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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
INTEROFFICE MEMORANDUM

TO: Chief Clerk DATE: January 8, 2010

THRU: Iliana Delgado, Team Leader
Water Rights Permitting Team

FROM: Esteban (Steve) Ramos, Project Manager
Water Rights Permitting Team

SUBJECT: Lower Colorado River Authority
Docket #2010-0025-WR
WRPERM 5838
CN600253637, RN104252267
Application No. 5838 to Amend LCRA Water Management Plan
TWC § 11.122, Requiring Mailed and Published Notice
Colorado River Basin
Travis, Bastrop, Fayette, Colorado, Wharton, and Matagorda Counties

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
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CHIEF CLERKS OFFICE

The Executive Director received an application from Lower Colorado River Authority seeking to amend its Water Management Plan pursuant to Texas Water Code §11.122 and Texas Commission on Environmental Quality Rules 30 TAC §§295.1, *et seq.*

The application was received on May 16, 2003. The application was declared administratively complete and filed with the Office of the Chief Clerk on May 7, 2004. Notice of the application was issued on September 14, 2004 to all water right holders of record in the Colorado River Basin and was subsequently published in the *Austin American-Statesman*, *Colorado County Citizen*, *Matagorda County Tribune*, *Bay City Tribune*, *Fayette County Record*, *El Campo Leader-News*, and *Bastrop Advertiser*. Requests for contested case hearing were received from the National Wildlife Federation, STP Nuclear Operating Co., Sierra Club—Lone Star Chapter, the City of Austin, and Texas Parks and Wildlife. As of the date of this memo, none of the hearing requests have been withdrawn. LCRA has indicated to staff that the proposed amendments and agreed order are the result of settlement negotiations and all hearing requesters agree to the issuance of the proposed agreed order. On December 16, 2009, the LCRA Board of Directors voted to seek TCEQ approval of the draft agreed order.

The application is now technically complete and the staff has recommended that the application be granted based on the analysis in the technical review memos.

Below is the caption for this application:

Consideration of the application of the Lower Colorado River Authority and proposed agreed order amending its Water Management Plan (WMP) in San Saba, Llano, Lampasas, Burnet, Blanco, Travis, Bastrop, Fayette, Wharton, Matagorda, and Colorado Counties. The proposed amendments would change the curtailment policy for interruptible stored water supplies, change the allocation of stored water for environmental protection, incorporate LCRA's Drought Contingency Plan into the WMP, and update the WMP Appendices. The commission will also consider any hearing requests that have not been withdrawn. (Steve Ramos, Shana Horton)

The LCRA Water Management Plan

In 1988, the Texas Water Commission issued a Final Judgment and Decree granting water rights to LCRA. The judgment required the LCRA to adopt and implement a water management plan and provided that it may be amended. LCRA has since amended its water management plan three times, with the most recent amendment in 1999.

Proposed Amendments

The proposed amendments to the WMP fall within four areas: curtailment policy for interruptible stored water supplies; allocation of stored water for environmental protection; incorporation of LCRA's Drought Contingency Plan into the WMP; and update of the WMP Appendices. The most significant change is in the curtailment policy for interruptible stored water supplies. The LCRA's proposed amendments to the WMP show the 2000 reported surface water demands by its firm customers from all sources of supply as approximately 296,000 acre-feet annually. The ten-year projected firm demands (through 2010), developed in 2000, were approximately 360,071 acre-feet per year–an increase of 63,471 acre-feet per year. Based on the analyses performed for Regional Planning purposes, the new projected ten-year demands (through 2010) are projected to be 285,000 acre-feet per year. Pursuant to the WMP, firm demand takes precedence over all other uses, therefore the proposed amendment to the WMP requests a reduction in interruptible supplies to compensate for the increase in firm water demand. The reduction is achieved by revising the annual interruptible water supply curtailment policy. Curtailment of interruptible supply will begin when the combined storage in Lake Buchanan and Travis reaches 1.4 million acre-feet instead of the current 1.1 million acre-feet. This will primarily affect the four major irrigation operations which account for the vast majority of interruptible water supplied by LCRA. The new triggers for irrigation curtailment apply to releases for instream flows downstream of Lake Travis and an intermediate release schedule for freshwater inflows to Matagorda Bay is also proposed.

Esteban (Steve) Ramos, Project Manager
Water Rights Permitting Team

Enclosure

cc: Lann Bookout, TCEQ
Kellye Rila, TCEQ
Iliana Delgado, TCEQ
Chris Loft, TCEQ
Justin Degrate, TCEQ
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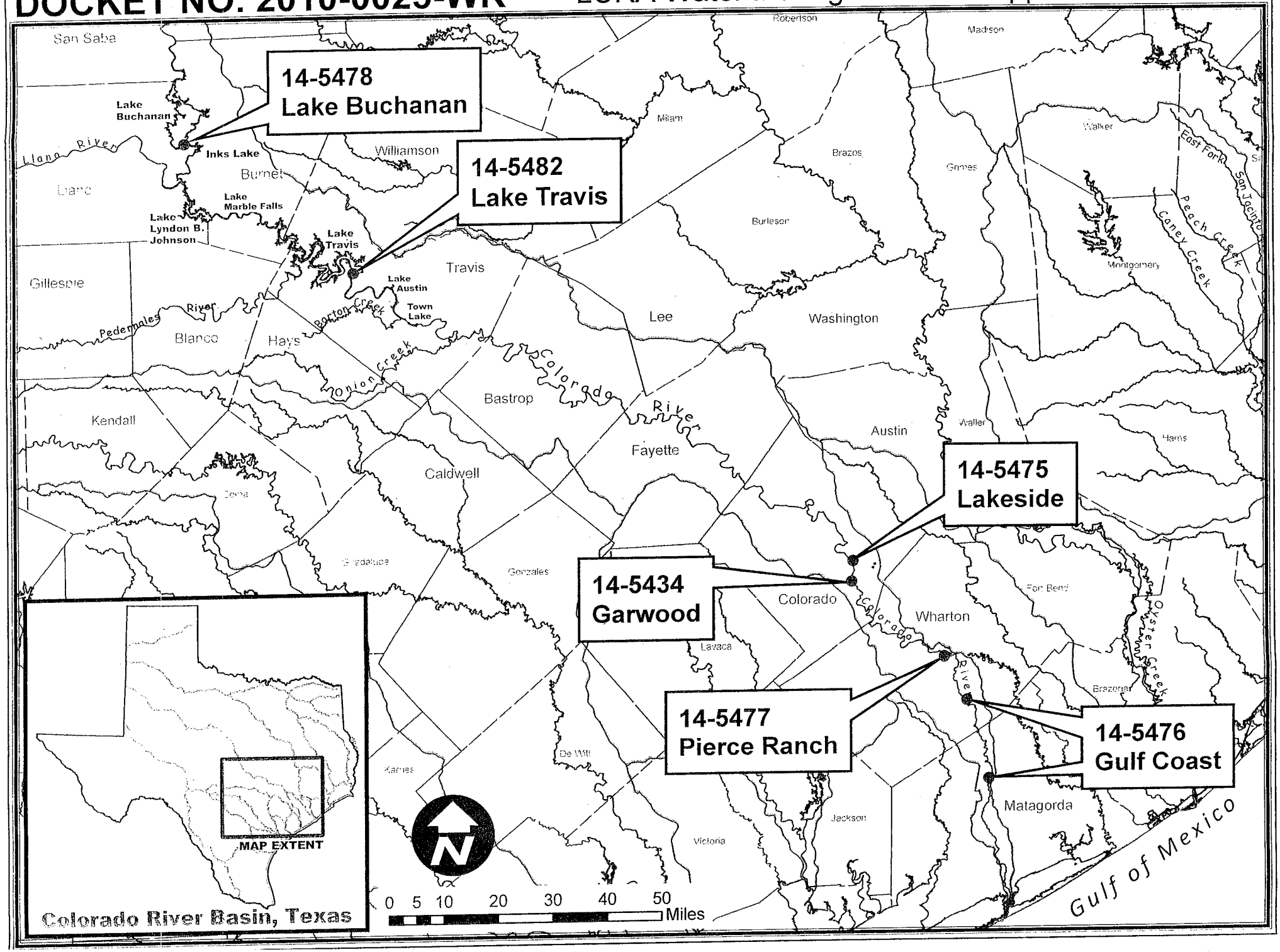
Shana Horton, TCEQ
Kathy Alexander, TCEQ

DOCKET NO. 2010-0025-WR

LCRA Water Managment Plan Application No. 5838



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Notice of an Application to Amend the LCRA Water Management Plan
and Notice of Public Comment Meeting
APPLICATION NO. 5838

The Lower Colorado River Authority has applied for amendments to its Water Management Plan. More information on the application and how to participate in the permitting process is given below.

APPLICATION. The Lower Colorado River Authority (LCRA), P.O. Box 220, Austin, TX, 78767-0220, applicant, seeks amendments to its Water Management Plan pursuant to Texas Water Code §11.122 and Texas Commission on Environmental Quality Rules 30 Texas Administrative Code § 295.1, *et seq*. Pursuant to 30 TAC §295.158, published notice is being given and mailed notice of the application is being given to the water right holders of record in the Colorado River Basin.

The Water Management Plan for the Lower Colorado River Basin (WMP) defines LCRA's water management programs and policies in accordance with the Final Order of Adjudication of the water rights for the Lower Colorado River Authority, the Enabling Act of the Lower Colorado River Authority, General Law of the State of Texas, particularly the Texas Water Code, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482, and the water policies of the Lower Colorado River Authority's Board of Directors. Revisions to the WMP were last approved by the Commission in 1999.

The applicant has requested numerous editorial and organizational changes to the existing WMP designed to correct errors, improve the readability, and achieve internal consistency of the document.

The major substantive proposed amendment to the existing WMP fall within four areas:

- Curtailment policy for interruptible stored water supplies.

  The existing WMP projected the ten-year future firm demands (through 2005) at about 230,000 acre-feet annually. Based on the Senate Bill 1 analyses, the new ten-year projected firm demands (through 2010) are about 285,000 acre-feet per year - an increase of 55,000 acre-feet per year. The primary reason for this increase is additional water needs to meet population and economic growth in the Austin area, including domestic water use around the Highland Lakes.

  With this large projected increase in firm water demand, and because firm water demands take priority over all other uses, proposed amendments to the existing WMP have been requested to give a compensating reduction in the interruptible supplies. This reduction will be achieved by revising the annual interruptible water supply curtailment policy, as discussed in detail in Chapter 4 of the existing WMP. The curtailment policy with requested amendments follows:

  1. Open Supply - If the total January 1 storage in Lakes Travis and Buchanan combined is greater than 1,400,000 acre-feet, then LCRA will supply all interruptible stored water demands.

2. Curtailment will begin if the total January 1 storage is less than 1,400,000 acre-feet and greater than 325,000 acre-feet. The reduction in interruptible stored water supply when combined storage on January 1 is less than 1,400,000 acre-feet, is shown in Figure 4-1. When the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,150,000 acre-feet, the interruptible stored water supply will be curtailed at a steeper rate.

3. Cutoff of the interruptible stored water supply for the coming year will occur when the combined storage in Lakes Buchanan and Travis on January 1 is less than or equal to 325,000 acre-feet.

4. Reserve Storage Pool - If at any time during the year the total storage in Lakes Buchanan and Travis, combined, is less than or equal to 200,000 acre-feet then all use of interruptible stored water will be stopped.

5. During periods of curtailment or cutoff instituted on January 1, LCRA will cancel the curtailment of interruptible stored water for the irrigation districts at any time during the year prior to July 31, if the combined storage in Lakes Buchanan and Travis is projected to be equal to or greater than 1.4 million acre-feet anytime in July. Further, the remaining available interruptible stored water supplies for the year may be reallocated, at this time, between irrigation operations if such allocations do not adversely affect any irrigation operation.

6. During periods of curtailments, LCRA will allow each irrigation operation the option of either: (1) using up to a maximum authorized volume of interruptible stored water allocated to that operation, or (2) using sufficient water to cultivate a level of acreage agreed upon among the customers within each particular district and LCRA.

- Allocation of stored water for environmental protection.

LCRA's proposed amendments to the existing WMP provide that an intermediate release schedule be provided for estuarine freshwater inflows that allows a slightly more gradual reduction of inflows to Matagorda Bay during low flow years. The proposed amendments are deemed by LCRA as a balance between a modest incremental decrease in irrigation water supplies during drought conditions and modest increased inflow to Matagorda Bay during non-drought years to help maintain the ecological health of the Bay. Based on a balance of environmental and irrigation impacts, the recommended amendments to the existing WMP include an increase of stored water released for estuarine freshwater inflow. This increase would be provided in years when the January 1 storage level in Lakes Buchanan and Travis is between 1.1 to 1.7 million acre-feet (55 and 86 percent full).

During the critical drought, LCRA proposes that the total stored water provided for environmental protection remain essentially the same as provided under the existing WMP. However, LCRA's proposed amendments provide that more of this commitment be met with firm, rather than interruptible stored water. The firm stored water so designated would increase from 16,950 acre-feet to 33,440 acre-feet. This additional firm commitment would be provided from available, but uncommitted supplies from Lakes Buchanan and Travis of about 50,000 acre-feet.

- Incorporation of LCRA's Drought Contingency Plan into the Water Management Plan.

The LCRA Drought Contingency Plan (DCP), as required by TCEQ rules (30 Tex. Admin. Code

§§288.20 et seq.), was last approved by the LCRA Board of Directors and submitted to the TCEQ in April 2000. Most of the DCP was taken verbatim from Chapter 4 of the existing WMP. Under current TCEQ rules, the DCP must be updated every five years. For the sake of convenience and to reduce confusion among its customers and other stakeholders, LCRA is requesting that the DCP be formally incorporated into this version of the WMP so that revisions can be made simultaneously in one document.

- Update of Appendices.

  The existing WMP contains two appendices; Volume I, which includes relevant LCRA Board policies, and Volume II, which contains technical information on the existing WMP. Changes to Volume I will reflect revisions made to the LCRA Board polices since 1999. Changes to Volume II will reflect changes in agreements between LCRA and the Colorado River Municipal Water District, to delete obsolete appendices, and to update LCRA's standard form contracts and administrative rules for raw water contracts.

A copy of the revised WMP along with a redline version of the existing WMP showing the proposed amendments is available for public viewing at the Texas Commission on Environmental Quality Office of the Chief Clerk, 12100 Park 35 Circle, Building F, Austin, Texas, 78753. Additionally, copies of the revised WMP, along with a redline version of the existing WMP, are available for public viewing at the offices of the County Clerk in the following counties: San Saba, Llano, Lampasas, Burnet, Blanco, Williamson, Bastrop, Fayette, Colorado, Wharton, and Matagorda.

The Commission will review the application as submitted by the applicant and may or may not grant the application as requested.

The application was received on May 16, 2003, and fees were received on April 30, 2004. The application was accepted for filing and declared administratively complete on May 7, 2004.

PUBLIC COMMENT MEETING. A public comment meeting is intended for the taking of public comment and is not a contested case hearing. A public comment meeting will be held at the following date, time, and place:

Monday, November 8, 2004 at 7:00 p.m.
Texas Commission on Environmental Quality
12100 Park 35 Circle
Building E, Room 201S
Austin, Texas, 78753

The public comment meeting will be held under the authority of Chapters 5 and 11, Texas Water Code, and the rules of TCEQ. TCEQ staff will also receive written comments on the proposed amendments for 30 days from the date of newspaper publication of this notice. Written comments may be mailed to the Office of the Chief Clerk at the address provided in the information section below.

CONTESTED CASE HEARING. The TCEQ may grant a contested case hearing on this application if a written hearing request is filed within 30 days from the date of newspaper publication of this notice. The Executive Director may approve the application unless a written request for a contested case hearing is filed within 30 days after newspaper publication of this notice.

To request a contested case hearing, you must submit the following: (1) your name (or for a group or association, an official representative), mailing address, daytime phone number, and fax number, if any; (2) applicant's name and permit number; (3) the statement "[*I/we*] request a contested case hearing"; (4) a brief and specific description of how you would be affected by the application in a way not common to the general public; and (5) the location and distance of your property relative to the proposed activity. You may also submit proposed conditions for the requested amendments to the existing WMP which would satisfy your concerns. Requests for a contested case hearing must be submitted in writing to the Office of the Chief Clerk at the address provided in the information section below.

If a hearing request is filed, the Executive Director will not approve the proposed amendments to the existing WMP and will forward the application and hearing request to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

INFORMATION. Written hearing requests or written public comments should be submitted to the Office of the Chief Clerk, MC 105, TCEQ, P.O. Box 13087, Austin, TX 78711-3087. For information concerning the hearing process, please contact the Public Interest Counsel, MC 103, at the same address. For additional information, individual members of the general public may contact the Office of Public Assistance at 1-800-687-4040. General information regarding the TCEQ can be found at our web site at www.tceq.state.tx.us.

Issued: September 14, 2004

AGREED ORDER APPROVING AMENDMENTS TO LOWER COLORADO RIVER AUTHORITY'S WATER MANAGEMENT PLAN

On the ___day of ____, 2010, the Texas Commission on Environmental Quality ("Commission") considered the Lower Colorado River Authority's ("LCRA") application (Application No. 5838) to amend its Water Management Plan (WMP) and having heard evidence and arguments concerning Application No. 5838 and the proposed order, the Commission makes the following Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

1) LCRA's Application No. 5838 to amend the WMP was received by the Commission on May 16, 2003, and was declared administratively complete on May 7, 2004.

