LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

MANAGEMENT PLAN

Revised and Re-adopted: September 12, 2014

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LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

1. DISTRICT MISSION

The Lower Trinity Groundwater Conservation District (the "District") mission is to design and implement a management plan that will protect and sustain the groundwater resources of Polk and San Jacinto counties, which will provide an efficient, economical, and environmentally sound source of groundwater resources in the District.

2. TIME PERIOD OF THIS PLAN

This plan will become effective upon adoption by the Lower Trinity Groundwater Conservation District Board of Directors and approved as administratively complete by the Texas Water Development Board. The plan will remain in effect for five (5) years after the date of approval or until a revised plan is adopted and approved.

3. STATEMENT OF GUIDING PRINCIPLES

The Lower Trinity Groundwater Conservation District recognizes that the groundwater resources of the region are of vital importance to the continued economic well being of landowners, agriculture, citizens, economy, environment and long term use of the resource within the District. This management plan is intended as a guide or blueprint for action of those individuals charged with the responsibility for the execution of District activities.

4. PURPOSE OF MANAGEMENT PLAN

The Lower Trinity Groundwater Conservation District was first created in 2003, in Chapter 863, Acts of the 78th Legislature and was then amended in 2005 by Senate Bill 1017 which created the District with 5 directors elected from Polk and San Jacinto Counties. A confirmation election was held on November 7, 2006 which confirmed the district and elected 5 initial directors from Polk and San Jacinto Counties. The board has adopted rules and held public hearings thereon in accordance with Texas Water Code, Section 36.001et.seq.

The primary objective of the Lower Trinity GCD plan is to be in compliance with Senate Bill 1 (SB1) which was enacted by the 75th Texas Legislature in 1997, which requires all groundwater conservation districts to develop a management plan. This plan defines the water needs and supply available to the District and the goals that this district will use to manage that groundwater resource.

This groundwater management plan fulfills the requirements of SB1 and the Texas Water Development Board rules, specifically Texas Administrative Code, Chapter 356 (31 TAC§356).The plan includes the requested 18 specific areas of groundwater data associated with the Lower Trinity GCD which is a requirement of the Texas Water Development Board.

The Texas Legislature enacted significant changes to the management of groundwater resources in Texas with the passage of House Bill 1763 (HB 1763) in 2005. HB 1763 created a long-term planning process in which groundwater conservation districts (GCDs) in each Groundwater Management Area (GMA) are required to meet and determine the Desired Future Conditions (DFCs) for the groundwater resources within their

boundaries by September 1, 2010. In addition, HB 1763required GCDs, to share management plans with the other GCDs in the GMA for review by the other GCDs.

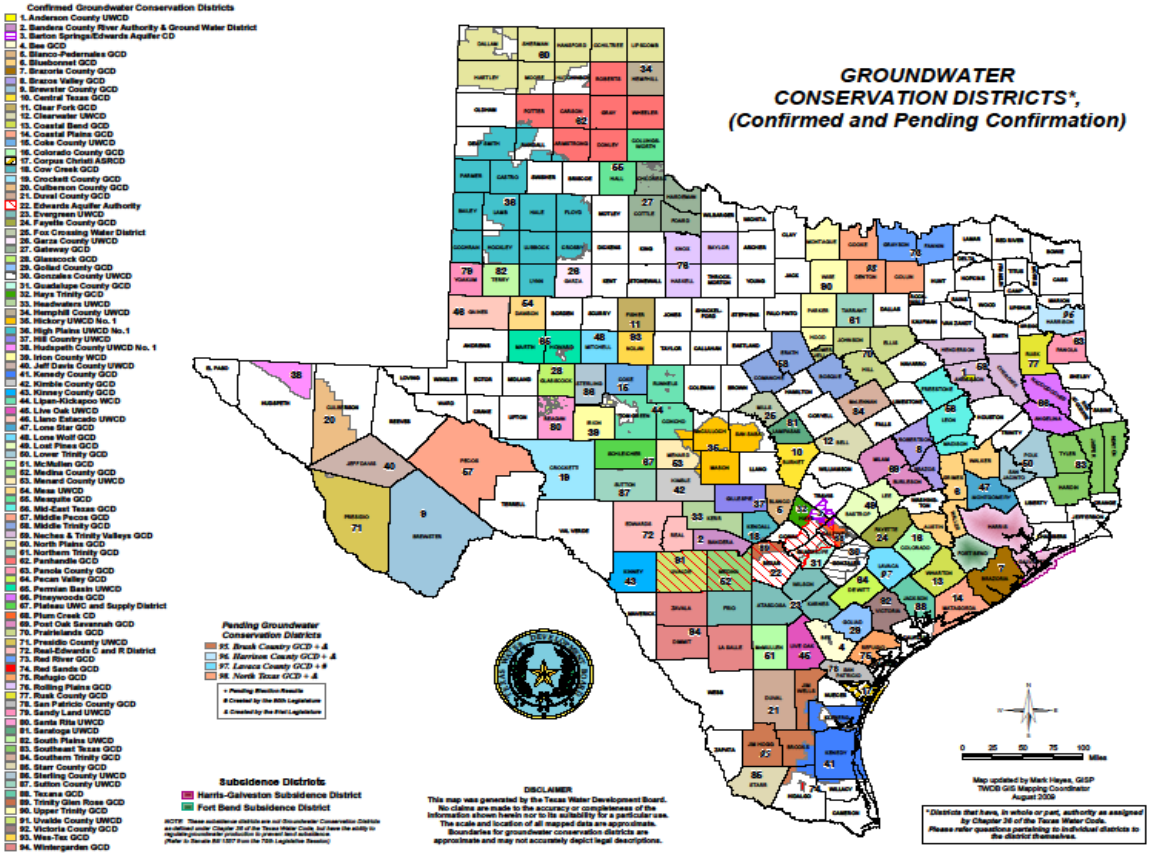
The Lower Trinity Groundwater Conservation District's management plan satisfies the requirements of SB 1, SB 2, HB 1763, the statutory requirements of Chapter 36 of the Texas Water Code, and the administrative requirements of the Texas Water Development Board's (TWDB) rule.
The current rules are available at our web-site at www.ltgcd.org under the section forms and documents.

5. GROUNDWATER RESOURCES

A. Location and Extent

The Lower Trinity Groundwater Conservation District contains Polk and San Jacinto counties in their entirety, which has a combined area of 1,689 square miles. Polk and San Jacinto counties are bounded by Angelina and Trinity counties to the north, Tyler County to the east, Hardin and Liberty counties to the south, and Montgomery and Walker counties to the west. Livingston is the county seat of Polk County and Coldspring is the county seat of San Jacinto County. Average rainfall in the district is approximately 48 inches. See Figure 1, Groundwater Conservation Districts (TWDB, 8/09).

Figure 1



B. Topography and Drainage

Polk County is in the East Texas Timberlands region on the east bank of the Trinity River. Its geographical center is at 94°50' north latitude and 30°49' west longitude. The county seat, Livingston, straddles U.S. highways 59 and 190 about seventy-six miles northeast of Houston. The county comprises 1,061 square miles, ranging in elevation from 100 to 300 feet. The land gently rolls in the north and has light-colored, loamy surfaces and deep, reddish clay subsoils. To the south the topography is more level, with acidic, sandy to loamy surfaces and deep, reddish loam or clay subsoils. Along the Trinity River the soils are dark with loamy surfaces and cracking clay subsoils. Marine deposits indicate that the region was once under the sea. Pine and hardwood forests cover much of the area; Polk County was the number one Timber producing county in Texas in 1990. Forty percent of the county is considered prime farmland. Cattle production is also a principle source of income. The Neches and Trinity rivers border the county, which is drained by seven primary streams: Menard, Sally, Tombigbee, Big Sandy, Long King, Piney, and Kickapoo creeks. Lake Livingston, a man-made reservoir on the Trinity River, began filling in 1969. Lake Livingston has a length of 55 miles and an average width of 0.42 miles. The average depth is 23 feet. Lake Livingston has 450 miles of shoreline and covers 82,600 acres. The average annual temperature is 67° F. Precipitation averages forty-eight inches annually, and the growing season lasts 250 days. Refer to the Handbook of Texas Online, Polk County@tshaonline.org/handbook. See Figure 2; Precipitation and Runoff in the Trinity River Basin. (U. S. Geological Survey & TWDB, Report 67, 1931-1960).

Figure2

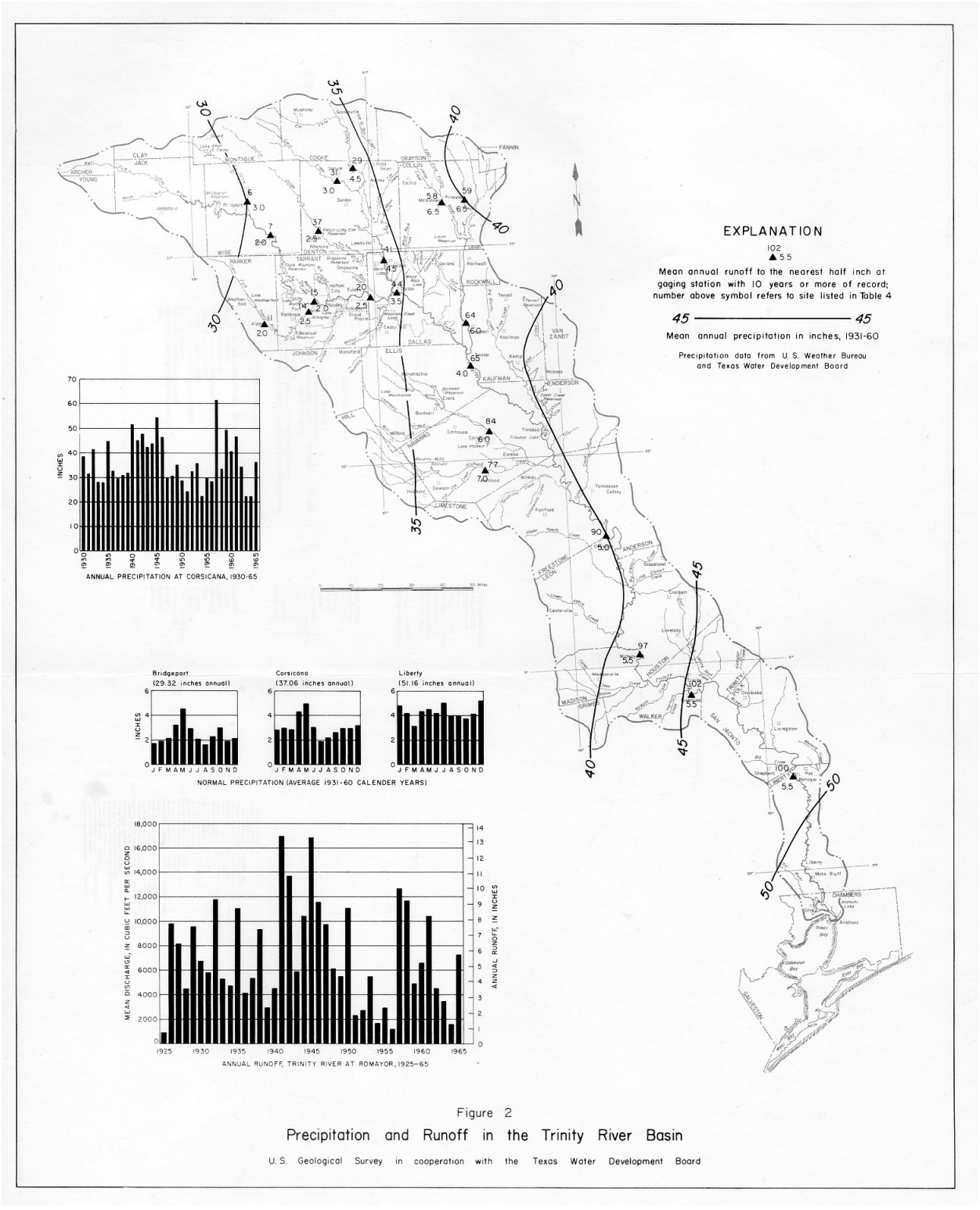


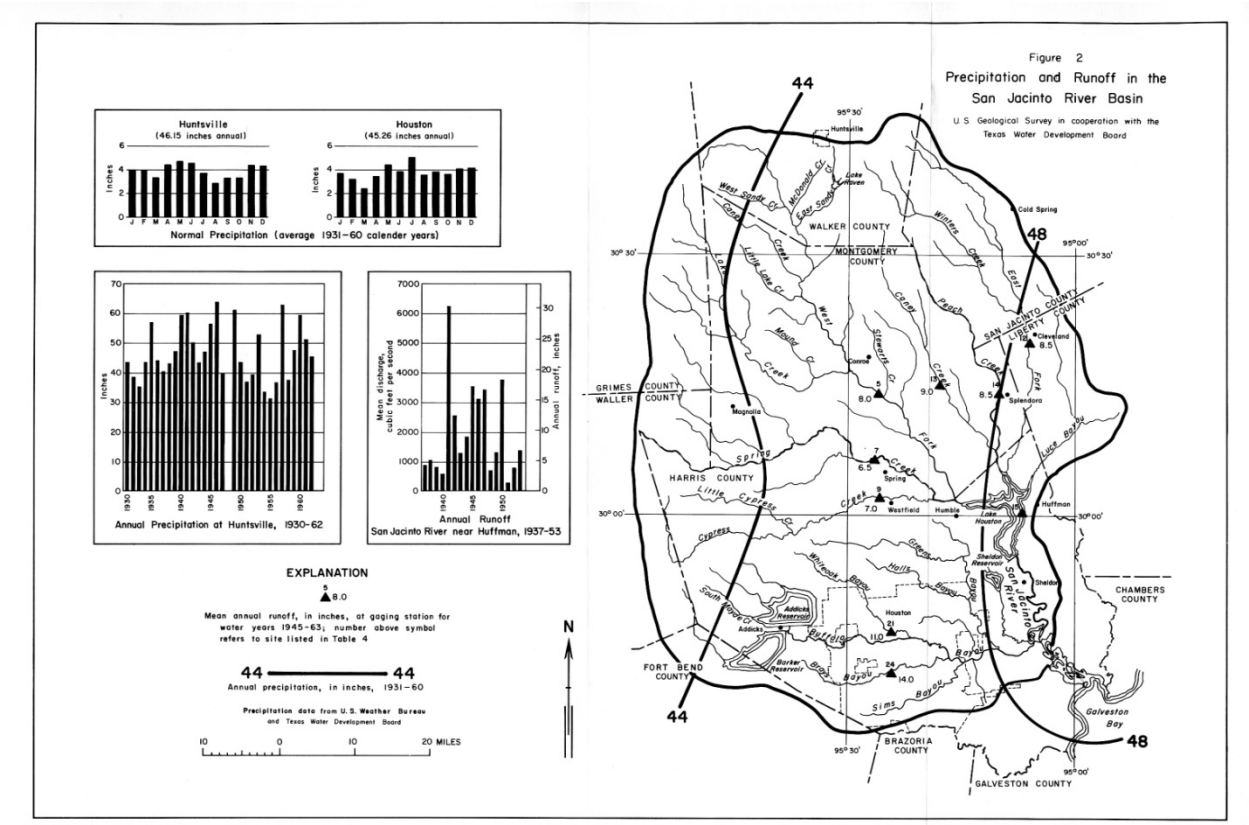
Figure 2

Precipitation and Runoff in the Trinity River Basin

U. S. Geological Survey in cooperation with the Texas Water Development Board

San Jacinto County is in southeastern Texas on the Trinity River. Shepherd, the largest town, is fifty miles north of Houston on U.S. Highway 59. The county's center is at 30°41' north latitude and 95°00' west longitude. San Jacinto County comprises 628 square miles of the East Texas Timberlands and is heavily wooded with longleaf and loblolly pine, cedar, oak, walnut, hickory, gum, ash, and pecan. Sixty percent of the county is in the Sam Houston National Forest. Gently rolling hills characterize the area, and the soils are reddish with a loamy surface and mostly clayey subsoils that are high in iron. Along the Trinity River, there are dark loamy to cracking clayey subsoils. Between 20 and 30 percent of the land is considered prime farmland. The Trinity River serves as the eastern boundary of the county. The San Jacinto River, Big Creek, Winter Bayou, and Stephen Creek also flow through the county, and Peach Creek flows along the southwestern boundary. The elevation ranges from 374 to 386 feet. Average annual precipitation is forty-eight inches, and the temperature ranges from an average low of 36° F in January to an average high of 94° in July. The average growing season extends 261 days. Refer to the Handbook of Texas Online, Figure 2a; Precipitation and Runoff in the San Jacinto River Basin (U.S. Geological Survey & TWDB, Report 13).

