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# ES - Executive Summary

## ES.1 Introduction

In 1997 the State Legislature, through Senate Bill 1, determined that the Texas State Water Plan for the 2000 - 2050 time frame would be developed through a regional water planning approach. To accomplish this task, the Texas Water Development Board (TWDB) divided the state into 16 regional water planning areas and appointed representational Regional Water Planning Groups (RWPG) that have guided the development of each region's plan. In 2001 a new set of rules and guidelines from the TWDB were enacted through Senate Bill 2. With the help of the Senate Bill 2, the 2002 State Water Plan received enormous public involvement compared to previous plans. The planning process is cyclic, with updated Regional Water Plans (RWPs) and State Water Plans (SWPs) produced every five years. The 2006 Region H Water Plan and the 2007 State Water Plan were created during the last planning cycle.

Region H encompasses all or part of fifteen counties in southeast Texas and includes the majority of the San Jacinto River basin and the lower reaches of the Brazos and Trinity River basins. A Location Map showing the regional boundaries is included at *Figure ES-3*. The Region H Water Planning Group (RHWPG) consists of 24 voting and 11 non-voting members that represent a diverse range of backgrounds and interests. Additional information about the RHWPG can be found in *Chapter 1* of the 2011 RWP or on the Region H Water website, <http://www.regionhwater.org>. Regional Water Planning is conducted under the oversight of the Texas Water Development Board. Information on Region H and the State Water Plan can be found at the Board website, <http://www.twdb.state.tx.us>.

Region H is an economic powerhouse crucial to the Texas and national economies. Adequate water supplies are essential to continued economic health and to the region's future growth. Two thirds of all U.S. petrochemical production and almost a third of the nation's petroleum industries are located in Region H. The area provides some of the state's most popular vacation spots that generate hundreds of millions of dollars in annual tourism revenues. The Port of Houston is the second busiest port in the nation. As of 2008, the Houston area employed 2.6 million people. Region H is generally characterized by urbanizing land uses and broad-based economic development. In areas outside of the urban core, agriculture dominates economic activities. Key contributors to each of six primary economic sectors are:

- Services - Medical (Texas Medical Center in Houston, University of Texas Medical Branch in Galveston), tourism, banking, construction and engineering.
- Manufacturing - Petroleum exploration, production and refining, petrochemicals, biotechnology, chemicals, computers and technology, and pulp and paper.
- Transportation - Port of Houston, rail and highway systems, Intracoastal Waterway, airlines, airports and air cargo facilities.
- Government - Federal, state and local including the Texas Department of Corrections, the Johnson Space Center, numerous law enforcement agencies, universities, colleges and school districts.
- Agriculture - Rice, soybeans, grain sorghum, peanuts, vegetables, hay, cattle, horses, swine, timber and pulp wood.
- Fishing - Commercial (oysters, shrimp, finfish) and recreational.

Any large-scale water supply or conveyance projects will require the close cooperation of political entities in the affected areas. While municipal and county governments are most visible in Region H,

there are numerous other governmental and regulatory agencies with jurisdiction over aspects of water supply development in the region. These include, but are not limited to:

- State Agencies
  - Texas Water Development Board (TWDB)
  - Texas Commission on Environmental Quality (TCEQ)
  - Texas Department of Parks and Wildlife (TPWD)
- River and Water Authorities
  - Brazos River Authority
  - San Jacinto River Authority
  - Trinity River Authority
  - Lower Neches Valley Authority
  - Coastal Water Authority
  - North Harris County Regional Water Authority
  - West Harris County Regional Water Authority
  - Central Harris County Regional Water Authority
  - North Fort Bend Water Authority
  - Gulf Coast Water Authority
  - Baytown Area Water Authority
  - Brazosport Water Authority
  - Clear Lake City Water Authority
  - North Channel Water Authority
- Subsidence and Groundwater Districts
  - Fort Bend Subsidence District
  - Harris-Galveston Subsidence District
  - Bluebonnet Groundwater Conservation District
  - Lone Star Groundwater Conservation District
  - Mid-East Texas Groundwater Conservation District
  - Brazoria County Groundwater Conservation District
- Councils of Governments

- Houston-Galveston Area Council of Governments
- Brazos Valley Council of Governments
- Deep East Texas Council of Governments
- Eleven soil and water conservation districts
- Numerous Utility Districts and Water Supply Corporations

Of particular note are the two subsidence districts, because the regulation of groundwater use to control land subsidence compels many municipalities to seek new surface water sources. The regional water authorities were formed to collectively address this surface water transition. The creation of public/private partnerships aligning the interests of the public with those of the manufacturing, agricultural, power generating and mining sectors will be essential in developing the water needed to support the population and economy of Region H.

For public review and comment, copies of the Initially Prepared Region H 2011 Regional Water Plan were made available at the County Clerks' offices in each of the 15 Region H counties and were available in one public library in each of the 15 counties. The Plan is comprised of ten chapters:

Chapter 1: Description of Region

Chapter 2: Presentation of Population and Water Demands

Chapter 3: Analysis of Current Water Supplies

Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs

Chapter 5: Impacts of Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas

Chapter 6: Water Conservation and Drought Management Recommendations

Chapter 7: Long Term Protection of the State's Water Resources, Agricultural Resources and Natural Resources

Chapter 8: Ecologically Unique Stream Segments, Unique Reservoir Sites, And Legislative Recommendations

Chapter 9: Water Infrastructure Financing

Chapter 10: Public Participation and Adoption of the Plan

For an in-depth discussion of any of the topics addressed in this Executive Summary, the reader is referred to the full report document. The full list of addresses of the 30 report holders is shown in *Table ES-3*.

## **ES.2 Population and Water Demand**

### **ES.2.1 Population Projections**

Population in Region H is projected to grow from approximately 6.0 million in 2010 to approximately 11.3 million in 2060. The doubling of population over the fifty-year planning period represents an

annual growth rate of slightly more than one percent. Population projections by county are shown in Table *ES-4*.

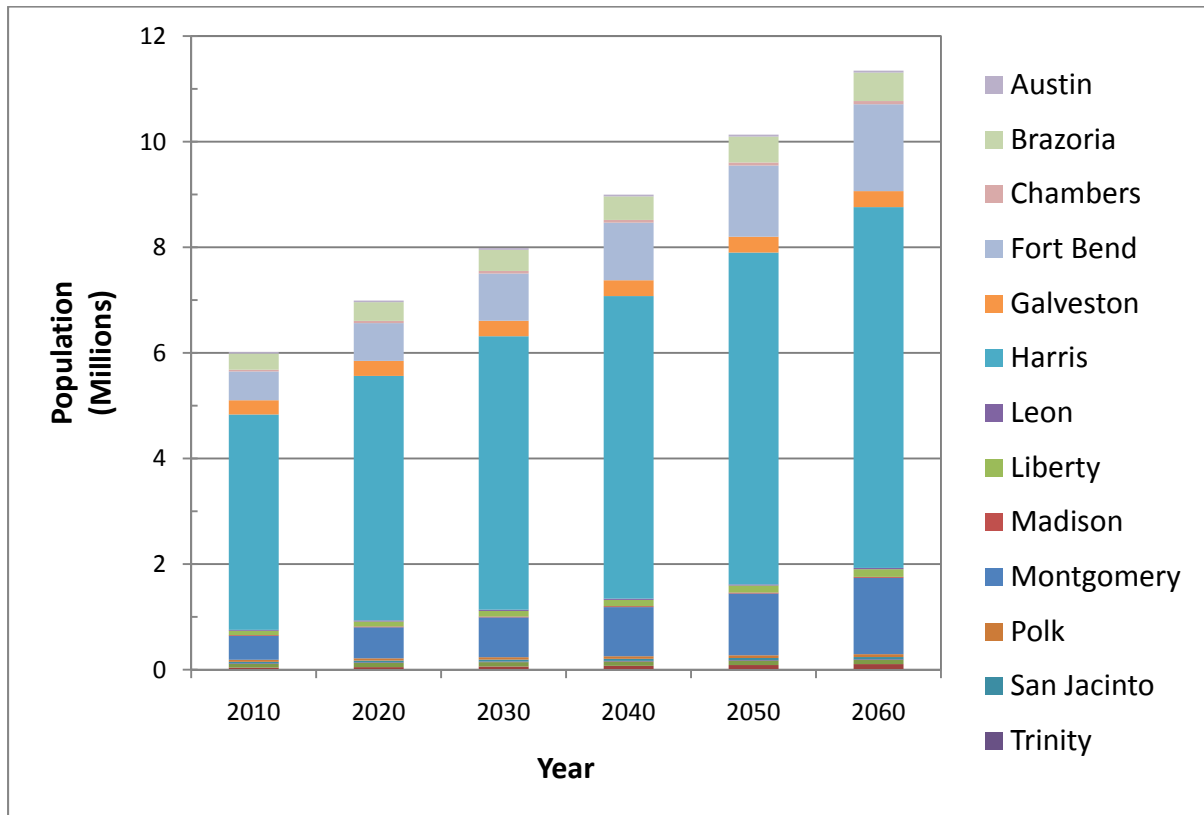
Population data are presented for each of the fifteen counties in the region, for cities of more than 500 persons, water districts providing 280 ac-ft/yr or more (0.25 mgd), and for collective reporting units (CRUs) consisting of grouped utilities having a common association. Within Region H, there are 257 municipal WUGs plus 15 county-other WUGs, further divided by basin and county. All smaller communities and rural areas, aggregated at the county level, are considered a WUG and are referred to as "County-Other" for each county.