2) Notice of the application to amend the WMP and of the public meeting on the proposed amendments to the WMP was published on September 27, 2004, in the Austin American-Statesman, a newspaper regularly published and generally circulated in Travis County, Texas; on September 29, 2004, in the Colorado County Citizen, a newspaper regularly published and generally circulated in Colorado County, Texas; on October 10, 2004, in the Matagorda County Tribune, a newspaper regularly published and generally circulated in Bastrop County, Texas; on October 10, 2004, in the Bay City Tribune, a newspaper regularly published and generally circulated in Matagorda County, Texas; on October 1, 2004, in the Fayette County Record, a newspaper regularly published and generally circulated in Fayette County, Texas; on September 29, 2004, in the El Campo Leader-News, a newspaper regularly published and generally circulated in Wharton County, Texas; and on September 25, 2004, in the Bastrop Advertiser, a newspaper regularly published and generally circulated in Bastrop County, Texas. These counties are the only counties in which persons reside who may be affected by action taken by the Commission on the proposed amendments.

3) On September 14, 2004, notice of an application to amend the WMP and notice of the public meeting was sent by first-class mail to the water right holders of record in the Colorado River Basin as required by law.

4) On November 8, 2004, the Commission held a public meeting. One person presented oral comments, and five (5) entities provided written comments in opposition to the proposed amendments.

5) The following persons/entities filed protests and requested a contested case hearing with the Commission regarding the proposed amendments: STP Nuclear Operating Company; City of Austin; Texas Parks and Wildlife Department; Sierra Club, Lone Star Chapter; and the National Wildlife Federation.

6) The applicant, LCRA, has requested numerous editorial and organization changes to the WMP designed to correct errors, improved readability and achieve internal consistency in the documents. All of these proposed non-substantive amendments to the WMP are detailed in mark-ups of the existing approved WMP dated May 16, 2003, June 10, 2004,

April 29, 2005, March 1, 2006, April 24, 2009, November 25, 2009, and December 17, 2009, that were filed with Commission by the LCRA.

7) LCRA's proposed amendments to the WMP fall within four areas: curtailment policy for interruptible stored water supplies; allocation of stored water for environmental protection; incorporation of LCRA's Drought Contingency Plan into the WMP; and update of the WMP Appendices.

8) LCRA's proposed amendments to the WMP show the 2000 reported surface water demands by its firm customers from all sources of supply as approximately 296,600 acre-feet annually. The ten-year projected firm demands (through 2010), developed in 2000, were approximately 360,071 acre-feet per year - an increase of 63,471 acre-feet per year. The primary reason for this projected increase is additional water use around the Highland Lakes. Since LCRA filed its application in 2003, its obligations to provide firm supply to the STP Nuclear Operating Company (STPNOC) have been clarified in an Amended and Restated Contract which, among other things, obligates LCRA to provide no more than 20,000 acre-feet per year (rolling five-year average) of firm supply for up to two nuclear generating units and up to 40,000 acre-feet per year (rolling five-year average) of firm supply for more than two generating units, with staged deliveries based on STPNOC's reservoir level subject only to LCRA bay and estuary restrictions and according to a Water Delivery Plan. Contractual Permit No. 327A was issued by the Commission on August 31, 2009, based on the Amended and Restated Contract and the included Water Delivery Plan. The total estimated firm demands for all LCRA customers to be satisfied under this WMP are sufficient to address any additional firm demand that STPNOC might have in the timeframe for which these present amendments to the WMP are intended to be effective, after taking into consideration firm water allocated for environmental purposes.

9) With this large projected increase in firm water demand, and because firm water demands take priority over all other uses, LCRA requested the proposed amendments to the WMP to provide a compensating reduction in interruptible supplies. This reduction will be achieved by revising the annual interruptible water supply curtailment policy. LCRA's proposal to amend curtailment policy is as follows:

(a) If the total water in storage in either Lakes Buchanan or Travis is less than 94% on January 1 or June 1, then interruptible water supplies will not be made available to any customers located outside the four downstream irrigation operations (Pierce Ranch, Garwood, Gulf Coast, and Lakeside).

(b) If the total combined water in storage in Lakes Buchanan and Travis on January 1 is equal to or greater than 1,400,000 acre-feet, then LCRA will supply the interruptible stored water demands of the downstream four irrigation operations. This is based on the assumption that the maximum annual demand for the interruptible stored water acreage of 83,700 acres projected for 2010, under a 1 in 5 dry year condition, was 273,000 acre-feet. Using that as the greatest interruptible stored water demand, a set of smaller interruptible stored water supplies were assumed to generate a set

of first and second crop acreages expected to be cultivated by each particular irrigation operations.

(c) Curtailment of interruptible supply to the irrigation operations will commence when the total combined January 1 storage in Lake Buchanan and Travis is less than 1,400,000 acre-feet. When the combined storage in Lakes Buchanan and Travis on January 1 is between 1,400,000 acre-feet and 1,150,000 acre-feet, the interruptible stored water supply available will vary beginning at 273,000 acre-feet available at 1.4 million acre-feet of storage and decreasing at a rate of approximately 31,200 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 195,000 acre-feet available at a combined storage of 1.15 million acre-feet. When the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,150,000 acre-feet, the interruptible stored water supply made available to the irrigation operations will vary beginning at 195,000 acre-feet available at 1.15 million acre-feet of storage and decreasing at a rate of approximately 4,250 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 160,000 acre-feet available at a combined storage of 325,000 acre-feet. This curtailment is depicted in Figure 4-1 of the Water Management Plan.

(d) Cutoff of the interruptible stored water supply for any purpose for the coming year will occur when the combined storage in Lakes Buchanan and Travis on January 1 is less than or equal to 325,000 acre-feet.

(e) If at any time during the year the total storage in Lakes Buchanan and Travis, combined, is less than or equal to 200,000 acre-feet, then all use of interruptible stored water will be stopped.

(f) During any period of curtailment or cutoff of interruptible supplies to the irrigation operations that is instituted on January 1, LCRA will cancel such curtailment at any time during the year prior to July 31, if the combined storage in Lakes Buchanan and Travis is projected to be equal to or greater than 1,400,000 acre-feet anytime in July. Further, the remaining available interruptible stored water supplies for the year may be reallocated, at this time, between irrigation operations if such allocations do not adversely affect any irrigation operation.

(g) During periods of curtailment, LCRA will allow each irrigation operation the option of either: (1) using up to a maximum authorized volume of interruptible stored water allocated to that operation, or (2) using sufficient water to cultivate a level of acreage agreed upon among the customers within each irrigation operation and LCRA.

10) LCRA's proposed amendments to the WMP also include a change in the procedure for supplying water for instream flow needs at certain locations downstream of Lady Bird Lake.

(a) To the extent that inflows are legally available for storage in Lakes Buchanan and Travis, LCRA will release such inflows to help satisfy target instream flow needs, as set out in Table 2-1 of the WMP, whenever the combined water storage in Lakes Buchanan and Travis on January 1 is at or above 1,400,000 acre-feet.

(b) LCRA will make such releases from Lakes Buchanan and Travis as are needed to help maintain critical instream flows, as set out in Table 2-1 of the WMP, at certain locations downstream of Lady Bird Lake. The level of releases to help maintain critical instream flows will not be limited by the inflows that are legally available for storage in Lakes Buchanan and Travis.

(c) In rare instances, LCRA's ability to meet the instream flow requirements set forth in this WMP may be impaired by certain unavoidable constraints such as the capacity of its hydro-generation units and hydro-generation scheduling mandates as well as unforeseen diversions, unforeseen changes in flow conditions downstream, and adjustments to the ratings of the applicable gages.

11) LCRA's proposed amendments to the WMP include a change in the reservoir operation procedure for providing water for estuarine fresh water inflow needs. The proposed amendment adds an intermediate level of supply for estuarine freshwater inflows that provides for a slightly more gradual reduction of the supply made available to Matagorda Bay than contained in the previously approved WMP. LCRA is required to release water from Lakes Buchanan and Travis to help maintain monthly estuarine inflows in accordance with the following procedure only to the extent that inflows are legally available for storage in Lake Buchanan and Travis as measured at the upstream gages:

(a) when the combined storage in Lakes Buchanan and Travis on January 1 is greater than or equal to 1,700,000 acre-feet, LCRA will release those storable inflows up to but not exceeding the amount needed to provide target freshwater inflow needs; and

(b) when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,700,000 acre-feet and greater than 1,100,000 acre-feet, LCRA will release those storable inflows up to but not exceeding the amount needed to provide one hundred and fifty percent of the critical freshwater inflow needs; and

(c) when the combined storage in Lakes Buchanan and Travis on January 1 is equal to or less than 1,100,000 acre-feet, LCRA will release those storable

inflows up to but not exceeding the amount needed to provide critical freshwater inflows in all years.

12) The proposed amendments are deemed by LCRA as a balance between a modest incremental decrease in irrigation water supplies during drought conditions and modest increased inflow to Matagorda Bay during non-drought years to help maintain ecologically important freshwater inflows to the Bay.

13) Based on LCRA's determination of a balance of environmental and irrigation impacts, the recommended amendments to the WMP include an increase of stored water released for estuarine freshwater inflow. This increase would be provided in years when the January 1 storage level in Lakes Buchanan and Travis is between 1,100,000 and 1,700,000 acre-feet (55 and 86 percent full, respectively).

14) Among the issues raised in the hearing requests filed regarding the proposed amendments was the degree to which the amendments reflected consideration of the best information on environmental flow needs available at that time. While that issue remains in dispute, all parties agree that credible and extensive scientific information relating to environmental flow needs is available at this time that is not incorporated in this order, but should be considered in developing and implementing an updated version of the WMP in the near future. That credible scientific information includes but is not limited to the August 2006 Matagorda Bay Freshwater Inflow Needs Study; the October 10, 2008 Matagorda Bay Health Evaluation; the March 31, 2008 Lower Colorado River, Texas Instream Flow Guidelines; and data collected by LCRA, TPWD, TWDB, and other agencies and researchers.

15) During the critical drought, LCRA proposes that the total stored water provided for environmental protection remain essentially the same as provided under the previously approved WMP. However, LCRA's proposed amendments provide that more of this commitment be met with firm, rather than interruptible stored water. The firm stored water so designated would increase from 16,950 acre-feet to 33,440 acre-feet. This additional firm commitment would be provided from available, but uncommitted supplies from Lakes Buchanan and Travis.

16) The LCRA Drought Contingency Plan (DCP), as required by Commission rules (30 Texas Administrative Code §§ 288.20 *et seq.*), was approved by the LCRA Board of Directors and submitted to the Commission in April 2000. The 2000 DCP was based on Chapter 4 of the WMP. Under current Commission rules, the DCP must be updated every five years. The DCP filed by LCRA with the Commission in 2000 was updated and approved by the LCRA Board of Directors and submitted to the Commission in April 2005. Consistent with the requirements of Chapter 288 of the Commission rules, LCRA also reviewed its DCP prior to May 1, 2009, but did not make any further changes to the DCP at that time. In December 2009, the LCRA Board approved further modifications to the DCP to reflect customer comment received in response to recent severe drought conditions. LCRA has submitted redline changes to Chapter 4 of the WMP that incorporates these recent changes.

17) On March 29, 1996 the Commission issued an Order severing a portion of the water rights authorized by Certificate of Adjudication No 14-2564 and combining them with LCRA's Certificate of Adjudication No. 14-5478 (Lake Buchanan). Certificate of Adjudication 14-5478C was issued to LCRA on the same date and authorized LCRA to transfer 532 acre-feet of water downstream to Lake Buchanan and consumptively use 500 acre feet per year of this water. Because the priority date of the severed water was senior to LCRA's rights to divert water from Lake Buchanan, LCRA requested and was granted on March 4, 1999, an increase in the Combined Firm Yield of Lakes Buchanan and Travis from 535,812 acre-feet to 536,312 acre-feet.

18) On August 29, 2003, LCRA filed a request with the Commission to cancel Certificate of Adjudication 14-5478C and for the Commission to rescind the March 29, 1996 Order severing water rights from Certificate Adjudication 14-2564 and combining them with LCRA's water rights authorized by Certificate of Adjudication 14-5478. On March 22, 2004, LCRA filed a Request to Abandon Certificate of Adjudication 14-5478C. Based on the abandonment, LCRA proposes that the WMP be amended to reflect a Combined Firm Yield of 535,812 acre-feet of water, which is the amount of the Combined Firm Yield prior to the issuance of Certificate of Adjudication 14-5478C.

19) The WMP contains two appendices: Volume 1, which includes relevant LCRA Board policies, and Volume II, which contains technical information on the WMP and previous amendments. Changes to Volume I will reflect revisions made to LCRA Board polices since 1999. Changes to Volume II will reflect changes in agreements between LCRA and the Colorado River Municipal Water District, delete obsolete appendices, and update LCRA's standard form contracts and raw water contract rules.

20) LCRA supports this Order. In order to provide some certainty and to ensure prompt action on a new revision to the WMP, each of the parties identified in Finding of Fact No. 5 agree not to oppose the approval of this Order.

CONCLUSIONS OF LAW

1) The Commission considered this Order under the authority and in accordance with Chapter 11 of the Texas Water Code, as amended, and 30 Texas Administrative Code ("TAC") Chapter 295.

2) The Commission has jurisdiction to consider and take action on LCRA's application to amend the WMP.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY THAT:

1) LCRA's amended Water Management Plan is approved with the following conditions:

   a) LCRA's amended Water Management Plan is subject to all findings, conclusions, and conditions contained in the Commission's Order dated

September 20, 1989, December 23, 1991, December 18, 1992 and March 1, 1999, approving and amending the WMP, except to the extent that this Order specifically provides otherwise.

b) Notwithstanding any other provision in the revised Water Management Plan, for purposes of establishing LCRA's obligations to supply interruptible stored water for agricultural use within the four major irrigation operations and to provide water for instream flows and freshwater inflows in calendar year 2010, the following shall apply:

1. LCRA's obligations to provide water for instream flows and freshwater inflows in January 2010 shall be governed by the Water Management Plan in effect on January 1, 2010.

2. From February 1, 2010 through December 31, 2010, LCRA's obligations shall be governed by the WMP in effect on February 1, 2010. In providing interruptible stored water for agricultural use within the four major irrigation operations and in providing water for instream flows and freshwater inflows during this period, LCRA's obligations shall be determined based on the combined storage in Lakes Buchanan and Travis on February 1, 2010.

c) LCRA shall implement the provisions of the amended Water Management Plan regarding the provision of instream flows in a manner so as maintain, on an instantaneous basis, instream flows of 46 cfs and 500 cfs critical flows as set forth in Table 2-1 during the times those respective flow values are in effect. During those times when the target instream flow requirements as set forth in Table 2-1 of the WMP are in effect, LCRA will schedule the passage of inflows to lakes Buchanan and Travis that are legally available for storage to maintain the target flows as a daily average. Furthermore, during those times when target instream flow requirements are in effect and when such inflows are sufficient to allow LCRA to satisfy the daily target flow requirement at the Bastrop gage, LCRA will also schedule the passage of these inflows to maintain the following minimum flows, as measured at any time at the Bastrop gage:

Month	**Minimum Flow (cfs) 100% of the time**	**Minimum Flow (cfs) 95% of the time**
January	266	
February	269	
March	233	
April	244	287
May	492	579
June	355	418
July	295	347
August	165	

September	201	
October	208	
November	241	
December	264	

It is hereby recognized that, in rare instances, LCRA's ability to meet the instream flow requirements set forth in this WMP may be impaired by certain unavoidable constraints such as the capacity of its hydro-generation units and hydro-generation scheduling mandates as well as unforeseen diversions, unforeseen changes in flow conditions downstream, and adjustments to the ratings of the applicable gages.

d) For purposes of estimating required releases of water from Lakes Buchanan and Travis to meet the instream flow or freshwater inflow requirements of this WMP, LCRA shall rely on stage data obtained from the gaging system jointly maintained and operated by the U.S. Geological Survey and LCRA for determining these requirements. If the ratings used to convert stage to flow published by LCRA and the USGS are not identical at the time required releases are estimated, LCRA shall have discretion to rely on the latest updated rating of the gage.

e) The approval of the amended WMP does not reflect a final determination, or create a presumption, that the environmental flow provisions contained therein are adequate or appropriate based upon more recent information available at this time.

f) Because of the importance of updating the environmental flow and drought curtailment provisions of the WMP to reflect the best available science and information, LCRA shall promptly initiate, by not later than July 1, 2010, a revision process designed to develop further proposed amendments to the Water Management Plan. The revision process should be reasonably calculated to allow meaningful participation by interested basin stakeholder groups and to achieve regional consensus, where possible.

LCRA shall file an application for approval of proposed amendments with the Executive Director by not later than July 1, 2013. That application shall include a summary of the steps taken by LCRA to further public participation and to achieve consensus, where possible, in developing the proposed amendments. To the extent that the Executive Director determines such application is not administratively complete, LCRA shall make reasonable and good faith efforts to timely provide any additional information necessary to have the application declared administratively complete at the earliest possible time.