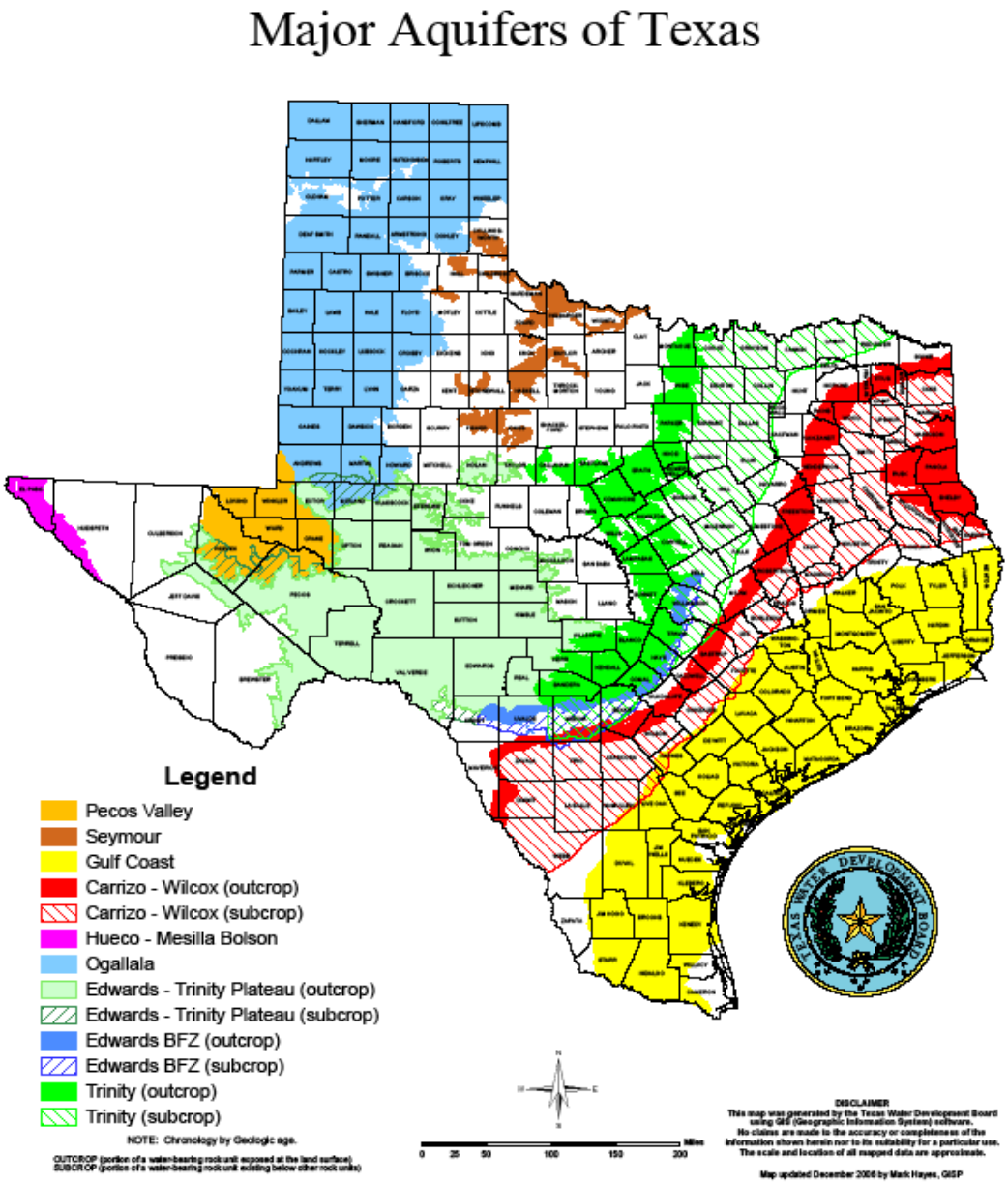
Figure 2a



C. Groundwater Resources of Polk and San Jacinto

The major aquifer in both counties is the Gulf Coast. See Figure 3, (TWDB, 12/06) and Figure 3A, (Popkin, B. 1971, Report 136, TWDB).

Figure 3



The Gulf Coast Aquifer is a major aquifer paralleling the Gulf of Mexico coastline from the Louisiana border to the Mexican border. It consists of several aquifers, including the Jasper, Evangeline, and Chicot aquifers, which are composed of discontinuous sand, silt, clay, and gravel beds. The maximum total sand thickness for the Gulf Coast Aquifer ranges from 700 feet in the south to 1,300 feet in the north. Freshwater saturated thickness averages about 1,000 feet. Water quality varies with depth and locality: it is generally good in the central and northeastern parts of the aquifer where it contains less than 500 milligrams per liter of total dissolved solids but declines to the south where it typically contains 1,000 to more than 10,000 milligrams per liter of total dissolved solids and where the productivity of the aquifer decreases. High levels of radionuclides, believed mainly to be naturally occurring, are found in some wells in Harris County in the outcrop and in South Texas. The aquifer is used for municipal, industrial, and irrigation purposes. In Harris, Galveston, Fort Bend, Jasper, and Wharton counties, water level declines of up to 350 feet have led to land subsidence. The planning groups recommended several water management strategies that use the Gulf Coast Aquifer, including drilling more wells, pumping more water from existing wells, temporary overdrafting, constructing new or

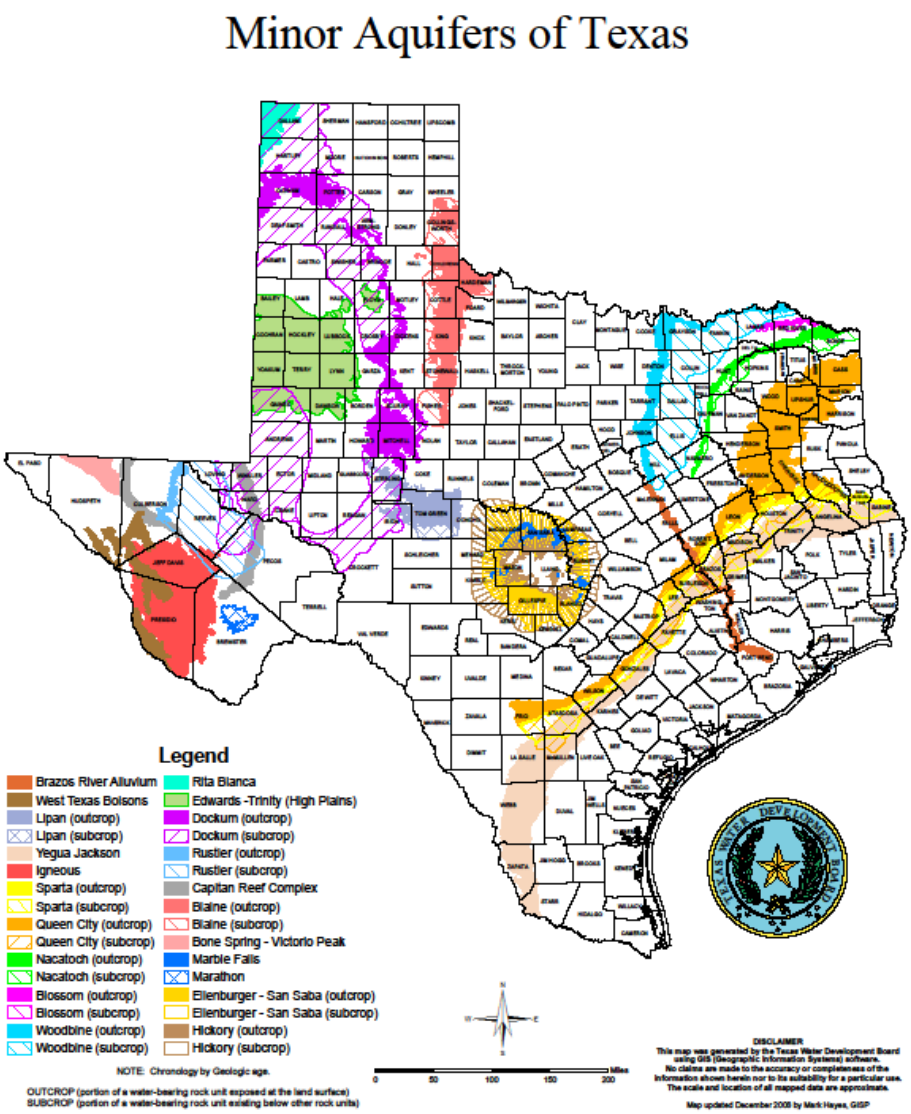
expanded treatment plants, desalinating brackish groundwater, developing conjunctive use projects, and reallocating supplies.

Aquifer characteristics

- Area of aquifer: 41,879 square miles
- Availability: 1,825,976 acre-feet per year (2010) to 1,681,738 acre-feet per year (2060)
- Proportion of aquifer with groundwater conservation districts: 73 percent
- Number of counties containing the aquifer: 54
- Please refer to the Region H 2007 State Water Plan.

A very small portion of Northern Polk County is located in the minor aquifer "Yegua Jackson". (For both major and minor aquifers, please refer to the Region H 2006 Water Plan (Region H, 2006) at the water resources site and TWDB publication report 345. See Figure 4 (TWDB, 12/06). See the TWDB GAM RUN 14-006 attached as Appendix E.

Figure 4



Yegua-Jackson Aquifer

The following geologic setting of the District has been extracted from Knox and others, 2007.

Study Area and Geologic Setting

This section of the report will describe the general study area in terms of location, physiography and climate and will also describe the geologic setting for the Yegua-Jackson Aquifer of Texas.

Description of the Study Area

The Yegua-Jackson Aquifer of Texas includes the outcrop of the Yegua Formation and the Jackson Group as well as a small area downdip of the outcrop. It lies just north of the extensive Gulf Coast Aquifer and just south of the Sparta Aquifer. The Yegua-Jackson Aquifer roughly parallels the Gulf Coast shoreline and lies from 70 to 120 miles inland of the coast (Figure 2-1). It is a narrow band ranging from 15 to 40 miles wide (Preston, 2006) extending almost 500 miles within Texas from the Mexican border to the Louisiana border and including parts of 35 counties (Preston, 2006). The aquifer extends north from the Mexican border in Starr County, paralleling the Rio Grande into Webb County, where it turns to the northeast. It becomes narrower (and dips more steeply) in the central extent from Wilson to Fayette counties, arching farther away from the coast to the north. The aquifer trends northeast from Bee County to Houston County, where it bends more eastward to meet the Louisiana border in Sabine County.

Rainfall varies across the study area, from an average of only about 20 inches per year in South Texas to over 50 inches per year in East Texas (Larkin and Bomar, 1983). This climate trend not only impacts aquifer recharge and downdip extent of fresh water, but also affects soil development and vegetation types. These latter issues can potentially complicate surface geology mapping, especially in East Texas where soils are thick and vegetation is extensive.

Land surface within the study area generally slopes gradually east and southeast across the upper coastal plain of Texas. Relief is generally subdued across the rolling lowlands, although outcrops of certain indurated sands can produce local topographic variations exceeding several tens of feet (Preston, 2006).

This study incorporated both available surface mapping and subsurface data to collect adequate information for numerical aquifer modeling. Thus, the study area extends as much as 60 miles downdip (coastward) of the southern aquifer boundary. Within this 36,000 square-mile area, geophysical well logs from oil and gas wells and a few water wells were selected and linked into a system of dip- and strike-oriented cross sections to evaluate the three-dimensional structure, stratigraphy, and lithology of the aquifer.

Refer to Exhibit D, page 39 for Historical Groundwater Pumpage Estimates Table for Specific Pumpage,

Historical Water Usage table in Exhibit D, page 39 water usage details.

D. Surface Water Resources of Polk and San Jacinto Counties

Lake Livingston is a reservoir located in the East Texas Piney Woods. Lake Livingston was built, is owned and is operated by the Trinity River authority of Texas (TRA) under contract with the City of Houston for water supply purposes. Two thirds of the 1,750,000 acre feet of surface water has been purchased by the City of Houston and TRA owns the other one-third. The lake is the largest lake constructed for water supply purposes located totally within the State of Texas.

Water stored in the lake is used to supply industrial, municipal and agricultural needs in the lower Trinity River Basin and the Houston/Galveston metropolitan area. Its significance in the face of the extraordinary growth experienced by this region of the Upper Texas Gulf Coast is tremendous.

The earth fill dam has a concrete spillway and was designed by Brown and Root, Incorporated. The average base width of the dam's earthen embankment is 310 feet wide. The spillway is designed and constructed to pass flows of three times the maximum-recorded flow of the river at this site.

Lake Livingston has a surface area of 83,000 acres and impounds 1,750,000 acre feet of water at its normal pool elevation of 131 feet above mean sea level. The average depth of the lake is 23 feet with a maximum depth of 90 feet. Lake Livingston has more than 450 miles of shoreline extending into San Jacinto, Polk, Walker, and Trinity Counties.

Lake Livingston was built with no flood control capabilities/flood storage capabilities, and because of this all water entering the lake whether from rainfall or inflow, must exit the lake as increase intake occurs. Source-wikipedia.org/wiki/Lake_Livingston.

The projected total surface water supplies were taken once every decade representing 6 years of actual data, which included decades 2010-2060 from Region H and I Regional Water Planning Group for Polk County totaled 38,417 acre feet and 6,090 total acre feet for San Jacinto County.

Please see Exhibit D, page 39, Projected Surface Water Supply Table for details.

E. Projected Total Water Demands For Polk and San Jacinto Counties

Refer to Exhibit D page 39, Projected Total Water Demands for other details.

F. Projected Water Needs For Polk and San Jacinto Counties

Refer to Exhibit D, page 39 for Projected Water Needs for Polk and San Jacinto Counties.

6. ESTIMATE OF THE MANAGED AVAILABLE GROUNDWATER

The Texas Water Code defines Modeled available groundwater as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition under Texas Water Code §36.108"

The joint planning process set forth in Texas Water Code §36.108 must be collectively conducted by all groundwater conservation districts within the same GMA. The District is a member of GMA 14. GMA 14 adopted DFC's for the following aquifers on August 25, 2010: Gulf Coast Aquifer, Carrizo Sand Aquifer, Queen Coty Aquifer, Sparta Aquifer, Yegua-Jackson Aquifer, and Relative River Alluvians within the GMA.

The adopted DFC's were forwarded to the TWDB for development of the Modeled Available Groundwater ("MAG") calculations. On November 18, 2011 the TWDB issued GAM RUN 10-038 MAG (Exhibit F) for the Gulf Coast Aquifer and GAM RUN 10-055 MAG Version 2 MAG for the Yegua-Jackson Aquifer on July 9, 2012. A summary of the Desired Future Conditions and Modeled Available Groundwater, relative to the Lower Trinity Groundwater District, are referred to in Appendix F as follows:

GAM RUN 10-038 MAG-Gulf Coast Aquifer- for the Desired Future Conditions (DFC) in Polk and San Jacinto County, see Table 1 page 70. For the Managed Available Groundwater ("MAG"), refer to Tables 3-6 on pages 76-79.

GMA RUN 10-055 MAG-Version 2 for the Yegua-Jackson Aquifer- for the Desired Future Conditions (DFC) for Polk County refer to page 90-91 and the Managed Available Groundwater for Polk County on page 98-Tables 2,4 and Table 6 on page 99.

Note: San Jacinto County is not is the Yegua-Jackson Aquifer.

7. PUBLIC INFORMATION

The District utilizes the website, newspaper, and public postings in accordance with the Texas Open Meetings Act, Texas Government Code Chapter 551 to insure local awareness of District activities. The transfer of information to the public is vital in the creation of awareness of the District function and the public support that is needed to manage and reduce production of water resources from the underground aquifer. The District will fully co-operate with the media and all interested parties in the education, management, and conservation of water resources within the District.

8. MANAGEMENT OF GROUNDWATER SUPPLIES

The District will manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in activities and practices, that when implemented would result in sustaining the level of groundwater use, while increasing the use of surface water. The existing observation well network will be used to monitor changing aquifer conditions of groundwater supplies within the District. If necessary the network may be expanded. The District will make a regular assessment of water supply and groundwater conditions and will report those conditions to the Board and to the public. The District will cooperate with investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the Board. The District will adopt rules to manage groundwater. The District may deny a water well drilling permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony. The relevant factors to be considered in making a determination to deny a permit or limit groundwater withdrawals will include:

1) The purpose of the rules of the District
2) The equitable distribution of the resource
3) The economic hardship resulting from permission or denial of a permit or the terms prescribed by the permit

In complying with the District's mission of protecting the resource, the District may require reduction of groundwater withdrawals to amounts that will not cause harm to the aquifer. To achieve this purpose, the District may, at the Board's discretion amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions observed by the District. The District will enforce the terms and conditions of permits and the rules of the District by injunction or other appropriate relief in a court of competent jurisdiction as provided for in the Texas Water Code (TWC) Section 36.102.

The District will evaluate the resources available within the District and determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

9. ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement the provisions of this plan and will utilize the provisions of this plan as a guidepost for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District and any additional planning efforts in which the District may participate will be consistent with the provisions of this plan.
The District will adopt rules relating to the permitting of wells and the production of
Groundwater. The rules adopted by the District shall be pursuant to TWC § 36.11 and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available. A copy of the rules is located on the District web site at the following internet address: http://ltgcd.org/rules.html.