The base county-level population projections were developed as part of the 2006 RWP using a standard cohort-component procedure in conjunction with data from the 2000 Census and other sources. This methodology was modified during the development of the 2011 RWP to account for growth in several counties that were not anticipated by the 2006 RWP projections. Increased population projections were developed for Brazoria, Chambers, Fort Bend, Harris, and Montgomery Counties based on information from the Texas State Data Center (SDC). These county populations were split into sub-county components known as Water User Groups (WUGs) based on data from the Year 2000 Census and SDC estimates. Additionally, two new water authorities, the Central Harris County Regional Water Authority and the North Fort Bend Water Authority, were added to the list of WUGs in the 2011 RWP along with three communities in Fort Bend and Montgomery Counties.

*Figure ES-1*, which was compiled using data generated as described above, shows that population growth in Brazoria, Fort Bend, Harris and Montgomery Counties represents approximately 89 percent of the Region H total population in year 2010 or approximately 5,387,370 persons. In year 2060, these same counties represent approximately 92 percent of the Region H total population or approximately 10,461,370 persons, as shown in *Figure ES-1*.

The approved projections are compiled in *Chapter 2: Population and Water Demand Projections*. The population projections serve as the basis for calculating municipal water demands.

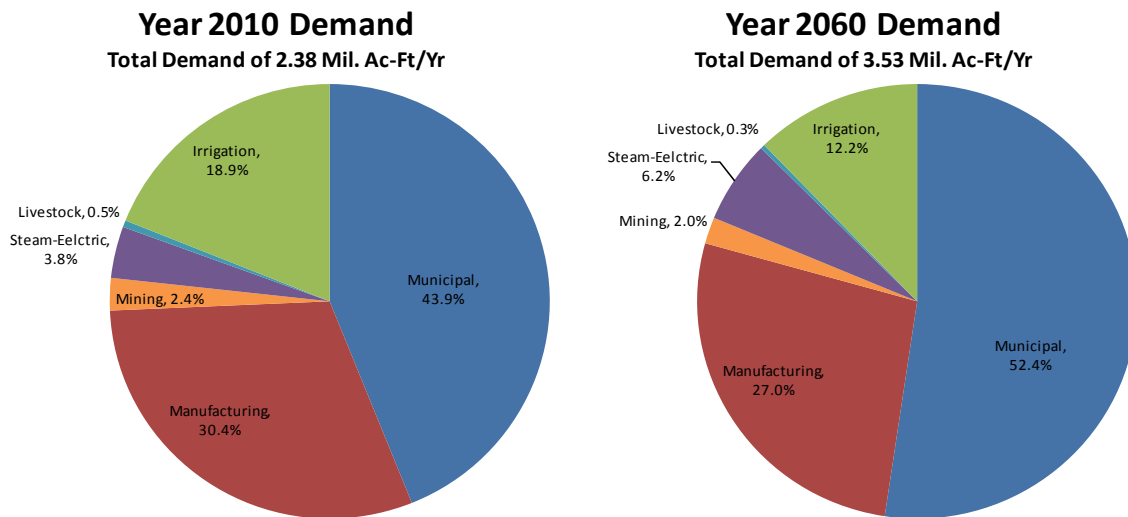
**Figure ES-1  
Region H Population Projections by County**



**ES.2.2 Water Demand Projections**

Region H water demands are projected to increase from approximately 2.38 million acre-feet per year in year 2010 to over 3.52 million acre-feet per year by year 2060. In addition to municipal demand, water consumption for manufacturing, steam-electric power generation and mining will increase throughout the planning period. Water demands for livestock production are projected to remain constant within Region H. Irrigation is expected to decrease in Brazoria County and remain constant in the other counties, resulting in an overall reduction in irrigation water demand through the planning period. *Table ES-5* presents the projected water demands over the planning period, summarized by county and totaled for Region H. *Figure ES-2* shows that municipal water demands are projected to account for over half of the total regional water demands by 2060. Manufacturing demands, while still increasing, will account for a smaller percentage of total water use (declining from 30% today to 28% in 2060). The projected municipal water demands reflect existing water conservation programs and expected (passive) conservation from plumbing code changes, the latter reducing per capita demands approximately 8 percent by 2060. Additional water conservation for municipalities, manufacturing and irrigation is recommended as a management strategy. Region H accounts for 40 percent of Texas’ manufacturing water use, the largest of the sixteen planning regions. Almost half of the total water demand in the Region is in Harris County.

**Figure ES-2  
Region H Water Demand Comparison**



## ES.3 Water Supplies

The total amount of water supply currently available to Region H from existing water sources is 3,556,538 acre-feet per year (ac-ft/yr) in 2010. Of that amount, about three-fourths is surface water. By the year 2030, the available supply will be 3,343,151 ac-ft per year. The reduction in supply between 2010 and 2030 reflects restrictions on the use of the Gulf Coast Aquifer, instituted to combat subsidence in a large part of the region. Groundwater supply is based on the projected sustainable yield of each aquifer and regulation on groundwater withdrawal, which limits extraction to the annual rate of recharge. Reduced reservoir yields due to sedimentation also contribute to the reduction in supply over time. The predominant sources of surface water supply are derived from three reservoirs: Lakes Conroe and Houston within the San Jacinto River basin and Lake Livingston within the lower Trinity River basin.

Surface water supply was determined using the TCEQ Water Availability Model, which analyzes permitted diversions against the historic rainfall record, which includes the drought of record period in the 1950's. In the Trinity and Brazos River Basins, limited wastewater return flows were included in the model, based on expectations that full reuse would not occur during the planning period. For all other basins, the yields are based upon the no-return-flow scenario used for water rights permitting. Some activities, such as livestock watering and mining, use riparian supplies and/or small impoundments that do not appear in the models. These supplies are considered "local sources" and are not projected to change in amount during the planning period.

A detailed analysis of water supply is found in the *Chapter 3: Analysis of Current Water Supplies*. A summary of available water supply by source is provided in *Table ES-6*.

## ES.4 Water Needs and Management Strategies

### ES.4.1 Water Demand Versus Supplies

Water supplies were compared to water demands to determine if any areas in the region are expected to experience water shortages during the planning period. Despite adequate overall water supplies for Region H through the year 2050, the RHWPG has identified communities that will experience water shortages during the planning period unless they take action to increase their



supplies. Some of these communities will be able to meet their demands simply by extending or increasing existing water supply contracts.

The projected shortages identified in the year 2010 totaled 290,890 acre-feet per year, increasing to as much as 1,236,335 acre-feet per year in the year 2060. This year 2060 shortage is greater than the deficit of 1,069,469 identified in the 2006 RWP. This is discussed in further detail in *Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs*.

## ES.4.2 Water Management Strategies

The RHWPG considered a variety of strategies for meeting the projected shortages and solicited input from the public before adopting a management plan. A detailed analysis process was developed to define potential water management strategies. The process addressed the specific shortages of all the WUG needs beyond existing supplies and then developed associated specific strategies assuming the WWPs would be the vehicle to solve WUG shortages. The process generally consisted of the following:

Water Conservation – For WUGs with projected shortages, an appropriate level of water conservation would be implemented, as discussed below.

Expanded Use of Groundwater – For WUGs in areas that benefit from adequate groundwater supplies to allow for future growth.

Contract Extension and Increase - For all WUGs currently served by a WWP, it was assumed that current contracts would be renewed throughout the planning period. Additionally, it was assumed that WUGs would increase their contracts with their current WWPs to meet projected growth, until current WWP supplies were fully allocated.

These general strategies were able to reduce the year 2010 shortages from 290,890 ac-ft/yr to 237,535 ac-ft/yr and the year 2060 shortage from 1,236,355 ac-ft/yr to 973,857 ac-ft/yr. After application of these general strategies, the remainder of the WUGs with shortages were grouped and addressed by county. Potential water management strategies were screened and considered to meet the needs of each county. The strategies considered included those in the 2006 Regional Water Plan, new water rights applications, wastewater reuse and seawater desalination. Management strategies that involved adjoining regions were coordinated with the appropriate water planning group.

The water management strategies selected to meet the projected growth in Region H are as follows:

### Conservation Strategies

- **Industrial Conservation**—Industries with projected shortages will seek out ways to reduce their water demand as a means of managing their operating costs. The wide range of industries within Region H, and their varying progress in this area, prevented the estimation of projected savings for this strategy for general use. However, some information provided by manufacturing users in Fort Bend County was used to apply some level of conservation to the 2011 RWP.
- **Irrigation Conservation**—Reduction of on-farm demands through land leveling, canal lining and other system improvements. Projected water savings are 18,792 ac-ft/yr in Brazoria County, 24,018 ac-ft/yr in Chamber County, 5,197 ac-ft/yr in Fort Bend County, 2,392 ac-ft/yr in Galveston County, 20,876 ac-ft/yr in San Jacinto County and 6,606 ac-ft/yr in Waller County.
- **Municipal Conservation**—Municipal conservation was applied at the WUG level based on projected savings provided by WUGs in their water conservation plans wherever possible. For other municipal WUGs, conservation was assumed to reduce demands at a level ranging

from 5.55% to 6.34%, depending on the size of the WUG. Projected water savings total 75,696 ac-ft/yr in year 2030 and 105,494 ac-ft/yr in year 2060.

