others will need research to determine their reliability during drought conditions.

A number of recommendations relating to innovative strategies will be made under other subheadings. In addition, TWDB makes the following major policy recommendations:

1. The Legislature should consider any recommendations from a TNRCC stakeholder process now examining disposal issues associated with desalination processes.
2. The Legislature should encourage research to evaluate potential impacts, including environmental impacts, and to quantify the availability of water resulting from brush control programs.

Environmental

Texas needs to ensure adequate freshwater flows in streams and rivers and into bays and estuaries.

This need was recognized in two ways in the regional water plans: (1) new projects received preliminary evaluations so as to pass appropriate flows for the environment (instream flows and freshwater inflows to bays and estuaries) and to protect water quality and (2) one region (H) recommended that certain stream reaches be protected and that Galveston Bay inflow needs be met. One reason other regions did not consider the protections of unique stream reaches dealt with uncertainty as to impacts of that designation. The 77th Texas Legislature subsequently addressed this uncertainty by amending statutory language.

Current Texas water law requires an evaluation of new surface water management strategy impacts on instream flows, bays and estuaries, and those ecosystems. **Additional clarity on what is considered an adequate environmental flow is needed.** Because of the complexities of defining an environmental flow as such, which species to protect and how to balance protection with the effects on the public welfare, additional policy directives are needed. Additional clarity is needed to define adequate environment flows with respect to duration, frequency, and location. Also, the vast majority of Texas water rights were appropriated before the provision in law of these environmental assessments. Therefore, **many river reaches and estuaries may not be managed with due consideration of the impacts of water use on these ecosystems.** Where additional water rights are sought, the full burden of environmental protection may fall on the last applicants, while prior applicants have no requirements applied to them. These prior applicants have invested and made other decisions on the basis of the laws and rules in place at the time that they received their water rights. **This is the essence of the environmental flow debate in Texas: how to provide for current environmental needs while recognizing our past practices and current law.** This dilemma is exacerbated because data on what a healthy ecosystem needs in many specific locations have not yet been derived.

Another environmental issue is protection of critical habitats that often are in competition with water supply projects. The Legislature may designate ecologically unique stream reaches and unique sites for reservoir construction. A stream reach with significant bottomland hardwoods may be eligible for either designation. These designation processes could be linked to protect certain ecologically unique stream reaches as habitat mitigation areas associated with specific water supply projects, thus creating a balanced outcome.

The answers to these complex policy issues are not easy. No clear consensus exists on these issues beyond the recognition of a problem regarding the provision of environmental flows. This issue could benefit greatly from additional dialogue and focused discussion.

TWDB makes the following major policy recommendations:

1. Dialogue should focus on environmental issues among a broad range of interested and impacted parties before the 78th Texas Legislature. The goal would be to establish consensus recommendations, where possible, regarding major changes needed, including what evaluation criteria to use to measure a sound ecological environment and identification of potential methodologies to protect environmental flows. The Legislature should consider establishing such criteria by statute.
2. The Legislature should consider adequately funding instream flow studies to determine flow conditions necessary to support a sound ecological environment (Texas Water Code §16.059).

3. The Legislature should consider providing funding for a voluntary conservation program in which most water saved would be made available to meet environmental water needs.
4. The Legislature should consider directing TNRCC, in coordination with TWDB and the Texas Parks and Wildlife Department (TPWD), to evaluate the status of flows using statutory evaluation criteria to be established for measuring a sound ecological environment by river basin, assuming various scenarios, including the full exercise of existing rights.
5. The Legislature should consider establishing policies that will facilitate natural resource agencies and water rights holders to **voluntarily provide environmental flows** by using purchases, the Texas Water Trust, or some similar method or concept.
6. The Legislature should consider coordinated designation of ecologically unique stream segments to protect habitat for mitigation purposes and unique reservoir sites to protect future water supplies.

Providing and Financing Water and Wastewater Service

Addressing the issue of providing water and wastewater service requires not only access to adequate quantity and quality of water supplies but also the infrastructure to treat and distribute this water and to likewise collect and treat effluent. It also requires competent, cost-effective service providers who have the skills and resources to build, manage, and maintain such systems.

In Texas, **all service delivery and most financing are locally generated.** It will remain so in the future. But **without external assistance, some local governments cannot develop the necessary internal expertise to provide the quality of service necessary under current health and safety requirements. Others, which may have the expertise, are unable to finance such service without external assistance.** Further, some areas that have significant population densities without adequate water or sewer facilities have no service providers at all. In some areas, newly created service providers, such as districts or other entities, may be unable to provide adequate service.

Economies of scale are significant in the provision of water or wastewater service. **Voluntary creation of regional systems, or consolidation where service levels are inadequate or nonexistent, may be necessary to create the basis for cost-effective and fully functioning and sustainable systems.** This could also reduce the need for external financial assistance, such as from the State.