Those proposed amendments shall address, at a minimum, the following:

1. Interruptible curtailment procedures needed to ensure that LCRA can satisfy projected firm customer demand should intense drought conditions such as those experienced over the past several decades recur;

2. An evaluation of the adequacy of the criteria for declaring a drought worse than drought of record;

3. An evaluation of the minimum combined storage of water in Lakes Buchanan and Travis necessary or appropriate to protect firm customers through a repeat of the drought of record or under conditions worse than a drought of record;

4. Incorporation of appropriate changes to reflect LCRA's agreements and obligations to STPNOC under the Settlement Agreement and Amended and Restated Contract, including the Water Delivery Plan;

5. LCRA's agreement with the City of Austin regarding return flows, consistent with Section VIII(C)(1) of the Settlement Agreement by and between the City of Austin and the LCRA Regarding Joint Water Resource Management and the Resolution of Certain Regulatory Matters Pending at the TCEQ, dated June 18, 2007;

6. Revisions to provisions governing the manner in which LCRA provides water from Lakes Buchanan and Travis to address environmental flow needs that shall use the best available scientific information, including the information referenced in Finding of Fact 15, and shall provide water for such needs to the maximum extent reasonable and practicable when considering all public interests as set forth in Texas Water Code §11.147 and any applicable environmental flow standards adopted pursuant to Texas Water Code § 11.1471. Such revisions shall include:

    i. a mechanism for adjusting the manner in which LCRA provides water for environmental flow needs that addresses significant improvements in storage conditions during the course of a year;

ii. a mechanism for limiting harmful intra-daily fluctuations of instream flows to prevent significant adverse impacts from periods of low flows; and

iii. specification, to the maximum extent reasonable, of an overall instream flow regime.

The Commission hereby directs the Executive Director's staff to make all reasonable efforts to complete its technical review of the application for proposed amendments to the Water Management Plan by not later than one year after the date of LCRA's application is declared administrative complete and, as part of that staff review process, to allow other interested persons who request the opportunity to do so to submit, consistent with the timeline established by Commission staff, information regarding environmental flow issues and other issues addressed by the amendments for consideration. To facilitate the prompt completion of the technical review, LCRA shall respond fully to all requests from the Executive Director's staff for additional information within 30 days after receipt of those requests unless otherwise agreed upon by the Executive Director's staff. Upon completion of the technical review, the application and associated hearing requests, if any, on that application will be given high priority and set for prompt consideration and action by the Commission.

g) Consistent with 30 Tex. Admin. Code Ch. 288, LCRA shall review and update, as appropriate, in accordance with the schedule required by such rules, those portions of Chapter 4 that relate to its Drought Contingency Plan (DCP) that do not change the triggers or amount of curtailment of interruptible supply or the triggers related to instream flows and bay and estuary inflows. Changes to other portions of the DCP, including any changes to LCRA's specific, quantified targets for water use reductions of firm customers required by chapter 288, do not constitute an amendment to the Water Management Plan requiring notice and an opportunity for contested case hearing, but must otherwise comply with the public notice requirements of Chapter 288 of the Commission's rules. Prior to implementing any mandatory firm water customer curtailment allowed under Texas Water Code section 11.039, LCRA shall work with its firm customers to develop a specific water curtailment plan, which must be approved by the LCRA Board and the Commission pursuant to other applicable procedures.

h) Nothing in this Order shall be construed to impair or limit any party's right to contest the LCRA's proposal for incorporating the results of existing or future freshwater inflow or instream flow studies in any future proceedings relating to amendments of the Water Management Plan.

i) Nothing in this Order, other than Findings of Fact 17 and 18, shall be construed as addressing the calculation of the combined firm yield of Lakes Buchanan and Travis and no party shall be deemed to have waived the right to contest in any future proceeding the calculation of the combined firm yield of Lakes Buchanan and Travis solely as a result of this Order.

j) The Commission acknowledges the challenges to the adequacy of the environmental flow provisions included in the proposed amendments to the Water Management Plan previously raised by the Texas Parks and Wildlife Department, National Wildlife Federation, and the Lone Star Chapter of the Sierra Club. Those parties have agreed that compliance by LCRA with the provisions of this Order would eliminate the need for a Commission proceeding to resolve those challenges. However, in the event that LCRA fails to meet any requirement set out in decretal paragraph (f) above, the Commission expressly recognizes that the issues raised by those challenges will again require consideration. Accordingly, any of those parties may, if it has reason to believe LCRA has failed to meet any such requirement, file, with the Office of the Chief Clerk, a written request seeking a hearing on the adequacy of environmental flow provisions approved by this Order and detailing the alleged failure by LCRA to comply with the requirements of decretal paragraph (f). Any such hearing request shall be set for prompt consideration by the Commission and, subject to compliance with routine requirements for hearing requests, shall be granted unless the Commission determines that LCRA has fully complied with the requirements of decretal paragraph (f).

k) LCRA agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the approval of the proposed amendments.

l) LCRA shall conform the text of the Water Management Plan to be consistent with the provisions of this Order.

2) The Chief Clerk of the Texas Commission on Environmental Quality shall forward a copy of this Order, to all parties.

3) If any part of this Order held to be invalid, the invalidity of any portion shall not affect the validity of the remainder of the Order.

4) Nothing in LCRA's Water Management Plan, as amended, or this Order shall be construed to impair, or to authorize LCRA or any other person or entity to impair, senior or superior water rights in the Colorado River Basin.

_____

For the Commission

DATE ISSUED

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Steve Ramos, Application Manager
Water Rights Permitting Team

September 30, 2009

Through: Lann Bookout, Team Leader
Surface Water Availability & Interstate Compacts Team

From: Kathy Alexander, Hydrologist
Surface Water Availability & Interstate Compacts Team

Subject: Lower Colorado River Authority
WRPERM 5838
CN600253637
Colorado River, Colorado River Basin
San Saba, Llano, Lampasas, Burnet, Blanco, Travis, Bastrop, Fayette, Wharton, Matagorda, and Colorado Counties

WATER AVAILABILITY REVIEW

Application Summary

The Water Management Plan for the Lower Colorado River Basin (WMP) defines the Lower Colorado River Authority's (LCRA) water management programs and policies in accordance with the Final Order of Adjudication of the water rights for the Lower Colorado River Authority, the Enabling Act of the Lower Colorado River Authority, General Law of the State of Texas, particularly the Texas Water Code, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482, and the water policies of the LCRA's Board of Directors. Revisions to the WMP were last approved by the Commission in 1999.

LCRA requested numerous organizational changes to the existing WMP designed to correct errors, improve the readability, and achieve internal consistency of the document. The substantive changes to the 1999 WMP fall within four areas:

- Curtailment policy for interruptible stored water supplies.

  The 1999 WMP projected the ten-year future firm demands (through 2005) to be 230,000 acre-feet per year. Based on the analyses performed for Regional Planning purposes, the new projected ten-year demands (through 2010) are projected to be 285,000 acre-feet per year. Pursuant to the WMP, firm demands take precedence over all other uses, therefore the proposed amendment to the WMP requests a reduction in interruptible supplies to compensate for the increase in firm water demand. The reduction is achieved by revising the annual interruptible water supply curtailment policy. Curtailment of interruptible supply will begin when the combined storage in Lake Buchanan and Travis reaches 1.4 million acre-feet instead of the current 1.1 million acre-feet

- Allocation of stored water for environmental protection

  LCRA's proposed amendments to the 1999 WMP provide for an intermediate release schedule for freshwater inflows to Matagorda Bay. Under the 1999 WMP, releases for freshwater inflows were reduced to meet critical needs, to the extent of storable inflows, when the combined storage in Lakes Travis and Buchanan was below 1.7 million acre-feet on January 1st. The proposed revisions would allow a gradual curtailment by reducing releases for freshwater inflows to meet 150% of critical needs when the combined storage in Lakes Travis and Buchanan were between 1.7 and 1.1 million acre-feet on January 1st. This will allow for a more gradual reduction during low flow years. The proposed amendments represent a balance between a modest incremental decrease in irrigation water supplies during drought conditions and a modest increase in inflows to Matagorda Bay during non-drought years to help maintain the ecological health of the bay. This balance between environmental and irrigation impacts includes an increase of stored water released for freshwater inflow during years when the combined storage in the Highland Lakes is between 1.1 million and 1.7 million acre-feet of water (55% and 86% of full capacity, respectively).

  During critical drought times, LCRA proposes that the total stored water provided for environmental flows remain essentially the same as under the 1999 WMP. The proposed amendment to the WMP does provide that more of the environmental commitment be met with firm, rather than interruptible, stored water. The firm water commitment would increase from 16,950 acre-feet to 33,440 acre-feet on an average basis over the critical drought and would be provided from available but uncommitted supplies from the Highland Lakes.

- Incorporation of LCRA's Drought Contingency Plan into the WMP

- Update of Appendices

No Injury Analysis

The request to update the Appendices does not require review by Hydrology staff. The request to incorporate the Drought Contingency Plan into the WMP also does not require review except insofar as the Drought Contingency Plan relates to water curtailment policies. However, the requests to alter the curtailment policy and to change the amount of water allocated to the environment are subject to review by Hydrology staff because of the potential impacts of these changes on other water rights and available river flows. Resource Protection staff had no specific recommendations for the application.

Staff reviewed the proposed changes to the WMP using the Full Authorization Simulation of the TCEQ Water Availability Model for the Colorado River Basin (Colorado WAM or WAM), which includes all water rights at their fully authorized amounts, provisions of the WMP that affect water availability for basin rights and does not include return flows. The period of record for the Colorado WAM is 1940 to 1998.

Using the Full Authorization Simulation of the Colorado WAM, staff created a baseline simulation that did not include the previously modeled provisions of the WMP and modeled LCRA's rights under Certificates 14-5482 and 14-5478 as a diversion of 1,500,000 acre-feet of water from the combined storage in Lakes Buchanan and Travis. Staff also updated the current version of the Colorado WAM, which includes provisions of the 1999 WMP to include the changes in curtailment policy and allocation of water for the environment which were requested in this application to amend the WMP.

Staff used a comparison of model results from the different simulations to evaluate the effects of the proposed changes on water rights and river flows. Volume reliability is defined as the percentage of the total demand that is actually supplied. The impact on volume reliability is calculated by summing the percentage difference between the volume reliabilities for each individual water right authorization for the different simulations and calculating an average. Staff's review indicates that between the baseline condition and the 1999 WMP, volume reliabilities of basin rights were generally improved. Thirty eight water rights showed reductions in volume reliability, with an average reduction of 0.47%. Seven hundred and sixty eight water rights showed increases in volume reliability, with an average increase of 3.2%. Between the baseline condition and the 2003 WMP, volume reliabilities of basin rights were also generally improved. Sixty one water rights showed decreases in volume reliability, with an average decrease of 3.4%. Seven hundred and sixty eight water rights showed increases in volume reliability, with an average increase of 15%.

With respect to flows downstream of Lakes Travis and Buchanan, staff compared the frequency of occurrence of modeled WMP environmental flow requirements at various control points. (Note that there were no changes at Bastrop between the four conditions so these flows were not included in the table below)

Table 1. Frequency that Monthly Instream Flow Requirements are Equalled or Exceeded

Location	Natural Flows	Without WMP	1999 WMP	2003 WMP
46 cfs at Austin	100%	92%	100%	100%
75 cfs at Austin	100%	86%	99%	99%
100 cfs at Austin	100%	80%	99%	99%
Target Flows at Columbus	98%	76%	91%	92%
Target Flows at Wharton	99%	61%	90%	90%

Table 2. Frequency that Annual Freshwater Inflows Equal or Exceed Natural Conditions

Annual Natural Flow Condition	Without WMP	1999 WMP	2003 WMP
25th Percentile (1,731,801 acre-feet)	5.1%	15.2%	15.2%
50th Percentile (2,668,280 acre-feet)	1.7%	3.3%	3.3%
75th Percentile (3,588,540 acre-feet)	1.7%	3.3%	3.3%

The LCRA measures inflows to the Highland Lakes as they occur and applies the requirements of the WMP with respect to downstream water rights and environmental flow requirements. This application does not request to amend the WMP with respect to passing water downstream for senior water rights nor does it request to amend existing instream flow or freshwater inflow numbers. LCRA only requested that an intermediate trigger be added for reduction in supplies of interruptible water and release of inflows to Matagorda Bay. In addition, LCRA proposed to meet more of the environmental demand with firm rather than interruptible water. LCRA would still have to comply with existing provisions of the WMP regarding downstream senior water rights and releases or pass through of water from the Highland Lakes for environmental purposes. Because of this, staff is of the opinion that the impacts on other water rights, as reflected in the WAM simulations, do not

represent a practical impact on other basin water rights or downstream river flows.

Conclusion

Based on the No Injury Analysis, staff can support granting the 2003 amendments to the LCRA Water Management Plan.

Kathy Alexander, Hydrologist

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Steve Ramos, Project Manager **Date:** September 24, 2009
Water Rights Team
Water Rights Permitting & Availability Section

Through: CL Chris Loft, Team Leader
9/28/09 Resource Protection Team
Water Rights Permitting & Availability Section

GE Gregg Easley, Aquatic Scientist
9/24/09 Resource Protection Team
Water Rights Permitting & Availability Section

From: JD Justin Degrate, Aquatic Scientist
9-24-09 Resource Protection Team
Water Rights Permitting & Availability Section

Subject: Lower Colorado River Authority-Management Plan
CN600253637
Water Right Application No. 5838
Lower Colorado River Basin

Environmental reviews of water right applications are conducted in accordance with §11.042, §11.147, §11.1491, §11.150, and §11.152 of the Texas Water Code and with Texas Commission on Environmental Quality (TCEQ) administrative rules which include 30 TAC §297.53 through §297.56. These statutes and rules require the TCEQ to consider the possible impacts of the granting of a water right on fish and wildlife habitat, water quality, and instream uses associated with the affected body of water. Possible impacts to bays and estuaries are also addressed.

ENVIRONMENTAL ANALYSIS

The Lower Colorado River Authority (LCRA) seeks to amend their existing Water Management Plan (WMP). The WMP for the Lower Colorado River Basin defines the LCRA's water management programs and policies in accordance with the Final Order of Adjudication of the water rights for the LCRA, the Enabling Act of the LCRA, General Law of the State of Texas, particularly the Texas Water Code, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482, and the water policies of the LCRA's Board of Directors. Revisions to the WMP were last approved by the Commission in 1999.

LCRA requested numerous organizational changes to the existing WMP designed to correct errors, improve readability, and achieve internal consistency of the document. The substantive changes to the 1999 WMP fall within the following areas:

- Curtailment policy for interruptible stored water supplies.

  Based on the analyses performed for Regional Planning purposes, the new projected ten-year demands (through 2010) are projected to be 285,000 acre-feet per year. Pursuant to the WMP, firm demands take precedence over all other uses, therefore the proposed amendment to the WMP requests a reduction in interruptible supplies to compensate for the increase in firm water demand. The reduction is achieved by revising the annual interruptible water supply curtailment policy. Curtailment of interruptible supply will begin when the combined storage in Lake Buchanan and Travis reaches 1.4 million acre-feet instead of the current 1.1 million acre-feet.

- Allocation of stored water for environmental flows

  LCRA's proposed amendments to the 1999 WMP provide for an intermediate release schedule for freshwater inflows to Matagorda Bay. Under the 1999 WMP, releases for freshwater inflows were reduced to meet critical needs, to the extent of storable inflows, when the combined storage in Lakes Travis and Buchanan was below 1.7 million acre-feet on January 1st. The proposed revisions would allow a gradual curtailment by reducing releases for freshwater inflows to meet 150% of critical needs when the combined storage in Lakes Travis and Buchanan were between 1.7 and 1.1 million acre-feet on January 1st. This will allow for a more gradual reduction during low flow years. The proposed amendments are deemed by LCRA as a balance between a modest incremental decrease in irrigation water supplies during drought conditions and a modest increase in inflows to Matagorda Bay during non-drought years to help maintain the ecological health of the bay. This balance between environmental and irrigation impacts includes an increase of stored water released for freshwater inflow during years when the combined storage in the Highland Lakes is between 1.1 million and 1.7 million acre-feet of water (55% and 86% of full capacity, respectively).

  During critical drought times, LCRA proposes that the total stored water provided for environmental flows remain essentially the same as under the 1999 WMP. The proposed amendment to the WMP does provide that more of the environmental commitment be met with firm, rather than interruptible, stored water. The firm water commitment would increase from 16,950 acre-feet to 33,440 acre-feet on an average basis over the critical drought and would be provided from available but uncommitted supplies from the Highland Lakes.

- Incorporation of LCRA's Drought Contingency Plan into the WMP

- Update of Appendices

Instream Uses staff reviewed the proposed changes to the WMP. In addition to the changes described above, the proposed changes include textual changes within the WMP document. These changes within the plan do not affect to a significant degree how LCRA would manage the Highland Lakes system in the future. However, Instream staff has the following concerns:

- The 1999 WMP recommends that flows be maintained at or above 500 cfs at Bastrop for a continuous period of not less than six weeks during the months of March, April and May for the Blue Sucker (*Cycleptus elongates*). The proposed revisions to the WMP recommend a mean daily flow of 500 cfs. In the application, LCRA acknowledges that the 500 cfs flow requirement should be recorded and monitored as an instantaneous flow requirement during that six-week period for daily operation purposes. Staff has concerns that allowing flows to drop below 500 cfs in a given day could adversely impact Blue Sucker spawning. However, studies of aquatic habitats in the Lower Colorado River are ongoing and these studies should be considered in future amendments to the WMP.