The District shall treat all citizens with equality. Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local conditions. In granting of discretion to any rule, the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the District Board shall not be construed as limiting the power of the District Board.

The District will seek the cooperation in the implementation of this plan and the management of groundwater supplies within the District. All activities of the District will be undertaken in cooperation and coordinated with the appropriate state, regional or local management entity.

10. MANAGEMENT GOALS, OBJECTIVES AND PERFORMANCE STANDARDS

A. Efficient Use of Groundwater

Management Objective: Each year, the District will require 100 percent of the new exempt and non-exempt wells that are constructed within the boundaries of the District to be registered or permitted with the District in accordance with the District Rules.

Performance Standard: The number of exempt and non-exempt wells registered or permitted by the District for the year will be incorporated into the Annual Report submitted to the Board of Directors of the District.

B. Controlling and Preventing Waste of Groundwater

Management Objective: Each year, the District will make an evaluation of the District Rules to determine whether any amendments are recommended to decrease the amount of waste of groundwater within the District.

Performance Standard: The District will include a discussion of the annual evaluation of the District Rules and the determination of whether any amendments to the rules are recommended to prevent the waste of groundwater in the Annual Report of the District provided to the Board of Directors of the District.

Management Objective: Each year, the District will provide information to the public on eliminating and reducing wasteful practices in the use of groundwater by publishing an article on groundwater waste reduction on the District's website at least once per year.

Performance Standard: Each year, the number of articles published on the District's website and a copy of the information provided in the groundwater waste reduction article on the District's website will be included in the District's Annual Report submitted to the Board of Directors of the District.

Management Objective: Each year, the District will provide information to the public on eliminating and reducing wasteful practices in the use of groundwater by speaking at least once per year at service organizations or public schools.

Performance Standard: Each year, the number of speaking appearances at service organizations or public schools and a copy of the information provided during speaking appearances by the District each year will be included in the District's Annual Report submitted to the Board of Directors of the District.

C. Conjunctive Use of Surface Water

Management Objective: Each year the District will coordinate conjunctive surface water management issues with the Trinity River Authority and the San Jacinto River Authority; and through the East Texas Regional Water Planning Group (Region I) and the Region H Planning Group, by inviting officials from the various groups to attend a District meeting at least once a year.

Performance Standard: A copy of the letters of invitation to the surface water providers and to the regional water planning groups will be included in the annual report to the Board of Directors. Refer to Appendix C

D. Natural Resource Issues that Impact the Use and Availability of Groundwater

Management Objective: Each year, the District will perform at least one study, or write an article for a publication on natural resource issues like endangered species, oil and gas drilling, forestry, mining, groundwater or surface water quality.

Performance Standard: Number of studies performed or articles submitted each year will be presented in the annual report to the Board of Directors of the District, which will include the results of all impact studies or articles.

E. Control and Prevent Subsidence

This Management Goal is not applicable to the District.

F. Develop a Management Strategy to Address Drought Conditions

Management Objective: The drought status will be monitored by downloading the updated Palmer Drought Severity Index (PDSI) map at least once monthly and check for the updates to the Drought Preparedness Council Situation Report (Situation Report) posted on the Texas Department of Public Safety – Division of Emergency Management website (http://www.txdps.state.tx.us/dem/sitrepindex.htm) at least once monthly.

Performance Standard: On a quarterly basis, the District will make an assessment of the status of drought in the District and prepare a quarterly report to the Board of Directors of the District. The downloaded PDSI maps and Situation Reports will be included in the quarterly report to the Board of Directors of the District.

Management Objective: The District will publish an article in two newspapers and one article on the District web site when the Palmer Drought Severity Index indicates that the District is experiencing moderate drought conditions (PDSI = -2 to -3) for three consecutive months.

Performance Standard: The number of times the Palmer Drought Severity Index indicates a moderate drought within the District for three consecutive months, the number of newspaper articles published, and the number of articles published on the District web site will be included in the annual report provided to the Board of Directors of the District.

Management Objective: In developing the contingency plan, the District will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the degree and effect of changes in aquifer conditions, the specific hydro geologic conditions of the aquifers within the District, and the appropriate conditions under which to implement the contingency plan. The drought contingency plan will be reviewed once annually in order to access whether any changes are required to the plan, and a report of the review will be written.

Performance Standard: The number of drought contingency plan reviews and a copy of the drought contingency plan review report will be included in the annual report to the Board of Directors of the District.

G. Conservation of Groundwater

Management Objective: Once a year the District will provide the public information on water conservation through an article published in local newspapers or the District's newsletter and website. The District will maintain a record of the article published.

Performance Standard: The annual report to the Board of Directors of the District will include the article published in local newspapers or the District's newsletter and website each year.

H. Recharge Enhancement

Recharge enhancement is not presently cost effective for the District. Therefore this Management Goal is not applicable to the District at this time.

I. Rainwater Harvesting

Rainwater harvesting is not presently cost effective for the District. Therefore this Management Goal is not applicable to the District at this time.

J. Precipitation Enhancement

Precipitation enhancement is not presently cost effective for the District. Therefore this Management Goal is not applicable to the District at this time.

K. Brush Control

Brush control is not presently cost effective for the District. Therefore this Management Goal is not applicable to the District at this time.

L. Addressing the Desired Future Conditions in a Quantitative Manner

Management Objective: The District will monitor groundwater conditions within the District by measuring the static water levels in at least twenty (20) monitor wells annually.

Performance standard: The recorded static water levels of the twenty (20) monitor wells will be included in the District's Annual Report.

11. METHODOLOGY

The District Manager will prepare an annual report on the District performances in achieving the management goals. The annual report will be presented to the Board of Directors during the first quarter of the calendar year. The report will include the number of instances each management activity was engaged in during the year. The annual report will be maintained on file at the District Office and made available to the public upon adoption by the Board of Directors of the District.

12. EXISTING TOTAL USEABLE AMOUNT OF GROUNDWATER (ac-ft/year)

Please refer to Appendix D, for 2012 State Water Plan Data Sets.

13. ESTIMATE OF GROUNDWATER USED AND DISCHARGED (ac-ft)

For the historical water pumpage reported in ac-ft. Refer to Appendix D for 2012 State Water Plan Data Sets.

14. GROUNDWATER MODELING INFORMATION FROM GAM 08-58 (ac-ft/year)

Refer to Appendix E for updated information.

A. Estimate of Groundwater Discharge to Springs and Surface Water Bodies, in ac-ft

Refer to Appendix E for update information.

B. Estimate of Annual Volume of Flow in and out of District Aquifers, in ac-ft

Refer to Appendix E for update information.

C. Estimated Annual Groundwater Recharge from Precipitation (ac-ft/year)

Refer to Appendix E GAM RUN 14-006.

15. PROJECTED DISTRICT-SURFACE WATER SUPPLY (ac-ft/year)

Refer to Appendix D.

16. PROJECTED DISTRICT-TOTAL WATER DEMANDS (ac-ft/year)

Refer to Appendix D for 2012 State Water Plan Data Sets.

17. PROJECTED WATER SUPPLY NEEDS AND MANAGEMENT STRATEGIES

Strategies include the following: a) By 2030, Lake Livingston Water Supply a public water supplier, plans to reduce groundwater usage by approximately 33 % or approximately 938 acre-feet/year by utilizing surface water from Lake Livingston. This is an estimate of reduction in total groundwater acre-feet/year usage per conversation with John Ganzer, Chief Financial Officer, Lake Livingston Water Supply Company, July 2009. They utilize approximately 33% of our groundwater usage. b) The District considers the 2007 State Water Management Plan adequate at this time for the other water user groups. c). Ground-water conservation will be achieved through public information (local newspapers and the District's newsletter).

Projected Water Needs **Unit: Acre Feet (ACFT)**

Positive values reflect a water surplus; reflect a water need.

Refer to Appendix D 2012 State Water Plan Data Sets.

Projected Water Management Strategies

Refer to Appendix D 2012 State Water Plan Data Sets.

18. BIBLIOGRAPHY

Chowdhury, A. H., 2008, GAM Run 08-58, Texas Water Development Board, 08-58, July 23, 5 p, (http://www.twdb.state.tx.us/gam/GAMruns/GR08-58.pdf).

Knox, P.R., Kelley, V.A., Vreugdenhil, A, Deeds, N. and S. Seni, 2007, Structure of the Yegua-Jackson Aquifer of the Texas Gulf Coastal Plain, Texas Water Development Board, Contracted Report 0604830617, 157 p.

Popkin, B., 1971, Ground Water Resources of Montgomery County, Texas Water Development Board, Report 136, 78 p.

Region H, 2006, Region H Water Plan, (http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionH/CD-Region%20H%202006%20Plan/)

19. COORDINATION WITH SURFACE WATER MANAGEMENT ENTITIES

The District will encourage the use of surface water supplies where available, to meet the needs of specific user groups within the District. Please see Lake Livingston Water Supply Company in Section 17, for their projected water supply needs and management strategies for one example.

The District will participate in the Region H and Region I Regional Water Planning Groups process by attending meetings as time permits. This activity will be noted in the annual Report submitted to the Board of Directors.

20. PLAN SUBMITTAL TO REGION "H AND I" GROUNDWATER PLANNING GROUPS

Attached as Exhibit "G" is the certified letter that was mailed to Jace Houston (Region H) and Kelley Holcomb (Region I), which include the two Groundwater Planning Groups for Polk and San Jacinto county. This is a copy of our adopted 2014 groundwater management plan forwarded to you to comply with statutory requirements.

APPENDIX

EXHIBIT

A

LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT
602 E. Church St. • Livingston, TX 77351
Mailing Address:
P.O. Box 1879
Livingston, Texas 77351
936-327-9531 Office
936-327-9532 Fax
www.ltgcd.org
ltgcdistrict@livingston.net • ltgcdistrict@gmail.com
Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

LOWER TRINITY GROUNDWATER CONSERVATION DISTIRCT

TO: THE BOARD OF DIRECTORS OF THE LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT AND TO ALL OTHER INTERESTED PERSONS!

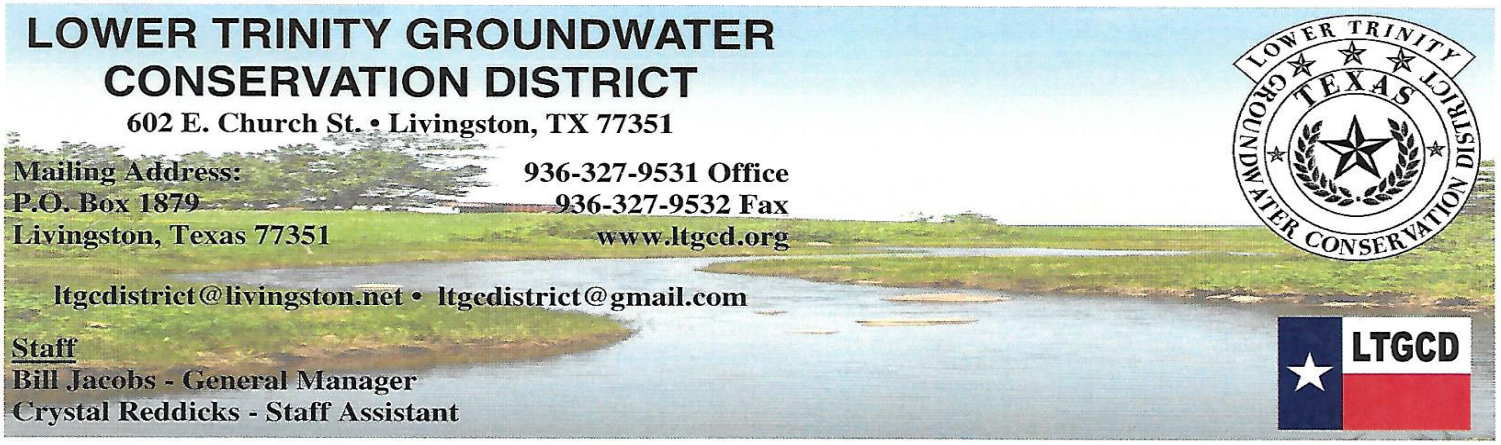
Notice is given that the Board of Directors of the Lower Trinity Groundwater Conservation District will hold a regular meeting on **September 12, 2014 at 10:30 A.M. at the Polk County Office Annex (Old Hospital), in Room 175, located at 602 E. Church Street in Livingston, Texas.**

As previously posted in accordance with the Open Meetings Act, the first item of Business will be a Public Hearing on adopting the District's Groundwater Management Plan (see No. 4 below).

Following the **Public Hearing** which begins at 10:30 A.M., the **Agenda** items of business may be discussed and/or acted upon in a different order than the order set forth below.

AGENDA:

1. Call to order;
2. Public Comment;
3. Reading and action if any, of the prior meeting minutes, (July 10, 2014);
4. Groundwater Management Plan:
    a. Groundwater Management Plan Resolution;
5. Camilla Water Supply-Well #5-finished-8/09-no application-Patricks ww-driller-update;
6. Romark Utilities-4th qtr. 2013 and Inv. # 145(3/3/14) past due-status;-pursue legal action-update;
7. GMA 14 update;
8. District Drought Status/weather report;
9. General Manager Report-July/August- 2014;
10. Treasurer/Financial Reports, including CD's
11. The next scheduled Board meeting is November 7, 2014; and
12. Adjourn.



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9. General Manager Report-July/August- 2014;
10. Treasurer/Financial Reports, including CD's
11. The next scheduled Board meeting is November 7, 2014; and
12. Adjourn.

RESOLUTION 2014-01

RESOLUTION OF THE BOARD OF DIRECTORS

LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

WHERE AS, the Board of Directors of the District have considered the adoption of the District Groundwater Management Plan; and

WHERE AS, the District is required by Texas Water Code, Chapter 36 to adopt a Groundwater Management Plan; and

WHERE AS, the District desires to be in compliance with Texas Laws and District Policy;

NOW, THEREFORE BE IT RESOLVED that the Board of Directors of the Lower Trinity Groundwater Conservation District adopt the Groundwater Management Plan for the District.

PASSED AND APPROVED ON THIS 12TH DAY OF SEPTEMBER, 2014.

LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

BY: _____
Vice President, Board of Directors

ATTEST: _____
Secretary/Treasurer, Board of Directors

APPENDIX

EXHIBIT B

Groundwater Management Plan Hearing Notice

The Lower Trinity Groundwater Conservation District will be holding a public hearing on adopting the District's Groundwater Management Plan. The hearing will be held at 10:30 A.M. on September 12, 2014 in room 175 at the Polk County Office Annex, which is located at 602 E. Church Street, in Livingston, Texas.

For more information, you may contact the District Office at: 936-327-9531, or go to: www. ltgcd.org to view a copy of the draft. Go to forms and documents section.

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For more information, you may contact the District Office at: 936-327-9531, or go to: www.ltgcd.org to view a copy of the draft. Go to forms and documents section.

This posting was also placed on the District Web Site in accordance to the Open Meetings guidelines.

LOWER TRINITY GROUNDWATER CONSERVATION DISRICT – PLAN HEARING NOTICE

POLK COUNTY ENTERPRISE
EIN# 74-1456949
P.O. Box 1276
Livingston, Texas 77351

Groundwater Management Plan Hearing Notice

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STATE OF TEXAS]

AFFIDAVIT OF PUBLICATION

COUNTY OF POLK]

My name is Alvin Holley, and I am Publisher of the POLK COUNTY ENTERPRISE. I am over the age of 18, have personal knowledge of the facts stated herein, and am otherwise competent to make this affidavit.

The POLK COUNTY ENTERPRISE is a legal newspaper publication Under Texas law, headquartered and regularly published in Polk County, Texas. It is a newspaper of general circulation and generally circulated in Polk County.

The attachment hereto was published in the POLK COUNTY ENTERPRISE, at or below our lowest rate, in its publication as follows:

No. __1__ Date_____August 21_____,2014
No. _____ Date _____,2014
No. _____ Date _____,2014
No. _____ Date _____,2014

Publication Fee $__22.80__

Alvin Holley

SUBSCRIBED AND SWORN TO BEFORE me this the 21st day of August, 2014.

GEORGIA S. BAILEY
NOTARY PUBLIC
STATE OF TEXAS
Comm. Exp. 10-31-2016

Georgia S. Bailey
Notary Public in and for the State of Texas
My commission expires 10/31/2016

LOWER TRINITY GROUNDWATER DISTRICT – GROUNDWATER MANAGEMENT PLAN HEARING NOTICE

SAN JACINTO NEWS TIMES
EIN#74-1456949
P.O. BOX 1689
SHEPHERD, TX 77371

STATE OF TEXAS]

AFFIDAVIT OF PUBLICATION

COUNTY OF SAN JACINTO]

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No. __1__ Date _____August 21_____, 2014
No. _____ Date _____, 2014
No. _____ Date _____, 2014
No. _____ Date _____, 2014

Publication Fee $__22.80__

Alvin Holley, Publisher

SUBSCRIBED AND SWORN TO BEFORE me this the 22nd day of August, 2014.