### **Contractual Strategies**

- **WUG-Level Contracts** – Contracts to WUGs from WWP were increased within the limits of existing supplies, including contracts to new customers. Additionally, some reallocation of existing supplies was performed where possible.
- **WWP Contracts** – Where possible, contracts will also be expanded between seller and buyer WWPs to enhance the use of existing supplies. Additionally, there are numerous cases where project sponsor WWPs will develop water supplies in order to provide water under contract to existing WWP customers before the water is sold to WUGs.
- **TRA to SJRA Contract** – Under this strategy, the SJRA will purchase approximately 76,500 ac-ft/yr of uncommitted supplies from the Trinity River Authority to serve Montgomery County.
- **TRA to Houston Contract** – Under this strategy, the City of Houston will purchase approximately 123,500 ac-ft/yr of uncommitted supplies from the Trinity River Authority.

### **Groundwater Strategies**

- **Expanded Use of Groundwater** – Only a portion of the groundwater available to Region H is developed supply (i.e., existing wells). An additional 90,617 ac-ft/yr of new well capacity is needed to fully utilize this resource.
- **Interim Groundwater Use** – In some cases, the near-term needs in the year 2010 will be met with the use of additional groundwater supplies. This is only recommended where existing groundwater regulation permits.
- **New Groundwater Wells for Livestock** – Development of new groundwater resources for meeting minor shortages to livestock supplies.

### **Groundwater Reduction Plans**

Incorporation of the many groundwater reduction plans that are planned and being carried out in Fort Bend, Galveston, Harris, and Montgomery Counties, including:

- **Central Harris County Regional Water Authority**
- **City of Houston**
- **City of Missouri City**
- **Fort Bend MUD 25**
- **Fort Bend WCID 2**
- **North Fort Bend Water Authority**
- **North Harris County Regional Water Authority**
- **Pecan Grove**
- **Richmond/Rosenberg**

- **River Plantation MUD**
- **San Jacinto River Authority WRAP**
- **Sugar Land**
- **West Harris County Regional Water Authority**

### Reservoir Strategies

- **Allen's Creek Reservoir** – This proposed reservoir creates 99,650 ac-ft/yr of supplies for the City of Houston and the Brazos River Authority.
- **Brazoria County Off-Channel Reservoir** – This proposed reservoir creates 24,000 ac-ft/yr of firm supply for manufacturing demands in Brazoria County.
- **Dow Off-Channel Reservoir** – This proposed reservoir creates 21,800 ac-ft/yr in firm supply by increasing the storage associated with an existing Dow water right.
- **Fort Bend Off-Channel Reservoir** – This proposed reservoir creates 46,000 ac-ft/yr of firm supply for municipal and industrial demands in Fort Bend County
- **GCWA Off-Channel Reservoir** – This proposed reservoir creates 39,500 ac-ft/yr of firm supply for manufacturing use served by GCWA. This reservoir uses existing water rights with surplus interruptible supply to produce this firm yield.

### Reuse Strategies

- **Fulshear Reuse** – Development of a direct reuse project for the City of Fulshear and surrounding utilities.
- **Houston Indirect Wastewater Reuse**—The City of Houston has applied for a water right permit to indirectly reuse up to 580,900 ac-ft/yr of wastewater discharges. A portion of that is recommended for direct reuse to industry.
- **Montgomery County MUD 8/9 Reuse** – Indirect reuse project for potable water by districts along Lake Conroe in Montgomery County.
- **NHCRWA Indirect Wastewater Reuse** –The North Harris County Regional Water Authority has the potential to indirectly reuse up to 126,000 ac-ft/yr of wastewater discharges.
- **Wastewater Reclamation for Industry** –This strategy proposes that 67,200 ac-ft/yr of Houston's municipal wastewater be treated and directly reused by industries along the Houston Ship Channel.
- **Wastewater Reclamation for Municipal Irrigation** – This strategy anticipates the development of direct reuse project incorporated into new community growth in the rapidly-developing counties of Region H.

### Permit Strategies

- **Brazos River Authority System Operations** –The Brazos River Authority has applied for a water right that permits existing additional yield within their reservoirs, and new yield that can be achieved through operation of their reservoirs as a basin-wide system. Approximately 25,350 ac-ft/yr of this water will be available for customers in Region H.

- **Houston Bayous Permit** –The City of Houston has applied for an interruptible supply permit in the lower San Jacinto basin. The conjunctive use of this supply with existing supplies owned in the Trinity River Basin will reduce interbasin transfers in non-drought years.

### **Infrastructure Strategies**

Inclusion of the many major infrastructure projects that will be implemented throughout the region in order to more effectively utilize existing water supplies or to allow the use of future water resources strategies, including:

- **Central Harris County Regional Water Authority Transmission and Distribution**
- **Chambers-Liberty Counties Navigation District West Chambers County System**
- **City of Houston Distribution Infrastructure Expansion**
- **City of Houston Treatment Infrastructure Expansion**
- **Harris County MUD 50 Surface Water Treatment Plant**
- **Luce Bayou Transfer**
- **LLWSSSC Surface Water Project**
- **North Fort Bend Water Authority Transmission and Distribution**
- **North Harris County Regional Water Authority Transmission and Distribution**
- **Pearland Surface Water Treatment Plant**
- **Sealy Groundwater Treatment Expansion**
- **West Harris County Regional Water Authority Transmission and Distribution**

### **Other Strategies**

- **Brazoria County Interruptible Supplies for Irrigation** –This strategy uses interruptible supplies to meet the needs of irrigation within Brazoria County, mirroring the system of annual contracts currently used in the area for surface-water-based irrigation.
- **Brazos Saltwater Barrier**—A proposed gated structure on the lower Brazos above Freeport to protect lower basin intakes from the seasonal saltwater influence, which is expected to worsen as the basin is fully utilized.
- **Freeport Desalination** – A proposed facility in Freeport for desalination of seawater for municipal use, thereby enhancing flows for manufacturing uses in the lower Brazos River basin.

The 2011 Region H Water Plan meets all projected water demands, at an estimated capital cost of approximately \$12.0 billion for the recommended water management strategies. A summary of the selected strategies, their yields and their costs is shown in *Table ES-7*. *Table ES-8* shows the recommended combination of strategies required for each County to meet its projected water shortages. An in-depth discussion of the recommended plan is contained in *Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs*.

### **ES.4.3 Impacts of the 2007 State Water Plan on Galveston Bay Inflows**

As a supplement to a 2009 study conducted by the RHWPG on environmental flows in the year 2060, another study was conducted to determine the impacts of management strategies in the decades of 2010, 2020, 2030, 2040, 2050, and 2060. This study over the entire planning horizon took into account impacts from upstream return flows from and reuse within Region C to determine overall variation in inflows to Galveston Bay. In general, the study demonstrated that near-term reductions in return flows from the upper Trinity River Basin were mitigated over time due to increased demands in the upper basin. These increased flows also counteracted increased used of water supplies by Region H.

### **ES.4.4 Socioeconomic Impact of Not Addressing Shortages**

Water supply is critical to public health, and failure to provide water would severely constrain economic and population growth in Region H. The TWDB has developed an assessment of the impacts of failing to meet the projected shortages within Region H, which is included in the 2011 RWP.

## **ES.5 Impacts of Management Strategies on Water Quality and Agricultural Areas**

Both surface and groundwater in Region H are generally of good quality, and can be used with conventional treatment only. Advanced treatment measures are recommended to develop direct wastewater reuse projects. The management strategies recommended in the plan are not anticipated to directly affect water quality in most basins, although the reduction of in-stream flows due to full use of water rights may indirectly increase the concentration of some contaminants (by reducing the overall volume of water). The Brazos Saltwater Barrier is specifically recommended to improve water quality in the lower Brazos basin, by preventing seawater from migrating above Freeport during periods of low flows. The Luce Bayou Transfer and the transfer of water to SJRA from Trinity River supplies will introduce Trinity River Water into the San Jacinto River Basin. It should be noted that Trinity River water is currently transferred into Harris County via other conveyances. The reuse of wastewater will produce a brine concentrate, which must be judiciously discharged to prevent adverse environmental impacts.

Reservoirs within Region H are anticipated to experience increased impacts as water supplies are utilized at a greater level. However, modeling the use of these supplies over the known hydrologic period of record indicates that lower lake levels do not persist for long periods outside of the drought of record.

Agricultural areas in Region H are generally served by a combination of groundwater and with surface water supplies, depending primarily on the location of use and the application. The groundwater use is not projected to change during the planning period. Surface water used for irrigation is typically contracted on a year-to-year basis. All irrigation needs are met in the plan, through a combination of water conservation and supply from new and existing sources.

## **ES.6 Water Conservation and Drought Management Plans**

Water conservation is recommended for all water user groups, although it is calculated and applied in the tables only for WUGs with shortages and WUGs with conservation plans that lend themselves to incorporation into the RWP. Surveys of municipal WUGs indicated that 86 percent of WUGs that were assigned water conservation as a strategy in the 2006 RWP beginning in the year 2010 had implemented water conservation plans. In some cases, the generic water conservation plans used in the 2006 RWP were replaced with actual targets set forth in these conservation plans.

Drought management plans are required for all WUGs to address brief periods of water shortage, but are not recommended as long-term management strategies, based on studies conducted during the first biennium of the 2011 planning phase. Drought management plans typically force conservation over a limited period of time. However, the drought of record that this plan must address lasted approximately five years. To achieve a sustained reduction in demand, water conservation strategies must be implemented, so that water users do not perceive the required changes as being temporary. Sample water conservation and drought management plans are included in *Chapter 6*.

