

TRANS-TEXAS WATER PROGRAM

SOUTHEAST AREA

Technical Memorandum

Galveston Bay Freshwater Inflows Study

April 22, 1998

**Sabine River Authority of Texas
Lower Neches Valley Authority
San Jacinto River Authority
City of Houston
Brazos River Authority
Texas Water Development Board**

This document is a product of the Trans–Texas Water Program: Southeast Area. The program’s mission is to propose the best economically and environmentally beneficial methods to meet water needs in Texas for the long term. The program’s three planning areas are the Southeast Area, which includes the Houston-Galveston metropolitan area, the South-Central Area (including Corpus Christi), North-Central Area (including Austin) and the West-Central Area (including San Antonio).

The Southeast Area of the Trans–Texas Water Program draws perspectives from many organizations and citizens. The Policy Management Committee and its Southeast Area sub-committee guide the program; the Southeast Area Technical Advisory Committee serves as program advisor. Local sponsors are the Sabine River Authority of Texas, the Lower Neches Valley Authority, the San Jacinto River Authority, the City of Houston and the Brazos River Authority.

The Texas Water Development Board is the lead Texas agency for the Trans–Texas Water Program. The Board, along with the Texas Natural Resource Conservation Commission, the Texas Parks & Wildlife Department and the Texas General Land Office, set goals and policies for the program pertaining to water resources management and are members of the Policy Management Committee.

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1. Introduction

As a part of the Trans-Texas Water Program (TTWP) for the Southeast Area, a number of important environmental issues were identified which are associated with future water resources management in the region. The Policy Management Committee for the Southeast Area TTWP subsequently created several focus groups to deal with some of these specific water issues. One of the groups was the Galveston Bay Freshwater Inflow Group (GBFIG), an ad hoc committee concerned with the health and productivity of Galveston Bay. As a result of the GBFIG's work, an analysis of projected freshwater inflows into Galveston Bay was conducted as a part of the TTWP and this technical memorandum summarizes the result of those studies.

1.1 Background

The State of Texas has studied the health and productivity of Galveston Bay for several years. This work has recently lead to a determination of recommended freshwater inflows for maximum productivity of Galveston Bay. In anticipation of these recommendations, the GBFIG was concerned over a number of issues related to current and future freshwater inflows into Galveston Bay:

- Based on existing authorized water rights permits, what are the impacts from current and future diversions on freshwater inflows to the bay?
- Does the geographic distribution of freshwater inflows significantly change

over time due to existing authorized diversions?

- How do current and future projected freshwater inflows compare to the recommended freshwater inflows necessary to maximize fisheries productivity?

1.2 Scope

GBFIG determined that a number of additional water availability hydrologic investigations were necessary to address the above questions. This technical memorandum describes the water availability studies that have been conducted to date. The objective of this study is to develop preliminary estimates of freshwater inflows into the bay under three different inflow scenarios;

- naturalized conditions,
- intermediate development conditions
- full development conditions.

Naturalized conditions are those streamflows which represent basin runoff that would have occurred in the absence of water resources development, water use or other human activities in the watershed. Intermediate Development conditions are simulated by estimating inflows based upon less than total use of full water rights and return flows. Full Development conditions represent full use of existing water rights and the respective return flows. These three scenarios were selected to compare water rights conditions to the State of Texas Bay and Estuary analysis. This study analyzes the statistical frequency of certain hy-

hydrologic flow conditions occurring within Galveston Bay.

1.3 Study Area

The Galveston Bay watershed contains 33,000 square miles and consists of the following two river basins and three coastal basins:

- Trinity River
- San Jacinto River
- Neches-Trinity Coastal
- Trinity-San Jacinto Coastal
- San Jacinto-Brazos Coastal

The commonly referenced Galveston Bay actually consists of four separate embayments, including:

- Galveston Bay
- Trinity Bay
- East Bay
- West Bay

Data prepared for the Texas Bay & Estuary Program suggests that the Trinity and San Jacinto Rivers typically contribute in excess of 80 percent of annual freshwater inflows into Trinity Bay and Galveston Bay while the coastal river basins primarily contribute freshwater inflows into East and West Bays.



2. State of Texas Bay & Estuary Study

The Texas Water Development Board (TWDB) and the Texas Parks & Wildlife Department (TPWD), under the Texas Bay & Estuary (B&E) Program, have recently completed a report on the effects of freshwater inflows on Galveston Bay. The report examines two main topics:

- Establishing the effects of freshwater inflows on living organisms, and
- Presentation of the methodology used in determining the freshwater inflow needs of the bay which would maintain an ecologically sound environment and a productive estuary.

The Galveston Bay B&E report builds upon the framework of an earlier study "Trinity -San Jacinto Estuary: A study of the influence of Freshwater Inflows" March 1981, (LP-113.)

The Galveston B&E study computed freshwater inflows into Galveston Bay for the historical period of 1941-1990. Freshwater inflows were determined by:

- compiling historical gauged inflow from the Trinity and San Jacinto basins,
- computing rainfall-runoff relationships for ungauged watersheds, and accounting for any diversions and return flows within those ungauged watersheds.

The results of this study over the period of record from 1941 to 1990 show

that an average of 10.1 million acre-feet per year of freshwater flows into Galveston Bay from the contributing watersheds in the following geographic distribution:

- Trinity basin-54%
- San Jacinto basin-28%
- San Jacinto-Brazos basin-10%
- Neches-Trinity basin-6%
- Trinity-San Jacinto basin-2%

Table 1 shows the statistical distribution of freshwater inflows into Galveston Bay from 1941 to 1990 from the B&E study. The TWDB and TPWD used these inflows in a number of biological, chemical and biochemical models. Parameters essential to fisheries productivity included:

- sediments
- nutrients
- salinity
- flow circulation
- other

Galveston Bay simulation models were developed for each of these parameters. Each of these parameters were then used as inputs into the TxEMP model, which is an optimization model used to search for feasible solutions to maintain the ecological health of the bay. The Galveston Bay B&E TxEMP

Table 1: Galveston Bay Annual Freshwater Inflows 1.

	<i>Hist- Min</i>	<i>10th %</i>	<i>25th %</i>	<i>Median</i>	<i>Average</i>	<i>75th %</i>	<i>90th %</i>	<i>Hist-Max</i>
<i>January</i>	41,630	150,485	311,617	699,490	900,903	1,446,186	2,090,450	2,858,000
<i>February</i>	70,990	155,190	415,427	946,475	929,369	1,345,840	1,865,649	2,577,000
<i>March</i>	73,530	164,399	327,000	652,800	927,065	1,504,404	1,982,064	2,729,000
<i>April</i>	136,200	193,935	384,400	632,500	1,038,525	1,590,000	2,388,805	5,290,000
<i>May</i>	139,400	260,000	461,500	1,273,700	1,522,301	2,127,080	3,616,000	4,571,000
<i>June</i>	56,540	190,324	351,900	839,700	1,218,681	1,826,800	3,222,000	4,011,820
<i>July</i>	44,350	107,705	219,765	340,376	632,396	936,127	1,559,200	2,439,189
<i>August</i>	20,590	77,980	136,747	225,265	379,458	550,350	754,760	2,110,600
<i>September</i>	15,740	93,325	193,340	330,246	533,187	625,930	1,466,565	2,484,919
<i>October</i>	21,100	49,885	117,258	251,895	538,943	556,100	1,476,164	3,590,900
<i>November</i>	31,300	89,480	190,740	351,500	651,704	744,110	1,740,750	4,565,000
<i>December</i>	55,290	93,865	194,560	626,802	768,678	1,075,700	1,812,163	2,582,000
<i>Total Flow</i>	706,660	1,626,573	3,304,254	7,170,749	10,041,210	14,328,627	23,974,570	39,809,428

1. *Prepared by Texas Water Development Board Period of Record – 1941 to 1990*
Historical Annual Minimum Inflow – 1,871,280 acre-feet (1956)
Historical Annual Maximum Inflow – 21,454,740 acre-feet (1973)

analysis has determined that the peak performance of the annual fisheries harvest is 11.6 million pounds and the required freshwater inflow necessary to generate that harvest is approximately 5,220,000 acre-feet per year. Important to this maximum fisheries harvest, the B&E analysis optimized the monthly distribution of inflows into the bay using the TxEMP model. Table 2 illustrates the optimized monthly inflow distribution used to compute

maximum fisheries harvest. Table 2 shows that the largest quantity of inflows are needed in the month of May (almost 1.3 million acre-feet or 24 % of annual inflows) and the lowest month of inflows occurs in October (over 75,000 acre-feet or 2.5 % of annual inflows). The B&E analysis establishes each monthly inflow as an independent quantity of need. Evaluation of future required inflows will focus on the ability to achieve each separate monthly flow target shown in Table 2.

Table 2: Maximum Harvest Monthly Inflow Distribution

<u>Month</u>	<u>Inflow (acre-feet)</u>	<u>Percentage (%)</u>
January	150,600	3
February	160,600	3
March	652,500	13
April	632,400	12
May	1,279,900	24
June	833,200	16
July	210,800	4
August	150,600	3
September	100,400	2
October	75,300	2
November	351,300	6
December	622,400	12
Total	5,220,000	100



3. Water Availability Analysis

A water availability model was developed to determine the relationship of current and future water right diversions on freshwater inflows into Galveston Bay. The model was created to analyze the impact of water right diversions and reservoir operations on future inflows into Galveston Bay and requires as input data the following basic parameters:

- Reservoir Facilities
- Hydrologic Data
- Water Rights Diversions
- Return Flows

Each of these data types is input into a river basin model that is essentially a water balance accounting program. Basically, the model adds and subtracts water inputs from upstream to downstream points.

3.1 Model Selection and Configuration

This water availability study used the Texas A & M Water Rights Analysis Package (WRAP3) software. WRAP3 is a generalized computer model which has the capability to simulate a stream/reservoir system, allows for flexible river-tributary configurations and water use under a priority-based water allocation system. The model also provides the flexibility to simulate interbasin transfers and/or other developed water sources, such as groundwater imports.

Control points are model parameters that describe the relative configuration of a river basin system and indicate the location of streamflow data, reservoirs and water right diversion points. Figure 1 represents a schematic of the Galveston Bay WRAP3 model, showing the various reservoirs, stream segments and associated control points. The model includes the two river basins and three coastal basins, with interbasin transfers that occur throughout the watershed.

This Galveston Bay watershed simulation model is very complex in its construction. The model is a multi-basin, multi-reservoir system. Figure 1 shows that three rivers (the San Jacinto, Brazos, and Trinity Rivers) and eleven bayous and creeks provide input of fresh water into Galveston Bay either directly or through interbasin transfers.

Water is accounted for in the Galveston Bay model in monthly timesteps. Therefore, all of the input data is structured in monthly increments. The control points illustrate the theoretical quantity of water in existence at any specific location. In this model, control point number 9,000 is used to account for the summation of all inflows into Galveston Bay. The model additionally is configured to illustrate contributing inflows from all of the individual creeks, bayous, and rivers and specific watershed basins using the appropriate control points.

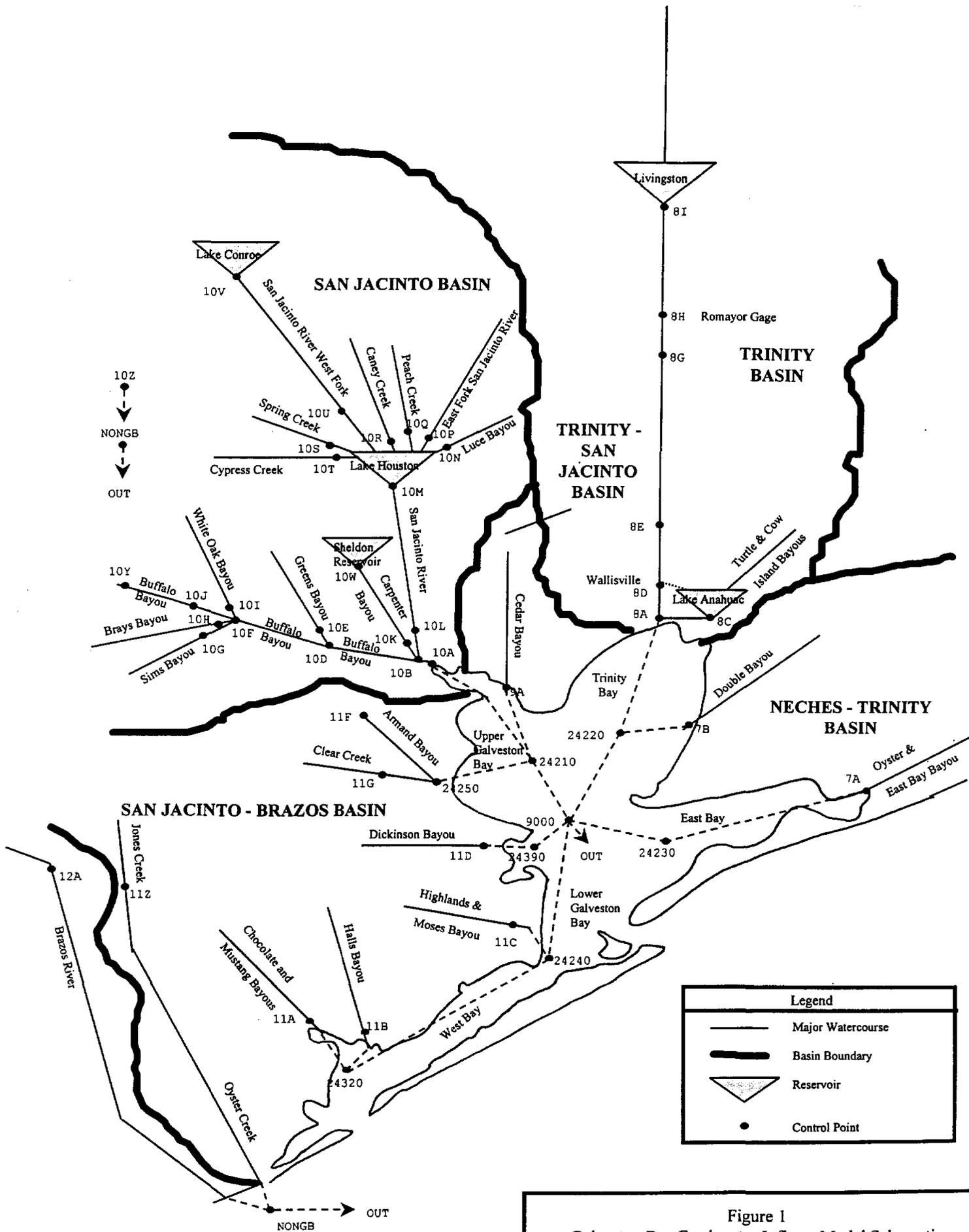


Figure 1
Galveston Bay Freshwater Inflows Model Schematic

It should be noted that the modeled San Jacinto basin is based on a model developed for this specific basin as a part of a previous San Jacinto River Basin Water Availability Study (Wurbs, TAMU). For this current analysis, return flows were incorporated into the originally prepared model.