Georgia S. Bailey
Notary Public, in and for the State of Texas
My Commission expires 10/31/2016

GEORGIA S. BAILEY
NOTARY PUBLIC
STATE OF TEXAS
Comm. Exp. 10-31-2016

LEGAL NOTICE

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APPENDIX

EXHIBIT C

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POLK COUNTY ENTERPRISE
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LOWER TRINITY GROUNDWATER DISTRICT – GROUNDWATER MANAGEMENT PLAN HEARING NOTICE

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LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

602 E. Church St. • Livingston, TX 77351

Mailing Address:
P.O. Box 1879
Livingston, Texas 77351

936-327-9531 Office
936-327-9532 Fax
www.ltgcd.org

ltgcdistrict@livingston.net • ltgcdistrict@gmail.com

Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

Trinity River Authority
Attn: Mark Waters
P. O. Box 360
Livingston, Texas 77351

To: Surface Water Management Entities

Dear Sirs:

This letter to surface water management entities provides evidence, that following notice and hearing, that the Lower Trinity Groundwater Conservation District has coordinated with all surface water management entities our Groundwater Management Plan for Polk and San Jacinto counties, [31 TAC § 356.51 and TWC § 36.1071 (a)].

The Board of Directors of the Lower Trinity Groundwater Conservation District by Resolution adopted the plan on September 12, 2014.

We ask for your review and comment concerning the plan which can be found on our website, www.ltgcd.org, under the forms and documents section.

Thank you for your time.

Sincerely,

Bill Jacobs

Bill Jacobs-GM
Lower Trinity GCD

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Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

Sumerset MUD 1
5420 LBJ FWY.
STE. 1300
Dallas, Texas 75240-62

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Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

Waterwood MUD 1
140 Waterwood
STE. 1300
Huntsville, Texas 77320-9645

To: Surface Water Management Entities

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Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

San Jacinto River Authority
P.O. BOX 329
210 East Lufkin Avenue
Conroe, Texas 77305-0329

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Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

Angelina/Neches River Authority
Attn: Kelley Holcomb-GM
210 East Lufkin Avenue
Lufkin, Texas 75901

To: Surface Water Management Entities

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Lower Trinity GCD

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Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

September 12, 2014

City Of Livingston
Livingston Regional Water Supply
Attn: James W. Wright
P.O. BOX 329
200 W. Church
Livingston, Texas 77351

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Bill Jacobs-GM
Lower Trinity GCD

APPENDIX

EXHIBIT D

Estimated Historical Water Use And 2012 State Water Plan Datasets:

Lower Trinity Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
April 25, 2014

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in part 1 are:

1. Estimated Historical Water Use (checklist Item 2)

   from the TWDB Historical Water Use Survey (WUS)

2. Projected Surface Water Supplies (checklist Item 6)
3. Projected Water Demands (checklist Item 7)
4. Projected Water Supply Needs (checklist Item 8)
5. Projected Water Management Strategies (checklist Item 9)

   reports 2-5 are from the 2012 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report. The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2012 SWP data available as of 4/25/2014. Although it does not happen frequently, neither of these datasets are static so they are subject to change pending the availability of more accurate WUS data or an amendment to the 2012 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2012 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2012. TWDB staff anticipates the calculation and posting of these estimates at a later date.

POLK COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	5,404	438	132	0	503	44	6,521
	SW	2,378	0	16	0	200	396	2,990
2010	GW	5,136	238	16	0	595	44	6,029
	SW	2,166	0	2	0	0	397	2,565
2009	GW	5,011	195	20	0	154	32	5,412
	SW	2,170	0	2	0	275	287	2,734
2008	GW	4,956	293	23	0	25	35	5,332
	SW	2,154	0	2	0	300	308	2,764
2007	GW	4,735	333	0	0	342	30	5,440
	SW	1,971	0	0	0	0	263	2,234
2006	GW	5,276	420	0	0	100	41	5,837
	SW	1,361	110	0	0	0	370	1,841
2005	GW	5,152	439	0	0	100	43	5,734
	SW	1,321	110	0	0	0	385	1,816
2004	GW	4,902	273	0	0	100	66	5,341
	SW	1,250	110	0	0	0	266	1,626
2003	GW	4,886	642	0	0	96	67	5,691
	SW	1,266	110	0	0	0	266	1,642
2002	GW	4,808	441	0	0	115	70	5,434
	SW	1,177	113	0	0	14	280	1,584
2001	GW	4,681	441	0	0	115	74	5,311
	SW	1,853	109	0	0	14	296	2,272
2000	GW	4,539	394	0	0	120	135	5,188
	SW	1,862	109	0	0	15	202	2,188

SAN JACINTO COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	3,739	5	1	0	131	116	3,992
	SW	0	0	3	0	0	465	468
2010	GW	2,875	5	4	0	0	114	2,998
	SW	88	0	6	0	148	452	694
2009	GW	2,908	9	0	0	0	67	2,984
	SW	0	0	0	0	0	266	266
2008	GW	3,010	9	0	0	0	68	3,087
	SW	42	0	0	0	259	266	567
2007	GW	2,919	10	0	0	0	83	3,012
	SW	48	0	0	0	135	333	516
2006	GW	3,285	11	0	0	0	87	3,383
	SW	56	0	0	0	0	346	402
2005	GW	3,244	11	0	0	0	83	3,338
	SW	28	0	0	0	0	333	361
2004	GW	4,384	11	0	0	0	71	4,466
	SW	44	0	0	0	0	283	327
2003	GW	2,934	32	0	0	0	71	3,037
	SW	48	0	0	0	0	283	331
2002	GW	2,995	35	0	0	0	57	3,087
	SW	64	0	0	0	667	231	962
2001	GW	2,942	35	0	0	0	61	3,038
	SW	83	0	0	0	667	241	991
2000	GW	3,219	39	0	0	0	114	3,372
	SW	84	0	0	0	667	171	922

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

POLK COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
H	COUNTY-OTHER	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	20	20	20	20	20	20
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	591	577	569	568	571	577
H	LIVINGSTON	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	5,601	5,601	5,601	5,601	5,601	5,601
H	TRINITY RURAL WSC	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	24	27	31	32	38	39
I	LIVESTOCK	NECHES	LIVESTOCK LOCAL SUPPLY	122	122	122	122	122	122
	Sum of Projected Surface Water Supplies (acre-feet/year)			**6,358**	**6,347**	**6,343**	**6,343**	**6,352**	**6,359**

SAN JACINTO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
H	COUNTY-OTHER	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	560	560	560	560	560	560
H	IRRIGATION	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	135	135	135	135	135	135
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	SAN JACINTO	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	63	70	73	75	75	74
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	137	150	159	163	162	158
H	RIVERSIDE WSC	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	0	0	5	10	10	10

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
H	SAN JACINTO WSC	TRINITY	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	280	280	280	280	280	280
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,175**	**1,195**	**1,212**	**1,223**	**1,222**	**1,217**

Projected Water Demands
TWDB 2012 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

POLK COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	COUNTY-OTHER	TRINITY	1,600	1,691	1,744	1,794	1,880	1,976
H	MINING	TRINITY	29	31	32	33	34	35
H	LIVESTOCK	TRINITY	134	134	134	134	134	134
H	LIVINGSTON	TRINITY	2,137	2,517	2,802	3,006	3,212	3,423
H	ONALASKA WSC	TRINITY	240	244	247	242	246	255
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	890	944	985	1,004	1,044	1,100
H	ONALASKA	TRINITY	189	229	260	281	302	325
H	TRINITY RURAL WSC	TRINITY	6	7	8	8	9	9
I	CORRIGAN	NECHES	270	320	358	378	389	408
I	COUNTY-OTHER	NECHES	1,110	1,319	1,480	1,583	1,647	1,730
I	MANUFACTURING	NECHES	619	725	825	930	1,026	1,110
I	LIVESTOCK	NECHES	202	202	202	202	202	202
I	IRRIGATION	NECHES	135	135	135	135	135	135
	Sum of Projected Water Demands (acre-feet/year)		**7,561**	**8,498**	**9,212**	**9,730**	**10,260**	**10,842**

SAN JACINTO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	COLDSPRING	SAN JACINTO	44	51	56	59	60	61
H	COUNTY-OTHER	SAN JACINTO	868	974	1,052	1,091	1,114	1,129
H	MANUFACTURING	SAN JACINTO	48	52	56	60	63	68
H	MINING	SAN JACINTO	23	23	22	21	20	20
H	LIVESTOCK	SAN JACINTO	142	142	142	142	142	142
H	MERCY WSC	SAN JACINTO	338	404	455	487	504	513
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	SAN JACINTO	95	114	127	133	137	140
H	COUNTY-OTHER	TRINITY	497	538	555	496	461	415
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	206	245	275	288	295	301
H	SAN JACINTO WSC	TRINITY	406	474	528	561	577	587

Projected Water Demands
TWDB 2012 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	COLDSPRING	TRINITY	163	186	205	216	222	225
H	LIVESTOCK	TRINITY	142	142	142	142	142	142
H	MINING	TRINITY	7	6	6	6	6	6
H	SHEPHERD	TRINITY	301	355	394	411	424	431
H	RIVERSIDE WSC	TRINITY	150	179	213	270	302	337
H	IRRIGATION	TRINITY	667	667	667	667	667	667
H	POINT BLANK	TRINITY	85	96	104	108	111	112
	Sum of Projected Water Demands (acre-feet/year)		**4,182**	**4,648**	**4,999**	**5,158**	**5,247**	**5,296**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

POLK COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	COUNTY-OTHER	TRINITY	20	-71	-124	-174	-260	-356
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	591	523	474	454	417	367
H	LIVESTOCK	TRINITY	0	0	0	0	0	0
H	LIVINGSTON	TRINITY	3,464	3,084	2,799	2,595	2,389	2,178
H	MINING	TRINITY	0	-2	-3	-4	-5	-6
H	ONALASKA	TRINITY	0	-40	-71	-92	-113	-136
H	ONALASKA WSC	TRINITY	0	-4	-7	-2	-6	-15
H	TRINITY RURAL WSC	TRINITY	18	20	23	24	29	30
I	CORRIGAN	NECHES	284	234	196	176	165	146
I	COUNTY-OTHER	NECHES	-208	-417	-578	-681	-745	-828
I	IRRIGATION	NECHES	151	151	151	151	151	151
I	LIVESTOCK	NECHES	21	21	21	21	21	21
I	MANUFACTURING	NECHES	42	-64	-164	-269	-365	-449
	Sum of Projected Water Supply Needs (acre-feet/year)		**-208**	**-598**	**-947**	**-1,222**	**-1,494**	**-1,790**

SAN JACINTO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	COLDSPRING	SAN JACINTO	0	-7	-12	-15	-16	-17
H	COLDSPRING	TRINITY	0	-23	-42	-53	-59	-62
H	COUNTY-OTHER	SAN JACINTO	0	-106	-184	-223	-246	-261
H	COUNTY-OTHER	TRINITY	1,402	1,361	1,344	1,403	1,438	1,385
H	IRRIGATION	TRINITY	0	0	0	0	0	0
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	SAN JACINTO	63	51	41	37	33	29
H	LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TRINITY	137	111	90	81	73	63
H	LIVESTOCK	SAN JACINTO	0	0	0	0	0	0
H	LIVESTOCK	TRINITY	0	0	0	0	0	0
H	MANUFACTURING	SAN JACINTO	0	-4	-8	-12	-15	-20
H	MERCY WSC	SAN JACINTO	0	-66	-117	-149	-166	-175

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
H	MINING	SAN JACINTO	0	0	0	0	0	0
H	MINING	TRINITY	0	0	0	0	0	0
H	POINT BLANK	TRINITY	0	-11	-19	-23	-26	-27
H	RIVERSIDE WSC	TRINITY	0	-29	-58	-110	-142	-177
H	SAN JACINTO WSC	TRINITY	280	212	158	125	109	99
H	SHEPHERD	TRINITY	0	-54	-93	-110	-123	-130
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**-300**	**-533**	**-695**	**-793**	**-869**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

POLK COUNTY

WUG, Basin (RWPG) All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [POLK]	0	71	124	174	260	356
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [POLK]	0	91	97	100	104	110
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY, TRINITY (H)							
LLWSSSC SURFACE WATER PROJECT	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	591	577	569	568	571	577
MUNICIPAL CONSERVATION - LARGE WUG	CONSERVATION [POLK]	0	54	62	64	66	70
MINING, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [POLK]	0	2	3	4	5	6
ONALASKA, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [POLK]	0	40	71	92	113	136
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [POLK]	0	13	14	16	17	18
ONALASKA WSC, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [POLK]	0	4	7	2	6	15
COUNTY-OTHER, NECHES (I)							
NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER [POLK]	208	417	624	832	832	832
MANUFACTURING, NECHES (I)							
NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER [POLK]	0	225	225	450	450	450
Sum of Projected Water Management Strategies (acre-feet/year)		**799**	**1,494**	**1,796**	**2,302**	**2,424**	**2,570**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

SAN JACINTO COUNTY

WUG, Basin (RWPG) — All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
COLDSPRING, SAN JACINTO (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	7	12	15	16	17
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	3	3	3	3	3
COLDSPRING, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	23	42	53	59	62
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	10	11	12	12	12
COUNTY-OTHER, SAN JACINTO (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	106	184	223	246	261
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	54	58	61	62	63
COUNTY-OTHER, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	174	268	124	33	0
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY, SAN JACINTO (H)							
LLWSSSC SURFACE WATER PROJECT	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	63	70	73	75	75	74
MUNICIPAL CONSERVATION - LARGE WUG	CONSERVATION [SAN JACINTO]	6	7	8	8	9	9
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY, TRINITY (H)							
LLWSSSC SURFACE WATER PROJECT	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	137	150	159	163	162	158
MUNICIPAL CONSERVATION - LARGE WUG	CONSERVATION [SAN JACINTO]	13	16	17	18	19	19
MANUFACTURING, SAN JACINTO (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	4	8	12	15	20

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet/year

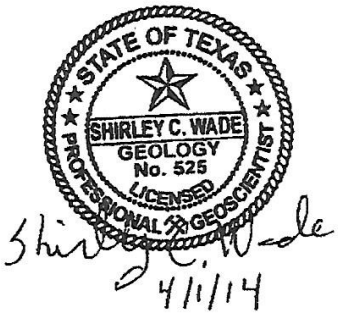
Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
MERCY WSC, SAN JACINTO (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	66	117	149	166	175
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	22	25	27	28	28
POINT BLANK, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	11	19	23	26	27
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	5	6	6	6	6
RIVERSIDE WSC, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	29	63	120	152	187
MUNICIPAL CONSERVATION - MEDIUM WUG	CONSERVATION [SAN JACINTO]	0	11	13	16	18	20
SAN JACINTO WSC, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	68	122	155	171	181
SHEPHERD, TRINITY (H)							
EXPANDED USE OF GW	GULF COAST AQUIFER [SAN JACINTO]	0	54	93	110	123	130
MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION [SAN JACINTO]	0	20	22	23	24	24
Sum of Projected Water Management Strategies (acre-feet/year)		**219**	**910**	**1,323**	**1,396**	**1,425**	**1,476**

APPENDIX

EXHIBIT E

GAM Run 14-006: Lower Trinity Groundwater Conservation District Management Plan

by Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
April 1, 2014



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GAM Run 14-006: Lower Trinity Groundwater Conservation District Management Plan

by Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
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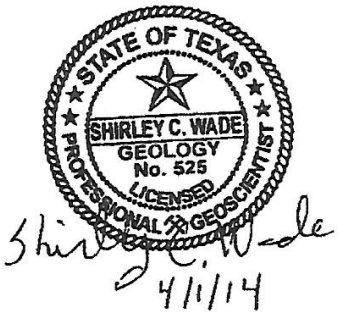

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GAM Run 14-006: Lower Trinity Groundwater Conservation District Management Plan

by Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
April 1, 2014

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers; and
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report—Part 2 of a two-part package of information from the TWDB to the Lower Trinity Groundwater Conservation District—fulfills the requirements noted above. Part 1 of the two-part package is the Historical Water Use/State Water Plan data report. The District will receive this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, stephen.allen@twdb.texas.gov, (512) 463-7317.

The groundwater management plan for the Lower Trinity Groundwater Conservation District should be adopted by the district on or before October 13, 2014 and submitted to the executive administrator of the TWDB on or before November 12, 2014. The current management plan for the Lower Trinity Groundwater Conservation District expires on January 11, 2015.