- The proposed revisions to the WMP indicate that LCRA may not be able to guarantee the instantaneous minimum flow requirement of 46 cfs at the Austin gage below Longhorn Dam. The application states that LCRA is pursuing an agreement with the City of Austin to avoid pulsed discharges. Staff has concerns that allowing flows to drop below 46 cfs could affect water quality.

- The 1999 WMP did not include critical instream flow requirements below the Bastrop gage. The proposed revisions to the WMP extend a 120 cfs critical flow requirement to the reach extending from Bastrop to Eagle Lake. The application states that the flows in this reach were extended to protect spawning habitat, noting that one of the most extensive rock outcrops between Austin and the Gulf of Mexico was located in the Eagle Lake Reach. The application states that this reach appears to provide significant spawning habitat for the Blue Sucker. The application further states that the 120 cfs flow requirement was extended based on the best information available and included water quality considerations. However, studies of aquatic habitats in the Lower Colorado River are ongoing and these studies should be considered in future amendments to the WMP.

- The proposed changes to the WMP include a recommended change in the reservoir operation procedure for providing water for freshwater inflow needs. This change adds an intermediate level of flows that results in a more gradual reduction of freshwater inflows. However, studies of freshwater inflows to Matagorda Bay are ongoing and these studies should be considered in future amendments to the WMP.

SUMMARY

The LCRA seeks to amend their existing Water Management Plan. Revisions to the plan were last approved by the TCEQ in 1999.

In staff's opinion, despite the concerns raised above, there are no complete or definitive studies that would indicate that the proposed changes to the Water Management Plan will result in a greater net adverse impact to the environment than under the existing Water Management Plan. Therefore, staff has no specific recommendations for this application. However, in future revisions of the Water Management Plan, the Lower Colorado River Authority should consider all information from ongoing studies within the basin.

This instream use assessment was conducted using current TCEQ operation procedures and policies and available data and information. Authorizations granted to the permittee by the water rights permit shall comply with all rules of the TCEQ, and other applicable State and Federal authorizations.

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Steve Ramos, Project Manager
Water Rights Permitting Team
Water Supply Division

Date: September 21, 2009

Thru: Christopher Loft, Team Leader CL 9/22/09
Resource Protection Team
Water Supply Division

Kristin Wang, Senior Water Conservation Specialist KW 9/21/09
Resource Protection Team
Water Supply Division

From: E. Scott Swanson, Water Conservation Specialist
Resource Protection Team
Water Supply Division

ESS 9/21/09

Subject: Lower Colorado River Authority Water Management Plan

The Lower Colorado River Authority (LCRA) seeks amendments to its Water Management Plan (WMP). A major substantive proposed amendment is the incorporation of the 2005 LCRA Drought Contingency Plan into the WMP.

The 2005 LCRA Drought Contingency Plan was reviewed and found to be administratively complete per 30 TAC Chapter 288.22.

The request is consistent with the approved January 2006 Region K Plan and the approved 2007 State Water Plan.

No further review is required by the Water Conservation Staff of the Resource Protection Team.

DEDICATION

This revision of LCRA's Water Management Plan
is dedicated to Dr. Quentin W. Martin (1946-2003).

TABLE OF CONTENTS

Chapter **Page**

PREFACE
A. Background P-1
B. Executive Summary P-2
C. Definitions P-11

Chapter 1 INTRODUCTION TO THE WATER MANAGEMENT PLAN
A. Goals of the Water Management Plan 1-1
B. LCRA Act 1-2
C. LCRA Water Resources Management – History and Guiding Principles 1-4
D. LCRA's Comprehensive Water Policy Review and Public Stakeholder Process 1-5
E. Organization of the WMP 1-6

Chapter 2 MANAGING THE SYSTEM AMONG COMPETING DEMANDS
A. Water Quality Issues and Demands 2-2
B. Flood Control Responsibilities 2-4
C. Water Supply 2-5
D. Water Demand 2-6

Chapter 3 DEVELOPMENT OF THE WATER MANAGEMENT PLAN
A. Introduction – The Significance of the Combined Firm Yield of Lakes Buchanan and Travis 3-2
B. Commitments Against Combined Firm Yield of Lakes Buchanan and Travis 3-2
C. Annual Allocation of Firm and Interruptible Stored Water 3-6
D. Summary of LCRA's Water Conservation Plan and Programs 3-12

Chapter 4 DROUGHT MANAGEMENT PLAN AND DROUGHT CONTINGENCY PLAN
A. Introduction 4-2
B. Water Users and Interest Groups 4-6
C. Projected 2010 Surface Water Demands During Droughts 4-9
D. Projected Water Supplies 4-18
E. Water Curtailment Policies 4-21
F. Annual Implementation of Drought Management and Drought Contingency Plans 4-39

Chapter 5 DETERMINATION OF THE COMBINED FIRM YIELD
A. Requirement of LCRA's Water Rights for Lakes Buchanan and Travis 5-2
B. Reservoir Operations Models 5-2
C. Downstream Senior Water Rights in the Lakes Buchanan and Travis Combined Firm Yield Model 5-6
D. Passage of Daily Reservoir Inflows in the Lakes Buchanan and Travis Combined Firm Yield Model 5-19

E. Operation of the Reservoir System in the Lakes Buchanan and Travis Combined Firm Yield Model 5-31

Chapter 6 SUMMARY OF LCRA'S WATER OPERATIONS SYSTEM
A. Introduction 6-1
B. Hydrometeorological Data Acquisition System 6-1
C. Hydrologic Models 6-1
D. Standard Operating Procedures for Lakes Buchanan and Travis 6-2

Tables

Table P-1 Drought Contingency Plan Summary P-9
Table 2-1 Schedule of Critical and Target Flows for the Colorado River Downstream of Austin 2-17
Table 2-2 Target and Critical Freshwater Inflow Needs for the Matagorda Bay System From the Colorado River 2-23
Table 3-1 Existing Firm Water Commitments as of April 2003 3-6
Table 3-2 Conservation Base Acreage or Other Priority Allocation of Interruptible Stored Water 3-9
Table 3-3 Maximum Interruptible Stored Water Available for Sale, Exclusive of Sales for the Conservation Base or Priority Allocation Acreage of the Four Irrigation Operations 3-11
Table 4-1 Major Water Rights and Authorized Rights in the Lower Colorado River Basin 4-4
Table 4-2 Reported 2000 and Projected 2010 Annual Firm Surface Water Demands Under Drought Conditions 4-11
Table 4-3 Reported Year 2000 and Projected Acreage and Surface Water Demands for Irrigation 4-15
Table 5-1 Downstream Water Rights Senior to the Highland Lakes 5-9
Table 5-2 Monthly Distribution of Annual City of Austin Return Flow, Calendar Years 1978-1987 5-13
Table 5-3 Monthly Return Flows for the City of Austin Adjusted for Historical Return Flows 5-13
Table 5-4 Downstream Reach Definition 5-14
Table 5-5 Daily Flow Routing Coefficients 5-15
Table 5-6 Modeled Reach Demands 5-18
Table 5-7 Summary of Downstream Flow Rate Simulation 5-25
Table 5-8 Total Diversion Demands for Senior Water Rights Below Mansfield Dam to be Met from Pass Throughs or Reservoir Inflows 5-26
Table 5-9 Simulated Monthly Senior Water Rights Diversions from Reservoir Inflows 5-27
Table 5-10 Simulated Monthly Channel Losses Satisfied by Reservoir Pass Throughs 5-28
Table 5-11 Simulated Monthly Flows Past Bay City from Reservoir Pass Throughs 5-29
Table 5-12 Simulated Monthly Storable Inflows 5-30
Table 5-13 Combined Firm Yield for Certificates 14-5478 and 14-5482 5-31
Table 5-14 Summary of LCRA's Highland Lake Water Rights 5-33
Table 5-15 Lake Travis Annual Demand Distribution (%) 5-35
Table 5-16 Highland Lakes Operations Simulation 5-37

Table 5-17 Highland Lakes Allowable Operations Contents 5-37
Table 6-1 Standard Operating Levels for the Highland Lakes 6-3

Figures

Figure 1-1 LCRA Water Service Area as of January 1, 2003 1-3
Figure 2-1 Major Tributary Streams, Passes and Bays in the Lavaca-Colorado Estuary 2-20
Figure 2-2 Process for Determining Freshwater Inflow Needs 2-22
Figure 4-1 Interruptible Stored Water Allocation During Curtailment 4-26
Figure 4-2 Simulated Irrigated Acreage (4 Irrigation Operations Combined) 4-40
Figure 4-3 Simulated Gulf Coast Acreage 4-41
Figure 4-4 Simulated Lakeside Acreage 4-42
Figure 4-5 Simulated Garwood Acreage 4-43
Figure 4-6 Simulated Pierce Ranch Acreage 4-44
Figure 4-7 Simulated Travis and Buchanan Storage Conditions 4-45
Figure 4-8 Lake Buchanan Simulated Elevation and Storage 4-46
Figure 4-9 Lake Travis Simulated Elevation and Storage 4-47
Figure 5-1 Highland Lakes Region 5-4
Figure 5-2 Municipal Daily Demand Distribution 5-10
Figure 5-3 Irrigation Daily Demand Distribution 5-11
Figure 5-4 Location of Stream Gages and Diversion Points for Routing of Reservoir Releases 5-16
Figure 5-5 Simulation of Downstream Flow Rate Decreases 5-21
Figure 6-1 Hydrologic Models 6-3

Volume I Appendices

A. LCRA Board Policies
- A1. Policy 501 Water Resources Management
- A2. Policy 503 Lowering LCRA Operated Lakes
- A3. Policy 507 Water Quality Leadership
- A4. Policy 508 Water Pricing
- A5. Policy 509 Water Conservation

B. B1. Corps of Engineers Flood Control Regulations Governing Releases from Mansfield Dam
B2. Agreement between LCRA and the Federal Emergency Management Agency

C. Order Approving LCRA's Water Management Plan and Amending Certificate of Adjudication Nos. 14-5478 and 14-5482, dated September 20, 1989

D. Order Approving LCRA's Drought Management Plan, dated December 23, 1991

E. Agreed Order Approving Amendments to LCRA's Water Management and Drought Management Plan, dated December 18, 1992

F. Order Approving Amendments to LCRA's Water Management Plan Including Its Drought Management Plan, dated March 1, 1999

Volume II Appendices

1A. Final Judgment and Decree – Texas Water Commission

1B. Documents Reflecting Agreement between LCRA and the Colorado River Municipal Water District regarding O.H. Ivie Reservoir

2A. Technical Data on LCRA's Dams
2B. Highland Lakes Monthly Net Evaporation Rates
2C. Highland Lakes Firm Yield Output
2D. Stacy Reservoir Firm Yield Output
3. LCRA Water Contract Rules and Firm Water Contract

VOLUME 1

WATER MANAGEMENT PLAN
FOR THE LOWER COLORADO RIVER BASIN

PREFACE

A. Background P-1
B. Executive Summary P-2
1. Legal Authority P-2
2. Summary of Water Management Plan P-3
a. Key Elements of the Water Management Plan P-3
b. Key Elements of the Drought Management and Drought Contingency Plans P-6
C. Definitions P-11

A. Background

The "business" of water resources management in Texas, and throughout the nation, is in the midst of transition and transformation. The transition is largely the result of ever increasing demands and competition for renewable but limited water supplies and a growing awareness of the limits of "traditional" water supply management strategies. Additionally, the spectra of long-range shifts in global climatic patterns have injected a new element of uncertainty in water resources planning and management. Clearly, the past may no longer be a valid guide to the future.

In response to new challenges and uncertainties, it is imperative that water management institutions, at all levels, adopt a balanced, flexible, and feasible approach that gives due weight to all the conflicting demands on the water, including the heavy economic dependence of the farmers on historic uses of irrigation water, rapidly emerging public interest in recreation, and environmental values. The challenge is to recognize both the historic uses and the forces of change, transform emerging problems into new opportunities, and guide the institutions of water resources management toward a new era where clean water in Central Texas is recognized as a scarce commodity.

On April 20, 1988 Judge J. F. Clawson of the 264th Judicial District of Bell County, Texas, signed the Final Judgment and Decree relating to LCRA's and the City of Austin's respective water rights. (See Appendix 1A, Volume II).[1] This settlement was the product of a long series of negotiations among LCRA, the City of Austin, and the Texas Water Commission (TWC), predecessor agency of the Texas Commission on Environmental Quality (TCEQ).

[1] The Appendices for Volume II of the Water Management Plan are also being updated at this time.

Under the Final Judgment and Decree, LCRA was granted the right to use 1,500,000 acre-feet annually from Lakes Buchanan and Travis. As part of this settlement LCRA was required to determine the Combined Firm Yield of both Lakes Buchanan and Travis. An interim level of Combined Firm Yield of 500,000 acre-feet was established by the Texas Water Commission (TWC) (predecessor to TCEQ) with an understanding that LCRA would establish the basis for the Combined Firm Yield calculation and submit it to the TWC. The amount of water available for use in excess of the Combined Firm Yield is considered interruptible water and may be sold only on an interruptible basis subject to annual availability and certain rules and conditions required by the TWC.

The purpose of this document, Water Management Plan for the Lower Colorado River Basin (WMP), is to define LCRA's water management programs and policies in accordance with these requirements.

The WMP is not a static document. As LCRA's blueprint for its operation of the Lakes Buchanan and Travis, the WMP is periodically revised to reflect changes in water demands. The last revision was completed by LCRA in February 1997 and approved by the Texas Natural Resources Conservation Commission (TNRCC) (predecessor to TCEQ) in 1999 (herein referred to as the 1999 WMP). The present revision was submitted to TCEQ in May 2003 and approved by TCEQ on _____. The most notable changed condition over the last five years has been a significant increase in projected municipal and industrial (firm) water demands. With this large projected increase in firm water demand, the WMP must be adjusted to give a compensating reduction in the interruptible stored water supplies available since firm water demands take priority. This reduction will be achieved by revising the annual interruptible stored water supply curtailment policy adopted in this WMP. Revisions to the WMP require approval by LCRA's Board of Directors, followed by approval by the TCEQ. Such revisions become amendments to LCRA's water rights for Lakes Buchanan and Travis.

The allocation of water to various types of use in the WMP is also reviewed on an annual basis by LCRA. LCRA will continue to provide to the TCEQ an Annual Report on or before March 1.

B. Executive Summary

1. Legal Authority

The legal authority underlying the development of the WMP is derived from four principal sources:

(1) The Final Order of Adjudication of the water rights of the Lower Colorado River Authority;
(2) The Enabling Act of the Lower Colorado River Authority;
(3) General law of the State of Texas, particularly the Texas Water Code; and
(4) The water policies of the Lower Colorado River Authority Board of Directors.

In combination, the authorities establish and define LCRA's responsibility to develop and implement a WMP. In particular, the final adjudication of LCRA's water rights includes provisions relating to

the manner in which LCRA will manage the Highland Lakes and the Colorado River above and below the Highland Lakes and directed LCRA to prepare and submit a proposed WMP to the Texas Water Commission, predecessor agency to the TCEQ. This document was initially developed and is periodically revised by LCRA pursuant to that directive.

2. Summary of Water Management Plan

a. Key Elements of the Water Management Plan

The key elements of the WMP include the following:

(1) Lakes Buchanan and Travis and the Colorado River will be managed together as a single system for water supply purposes.

(2) LCRA will manage the system to maximize the beneficial use of water derived from inflows below the Highland Lakes.

(3) LCRA will manage the system to stretch and conserve the waters stored in Lakes Buchanan and Travis.

(4) All demands for water from the Colorado River downstream of Lakes Buchanan and Travis should be satisfied to the extent possible by run-of-river flows of the Colorado River.

(5) Inflows should be passed through Lakes Buchanan and Travis to honor downstream senior water rights only when those rights cannot be satisfied by the flow in the river below the Highland Lakes.

(6) The firm, uninterruptible commitments of water from Lakes Buchanan and Travis should not exceed the Combined Firm Yield.

(7) The water from Lakes Buchanan and Travis will be available on an interruptible basis as long as LCRA's ability to meet the demand for firm water is not impaired.

(8) Water shall not be released through any dam solely for hydroelectric generation, except during emergency shortages of electricity, and during other times that such releases will be needed for another beneficial purpose.

(9) Competing demands on the system include water quality matters, flood control, water supply, recreation and tourism, hydroelectric power, instream flows and bays and estuaries.

(10) The Combined Firm Yield of Lakes Buchanan and Travis is determined to be 535, 812 acre-feet, including that portion allocated to O.H. Ivie Reservoir, which is owned and operated by the Colorado River Municipal Water District.

(11) To supply existing firm water commitments, including commitments to the environment as proposed herein and the allocation of firm water to O. H. Ivie Reservoir, during a repetition of the critical drought would require an average of 442,350 acre-feet per year to be released, diverted, or otherwise committed from storage in Lakes Buchanan and Travis.

(12) LCRA's Board of Directions has reserved 50,000 acre-feet of the remaining Combined Firm Yield of Lakes Buchanan and Travis for the future needs within LCRA's 35-county water service area, particularly those areas now using ground water supplies that are becoming depleted or are of poor water quality.

(13) The four downstream irrigation operations (Gulf Coast, Lakeside, Garwood and Pierce Ranch) will have first priority for all the interruptible stored water in the annual allocation process to the extent of their Conservation Base acreage or Priority Allocation acreage, whichever applies.