3.2 Scenarios

Three water availability analysis inflow scenarios were developed: naturalized, intermediate development, and full development conditions. These conditions were selected for analytical and comparative purposes. Two types of comparisons can potentially be performed using these conditions. First, the impact on freshwater inflows from water rights diversions can be tracked over time. This can be seen by comparing water use data input in the three scenarios as seen below:

Naturalized Conditions: No water rights diversions.

Intermediate Development Conditions: Year 1997 water usage diversions in the San Jacinto and Coastal basins and downstream of Lake Livingston in the Trinity basin. Full development conditions upstream of Lake Livingston in the Trinity basin.

Full Development Conditions: Maximum use of current water right permit diversions for the entire study area.

The expectation is that total inflows into Galveston Bay will decrease from the naturalized to the full development

condition. At issue is how much change will occur.

Secondly, these inflow conditions can be compared to the Galveston Bay B&E analysis results. The B&E study computes recommended freshwater inflow targets. GBFIG study results can then be compared to the B&E targets to determine the relationship of the targets to inflows resulting from intermediate and full development water rights diversions.

One factor related to water availability models should be noted. Water availability models are by their nature theoretical and do not reflect actual flow conditions. Generally, various water rights diversion assumptions are superimposed on historical hydrologic conditions. For instance, year 1998 water diversions are applied to year 1954 rainfall and runoff conditions. This procedure is valid for analyzing water availability, but may create confusion when compared to actual historical river streamflow conditions.

The following chapters describe each of the scenarios under study. The final chapters present a discussion of the results including a comparison of this Galveston Bay water availability analysis results to the B&E study.



4. Reservoir Facilities

The primary surface water supply reservoirs analyzed in this study were Lake Houston, Lake Conroe and Sheldon Reservoir within the San Jacinto basin, and Lake Livingston and Lake Anahuac within the Trinity River basin. Although, the current plan for the Wallisville Salt Water Barrier calls for a pool elevation of two feet, the plan will not create a permanent impoundment. The Wallisville Salt Water Barrier project is therefore not considered in this analysis. Additional reservoirs exist in the upper Trinity basin upstream of Lake Livingston; however, those reservoirs were not modeled in detail. Instead, the analysis of water availability incorporates these reservoirs through the inflow data used for the Trinity basin as further discussed in the next section of this report.

4.1 Ownership and Capacity

Lake Houston was built in 1954. The City of Houston owns and operates Lake Houston. Lake Livingston was completed in 1969. Lake Livingston was developed by the City of Houston in cooperation with the Trinity River Authority, which operates that facility. Lake Conroe was completed in 1973. The San Jacinto River Authority operates Lake Conroe. The Wallisville barrier is expected to begin operation in 1998. The Wallisville structure will be operated by the U.S. Army Corps of Engineers. Lake Anahuac is owned and operated by the Chambers and Liberty Counties Navigation District and is located on Turtle Bayou in Chambers County. The origi-

nal project began operation in 1914 with modifications to the dam and spillway occurring in 1952 and 1990. Table 3 summarizes key data for each reservoir.

The area and capacity information in Table 3 for Lake Houston and Lake Conroe reflects the reservoir characteristics expected to exist as of the year 2000. These areas and volumes were projected based on volumetric surveys made by the Texas Water Development Board in 1994⁽¹⁾ and 1996⁽²⁾, respectively. The information shown for Lake Livingston is also for the year 2000 and is based on a study made in 1991 by the Bureau of Reclamation⁽³⁾. The capacity and area values shown for the Wallisville project are based on the Corps' design studies⁽⁴⁾. More detailed area and capacity tables are in Appendix A.

4.2 Water Rights

The combined sum of the water rights associated with these reservoir projects is 1,667,002 acre-feet per year. Approximately 71 percent of the total rights belong to the City of Houston, which has the right to divert 1,175,467 acre-feet per year. The Trinity River Authority owns rights amounting to 403,200 acre-feet per year, or 24.0 percent of the total. The San Jacinto River Authority (SJRA) owns rights amounting to 33,333 acre-feet per year or 2 percent of the total, and the Chambers Liberty Counties Navigation District owns rights amounting to 51,600 acre-feet per year or 5 percent of the total. Table 4 summarizes water rights associated with each reservoir.

Table 3: Key Data for the Dams and Reservoirs

	Lake Houston	Lake Livingston	Lake Conroe	Wallisville Salt Barrier	Lake Anahuac
Owner/operator	Houston	TRA	SJRA	USACOE	CLCND
Year Started operation	1954	1969	1973	1998 (Est.)	1914
Capacity (Acre-Feet)	131,540	1,718,778	413,941	-	29,500
Surface area (Acres)	11,817	82,950	20,074	3,800	5,200
Drainage area (Sq. Mi.)	2,828	16,583	445	17,845	199
Elev. At top of conservation storage	44.5	131.0	201.0	-	4.0

Note: The Wallisville salt water barrier will normally be operated at or slightly above normal water levels. It will not have any conservation storage as such.

Table 4: Reservoir Capacities and Associated Water Rights

	Houston	Water Rights				Total
		SJRA	TRA	CLCND	Other	
Lake Livingston	902,800	0	351,600	0	0	1,254,400
Lake Houston	168,000	0	0	0	0	168,000
Lake Conroe	66,667	33,333	0	0	0	100,000
Lake Anahuac	-	-	-	54,127	-	54,127
Wallisville SWB	38,000	0	51,600	0	0	89,600
Sheldon Reservoir	0	0	0	0	875	875
Total	1,175,467	33,333	403,200	54,127	875	1,667,002



5. Hydrologic Data

Hydrologic data used in the simulation model includes:

- Naturalized streamflows
- Evaporation

Naturalized streamflows represent the basin runoff that would have occurred in the absence of water resources development, water use or other human activities in the watershed. Naturalized streamflows are generated from actual streamflow runoff. Adjustments must be made to actual runoff data to compute naturalized flows. Naturalized streamflows, for the period of record of 1946 -1980, for all basins contributing to Galveston Bay have been compiled from the sources, shown in Table 5. A brief description of each source of streamflow data is provided below.

5.1 San Jacinto River Basin

The San Jacinto River Basin Water Availability study (Wurbs, TAMU) utilized the naturalized streamflows developed for the 1983 Texas Department of Water Resources model. These flows were based on adjustments of historical gauged flows and extension of recorded flows using regression analyses. This Galveston Bay study uses the same naturalized flows for the San Jacinto River Basin.

5.2 Coastal Basins

The State of Texas LP-113 study and the subsequent Bay and Estuary study of freshwater inflows to Galveston Bay generated basin runoff volumes for the unengaged watersheds in the coastal basins. These flows were computed by ap-

plying weighted daily precipitation depths, Soil Conservation Service Curve Numbers, and soil depletion index values into calibrated water yield models. Although both studies employ similar methods for computing watershed runoff, they use slightly different watershed delineations. In order to develop continuous records of naturalized flows for the coastal basin watersheds, two or more watersheds of the above studies are combined into "control point" basins. The purpose of this combination is to create basins that have similar boundaries to the Bay and Estuary and the LP-113 studies.

5.3 Trinity River Basin

The naturalized streamflows downstream from Livingston Dam are obtained from the TNRCC database as two sets of flows; baseflows and storm runoff. The summation of baseflow and storm runoff are used as the naturalized streamflows for the watersheds downstream of Lake Livingston.

Model inflows into Lake Livingston are not naturalized flows. For the period from 1946 to 1970, adjustments were made to the inflows developed for the 1997 *Trans-Texas Water Program Report on System Operation of Surface Water Supply Sources in the Houston Area*. The inflows used in the System Operation study approximate the future full development of existing water rights condition but do not include return flows originating in the Dallas-Fort Worth Metroplex. The current (year 1997) level of return flows were developed and added to the Systems Operation Study

inflows for this Galveston Bay study. The period of record was extended from 1971 through 1980 by relating historical flows at gauging stations above Lake Livingston and making appropriate adjustments to approximate current conditions.

As described above, inflow data upstream and into Lake Livingston and inflow data downstream of Lake Livingston and in all the other Galveston Bay subwatersheds are created differently. Inflow data upstream of Lake Livingston represent streamflow that are *projected* to occur in the future upon full development utilization of all existing water rights permits in the upper Trinity basin. Additionally, these same set of flows are used in both the intermediate development condition and full development condition model scenario simulations. All of the inflow data within the

remaining Galveston Bay water availability model subwatersheds are naturalized flows. Computed flows in these subwatersheds will change from the intermediate to the full development condition scenario based on the quantity of diversions and return flows within each subwatershed. The intermediate development condition therefore is actually a hybrid analysis using full development conditions upstream of Lake Livingston but actual year 1997 conditions in all other subwatersheds.

5.4 Evaporation Data

Evaporation data was taken from a 1978 City of Houston water availability study.⁽⁵⁾ Monthly depths of net reservoir loss from lake surfaces from the City of Houston study were originally obtained from data published by the TWDB.⁽⁶⁾

Table 5: Streamflow Data Sources

Watershed	Period of Record	Source of Data
San Jacinto River Basin	1940 - 1980	San Jacinto River Basin Water Availability Model, prepared for the TNRCC by Dr. Ralph A. Wurbs of Texas A&M University, October 1996.
Trinity River Basin Below Lake Livingston	1941 - 1980	Trinity River Basin Water Availability Model (24-20 to 24-46)
Coastal Basins	1941 - 1976	Trinity-San Jacinto Estuary: A study of the influence of Freshwater Inflows, Texas Department of Water Resources, LP-113, 1981.
(ungaged areas)	1977 - 1990	Freshwater Inflows to Galveston Bay, TWDB
(gaged areas)	1977 - 1990	Sub-basin runoff generated assuming equal runoff rates per square mile of contributing drainage area (GBFIG study).



6. Water Rights Diversions

Different sets of water rights diversion data were used in this Galveston Bay study depending upon which scenario was considered. The naturalized flow condition model does not include any water rights diversions. The full development condition model contains the full permitted diversions from the TNRCC water rights master file database listed in Appendix B. The intermediate development condition model downstream of Lake Livingston and all other watershed basins contain current (year 1997) surface water usage amounts based on records of major water rights holders, TWDB data, and the assumption of full usage for minor water rights. The intermediate and full development condition water rights usage amounts are summarized in Table 6.

6.1 Trinity Basin Fixed Rights

There are several large water rights on the Trinity River downstream from Lake Livingston that are senior to the Lake Livingston rights. When the Livingston project was being developed, contractual agreements were signed by the City of Houston, the TRA and three of the owners of such prior rights, defining obligations to release water from Lake Livingston in recognition of the downstream priorities. These were referred to as the "fixed right" obligations associated with Lake Livingston. Basically, they set the annual downstream withdrawal amounts for each of the senior rights that are to be supported by releases from Lake Livingston.

Under the terms of the agreements, the users of Lake Livingston consented to

release water as required to make reliable:

- 88,820 acre-feet per year of diversions by the Chambers-Liberty Counties Navigation District
- 33,000 acre-feet per year by the Dayton Canal Company
- 86,000 acre-feet per year by the Devers Canal Company.

All of these uses were for irrigation.

The Chambers-Liberty Counties navigation District's diversion point is just upstream from the Wallisville Salt Water Barrier site, and the other two fixed rights diversion points are near the Coastal Water Authority diversion station.

Since these settlements were in recognition of senior certified filings and permits, for the most part, they do not constitute part of the Lake Livingston yield and must be satisfied in preference to that yield. The one exception is the Devers right, of which 27,500 acre-feet per year is earmarked as being part of the project yield, to be charged against the Lake Livingston permit.

In addition to the three "fixed right" agreements, a fourth senior right of 45,000 acre-feet, belonging to the Southern Canal Company, was purchased outright by the City Houston, is still owned by the City, and its effect on Lake Livingston will be similar to that of the three fixed right agreements.

The downstream water rights situation has been affected by a recent purchase by the San Jacinto River Authority of

Table 6: Water Right Diversions

	Full Development Condition (ac-ft/yr)	Intermediate Development Condition (ac-ft/yr)
Brazos Water Rights		
diverted to San Jacinto - Brazos Basin		
Gulf Coast Water Authority	224,931	130,911
Choc Bayou Water Co.	155,000	100,000
Total	379,931	230,911
San Jacinto - Brazos Water Rights		
Choc Bayou Water Co.	57,500	230,911
Gulf Coast Water Authority	12,000	2,394
Other Water Rights	9,363	9,363
Total	78,863	30,757
San Jacinto Water Rights		
San Jacinto River Authority	88,333	80,142
City of Houston	234,667	58,759
Water Rights	23,043	23,043
Total	346,043	161,944
San Jacinto - Trinity Water Rights		
Houston Lighting & Power	30,000	30,000
Other Water Rights	15,539	15,539
Total	45,539	45,539
Lower Trinity Water Rights		
Chambers Liberty CND (1)	88,820	22,000
Trinity River Authority	403,200	89,015
City of Houston	985,800	477,305
Dayton Canal (2)	33,000	-
Devers Canal (3)	2,500	2,500
San Jacinto River Authority	56,000	-
Other Water Rights(4)	65,184	45,607
Total	1,634,504	636,427
Neches - Trinity Water Rights		
U.S. Anahuac NWR	26,932	9,900
Other Water Rights	28,118	28,118
Total	55,050	38,018
Grand Total	2,560,553	1,143,596

(1) 88,820 ac-ft/yr maximum diversion from Trinity River, an additional 54,127 ac-ft/yr is permitted from Turtle Bayou, Lake Anahuac, and Trinity Bay and is included in the "Other Water Rights" value.

(2) 33,000 ac-ft/yr maximum diversion from Trinity River, an additional 5,000 ac-ft/yr is permitted from Big Ditch, a tributary of the Trinity River and is included in the "Other Water Rights" value.

(3) An additional 27,500 ac-ft/yr is supplied under a "fixed rights" contractual agreement with the Trinity River Authority.

(4) In 1997 CLCND did not use 20,000 Ac-Ft of their Turtle Bayou Rights.

56,000 acre-feet per year that was formerly part of the Devers rights.

For purposes of this study, it was assumed that the downstream water right obligations at Lake Livingston are not altered by that purchase.

In all, there are 252,820 acre-feet per year of prior rights downstream from Lake Livingston that involve obligations for pass-through or releases from the lake. Of that amount, only 27,500 acre-feet per year would count as new yield developed by Lake Livingston.