This report discusses the methods, assumptions, and results from a model run using the newly updated groundwater availability model for the northern portion of the Gulf Coast Aquifer System (Kasmarek, 2013). This model run replaces the results of GAM Run 08-58 (Chowdhury, 2008). GAM Run 14-006 meets current standards set after the release of GAM Run 08-58. Tables 1 and 2 summarize the groundwater availability model data required by statute, and Figures 1 and 2 show the area of the model from which the values in the table were extracted. If after review of the figures, the Lower Trinity Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the northern portion of the Gulf Coast Aquifer System Version 3.01 was run for this analysis. Lower Trinity Groundwater Conservation District water budgets were extracted for the historical model period (1980 through 2009) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of the aquifer located within the district is summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes five layers which represent the outcrop of the Yegua-Jackson Aquifer and younger overlying units—the Catahoula Formation (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper

portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5, collectively, for the portions of the model that represent the Yegua-Jackson Aquifer). In separate water budget calculations we calculated groundwater flow between the Catahoula Formation and the underlying Yegua-Jackson Aquifer.
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Gulf Coast Aquifer System

- We used version 3.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System for this analysis. See Kasmarek (2013) for assumptions and limitations of the model.
- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).
- Water budgets for the district were determined for the Gulf Coast Aquifer System (Layers 1 through 4).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model run in the district, as shown in Tables 1 and 2.

- Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and springs.

- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.

- Flow between aquifers—The net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	4,114
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	3,879
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	1,950
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	2,826
Estimated net annual volume of flow between each aquifer in the district	To the Yegua-Jackson Aquifer from the confined portion of the Yegua and Jackson groups	434

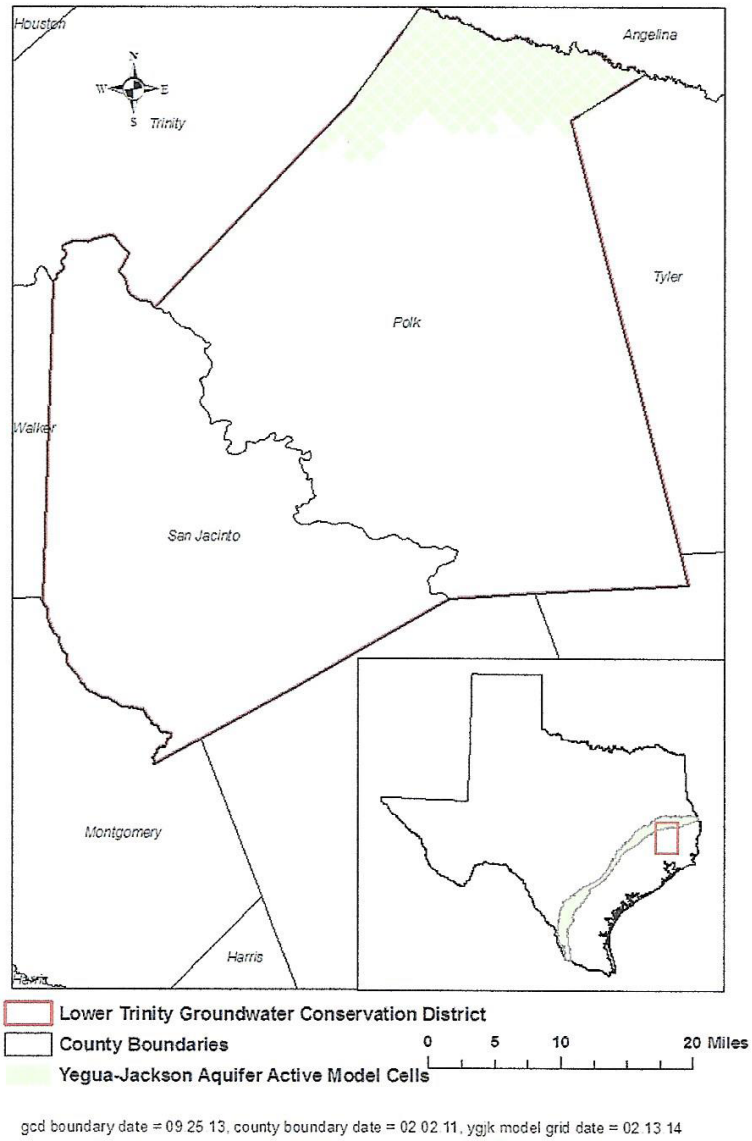

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR THE LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	23,261[1]
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	16,820[1]
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	3,618
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	11,614
Estimated net annual volume of flow between each aquifer in the district	To the confined portion of the Yegua-Jackson units from the Gulf Coast Aquifer and other overlying units	104

[1] We have changed the approach for estimating recharge and surface water discharge from the groundwater availability model for the Gulf Coast Aquifer System. In previous reports we extracted general head boundary outflows for areas representing stream channels and reported surface water discharge for those zones, and we reported general head boundary inflow as recharge for areas not covered by stream channels. For this analysis we represent all general head boundary inflow within the groundwater conservation district as recharge and all general head boundary outflow as surface water discharge.

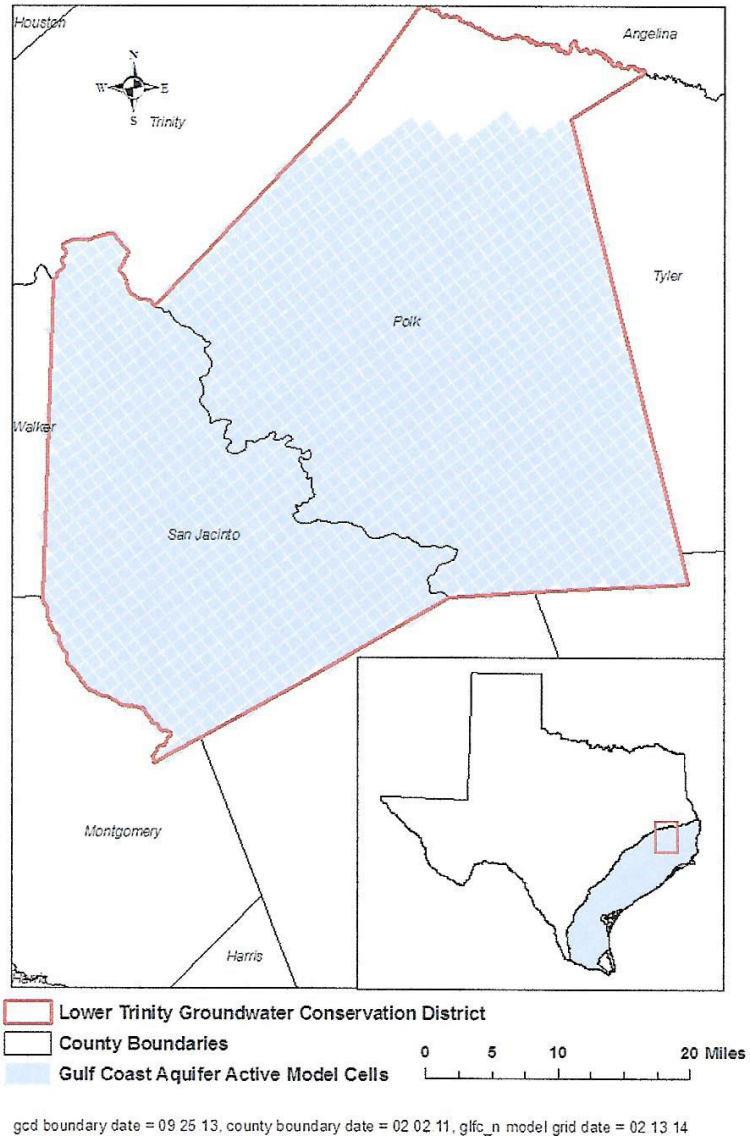

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

The groundwater model(s) used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES:

Chowdhury, A., 2008, GAM Run 08-58: Texas Water Development Board, GAM Run 08-58 Report, 5 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR08-76.pdf.

Deeds, N.E., Yan, T., Singh, A., Jones, T.L., Kelley, V.A., Knox, P.R., Young, S.C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p., http://www.twdb.texas.gov/groundwater/models/gam/ygjk/YGJK_Model_Report.pdf.

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software.

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, MODFLOW-2000, The U.S. Geological Survey modular ground-water model-User guide to modularization concepts and the ground-water flow process: U.S. Geological Survey, Open-File Report 00-92.

Kasmarek, M.C., 2013, Hydrogeology and simulation of groundwater flow and land-surface subsidence in the northern part of the Gulf Coast Aquifer System, Texas, 1891-2009: United States Geological Survey Scientific investigations Report 2012-5154, 55 p. http://www.twdb.texas.gov/groundwater/models/gam/glfc_n/HAGM.SIR.Version1.1.November2013.pdf

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972.

Texas Water Code, 2011, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf

APPENDIX

EXHIBIT F

GAM Run 10-038 MAG

By Mohammad Masud Hassan, P.E.

Edited and finalized by Shirley Wade to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-0883
November 18, 2011

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on November 18, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Gulf Coast Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 14 declines from approximately 978,000 acre-feet per year to 844,000 acre-feet per year between 2010 and 2060. This is shown divided by county, regional water planning area, and river basin in Table 2 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district for each unit of the Gulf Coast Aquifer in tables 3 through 18. The estimates were extracted from Groundwater Availability Modeling Run 10-023, Scenario 3, which meets the desired future conditions adopted by Groundwater Management Area 14.

REQUESTOR:

Mr. Lloyd Behm of the Bluebonnet Groundwater Conservation District on behalf of Groundwater Management Area 14

DESCRIPTION OF REQUEST:

In a letter dated August 25, 2010, Mr. Lloyd Behm provided the Texas Water Development Board (TWDB) with the desired future conditions of the Gulf Coast Aquifer adopted by the members of Groundwater Management Area 14. As shown in Resolution No. 2010-01, the desired future conditions for the Gulf Coast Aquifer within Groundwater Management Area 14 were stated as average water-level declines (drawdowns) over a specified time period. The average drawdowns (in feet) specified as desired future conditions for Groundwater Management Area 14 are shown in Table 1.

Table 1: Desired future conditions (average drawdown in feet) for the Gulf Coast Aquifer in Groundwater Management Area 14. Negative values indicate a water level rise.

County	Austin	Brazoria	Brazos	Chambers	Grimes	Hardin	Jasper	Jefferson	Liberty
Duration (years)	52	52	52	52	52	52	52	52	52
	Base year 2008								
Chicot Aquifer	17	45	-	43	0	17	10	25	32
Evangeline Aquifer	10	40	-	36	5	27	23	26	37
Burkeville Confining Unit	11	-	-	-	10	23	24	-	28
Jasper Aquifer	20	-	7	-	28	37	21	-	64

Table 1: Continued.

County	Montgomery		Newtown	Orange	Polk	San Jacinto	Tyler	Walker	Waller	Washington
Duration (years)	8	44	52	52	52	52	52	52	52	52
	Base year 2008	Base year 2016	Base year 2008							
Chicot Aquifer	3	6	9	14	4	5	3	-	7	-
Evangeline Aquifer	13	25	20	19	4	7	16	10	8	1
Burkeville Confining Unit	10	23	22	-	20	18	19	5	9	17
Jasper Aquifer	61	-38	18	-	41	72	33	33	25	20

In response to receiving the adopted desired future conditions, the Texas Water Development Board has estimated the modeled available groundwater in Groundwater Management Area 14. Since the desired future conditions were divided by unit within the Gulf Coast Aquifer (Chicot Aquifer, Evangeline Aquifer, Burkeville Confining Unit, and Jasper Aquifer), modeled available groundwater is presented separately for each unit.

METHODS:

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Gulf Coast Aquifer to assist the members of Groundwater Management Area 14 in developing desired future conditions. The location of Groundwater Management Area 14, the Gulf Coast Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. As described in Resolution No. 2010-01, the management area considered Scenario 3 of GAM Run 10-023 when developing desired future conditions for the Gulf Coast Aquifer (Oliver, 2010). Since each of the above desired future conditions is met in Scenario 3 of GAM Run 10-023, the estimated pumping for Groundwater Management Area 14 presented here was taken directly from that simulation. The pumping was then divided by county, regional water planning area, river basin, and groundwater conservation district (Figure 2).

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the northern portion of the Gulf Coast Aquifer are described below:

- The results presented in this report are based on Scenario 3 in GAM Run 10-023 (Oliver, 2010). See GAM Run 10-023 for a full description of the methods, assumptions, and results for the groundwater availability model run.
- We used version 2.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer. See Kasmarek and Robinson (2004) and Kasmarek and others (2005) for assumptions and limitations of the model.
- The model includes four layers representing the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the

Jasper Aquifer, which includes the more transmissive portions of the Catahoula Formation (Layer 4).

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 12, 2010 version of the file that associates the model grid with political and natural boundaries for the Gulf Coast Aquifer.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated December 29, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Gulf Coast Aquifer in Groundwater Management Area 14 as a result of the desired future conditions declines from approximately 978,000 acre-feet per year in 2010 to 844,000 acre-feet per year in 2060. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 2).

The modeled available groundwater for the four units of the Gulf Coast Aquifer is also summarized by county (tables 3 through 6), regional water planning area (tables 7 through 10), river basin (tables 11 through 14), and groundwater conservation district (tables 15 through 18). In tables 15 through 18, the modeled available groundwater both excluding and including areas outside of a groundwater conservation district is shown.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Oliver, W., 2010, GAM Run 10-023: Texas Water Development Board, GAM Run 10-023 Report, 32 p.

Kasmarek, M.C., and Robinson, J.L., 2004, Hydrogeology and simulation of groundwater flow and land-surface subsidence in the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2004-5102, 111 p.

Kasmarek, M.C., Reece, B.D., and Houston, N.A., 2005, Evaluation of groundwater flow and land-surface subsidence caused by hypothetical withdrawals in the northern part of the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2005-5024, 70 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Texas Water Development Board, 2007, Water for Texas – 2007-Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 2: Modeled available groundwater for the Gulf Coast Aquifer in Groundwater Management Area 14. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Austin	H	Brazos	6,585	6,585	6,585	6,585	6,585	6,585
		Brazos-Colorado	15,608	15,608	15,608	15,608	15,608	15,608
		Colorado	121	121	121	121	121	121
Brazoria	H	Brazos	6,658	6,658	6,658	6,658	6,658	6,658
		Brazos-Colorado	11,648	11,648	11,648	11,648	11,648	11,648
		San Jacinto-Brazos	32,090	32,090	32,090	32,090	32,090	32,090
Brazos	G	Brazos	1,189	1,189	1,189	1,189	1,189	1,189
Chambers	H	Neches-Trinity	9,527	9,527	9,527	9,527	9,527	9,527
		San Jacinto-Brazos	0	0	0	0	0	0
		Trinity	10,112	10,112	10,112	10,112	10,112	10,112
		Trinity-San Jacinto	2,068	2,068	2,068	2,068	2,068	2,068
Fort Bend	H	Brazos	60,217	52,923	43,673	43,189	42,862	42,953
		Brazos-Colorado	20,633	22,023	18,095	17,715	17,043	17,077
		San Jacinto	9,723	9,524	9,043	8,809	8,642	8,650
		San Jacinto-Brazos	23,356	24,235	21,266	22,457	23,765	23,810
Galveston	H	Neches-Trinity	0	0	0	0	0	0
		San Jacinto-Brazos	4,774	5,257	5,867	5,841	5,814	5,815
		Trinity-San Jacinto	0	0	0	0	0	0
Grimes	G	Brazos	10,889	10,889	10,889	10,889	10,889	10,889
		San Jacinto	2,197	2,197	2,197	2,197	2,197	2,197
		Trinity	764	764	223			
Hardin	I	Neches	34,821	34,821	34,821	34,821	34,821	34,821
		Trinity	138	138	138	138	138	138
Harris	H	San Jacinto	293,855	249,851	197,553	197,326	196,992	197,270
		San Jacinto-Brazos	4,801	7,202	6,798	7,563	8,428	8,440
		Trinity-San Jacinto	6,894	5,893	5,026	5,141	5,259	5,266
Jasper	I	Neches	37,659	37,620	37,541	37,541	37,541	37,541
		Sabine	29,953	29,953	29,953	29,953	29,953	29,953
Jefferson	I	Neches	804	804	804	804	804	804
		Neches-Trinity	1,641	1,641	1,641	1,641	1,641	1,641
Liberty	H	Neches	5,074	5,074	5,074	5,074	5,074	5,074
		Neches-Trinity	364	364	364	364	364	364
		San Jacinto	5,852	5,852	5,852	5,852	5,852	5,852
		Trinity	22,887	22,887	22,887	22,887	22,887	22,887
		Trinity-San Jacinto	8,856	8,856	8,856	8,856	8,856	8,856