(14) In recognition of the importance of recreation and tourism demands, additional sales of interruptible stored water, other than for the four irrigation operations pursuant to a semiannual allocation, will be limited based on the volume of water in Lakes Buchanan and Travis. The supply of interruptible stored water available for the January through June period will be based on the January 1 storage levels in Lakes Buchanan and Travis taken separately. The supply for the July through December period will be based on the minimum of the maximum storage levels in April, May and June in Lakes Buchanan and Travis taken separately. No sales will occur if either lake is less than 94% of its maximum conservation capacity. If both lakes are at their maximum conservation capacity as calculated above for either six-month period then such interruptible stored water sales will be limited to a total of 30,000 acre-feet for that year. For projected lake volumes between 94% and 100% of conservation capacity, such interruptible stored water sales will be limited proportionately, based on the storage reservoir with the lowest percentage of capacity on January 1 as calculated above.

(15) Instream flow needs will be met by the release of stored water from Lakes Buchanan and Travis to maintain the daily river flows at no less than the critical instream flow needs in all years. Daily river flows will be maintained at the target instream flow needs in those years when the four major irrigation operations are not curtailed, to the extent of inflows each day to the Highland Lakes as measured at the upstream streamgages. Releases of stored water will be a combination of firm and interruptible water supplies. Firm stored water will be supplied in years when the four major

irrigation operations' interruptible stored water supplies are curtailed. Interruptible stored water will be supplied in all other years. Total commitments of the Combined Firm Yield from Lakes Buchanan and Travis for instream flow maintenance will be an average of 27,380 acre-feet per year, with a maximum of:

(a) 51,100 acre-feet in any one year;
(b) 85,700 acre-feet in any two consecutive years;
(c) 114,200 acre-feet in any three consecutive years;
(d) 147,700 acre-feet in any four consecutive years;
(e) 184,500 acre-feet in any five consecutive years;
(f) 212,200 acre-feet in any six consecutive years;
(g) 246,500 acre-feet in any seven consecutive years; and
(h) 273,800 acre-feet in any eight to ten consecutive years.

(16) Bays and estuary needs will be met by releasing monthly stored water from Lakes Buchanan and Travis to meet target inflow needs of 1.03 million acre-feet per year if January 1 storage level in Lakes Buchanan and Travis combined is greater than 1.7 million acre-feet. Critical inflow needs of 171,120 acre-feet per year will be met in all years with releases of stored water from Lakes Buchanan and Travis. In years when the January 1 combined storage in Lakes Buchanan and Travis is less than 1.7 million acre-feet but greater than 1.1 million acre-feet (*i.e.* 86% and 55% full, respectively), one hundred and fifty percent (150%) of critical inflow needs (256,680 acre-feet per year) will be met, subject to the available monthly storable inflows into Lakes Buchanan and Travis. Releases of stored water will be a combination of firm and interruptible water supplies. Firm stored water will be supplied in years when the four major irrigation operations' interruptible stored water supplies are curtailed. Interruptible stored water will be supplied in all other years. Total commitments of the Combined Firm Yield from Lakes Buchanan and Travis for bays and estuaries (estuarine inflows) will be an average of 6,060 acre-feet per year, with a maximum of:

(a) 20,660 acre-feet in any one year;
(b) 23,570 acre-feet in any two consecutive years;
(c) 23,680 acre-feet in any three consecutive years;
(d) 32,220 acre-feet in any four consecutive years;
(e) 40,800 acre-feet in any five consecutive years;
(f) 41,400 acre-feet in any six consecutive years;
(g) 47,800 acre-feet in any seven consecutive years; and
(h) 60,600 acre-feet in any eight to ten consecutive years.

(17) The total firm stored water commitment for both environmental purposes will be an average of 33,440 acre-feet per year. Estimated interruptible stored water supplied

during the critical drought for both purposes will be an additional 23,030 acre-feet per year.

b. Key Elements of the Drought Management and Drought Contingency Plans

The key elements of the Drought Management and Drought Contingency Plans (DMP/DCP) include the following:

(1) A 10-year time period from 2000-2010 is the time frame for the DMP/DCP.

(2) The DMP/DCP establishes criteria for the curtailment of stored water that is committed through contract or by LCRA Board resolution.

(3) Establishes a criteria for interruptible stored water supply curtailments that protects firm demands, establishes a Reserve Storage Pool, and provides for gradual curtailment in order to protect the full demand of first crop rice in all years of the critical drought.

(a) Open Supply - If the total January 1 storage in Lakes Travis and Buchanan combined is equal to or greater than 1,400,000 acre-feet, then LCRA will supply all interruptible stored water demands. This assumes 273,000 acre-feet of interruptible storage water is sufficient to irrigate a total of 83,700 acres within the four irrigation operations, with seventy percent (70%) of that acreage being irrigated for a ratoon, or second, crop of rice.

(b) Curtailment occurs in stages when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1.4 million acre-feet and greater than 325,000 acre-feet. If combined storage on January 1 is between 1.4 million acre-feet and 1.15 million acre-feet, the interruptible stored water supply available will vary beginning at 273,000 acre-feet available at 1.4 million acre-feet of storage and decreasing at a rate of approximately 31,200 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 195,000 acre-feet available at a combined storage of 1.15 million acre-feet. When the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,150,000 acre-feet, the interruptible stored water supply available will vary beginning at 195,000 acre-feet available at 1.15 million acre-feet of storage and decreasing at a rate of approximately 4,250 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 160,000 acre-feet available at a combined storage of 325,000 acre-feet.

(c) Cutoff of interruptible supply for the coming year occurs when combined storage in Lakes Buchanan and Travis on January 1 is less than or equal to 325,000 acre-feet.

(d) Review and cancel the curtailment of interruptible stored water for the irrigation operations at any time during the year prior to July 31, if the combined storage in Lakes Buchanan and Travis is projected to be equal to or greater than 1.4 million acre-feet anytime in July.

(e) Reserve Storage Pool - Cutoff of all interruptible supplies when combined storage in Lakes Buchanan and Travis is less than or equal to 200,000 acre-feet.

(f) Allow each irrigation operation the option of a fixed maximum amount of interruptible stored water or all the water necessary to cultivate a maximum acreage agreed upon by the operation and LCRA.

(g) At any time when the combined storage in Lakes Buchanan and Travis drops below 1.6 million acre-feet, LCRA will implement an aggressive public information campaign to provide up-to-date information on water supply conditions. LCRA will also ask its firm wholesale water customers to implement voluntary water use reduction measures with a water use reduction goal of 5 percent.

(h) At any time when the combined storage in Lakes Buchanan and Travis drops below 1.4 million acre-feet, LCRA will further encourage water conservation and will ask its firm wholesale water customers to continue implementing the voluntary water restriction components of these customers' Drought Contingency Plans.

(i) At any time when the combined storage in Lakes Buchanan and Travis drops below 900,000 acre-feet, LCRA will ask all firm water customers to consider implementing the mandatory component of these customers' Drought Contingency Plans with a water use reduction goal of 10 to 25 percent. LCRA will also begin discussions with firm water customers to develop a specific stored water curtailment plan, to be approved by the LCRA Board and TCEQ.

(j) During a drought more severe than the Drought of Record, LCRA will implement a mandatory pro rata curtailment of up to 35 percent among all of its firm water supply customers according to the amount of firm water to which they are legally entitled under the terms of their contract and consistent with the curtailment plan approved by the LCRA Board and TCEQ. All uses of interruptible stored water will be totally cutoff prior to and during any mandatory curtailment of firm stored water customers.

(k) Require legally enforceable local drought contingency plans for LCRA firm water customers and the four major irrigation operations.

TABLE P-1, below, summarizes these plan elements.

TABLE P-1. DROUGHT CONTINGENCY PLAN SUMMARY TABLE

	A	B	C	D	E	F	G	H
	Drought Response Levels and Stages	**Water Use Reduction Goals**	**Water in Storage (acre-feet)**	**Status (Date)**	**Actions Affecting Interruptible Supplies**	**Actions Affecting Firm Supplies**	**Actions Affecting Instream Flows**	**Actions Affecting Matagorda Bay Freshwater Inflows**
1			**1, 985,000**	January 1	Full Supply	Full Supply	1. Full Supply for Critical Needs 2. Supply for Target Needs Limited to Storable Inflows	Supply for Critical and Target Needs Limited to Storable Inflows
2			**N/A**	January 1 or July 1 – Other customers (either Lake Travis or Buchanan less than 94% full)	1. Interruptible Supplies Cease for All Customers Except Four Major Irrigation Operations 2. Full Supply for Four Major Irrigation Operations			
3			**Less than 1,700,000**	January 1				1. Supply 150% of Critical Needs Limited to Storable Inflows 2. Cease Meeting Target Needs
4	**Firm Stage 1: Voluntary Conservation**	**5% of firm demand**	**Less than 1,600,000**	At Any Time During Year		Full Supply Begin Voluntary Conservation Begin Aggressive Public Information		
5	**Interruptible Level 1: Initial Curtailment**	***0-30% of interruptible demand**	**Less than 1,400,000**	January 1 At Any Time – Conservation	Begin Curtailment for Four Major Irrigation Operations with interruptible stored water ranging from 273,000 acre-feet available at storage of 1.4 million acre-feet to 195,000 acre-feet at storage of 1.15 million acre-feet	Full Supply Further Encourage Voluntary Conservation	1. Full Supply for Critical Needs Only 2. Cease Meeting Target Needs	
6	**Interruptible Level 2: Steeper Curtailment**	***30-40% of interruptible demand**	**Less than 1,150,000**	January 1	Continued Curtailment for Four Major Irrigation Operations with interruptible stored water ranging from 195,000 acre-feet at storage of 1.15 million acre-feet available to 160,000 acre-feet at storage of 325,000 acre-feet			
7	*NOTE: Interruptible water use reductions are built-in to the interruptible stored water curtailment schedule.							

TABLE P-1. DROUGHT CONTINGENCY PLAN SUMMARY TABLE

	A	B	C	D	E	F	G	H
	Drought Response Levels and Stages	**Water Use Reduction Goals**	**Water in Storage (acre-feet)**	**Status (Date)**	**Actions Affecting Interruptible Supplies**	**Actions Affecting Firm Supplies**	**Actions Affecting Instream Flows**	**Actions Affecting Matagorda Bay Freshwater Inflows**
8			**Less than 1,100,000**	January 1 - Environmental Flows At Any Time - Conservation	↓	↓		Supply Only for Critical Needs Limited to Storable Inflows
9	**Firm Stage 2: Requested Mandatory Conservation**	**10-25% of firm demand**	**Less than 900,000**	At Any Time During Year	↓	Full Supply Request Mandatory Conservation Restrictions Meet with Firm Customers to Develop Curtailment Plan TCEQ and LCRA Board Approve Curtailment Plan		↓
10	**Firm Stage 3: Pro-Rata Curtailment**	**Up to 35% of firm demand**	**Less than 600,000** If Drought Worse Than Drought of Record*	At Any Time During Year	Interruptible Supplies Cease, Unless Drought Less than 36 Months in Duration, then Interruptible Supplies Cease No Earlier than Following July 31 or Jan. 1, which ever comes first	Curtail Firm Customers on Prorata Basis with Other Firm Users According to Approved Plan	Curtail on Prorata Basis with Other Firm Users	Curtail on Prorata Basis with Other Firm Users
11	**Interruptible Level 3: Cutoff Supplies**	**100% of interruptible demand**	**Less than 325,000**	January 1	Interruptible Supplies Cease	↓	↓	↓
12	**Interruptible Level 4: Cutoff Supplies**	**100% of interruptible demand**	**Less than 200,000**	At Any Time During Year	↓	↓	↓	↓
13	*NOTE: Drought Worse than Drought of Record defined by all of the following conditions occurring simultaneously at any time: 1. Combined Storage in Lakes Travis and Buchanan being less than 600,000 acre-feet. 2. Drought duration of at least 24 months. 3. The cumulative inflow deficit of the current drought exceeding that of the drought of record by at least 5% for a minimum of six consecutive months. 4. Declaration of the LCRA Board based on all three of the above conditions occurring simultaneously.							

C. Definitions

To understand the WMP, it is important to know the definitions of the key legal and hydrologic terms used in this plan. The major terms are defined below and should be considered specific to LCRA.

adjudication - a court proceeding to determine all rights to the use of water on a particular stream system.

beneficial use of water - use of the amount of water that is economically necessary for a purpose authorized by law, when reasonable intelligence and reasonable diligence are used in applying the water to that purpose. Such uses include domestic use, municipal uses, industrial use, agricultural use, hydroelectric power, navigation, fish and wildlife, etc. The benefit may vary from one location to another and by custom. Beneficial uses are defined by statute in the Texas Water Code.

combined firm yield - a specific amount or quantity of water stated in acre-feet that represents the maximum average annual demand that can be met from a reservoir system during a simulation of a repetition of the system's Drought of Record, while honoring the full extent of upstream and downstream senior water rights.

conservation base acreage - the historical 10-year average acres irrigated at a total of 5.25 acre-feet of water per acre irrigated.

curtail - to reduce the supply of water being provided through a diversion by reducing the amount of water served under the contract for a specific period of time. Curtailment may occur during drought or other emergency conditions.

critical drought period - the period of time during which the reservoir system was last full and refilled, and the storage content was at its minimum value.

cutoff(water) - to discontinue, or to terminate completely, the supply of water provided under contracts for diversion for a certain period of time. Cutoff may occur during drought or other emergency conditions.

diversion demand - the water pumped from a water body for beneficial use.

domestic water use –use of water by an individual or a household to support domestic activity. Such use may include water for drinking, washing, or culinary purposes; for irrigation of lawns, or of a family garden and/or orchard; for watering of domestic animals; and for water recreation including aquatic and wildlife enjoyment, but does not include water used to support activities for which consideration is given or received or for which the product of the activity is sold.

drawdown - the lowering of the water level in a water body by diversion, pumping, or release.

drought - a prolonged period of dryness or lack of rainfall that has a significant effect on water or water-related uses.

drought of record - the drought that occurred during the critical drought period.

firm water - a supply of stored water that is drawn from the combined firm yield of the reservoir system. Such supplies are diverted or otherwise committed under a contract or resolution issued by the LCRA Board.

firm yield - the maximum average annual supply of water that can be supplied from a water source without shortages during a repetition of the critical drought period.

gaging station - particular site on a stream, canal, or lake where systematic observations of hydrological data are obtained.

instream flow - the specific amount of water needed to flow in a stream or river to support aquatic life, minimize pollution, or for recreational use, usually stated as a daily mean discharge values in cubic feet per second.

interruptible stored water - stored water supplied pursuant to contract or resolution, where the contract, resolution or special conditions defining the commitment specifically provides that such commitment is "subject to interruption or curtailment."

irrigation - The use of water for the irrigation of crops, trees, and pasture land, including, but not limited to, golf courses and parks, which do not receive water through a municipal distribution system.

reserve storage pool - a storage level that, when reached at any time during the year, would require the total cutoff of all water for interruptible use.

run-of-river flows - the natural flow in the river that is available under law at a given point on the river at a given instant in time to honor a right with a given priority date. This flow is determined by hydrologic studies that assume that all reservoirs and diversions under upstream junior rights do not exist. Rights to use run-of-river flows for beneficial uses, rights to store inflows in reservoirs, and pass-through of inflows and releases from reservoirs, are regulated by the TCEQ.

storable inflows - the actual daily inflows to the reservoir system minus the daily pass throughs from the reservoir system required to meet downstream senior water rights.

storage capacity - the quantity of water that can be contained in a reservoir.

streamflow - rate of flow of water that occurs in a natural channel.

water conservation - those practices, techniques, and technologies that will: (1) reduce the consumption, loss or waste of water, (2) improve the efficiency in the use of water, or (3) increase the recycling and reuse of water, so that a water supply is made available for future or alternative uses.

water right - a legally protected right, granted by law, to impound, divert, convey, or store state water and put it to one or more beneficial uses.

CHAPTER 1
INTRODUCTION TO THE WATER MANAGEMENT PLAN

A. Goals of the Water Management Plan 1-1
B. LCRA Act 1-2
C. LCRA Water Resources Management – History and Guiding Principles 1-4
D. LCRA's Comprehensive Water Policy Review and Public Stakeholder Process 1-5
E. Organization of the WMP 1-6

A. Goals of the Water Management Plan

The 1988 Final Judgment and Decree adjudicating LCRA's Highland Lakes water rights required LCRA to submit a reservoir operations plan describing how LCRA would determine the amount of firm and interruptible stored waters and how LCRA would manage the waters in Lakes Buchanan and Travis and the Colorado River. The Water Management Plan for the Lower Colorado River Basin (WMP) was developed using the following goals and guidelines as provided in the Final Judgment and Decree:

1. Lakes Buchanan and Travis and the Colorado River will be managed together as a single system for water supply purposes.

2. LCRA will manage the system to maximize the beneficial use of water derived from inflows below the Highland Lakes.

3. LCRA will manage the system to stretch and conserve the waters stored in Lakes Buchanan and Travis.

To achieve the goals stated above, LCRA will manage the system according to the following guidelines:

1. All demands for water from the Colorado River downstream of Lakes Buchanan and Travis should be satisfied to the extent possible by run-of-river flows of the Colorado River;

2. Inflows should be passed through Lakes Buchanan and Travis to honor downstream senior water rights only when those rights cannot be satisfied by the flow in the Colorado River below the Highland Lakes;

3. The firm, uninterruptible commitments of water from Lakes Buchanan and Travis should not exceed the Combined Firm Yield;

4. The water from Lakes Buchanan and Travis will be available on an interruptible basis as long as LCRA's ability to meet the demand of its firm water customers is not impaired;

5. Water shall not be released through any dam solely for hydroelectric generation, except during emergency shortages of electricity and during other times that such releases will be needed for another beneficial purpose.