6.2 Interbasin Transfers

There are a total of two "surface water" interbasin transfers which are simulated in this Galveston Bay water availability model. The first transfer is from the Brazos Basin to the Brazos-San Jacinto River Basin, via the Chocolate Bayou Water Company and the Gulf Coast Water Authority's canal systems. The second transfer is from the Trinity River to the San Jacinto River Basin, via the Coastal Water Authority's main canal. Addi-

tionally, for the future case, the San Jacinto River Authority's Trinity River rights will be conveyed through the CWA main canal. Groundwater use within the San Jacinto basin is a significant source of "importation", the impact of which is explained later in Section 7, Return Flows.

6.3 Unappropriated Streamflow

The WRAP3 software used in this water availability study has the capability to compute available unappropriated streamflows at each of the control points. For this analysis, water rights diversions are simulated to occur at the reservoir associated with a particular water right. Modeled water rights generally occur at reservoirs upstream of their actual point of diversion. Streamflows downstream of reservoirs therefore represent theoretical worst-case flow conditions.



7. Return Flows

Return flows represent water discharged back into streams after it has been previously diverted and used. Examples of return flows include:

- effluent from wastewater treatment plants
- runoff from irrigation
- return of water used in industrial processes.

Return flow factors are used in the WRAP3 software and represent the ratio of return flow to the diversion amount. Return flow factors vary by water use type.

Return flow factors used in this study are listed in Table 7. Return flows into Lake Livingston have been assumed to remain the same for both the existing and full development cases.

Table 7: Return Flow Factors

Use Type	Return Flow Factor
Municipal CO (1) Existing	1.04
Municipal CO (1) Future	0.85
Municipal (Non-COH)	0.60
Industrial	0.61
Irrigation	0.55
Mining	0.00

7.1 Municipal

Two municipal return flow factors were used in this water availability study, one for the City of Houston (COH) and the other for all other municipal water rights. The basis for segregating the COH's municipal use over all others is due to the City's significant amount of groundwater use. Currently, the COH relies on a conjunctive use of approximately 65% surface water and 35% groundwater. Relating total municipal demand to total municipal wastewater discharges (excluding inflow/infiltration), results in a municipal return flow factor of 0.68. In order to account for that portion of return flows resulting from groundwater, a ratio of the total return flow factor (0.68) to the current surface water usage (0.65) was computed resulting in an existing "adjusted" return flow factor of 1.04. For the future case, the COH will convert to 80 percent surface water use in conformance with the Harris-Galveston Coastal Subsidence District groundwater conversion schedule, which results in an "adjusted" return flow factor of 0.85.

As discussed, the computed return flows associated with groundwater within the City of Houston was determined. These groundwater based return flows will generally exist within the Buffalo Bayou subwatershed of the San Jacinto river basin. An additional source of groundwater return flows exists within the San Jacinto river basin upstream of Lake Houston. The source of these groundwater flows are the large number (over 400) of municipal utility districts. This

water availability study includes these existing flows based on wastewater discharge information compiled by the Texas Natural Resources Conservation Commission. Groundwater return flows upstream of Lake Houston are approximately 52,000 acre-feet per year. This level of groundwater return flows are used in both the intermediate and full development condition simulations.

7.2 Other Uses

The industrial return flow factor was determined by relating the City of Houston Surface Water Contract customer demands located along the ship channel to the TNRCC reported return flows.

The irrigation return flow factor was obtained from extensive irrigation studies in the Texas Rice Belt⁽⁷⁾.

This five-year study was a joint effort between the Soil Conservation Service, the Texas Agricultural Experiment Station and the Texas Rice Research Foundation.

7.3 Location

Along with the return flow quantities, return flow locations are specified for each water right in the model. The control point at which the return flows were applied was determined for major water right holders. The return flow location is determined based on review of specific data provided by these major users and area maps. The WRAP3 software assumes that return flows re-enter the system in the same month as the diversion.



8. Summary of Findings

Prior to reviewing the Galveston Bay water availability model results, it is important to note two major distinctions between the Bay & Estuary study and this current analysis:

- The period of record of the B&E study is 49 years (1941 - 1990), while the Galveston Bay water availability study period of record is 35 years (1946 - 1980)
- The Bay & Estuary study analyzed historical freshwater inflows, while this current study determined inflows by superimposing current and future diversions upon naturalized streamflows.

To illustrate the impact of the different period of record, analysis of average annual inflows into Galveston Bay reveals that the periods from 1942-1945 and from 1981 through 1989 were historically very wet periods. When these thirteen years are deleted from the historical record; average annual inflows decrease from 10.1 to 9.04 million acre-feet. This thirteen year period affects the total average annual inflows by approximately ten (10) percent.

The second significant distinction primarily results from the current study being a water rights analysis program versus the B&E study which computed freshwater inflow targets based on historical streamflows. Another difference between both studies relates to inflows into Lake Livingston from the upper Trinity River watershed. This Galveston Bay water availability study assumed full development and diversions within

the upper Trinity River watershed. Full development means that all of the currently permitted surface water rights are assumed to be diverted from the system and used by each water right holder primarily in the Fort Worth and Dallas regions. This water use situation does not currently exist in reality, and will not exist until some relatively distant future time period.

This water availability study assumes imposition of the upper Trinity basin full development case for both the intermediate and full development condition hydrologic simulation models. The resultant intermediate development condition hydrologic model does not represent actual existing inflow conditions, but more of a theoretical analysis of ultimate surface water use upstream of Lake Livingston imposed on actual existing year 1997 surface water use downstream of Lake Livingston and in all other Galveston Bay watershed basins.

For this study, differences due to the period of record were reconciled by truncating the period of record used in the Bay & Estuary study to 35 years (1946 - 1980). This data truncation will allow for more appropriate comparisons between the two studies. However, the inherent differences between the modeling approaches of both studies needs to be considered when comparing the two sets of inflows (B&E vs. water availability) to each other.

As a result of decreasing the B&E study period of record, the average inflow into the bay is 9.04 million acre-feet as op-

posed to 10.1 million acre-feet. Table 8 shows the statistical distribution of flows into the bay for the B&E study reduced period of record. As discussed in Chapter 2, the B&E study concluded that the maximum fisheries productivity of Galveston Bay occurs with monthly inflows that sum up to 5,220,000 acre-feet per year. For this current study, this maximum fisheries productivity target was established to assess monthly inflows for comparison to the naturalized, intermediate, and full development condition simulations.

Table 9 shows the statistical distribution of inflows into the bay for the "naturalized conditions". On average, under natural conditions freshwater inflows into Galveston Bay are about 8.9 million acre-feet.

Table 10 shows the statistical distribution of inflows into the bay for the "intermediate development conditions". On average, the intermediate development condition scenario results show that approximately 7.5 million acre-feet of water is theoretically available.

Table 11 shows the statistical distribution of inflows into the bay for the "full development conditions". On average, under full use of existing water rights permits, inflows into the bay are about 7.1 million acre-feet.

Table 12 presents a comparison of the monthly inflows ranking for each scenario to the desired B&E monthly inflow target.

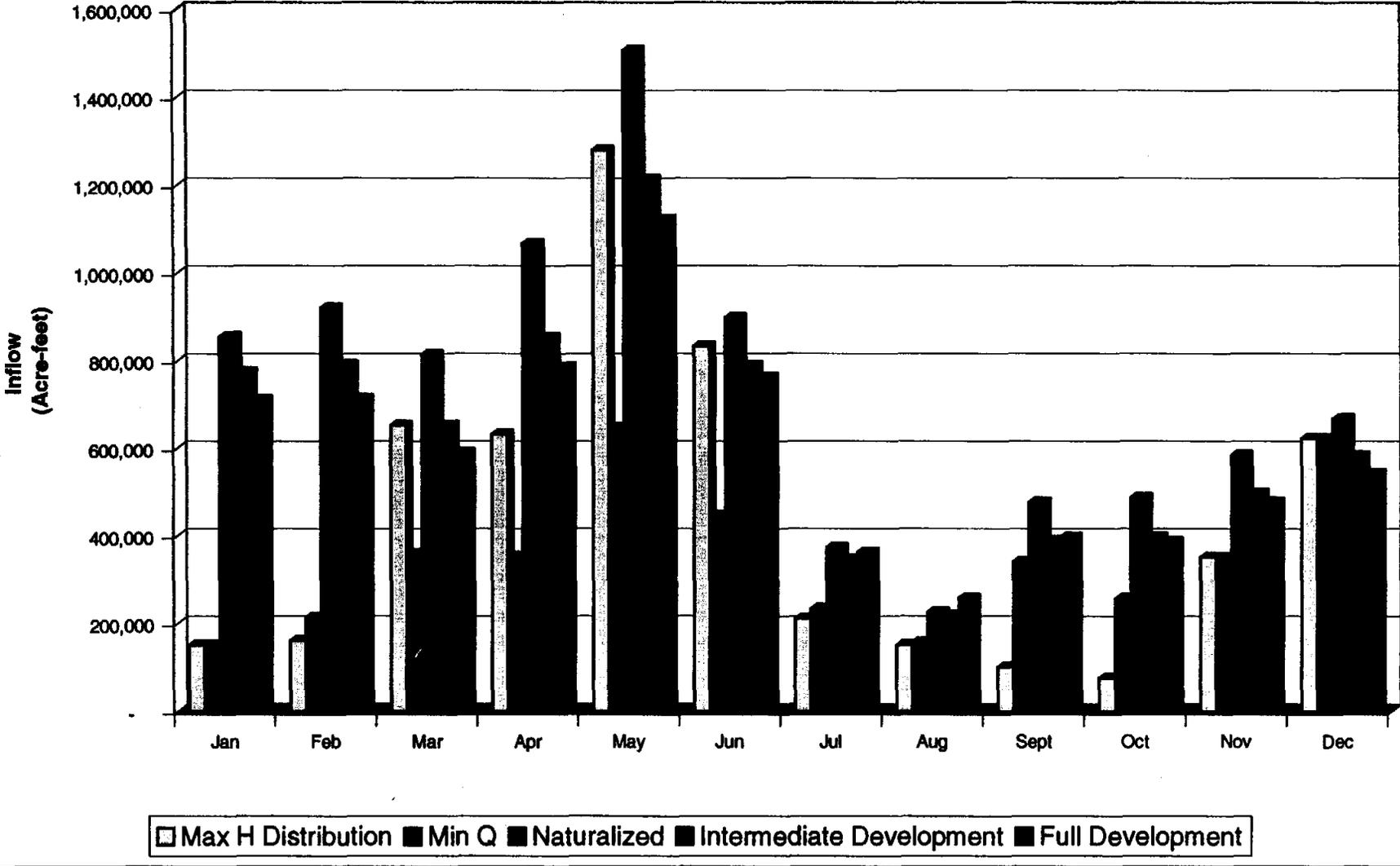
Figure 2 shows the average monthly inflows distribution for the water availability scenarios and the "maximum harvest" monthly inflow. Figure 2 also

contains the B&E study MinQ monthly inflows distribution. MinQ inflows represent the minimally acceptable inflows required to maintain the bay and estuary fisheries harvest. Inflows below the MinQ monthly target for sustained periods could potentially harm the bay fisheries ecosystem.

Determination of Galveston Bay freshwater inflow trends can be seen by comparing the results from the above referenced tables. Key findings include:

- The B&E study (Table 8) and the naturalized condition (Table 9) total annual inflows within each percentile ranking show less than 10 percent difference between the two studies. This situation suggests that historical diversions and reservoir development throughout the Trinity basin has had little effect on annual inflows into Galveston Bay. Therefore, comparisons between the intermediate and full development conditions versus the naturalized condition can be viewed as similar to comparisons between the intermediate and full development conditions versus the B&E study inflows.
- Figure 2 shows that average monthly inflows for the naturalized, intermediate, and full development conditions exceed the maximum harvest target inflow in the months of January, February, April, July, August, September, October and November. This fact suggests that there will be minimal problems meeting or exceeding required inflow targets for these eight months.

Figure 2: Monthly Inflow Distribution



- In three months (May, June, and December), the MaxH target inflow is greater than the average intermediate and full development condition inflow, and in March, the MaxH target is only slightly higher (58,915 acre-feet) than the full development condition inflow. For the months of May, June and December, the total combined shortfall from the full development condition to the MaxH target inflow is approximately 297,800 acre-feet or approximately 12 percent of total inflows for these three months.
- Inflows for the full development condition significantly exceed all MinQ monthly targets except in the month of December (80,400 acre-feet). In December, the MinQ and MaxH inflows are equivalent. Interestingly, the December naturalized condition inflow is only slightly higher (45,600 acre-feet) than the MinQ target inflow.
- Table 12 shows that for six months (January, February, July, August, September, October) the full development condition inflows exist in a range between the 10th percentile and the median which is similar to the MaxH target inflows. In the remaining six months full development condition inflows exist between the median and average inflows ranking. During these six months, the naturalized condition inflows also exist between the median and average inflows ranking.
- Review of the historical minimum (Hist-Min) percentile ranking for the three scenarios indicates that minimum annual inflows would significantly increase over time as a result of increases in diversions. This situation implies that the worst case annual inflow condition should improve over time by as much as 651,600 acre-feet per year.