Table 2: Continued.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Montgomery	H	San Jacinto	73,264	61,629	61,629	61,629	61,629	61,629
Newton	I	Neches	176	176	176	176	176	176
		Sabine	34,001	34,001	33,963	33,963	33,963	33,963
Orange	I	Neches	3,925	3,925	3,925	3,925	3,925	3,925
		Neches-Trinity	256	256	256	256	256	256
		Sabine	15,832	15,832	15,832	15,832	15,832	15,832
Polk	H	Trinity	21,830	21,830	21,830	21,783	21,783	21,783
		Neches	14,912	11,886	11,886	11,886	11,276	11,224
San Jacinto	H	San Jacinto	10,368	10,368	10,368	10,368	10,368	10,368
		Trinity	10,611	8,811	8,811	8,811	8,811	8,811
Tyler	I	Neches	38,199	38,199	38,156	38,156	38,156	38,156
Walker	H	San Jacinto	9,139	9,116	9,116	9,116	9,116	9,116
		Trinity	8,873	8,873	8,873	8,797	8,797	8,797
Waller	H	Brazos	14,933	14,933	14,933	14,933	14,933	14,933
		San Jacinto	26,694	26,694	26,694	26,694	26,694	26,694
Washington	G	Brazos	12,972	12,972	12,972	12,604	12,604	12,604
		Colorado	73	73	73	73	73	73
Total			**977,816**	**913,948**	**843,660**	**843,666**	**843,820**	**844,244**

Table 3: Modeled available groundwater for the Chicot Aquifer portion of the Gulf Coast Aquifer summarized by county in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Austin	1,300	1,300	1,300	1,300	1,300	1,300
Brazoria	48,125	48,125	48,125	48,125	48,125	48,125
Chambers	21,328	21,328	21,328	21,328	21,328	21,328
Fort Bend	83,006	75,916	61,657	61,004	60,061	60,177
Galveston	4,303	4,697	5,233	5,194	5,152	5,153
Grimes	0	0	0	0	0	0
Hardin	1,263	1,263	1,263	1,263	1,263	1,263
Harris	70,219	68,839	56,850	58,641	61,185	61,272
Jasper	10,835	10,835	10,835	10,835	10,835	10,835
Jefferson	2,345	2,345	2,345	2,345	2,345	2,345
Liberty	14,576	14,576	14,576	14,576	14,576	14,576
Montgomery	1,482	1,722	1,722	1,722	1,722	1,722
Newton	501	501	501	501	501	501
Orange	18,809	18,809	18,809	18,809	18,809	18,809
Polk	0	0	0	0	0	0
San Jacinto	0	0	0	0	0	0
Tyler	0	0	0	0	0	0
Walker	0	0	0	0	0	0
Waller	300	300	300	300	300	300
Total	**278,392**	**270,556**	**244,844**	**245,943**	**247,502**	**247,706**

Table 4: Modeled available groundwater for the Evangeline Aquifer portion of the Gulf Coast Aquifer summarized by county in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Austin	20,013	20,013	20,013	20,013	20,013	20,013
Brazoria	2,271	2,271	2,271	2,271	2,271	2,271
Chambers	379	379	379	379	379	379
Fort Bend	30,923	32,789	30,420	31,166	32,251	32,313
Galveston	471	560	634	647	662	662
Grimes	3,002	3,002	3,002	3,002	3,002	3,002
Hardin	33,696	33,696	33,696	33,696	33,696	33,696
Harris	234,977	193,759	152,256	151,126	149,225	149,435
Jasper	40,755	40,755	40,755	40,755	40,755	40,755
Jefferson	100	100	100	100	100	100
Liberty	27,669	27,669	27,669	27,669	27,669	27,669
Montgomery	39,381	38,293	38,293	38,293	38,293	38,293
Newton	21,288	21,288	21,288	21,288	21,288	21,288
Orange	1,204	1,204	1,204	1,204	1,204	1,204
Polk	8,311	8,311	8,311	8,311	8,311	8,311
San Jacinto	8,178	8,178	8,178	8,178	8,178	8,178
Tyler	20,592	20,592	20,592	20,592	20,592	20,592
Walker	2,001	2,001	2,001	2,001	2,001	2,001
Waller	41,027	41,027	41,027	41,027	41,027	41,027
Washington	3,239	3,239	3,239	3,239	3,239	3,239
Total	**539,477**	**499,126**	**455,328**	**454,957**	**454,156**	**454,428**

Table 5: Modeled available groundwater for the Burkeville Confining Unit portion of the Gulf Coast Aquifer summarized by county in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Austin	0	0	0	0	0	0
Fort Bend	0	0	0	0	0	0
Grimes	0	0	0	0	0	0
Hardin	0	0	0	0	0	0
Harris	335	329	256	249	254	254
Jasper	1	1	1	1	1	1
Liberty	0	0	0	0	0	0
Montgomery	0	0	0	0	0	0
Newton	0	0	0	0	0	0
Polk	744	744	744	744	744	744
San Jacinto	2,699	899	899	899	899	899
Tyler	1	1	1	1	1	1
Walker	0	0	0	0	0	0
Waller	0	0	0	0	0	0
Washington	368	368	368	0	0	0
Total	**4,148**	**2,342**	**2,269**	**1,894**	**1,899**	**1,899**

Table 6: Modeled available groundwater for the Jasper Aquifer portion of the Gulf Coast Aquifer summarized by county in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Austin	1,001	1,001	1,001	1,001	1,001	1,001
Brazos	1,189	1,189	1,189	1,189	1,189	1,189
Fort Bend	0	0	0	0	0	0
Grimes	10,848	10,848	10,307	10,084	10,084	10,084
Hardin	0	0	0	0	0	0
Harris	19	19	15	14	15	15
Jasper	16,021	15,982	15,903	15,903	15,903	15,903
Liberty	788	788	788	788	788	788
Montgomery	32,401	21,614	21,614	21,614	21,614	21,614
Newton	12,388	12,388	12,350	12,350	12,350	12,350
Polk	27,687	24,661	24,661	24,614	24,004	23,952
San Jacinto	10,102	10,102	10,102	10,102	10,102	10,102
Tyler	17,606	17,606	17,563	17,563	17,563	17,563
Walker	16,011	15,988	15,988	15,912	15,912	15,912
Waller	300	300	300	300	300	300
Washington	9,438	9,438	9,438	9,438	9,438	9,438
Total	**155,799**	**141,924**	**141,219**	**140,872**	**140,263**	**140,211**

Table 7: Modeled available groundwater for the Chicot Aquifer portion of the Gulf Coast Aquifer summarized by regional water planning area in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	0	0	0	0	0	0
H	244,639	236,803	211,091	212,190	213,749	213,953
I	33,753	33,753	33,753	33,753	33,753	33,753
Total	**278,392**	**270,556**	**244,844**	**245,943**	**247,502**	**247,706**

Table 8: Modeled available groundwater for the Evangeline Aquifer portion of the Gulf Coast Aquifer, summarized by regional water planning area in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	6,241	6,241	6,241	6,241	6,241	6,241
H	412,014	371,663	327,865	327,494	326,693	326,965
I	121,222	121,222	121,222	121,222	121,222	121,222
Total	**539,477**	**499,126**	**455,328**	**454,957**	**454,156**	**454,428**

Table 9: Modeled available groundwater for the Burkeville Confining Unit portion of the Gulf Coast Aquifer summarized by regional water planning area in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	368	368	368	0	0	0
H	3,660	1,854	1,781	1,774	1,779	1,779
I	120	120	120	120	120	120
Total	**4,148**	**2,342**	**2,269**	**1,894**	**1,899**	**1,899**

Table 10: Modeled available groundwater for the Jasper Aquifer portion of the Gulf Coast Aquifer, summarized by regional water planning area in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	21,475	21,475	20,934	20,711	20,711	20,711
H	77,102	66,292	66,288	66,164	66,165	66,165
I	57,222	54,157	53,997	53,997	53,387	53,335
Total	**155,799**	**141,924**	**141,219**	**140,872**	**140,263**	**140,211**

Table 11: Modeled available groundwater for the Chicot Aquifer portion of the Gulf Coast Aquifer, summarized by river basin in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	56,046	48,386	40,433	39,803	39,240	39,305
Brazos-Colorado	33,286	34,676	30,748	30,368	29,696	29,730
Colorado	0	0	0	0	0	0
Neches	15,293	15,293	15,293	15,293	15,293	15,293
Neches-Trinity	11,751	11,751	11,751	11,751	11,751	11,751
Sabine	19,368	19,368	19,368	19,368	19,368	19,368
San Jacinto	66,403	63,365	51,927	52,931	54,591	54,665
San Jacinto-Brazos	50,045	51,558	49,627	50,634	51,578	51,604
Trinity	17,646	17,646	17,646	17,646	17,646	17,646
Trinity-San Jacinto	8,554	8,513	8,051	8,149	8,339	8,344
Total	**278,392**	**270,556**	**244,844**	**245,943**	**247,502**	**247,706**

Table 12: Modeled available groundwater for the Evangeline Aquifer portion of the Gulf Coast Aquifer, summarized by river basin in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	36,717	37,083	35,786	35,932	36,168	36,194
Brazos-Colorado	14,527	14,527	14,527	14,527	14,527	14,527
Colorado	23	23	23	23	23	23
Neches	78,653	78,653	78,653	78,653	78,653	78,653
Neches-Trinity	37	37	37	37	37	37
Sabine	44,700	44,700	44,700	44,700	44,700	44,700
San Jacinto	317,937	275,930	234,666	233,209	231,042	231,254
San Jacinto-Brazos	14,976	17,226	16,394	17,317	18,519	18,551
Trinity	22,643	22,643	22,643	22,643	22,643	22,643
Trinity-San Jacinto	9,264	8,304	7,899	7,916	7,844	7,846
Total	**539,477**	**499,126**	**455,328**	**454,957**	**454,156**	**454,428**

Table 13: Modeled available groundwater for the Burkeville Confining Unit portion of the Gulf Coast Aquifer, summarized by river basin in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	368	368	368	0	0	0
Brazos-Colorado	0	0	0	0	0	0
Colorado	0	0	0	0	0	0
Neches	119	119	119	119	119	119
Sabine	1	1	1	1	1	1
San Jacinto	335	329	256	249	254	254
San Jacinto-Brazos	0	0	0	0	0	0
Trinity	3,325	1,525	1,525	1,525	1,525	1,525
Trinity-San Jacinto	0	0	0	0	0	0
Total	**4,148**	**2,342**	**2,269**	**1,894**	**1,899**	**1,899**

Table 14: Modeled available groundwater for the Jasper Aquifer portion of the Gulf Coast Aquifer, summarized by river basin in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	20,312	20,312	20,312	20,312	20,312	20,312
Brazos-Colorado	76	76	76	76	76	76
Colorado	171	171	171	171	171	171
Neches	41,505	38,440	38,318	38,318	37,708	37,656
Sabine	15,717	15,717	15,679	15,679	15,679	15,679
San Jacinto	46,417	35,607	35,603	35,602	35,603	35,603
San Jacinto-Brazos	0	0	0	0	0	0
Trinity	31,601	31,601	31,060	30,714	30,714	30,714
Trinity-San Jacinto	0	0	0	0	0	0
Total	**155,799**	**141,924**	**141,219**	**140,872**	**140,263**	**140,211**

Table 15: Modeled available groundwater for the Chicot Aquifer portion of the Gulf Coast Aquifer, summarized by groundwater conservation district (GCD) in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bluebonnet GCD	1,600	1,600	1,600	1,600	1,600	1,600
Brazoria County GCD	48,125	48,125	48,125	48,125	48,125	48,125
Brazos Valley GCD	0	0	0	0	0	0
Lone Star GCD	1,482	1,722	1,722	1,722	1,722	1,722
Lower Trinity GCD	0	0	0	0	0	0
Southeast Texas GCD	12,599	12,599	12,599	12,599	12,599	12,599
Total (groundwater conservation districts)	**63,806**	**64,046**	**64,046**	**64,046**	**64,046**	**64,046**
Fort Bend Subsidence District	83,006	75,916	61,657	61,004	60,061	60,177
Harris-Galveston Coastal Subsidence District	74,522	73,536	62,083	63,835	66,337	66,425
No District	57,058	57,058	57,058	57,058	57,058	57,058
Total (all areas)	**278,392**	**270,556**	**244,844**	**245,943**	**247,502**	**247,706**

Table 16: Modeled available groundwater forthe Evangeline Aquifer portion of the Gulf Coast Aquifer, summarized by groundwater conservation district (GCD) in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bluebonnet GCD	66,043	66,043	66,043	66,043	66,043	66,043
Brazoria County GCD	2,271	2,271	2,271	2,271	2,271	2,271
Brazos Valley GCD	0	0	0	0	0	0
Lone Star GCD	39,381	38,293	38,293	38,293	38,293	38,293
Lower Trinity GCD	16,489	16,489	16,489	16,489	16,489	16,489
Southeast Texas GCD	116,331	116,331	116,331	116,331	116,331	116,331
Total (groundwater conservation districts)	**240,515**	**239,427**	**239,427**	**239,427**	**239,427**	**239,427**
Fort Bend Subsidence District	30,923	32,789	30,420	31,166	32,251	32,313
Harris-Galveston Coastal Subsidence District	235,448	194,319	152,890	151,773	149,887	150,097
No District	32,591	32,591	32,591	32,591	32,591	32,591
Total (all areas)	**539,477**	**499,126**	**455,328**	**454,957**	**454,156**	**454,428**

Table 17: Modeled available groundwater for the Burkeville Confining Unit portion of the Gulf Coast Aquifer, summarized by groundwater conservation district (GCD) in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bluebonnet GCD	0	0	0	0	0	0
Brazoria County GCD	0	0	0	0	0	0
Brazos Valley GCD	0	0	0	0	0	0
Lone Star GCD	0	0	0	0	0	0
Lower Trinity GCD	3,443	1,643	1,643	1,643	1,643	1,643
Southeast Texas GCD	2	2	2	2	2	2
Total (groundwater conservation districts)	**3,445**	**1,645**	**1,645**	**1,645**	**1,645**	**1,645**
Fort Bend Subsidence District	0	0	0	0	0	0
Harris-Galveston Coastal Subsidence District	335	329	256	249	254	254
No District	368	368	368	0	0	0
Total (all areas)	**4,148**	**2,342**	**2,269**	**1,894**	**1,899**	**1,899**

Table 18: Modeled available groundwater for the Jasper Aquifer portion of the Gulf Coast Aquifer, summarized by groundwater conservation district (GCD) in Groundwater Management Area 14 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bluebonnet GCD	28,160	28,137	27,596	27,297	27,297	27,297
Brazoria County GCD	0	0	0	0	0	0
Brazos Valley GCD	1,189	1,189	1,189	1,189	1,189	1,189
Lone Star GCD	32,401	21,614	21,614	21,614	21,614	21,614
Lower Trinity GCD	37,789	34,763	34,763	34,716	34,106	34,054
Southeast Texas GCD	46,015	45,976	45,816	45,816	45,816	45,816
Total (groundwater conservation districts)	**145,554**	**131,679**	**130,978**	**130,632**	**130,022**	**129,970**
Fort Bend Subsidence District	**0**	**0**	**0**	**0**	**0**	**0**
Harris-Galveston Coastal Subsidence District	**19**	**19**	**15**	**14**	**15**	**15**
No District	10,226	10,226	10,226	10,226	10,226	10,226
Total (all areas)	**155,799**	**141,924**	**141,219**	**140,872**	**140,263**	**140,211**

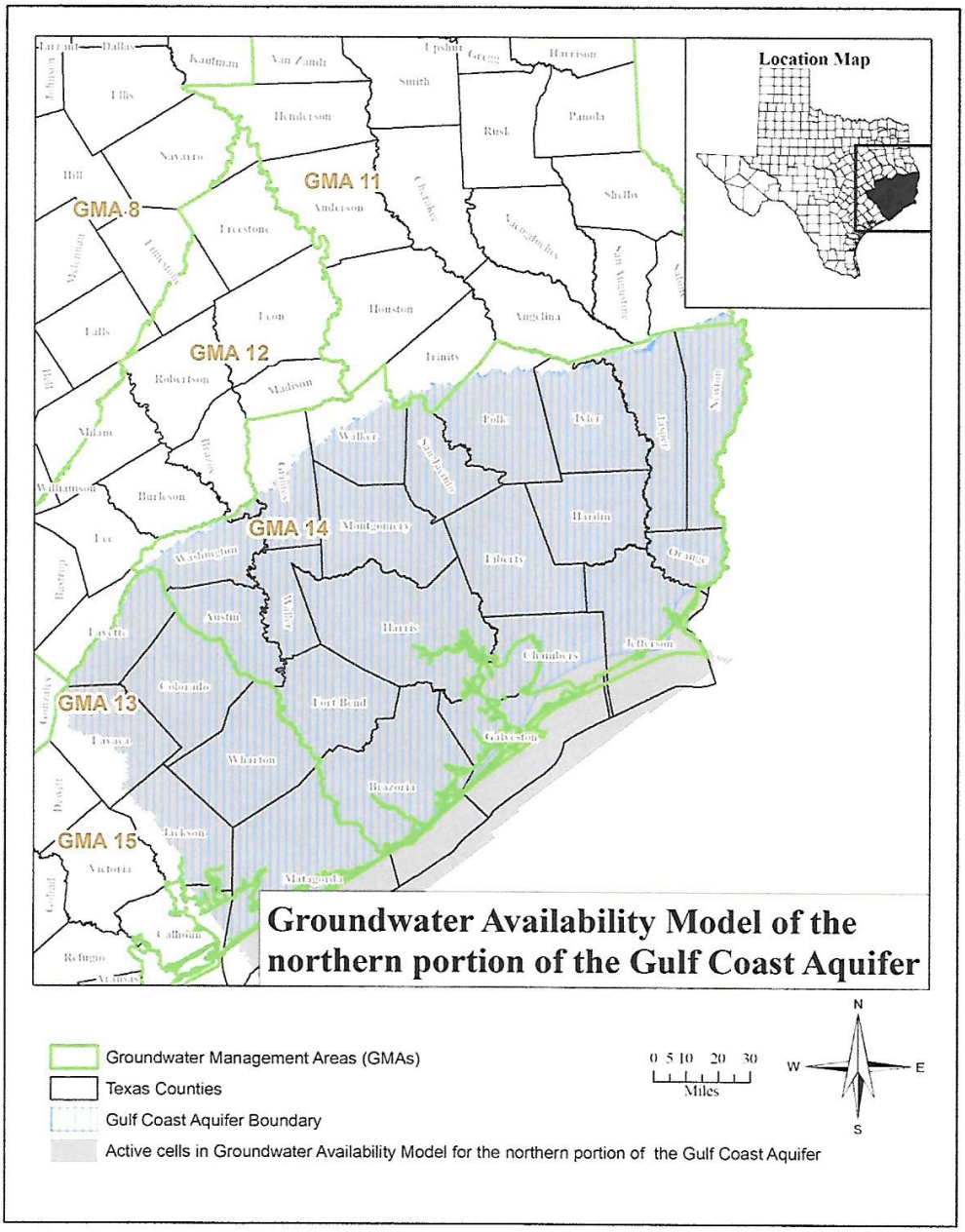

Figure 1: Map showing the areas covered by the groundwater availability model for the northern portion of the Gulf Coast Aquifer.