B. LCRA Act

Through the passage of the LCRA Act by the Texas Legislature in 1934, LCRA was established as a "conservation and reclamation district" consisting of ten counties that comprise the watershed of the lower Colorado River. Those ten counties are Blanco, Burnet, Fayette, Colorado, Llano, Travis, Bastrop, Wharton, San Saba, and Matagorda. The LCRA Act was amended in 1993 to expand LCRA's water service area to include all or part of an additional twenty-four counties. In 1999, the LCRA Act was amended to include Williamson County in LCRA's water service area and was again amended in 2001 to allow LCRA to enter into an agreement with the San Antonio Water System (SAWS) to provide water. LCRA's current water service area is depicted in Figure 1-1. The 1999 amendment contains specific restrictions on LCRA water sales to Williamson County. Similarly, the 2001 amendment contains very lengthy and detailed restrictions and study requirements prior to any transfer of water to SAWS. The Highland Lakes system is comprised of two water storage reservoirs, Lakes Buchanan and Travis, and three intermediate pass-through reservoirs, Lakes Inks, LBJ and Marble Falls. Lake Austin, the last of the lakes in the chain, is owned by the City of Austin but operated by LCRA under agreement and may be referred to as part of the system from time to time. Technical data on each of the dams and lakes is included in Appendix 2A of Volume II.

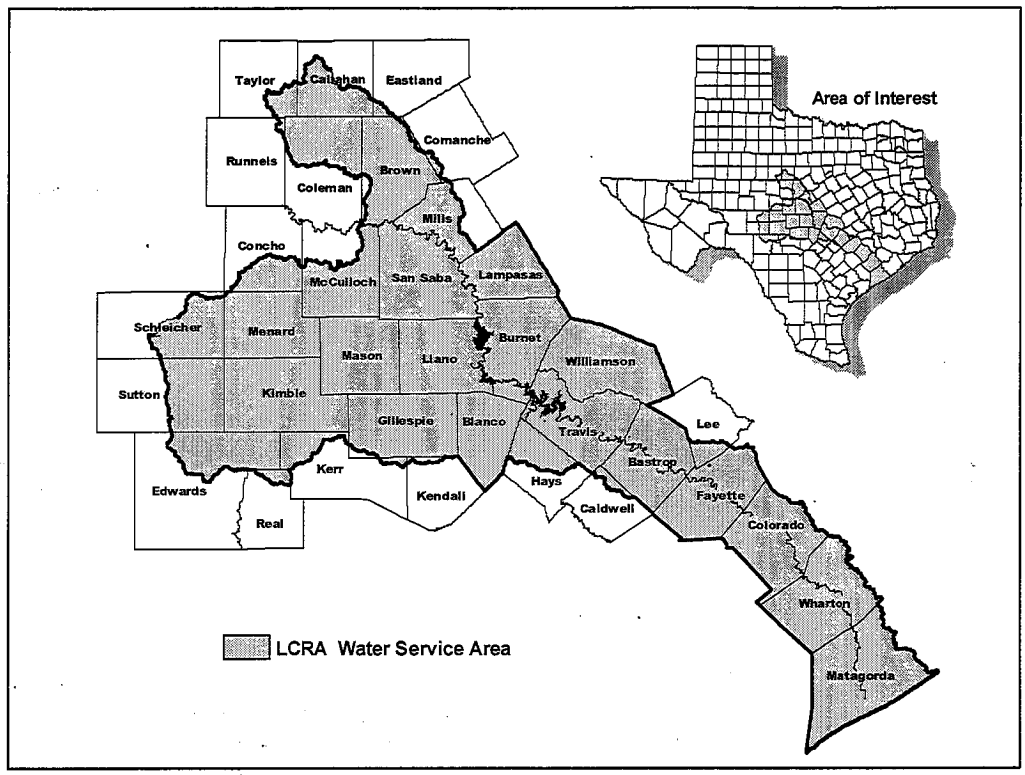


Figure 1-1. LCRA Water Service Area as of January 1, 2003.

LCRA has been delegated the responsibility of harnessing the Colorado River and its tributaries and making them productive for the people within LCRA's water service area.

The Act establishes LCRA's mission in four areas--water, electric energy, conservation and lands. In water, LCRA is empowered to control floods and control, store, sell, preserve and distribute the waters of the Colorado River and its tributaries. The waters are to be used for beneficial purposes including irrigation, generation of electric energy, reclamation of arid lands and the creation of lakes for water storage. LCRA is required to prevent flood damage to people and property by the Colorado River and to control the uses of the surface of the lakes it created.

Consistent with the control of the waters, LCRA is empowered to develop, distribute, and sell the energy created through hydroelectric generation both inside and outside the 10-county district. Later legislation allowed LCRA to expand its electric generation capabilities beyond hydropower through developing fossil fuel generation facilities.

As a conservation and reclamation district, LCRA is to conserve and develop the lands, forests and water of the district and to study and correct both artificial and natural sources of pollution that may affect the ground and surface waters within the district. LCRA is also empowered to provide water and wastewater treatment services within the district.

During the construction of the dams and development of the Highland Lakes system LCRA acquired large tracts of land that surround the reservoir system. The Act authorizes LCRA to develop, manage, and promote the use of these lands for parks, recreational facilities and natural science laboratories and to promote the preservation of fish and wildlife. LCRA must also provide public access to, and use of, its lakes and lands for recreation.

Each of the many purposes, functions, and uses of the elements of the river—the lakes, the lands, the ground and surface waters, the bays and estuaries—must be considered as parts of an integrated system.

The WMP describes the issues and conflicts that LCRA must recognize and, where possible, resolve.

C. LCRA Water Resources Management – History and Guiding Principles

It is important to consider the historical context in which this WMP has evolved. In the early years of LCRA's existence, the predominant priorities in water resources management were to moderate and control the floods and droughts in the Lower Colorado River Basin. This was accomplished through the construction of dams in the Hill Country west of Austin, which created the Highland Lakes.

The results have been impressive. The ravages of floodwaters have largely been controlled. These same dams have also provided a dependable source of water supply for municipal, industrial, agricultural, and mining uses. Additionally, the Highland Lakes provided the source of inexpensive, renewable electrical energy, and recreational opportunities for the citizens and communities of Central Texas. In sum, the work of LCRA in its early years provided the foundation on which much of the present day population and economy of Central Texas depend.

Notwithstanding the successes of the past, in developing a WMP for the river, LCRA today faces an array of water management issues and opportunities that were scarcely envisioned a half-century ago. Recreation has emerged as a major use, both on the lakes and the river. Maintaining the aquatic habitat in the river channel and in the bays and estuaries is a major use, as is water quality and the use of the river to sustain a growing population and economy. This intensified competition among the various users of the water resource is placing increasing stress on the ecological and environmental resources supported by the Colorado River. LCRA, in partnership with the State of Texas, local governments, and private interests, must confront these challenges as we develop a meaningful WMP.

LCRA's WMP is grounded in these key principles:

(1) LCRA recognizes the supremacy of the State of Texas, acting through the TCEQ, as the ultimate authority for water resources management and as the arbiter of disputes involving the allocation of water from the Colorado River and its tributaries. LCRA, within the intent and meaning of its legal authority, is the steward of the water rights granted to it by the State of Texas. Further, LCRA recognizes the responsibilities and prerogatives conferred upon local political subdivisions of the State and the rights of private citizens and corporations.

(2) Many water management issues and opportunities are regional in scope and effect. Solutions and strategies must be built upon regional consensus and action. LCRA considers its role as one of consensus-building among competing users of Colorado River water and among the public and private interests concerned with the management of the Colorado River.

(3) LCRA, in exercising its responsibilities as a steward of the water resources of the Colorado River and its tributaries, will strive to maximize the beneficial use of Colorado River water and achieve a sustainable balance among the competing demands on the system. In pursuing this objective, LCRA will implement management procedures and programs addressing:

(A) The efficient management of available water supplies as an integrated system;
(B) Water demand management measures including long-term conservation measures and short-term drought contingency measures;
(C) Protection and, where possible, enhancement of water-related environmental values; and
(D) Future water supply development and augmentation.

D. LCRA's Comprehensive Water Policy Review and Public Stakeholder Process

LCRA has approached the development of the WMP as much more than a set of complex engineering tools to serve as guidelines for operating the structures on the Colorado River system. The development of the WMP stimulated a comprehensive review of how LCRA has developed and operated the Highland Lakes and the lower Colorado River system for the past 60 years to meet the needs of the area it serves.

As a foundation for the prior versions of the WMP, LCRA conducted a comprehensive review of the policies and programs that guide and shape the way LCRA manages the river system. This review was conducted as a series of meetings held as joint public meetings of the LCRA Board's Planning and Public Policy and Natural Resources Committees. The meetings were designed to use staff expertise and information from outside experts to analyze the environmental, social, economic and legal factors that shape the issues that LCRA faces in managing the Colorado River system.

An important part of these public meetings was the involvement of the State agencies, environmental groups, business, industry and agricultural interests, wholesale electric customers and other constituencies whose interests are affected by LCRA policies. The process was designed to assure that participation was effective in informing LCRA of public views and also so that these constituencies would be better informed about the issues involved in the policy decisions. An issues inventory was developed and briefing papers were prepared for each of the meetings. Summaries of the meetings elements were developed and distributed to the LCRA Board and members of the public.

As a result of the Board and the public review, LCRA adopted a set of water and flood control policies to address many of the issues in water quality and water supply that face LCRA today and

will continue to face the agency well into the future. These policies undergo periodic review and revision by the LCRA Board. (See Appendix A, Volume I for the most current versions of these policies).[1] These policies, read in conjunction with LCRA's Certificates of Adjudication for the Highland Lakes, have formed the foundation of LCRA's WMP.

In developing the initial WMP and all of its subsequent revisions, LCRA has sought broad public participation through the work of an Advisory Committee and a series of public information and input meetings in the LCRA district. The Advisory Committee included over two dozen representatives from varied interests in the river basin. Taking part in the process were State and local officials, rice farmers, representatives of tourism and recreation interests, coastal sports and commercial fishing interests, business and industry and economic development representatives and environmental interest group leaders. The other major water right holders on the Lower Colorado River were also active participants on the Advisory Committee.

The purpose of the Advisory Committee has been to provide information to LCRA on the attitudes and interests of the major organizations and groups concerned with the allocation and management of LCRA's water resources. LCRA management and staff appreciate the commitment of time and energy made by the Advisory Committee. The Advisory Committee has actively participated in the development of the technical studies and the analysis of the policy options during every revision of the WMP. In addition, they aided LCRA by providing information on the WMP to the public and the local news media. Many of the policy concepts and alternatives found in the WMP are the direct result of suggestions made by the Advisory Committee. However, neither the report as a whole, nor any portion thereof, necessarily reflects the views of the Advisory Committee or any member of the Advisory Committee.

E. Organization of the WMP

Volume I of the WMP is organized as follows:

(1) Chapters 1-3 of the WMP describe the issues and conflicts in the demands on the Colorado River system and lays out the policies and management actions LCRA will use to accommodate the variety of demands on the system.

(2) Chapter 4 of the WMP describes the issues and conflicts in the demands on the Colorado River system during drought periods and sets forth the policies and

[1] Since the WMP's last approval in 1999, the LCRA Board of Directors has amended or consolidated several of its policies related to water. Board Policy 502 "Interbasin Transfers" and Board Policy 504 "Water Resources Management" were repealed by the LCRA Board on June 21, 2000 and combined, with amendments, into Board Policy 501 "Water Resources Management," initially adopted on Aug. 18, 1999 and subsequently amended June 21, 2000, Sept. 18, 2002, and November 16, 2005. Board Policy 503 "Lowering of LCRA Operated Lakes" was amended on Oct. 20, 1999, Sept. 18, 2002, and October 20, 2004. Board Policy 507 "Water Quality Leadership" was amended on December 13, 2000. Board Policy 509 "Water Conservation" was last amended on June 21, 2000. Board Policy 508 "Water Pricing Policy" is included, but has not been amended since December 16, 1988, but a reformatted version of the policy is contained in this submission.

management actions LCRA will use to address the competing demands for water in times of shortage based on 2010 projected demands for water.

(3) Chapters 5-6 of the WMP describe the engineering and hydrological models and data sources and the process for the determination of the Combined Firm Yield of Lakes Buchanan and Travis.

Volume II of the WMP is a compilation of several technical appendices used to develop the WMP.

CHAPTER 2
MANAGING THE SYSTEM AMONG COMPETING DEMANDS

A. Water Quality Issues and Demands 2-2
1. Point Source Pollution 2-2
2. Nonpoint Source Pollution 2-3
3. Soil Erosion and Sedimentation 2-3
4. Dissolved Oxygen Problems 2-4
5. Upstream Pollutants 2-4
B. Flood Control Responsibilities 2-4
C. Water Supply 2-5
D. Water Demand 2-6
1. Municipal and Domestic Water Demands 2-6
a. Municipal Demand 2-6
b. Domestic Water Use Demand 2-7
2. Industrial Demands 2-7
a. Manufacturing Use 2-7
b. Steam Electric Use 2-8
3. Demands for Interruptible Stored Water 2-8
a. Irrigation Demands 2-8
b. Agriculture Conservation 2-10
4. Recreation and Tourism Demands 2-10
a. Managing Lake Levels for Recreation and Tourism 2-11
b. Downstream Recreation 2-13
5. Hydroelectric Power Demand 2-13
6. Mining Demand 2-13
7. Instream Flow & Estuarine Freshwater Inflow Requirements 2-14
a. Critical Flows 2-14
b. Target Flows 2-15
c. Maintenance Flows 2-15
8. Bay and Estuary Requirements 2-18
a. Methodology for Determining Freshwater Inflow Needs 2-21
b. Freshwater Inflow Needs 2-22
c. Revision of Freshwater Inflow Need from the Colorado River from Matagorda Bay 2-24

Demands on the Highland Lakes and the lower Colorado River system are many, varied, and often compete with one another. These demands are dynamic and will continue to evolve not only as the population grows throughout the region, but also as a result of changes in federal agricultural programs, the effectiveness of various conservation and reuse efforts, developments in our understanding of water needs for environmental purposes, and many other factors.

LCRA's reservoir system is designed to store waters from winter and spring rains and make that water available for use during the summer months for agricultural needs, water supply, and hydroelectric generation. During the summer months, these water demands cause a decline in the reservoir levels, thus providing storage for the next year's winter and spring rains. This type of operating pattern enables LCRA to serve a variety of functions with its reservoir system. It can also create conflicts among these functions. If the system's ability to meet all of these demands is to be maximized, compromises must be made among the competing demands.

LCRA must continually re-evaluate its WMP to assure that the competing demands are being met according to their priority within the framework of legal and financial constraints on the system. This chapter describes various demands on the system, the measures LCRA implements to address these various demands, and identifies those areas where further analysis is needed to adequately understand and address these various demands and the challenges they present.

A. Water Quality Issues and Demands

Everyone favors "clean water," but achieving an understanding of the value of water quality so that the necessary investments and efforts are made is a major challenge to LCRA's management responsibility. This is an issue in which every user of the river has an interest and responsibility. The problem areas are as follows:

1. Point Source Pollution

In managing the river system, LCRA must consider the impact of point sources of pollution entering the tributaries and the river, even though the TCEQ is the agency that establishes regulatory standards to control point sources of pollution. But even if a point source of pollution is lawful, the assimilation of sewage treatment plant wastes is a function and use of the lakes and the river for which no one pays in dollars and everyone pays in quality. During the low flow periods of the year, when LCRA is not releasing water for the agricultural operations downstream, the flows of the Colorado River below Austin are dominated by treated wastewater effluent discharged by the City of Austin, with such effluent sometimes comprising as much as 90 percent of the total flow. This condition is exacerbated during periods of low rainfall or drought that affect not only the quality of the river but also its aesthetic value. Downstream residents complain about the smell of the river and its loss of use for recreation, fishing, and as a water supply for grazing livestock.

During prior efforts to revise the WMP, many stakeholders raised concerns regarding LCRA's role in monitoring and reducing the volume and concentration of point source pollution. While water quality is an ongoing concern of LCRA, specific concerns regarding water quality impacts from point

source discharges were not identified during the stakeholder process employed for the current revisions of the WMP. LCRA nonetheless actively monitors and, in some cases, actively participates in water quality permitting activities at the TCEQ that have the potential to affect the water quality in the lower Colorado River basin.

2. Nonpoint Source Pollution

Runoff from urban and agricultural areas, soil erosion, and leakages from faulty septic tank and waste dumps all represent nonpoint sources (NPS) of pollution. The EPA estimates that approximately 73 percent of the pollution in the nation's rivers is caused by nonpoint sources.

Due to the high quality of water in the Highland Lakes chain, there is great concern for preventing NPS pollution and maintaining this high quality of water for the future. The lakes serve as a source of drinking water for over a million citizens of the Austin-Travis County metropolitan area and all of its uses are enhanced by maintaining a high degree of purity.

While LCRA is encouraging and supporting economic development, tourism, and recreation activities in the Highland Lakes and the Colorado River downstream, there is the awareness that increased usage and development will result in more nonpoint source pollution unless effective controls are put in place.