## **ES.7 Protection of Water Resources and Natural Resources**

The management strategies recommended in this plan will fully utilize the currently available water rights in all but the Trinity River basin. The two reservoirs recommended in the Brazos River basin and the recommended transfers from the Trinity River Basin will require some environmental mitigation due to habitat impacts. The recommended reuse of wastewater will further reduce in-stream flows, particularly during drought conditions. Some of this reduction will be mitigated by an overall increase in wastewater discharges beyond the current level.

Groundwater use in the region is projected to increase within the sustainable yield of the aquifers or the regulated withdrawal cap, as applicable. The export of groundwater from its county of origin is not recommended in this plan.

The most significant water-dependant natural resource in the region is Galveston Bay. In 2009, the RHWPG completed a study of the individual impacts of management strategies on flows to Galveston Bay. The results are shown in *Table ES-9*, comparing the inflow frequencies to the GBFIG inflow targets. Recommendations to the Legislature

## **ES.8 Recommendations to the Legislature**

The Texas Water Code guides the regional water planning groups to adopt recommendations on Unique Stream Segments, Unique Reservoir Sites, and legislative policy. *Chapter 8* of the 2011 RWP describes these recommendations in depth and a summary is provided below.

### **ES.8.1 Unique Stream Segments**

The Texas Water Code offers the opportunity to identify river and stream segments of unique ecological value. The selection criteria established within the Texas Water Code are as follows:

- Biological Function
- Hydrologic Function
- Riparian Conservation Area
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value
- Threatened or Endangered Species/Unique Natural Communities

Stream segments designated by the legislature as having unique ecological value cannot be developed as reservoir sites by the State or any political subdivision of the State. After consideration of the above factors during the development of the 2006 RWP, the eight streams listed in *Table ES-1* were recommended as Streams of Unique Ecological Value in Region H. These segments were subsequently designated by the Texas State Legislature. No additional sites were nominated for designation in the 2011 RWP.

The entire stream segment length was designated for Armand Bayou and Menard Creek (segment within Region H). For the remaining six streams, only those portions adjacent to or within riparian conservation areas were designated as unique streams.

**Table ES-1**  
**Stream Segments Recommended as Ecologically Unique**

<b><u>Stream Segments (Not in priority order)</u></b>	<b><u>County</u></b>
Armand Bayou	Harris
Austin Bayou	Brazoria
Bastrop Bayou	Brazoria
Big Creek	Fort Bend
Big Creek	San Jacinto
Cedar Lake Creek	Brazoria
Menard Creek	Liberty, Hardin*, Polk
Oyster Bayou	Chambers

\*Hardin County portion is in Region I.

### ES.8.2 Unique Reservoir Sites

The Texas Water Code offers an opportunity to designate sites of unique value for use as surface water supply reservoirs. Designation by the Legislature as a unique reservoir site prevents the State from constructing major infrastructure (such as major highways) within the project limits. Through use of a decision-based water management strategy analysis and selection process, the RHWPG selected five surface water reservoir projects, Allens Creek, and Dow, GCWA, Brazoria County, and Fort Bend County Off-channel reservoirs, for inclusion in the 2011 Regional Water Plan. Three other sites, Little River, Little River Off-Channel, and Bédias Reservoirs, were considered in past plans; Little River Off-Channel has been retained as an alternative reservoir site. The RHWPG recommends four Unique Reservoir Sites in the 2011 RWP: Allens Creek, Little River, Little River Off-Channel, and Bédias Reservoirs. *Table E-2* lists these sites along with a short description.

**Table ES-2  
Reservoir Sites Recommended as Unique**

<u>Name</u>	<u>County</u>	<u>General Location</u>
Allens Creek	Austin	1 Mile N. of the City of Wallis
Little River	Milam	Main stem of Little River, immediately upstream of its confluence with the Brazos River
Little River, Off-Channel	Milam	Beaver Creek, approx. 5 Miles NE of City of Milano
Bedias Reservoir	Madison (Principally)	Bedias Creek, 3.5 Miles W. of State Hwy 75

### ES.8.3 Regulatory, Administrative, and Legislative Recommendations

Section 357.7(a)(10) of the Texas Water Development Board regional water planning guidelines requires that a regional water plan include recommendations for regulatory, administrative, and legislative changes. These recommendations are addressed to each governmental agency that has the appropriate jurisdiction over each subject. It is generally assumed that regulatory recommendations are directed towards the Texas Commission on Environmental Quality (TCEQ), that administrative recommendations are directed towards the Texas Water Development Board (TWDB), and that legislative recommendations are directed towards the State of Texas Legislature.

The Region H Water Planning Group has currently adopted the following regulatory, administrative, and legislative recommendations:

#### Regulatory and Administrative Recommendations

- Clarify the agency rules to address consistency with the regional water plans.
- Clarify agency rules on quantitative environmental analysis.
- Modify the rules for wastewater permitting so that reclamation facilities are assessed in conjunction with their source water facilities.

#### Legislative Recommendations

- Remove barriers to interbasin transfers of water.
- Increase funding for the Bays and Estuaries programs of state resource agencies and for additional monitoring and research to scientifically determine freshwater inflow needs.
- Maintain the current rule of capture basis of groundwater law within Texas in all areas not subject to defined subsidence or groundwater conservation districts.
- Support development of Groundwater Conservation Districts to protect current groundwater users, and encourage these districts to study and manage aquifer storage and recovery.
- Establish financing mechanisms for development of new water supply projects identified within the adopted regional water plans.



- Continue funding of the State of Texas Groundwater Availability Modeling effort.
- Establish funding for agricultural research into the area of efficient irrigation practices.
- Implement the programs recommended by the Water Conservation Implementation Task Force.
- Establish funding for research in advanced conservation technologies.
- Resolve the issues related to water rights permitting for indirect reuse, and advocate water reuse statewide.
- Establish flood damage liability limits for water supply reservoirs.
- Direct the State Demographer's office to explore the potential changes in population distribution made possible by rapid advancements in information technology.
- Continue funding of the Regional Water Planning process.

### **Infrastructure Financing Recommendations**

- Increase the funding of the State Participation Program as needed to allow development of water supply projects sized to meet projected long-term demands.
- Increase the funding of the State Revolving Fund Programs in future decades, and expand the program to include coverage for system capacity increases to meet projected growth for communities.
- Increase funding of the State Loan Program to allow financing of near-term infrastructure cost projections.
- Increase funding of the Agricultural Water Conservation loan program, leverage Federal grant programs by providing the local matching share, and consider adding a one-time grant or subsidy program to stimulate early adoption of conservation practices by individual irrigators.
- Continue State and Federal support of the Texas Community Development program, and increase the allocation of funds for the Small Town Environment Program.
- Increase funding of the Regional Water Supply and Wastewater Facilities Planning Program in anticipation of upcoming development throughout the state, and expand the program to include the costs for preliminary engineering design and development of detailed engineering cost estimates of recommended facilities.
- Support continued and increased funding of the USDA Rural Utilities Service programs at the Federal level, and fund the State Rural Water Assistance Fund.
- Provide research grants for the study of current and upcoming desalination technologies available to wholesale and retail water suppliers. Continue to fund appropriate demonstration facilities to develop a customer base, and pursue Federal funding for desalination programs.
- Provide increased research grants to study and better develop drought-resistant crop species and efficient irrigation practices.
- Support regulatory changes that will allow USACE to increase water supply storage in new reservoirs that they construct and manage, and investigate other alternatives for increased involvement of USACE in funding water supply projects.

- Region H supports the forming of regional facilities and encourages the State to remove any impediments to these entities, including restrictions to the use of public/private partnerships. Additionally, the State Participation Program should be made available to these public/private partnerships and to private nonprofit water supply corporations.

## **ES.9 Water Infrastructure Financing Recommendations**

Approximately \$12.0-billion in capital costs were identified for meeting needs throughout the planning period. These capital costs primarily represent infrastructure (wells, pump stations, treatment facilities, transmission mains, etc) required to implement water management strategies at the wholesale water provider and WUG level. These costs do not include annual costs and debt service associated with the new projects. Additionally, these costs do not represent improvements that will be required within individual WUGs for providing adequate water supply.