Table 8: B&E Study Annual Inflows for Reduced Period of Record

Month	Water Theoretically Available (Acre-Feet)							
	Hist-Min	10th %	25th %	Median	Average	75th %	90th %	Hist-Max
January	41,630	115,170	272,045	615,200	883,903	1,475,253	1,853,368	2,858,000
February	70,990	154,348	392,010	982,116	939,375	1,345,180	1,926,922	2,577,000
March	73,530	146,220	290,960	574,200	779,555	1,146,200	1,857,800	2,250,030
April	136,200	189,300	353,650	619,800	976,482	1,557,880	2,201,000	3,132,680
May	139,400	196,850	386,500	1,235,500	1,381,790	1,817,413	3,211,200	4,571,000
June	56,540	159,260	322,031	517,200	1,011,118	1,582,090	2,716,680	4,011,820
July	44,350	106,892	190,316	287,700	458,110	530,860	934,414	2,374,048
August	20,590	61,638	118,378	198,855	299,346	433,290	710,352	878,280
September	15,740	76,012	165,230	300,800	507,748	576,707	1,352,350	2,484,825
October	21,100	44,824	90,654	227,150	499,404	407,759	1,011,730	3,590,900
November	31,300	89,244	158,425	305,000	600,394	547,902	1,098,918	4,565,000
December	55,290	90,918	171,645	612,200	704,386	1,019,400	1,607,972	2,582,000
Total Q	706,660	1,430,676	2,911,844	6,475,721	9,041,612	12,439,932	20,482,706	35,875,583

Table 9: Naturalized Conditions

Month	Water Theoretically Available (Acre-Feet)							
	Hist-Min	10th %	25th %	Median	Average	75th %	90th %	Hist-Max
January	33,358	103,694	268,001	525,016	854,894	1,421,759	1,838,401	2,859,665
February	106,198	165,626	401,575	899,958	920,752	1,263,949	1,881,874	2,459,079
March	47,552	148,719	295,545	583,461	814,636	1,262,599	1,864,710	2,228,501
April	154,595	204,462	454,995	642,070	1,067,286	1,514,503	2,635,333	3,274,374
May	171,559	288,420	497,248	1,087,628	1,507,560	2,412,847	3,256,737	4,835,160
June	79,489	185,994	255,799	480,448	898,343	1,294,658	2,426,712	3,978,661
July	18,956	90,297	130,044	196,060	374,206	527,675	791,283	2,267,940
August	22,891	44,652	78,016	141,399	226,105	378,185	538,835	643,340
September	17,096	69,503	129,666	298,614	478,180	550,328	1,181,435	2,362,366
October	15,582	34,080	89,328	219,872	488,306	455,257	1,064,364	3,024,584
November	17,358	67,099	129,710	297,823	584,148	508,463	1,162,346	4,217,206
December	49,439	65,765	155,288	534,502	667,979	927,062	1,485,357	2,389,294
Total Q	734,073	1,468,312	2,885,212	5,906,851	8,882,394	12,517,282	20,127,387	34,540,170

Table 10: Intermediate Development Conditions

Month	Water Theoretically Available (Acre-Feet)							
	Hist-Min	10th %	25th %	Median	Average	75th %	90th %	Hist-Max
January	47,708	105,955	217,916	504,378	775,485	1,260,396	1,658,089	2,751,772
February	76,274	106,135	286,608	772,752	790,456	1,153,430	1,628,202	2,206,862
March	67,984	128,986	249,246	439,053	653,207	851,585	1,369,791	1,951,635
April	119,262	206,188	313,272	549,212	854,003	1,177,001	1,949,122	2,672,934
May	90,478	148,013	270,275	1,040,550	1,214,792	1,884,553	2,879,303	3,760,395
June	77,722	93,299	185,188	357,107	789,729	1,230,355	2,169,372	3,628,845
July	64,915	89,213	108,240	172,709	346,478	506,300	724,760	2,120,820
August	64,930	71,872	89,897	125,997	219,085	355,428	461,382	845,227
September	55,012	83,633	111,064	226,889	389,052	423,985	1,035,879	2,043,430
October	52,366	57,747	75,340	186,665	398,347	416,378	759,097	2,678,973
November	49,500	60,402	103,815	237,151	498,177	463,846	1,151,606	3,668,744
December	47,368	89,296	144,443	337,483	583,952	780,380	1,426,240	2,058,823
Total Q	813,517	1,240,740	2,155,304	4,949,945	7,512,764	10,503,635	17,212,843	30,388,460

Table 11: Full Development Conditions

Month	Water Theoretically Available (Acre-Feet)							
	Hist-Min	10th %	25th %	Median	Average	75th %	90th %	Hist-Max
January	92,922	116,260	170,926	459,318	711,995	1,209,398	1,630,678	2,726,326
February	94,953	121,039	268,497	552,599	713,753	1,020,140	1,582,836	2,182,662
March	103,073	120,962	201,910	416,151	591,085	848,500	1,275,206	1,866,497
April	137,082	160,634	257,955	485,991	786,323	1,127,789	1,910,660	2,636,822
May	128,723	149,822	216,087	994,010	1,121,687	1,770,307	2,673,458	3,709,206
June	144,361	157,811	184,035	326,385	762,473	1,108,249	2,109,110	3,520,184
July	134,403	148,145	173,986	213,797	362,621	460,431	679,226	2,066,364
August	132,235	137,970	149,168	175,338	258,265	317,315	470,027	800,584
September	114,073	130,879	156,290	245,233	397,583	425,692	888,863	1,999,581
October	108,832	112,715	125,432	153,831	386,480	308,176	648,426	2,630,031
November	100,153	105,371	125,524	208,061	477,654	392,370	1,073,146	3,437,842
December	94,920	107,582	161,865	264,869	543,040	654,577	1,392,403	1,969,655
Total Q	1,385,729	1,569,191	2,191,677	4,495,583	7,112,961	9,642,942	16,334,039	29,545,754

Findings associated with geographic distribution of inflows are shown in Table 13 and include the following:

- With time the Trinity River basin contribution significantly decreases in approximately the same proportion as inflow increases in the San Jacinto and the San-Jacinto-Brazos river basins. This situation occurs as a result of future increases in interbasin transfers from the Trinity river to the San Jacinto and San Jacinto-Brazos basins.
- Inflow contributions from the two river basins will decrease in relationship to the coastal basins. Combined inflows from the Trinity and San Jacinto river basins will decrease from approximately 84% to 76%. This situation implies that lower inflow quantities are projected to occur within the upper portions of Galveston and Trinity bays.
- The percentage of inflow contributions from the coastal basins is projected to increase over time from approximately 16% to 24%.

Table 12: Monthly Inflows Distribution Ranking

	<i>B&E MaxH Distribution</i>	<i>B&E Max Harvest Ranking</i>	<i>Naturalized Flow Condition</i>	<i>Intermediate Development Condition</i>	<i>Full Development Condition</i>
<i>January</i>	150,600	10%	18%	17%	14%
<i>February</i>	160,600	10%	9%	17%	18%
<i>March</i>	652,500	50%	56%	57%	58%
<i>April</i>	632,400	50%	50%	52%	58%
<i>May</i>	1,279,900	50%	52%	63%	67%
<i>June</i>	833,200	50%	70%	72%	72%
<i>July</i>	210,800	25%	51%	56%	49%
<i>August</i>	150,600	30%	51%	59%	26%
<i>September</i>	100,400	10%	16%	21%	**
<i>October</i>	75,300	15%	22%	25%	**
<i>November</i>	351,300	50%	55%	67%	70%
<i>December</i>	622,400	50%	55%	66%	70%

** Below 10th Percentile

Table 13: Inflows Distribution by Basin

<i>Basin</i>	<i>Inflows Distribution (acre-feet)</i>		
	<i>Naturalized Condition</i>	<i>Intermediate Development Condition</i>	<i>Full Development Condition</i>
<i>Trinity</i>	5,684,700 (64%)	3,906,600 (52%)	3,058,600 (43%)
<i>San Jacinto</i>	1,776,500 (20%)	2,103,600 (28%)	2,347,300 (33%)
<i>San Jacinto-Brazos</i>	799,400 (9%)	901,500 (12%)	924,700 (13%)
<i>Trinity-San Jacinto</i>	88,800 (1%)	150,300 (2%)	213,400 (3%)
<i>Neches-Trinity</i>	532,900 (6%)	525,900 (7%)	569,000 (8%)



9. Conclusions and Recommendations

Conclusions

The key findings of the Galveston Bay Freshwater Inflows study consist of the following:

- Increases in water rights diversions will continue to decrease the availability of freshwater inflows that enter Galveston Bay. Future projected diversions may decrease inflows by as much as 30 percent lower than inflows that would have historically occurred during naturalized flow conditions.
- Based on the model construction, it is difficult to determine whether diversions upstream of Lake Livingston or downstream of the lake and in any of the local watersheds has the greatest impact on freshwater inflows. Future studies should investigate this issue.
- River basin geographic distribution of inflows are projected to occur with lower flows than historically occurring in upper Trinity Bay and greater than historical flows occurring in upper Galveston, East and West bays.
- With maximum use of existing permitted water rights, there does not appear to be a problem in meeting Galveston Bay monthly inflow targets in eight months (January, February, April, July, August, September, October, November) of the year.
- In the months of May, June and December, there may be a potential for insufficient freshwater inflows into

Galveston Bay. The total projected shortfall for these months (297,800 acre-feet) represent approximately 12% of total inflows for these months.

- While the models discussed in this study illustrate projected inflows, this study did not analyze the relationship of inflows to fisheries harvest. The simulation scenarios in this study illustrate that total inflow quantity, monthly distribution, and geographic distribution will change. There was no analysis conducted to determine which of these parameters may have the greatest impact on fisheries productivity.
- Projected worst case inflow conditions should significantly improve. This improvement suggests that future low flow conditions may not be as harsh as has historically occurred. As development within the Galveston Bay watershed continues, return flows should increase, therefore increasing total projected monthly inflow.

Recommendations

Based on this study, a number of recommendations for further analysis can be made.

- Additional hydrologic analysis should be conducted to extend the period of record from 35 to approximately 55 years. A longer period of analysis will provide a more accurate assessment of inflows for the months of March, May, June and December.
- The TWDB should run the hydrodynamic model (TxBlend) for the three

water availability scenarios and then TPWD/TWDB should evaluate the resulting monthly salinity gradients output for geographic/spatial effects on the ecosystem, especially fixed communities like oyster reefs and wetlands.

- The State B&E program should evaluate the effects of reduced inflows (eg. less than MinQ) on biological production, such as the period when inflows

are reduced over several years in a row (eg. as in a drought of 3-4 years). Special emphasis could be placed on examining monthly effects from reduced inflows in spring (May-June).

- An explicit determination of fisheries harvest should be generated for the monthly inflows shown in this study to assess the temporal and spatial relationship of inflows quantity to fisheries harvest.



10. References

- (1) Texas Water Development Board: *Volumetric Survey of Lake Houston*, Austin May 1994.
- (2) Texas Water Development Board: *Volumetric Survey of Lake Conroe*, Austin July 1996.
- (3) United States Department of Interior Bureau of Reclamation: *Lake Livingston Project Area and Capacity Tables*, Denver, December 1991.
- (4) U.S. Army Corps of Engineers, Galveston District: *Wallisville Lake Feature Design Memorandum, Appendix A, Hydrology and Hydraulics*, 1996.
- (5) Black and Veatch: *Review of Alternative Surface Water Supplies for the City of Houston, Texas*, Dallas, March 1978.
- (6) Texas Water Development Board: *Texas Water Oriented Data Bank Net-Evaporation Quadrangles*.
- (7) Bettge, R.F. and McGauley, G.N.: *Trends in Irrigation Water Use – Texas Rice Belt: Proceedings of ASCE Conference, San Antonio, 1985*.
- (8) Freese and Nichols, Inc: *System Operation of Surface Water Supply in the Houston Area*, prepared for the Trans-Texas Water program, November 1997.
- (9) Longley, W.L., ed.: *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determining Needs*, Texas Water Development Board and Texas Parks and Wildlife Department, Austin, 1994.



Appendix A

Reservoir Data

Lake Houston
Area, Capacity and Elevation Relationships as of the Year 2000

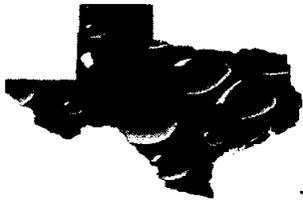
<i>Elevation (Feet)</i>	<i>Area (Acres)</i>	<i>Capacity (Acre-Feet)</i>
9	0	0
10	15	5
11	50	35
12	91	104
13	138	218
14	193	382
15	258	606
16	329	899
17	409	1,266
18	502	1,721
19	615	2,278
20	752	2,960
21	942	3,805
22	1,159	4,853
23	1,376	6,118
24	1,661	7,634
25	2,015	9,469
26	2,411	11,678
27	2,831	14,296
28	3,279	17,348
29	3,745	20,857
30	4,158	24,806
31	4,585	29,176
32	5,002	33,967
33	5,442	39,187
34	5,893	44,853
35	6,383	50,989
36	6,859	57,608
37	7,302	64,687
38	7,698	72,186
39	8,085	80,076
40	8,494	88,364
41	8,914	97,067
42	9,381	106,213
43	9,900	115,852
44	10,386	125,993
44.5	11,817	131,540

Lake Conroe
Area, Capacity and Elevation Relationships as of the Year 2000

<i>Elevation (Feet)</i>	<i>Area (Acres)</i>	<i>Capacity (Acre-Feet)</i>
145	0	0
147	33	16
149	177	202
151	415	785
153	732	1,921
155	1,037	3,698
157	1,486	6,200
159	1,960	9,616
160	2,212	11,701
161	2,427	14,020
162	2,661	16,564
163	2,963	19,375
164	3,282	22,497
165	3,572	25,923
166	3,907	29,662
167	4,229	33,729
168	4,508	38,097
169	4,826	42,764
170	5,226	47,789
171	5,566	53,184
172	5,904	58,919
173	6,226	64,983
174	6,582	71,387
175	7,007	78,181
176	7,608	85,487
177	8,081	93,330
178	8,523	101,632
179	8,999	110,392
180	9,397	119,590
181	9,818	129,197
182	10,226	139,219
183	10,580	149,622
184	10,936	160,380
185	11,333	171,514
186	11,752	183,056
187	12,182	195,023
188	12,638	207,433
189	13,038	220,271
190	13,445	233,512
191	13,882	247,175
192	14,389	261,310
193	14,912	275,961
194	15,457	291,145
195	16,030	306,888
196	16,611	323,208
197	17,177	340,101
198	17,857	357,618
199	18,317	375,705
200	19,043	394,384
201	20,074	413,941

Lake Livingston
Area, Capacity and Elevation Relationships

<i>Elevation (Feet)</i>	<i>Area (Acres)</i>	<i>Capacity (Acre-Feet)</i>
63	0	0
65	149	131
67	306	583
69	463	1,352
71	579	2,415
73	653	3,647
75	727	5,027
77	800	6,555
79	874	8,230
81	1,281	10,213
83	2,020	13,507
85	2,759	18,281
87	3,498	24,536
89	4,237	32,269
91	5,920	41,940
93	8,547	56,387
95	11,173	76,092
97	13,800	101,055
99	16,426	131,272
101	20,003	167,211
102	22,266	188,336
103	24,529	211,725
104	26,793	237,377
105	29,056	265,295
106	31,319	295,475
107	33,582	327,919
108	35,845	362,627
109	38,109	399,598
110	40,372	438,834
111	42,294	480,163
112	44,216	523,415
113	46,138	568,589
114	48,061	615,685
115	49,983	664,704
116	51,905	715,646
117	53,827	768,509
118	55,749	823,294
119	57,671	880,002
120	59,594	938,632
121	61,648	999,250
122	63,701	1,061,922
123	65,755	1,126,648
124	67,809	1,193,427
125	69,863	1,262,261
126	71,917	1,333,149
127	73,971	1,406,091
128	76,025	1,481,086
129	78,079	1,558,136
130	80,133	1,637,240
131	82,950	1,718,778