The causes and sources of NPS pollution are dispersed and difficult to manage without broad public awareness and support. LCRA's Water Quality Leadership Policy requires effective implementation to control NPS pollution through research, monitoring, education, and the use of LCRA's ordinance making powers to prevent and control sources of nonpoint pollution within the 10-county district.

During this revision of the WMP, the nonpoint source pollution of the Colorado River was not identified as an issue of concern among the stakeholders. In past years, however, LCRA has received comments and letters of support regarding its efforts in nonpoint source pollution abatement from various interest groups. Although this issue was not specifically identified for attention in the WMP revision process, LCRA has continued its efforts to ensure that the Colorado River is not adversely affected by nonpoint source pollution through the enforcement of its own Nonpoint Source Ordinance and rules and through active participation in the TCEQ's Total Maximum Daily Load (TMDL) efforts in the Colorado River basin.

3. Soil Erosion and Sedimentation

Soil erosion and the resulting sedimentation in the Highland Lakes, the Colorado River, and its streams and tributaries is a cross cutting issue in water quality and water supply. The sedimentation in the lakes causes problems for boating and fishing. The build up of silt also reduces the storage capacity of the lakes for water supply and for holding floodwaters. Siltation downstream of the Highland Lakes in the river channel reduces the capacity of the river for holding flood releases. Both in the lakes and in the river, the silt in the water causes problems of turbidity or cloudiness, thus reducing the aesthetics of the water and may cause higher water treatment costs. This factor often

shows up in LCRA's Water Quality Index and triggers lower ratings for many areas. Beyond increased turbidity, soil erosion can contribute to water quality problems by carrying pesticides, herbicides, and other pollutants into the water along with the soil particles.

4. Dissolved Oxygen Problems

The dissolved oxygen content of LCRA's releases of stored water through the hydroelectric turbines in the dams has caused water quality problems in the summer months. The deep lakes stratify during the warmer months of the year, which prevents replenishment of oxygen at the levels from which the turbines draw water. The passage of water with low levels of dissolved oxygen from one reservoir into another or into the river system can cause fish kills and reduce the assimilative capacity of the river system. In 2000, to address particular concerns below Mansfield Dam (Lake Travis), LCRA modified its hydroelectric turbines with a water aeration system that significantly enhances the levels of dissolved oxygen in the river below the dam.

5. Upstream Pollutants

Pollutants from the watershed upstream of the Highland Lakes and outside of LCRA's district can also affect the resources for which LCRA is responsible. An example of this is the inflows of high concentrations of salts in the water from seepage from natural springs and highly concentrated bodies of salty water in the upper watershed combined with high rainfall in the "salt water" basin. Abandoned unplugged oil wells may also be a cause of this problem. Remedial action has been taken by the Colorado River Municipal Water District (CRMWD), but the problem persists.

B. Flood Control Responsibilities

Flood control is one of the primary reasons for LCRA's existence. The series of dams and reservoirs from Buchanan through Mansfield contribute to the control of the lower Colorado River and the protection of lands and communities within the lower Colorado River basin. While all the dams and reservoirs aid in controlling and storing the waters of the Colorado, Mansfield Dam is the only designated flood control structure. Mansfield Dam flood storage space is between the elevation of 681 feet mean sea level (msl) and the spillway crest elevation of 714 feet msl, providing approximately 800,000 acre-feet of dedicated flood control storage. During flood control operations, Mansfield Dam is operated in accordance with regulations specifically developed for that facility by the U.S. Corps of Engineers, the U.S. Bureau of Reclamation, and LCRA and published in the Code of Federal Regulations (see Appendix B, Volume 1; 33 C.F.R.§ 208.19).

Over the years, as floods no longer ravaged the river basin washing out riverbanks and clearing away vegetation, the capacity of the channel to contain water releases, especially during flood conditions, has been reduced. U.S. Corps of Engineers rules require LCRA to limit the rates of releases during flood events in an attempt to minimize downstream flood damage. These limitations on allowed outflow from Lake Travis can result in increased water levels upstream of Mansfield Dam, which, in turn, may result in damage to properties around Lake Travis. This balancing problem is compounded by encroachments on the floodplains both upstream and downstream. Lake and river residents have

built boathouses and structures into the floodplain and suffer property losses during flood occurrences. LCRA's management requires renewed efforts to remove encroachments and put people on clear notice that they are at risk.

The schedule by which floodwaters must be released from the flood control storage space between the elevations of 681 feet msl and 714 feet msl in Lake Travis is governed by the U. S. Army Corps of Engineers' Water Control Manual for Mansfield Dam. This release schedule was designed to minimize damages both downstream and upstream of the dam without endangering the safety of the dam. A brief description of this schedule is as follows:

RESERVOIR ELEVATIONS feet msl	RELEASE cfs
681 to 683	3,000
683 to 685	5,000
685 to 691	5,000 during Jan/Feb/Mar/ Apr/July/Aug/Nov/Dec 30,000 during May/June/Sept/Oct
691 to 710	30,000
710 to 714	50,000
714 to 722	90,000

LCRA maintains an active and continuous program to educate those members of the public who may be adversely affected by flooding along the lower Colorado River and the Highland Lakes. Moreover, during specific flood events, LCRA notifies individuals who may be affected and the general public about the flood and projected lake levels, gate operations, downstream flood stage projections, and other impacts.

LCRA believes that the existing policy of delicately balancing the adverse impacts of rising flood waters in the reservoir against the damages resulting from downstream flood releases is the best option.

C. Water Supply

Under the constraints specified in the Final Judgment and Decree, LCRA determined as part of its 1989 WMP that the Combined Firm Yield of Lakes Buchanan and Travis was 535,812 acre-feet per year. Of that amount, 90,546 acre-feet are allocated to O. H. Ivie Reservoir. The remaining 445,266 acre-feet are available to supply LCRA's current and future contractual commitments and agreements for firm water supply. The development of this Combined Firm Yield estimate is discussed in more detail in Chapter 5 of this document.

Currently, LCRA estimates that 368,364 acre-feet of firm stored water is already under contract or held in reserve to back up existing or new contracts for firm water, such as those held by the City of Austin and the STP Nuclear Operating Company. This comprises approximately 83 percent of the total 445,266 acre-feet of the Combined Firm Yield that is available for commitment (excluding that portion allocated to O. H. Ivie Reservoir).

With the exception of the City of Pflugerville, all of the municipalities downstream of Austin currently draw their water supplies from ground water sources. Ground water also supplies 40 percent of the agricultural irrigation in LCRA's service area. Upstream of Austin, the municipalities use a mixture of ground and surface waters.

As economic and industrial development increases, the demand for water increases. As other demands are more accurately determined, such as the fresh water needs in the bays and estuaries, the demands on the system are also likely to increase. LCRA is thus faced with the conflict between near-term demands and holding some remaining amount of the firm water in reserve for future users. The LCRA Board has attempted to address this conflict by reserving 50,000 acre-feet of firm water for future uses authorized under LCRA's certificates of adjudication within LCRA's water service area.

D. Water Demand

LCRA supplies water to two general categories of water demands: firm and interruptible. Firm demands presently include the water for municipal, domestic, industrial, steam-electric power generation, some irrigation, and instream flow and estuarine flow maintenance. Currently, interruptible stored water is used almost entirely for agricultural irrigation, specifically rice irrigation, and environmental flow maintenance. Detailed projected demands for 2010 are described in Chapter 4.

Year 2000 surface water demands within the lower Colorado River basin totaled approximately 675,800 acre-feet annually, including stored water released from Lakes Buchanan and Travis to maintain instream flows and freshwater inflows to the bay and estuary in the lower Colorado River (see Tables 4-2 and 4-3, *infra*). About 56 percent of surface water diversions are used for rice irrigation in the four major irrigation operations located in Colorado, Wharton, and Matagorda Counties. The next largest demand for surface water is the City of Austin, which in year 2000, used approximately 163,700 acre-feet for municipal use and steam-electric power generation under its own run-of-river rights and contracts for stored water from Lakes Buchanan and Travis.

1. Municipal and Domestic Water Demands

a. Municipal Demand

Municipal use includes water used by private residences, commercial establishments, public offices, industries, and institutions to the extent that such uses are included in the definition of municipal use as provided by the rules of the TCEQ. Eighty percent of the municipal use in LCRA's service area is in Travis County. The Austin area experienced rapid population growth during the early and mid 1980's and again in the 1990's. The Austin area is expected to show a steady growth over the long-term with the normal cycles of advances and pauses associated with economic growth.

The City of Austin's total diversion from Lake Austin and Lady Bird Lake for 2000 was 153,300 acre-feet. In 2000, approximately 65 percent of this demand was met through the City's own senior water rights. While much of the City of Austin's water is currently obtained from the Colorado River under the City's own water rights, especially during wet years, LCRA provides stored water from the Lakes Buchanan and Travis to back-up Austin's water rights under a series of contractual agreements. Also, some portion of the growth in the Austin area has occurred in areas served by municipal utility districts, LCRA's water utility, or other communities in Travis and Williamson Counties that purchase stored water from the lakes.

Over the long-term, Hays, Bastrop and Burnet Counties are forecasted to be the other three counties with the greatest gains in municipal use. This is due to their proximity to Travis County and the associated spillover of population growth and related services.

LCRA currently supplies water to about 50 water utilities, communities, and cities within LCRA's 10-county district, exclusive of Austin. The current annual demand of all these contracts is approximately 80,748 acre-feet per year.

At present, the City of Pflugerville is the only community downstream of Austin that is supplied water from the Combined Firm Yield of Lakes Buchanan and Travis for potable water use.

LCRA currently requires an approved conservation plan of its new water customers through its water contracts.

b. Domestic Water Use Demand

In August 2000, LCRA estimated that total diversions from the Highland Lakes for domestic water use (not including domestic water demands satisfied through a municipal water supplier) to be 4,536 acre-feet of water. Of this total, approximately 4,362 acre-feet (96%) is believed to be used for landscape irrigation. The remainder is believed to be used for cooking and washing (approx. 129 acre-feet), watering of domestic livestock (approx. 45 acre-feet), and recreational use.

2. Industrial Demands

Industrial demands include both water for manufacturing use and cooling water for electric power production other than hydroelectric generation.

a. Manufacturing Use

LCRA supplies water for various industrial uses within its 10-county statutory district. The water supply for these industrial uses is considered a firm demand on the system.

The largest current and projected manufacturing water users are located in Travis and Matagorda counties and account for slightly more than 80 percent of total manufacturing water use. Most of the manufacturing in Travis County is served by treated water from the City of Austin, which is

considered to be municipal use under TCEQ rules. Growth in demand in this sector increased in the last decade, particularly in microelectronic manufacturing--a high water demand industry. Downstream, demand for industrial use has experienced modest increases in Matagorda County in the petrochemical industry.

LCRA has established programs for industrial water conservation and encourages existing and new industrial users to consider efficiency and direct re-use strategies for industrial processes.

b. Steam Electric Use

Much of the demand for steam electric use is from electric generating plants in Bastrop, Fayette, Llano, Matagorda, and Travis Counties. LCRA's own system of power plants makes up the largest demand for this sector at a current demand of about 22,000 acre-feet per year. Uses include total evaporative use, plant use and the addition of a reservoir at the Fayette Power Project (FPP). The second largest user, the South Texas Project (STP), is served by LCRA pursuant to a contract that provides the facility with water under a run-of-river water right jointly owned by LCRA and the STP Nuclear Operating Company, backed-up by firm stored water from Lakes Buchanan and Travis. The City of Austin's generating plants are served under the City's own water rights, and are backed up with stored water from Lakes Buchanan and Travis under a series of contracts with LCRA.

Most of the current industrial users are located downstream of the Highland Lakes, thus allowing a portion of their demand to be supplied from the run-of-river water originating below Lake Travis. LCRA's system under the WMP allows for full utilization of the water in the river before calling for releases from storage in the reservoirs.

3. Demands for Interruptible Stored Water

Under the Final Judgment and Decree, LCRA is permitted to develop contractual commitments with water users whose demands do not have to be met 100 percent of the time. LCRA's WMP allows such demands for interruptible stored water to be met to the extent water is available each year after firm demands are satisfied. At the present time, the contracts for the Combined Firm Yield of Lakes Buchanan and Travis are not using their full commitment. By applying an "overdraft" concept, the portion of the Combined Firm Yield that is not yet committed and the water that is committed but not yet being used determines the interruptible stored water that is available each year. The water that is captured and stored during flood events also adds to the amount of interruptible stored water that is available. Over time, as the current firm contracts draw fully on their commitments and the remainder of the Combined Firm Yield is contracted for, there will be less interruptible stored water available on an annual basis.

a. Irrigation Demands

Currently the vast majority of LCRA's commitments for interruptible stored water are for irrigation downstream. Most of the irrigation is for rice farming, although row crops, pecans, turf grass, and golf courses also use interruptible stored water for irrigation. As the irrigation operations have

historically used the waters that are now considered part of LCRA's interruptible stored water supply, one way of mitigating the potential future conflicts is to assure the irrigation operations a priority call to a portion of the interruptible stored waters that are made available on an annual basis.

In good years with adequate rainfall, there is an abundance of interruptible stored water compared to the current demand, which is largely for growing rice. These four operations (Garwood, Gulf Coast, Lakeside, and Pierce Ranch) are primarily concerned with the growing of rice, although there are some turf and row crops grown within these operations. The real conflict would occur during a drought in the years ahead as other demands compete.

Irrigation water represents the largest demand of any user on the lower Colorado River system with rice irrigation in the lower basin constituting about 56 percent of the total annual use. The demand for water to irrigate rice varies greatly from year to year based upon the number of acres irrigated and weather conditions throughout the irrigation season. The number of acres irrigated is highly dependent upon federal agricultural programs affecting rice as well as the world market for rice.

Most of the rice irrigated by water from the Colorado River is concentrated in four irrigation operations whose annual demand on the system is projected to be 436,200 acre-feet of water in the year 2010 (see Table 4-3). These include the Lakeside, Gulf Coast, and Garwood Irrigation Operations, which are owned and operated by LCRA, and Pierce Ranch. These irrigation operations represent about 60 percent of total irrigated agriculture for water use in the three counties. The remaining 40 percent comes from pumped ground water.

LCRA owns run-of-river water rights associated with each of its irrigation operations as well as Pierce Ranch. These water rights have very early priority dates to divert surface water from the Colorado River, and LCRA has relied on these rights to the extent water is available, to satisfy irrigation customers' needs up to their permitted rights. These water rights allow the operations to pump water from the river as it is available without LCRA having to release water from storage. However, often in the height of the irrigation season, rainfall inflows are insufficient to supply these needs. During these periods, LCRA releases water from storage to make up the deficit. The demand on Lakes Buchanan and Travis for the release of interruptible stored water for the rice irrigation season varies greatly from year to year. During an average year, about 30 percent of the total water needed for irrigation comes from interruptible stored water released from storage in Lakes Buchanan and Travis.

Because a very large percentage of the overall demand on the system is related to irrigated agriculture, that demand must be met in the most efficient way possible. LCRA's ability to constantly monitor the amount of water in the river available to meet these demands through the Hydromet System allows full utilization of the flows originating below Lake Travis prior to making any releases from storage. The operational goal for the system is to ensure that the amount of flow passing the last diversion point meets the instream flow needs and requirements for the bays and estuaries as required by this WMP.

As discussed fully in Chapter 4, the four downstream irrigation operations (Gulf Coast, Lakeside, Garwood, and Pierce Ranch) have first priority for the interruptible stored water in the annual allocation process. This priority is set by establishing a Conservation Base for LCRA's Lakeside and Gulf Coast irrigation operations. The Conservation Base acreage will be the historical 10-year average acres irrigated (see Table 3-2) at a total of 5.25 acre-feet of water per acre irrigated. In 1999, LCRA purchased the Pierce Ranch water right of 55,000 acre-feet. In return, LCRA agreed to supply Pierce Ranch with interruptible stored water from Lakes Buchanan and Travis at an annual rate of 20,000 acre-feet based on a five year rolling average with a 30,000 acre-feet one year maximum in any calendar year, and subject to curtailment as set out in the Water Management Plan. The Garwood acreage is based upon a priority allocation as set forth in contractual agreements with LCRA.

b. Agriculture Conservation

As the largest user of water from the lower Colorado River system, irrigated agriculture also provides the best opportunity for reduction of the overall demand through conservation programs. LCRA currently has underway a water conservation program within the Lakeside and Gulf Coast irrigation operations. These conservation activities are directed at improving the efficiency of the water delivery systems and improving water use efficiency on the individual farms served by the operations. Formerly, LCRA provided water to individual customers of the irrigation operations on a per acre of rice irrigated basis. Since 1993, LCRA has sold water on a per acre-foot basis in the Gulf Coast and Lakeside Divisions. LCRA's sale of interruptible stored water for rice irrigation on a volumetric basis, as opposed to a per acre of rice basis, should encourage conservation among rice farmers.

Historical data shows that as much as seven (7) acre-feet of water had to be pumped from the river to irrigate one acre of rice. The TCEQ, in its Final Adjudication order of all of the irrigation rights in the lower Colorado River basin, stated that the use of more than 5.25 acre-feet of water for the irrigation of one acre of rice constituted a waste of water. This goal can be achieved and, in fact, recent results indicate that the overall irrigation demand can be reduced by as much as 25 to 30 percent, thus bringing water use per acre to well within the TCEQ's required 5.25 acre-feet per acre. A reduction of this magnitude could have a major impact on the reservoir system's ability to meet other competing demands.