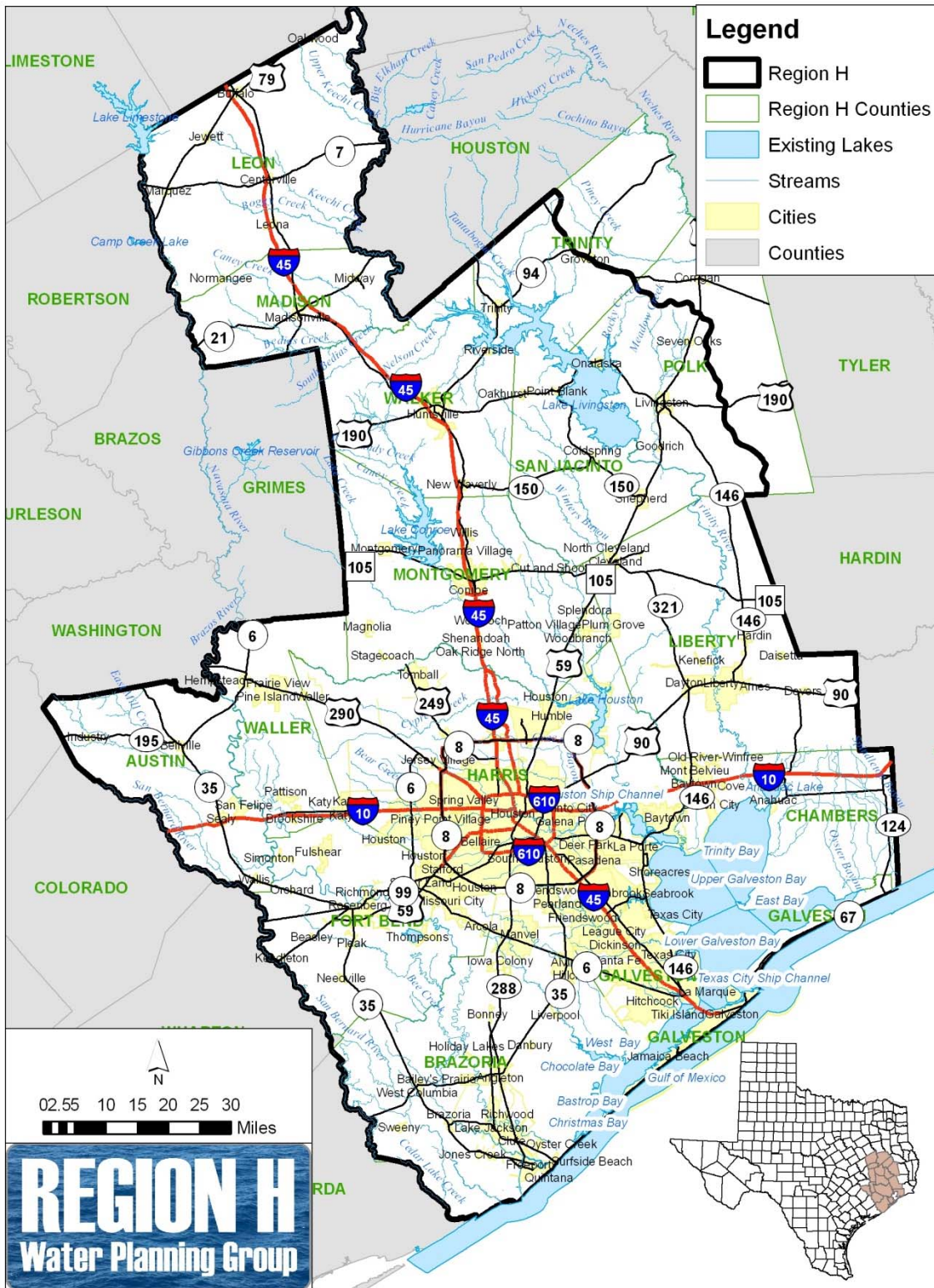
With the assistance of the RHWPG, the TWDB conducted a survey of water utilities. Anticipated costs developed as part of the RWP were submitted to WUGs in order to determine their interest in pursuing one or more of the financial assistance programs offered by TWDB. Please see *Chapter 9* for an overview of this methodology and the results for Region H.

## **ES.10 Public Participation**

During the course of developing the 2011 RWP, the RHWPG conducted numerous public meetings corresponding with various phases of plan development. In addition, the group provided notice for two public hearings and two public meetings corresponding to the initiation of the two bienniums of planning within this phase and discussion of the development and approval of population and water demand projections for the 2011 RWP.

After the submittal of the IPP to TWDB by March 1, 2010, the RHWPG also conducted three public hearings to receive comment from the public. Details of these meetings and comments from the public and interested agencies are provided in *Chapter 10* of the RWP.

Figure ES-3  
Region H Location Map



**Table ES-3  
Public Repositories of the Region H Regional Water Plan**

**AUSTIN COUNTY**

County Clerk  
County Courthouse  
1 East Main  
Bellville, TX 77418

**AUSTIN COUNTY**

Gordon Library  
917 Circle Drive  
Sealy, TX 77474

**BRAZORIA COUNTY**

County Clerk  
County Courthouse  
111 East Locust  
Angleton, TX 77515

**BRAZORIA COUNTY**

Angleton Public Library  
401 East Cedar  
Angleton, TX 77515

**CHAMBERS COUNTY**

County Clerk  
County Courthouse  
Anahuac, TX 77514

**CHAMBERS COUNTY**

Chambers County Library  
– Main Branch  
202 Cummings  
Anahuac, TX 77514

**FORT BEND COUNTY**

County Clerk  
301 Jackson  
Richmond, TX 77469

**FORT BEND COUNTY**

George Memorial Library  
1001 Golfview  
Richmond, TX 77469

**GALVESTON COUNTY**

County Clerk  
County Courthouse  
722 Moody  
Galveston, TX 77550

**GALVESTON COUNTY**

Rosenberg Library  
2310 Sealy  
Galveston, TX 77550

**HARRIS COUNTY**

County Clerk  
Harris County Administration  
Building  
1001 Preston Avenue  
Houston, TX 77002

**HARRIS COUNTY**

Houston Public Library  
1<sup>st</sup> Floor, Bibliographic Information  
Center  
500 McKinney  
Houston, TX 77002

**LEON COUNTY**

County Clerk  
Leon County Courthouse  
Centerville, TX 75833

**LEON COUNTY**

Leon County Library  
129 East Main  
Centerville, TX 75833

**LIBERTY COUNTY**

County Clerk  
County Courthouse  
1923 Sam Houston  
Liberty, TX 77575

**LIBERTY COUNTY**

Sam Houston Regional Library  
And Research Center  
FM1011  
Liberty, TX 77575

**MADISON COUNTY**

County Clerk  
101 West Main, Room 102  
Madisonville, TX 77864

**MONTGOMERY COUNTY**

County Clerk  
County Courthouse  
301 N. Thompson  
Conroe, TX 77301

**POLK COUNTY**

County Clerk  
County Courthouse, 1<sup>st</sup> Floor  
101 West Church  
Livingston, TX 77351

**SAN JACINTO COUNTY**

County Clerk  
County Courthouse  
#1 Highway 150  
Coldspring, TX 77331

**TRINITY COUNTY**

County Clerk  
County Courthouse  
1<sup>st</sup> and Main  
Groveton, TX 75845

**WALKER COUNTY**

County Clerk  
County Courthouse  
1100 University Avenue  
Huntsville, TX 77340

**WALLER COUNTY**

County Clerk  
County Courthouse  
836 Austin Street  
Hempstead, TX 77445

**MADISON COUNTY**

Madison County Library  
605 South May  
Madisonville, TX 77864

**MONTGOMERY COUNTY**

Montgomery County Central  
Library  
104 Interstate 45 North  
Conroe, TX 77301

**POLK COUNTY**

Murphy Memorial Library  
601 West Church  
Livingston, TX 77351

**SAN JACINTO COUNTY**

Coldspring Library  
220 South Bonham  
Coldspring, TX 77331

**TRINITY COUNTY**

Blanche K. Werner Library  
Highway 19  
Trinity, TX 75862

**WALKER COUNTY**

Huntsville Public Library  
1216 – 14<sup>th</sup> Street  
Huntsville, TX 77340

**WALLER COUNTY**

Waller County Library -  
Brookshire/Pattison  
3815 Sixth Street  
Brookshire, TX 77423

**Table ES-4  
Region H Population Projections**

<b>County</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Austin	27,173	30,574	32,946	34,355	35,031	35,958
Brazoria	305,649	354,708	401,684	444,981	490,875	538,795
Chambers	34,282	40,786	46,838	52,083	57,402	62,850
Fort Bend	550,121	719,737	893,875	1,090,710	1,348,851	1,643,825
Galveston	268,714	284,731	294,218	298,057	300,915	302,774
Harris	4,078,231	4,629,335	5,180,439	5,731,543	6,282,647	6,833,751
Leon	18,231	21,137	22,863	22,971	22,809	23,028
Liberty	81,930	94,898	107,335	119,519	132,875	147,845
Madison	13,905	14,873	15,644	16,364	17,002	17,560
Montgomery	453,369	588,351	751,702	931,732	1,169,199	1,444,999
Polk (part)	37,650	42,196	45,779	48,561	51,535	54,380
San Jacinto	27,443	32,541	36,617	39,159	40,630	41,299
Trinity (part)	11,571	12,485	12,786	12,631	12,131	11,673
Walker	70,672	77,915	81,402	80,547	80,737	80,737
Waller	41,137	51,175	62,352	74,789	89,598	106,608
<b>Region H Total</b>	<b>6,020,078</b>	<b>6,995,442</b>	<b>7,986,480</b>	<b>8,998,002</b>	<b>10,132,237</b>	<b>11,346,082</b>