Appendix B

Water Rights Data

TNRCC Water Rights: Neches - Trinity Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
7	004495	121	760614	STAR ENTERPRISE			TAYLOR ETC	Jefferson	2	Port Arthur Refinery	
7	004441	336	981231	RICE-CARDEN CORP			Port Arthur Basin	Jefferson	2		
7	004305	1200	690414	WILLIAM S EDWARDS		2139	ELM BAYOU	Chambers	2		Fish Farming
7	004304	5320	680715	CHARLES T JONES ETAL			E BAY BAYOU	Chambers	2		Fish Farming
7	004494	107787	710322	CHEVRON U.S.A. INC			DD #7 CANAL	Jefferson	2		
7	004291	43	431029	JOHN G MIDDLETON, ETAL			E FRK DOUBLE	Chambers	3		
7	004480	55	651105	CITY OF BEAUMONT		16	HILLEBRANDT	Jefferson	3		
7	004463	63	140606	B E QUINN III, ETAL			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4456
7	004303	68	700921	DON W. LAGOW & WIFE			ONION BAYOU	Chambers	3		DIV RATE WITH ADJ 4301
7	004467	77	001231	LOLA GILL OWEN			S FRK TAYLOR	Jefferson	3		
7	004467	77	001231	GEORGE SOCKRIDER			S FRK TAYLOR	Jefferson	3		
7	004491	77	500331	MARVIN DUDLEY			HILLEBRANDT	Jefferson	3		
7	004288	204	450331	GENE A NELSON ET AL			E FRK DOUBLE	Chambers	3		
7	004466	205	140621	R L HECKAMAN			N FRK MAYHAW	Jefferson	3		
7	004462	217	140606	BAR C RANCH COMPANY			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4455
7	004452	242	471231	Riceland Properties Inc			S FRK MAYHAW	Jefferson	3		
7	004292	250	680715	DONALD G NELSON ET AL			BATISTE	Chambers	3		
7	004458	276	140606	BAR C RANCH COMPANY			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4455
7	004445	335	140625	Edwin A Bluestein Jr & Wife			S FRK TAYLOR	Jefferson	3		
7	004473	336	540630	JIM R & H E WINGATE			S FRK TAYLOR	Jefferson	3		
7	004446	350	140625	Ralph M Sharpe Jr Trustee			S FRK TAYLOR	Jefferson	3		RATE ON ADJ 4445
7	004448	350	140918	Herbert Clubb and Sons Inc			MAYHAW BAYOU	Jefferson	3		
7	004456	350	140606	Dorothy Nell Wilber et al			N FRK MAYHAW	Jefferson	3		
7	004289	382	450331	OCTAVIA F STANLEY	Lake Anahuac		E FRK DOUBLE	Chambers	3		LAKE ANAHUAC
7	004290	382	450331	THOMAS L FAHRING, JR			E FRK DOUBLE	Chambers	3		DIV RATE WITH ADJ 4288
7	004447	396	001231	James L Broussard et al			S FRK TAYLOR	Jefferson	3		Jointly Owns 396 AF to IRR 113 AC
7	004461	397	140606	Robert L. Shellhammer & Wife			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4455
7	004472	400	180323	JIM R. WINGATE			S FRK TAYLOR	Jefferson	3		
7	004265	403	821108	W J WINZER JR			SPINDLETOP B	Chambers	3		Rate see A 4264, Amend 11/23/87
7	004310	413	381231	W. J. WINZER, JR			SPINDLETOP	Chambers	3		
7	004486	438	001231	CARL D. LEVY, TRUSTEE			BAYOU DIN	Jefferson	3		
7	004312	470	541231	JESS MATTHEWS JR ET AL			SPINDLETOP	Chambers	3		ALSO CO 123, AMEND 11/23/87
7	004312	470		EDITH SMITH HEBERT			SPINDLETOP	Chambers	3		Jointly owns 501 AF TO IRR 1754 AC
7	004229	480	530331	Patrick & Michael Phelan		1040	Unnamed Trib Spindletop	Jefferson	3		
7	004478	500	140610	SHIRLA HOWARD ETAL		2000	FISH BOX	Jefferson	3		Also use 7-rate on ADJ 4479
7	004479	500	140610	Chemical Waste Management		200	FISH BOX	Jefferson	3		
7	004439	504	520430	O D & ROBERT CLUBB			N FRK TAYLOR	Jefferson	3		
7	004459	511	140606	B E WILBER			MAYHAW BAYOU	Jefferson	3		
7	004471	525	140623	HERBERT CLUBB			MAYHAW BAYOU	Jefferson	3		
7	004454	539	140606	RUSSELL & IVO PHEND JR			N FRK MAYHAW	Jefferson	3		
7	004464	560	140606	Dorothy Nell Wilber et al			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4456
7	004060	595	800616	ETHEL STEPHENSON			MAYHAW BAYOU	Jefferson	3		315.54 ACRES
7	004465	600	570202	Water J Crawford et al		600	S FRK MAYHAW	Jefferson	3		OCT TO MAR
7	004457	607	840606	G A N MCFADDIN ETAL			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4455
7	004469	620	670731	C C WILBER			MAYHAW BAYOU	Jefferson	3		RATE ON ADJ 4459
7	004294	674	570329	BROWN FOUNDATION, INC		2669	DRAINAGE DITCH	Chambers	3		
7	004297	675	750714	CHAMBERS, COUNTY OF		675	OYSTER BAYOU	Chambers	3		
7	004443	700	140618	JIM R WINGATE			N FRK TAYLOR	Jefferson	3		
7	004444	700	180330	PANSY E WINGATE			N FRK TAYLOR	Jefferson	3		JOINTLY OWNS 700 AF
7	004488	788	140601	J E BROUSSARD II ETAL			HILLEBRANDT	Jefferson	3		
7	004466	826	140621	LOLA GILL OWEN			N FRK MAYHAW	Jefferson	3		RATE ON ADJ 4456
7	004455	844	140606	BAR C RANCH COMPANY			N FRK MAYHAW	Jefferson	3		
7	004300	875	140606	J. C. JACKSON ESTATE		252	OYSTER BAYOU	Chambers	3		
7	004292	880	821220	Eloise Barrow Merdith			Unnamed Trib Robinson Lake	Chambers	3		TRIB ROBINSON LAKE
7	004293	880	821220	LOUISE BARROW GORTON			Unnamed Trib Robinson Lake	Chambers	3		TRIB ROBINSON LAKE
7	004298	891	450531	BROWN BROTHERS FARM		120	OYSTER BAYOU	Chambers	3		
7	004492	900	790924	BERNIE BROWN ET AL			RHODAIR GULLY	Jefferson	3		
7	004451	969	191231	JUNKER SPENCER ESTATE			S FRK TAYLOR	Jefferson	3		
7	004490	1050	180406	LOUIS M HEBERT JR		380	HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004308	1109	290331	L C DEVILLIER			RUSH DITCH	Chambers	3		
7	004264	1123	821108	W J WINZER JR ET AL			SPINDLETOP B	Chambers	3		AMEND 11/23/87
7	004485	1138	140622	MARGARET TODD ESTATE			BAYOU DIN	Jefferson	3		RATE ON ADJ 4484
7	004228	1191	471029	NOLIA F BOUDREAUX ETAL		1572	SAND GULLY	Jefferson	3		

TNRCC Water Rights: Neches - Trinity Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
7	004290	1220	821220	DON WESLEY LAGOW ET AL		187	Unnamed Trib Robinson Lake	Chambers	3		AMEND 1/30/84
7	004291	1220	821220	Solmon Wesley Barrow et al		800	Unnamed Trib Robinson Lake	Chambers	3		TRIB ROBINSON LAKE
7	005016	1250	850912	JOHN M BLACKWELL		411	SPINDLETOP BR	Chambers	3		& CO 123, AMND 11/23/87
7	005069	1250	860624	RUTH L MACKAN ET AL			PIGNOT GULLEY	Jefferson	3		
7	004312	1284	830531	JESS MATTHEWS JR ET AL			SPINDLETOP	Chambers	3		* Shares 501 AF to IRR 1754 AC
7	004295	1400	490318	JEWEL FITZGERALD		773	CANE	Chambers	3		2 LAKES
7	004466	1444	140621	EARLENE BENSON ET AL			N FRK MAYHAW	Jefferson	3		
7	004474	1500	180923	JOEL E. LEVINGSTON, ET UX			TAYLOR	Jefferson	3		
7	004468	1551	140606	C C WILBER, ET AL			MAYHAW BAYOU	Jefferson	3		RATE ON ADJ 4459
7	004293	1780	411105	Edmonds Brothers Farms		530	W FRK DOUBLE	Chambers	3		
7	004450	1800	140918	James L Broussard & Wife			MAYHAW BAYOU	Jefferson	3		
7	004299	1834	140626	OCIE R JACKSON			OYSTER BAYOU	Chambers	3		Jointly owns 1834 AF to IRR 696 AC
7	004449	1862	161231	Herbert Clubb and Sons Inc			MAYHAW BAYOU	Jefferson	3		
7	004301	2000	700921	BARROW RANCHES		604	ONION BAYOU	Chambers	3		
7	004306	2100	401115	Dorothy C. McBride, et al		353	ELM BAYOU	Chambers	3		ALSO CO 123
7	004309	2118	041231	Spindletop Bayou Farms		480	SPINDLETOP	Chambers	3		SEASONAL
7	004304	2240	430505	CHARLES T JONES ETAL		485	E BAY BAYOU	Chambers	3		
7	004314	2402	661010	Max L. Fortenberry et al			SAND	Jefferson	3		
7	004487	2483	140629	John Gardner Nelson et al			HILLEBRANDT	Jefferson	3		
7	004453	2550	140606	Riceland Properties Inc			N FRK MAYHAW	Jefferson	3		
7	004311	2700	211217	JOHN MIDDLETON		649	SPINDLETOP	Chambers	3		2 Lakes-Also CO 123, Amend 11/23/87
7	004481	2800	140701	J E BROUSSARD II ETAL			HILLEBRANDT	Jefferson	3		
7	004271	3000	821129	Joe Broussard II Partn et al	Beaumont Rice Mills		MAYHAW BAYOU	Jefferson	3		
7	004460	3150	140606	C C WILBER ETAL			N FRK MAYHAW	Jefferson	3		AMEND 1/17/86, 11/27/90
7	004100	3358	810120	CITY OF BEAUMONT			Willow Marsh Br	Jefferson	3		RATE ON ADJ 4455
7	004484	3500	140622	STEINHAGEN BROTHERS			BAYOU DIN	Jefferson	3		AMEND 7/8/82 ADD DIV PTS-
7	004489	3500	691020	Texas Rice Land Company			JOHNS GULLEY	Jefferson	3		
7	004470	3805	140603	J H TAYLOR		320	MAYHAW BAYOU	Jefferson	3		
7	004287	4900	460312	W E JENKINS, JR ETAL		589	E FRK DOUBLE	Chambers	3		2 LAKES
7	004482	5000	140603	Jefferson Land Company		100	HILLEBRANDT	Jefferson	3		
7	004302	5932	700921	United States Dept of Interior	Anahuac NWR - Barrow Unit	348	ONION BAYOU	Chambers	3	Anahuac NWR	DIV RATE WITH ADJ 4301
7	004313	6365	390701	Bruce Wilber Pipkin Estate		1037	SPINDLETOP	Jefferson	3		2 LAKES
7	004440	7500	291231	JOHN F GAULDING ETAL			N FRK TAYLOR	Jefferson	3		
7	004476	9477	140624	LOVELL LAKE COMPANY			TAYLOR	Jefferson	3		
7	004475	12000	140627	M Half Circle Ranch Company			TAYLOR	Jefferson	3		
7	004477	14416	001231	JOE BROUSSARD II ETAL			TAYLOR	Jefferson	3		
7	004296		431231	US Anahuac Wildlife Refuge	Anahuac Natl Wildlife Refuge		OYSTER BAYOU	Chambers	3	Anahuac NWR	3 Res. 21000 AF for uses 8 & 3.
7	004444		180330	Richard N Eubanks Estate			N FRK TAYLOR	Jefferson	3		JOINTLY OWNS 700 AF
7	004444		180330	W G BURRELL ESTATE			N FRK TAYLOR	Jefferson	3		JOINTLY OWNS 700 AF
7	004447		001231	RAY M BROUSSARD			S FRK TAYLOR	Jefferson	3		Jointly owns 396 AF to IRR 113 AC
7	004447		001231	INEZ B DURDIN			S FRK TAYLOR	Jefferson	3		Jointly owns 396 AF to IRR 113 AC
7	004447		001231	BERNICE B SCHOLZ			S FRK TAYLOR	Jefferson	3		Jointly owns 396 AF to IRR 113 AC
7	004447		001231	VIVIAN B FORE SMITH			S FRK TAYLOR	Jefferson	3		Jointly owns 396 AF to IRR 113 AC
7	004447		001231	Gail McBride & Jo Refla Meaux			S FRK TAYLOR	Jefferson	3		Jointly owns 396 AF to IRR 113 AC
7	004490		180406	QUIDA ABERCROMBIE			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	Marlin R Hebert Jr et al			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	MARIE BORDAGES ET AL			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	J L GAFFORD			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	HILLARY B HEBERT			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	THOMAS W QUAIDY			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	HILLARY QUAIDY			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	ROSE CATHERINE RUSSELL			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	L C RUSSELL			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	MARY LOU MADAFFRI			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	L M HEBERT III ET UX			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	LOUISE KIRKPATRICK			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	HARRY M HEBERT ET AL			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	Issac E & Ruby Hillebrandt			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004490		180406	IONE HEBERT MATTHEWS			HILLEBRANDT	Jefferson	3		Jointly owns 1050 AF
7	004442	77	530408	Clark Port Arthur Pipeline Co			N FRK TAYLOR	Jefferson	4		
7	004390	30000	830822	United States Dept of Energy	Big Hill Spr Site		Intracoastal Waterway	Jefferson	4		AMND 7/12/90 87291 AF ABANDONED 3/20/96
7	005059	30	860519	JERE RUFF		3	Unnamed Trib Elm Bayou	Chambers	7		(DUCK HUNTING)
7	004422		840103	United States Dept of Interior		3450	Wild Cow Bayou	Jefferson	7		

TNRCC Water Rights: Neches - Trinity Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
7	005467	14	930816	RANDY G PRICE, ET UX		14	UNNAMED TRIB	Chambers	8		OFF-CHAN RES #2
7	005467	36	930816	RANDY G PRICE, ET UX		36	UNNAMED TRIB	Chambers	8		OFF-CHAN RES #3
7	005467	150	930816	RANDY G PRICE, ET UX	Trib of Oyster Bayou	14	UNNAMED TRIB	Chambers	8		Trib of Oyster Bayou; Off-Channel Res #1
7	004493	7000	590130	Texas Parks & Wildlife Dept	JD Murphee WMA	32000	BIG HILL	Jefferson	8		Waterfowl Management
7	004296	21000	431231	US Anahuac Wildlife Refuge	Anahuac Natl Wildlife Refuge	1025	OYSTER BAYOU	Chambers	8	Anahuac NWR	3 Res. 21000 AF for uses 8 & 3.
7	004307		750113	Trinity Bay Conservation Dist			ELM BAYOU	Chambers	8		Salt Water Intrusion Barrier
7	005317		901011	Jefferson Co Navigation Dist		4505	TAYLOR BAYOU	Jefferson	8		