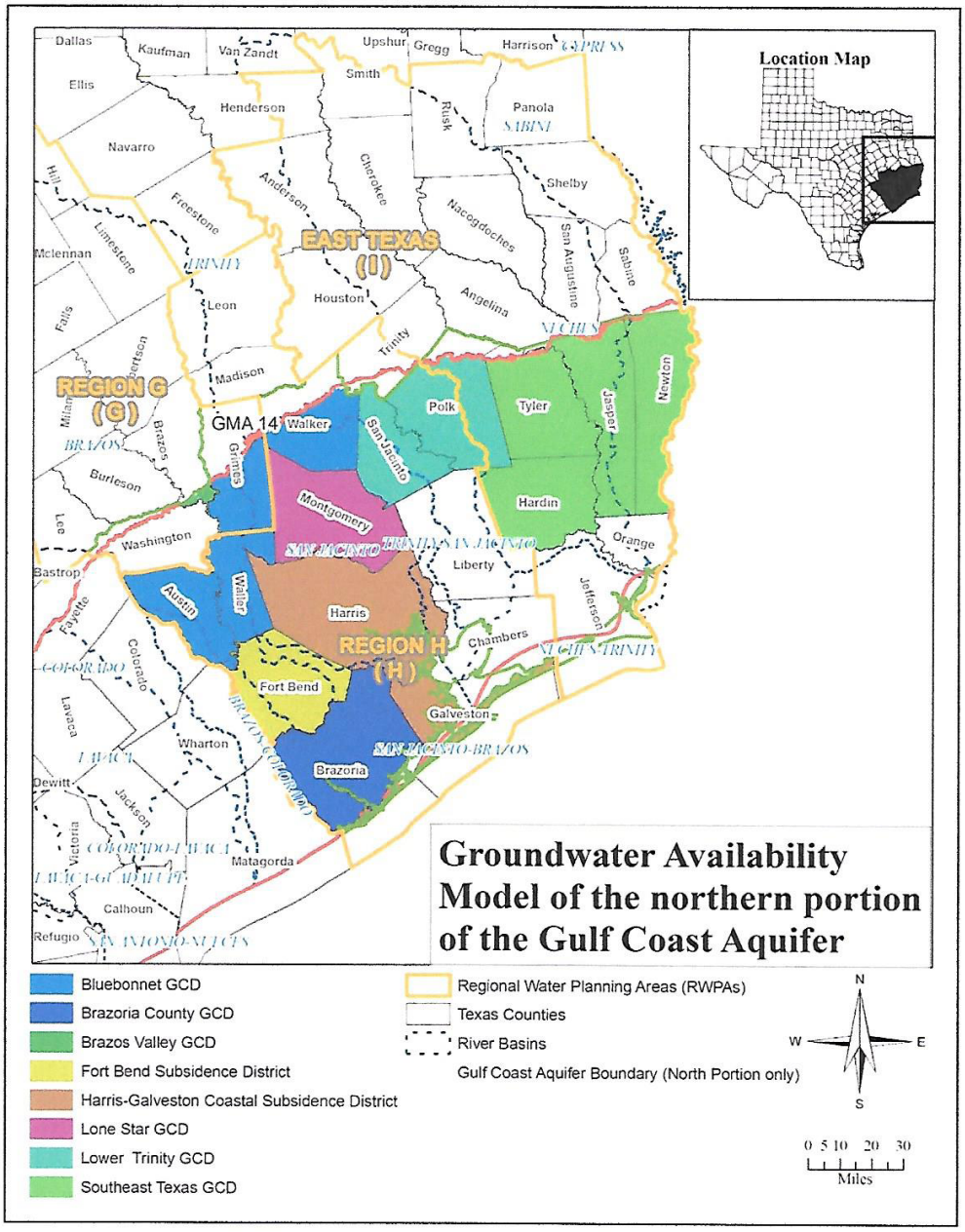

Figure 2: Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), subsidence districts, counties, and river basins in Groundwater Management Area 14.

GAM Run 10-055 MAG Version 2: Modeled Available Groundwater for the Yegua-Jackson Aquifer in Groundwater Management Area 14

by Wade Oliver
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-2386
July 9, 2012

Updated to Version 2 by Radu Boghici and Shirley Wade to reflect refined modeled available groundwater estimates

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 9, 2012.

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July 9, 2012

Updated to Version 2 by Radu Boghici and Shirley Wade to reflect refined modeled available groundwater estimates

EXECUTIVE SUMMARY:

The modeled available groundwater for the Yegua-Jackson Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 14 is approximately 7,900 acre-feet per year between 2010 and 2060. This is shown divided by county, regional water planning area, and river basin in Table 2 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 3 through 6. The modeled available groundwater amounts were estimated by iteratively adjusting the pumping between 2010 and 2060 in the groundwater availability model for the Yegua-Jackson Aquifer in the areas defined by the districts as relevant for the joint planning process.

The first version of this report showed modeled available groundwater for Jasper, Newton, and Tyler counties based on the pumping assumed in the groundwater availability model simulation. However, Groundwater Management Area 14 only specified desired future conditions in the Yegua-Jackson Aquifer for Grimes, Polk, Walker, and Washington counties. Therefore, we updated this report to only depict modeled available groundwater in Grimes, Polk, Walker, and Washington counties.

REQUESTOR:

Mr. Lloyd Behm of Bluebonnet Groundwater Conservation District on behalf of Groundwater Management Area 14

DESCRIPTION OF REQUEST:

In a letter dated August 25, 2010, Mr. Lloyd Behm provided the Texas Water Development Board (TWDB) with the desired future conditions of the Yegua-Jackson Aquifer adopted by the members of Groundwater Management Area 14. The desired future conditions, as shown in Resolution No. 2010-01, are:

Grimes County (Bluebonnet Groundwater Conservation District)

- From estimated 2010 conditions, the average drawdown of the unconfined portion of the Yegua should not exceed approximately 10 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the confined portion of the Yegua should not exceed approximately 15 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the brackish confined portion of the Yegua should not exceed approximately 20 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the unconfined portion of the Jackson should not exceed approximately 10 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the confined portion of the Jackson should not exceed approximately 15 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the brackish confined portion of the Jackson should not exceed approximately 20 feet average drawdown across the areas of occurrence of the aquifer.

Polk County (Lower Trinity Groundwater Conservation District)

- From estimated 2010 conditions, the average drawdown of the Yegua-Jackson should not exceed approximately 2 feet average drawdown across the areas of occurrence of the aquifer.

Walker County (Bluebonnet Groundwater Conservation District)

- From estimated 2010 conditions, the average drawdown of the unconfined portion of the Yegua should not exceed approximately 10 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the confined portion of the Yegua should not exceed approximately 15 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the brackish confined portion of the Yegua should not exceed approximately 20 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the unconfined portion of the Jackson should not exceed approximately 10 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the confined portion of the Jackson should not exceed approximately 15 feet average drawdown across the areas of occurrence of the aquifer.
- From estimated 2010 conditions, the average drawdown of the brackish confined portion of the Jackson should not exceed approximately 20 feet average drawdown across the areas of occurrence of the aquifer.

Washington County

- From estimated 2010 conditions, no additional drawdown of the Yegua Jackson across the area of occurrence of the aquifer.

In response to receiving the adopted desired future conditions, the Texas Water Development Board has estimated the modeled available groundwater for the groundwater conservation districts within Groundwater Management Area 14.

METHODS:

The locations of Groundwater Management Area 14, the Yegua-Jackson Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. The TWDB previously completed several predictive groundwater availability model simulations of the Yegua-Jackson Aquifer to assist the members of Groundwater Management Area 14 in developing a desired future condition. These simulations are documented in Groundwater Availability Modeling (GAM) Task 10-012 (Oliver, 2010).

In the results presented in GAM Task 10-012, no distinction was made between the unconfined, confined, and brackish confined portions of the aquifer. As shown above, the desired future conditions for Grimes and Walker counties were divided into unconfined, confined, and brackish confined areas of the aquifer and were developed with the assistance of Mr. Randy Williams of Bar-W Groundwater Exploration. In order to ensure the analysis here was consistent with the intent of the desired future conditions, the TWDB requested, and Mr. Williams provided, the delineations of the unconfined, confined, and brackish confined areas. These are shown in figures 2 and 3 for the Yegua and Jackson portions of the aquifer, respectively. Note in Figure 2 that the unconfined and confined portions of the Yegua unit were not provided within Walker County. However, the limits of these two areas were determined using the locations of the overlying unconfined area of the Jackson unit and the brackish confined area of the Yegua unit.

The TWDB used the groundwater availability model when analyzing desired future conditions for the Yegua-Jackson Aquifer. Because none of the previously run simulations matched the desired future conditions in Grimes and Walker counties, it was necessary to perform an additional run for this analysis. In this run, pumping was kept at the same level as the "base" scenario in GAM Task 10-012 for areas outside Grimes and Walker counties. In Grimes and Walker counties, the zones provided by Mr. Williams were implemented into the groundwater availability model as shown in figures 2 and 3. It is important to note that, though there are active areas in the model in Grimes and Walker counties outside of these zones, these areas were not included when estimating drawdown or pumping.

Pumping was adjusted in each of the above zones using PEST (Watermark Numerical Computing, 2004), an industry-standard inverse modeling software package, to match—to the extent possible—the above desired future conditions.

The best fit that could be achieved through this process was within 1-foot of each of the desired future conditions and is considered well within the uncertainty of the model. These values are shown in Table 1. Because a precise match could not be made, the TWDB requested confirmation from the districts in Groundwater Management Area 14 that the drawdowns achieved were consistent with the intent of the desired future conditions. This confirmation was received at the Groundwater Management Area 14 meeting held on May 24, 2011.

The modeled available groundwater as a result of the desired future conditions for the Yegua-Jackson Aquifer in Groundwater Management Area 14 is approximately 7,900 acre-feet per year. This pumping was then divided by county, regional water planning area, river basin, and groundwater conservation district (Figure 4).

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- The model includes five layers representing the Yegua-Jackson Aquifer and the overlying Catahoula unit.
- Deeds and others (2010) define which areas of the model correspond to the Lower Yegua, Upper Yegua, Lower Jackson, Upper Jackson and Catahoula units. The locations of the unconfined zones for Grimes and Walker counties provided by Mr. Randy Williams did not precisely correspond to the modeled definition of these areas. Since the outcrop (and unconfined) layer of the model (Layer 1) is intended to represent the conditions at a particular location, regardless of the unit named, the zones provided by Mr. Williams were honored when integrating those areas into the model.
- As reported in Deeds and others (2010), the mean absolute errors (a measure of the difference between simulated and measured water levels during model calibration) for the Jackson Group (combined upper and lower Jackson units), Upper Yegua, and Lower Yegua portions of the aquifer for the historical-calibration period of the model are 31.1, 23.9, and 24.5 feet, respectively. These represent

10.3, 5.7, and 6.3 percent of the hydraulic head drop across each model area, respectively.

- The recharge used for the model simulation represents average recharge as described in Deeds and others (2010).

- The model results presented in this report were extracted from all areas of the model representing the units comprising the Yegua-Jackson Aquifer. This includes some areas outside the "official" boundary of the aquifers shown in the 2007 State Water Plan (TWDB, 2007). For this reason, the results may reflect water of quality ranging from fresh to brackish and saline.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated July 12, 2011, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the TWDB is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The desired future conditions, drawdown achieved in the TWDB "best fit" simulation, and estimated pumping for each of the areas defined above are shown in Table 1. Notice that the drawdowns achieved in the model simulation are all within approximately 1-foot of the desired future condition.

As described in the Methods section above, pumping was kept at the same level as the "base" scenario in GAM Task 10-012 in the areas outside those shown in

Table 1. The modeled available groundwater for all areas within Groundwater Management Area 14 for the Yegua-Jackson Aquifer is shown divided by county, regional water planning area, and river basin in Table 2. This is also summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 3, 4, 5, and 6, respectively. In Table 6, note that the modeled available groundwater is subtotaled for only district areas relevant to the desired future conditions.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the

groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Deeds, N.E., Yan, T., Singh, A., Jones, T.L., Kelley, V.A., Knox, P.R., Young, S.C., 2010, Groundwater Availability Model for the Yegua-Jackson Aquifer: Final Report Prepared for the Texas Water Development Board by INTERA, Inc., 582 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Oliver, W., 2010, GAM Task 10-012, Texas Water Development Board Groundwater Availability Modeling Task Report, 48 p.

Texas Water Development Board, 2007, Water for Texas – 2007 – Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

TABLE 1: COMPARISON BETWEEN DESIRED FUTURE CONDITIONS (DFCS) FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 14 AND THE "BEST FIT" DRAWDOWN ACHIEVED IN THE MODEL SIMULATION. THE ESTIMATED PUMPING ASSOCIATED WITH THE SIMULATION FOR EACH AREA WITH A DEFINED DESIRED FUTURE CONDITION IS ALSO SHOWN.

County	*Unit*	*DFC (feet of drawdown)*	*TWDB "Best Fit" Scenario Drawdown (feet)*	*Pumping (acre-feet per year)*
Grimes	Yegua (Unconfined)	10	9.3	1,083
Grimes	Yegua (Confined)	15	15.8	0
Grimes	Yegua (Brackish Confined)	20	19.8	312
Grimes	Jackson (Unconfined)	10	10.0	1,729
Grimes	Jackson (Confined)	15	14.9	22
Grimes	Jackson (Brackish Confined)	20	20.0	132
Polk	Yegua-Jackson	2	2.5	360
Walker	Yegua (Unconfined)	10	10.1	366
Walker	Yegua (Confined)	15	15.0	40
Walker	Yegua (Brackish Confined)	20	20.0	340
Walker	Jackson (Unconfined)	10	9.7	3,342
Walker	Jackson (Confined)	15	15.5	0
Walker	Jackson (Brackish Confined)	20	19.9	86
Washington	Yegua-Jackson	0	-0.7	134

TABLE 2: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 14. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY, REGIONAL WATER PLANNING AREA, AND RIVER BASIN.