**Table ES-5**  
**Region H Water Demand Projections (in ac-ft/yr)**

<b>AUSTIN</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	4,123	4,658	5,027	5,191	5,278	5,446
Manufacturing	210	233	253	272	288	313
Steam-Electric	0	0	0	0	0	0
Mining	51	56	59	62	65	67
Irrigation	10,617	10,617	10,617	10,617	10,617	10,617
Livestock	1,615	1,615	1,615	1,615	1,615	1,615
Total Water Use	16,616	17,179	17,571	17,757	17,863	18,058
<b>BRAZORIA</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	47,184	53,523	59,656	65,134	71,567	78,598
Manufacturing	260,239	286,554	309,841	333,348	354,093	379,241
Steam-Electric	0	0	0	0	0	0
Mining	4,104	4,502	4,737	4,969	5,201	5,419
Irrigation	135,033	123,115	118,544	115,788	115,788	115,788
Livestock	1,614	1,614	1,614	1,614	1,614	1,614
Total Water Use	448,174	469,308	494,392	520,853	548,263	580,660
<b>CHAMBERS</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	4,985	5,854	6,648	7,338	8,067	8,863
Manufacturing	11,802	12,959	13,987	15,011	15,932	17,122
Steam-Electric	4,435	3,536	4,134	4,863	5,751	6,834
Mining	37,422	40,532	42,427	44,286	46,130	47,742
Irrigation	117,777	117,777	117,777	117,777	117,777	117,777
Livestock	462	462	462	462	462	462
Total Water Use	176,883	181,120	185,435	189,737	194,119	198,800
<b>FORT BEND</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	109,869	143,023	174,552	208,691	251,533	300,689
Manufacturing	6,863	7,199	7,468	7,685	7,829	7,410
Steam-Electric	66,026	68,046	79,553	93,582	110,682	131,527
Mining	3,010	3,070	3,105	3,138	3,169	3,196
Irrigation	53,455	53,455	53,455	53,455	53,455	53,455
Livestock	1,171	1,171	1,171	1,171	1,171	1,171
Total Water Use	240,394	275,964	319,304	367,722	427,839	497,448
<b>GALVESTON</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	46,090	47,390	47,818	47,487	47,393	47,641
Manufacturing	41,005	44,330	47,046	49,692	51,967	55,491
Steam-Electric	5,034	4,013	4,692	5,519	6,528	7,757
Mining	265	279	286	293	300	307
Irrigation	10,342	10,342	10,342	10,342	10,342	10,342
Livestock	325	325	325	325	325	325
Total Water Use	103,061	106,679	110,509	113,658	116,855	121,863

**Table ES-5 (Cont.)**  
**Region H Water Demand Projections (in ac-ft/yr)**

<b>HARRIS</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	709,300	789,397	868,320	948,412	1,030,899	1,119,593
Manufacturing	395,997	424,761	449,218	470,881	487,094	478,957
Steam-Electric	7,728	23,962	28,015	32,955	38,977	46,317
Mining	1,282	1,434	1,529	1,624	1,720	1,805
Irrigation	15,300	15,300	15,300	15,300	15,300	15,300
Livestock	1,133	1,133	1,133	1,133	1,133	1,133
Total Water Use	1,130,740	1,255,987	1,363,515	1,470,305	1,575,123	1,663,105
<b>LEON</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	2,128	2,376	2,489	2,456	2,414	2,437
Manufacturing	714	842	967	1,093	1,207	1,313
Steam-Electric	0	0	0	0	0	0
Mining	1,517	1,464	1,435	1,409	1,384	1,364
Irrigation	542	542	542	542	542	542
Livestock	1,691	1,691	1,691	1,691	1,691	1,691
Total Water Use	6,592	6,915	7,124	7,191	7,238	7,347
<b>LIBERTY</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	10,470	11,759	12,980	14,211	15,629	17,362
Manufacturing	393	465	537	611	678	736
Steam-Electric	2,962	4,240	4,957	5,831	6,896	8,195
Mining	8,730	8,753	8,766	8,778	8,790	8,800
Irrigation	82,901	82,901	82,901	82,901	82,901	82,901
Livestock	757	757	757	757	757	757
Total Water Use	106,213	108,875	110,898	113,089	115,651	118,751
<b>MADISON</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	1,793	1,867	1,921	1,954	2,010	2,075
Manufacturing	260	289	316	343	367	398
Steam-Electric	0	0	0	0	0	0
Mining	24	24	24	24	24	24
Irrigation	19	19	19	19	19	19
Livestock	750	750	750	750	750	750
Total Water Use	2,846	2,949	3,030	3,090	3,170	3,266
<b>MONTGOMERY</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	74,871	98,947	122,197	146,984	180,292	219,432
Manufacturing	2,045	2,332	2,608	2,883	3,126	3,392
Steam-Electric	5,046	8,537	9,981	11,741	13,886	16,502
Mining	480	509	526	543	559	573
Irrigation	66	66	66	66	66	66
Livestock	510	510	510	510	510	510
Total Water Use	83,018	110,901	135,888	162,727	198,439	240,475



**Table ES-5 (Cont.)  
Region H Water Demand Projections (in ac-ft/yr)**

<b>POLK</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	5,062	5,632	6,046	6,335	6,693	7,088
Manufacturing	0	0	0	0	0	0
Steam-Electric	0	0	0	0	0	0
Mining	29	31	32	33	34	35
Irrigation	0	0	0	0	0	0
Livestock	134	134	134	134	134	134
<b>Total Water Use</b>	<b>5,225</b>	<b>5,797</b>	<b>6,212</b>	<b>6,502</b>	<b>6,861</b>	<b>7,257</b>
<b>SAN JACINTO</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	3,153	3,616	3,964	4,120	4,207	4,251
Manufacturing	48	52	56	60	63	68
Steam-Electric	0	0	0	0	0	0
Mining	30	29	28	27	26	26
Irrigation	667	667	667	667	667	667
Livestock	284	284	284	284	284	284
<b>Total Water Use</b>	<b>4,182</b>	<b>4,648</b>	<b>4,999</b>	<b>5,158</b>	<b>5,247</b>	<b>5,296</b>
<b>TRINITY</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	1,203	1,260	1,255	1,206	1,145	1,102
Manufacturing	0	0	0	0	0	0
Steam-Electric	0	0	0	0	0	0
Mining	6	6	6	6	6	6
Irrigation	467	467	467	467	467	467
Livestock	211	211	211	211	211	211
<b>Total Water Use</b>	<b>1,887</b>	<b>1,944</b>	<b>1,939</b>	<b>1,890</b>	<b>1,829</b>	<b>1,786</b>
<b>WALKER</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	16,920	16,607	17,244	16,240	16,042	15,786
Manufacturing	3,208	3,718	4,188	4,666	5,083	5,517
Steam-Electric	0	0	0	0	0	0
Mining	13	13	13	13	13	13
Irrigation	11	11	11	11	11	11
Livestock	632	632	632	632	632	632
<b>Total Water Use</b>	<b>20,784</b>	<b>20,981</b>	<b>22,088</b>	<b>21,562</b>	<b>21,781</b>	<b>21,959</b>
<b>WALLER</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	5,713	7,003	8,469	10,084	12,093	14,454
Manufacturing	89	101	112	123	133	144
Steam-Electric	0	0	0	0	0	0
Mining	13	13	13	13	13	13
Irrigation	22,978	22,978	22,978	22,978	22,978	22,978
Livestock	939	939	939	939	939	939
<b>Total Water Use</b>	<b>29,799</b>	<b>31,101</b>	<b>32,578</b>	<b>34,204</b>	<b>36,223</b>	<b>38,595</b>

**Table ES-5 (Cont.)**  
**Region H Water Demand Projections (in ac-ft/yr)**

<b>REGION H TOTAL</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Municipal	1,042,864	1,192,912	1,338,586	1,485,843	1,655,262	1,844,817
Manufacturing	722,873	783,835	836,597	886,668	927,860	950,102
Steam-Electric	91,231	112,334	131,332	154,491	182,720	217,132
Mining	57,043	60,782	63,053	65,285	67,501	69,457
Irrigation	450,175	438,257	433,686	430,930	430,930	430,930
Livestock	12,228	12,228	12,228	12,228	12,228	12,228
Total Water Use	2,376,414	2,600,348	2,815,482	3,035,445	3,276,501	3,524,666

**Table ES-6  
Summary of Water Supplies Available for Study Years 2010, 2030 and 2060**

<u>Supply Source</u>	<u>Supply Available (acre-feet/year)</u>		
	Year 2010	Year 2030	Year 2060
<b>Groundwater</b>			
Gulf Coast Aquifer	812,709	685,529	685,843
Carrizo-Wilcox Aquifer	10,493	9,756	9,610
Queen City Aquifer	7,906	7,906	7,906
Sparta Aquifer	17,414	17,414	17,414
Brazos River Alluvium	41,539	41,539	41,539
Yegua-Jackson Aquifer	6,400	6,400	6,400
Undifferentiated Aquifer	1,117	1,117	1,117
<b>Subtotal</b>	<b>897,578</b>	<b>769,661</b>	<b>769,829</b>
<b>Surface Water</b>			
Neches River Basin <sup>1</sup>	63,863	63,946	64,177
Neches-Trinity Coastal Basin	21,754	21,754	21,754
Trinity River Basin	1,568,530	1,489,530	1,568,530
Trinity-San Jacinto Coastal Basin	34,313	34,313	34,313
San Jacinto River Basin	321,800	314,000	302,300
San Jacinto-Brazos Coastal Basin	33,051	33,051	33,051
Brazos River Basin <sup>1</sup>	573,081	573,278	573,342
Brazos-Colorado Coastal Basin	12,019	12,019	12,019
Local Supplies, all basins <sup>3</sup>	30,549	31,599	31,895
<b>Subtotal</b>	<b>2,658,960</b>	<b>2,573,490</b>	<b>2,641,381</b>
<b>Total</b>	<b>3,556,538</b>	<b>3,343,151</b>	<b>3,411,210</b>

<sup>1</sup> Supplies represent current allocations to Region H only. Supplies include 63,863 acre-ft per year of firm water currently contracted from upstream LNVA to Region H customers. Total LNVA supply is greater but may not be available to Region H.