TNRCC Water Rights: Trinity Basin

Basin	WR Number	Amount In Ac-Ft/Yr	Priority	Name	Facility	Res Cap In Ac-Ft	Stream	County	Use	Location	Remarks
B	004279	2147	711111	Chambers-Liberty Cox ND			TRINITY RIVER	Chambers	1		
B	005097	3500	650303	HOUSTON CO WCID 1		19500	LTL ELKHART	Houston	1		
B	004248	10000	590923	TRINITY RIVER AUTHORITY	WALLISVILLE		TRINITY RIVER	Polk	1		WALLISVILLE
B	004261	10000	590923	CITY OF HOUSTON	WALLISVILLE	51600	TRINITY RIVER	Polk	1		WALLISVILLE
B	004248	40000	590923	TRINITY RIVER AUTHORITY	LAKE LIVINGSTON		TRINITY RIVER	Polk	1		LAKE LIVINGSTON
B	004261	444000	590923	CITY OF HOUSTON	LIVINGSTON	1750000	TRINITY RIVER	Polk	1		LIVINGSTON
B	004261		590923	CITY OF HOUSTON	LYNCHBURG	4700	TRINITY RIVER	Polk	1		LYNCHBURG
B	005318	130	901010	Northwestern Resources Co.		418	UNNAMED TRIB	Leon	2		AND 81. 15 LAKES
B	004250	1200	310428	Texas Parks and Wildlife Dept	Huntsville Fish Hatchery	51	HARMON	Walker	2		
B	004248	11600	590923	TRINITY RIVER AUTHORITY	WALLISVILLE		TRINITY RIVER	Polk	2		WALLISVILLE
B	004261	28000	590923	CITY OF HOUSTON	WALLISVILLE		TRINITY RIVER	Polk	2		WALLISVILLE
B	004279	30000	711111	Chambers-Liberty Cox ND			TRINITY RIVER	Chambers	2		
B	004261	31600	131230	CITY OF HOUSTON	SOUTHERN CANAL		TRINITY RIVER	Polk	2		SOUTHERN CANAL
B	004248	207150	590923	TRINITY RIVER AUTHORITY	LIVINGSTON		TRINITY RIVER	Polk	2		LIVINGSTON
B	004261	458800	590923	CITY OF HOUSTON	LIVINGSTON		TRINITY RIVER	Polk	2		LIVINGSTON
B	004285		491231	Charles & Paul Haidusek		265	WHITES	Liberty	2		FISH FARMING
B	004258	3	610630	C J RICHARDSON & WIFE			Unnamed Trib White Rock Crk	Trinity	3		
B	005090	5	590630	E S DARSEY & WIFE		4	UNNAMED TRIB LITTLE	Houston	3		TRIB LITTLE-ELKHART-2 LAKES
B	004238	6	680630	RAY SIMPSON & WIFE		3	UNNAMED TRIB SPRING	Leon	3		
B	005093	9	561231	Charles Wendell Warner ET AL			UNNAMED TRIB CANEY	Houston	3		
B	005094	20	640731	WADE L PENNINGTON		36	UNNAMED TRIB CANEY	Houston	3		2 LAKES
B	005098	20	640830	WADE L PENNINGTON			UNNAMED TRIB LTL ELKHART	Houston	3		
B	004253	20	730430	ROBERT D JAMESON			L CAROLINA	Walker	3		
B	005095	40	581231	JUDY ELAINE GOAR		80	UNNAMED TRIB CANEY	Houston	3		
B	005087	43	570731	BEN H CAUDLE ETAL			UNNAMED TRIB BIG ELKHART	Houston	3		
B	005083	50	670731	MRS A P VAN WINKLE ETAL		15	UNNAMED TRIB BUFFALO	Leon	3		
B	005096	50.9	831231	CD Cheatham Jr & Ette Chealam		98	UNNAMED TRIB CANEY	Houston	3		JOINTLY OWNS 50.9 AF TO IRR 54.6 AC
B	004233	65	550711	PEGGY W CANNON ET AL		95	UNNAMED TRIB HURRICANE	Houston	3		2 LAKES - SEASONAL
B	004230	67	480731	ELSIE ANNE EAKIN		36	UNNAMED TRIB HAMMOND	Houston	3		
B	005086	70	551231	WILLIE BEDFORD CASKEY		25	CHAFFIN	Houston	3		
B	005088	80	570731	HENRY C BROWN ESTATE			BIG ELKHART CRK	Houston	3		JOINTLY OWNS 80 AF TO IRR 80 ACRES
B	004232	81	750120	SPRING CREEK Country Club		480	SPRING CRK	Houston	3		
B	005091	83	640731	ARMINE SKIDMORE ESTATE		50	UNNAMED TRIB LTL ELKHART	Houston	3		2 LAKES
B	005092	84	500731	JAMES KENT DAILEY ESTATE		20	UNNAMED TRIB CANEY	Houston	3		
B	004254	88	600531	ERNEST MARIETTA & WIFE		40	UNNAMED TRIB WHITE ROCK CRK	Houston	3		
B	005089	88	580731	ERNEST E HUFF		90	UNNAMED TRIBS BIG ELKHART	Houston	3		3 LAKES
B	004231	100	611030	BISON DEVELOPMENT CO.			HAMMOND	Houston	3		
B	004284	104	490430	STEPHEN & LOUIS MECHE			WHITES	Liberty	3		
B	004256	150	741015	WESTWOOD SHORES, INC.		387	Unnamed Trib White Rock Crk	Trinity	3		3 REC
B	005075	170	520630	JOHN A MCCALL, ET AL	4 Res on Qualey Crk	99	TRINITY RIVER	Houston	3		4 RESERVOIRS ON QUALEY CREEK
B	004234	170	520731	O. O. BROWN, TRUSTEE ETAL		100	UNNAMED TRIB TRINITY RIVER	Houston	3		
B	004282	172	670331	Donald R Maxwell et al			Unnamed Trib Cow Island	Liberty	3		
B	005085	175	571231	C W KENNEDY III ETAL		216	UPPER KEECHI CRK	Leon	3		
B	004249	179	840406	Texas Dept of Criminal Justice	ELLIS STATE FARM	280	TURKEY	Walker	3		
B	004281	232	470430	RAY STOESSER, ET AL			COW ISLAND	Liberty	3		
B	004235	353	591231	GRADY B. LAKE, JR.			TRINITY RIVER	Houston	3		
B	004280	395	600428	GEORGE W MAXWELL		844	COW ISLAND	Liberty	3		IF NO WATER FROM TRA
B	004285	440	580109	Charles & Paul Haidusek		440	WHITES	Liberty	3		DIV RATE ON ADJ 4284
B	005076	500	540731	Texas-Ohio Gas, Inc, A Tx Corp			TRINITY RIVER	Houston	3		
B	005081	500	860521	JOHN W KLEIN			BIG ELKHART CRK	Houston	3		EXP 12/31/2006, AMEND 10/23/92

TNRCC Water Rights: Trinity Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
8	004283	640	750218	A. REESE BROWN		640	N Frk Long Island	Liberty	3		2 LAKES
8	004240	701	570416	Texas Dept of Criminal Justice	Ferguson State Farm	830	UNNAMED TRIB TRINITY RIVER	Madison	3		SEASONAL
8	004288	710	870531	JETT HANKAMER & SONS		92	WHITES	Chambers	3		
8	004241	961	551017	Texas Dept of Criminal Justice	Ferguson State Farm	740	UNNAMED TRIB TRINITY RIVER	Houston	3		
8	005061	1000	860521	JOHN W KLEIN			BIG ELKHART CRK	Houston	3		EXP 12/31/2006, AMEND 10/23/92
8	004239	1240	490203	SEVEN J STOCK FARM, INC.			TRINITY RIVER	Houston	3		
8	004289	1932	691211	Trinity Plantation, Inc et al		405	MENARD	Liberty	3		
8	005271	2500		Devers Canal Rice Pro Assn Inc	2 Off-Channel Reservoirs	1195	TRINITY RIVER	Liberty	3		AMEND 5/22/95, MULTI-COUNTY & PRIORITY
8	004261	13400	131230	CITY OF HOUSTON	SOUTHERN CANAL		TRINITY RIVER	Polk	3		SOUTHERN CANAL
8	004248	30000	590923	TRINITY RIVER AUTHORITY	WALLISVILLE		TRINITY RIVER	Polk	3		WALLISVILLE-TO SERVICE AREA
8	004277	38000	130702	DAYTON CANAL CO		65	TRINITY RIVER	Liberty	3		
8	005271	56000	360924	San Jacinto River Authority			TRINITY RIVER	Liberty	3		AMEND 5/22/95, MULTIPLE USES, COUNTY, PRIOR
8	004248	104450	590923	TRINITY RIVER AUTHORITY	LIVINGSTON		TRINITY RIVER	Polk	3		LIVINGSTON
8	004279	110000	060414	Chambers-Liberty Cox ND	LAKE ANAHUAC	35300	TRINITY RIVER	Chambers	3		LAKE ANAHUAC
8	004279	800	361107	Chambers-Liberty Cox ND			TRINITY RIVER	Chambers	4		
8	004009	36	791119	BROOKHILL CORP INC		36	MEETINGHOUSE	Liberty	7		ALSO DOM & LIVESTOCK
8	004147	41	810907	Wiggins Land Co of Texas		41	Unnamed Trib Coley Crk	San Jacinto	7		
8	004270	150	391231	US FOREST SERVICE	San Jacinto County	104	DOUBLE	San Jacinto	7		
8	004102	211	810223	GIBBS BROTHERS and Company		211	Unnamed Trib Town Br	Walker	7		D & L
8	004335	400	820624	T E DUKE		895	MENARD	Polk	7		
8	005374	488	910819	MATTIE K. CARTER TRUST			UNNAMED TRIB	Leon	7		IMPOUNDMENT
8	004280	805	800428	GEORGE W MAXWELL			COW ISLAND	Liberty	7		
8	004288		660907	Eileen Fowler, Attorney et al		948	MILL	Liberty	7		
8	004273		790221	A G SERVICES INC		299	Unnamed Trib Gaylor	Liberty	7		
8	004274		800107	Knights Forest Prop Owners		88	GREENS	Liberty	7		
8	004275		790102	LAKECROFT INC		98	LONG JOHN	Liberty	7		
8	004276		681028	Price & Ellen Danial Trustee		1794	LAKE BAYOU	Liberty	7		
8	004278		800331	Floyd A Wenzel & L S Sodalak		150	Unnamed Trib Trinity	Liberty	7		
8	004480		840612	WELDON ALDERS		7064	BIG CANEY CRK	Liberty	7		

TNRCC Water Rights: Trinity - San Jacinto Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
9	003926	30000	670106	Houston Lighting & Power Co.		13750	CEDAR BAYOU	Chambers	2	Cedar Bayou P	Imp. priority 4-4-83
9	003912	4	480430	STOESSER FARMS, INC.			CEDAR BAYOU	Liberty	3		
9	003921	60	710601	RICHARD L SHUMAN		20	ADLONG DITCH	Harris	3		
9	005505	125	941025	FKM & Luel Partnerships Ltd			BRAYS BAYOU	Harris	3		Ponds 1&2. Amended 5/16/97: 2 div points
9	003914	235	530310	Riceland Properties Inc		416	CEDAR BAYOU	Harris	3		
9	003915	308	420430	ROY A SEABERG ET AL			CEDAR BAYOU	Harris	3		& CO 146
9	003910	327	450430	ROY A. SEABERG		50	SALT FLAT DRN	Liberty	3		
9	003915	342	420430	Riceland Properties Inc			CEDAR BAYOU	Harris	3		& CO 146
9	003923	347	700120	BILLY E. MURFF		365	CEDAR BAYOU	Harris	3		
9	003911	525	690430	STOESSER FARMS INC		42	CEDAR BAYOU	Liberty	3		
9	003923	607	430129	BILLY E. MURFF			CEDAR BAYOU	Harris	3		See Adj 3922 for rate
9	003914	685	530310	ROY A SEABERG ET AL			CEDAR BAYOU	Harris	3		
9	003922	700	700120	CEDAR BAYOU LTD			CEDAR BAYOU	Harris	3		
9	003922	800	430129	CEDAR BAYOU LTD			CEDAR BAYOU	Harris	3		
9	003916	881	570531	MARCELLA B ZALESKY			COFFEE SLOUGH	Liberty	3		
9	003925	1067	561105	J.M. FROST, III		480	HICKORY ISLAND	Liberty	3		Imp. priority 10-13-70
9	003919	1152	550531	J M FROST III	Off-Channel Lake Prior	472	CEDAR BAYOU	Liberty	3		Off-Channel Lake Prior. 10-13-70
9	003913	1200	720124	Riceland Properties Inc		605	CEDAR BAYOU	Harris	3		& CO 146-2 Lakes 475 & 130 AF
9	003909	1402	470430	STOESSER FARMS, INC.		480	CEDAR BAYOU	Liberty	3		
9	003924	2133	561105	W H Keenan Trust et al		1050	HICKORY ISLAND	Chambers	3		Incl 7 AF on-channel
9	003918	2500	550531	W H Keenan Trust et al		570	CEDAR BAYOU	Liberty	3		2 Lakes-See file for priorities
9	003917	50	760524	Bruce A Berry Trustee		142	COFFEE SLOUGH	Liberty	7		Exp 12/31/94; Amend 4/25/94
9	003920	100	630905	James L Robertson Trustee		184	CEDAR BAYOU	Liberty	7		
9	003956		751110	Lake Hollyhill Owners Assn			UNNAMED TRIB	Grimes	7		Trib of Mill