County	Region	Basin	2010	2020	2030	2040	2050	2060
Grimes	G	Brazos	1,954	1,954	1,954	1,954	1,954	1,954
Grimes	G	San Jacinto	80	80	80	80	80	80
Grimes	G	Trinity	1,244	1,244	1,244	1,244	1,244	1,244
Polk	H	Trinity	0	0	0	0	0	0
Polk	I	Neches	360	360	360	360	360	360
Walker	H	San Jacinto	351	351	351	351	351	351
Walker	H	Trinity	3,823	3,823	3,823	3,823	3,823	3,823
Washington	G	Brazos	134	134	134	134	134	134
Washington	G	Colorado	0	0	0	0	0	0
Total			**7,946**	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**

TABLE 3: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER SUMMARIZED BY COUNTY IN GROUNDWATER MANAGEMENT AREA 14 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	2010	2020	2030	2040	2050	2060
Grimes	3,278	3,278	3,278	3,278	3,278	3,278
Polk	360	360	360	360	360	360
Walker	4,174	4,174	4,174	4,174	4,174	4,174
Washington	134	134	134	134	134	134
Total	**7,976**	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**

TABLE 4: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER SUMMARIZED BY REGIONAL WATER PLANNING AREA IN GROUNDWATER MANAGEMENT AREA 14 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Region	2010	2020	2030	2040	2050	2060
G	3,412	3,412	3,412	3,412	3,412	3,412
H	4,174	4,174	4,174	4,174	4,174	4,174
I	360	360	360	360	360	360
Total	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**

TABLE 5: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER SUMMARIZED BY RIVER BASIN IN GROUNDWATER MANAGEMENT AREA 14 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Basin	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Brazos	2,088	2,088	2,088	2,088	2,088	2,088
Neches	360	360	360	360	360	360
San Jacinto	431	431	431	431	431	431
Trinity	5,067	5,067	5,067	5,067	5,067	5,067
Total	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**

TABLE 6: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) IN GROUNDWATER MANAGEMENT AREA 14 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Bluebonnet GCD	7,452	7,452	7,452	7,452	7,452	7,452
Lower Trinity GCD	360	360	360	360	360	360
District Areas Considered Relevant in Desired Future Conditions	**7,812**	**7,812**	**7,812**	**7,812**	**7,812**	**7,812**
No District	134	134	134	134	134	134
Total	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**	**7,946**

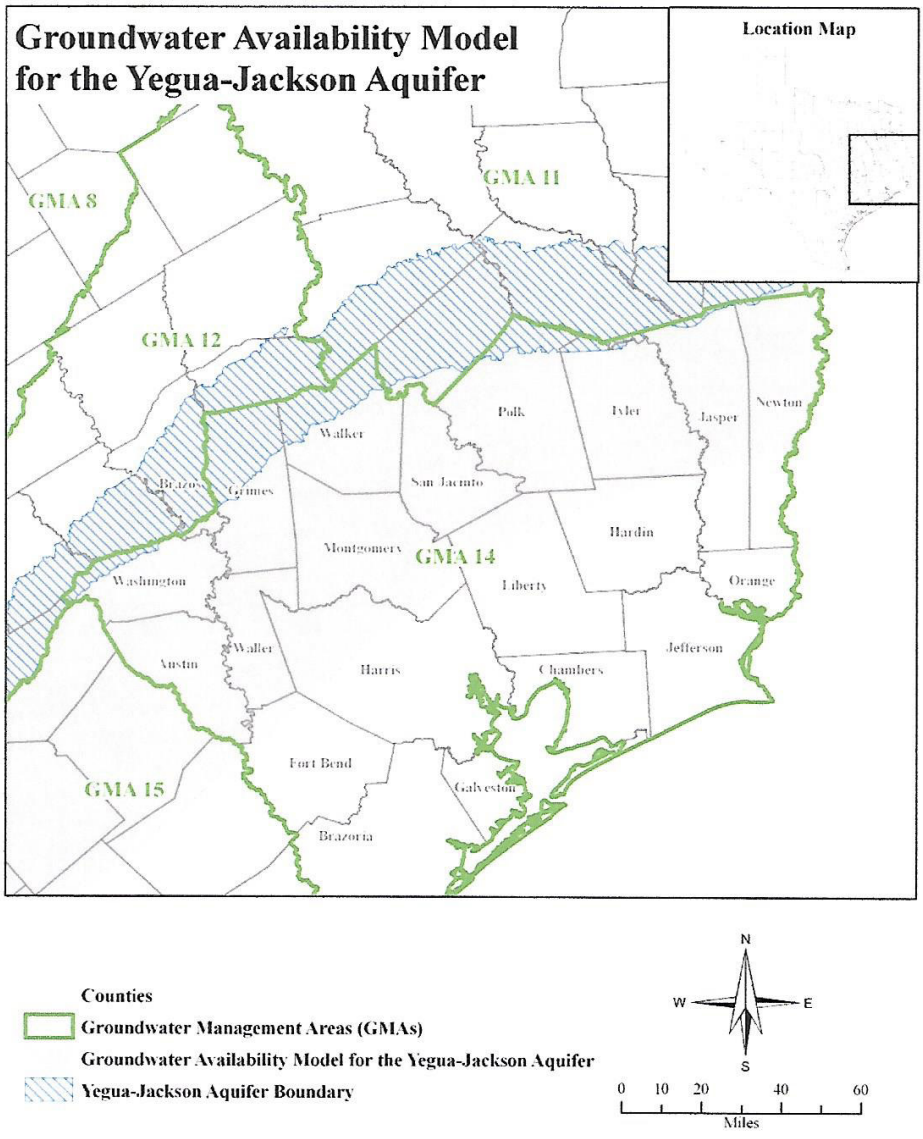

FIGURE 1. MAP SHOWING THE AREAS COVERED BY THE GROUNDWATER AVAILABILITY MODEL REPRESENTING THE YEGUA-JACKSON AQUIFER.

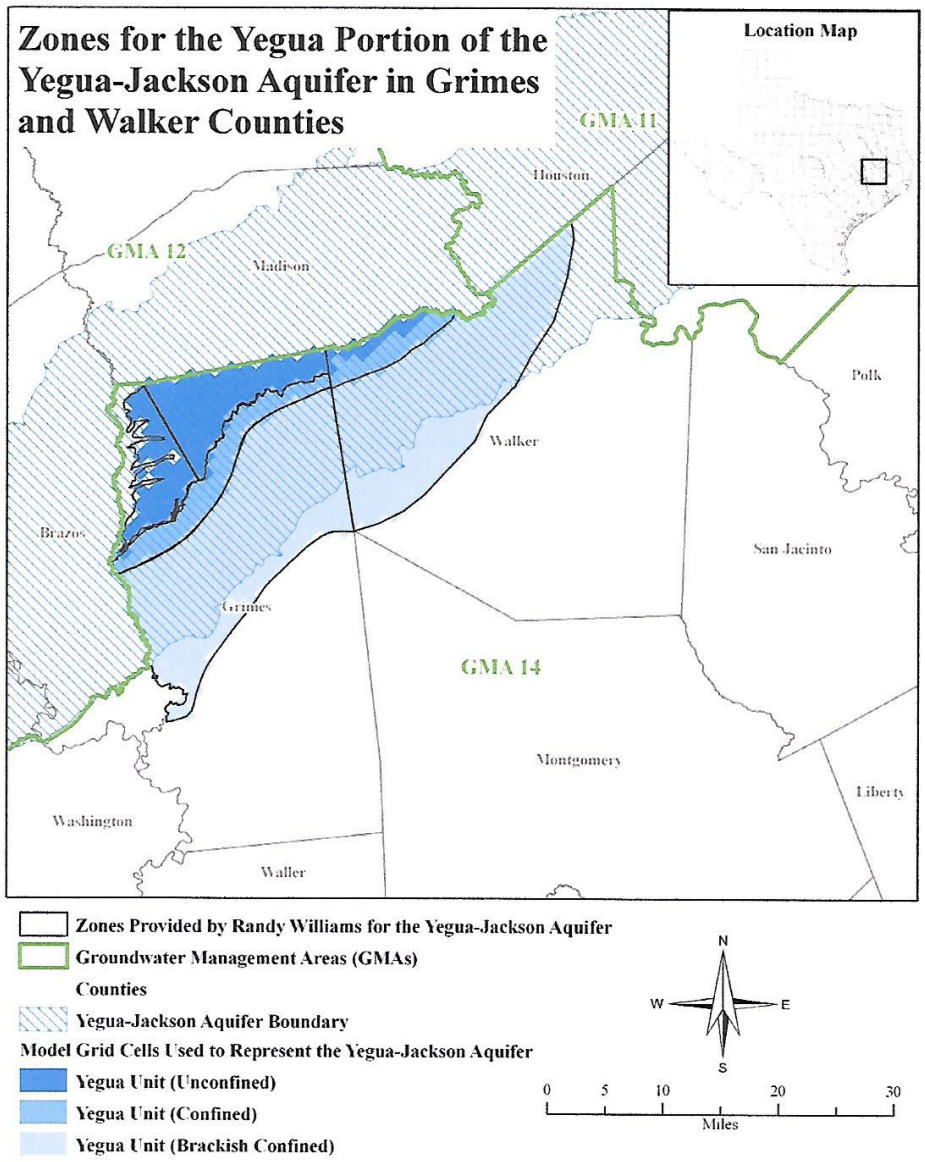

FIGURE 2. MAP SHOWING THE ZONES PROVIDED BY MR. RANDY WILLIAMS FOR THE YEGUA PORTION OF THE YEGUA-JACKSON AQUIFER IN GRIMES AND WALKER COUNTIES.

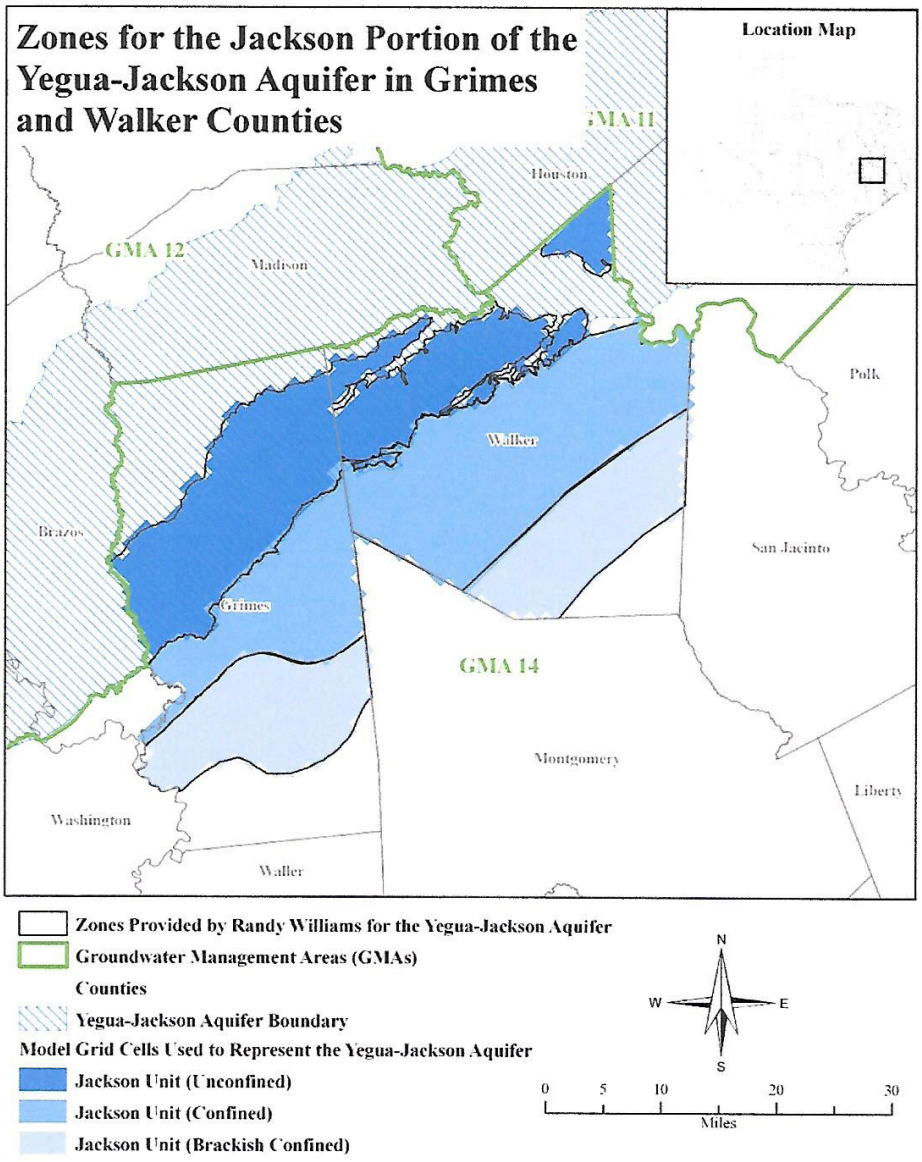

FIGURE 3. MAP SHOWING THE ZONES PROVIDED BY MR. RANDY WILLIAMS FOR THE JACKSON PORTION OF THE YEGUA-JACKSON AQUIFER IN GRIMES AND WALKER COUNTIES.

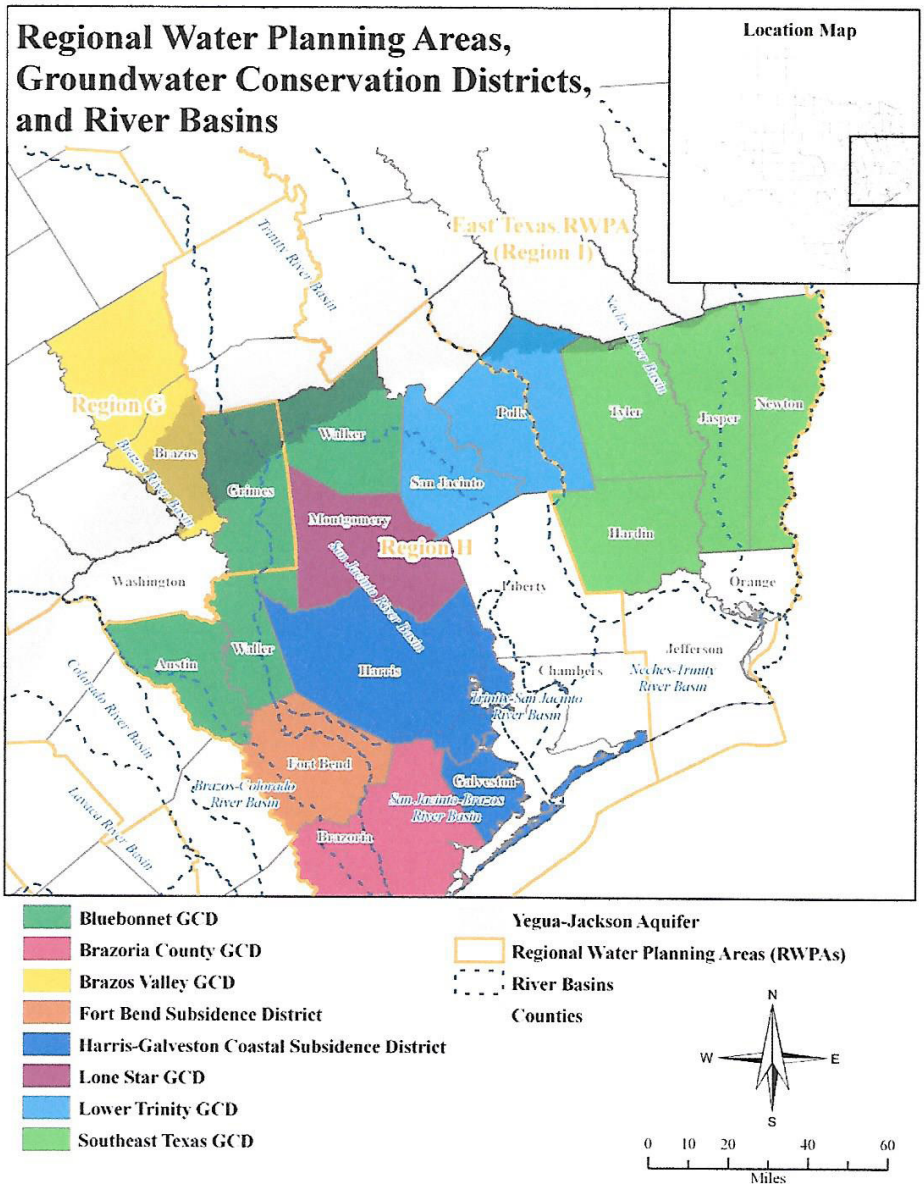

FIGURE 4. MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER CONSERVATION DISTRICTS, COUNTIES, AND RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 14.

APPENDIX

EXHIBIT

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LOWER TRINITY GROUNDWATER CONSERVATION DISTRICT

602 E. Church St. • Livingston, TX 77351

Mailing Address:
P.O. Box 1879
Livingston, Texas 77351

936-327-9531 Office
936-327-9532 Fax
www.ltgcd.org

ltgcdistrict@livingston.net • ltgcdistrict@gmail.com

Staff
Bill Jacobs - General Manager
Crystal Reddicks - Staff Assistant

12/13/2013

Region H Water Planning Group
c/o Jace Houston - Chairman
P. O. Box 329
Conroe, Texas 77305

Dear Sir:

We would like to invite you to our first quarterly Board Of Directors meeting in 2014, to share information concerning the activities of the Lower Trinity Groundwater District which serves Polk and San Jacinto Counties of East Texas.

That meeting will be held on January 10, 2014 at 10:30 A.M. at the Polk County Office Annex, room 175, which is located on Highway 190 East at 602 East Church Street in Livingston, Texas.

We also will post the meeting on our website at www.ltgcd.org. Additional information concerning the District can also be found on our website.

Our e-mail address is ltgcdistrict@livingston.net.

Sincerely,

Bill Jacobs

Bill Jacobs-GM
Lower Trinity GCD