<sup>2</sup> Supplies include 155,031 acre-ft per year of firm water currently contracted from upstream BRA system reservoirs to Region H customers. The total BRA supply is greater but is not available to Region H. The remaining Brazos River Basin supply is comprised of Lower Brazos Basin permits owned by Dow Chemical, GCWA, NRG, Brazosport Water Authority, and private irrigators.

<sup>3</sup> Local supplies refer to stock ponds and similar supplies that meet localized demands, predominantly from livestock or mining activities.

**Table ES-7  
Recommended Water Management Strategies**

<u>WMS</u>	<u>Max Project Volume (ac-ft/yr)</u>	<u>WWP Capital Cost \$</u>	<u>WUG Capital Cost \$</u>	<u>Starting Decade</u>
<b>Conservation Strategies:</b>				
Industrial Conservation	TBD	\$0	TBD	2010
Irrigation Conservation	77,881	\$0	\$757,436	2010
Municipal Conservation	105,494	\$0	\$0	2010
<b>Contractual Strategies:</b>				
Expand/Increase Current Contracts	142,599	\$0	See Contracts	2010
New Contracts from Existing Supplies	83,558	\$0	See Contracts	2010
Reallocation of Existing Supplies	N/A	\$0	See Contracts	2010
TRA to SJRA Contract	76,476	\$302,781,597	See Contracts	2040
TRA to Houston Contract	123,524	See Luce Bayou	See Contracts	2030
WUG-Level Contracts <sup>1</sup>	N/A	\$0	\$2,390,273,157	2010
WWP Contracts	N/A	\$0	\$0	2010
<b>Groundwater Strategies:</b>				
Expanded Use of Groundwater	90,617	\$0	\$165,928,999	2010
Interim Strategies	45,512	\$0	\$86,701,535	2010
New Groundwater Wells for Livestock	41	\$0	\$18,635	2020
<b>Groundwater Reduction Plans:</b>				
CHCRWA GRP	4,806	See CHCRWA Trans.	\$0	2010
COH GRP	TBD	See COH Treatment	\$58,235,873	2010
City of Missouri City GRP	17,562	\$92,070,990	\$6,618,706	2010
Fort Bend MUD 25 GRP	589	\$0	\$776,145	2020
Fort Bend WCID 2 GRP	5,753	\$24,828,857	\$0	2020
NFBWA GRP <sup>2</sup>	106,402	See NFBWA Trans.	\$1,638,063	2020
NHCRWA GRP <sup>2</sup>	117,755	See NHCRWA Trans.	\$17,814,585	2010
Pecan Grove GRP	1,700	\$0	\$15,960,000	2020
Richmond/Rosenberg GRP	7,500	\$117,220,150	\$0	2020
River Plantation GRP	368	\$0	\$484,926	2010
SJRA WRAP <sup>3</sup>	129,010	\$900,000,000	\$217,856,853	2020
Sugar Land GRP	9,796	\$161,360,049	\$6,360,101	2020
WHCRWA GRP <sup>2</sup>	78,839	See WHCRWA Trans	\$35,268,970	2010
<b>Infrastructure Strategies:</b>				
CHCRWA Transmission Line	4,806	TBD	N/A	2010
CHCRWA Internal Distribution	4,806	TBD	N/A	2010
CLCND West Chambers System	2,800	\$20,380,000	See Contracts	2020
COH Distribution Expansion	TBD	\$261,040,000	N/A	2010
COH Treatment Expansion	Varies by decade	\$2,045,672,161	N/A	2010
Harris County MUD 50 WTP	632	\$0	\$6,131,600	2020
Huntsville WTP	11,200	\$61,023,906	\$0	2010
LLWSSC Surface Water Project	954	\$0	\$3,087,974	2010
Luce Bayou Transfer	450,000	\$253,916,914	\$0	2020

NFBWA Internal Distribution	106,402	\$225,000,000	N/A	2020
NFBWA Shared Transmission Line	71,876	\$213,000,000	N/A	2020
NHCRWA Internal 2010 Distribution	34,714	\$153,149,640	N/A	2010
NHCRWA Internal 2020 Distribution	91,167	\$345,292,192	N/A	2020
NHCRWA Internal 2030 Distribution	117,755	\$37,439,584	N/A	2030
NHCRWA Transmission 2010	34,714	\$80,690,624	N/A	2010
NHCRWA Transmission 2020	91,167	\$172,558,512	N/A	2020
NHCRWA Transmission 2030	117,755	\$0	N/A	2030
Pearland SWTP	13,420	\$0	\$265,000,000	TBD
Sealy GW Treatment Expansion	888	\$0	\$6,450,000	2020
WHCRWA Internal Distribution	78,839	\$552,472,000	N/A	2010
WHCRWA Transmission Line	78,839	\$290,084,193	N/A	2010

**Reservoir Strategies:**

Allens Creek Reservoir	99,650	\$222,752,400	See Contracts	2020
Brazoria County Off-channel Reservoir	24,100	\$173,898,602	See Contracts	2060
Dow Off-channel Reservoir	21,800	\$124,468,000	See Contracts	2020
Fort Bend County Off-channel Reservoir	46,000	\$202,514,788	See Contracts	2050
GCWA Off-channel Reservoir	39,500	\$197,448,012	See Contracts	2030

**Reuse Strategies:**

Fulshear Reuse	430	\$0	\$566,625	TBD
Houston Indirect Reuse	128,801	\$0	\$721,822,850	2040
Montgomery MUD 8/9 Indirect Reuse	1,120	\$0	\$12,245,687	2016
NHCRWA Indirect Reuse	16,300	\$0	\$66,778,694	2040
Wastewater Reuse for Industry	67,200	\$332,051,761	\$0	2060
Wastewater Reclamation for Mun. Irrigation	36,388	\$0	\$48,043,249	2030

**Permit Strategies:**

BRA System Operations Permit	25,400	TBD	See Contracts	2020
Houston Bayous Permit*	0	\$20,956,000	\$0	2020

**Other Strategies:**

Brazoria Co. Interruptible Supplies for Irr.	104,977	\$0	\$0	2010
Freeport Desalination Plant	33,600	\$255,699,000	See Contracts	2050
Brazos Saltwater Barrier	N/A	\$44,470,739	\$0	2030

1. WUG-level costs for a number of WMS are indicated as "See Contracts". The WUG-level costs for these strategies will be infrastructure costs associated with implementing *future* contracts from WWPs. For simplification, these costs are collectively represented under the "WUG-Level Contracts" WMS, as common infrastructure from a WUG may treat or transmit water from multiple WMS.
2. Yield value includes surface water transmission volume and is therefore not additional yield.
3. Includes supply volume of TRA to SJRA Contract
4. The Houston Bayous Permit has not yet been approved by TCEQ.

**Table ES-8  
Recommended Water Management Strategies by County (in ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Austin</b>						
Initial Shortage	0	-739	-1,240	-1,496	-1,635	-1,865
Expanded GW	0	739	1,240	1,496	1,635	1,865
Municipal Conservation	0	223	251	265	273	285
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>223</b>	<b>251</b>	<b>265</b>	<b>273</b>	<b>285</b>
<b>Brazoria</b>						
Initial Shortage	-150,907	-186,760	-211,634	-238,588	-266,405	-299,199
Expanded GW	0	4,049	12,988	13,515	15,658	16,209
Municipal Conservation	1,476	2,610	2,978	3,249	3,567	3,918
Contract Expansions	7,750	7,750	7,750	7,750	7,750	7,750
<b>Net Shortage</b>	<b>-141,681</b>	<b>-172,351</b>	<b>-187,918</b>	<b>-214,074</b>	<b>-239,430</b>	<b>-271,322</b>
Irrigation Conservation	18,792	18,792	18,792	18,792	18,792	18,792
Wastewater Reclamation for Mun. Irrigation	0	0	116	227	344	465
Brazoria Co. Interruptible Supplies for Irr.	98,189	86,759	64,000	64,000	64,000	64,000
Reallocate Existing Supply	13,694	13,694	13,895	13,988	14,019	13,694
Interim Strategies	24,916	0	0	0	0	0
GCWA Offchannel Reservoir	0	0	39,500	39,500	39,500	39,500
Allens Creek Lake/Reservoir	0	45,277	41,779	66,665	58,092	66,196
BRA System Operations Permit	0	3,010	3,010	3,010	3,010	3,010
Brazoria OCR	0	0	0	0	0	24,000
Freeport Desalination Plant	0	0	0	0	33,600	33,600
Dow Offchannel Reservoir	0	21,800	21,800	21,800	21,800	21,800
New Groundwater Wells for Livestock	0	27	27	27	27	27
<b>Total after Recommendations</b>	<b>13,910</b>	<b>17,008</b>	<b>15,001</b>	<b>13,935</b>	<b>13,754</b>	<b>13,762</b>
<b>Chambers</b>						
Initial Shortage	-42,520	-47,412	-50,831	-54,251	-57,612	-61,065
Expanded GW	0	577	681	796	905	1,010
Municipal Conservation	137	195	219	239	263	291
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-42,383</b>	<b>-46,640</b>	<b>-49,931</b>	<b>-53,216</b>	<b>-56,444</b>	<b>-59,764</b>
Irrigation Conservation	24,018	24,018	24,018	24,018	24,018	24,018
CLCND W Chambers System	0	1,691	1,978	2,235	2,511	2,804
Reallocate Existing Supply	21,010	21,264	21,389	21,509	21,627	21,725
Interim Strategies	903	0	0	0	0	0
New Contract from Existing Supply	13,823	17,083	19,972	22,888	25,732	28,672
<b>Total after Recommendations<sup>1</sup></b>	<b>17,371</b>	<b>17,416</b>	<b>17,426</b>	<b>17,434</b>	<b>17,444</b>	<b>17,455</b>
<b>Fort Bend</b>						
Initial Shortage	-86	-11,410	-52,608	-84,380	-123,623	-178,948
Expanded GW	0	6,886	3,423	3,813	4,378	5,052
Municipal Conservation	1,435	7,077	10,277	12,253	14,678	17,497
Contract Expansions	0	367	1,295	1,226	1,225	1,016
<b>Net Shortage</b>	<b>1,349</b>	<b>2,920</b>	<b>-37,613</b>	<b>-67,088</b>	<b>-103,342</b>	<b>-155,383</b>
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCRWA GRP	0	0	0	0	0	0