TNRCC Water Rights: San Jacinto Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
10	00070	50	730109	GULF STATES UTILITIES CO			W SAN JACINTO RIVER	Montgomery	1	LEWIS CREEK PLANT	
10	004964	55000	420725	SAN JACINTO RIVER AUTH	Highlands Res, Water from Lake Houston	3800	SAN JACINTO RIVER	Harris	1		55,000 AF FOR ALL 3 USES
10	004963	66000	590112	SAN JACINTO RIVER AUTH ET AL	LK CONROE	430260	W FRK SAN JACINTO RIVER	Montgomery	1		LK Conroe, & CO 101 & REC
10	004965	168000	400507	CITY OF HOUSTON	LK HOUSTON	160000	SAN JACINTO RIVER	Harris	1		LK HOUSTON, & USE 1 & 3
10	005334	0.4	901127	COOPER'S MARINE SER, INC	SAN JACINTO RV		OLD RIVER CHANNEL	Harris	2		San Jacinto RV, 0.4 AF/Barge Wash/Clean
10	005498	10	940811	Louisiana-Pacific Corporation		1	E FRK SAN JACINTO RIVER	Liberty	2		Fire Crt, Consumptive Use-See Acreage
10	005560	25	961017	BROWN & ROOT INC			GREENS BAYOU	Harris	2		
10	005340	30	910116	WESTERN TOWING CO			SAN JACINTO RIVER	Harris	2		
10	005299	67	900622	Texas Southwest Shipyard Printz			SAN JACINTO RIVER	Harris	2		
10	005507	76.8	941207	Elf Atochem North America Inc	HOUSTON PLANT		GREENS BAYOU	Harris	2		74.1 Fire Suppression, 2.7 Tank Cleaning
10	005191	100	880725	Paklank Corporation-Deer Park	DEER PARK TERMINAL		BUFFALO BAYOU	Harris	2		
10	005353	100	910320	Paklank Corp-Galena Park Term	GALENA PARK TERMINAL		BUFFALO BAYOU	Harris	2		
10	004375	230	830620	KOCIDE CHEMICAL CORP			SIMS BAYOU	Harris	2		
10	005432	245	920928	Newpark Shipbuilding & Repair			BUFFALO BAYOU	Harris	2		Diversion from 3 Docks - #1, #2 & #3
10	003987	307	761004	Gulf Coast Portland Cement Co			UNNAMED TRIB BUFFALO	Harris	2		
10	005430	500	920901	BASIS PETROLEUM INC			BUFFALO BAYOU	Harris	2		
10	003995	1813	470414	TEXAS PARKS & WILDLIFE DEPT	SHELDON WMA		CARPENTERS	Harris	2		
10	003993	5400	761101	OILTANKING OF TEXAS, INC			BUFFALO BAYOU	Harris	2		
10	000070	6400	730109	GULF STATES UTILITIES CO	LAKE CONROE		W SAN JACINTO RIVER	Montgomery	2	LEWIS CREEK PLANT	MAY RENEW (expires 2003)
10	003988	6700	650407	HOUSTON L&P CO-DEEFPWTR			BUFFALO BAYOU	Harris	2	DEEP WATER PLANT	
10	003991	7880	800404	PHILLIPS PETROLEUM COMPANY	HOUSTON CHEMICAL COMPLEX		BUFFALO BAYOU	Harris	2	Houston Chemical Complex	
10	003996	12500	650407	HOUSTON L&P-SAM BERTRAM	Sam Berton Steam Electric Plant		SAN JACINTO RIVER	Harris	2	SAM BERTRON PLANT	Unlimited Diversion, Amend 5/13 & 8/5/86
10	004963	28500	590112	SAN JACINTO RIVER AUTH ET AL			W FRK SAN JACINTO RIVER	Montgomery	2		
10	003989	33200	701102	MOBIL OIL CORP	PASADENA PLANT		BUFFALO BAYOU	Harris	2	PASADENA PLANT	
10	003992	34000	711026	ETHYL CORPORATION			BUFFALO BAYOU	Harris	2		
10	003990	45289	440412	ARMCO, INC			BUFFALO BAYOU	Harris	2	GREENS PORT INDUSTRIAL	
10	003994	140000	480630	OCCIDENTAL CHEMICAL CORP			BUFFALO BAYOU	Harris	2		
10	004964		420725	SAN JACINTO RIVER AUTH	Highlands Res, Water from Lake Houston		SAN JACINTO RIVER	Harris	2		55,000 AF FOR ALL 3 USES
10	004966		670808	GULF STATES UTILITIES CO	LEWIS CR RES	17000	LEWIS CRK	Montgomery	2	LEWIS CREEK PLANT	Lewis Cr Res & Rec, Thermal Electric Pft
10	004966		670806	GULF STATES UTILITIES CO	FROM LAKE CONROE		LEWIS CRK	Montgomery	2	LEWIS CREEK PLANT	FROM LAKE CONROE
10	003970	15	620731	JOE MANNING, JR			E FRK SAN JACINTO RIVER	Liberty	3		
10	004309	16	830124	Jacqueline H G Albrecht, et al			UNNAMED TRIB HEGAR CRK	Walker	3		
10	003986	19	720911	MUSEUM OF FINE ARTS			BUFFALO BAYOU	Harris	3		
10	003961	25	741104	P. B. & CAROLYN SMITH			PANTHER	Montgomery	3		
10	003966	25	770620	CHUDLEIGH FARMS, INC.			Unnamed Trib CYPRESS CRK	Harris	3		
10	003984	26	630630	LENOIR M JOSEY INC	W C DAVIS SURVEY		LANGHAM	Harris	3		
10	003952	32	750623	Tennessee Gas Transmission Co			UNNAMED TRIB SPRING	Walker	3		
10	003974	40	741007	VERNON EUGENE RHOTON			UNNAMED TRIB CANEY	Montgomery	3		
10	003982	45	520630	Cinco Ranch East Development			BUFFALO BAYOU	Harris	3		
10	004066	45	800811	MARIAN W FLEMING		9	BEAR BR (Buffalo Bayou)	Harris	3		AMEND 2/26/90
10	003980	59	421207	ROY A SEABERG, ET AL	2 OFF-CHANNEL LAKES	400	SAN JACINTO RIVER	Harris	3		2 OFF-CHANNEL LAKES
10	004038	66	800331	CONROE COUNTRY CLUB			Unnamed Trib W Frk San Jacinto River	Montgomery	3		AMND 3/8/96
10	003967	100	630630	LENOIR M JOSEY INC	JAMES BREWSTER SURVEY		CYPRESS CRK	Harris	3		
10	005522	109	950227	DEER PARK, CITY OF	DEER PARK GOLF COURSE		Unnamed Trib Patrick's Bayou	Harris	3		
10	004248	116	820920	PANORAMA COUNTRY CLUB INC		93	STEWART'S CRK	Montgomery	3		
10	005436	138	921109	KINGWOOD COUNTRY CLUB, INC.		112	BEAR BR (Spring Crk)	Harris	3		& 7, On-Chan Res A-1, C, D, Off-Chan D-1
10	003930	140	781127	ELKINS LAKE RECREATION CORP.		912	PRAIRIE	Walker	3		3 LAKES, AMEND 5/93
10	005257	175	890913	LAKESIDE COUNTRY CLUB		235	BUFFALO BAYOU	Harris	3		& REC, AMEND 10/4/91
10	005336	175	901205	HOUSTON COUNTRY CLUB		20	BUFFALO BAYOU	Harris	3		& RECREATION
10	003964	200	611231	LENORA WARREN JORDAN ET AL			ROCK HOLLOW	Harris	3		
10	005311	220	900907	BRAE-BURN COUNTRY CLUB		13.2	BRAYS BAYOU	Harris	3		& REC; 3 Res, Amend 7/16/91, 10/31/94
10	005209	230	881215	Inwood Forest Golf & CtryClub		16	WHITE OAK BAYOU	Harris	3		& REC
10	003941	300	740701	SELECTED LANDS CORP		160	CANEY	Grimes	3		ALSO REC.
10	003960	310	740121	The Woodlands Corporation		110	UNNAMED TRIBS PANTHER	Montgomery	3		ALSO REC-2 LAKES
10	005332	378	901128	PINE FOREST COUNTRY CLUB		35	BEAR BR (Buffalo Bayou)	Harris	3		AND RECREATION
10	003985	460	780130	RIVER OAKS COUNTRY CLUB		75	BUFFALO BAYOU	Harris	3		
10	004188	500	820217	THE WOODLANDS CORP			BEAR BR (Spring Crk)	Montgomery	3		
10	003963	501	500531	DAVID N. NELSON ETAL		220	CYPRESS CRK	Walker	3		& CO 101
10	003959	750	720905	Lake Woodlands Prop Owners Assn		1460	PANTHER	Montgomery	3		ALSO REC.
10	003983	800	161231	HAROLD & JESSE FREEMAN		150	BEAR BR (Buffalo Bayou)	Harris	3		
10	003995	875	470414	TEXAS PARKS & WILDLIFE DEPT	SHELDON WMA	5354	CARPENTERS	Harris	3		ALSO REC
10	003980	1541	421207	RICELAND PROPERTIES, INC			SAN JACINTO RIVER	Harris	3		
10	003979	2354.96	650802	RICELAND PROPERTIES INC			LUCE	Liberty	3		
10	003979	2644.04	650802	F E GUTHRIE ET AL		2534	LUCE	Liberty	3		
10	003965	2941	511231	Estate of Alta G Longenbaugh	Highlands Res, Water from Lake Houston	1408	CYPRESS CRK	Harris	3		4 Lakes Also REC, Amend 3/9/87
10	004964		420725	SAN JACINTO RIVER AUTH	Highlands Res, Water from Lake Houston		SAN JACINTO RIVER	Harris	3		55,000 AF FOR ALL 3 USES
10	004963	5500	590112	SAN JACINTO RIVER AUTH ET AL			W FRK SAN JACINTO RIVER	Montgomery	4		
10	005055	40	860410	Harris County Precinct Four		37	CYPRESS CRK	Harris	7		
10	005408	83	920310	The Woodlands Corporation		83	UNNAMED TRIB DECKER BR	Montgomery	7		RES; EXP 12/31/2002; AMEND 7/94
10	003968	96	560430	COMPAQ COMPUTER CORP	OFF-CHANNEL LAKE	90	PILLOT	Harris	7		OFF-CHANNEL LAKE
10	004255	141	821101	Frontier Lakes Prop Owners Assn		206	Unnamed Trib Lt Caney Crk	Montgomery	7		3 RES, 9/29/88
10	005408	177	920310	The Woodlands Corporation		177	UNNAMED TRIB DECKER BR	Montgomery	7		RES; EXP 12/31/2002; AMEND 7/93, 7/94
10	004188	600	820217	The Woodlands Corporation		600	BEAR BR	Montgomery	7		
10	005471	1164	931018	Properties of Southwest Inc	IMPOUNDMENT (INDIGO LAKE)	1164	LOG GULLY	Montgomery	7		IMPOUNDMENT (INDIGO LAKE);AMEND 10/31/94
10	003927		660907	M. B. ETHEREDGE			MCDONALD	Walker	7		
10	003928		720214	HEATH BRANCH FISHING CLUB			MCDONALD	Walker	7		

TNRCC Water Rights: San Jacinto Basin

Basin	WR Number	Amount in Ac-FYr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
10	003929		501108	SUNSET LAKE CLUB		320	MCDONALD	Walker	7		
10	003931		550502	TEXAS PARKS & WILDLIFE DEPT	HUNTSVILLE STATE PARK	1200	PRAIRIE ET AL	Walker	7	Part Operations & Maint Branch	
10	003932		760412	C.I.A. HIDDEN FOREST, INC			UNNAMED TRIB CANEY	Montgomery	7		
10	003933		750609	LAKE MT PLEASANT SUBD ASSN		207	UNNAMED TRIB CANEY	Montgomery	7		AMEND 11/31/89
10	003934		750618	Flamingo Lake Lot Owners Assn		210	Unnamed Trib LII Caney Crk	Montgomery	7		
10	003935		750120	J S HULON			UNNAMED TRIB LEWIS	Montgomery	7		
10	003936		740603	CAPE CONROE, LTD.		67	UNNAMED TRIB STEWART	Montgomery	7		2 LAKES
10	003937		750303	PINE LAKE CLUB, INC		93	UNNAMED TRIB ATKINS	Montgomery	7		
10	003938		750127	WEISINGER ESTATE		68	UNNAMED TRIB ATKINS	Montgomery	7		
10	003939		750203	Lake Conroe Forest Owners Assn		242	UNNAMED TRIB RUSH	Montgomery	7		3 LAKES
10	003940		750203	LAKE FOREST FALLS, INC.		605	BASE	Montgomery	7		
10	003942		741202	Tri-Lake Estates Prop. Owners			UNNAMED TRIB LAKE CRK	Montgomery	7		
10	003943		750707	177 LAKE ESTATES ASSN, INC			UNNAMED TRIB LAKE CRK	Montgomery	7		
10	003944		751201	LAKE BOHANZA PROP. OWNERS		116	UNNAMED TRIB MOUND	Montgomery	7		
10	003945		750406	Deer Lake Lodge Prop. Owners		70	UNNAMED TRIB MOUND	Montgomery	7		
10	003946		551108	LAKE FOREST LODGE, INC.		182	FISH	Montgomery	7		
10	003947		781010	MITCHELL DEVELOPMENT CORP		287	FISH	Montgomery	7		
10	003948		750120	SAN JACINTO GIRL SCOUTS			UNNAMED TRIB STEWARTS	Montgomery	7		
10	003949		750120	Riverbrook Community Imp Assn		117	Unamed Trib W Frk San Jacinto River	Montgomery	7		
10	003950		790604	CONROE CREOSOTING CO		44	LITTLE CANEY	Montgomery	7		
10	003951		750728	MAGNOLIA BEND PROP. OWNERS			OLD BOGGY	Montgomery	7		
10	003953		751027	Lake Winona Prop Owners Assn			UNNAMED TRIB WALNUT	Grimes	7		
10	003954		751222	WOODLANDS LAKE CIVIC CLUB			UNNAMED TRIB LOG GULLY	Montgomery	7		
10	003955		750721	Stagecoach Farms Civic Club		125	UNNAMED TRIB SULPHUR	Montgomery	7		2 LAKES
10	003957		750217	C. R. HOCOTT, TRUSTEE, ETAL		48	UNNAMED TRIB MILL	Montgomery	7		4 LAKES
10	003958		750408	LESTER NEIDIGK		246	MILL	Montgomery	7		
10	003962		790212	GALVESTON-HOUSTON CO.		48	UNNAMED TRIB MOUND	Walker	7		
10	003964		520728	LENORA WARREN JORDAN ET AL		640	ROCK HOLLOW	Harris	7		
10	003969		790630	ELMORE P WATSON ESTATE			UNNAMED TRIBS PHELPS	Walker	7		
10	003971		750707	BESS N. FISH			UNNAMED TRIB CANEY	Montgomery	7		
10	003972		750127	CHARLES G. DUNWOODY, JR.			UNNAMED TRIB LTL CANEY	Montgomery	7		
10	003973		750106	Arrowhead Lakes Prop. Owners		247	UNNAMED TRIB LTL CANEY	Montgomery	7		
10	003975		750106	Royal Forest Colony Club Inc		360	UNNAMED TRIB CANEY	Montgomery	7		
10	003976		750224	Spring Lake Improvement Assn. E134		57	UNNAMED TRIB CANEY	Montgomery	7		
10	003977		740328	MCRAE LAKE CIVIC IMP. ASSN.		61	MCRAE	Montgomery	7		
10	003978		740715	W. J. MCKNIGHT ESTATE			MCRAE	Montgomery	7		
10	003981		770613	A. P. LEONARDS			GRANITE	Harris	7		
10	004036		800331	CONROE COUNTRY CLUB		65	Unamed Trib W Frk San Jacinto River	Montgomery	7		AMND 8/12/83 3/8/96
10	004523		841204	J H WILKENFELD TRUSTEE ET AL		18.7	Unamed Trib W Frk San Jacinto River	Montgomery	7		AMEND 3/7/89
10	005261		891101	BURTICE MILLER		65	UNNAMED TRIB WEIRS CRK	Montgomery	7		
10	005408		920310	The Woodlands Corporation		92	UNNAMED TRIB DECKER BR	Montgomery	7		EXP 12/31/2002, AMEND 7/53
10	005437		921109	Kingwood Lakes Community Assn		161	BEAR BR	Harris	7		IMPOUNDMENT
10	005522		950227	DEER PARK, CITY OF		119.3	Unamed Trib Patrick's Bayou	Harris	7		
10	005572		970117	Properties of Southwest Inc		11	Unamed Trib WALNUT CRK	Montgomery	7		STORMWATER DETENTION & AMENITY POND
10	005576		970220	LIPAR GROUP INC		345	UNNAMED TRIB DRY CRK	Montgomery	7		DIVERSION FOR D&L ONLY
10	005363	967	910528	COVE CREEK CORP			COVE CRK	Harris	8		
10	005362		920606	Harris Co Flood Control Dist			KEEGAN BAYOU	Harris	8		DIVERSION FROM KEEGANS BAYOU & UNIT D140
10	005514		950131	LIEVEN J VAN RIET, TRUSTEE	3-Compartment Reservoir Complex, 3 Dams	500	Unamed Trib CYPRESS CRK	Harris	8		3 YRS TO COMPLETE