A consistent outcome of the regional water planning process is a desire to implement plans to ensure that the needs of Texans are met. Without implementation, Texans clearly will not have the ability to meet their water needs. And yet implementation will not be without a cost. The water supply acquisition projects included in the regional water plans will cost approximately \$17.9 billion. Needs for water and wastewater treatment, flood control, and internal community infrastructure costs will raise the amount for this 50-year period to \$108.6 billion. Although local utility customers will pay most of this, some communities will be unable to afford it alone. For those, including many rural areas and small towns and some major city/regional projects, more cost-effective financing alternatives will be necessary. **Every regional plan emphasizes the need for an expanded State role in financing these supply enhancements.** The 77th Texas Legislature started the process of addressing this issue and other issues with Senate Bill 2 and Senate Bill 312. Although all these steps are significant, **additional efforts need to focus on filling critical gaps in State assistance programs.**

To ensure that the State's role is more effective in the future, TWDB makes the following major policy recommendations:

1. The role of **State assistance programs needs to be expanded to ensure that problems are addressed and long-term State goals are achieved.** State assistance cannot meet all needs nor does it need to. (In fact, current State assistance programs require a local commitment to repayment in the vast majority of cases.) Rather, State assistance should **focus on key gaps where basic needs or cost-effective opportunities cannot be met by local funds.** These gaps include **funding cost-effective, regional projects** (including those serving rural areas); **supporting disadvantaged communities;** and **funding nontraditional water management strategies and agricultural and municipal water conservation.** TWDB should establish a priority system for projects receiving State assistance from programs that cannot fund all applicants. The priority system should consider the level of conservation achieved by the applicant.
2. In order to achieve State goals, **more flexibility than is available under current bond financial programs needs to be provided.** Some needed projects, such as certain conservation activities on farms or in homes, cannot be financed by using tax-exempt bonds. Use of appropriated funds also can eliminate some of the necessary overhead associated with bonds. Some needed work will require high levels of assistance that cannot be provided by self-supporting bond programs. Therefore, the Legislature should consider **dedicating specific funding sources to enhance the State's ability to assist local governments in implementing water infrastructure projects and meeting the needs of the State's growing population.**
3. In order to ensure that all Texas communities that require assistance are provided access to State financial assistance, the Legislature should consider providing funding specifically for **outreach assistance** and for **developing training programs in financial and technical management.**
4. The Legislature should **facilitate public-private partnerships** by making statutory changes that enable the State to provide financial assistance to local governments for use in developing water-related infrastructure through public-private partnerships.
5. As part of the expanded assistance mentioned above, the Legislature should **commit adequate funding to the Rural Water Assistance Fund.**
6. The Legislature should **target financial assistance for mitigating costs of compliance to new drinking water treatment standards.**
7. The Legislature should consider whether existing statutes or their enforcement needs to be modified **to assure that water and wastewater service is assigned and provided for all future development in Texas.** This review should include analysis of regional development of service, assignment of service responsibility, and ensuring appropriate provision of service once assigned.

Data

Planning for the water needs of all Texas communities is a data-intensive effort. The Planning Groups recognized this need. More than 2,200 cities and other water users exist for which population and water demand values, projections of supply from current water sources, and evaluations of alternative water sources must be determined, now and for 50 years into the future. **The current accuracy of data used in planning varies, although better information on groundwater availability, groundwater use for irrigation, and environmental water needs is particularly sought.**

Events of September 11, 2001 show that ready access to some natural resource data and infrastructure information may not be in the best interests of public safety and welfare. Some consideration of additional security for that information is warranted.

TWDB makes the following major policy recommendations:

1. The Legislature should consider funding studies to **better describe groundwater and surface water interaction.**
2. The Legislature should consider funding **comprehensive studies and data collection on agricultural water use.**
3. The Legislature should consider **funding basic groundwater research** that is necessary to generate and analyze basic data needed and to **continue the development of groundwater availability models for all major and minor aquifers.**
4. **TWDB, TNRCC, TPWD and other governmental entities** responsible for most water-related information in Texas **should enhance the compatibility of technical information by increasing communication with one another and by identifying opportunities for improving data integration and data transfer and decreasing information redundancy and by supporting the Strategic Mapping (StratMap) digital base map layers as a common geographic framework on which to efficiently build, standardize, and centrally disseminate water-related data sets via the Internet.**
5. The Legislature should consider **supporting and funding enhanced real-time and Internet-based electronic data collection, transmittal, and storage methods** for surface water flow, groundwater levels, groundwater pumpage, and water quality while maintaining appropriate levels of data accuracy. Both real-time and Internet-based methods could **substantially reduce the cost** of some types of data collection, while facilitating more timely and flexible analysis and dissemination of critical water data.
6. The Legislature should consider exempting certain selected and sensitive data relating to natural resources and infrastructure from public disclosure for public security purposes if that data could be used to threaten public safety or welfare.