	2010	2020	2030	2040	2050	2060
NFBWA GRP	0	0	0	0	0	0
Sugar Land GRP	0	488	4,921	4,835	4,915	4,961
Missouri City GRP	0	4,401	4,401	4,401	4,401	4,401
Wastewater Reclamation for Mun. Irrigation	0	0	2,136	4,744	8,403	12,277
Fort Bend MUD 25 GRP	0	589	589	589	589	589
BRA System Operations Permit	0	3,611	15,860	22,340	22,340	22,340
Fort Bend OCR	0	0	0	0	90	45,943
Allens Creek Lake/Reservoir	0	0	0	6,605	25,864	16,145
TRA to Houston Contract	0	0	13,813	27,824	39,179	39,179
Reallocate Existing Supply	0	0	4,687	4,510	3,720	13,762
Fulshear Reuse	0	287	430	430	430	430
Industrial Conservation	0	558	558	558	558	558
<b>Total after Recommendations</b>	<b>6,546</b>	<b>18,051</b>	<b>14,979</b>	<b>14,945</b>	<b>12,344</b>	<b>10,399</b>

**Galveston**

Initial Shortage	-16,307	-16,466	-17,787	-18,738	-19,884	-21,276
Expanded GW	0	811	1,352	1,350	1,352	1,352
Municipal Conservation	768	846	886	896	903	914
Contract Expansions	0	25,630	25,630	25,630	25,630	25,630
<b>Net Shortage</b>	<b>-15,539</b>	<b>10,821</b>	<b>10,081</b>	<b>9,138</b>	<b>8,001</b>	<b>6,620</b>
Irrigation Conservation	2,392	2,392	2,392	2,392	2,392	2,392
New Contract from Existing Supply	16	23	26	29	33	37
Interim Strategies	6,410	0	0	0	0	0
Allens Creek Lake/Reservoir	0	12,101	13,234	14,175	15,310	16,687
New Groundwater Wells for Livestock	0	14	14	14	14	14
Interruptible Supplies for Irr.	6,788	0	0	0	0	0
<b>Total after Recommendations</b>	<b>67</b>	<b>25,351</b>	<b>25,747</b>	<b>25,748</b>	<b>25,750</b>	<b>25,750</b>

**Harris**

Initial Shortage	-51,413	-194,925	-270,301	-323,711	-375,414	-458,509
Expanded GW	0	15,481	27,659	27,693	27,727	27,560
Municipal Conservation	37,292	46,836	51,902	56,748	61,656	66,947
Contract Expansions	0	108,852	66,039	51,840	42,538	31,971
<b>Net Shortage</b>	<b>-14,121</b>	<b>-23,756</b>	<b>-124,701</b>	<b>-187,430</b>	<b>-243,493</b>	<b>-332,031</b>
New Contract from Existing Supply	23,008	31,264	38,732	54,777	54,805	54,849
NHCRWA GRP	0	0	0	0	0	0
WHCRWA GRP	-65	-258	-409	-566	-751	-968
COH GRP	0	0	0	0	0	0
Missouri City GRP	0	386	386	386	386	386
Wastewater Reclamation for Mun. Irrigation	0	0	3,268	6,616	10,027	13,431
Reallocate Existing Supply	18,253	15,276	7,308	19,232	30,220	96,881
Interim Strategies	15	0	0	0	0	0
Allens Creek Lake/Reservoir	0	15	83	336	384	622
TRA to Houston Contract	0	0	93,744	86,519	75,164	75,164
NHCRWA Indirect Reuse	0	0	0	7,300	16,300	16,300
Wastewater Reuse for Industry	0	0	0	0	0	67,200
Houston Indirect Reuse	0	0	0	66,420	114,679	128,801
<b>Total after Recommendations</b>	<b>27,090</b>	<b>22,927</b>	<b>18,411</b>	<b>53,590</b>	<b>57,721</b>	<b>120,635</b>

	2010	2020	2030	2040	2050	2060
<b>Leon</b>						
Initial Shortage	0	-376	-614	-707	-779	-908
Expanded GW	0	376	614	707	779	908
Municipal Conservation	0	126	140	124	107	116
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Liberty</b>						
Initial Shortage	-11,846	-15,142	-18,687	-22,539	-27,061	-32,363
Expanded GW	0	2,537	4,590	6,809	9,399	12,544
Municipal Conservation	0	539	641	744	868	995
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-11,846</b>	<b>-12,066</b>	<b>-13,456</b>	<b>-14,986</b>	<b>-16,794</b>	<b>-18,824</b>
Irrigation Conservation	20,876	20,876	20,876	20,876	20,876	20,876
Reallocate Existing Supply	6,657	6,697	6,732	6,767	6,805	6,833
<b>Total after Recommendations</b>	<b>15,687</b>	<b>15,507</b>	<b>14,152</b>	<b>12,657</b>	<b>10,887</b>	<b>8,885</b>
<b>Madison</b>						
Initial Shortage	-1	-130	-228	-239	-323	-450
Expanded GW	0	130	228	239	323	450
Municipal Conservation	1	91	110	112	116	119
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Montgomery</b>						
Initial Shortage	-17,728	-47,619	-69,513	-81,350	-120,398	-165,162
Expanded GW	0	5,615	4,471	5,614	9,034	11,820
Municipal Conservation	4,460	6,007	7,384	8,838	10,795	13,089
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-13,268</b>	<b>-35,997</b>	<b>-57,658</b>	<b>-66,898</b>	<b>-100,569</b>	<b>-140,253</b>
MUD 8 AND 9 Reuse	0	657	816	1,120	1,120	1,120
Wastewater Reclamation for Mun. Irrigation	0	0	1,752	3,838	6,787	10,215
SJRA WRAP	0	36,377	55,538	54,582	53,581	52,534
Interim Strategies	13,268	0	0	0	0	0
TRA To SJRA Contract	0	0	0	7,935	39,096	76,476
<b>Total after Recommendations</b>	<b>0</b>	<b>1,037</b>	<b>448</b>	<b>577</b>	<b>15</b>	<b>92</b>
<b>Polk</b>						
Initial Shortage	0	-117	-205	-272	-384	-513
Expanded GW	0	117	205	272	384	513
Municipal Conservation	0	158	173	180	187	198
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>



	2010	2020	2030	2040	2050	2060
<b>San Jacinto</b>						
Initial Shortage	0	-300	-533	-695	-793	-869
Expanded GW	0	542	928	984	1,007	1,060
Municipal Conservation	19	148	163	174	181	184
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>
<b>Total after Recommendations</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>
<b>Trinity</b>						
Initial Shortage	0	0	0	0	0	0
Expanded GW	0	36	36	21	0	0
Municipal Conservation	0	2	1	0	0	0
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Walker</b>						
Initial Shortage	0	-815	-1,655	-1,973	-2,384	-2,853
Expanded GW	0	816	1,651	1,963	2,374	2,843
Municipal Conservation	0	68	74	89	90	92
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Waller</b>						
Initial Shortage	-82	-1,926	-2,940	-4,579	-8,177	-12,355
Expanded GW	0	1,447	2,231	3,644	5,382	7,431
Municipal Conservation	17	392	497	592	708	849
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-65</b>	<b>-87</b>	<b>-212</b>	<b>-343</b>	<b>-2,087</b>	<b>-4,075</b>
Irrigation Conservation	0	0	0	0	6,606	6,606
WHCRWA GRP	65	258	409	566	751	968
<b>Total after Recommendations</b>	<b>0</b>	<b>171</b>	<b>197</b>	<b>223</b>	<b>5,270</b>	<b>3,499</b>

## Notes:

<sup>1</sup>Lines for reallocation of existing supplies include only the positive portions of reallocations, as negative portions remove surpluses from some WUGs.

A. Shortage values reflect the sum of all WUG shortages without offsets for other WUG surpluses.

**Table ES-9**  
**Overall Frequencies of Meeting Monthly Inflow Targets**

<b>Inflow Target</b>	<b>Max H</b>	<b>Min Q</b>	<b>Min Q-Sal</b>
Historical Frequency	66%	78%	82%
GBFIG Target Frequency	50%	60%	75%
Naturalized	68%	67%	83%
Current Conditions	63%	58%	79%
Full Authorized Diversions with Return Flows	59%	53%	75%
Full Authorized Diversions with no Return Flows	43%	43%	56%
Full Diversions with RF and Region C & H Strategies (2006 Plans)	62%	59%	77%