TNRCC Water Rights: San Jacinto - Brazos Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap in Ac-Ft	Stream	County	Use	Location	Remarks
11	005169	12000	480514	GULF COAST WATER AUTHORITY		8925	JONES CRK	Fort Bend	1		USE 2,3,7, COS 020,084,101
11	005170	18000	480514	FORT BEND COUNTY WCID 1			JONES	Fort Bend	1		& REC & IND
11	004534	92	850103	D & C FISH FARM INC		240	AUSTIN BAYOU	Brazoria	2		FISH FARMING
11	005064	160	860527	JAY CHARLES SVOBODA		80	IOWA COLONY DD	Brazoria	2		CRAWFISH FARMING
11	005345	192	760712	C E ZWAHR ET AL			AUSTIN BAYOU	Brazoria	2		
11	004535	200	850103	ANNA KOLANCY		250	AUSTIN BAYOU	Brazoria	2		& REC; FISH FARMING
11	005256	252	890829	JOHN D VIEMAN ET AL		162	AUSTIN BAYOU	Brazoria	2		& REC
11	005485	280	940420	PHILLIPS PETROLEUM CO	Brazos River Harbor		BRAZOS HARBOR	Brazoria	2	Freeport Terminals	BRAZOS RIVER HARBOR
11	005352	1198	850923	THE RANDOLPH CO ET AL		921	AUSTIN BAYOU	Brazoria	2		Fish Farming - 3 Off Channel Lakes
11	005350	4440	650407	HOUSTON L&P WEBSTER	Webstar Plant		CLEAR	Harris	2	Webstar Plant	
11	001724	18159	890101	IMPERIAL HOLLY CORPORATION			JONES	Fort Bend	2		& MUNICIPAL
11	005286	25000	900306	TEXAS COPPER CORPORATION			BARGE CANAL	Galveston	2		COOLING & PROCESS WATER (little consumptive use)
11	005363	30000	640811	HOUSTON L&P ROBINSON PLANT	P H Robinson Plant		DICKINSON	Galveston	2	P H Robinson Plant	"UNLIMITED" DIVERSION (from Dickinson Bay)
11	005367	33600	761115	CHOCOLATE BAYOU WATER CO			Unnamed Trib Chocolate	Brazoria	2		
11	005361	107970	701130	STERLING CHEMICALS INC	Texas City Plant		GALVESTON BAY	Galveston	2	Texas City Plant	(Little consumptive use - for cooling)
11	005334	4209000	400506	DOW CHEMICAL COMPANY			FREEPORT CHANNEL	Brazoria	2		
11	005357		761115	CAIN CHEMICALS INC			Unnamed Trib Chocolate	Brazoria	2		DUCK LAKE
11	005358		890526	AMOCO CHEMICAL CO	Chocolate Bayou Plant	1860	CHOCOLATE	Brazoria	2	Chocolate Bayou Plant	STORAGE OF PURCHASE WATER
11	005362	46	810928	CHAPARRAL RECREATION ASSOC		15	Unnamed Trib Dickenson	Galveston	3		ALSO USE 7
11	005359	54	451231	ALVIN GOLF & COUNTRY CLUB			MUSTANG	Brazoria	3		
11	005336	100	561105	THE LAKES LIMITED			OYSTER CRK	Fort Bend	3		
11	005230	150	890502	BAYWOOD COUNTRY CLUB		6	ARMAND BAYOU	Harris	3		
11	005170	159	140627	FORT BEND COUNTY WCID 1		8925	JONES	Fort Bend	3		
11	005360	160	620415	JAMES SCOPEL			Unnamed Ditch Mustang	Brazoria	3		
11	005354	187	600331	R T MARSHALL TRUSTEE			W FRK CHOCOLATE	Brazoria	3		
11	004535	225	850103	ANNA KOLANCY			AUSTIN BAYOU	Brazoria	3		
11	005338	300	400424	TEXAS DEPT OF CRIMINAL JUSTICE	Retrieve State Farm	90	OYSTER CRK	Brazoria	3		AMEND 3/19/91
11	004355	360	830418	J V 3 INC		73	AUSTIN BAYOU	Brazoria	3		
11	005342	400	140629	E C STOKLEY TRUSTEE		440	BASTROP BAYOU	Brazoria	3		
11	005348	454	140625	CLEVELAND DAVIS III ETAL			AUSTIN BAYOU	Brazoria	3		
11	005400	538	920219	SOUTH SHORE HARBOUR DEV LTD		92	Unnamed Trib Clear Creek	Galveston	3		EXP 12/31/2002
11	005358	560	480331	J W ISAACS			COUNTY DITCH	Brazoria	3		
11	005341	600	140630	TOM TIGNER TRUST			BASTROP BAYOU	Brazoria	3		
11	004456	657	840522	C F BROWN JR TRUSTEE		120	FLORES BAYOU	Brazoria	3		
11	005347	683	140625	ALBERT KUCHAR			AUSTIN BAYOU	Brazoria	3		
11	005345	706	361209	C E ZWAHR ET AL		1480	AUSTIN BAYOU	Brazoria	3		
11	005364	968	431231	ROBERT L ALEXANDER			CLEAR	Brazoria	3		Jointly owns 968 AF to IRR 242 AC
11	005256	979	890829	JOHN D VIEMAN ET AL			AUSTIN BAYOU	Brazoria	3		Must complete construct by 4/19/97
11	005023	1000	851016	REX C BAILEY JR ET AL			OLD BRUSHY BR	Brazoria	3		& REC
11	005349	1000	470322	BIERI FARM, INC.		1292	FLORES BAYOU	Brazoria	3		5 LAKES-242 LEASED ACRES
11	005335	1316	561105	LARRY J SCHULGEN, TRUSTEE		379	UNNAMED TRIB OYSTER	Fort Bend	3		2 LAKES-ALSO USE 7
11	005344	1482	361231	MRS W M GARRETT		414	AUSTIN BAYOU	Brazoria	3		5 LAKES
11	005351	1500	400116	A FARRER ETAL		550	AUSTIN BAYOU	Brazoria	3		2 OFF-CHANNEL LAKES
11	005023	1600	851016	REX C BAILEY JR ET AL			OLD BRUSHY BR	Brazoria	3		
11	004449	2000	840506	GARRETT RANCH INC			AUSTIN BAYOU	Brazoria	3		
11	005356	2000	681115	JOHN R & J W ISAACS		40	CHOCOLATE	Brazoria	3		
11	005346	2812	140625	DONALD JOE BULANEK ET AL		783	FLORES BAYOU	Brazoria	3		4 OFF-CHANNEL LAKES
11	004509	2925	841030	RAYMOND LE COMPTE ET AL		1455	Unnamed Trib King Creek	Brazoria	3		
11	005352	3620	140616	THE RANDOLPH CO ETAL		3620	AUSTIN BAYOU	Brazoria	3		4 OFF-Channel Lakes-ALSO USE 7
11	005343	5871	710301	TIGNER IRRIGATION CO.		750	NEW BRUSHY BAYOU	Brazoria	3		
11	005357	23900	270803	CHOCOLATE BAYOU WATER CO		8951	Unnamed Trib Chocolate	Brazoria	3		3 OFF-Channel RES ALSO USE 7
11	005364		431231	MARTHA A CROUCH			CLEAR	Brazoria	3		JOINTLY OWNS 968 AF TO IRR 242 AC
11	005183	12	880610	HARRIS COUNTY (PRECINCT ONE)		30	Unnamed Trib Clear Creek	Harris	7		
11	005020	30	851001	RALPH SHUMAN		42	BASTROP BAYOU	Brazoria	7		
11	005353	90	800616	U S FISH & WLDLIFE SERVICE	Olney Pond	30	BASTROP BAYOU	Brazoria	7	Brazoria National Wildlife Refuge	OFF-CHANNEL
11	005574	116.5	970128	LSF DEVELOPMENT CORP		198	DICKINSON BAYOU	Galveston	7		
11	005336	442	561105	THE LAKES, LIMITED		442	OYSTER CRK	Fort Bend	7		2 OFF CHANNEL LAKES
11	005345	1003	780712	C E ZWAHR ET AL			AUSTIN BAYOU	Brazoria	7		
11	005340	1080	681231	U S FISH & WLDLIFE SERVICE	Roscoe's Terrace		BIG SLOUGH	Brazoria	7	Brazoria National Wildlife Refuge	MARSH FOR WLDLIFE
11	005333		710631	VELASCO DRAINAGE DISTRICT			OLD BRAZOS RIVER	Brazoria	7		NAVIGATION GATE
11	005337		530610	FORT BEND COUNTY, TEXAS		1600	NONE	Fort Bend	7		
11	005339		800616	U S FISH & WLDLIFE SERVICE	Salt Lake Weir	750	UNNAMED TRIB SALT	Brazoria	7	Brazoria National Wildlife Refuge	
11	005365		910621	MISSOURI CITY, CITY OF	Key Court Dam & Lake Kamesha Reservoir	120	Unnamed Trib Oyster Crk	Fort Bend	7		
11	005379		910830	LAKE JACKSON ASSOCIATION		380	Unnamed Trib Oyster Crk	Brazoria	7		
11	005429	70	920826	TEXAS AGRICULTURAL EXT SERVICE	Wildlife & Fisheries Sciences	56	COTTONWOOD BAY	Brazoria	8	Wildlife & Fisheries Sciences	OFF-CHANNEL IMPOUNDMENT
11	005369	130	910828	HARRIS COUNTY		89	CLEAR CRK	Harris	8		
11	005178		880429	CITY OF LEAGUE CITY			Unnamed Trib Benson Bayou	Galveston	8		
11	005321		810829	MONSANTO COMPANY	Monsanto Res	2500	NONE	Brazoria	8		MONSANTO RES FOR WATER FROM BRAZOS RA

TNRCC Water Rights: Brazos Basin

Basin	WR Number	Amount in Ac-Ft/Yr	Priority	Name	Facility	Res Cap In Ac-Ft	Stream	County	Use	Location	Remarks
12	005168			BRAZOS RIVER AUTHORITY	EXCESS FLOWS		BRAZOS RIVER	Fort Bend	1		& OTHER COS
12	005167			BRAZOS RIVER AUTHORITY			BRAZOS RIVER	Fort Bend	1		INTERBASIN TRANSFER
12	005168	99932	260115	Gulf Coast Water Authority			BRAZOS RIVER	Fort Bend	1		USE 2 & 3, COS 020,084,101
12	005171	75000	390201	Gulf Coast Water Authority			BRAZOS RIVER	Fort Bend	1		& USE 2,4
12	005167			BRAZOS RIVER AUTHORITY			BRAZOS RIVER	Fort Bend	2		INTERBASIN TRANSFER
12	005322	10000	290208	Chocolate Bayou Water Co		864	BRAZOS RIVER	Fort Bend	2		3 RESVR 8/88 FISH FM AMEND 10/29/9
12	005325	28711	551216	HOUSTON L&P CO-PARISH	SMITHERS LAKE	18750	DRY	Fort Bend	2	W A PARISH PLANT	SMITHERS LAKE
12	005320	12000	261023	RICHMOND IRR CO & HL & P			BRAZOS RIVER	Fort Bend	2		
12	005322	145000	290208	Chocolate Bayou Water Co			BRAZOS RIVER	Fort Bend	3		AMEND 10/29/90
12	005171	50000	501212	Gulf Coast Water Authority			BRAZOS RIVER	Fort Bend	3		& COS 020, 084, & USE 1,2,4
12	005320	28000	261023	RICHMOND IRR CO & HL & P			BRAZOS RIVER	Fort Bend	3		
12	004554	884	850406	TWINWOOD CORP NV ET AL		1489	UNNAMED TRIB BRAZOS RIVER	Fort Bend	3		& REC, 7
12	005552	2300	960507	CSB ASPHALT COMPANY INC		8	BRAZOS RIVER	Fort Bend	4		
12	005110		861118	Fort Bend County Levee ID #11		354	M BAYOU	Fort Bend	7		
12	005324		550711	MARY D. MYERS	LAKE PAW PAW	500	UNNAMED TRIBS BIG	Fort Bend	7		LAKE PAW PAW
12	005326	310	781211	TEXAS PARKS & Wildlife Dept	HALE RANCH PARK	854	UNNAMED TRIB BIG	Fort Bend	7	PARK OPERATIONS & MAINT BRANCH	10 LAKES-HALE RANCH PARK
12	005115		861218	FORT BEND CO. Drainage Dist.			BIG CRK	Fort Bend	8		
12	005173		880316	Fort Bend County Levee ID #11			MIDDLE BAYOU	Fort Bend	8		FLOOD CONTROL
12	005199		881025	Fort Bend Flood Control WSC			STEEP BANK CRK	Fort Bend	8		
12	005168		470317	Gulf Coast Water Authority		7308	BRAZOS RIVER	Fort Bend	8		
12	000089	14580	681203	SOUTH TEXAS WATER CO			BRAZOS RIVER	Galveston	2		ALL RIGHTS
12	000089	14550	681203	SOUTH TEXAS WATER CO			BRAZOS RIVER	Galveston	3		