4. Recreation and Tourism Demands

The use of water for recreation and tourism is closely linked to the population of an area, nearness of the recreation, and the value of the resource to recreational users. Recreational users are interested in qualities including: full lakes, flowing rivers, clean water, and aesthetics.

In many areas, recreational uses of the waterways are increasing steadily. The entire Highland Lakes area, from Lake Austin to Lake Buchanan, receives a great deal of recreational use from boaters, park visitors, and swimmers from all over Texas and the Southwestern United States.

Recreation and tourism demands in the Highland Lakes area are an important contributor to the local area economies. Recreation is not just fun, it is a critical economic factor in the life of citizens of the Hill Country.

a. Managing Lake Levels for Recreation and Tourism

The recreation industry associated with the Highland Lakes has experienced phenomenal growth over the past decade and is currently the major economic stability factor in many of the counties surrounding the Highland Lakes. The viability of this recreational industry is strongly tied to the level of water in the reservoirs. In the pass through lakes--Inks, LBJ, Marble Falls, and Austin--little impact is felt from variations in the levels of Lake Buchanan and Travis.

The original purposes of flood control and water supply for the rice farmers and others for which Lake Travis and Buchanan were constructed dictate that the lake levels will follow an annual cycle--that of filling the conservation storage space in the winter and spring months of the year to be drawn down by water uses during the summer months. The recreational users of these reservoirs are accustomed to a certain amount of variation in the lake levels. However, two or more consecutive years of below normal inflows into the reservoirs results in some extreme variations that can have an adverse impact on recreational interests.

Because these multiple purpose reservoirs were not constructed to maximize the recreational use of the reservoirs, the demands for stability in the reservoir levels by these incidental beneficiaries (the recreation interests) present conflicts that are extremely difficult to accommodate. If limits were placed on how far down the reservoirs' water levels are allowed to decline, a corresponding limitation on the amount of water that is available to supply the other demands on the reservoir system would also be required.

It is neither practical, nor in the public interest, to limit drawdown from demands for municipal, industrial, agricultural, or critical instream and bay and estuary uses. To the extent that the annual analysis of the amount of water in storage reveals that there are interruptible stored water supplies available after meeting the demands of the irrigation operations, interruptible stored water may be held in the reservoirs to maintain lake levels to the extent that such waters are not required to be released to meet critical instream flows requirements.

LCRA recognizes the importance of the recreational economy of the region by limiting additional sales of interruptible stored water, other than for the four irrigation operations' Conservation Base acreage or Priority Allocation acreage, based on the volume of water in Lakes Buchanan and Travis. The supply of interruptible stored water available for the January through June period will be based on the January 1 storage levels in Lakes Buchanan and Travis taken separately. The supply for the July through December period will be based on the minimum of the maximum storage levels in April, May, and June in Lakes Buchanan and Travis taken separately. No such sales may occur if either lake is less than 94% of its maximum conservation capacity. If both lakes are at their maximum conservation capacity as calculated above for either six-month period, then such interruptible stored water sales would be limited to a total of 30,000 acre-feet for that year. For lake

volumes between 94% and 100% of conservation capacity, interruptible stored water sales would be limited proportionately, based on the storage reservoir with the lowest percentage of capacity as calculated above.

The current operation of the Lakes Buchanan and Travis contemplated water releases from Lakes Buchanan and Travis to meet downstream water demands, primarily for irrigation. The operation takes approximately equal amounts of water from both lakes, with the water from Lake Travis being released first, followed by water releases from Lake Buchanan. In general, the result of this operation is that Lake Travis water levels are reduced during the spring and early summer while Lake Buchanan levels are stable or increasing during that period. Starting in mid- or late July, Lake Buchanan levels begin to fall while the level of Lake Travis remains generally stable, but at a lower elevation than at the beginning of the irrigation season. During the WMP revision process, members of the WMP Advisory Committee representing Lake Travis recreation interests proposed changing the current operation of the Highland Lakes to increase the level of water storage in Lake Travis during the summer by proposing that releases from each lake be equal (the "equal draw proposal").

Study of this recommendation during the WMP revision showed that LCRA did not have sufficient economic impact information to assess the impact of such an operational change on recreation and tourism on Lake Travis. Additionally, the potential impact of the operational change on flooding and flood damages was not assessed due to insufficient information. LCRA committed to continue to study this issue and to examine alternative operational policies that may be mutually beneficial to both lakes' interests. Additionally, LCRA will evaluate requests for additional studies of physical improvements to the lakes to encourage recreation and tourism. The study may be enlarged to include proposed improvements, such as extending boat ramps.

The study is intended to determine if recommendations will be made to change the current operational policies for Lakes Travis and Buchanan to improve recreational benefits. The study would include:

- economic analyses of impacts on local economies resulting from potential changes in water levels in Lakes Buchanan and Travis on seasonal recreation and tourism and the local economies;

- impacts on water supply, hydropower generation, and other uses due to operational changes; and

- evaluation of tradeoffs in water use benefits between alternative operational policies.

Alternative operating policies for Lakes Buchanan and Travis will be evaluated, including but not limited to the "equal draw" proposal that was made during the WMP revision process. In addition to the lake operations issue, several lake interest representatives raised other issues related to encouragement of recreation and tourism activities. The need for such changes to encourage recreation will occur during dry periods regardless of modest operational changes as envisioned in

the "equal draw" proposal. These "non-operations" related activities or programs that can be pursued will be analyzed and included in the economic evaluations.

b. Downstream Recreation

The river downstream of the Highland Lakes is a potential source of recreation of vast importance to the people who live along its shores. Water levels are very low and water quality deteriorates in the winter months when the river below Austin primarily consists of treated wastewater discharged by the City of Austin. LCRA's commitment to maintain instream flows may partially ameliorate this condition. However, as with many rivers, the Colorado has many broad low areas where the flow is not sufficient for boating.

The more fundamental conflict is between people who want LCRA to keep the Highland Lakes full for recreation upstream and people who live along the river who want LCRA to release water to improve the downstream recreation potential. As with demands for stability in reservoir elevations to accommodate recreational use of the reservoirs, demands for stability in downstream river flows are extremely difficult to address because the reservoirs were not constructed to maximize recreational use of the river downstream. Crucial to improving downstream recreation are better controls on wastewater treatment plants and nonpoint pollution from Austin, the downstream communities, and other users.

Gaining access to the river downstream of Austin is often difficult because there are few boat ramps and riverside parks. LCRA has developed additional boat launches and recreation areas along the river throughout the 10-county district to give the public better access to the Colorado River.

5. Hydroelectric Power Demand

Hydroelectric power plants located in each of the dams owned and operated by LCRA total approximately 281 megawatts of capacity. Until the 1960s, the hydro plants represented LCRA's total capability for generating electric energy. These plants still represent the cheapest power produced. The Final Judgment and Decree recognizes the competing needs for the stored water in the reservoirs, and as a result hydropower has been subordinated to be a by-product of the release of water for other purposes or when hydropower generation will not impair LCRA's ability to satisfy all stored water demands. To the maximum extent possible, releases of water through all of the structures are made to take maximum advantage of the energy produced by those releases. LCRA retains the right to make releases solely for hydropower production in times of emergency as part of the WMP operating policies.

6. Mining Demand

There is presently very little demand for water for mining purposes, and LCRA does not anticipate any major increases in this demand.

7. Instream Flow & Estuarine Freshwater Inflow Requirements

As described in more detail below, both firm and interruptible supplies are used to meet the water demands for instream flow and estuarine freshwater inflows. The amount of water flowing within the river channel supports the strengths and diversity of the aquatic life in the system. As flows decrease, the river ecosystem can be depleted and some species destroyed.

In 1992, LCRA completed an instream flow needs study. The results of that study are two sets of instream flow needs: critical flows and target flows. The following schedule of flows takes into consideration the water quality and physical habitat requirements of the fish community native to the Colorado River.

a. Critical Flows

Since all City of Austin wastewater plants discharge into the Colorado River downstream of Highway 183, return flows of treated effluent bypass the Austin gage, effectively de-watering parts of the river immediately downstream of Longhorn Dam when no releases are being made from the dam. Flows of less than ten (10) cfs were historically common at this gage during the non-irrigation season, although flows substantially increased immediately downstream. Although this segment does not have the capacity to support a balanced, natural community due to its proximity to the dam, it is nevertheless appropriate to maintain a minimum flow in this reach. A review of historical flow records indicate that flow seldom fell below 50 cfs during dry periods before impoundment by the Highland Lakes. Therefore, LCRA's 1992 study of instream flow needs recommended an instantaneous flow of at least 46 cfs be maintained at the Austin gage at all times. A flow of 46 cfs represents the 7Q10 (the seven-day average low flow expected to occur every ten years) for the Austin gage based on the period of record prior to impoundment by the Highland Lakes (1898 to 1940). Maintenance of these flows at the Austin gage requires close coordination with the City of Austin employees operating Longhorn Dam to avoid pulsed discharges from the dam's automatic gates. At times, LCRA may not be able to guarantee this instantaneous minimum due to actions by the City of Austin, which LCRA cannot control.

In addition, if the critical flow of 46 cfs should occur for an extended period of time, then operational releases are made by LCRA to temporarily alleviate the critical flow conditions. Specifically, should the flow at the Austin gage be below a 65 cfs daily average for a period of 21 consecutive days, LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release condition persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days.

A mean daily discharge of greater than 120 cubic feet per second as measured at the Bastrop Gage should be maintained at all times except March, April, and May (critical flow months) in order to provide adequate water quality conditions in the Colorado River. This is a minimum flow based on the TCEQ's standard of a daily average of greater than five milligrams per liter dissolved oxygen and meets the criteria for the high quality aquatic habitat designation in segment 1402 and 1428. Model

simulations indicate that this discharge will provide a minimum daily average of greater than six mg/l dissolved oxygen throughout most of segment 1428. This recommendation is based on the assumption that the City of Austin will maintain effluent quality at or above current levels. Minimum flow recommendations should be considered subject to revision as predictive capabilities are improved.

The seasonally adjusted target flow recommendations given below are largely adequate to meet the critical flow requirements for the target species during the spawning season. However, until more information on the flow requirements of the Blue Sucker (Cycleptus elongatus) during critical periods are available, LCRA has agreed to maintain an instantaneous flow at or above **500 cfs** from Bastrop to Eagle Lake for a continuous period of not less than six weeks during the months of March, April, and May. Further studies on the life history of the Blue Sucker in the Colorado River are needed.

b. Target Flows

A schedule of flows that provides an optimal range of habitat complexity to support a well balanced, native aquatic community was determined for each study reach. These flow regimes are considered an optimal range and should be maintained whenever water resources are adequate but should be classified as an interruptible demand subject to curtailment when water resources become limited during drought periods. Since native fish species are adapted to normal seasonal variations in flow regimes, target flows were adjusted monthly to emulate the annual cycle. It is interesting to note that the composite optimal flows are roughly equivalent to the historic median flows prior to impoundment. The following recommended target flows are based on the Bastrop study reach since this segment contains suitable habitat for the Blue Sucker (Cycleptus elongatus), listed as a threatened (protected non-game) species by the Texas Parks and Wildlife Department (TPWD). Since diversions for irrigation have the potential to reduce flows significantly in the lower reaches, flow monitoring at Eagle Lake and Egypt should continue to assure that target flows for those reaches are also met.

c. Maintenance Flows

While there have been no macrophyte studies performed on the Colorado River below Longhorn Dam, it is believed that periodic spates of high flows are needed to prevent siltation and dense macrophyte growth. It is presumed that these flows would be provided by natural high rainfall events.

These recommendations for critical and target instream flows, as shown on Table 2-1 below, represent a balanced, long-term approach to satisfying instream flow requirements that take into account both natural flow regimes and water quality conditions needed to support a healthy, diverse native fish community downstream of Austin. The recommended flows are based on a technically sound, scientific instream flow study. As described in more detail in Chapter 4, LCRA supplies both firm and interruptible stored water to meet the instream flow needs. With every WMP update, LCRA's commitment towards instream flows is determined after carefully balancing the impact on

the environment and irrigation needs with increases in the demand for firm water.

TABLE 2-1
SCHEDULE OF CRITICAL AND TARGET FLOWS FOR THE COLORADO RIVER DOWNSTREAM OF AUSTIN

Month	Critical Flows (cfs)		Target Flows (cfs)		
	Austin	Bastrop to Eagle Lake	Bastrop	Eagle Lake	Egypt
January	46[c]	120	370	300	240
February	46[c]	120	430	340	280
March	46[c]	500[b]	560	500[a]	360
April	46[c]	500[b]	600	500[a]	390
May	46[c]	500[b]	1030	820	670
June	46[c]	120	830	660	540
July	46[c]	120	370	300	240
August	46[c]	120	240	200	160
September	46[c]	120	400	320	260
October	46[c]	120	470	380	310
November	46[c]	120	370	290	240
December	46[c]	120	340	270	220

a Since target flows at Eagle Lake (based on overall community habitat availability) were insufficient to meet Blue Sucker (Cycleptus elongatus) spawning requirements during March and April, target flows were superseded by critical flow recommendations for this reach.

b This flow should be maintained for a continuous period of not less than six weeks during these months. A flow of 120 cfs will be maintained on all days not within the six week period.

c LCRA will maintain a mean daily flow of 100 cfs at the Austin gage, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, until the combined storage in Lakes Buchanan and Travis reaches 1.4 million acre-feet of water. A mean daily flow of 75 cfs, will then be maintained until the combined storage in Lakes Buchanan and Travis reaches 1.0 million acre-feet of water, then a critical flow of 46 cfs will be maintained at all times, regardless of inflows.

In addition, if the critical flow of 46 cfs should occur for an extended period of time, then operational releases will be made by LCRA to temporarily alleviate the critical flow conditions. Specifically, should the flow at the Austin gage be below a 65 cfs daily average for a period of 21 consecutive days, LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release conditions persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days.

8. Bay and Estuary Requirements

LCRA recognizes the importance of freshwater inflows to the productivity of the Matagorda Bay system to which the Colorado River contributes. The Matagorda Bay system is the second largest estuary on the Texas Gulf Coast. This estuary, also known as the Lavaca-Colorado estuary, covers approximately 352 square miles, and its largest single body of water is Matagorda Bay. Other major bays in the estuary are Lavaca, East Matagorda, Keller, Carancahua, and Tres Palacios (Figure 2-1). The abundant production of fin fish and shellfish make this environmentally sensitive area important not only as an ecological resource, but also as a source of economically significant commercial and sports fisheries. Many factors contribute to this high natural productivity, but one of the most significant is an ample source of freshwater. Freshwater inflows are vital to the continued health of the natural ecosystems in and around the Matagorda Bay system.

In 1991, the U.S. Corps of Engineers re-routed the Colorado River into West Matagorda Bay to increase biological productivity by increasing the amount of freshwater entering the estuary. However, a storm blocked the new route until its channel could be dredged in 1992, when it became fully functional.

The Colorado River contributes freshwater to the estuary directly from the river and indirectly through return flows from rice fields irrigated from the river. Prior to the 1991 change, an average of 1.3 million acre-feet annually from the Colorado River entered the estuary at the mouth of the river, with about 150,000 acre-feet contributed through irrigation return flows. With the change in the Colorado River delta in 1991, the full average of 1.8 million acre-feet of annual flow of the Colorado River now enters Matagorda Bay.

It is relatively easy to quantify the water needs for municipal, industrial, agricultural and other human uses of water. However, the influence of water on the complex interactions in aquatic ecologies found in streams, lakes and estuaries are not well quantified. To more fully understand the implications of changes in freshwater inflows to estuarine ecosystems, state and federal agencies began studies of the Texas estuaries in the 1960s.

In 1985, the Texas Legislature directed the Texas Parks and Wildlife Department (TPWD) and Texas Water Development Board (TWDB) to continue studies of the estuaries and determine sufficient information so that the need for freshwater inflows to the estuaries could be considered in the allocation of the state's water resources. These studies were to be completed by December 31, 1989. However, due to funding reductions, changes in priorities and other factors, they were significantly delayed.

LCRA was directly affected by the delay in completing these studies. The TWC's Order, dated September 20, 1989, approving the WMP (see Appendix C) required that LCRA return to the TWC in 1993 with recommendations to modify the plan based on the results of the state's studies. Until the studies were completed, a schedule of interim minimum freshwater inflows was specified. This schedule called for a minimum monthly mean flow of 200 cfs, a minimum seasonal mean flow of

375 cfs, and a minimum annual flow of 272,000 acre-feet measured at the USGS stream gage at Bay City.

To expedite the state's freshwater inflow needs study of the Matagorda Bay system, LCRA entered into a cooperative agreement with TPWD, TWDB and TCEQ in 1993. LCRA agreed to adapt or modify existing methods used by the TPWD and TWDB and apply those methods to compute alternative freshwater inflow needs for the estuary. The participating state agencies would provide timely technical assistance to LCRA from the other participating parties. LCRA would also prepare a report on the methodology, data and results of the computation of alternative freshwater inflow needs.

Emphasis in the study was to be on the estuary west of the Colorado River in determining freshwater inflows from the Colorado and Lavaca Rivers and coastal basins. To the extent possible, the impact of freshwater inflows on the environmental conditions in East Matagorda Bay would be evaluated. Full analysis of East Matagorda Bay would be contingent on adequate external funding to allow LCRA to contract for an evaluation of the hydrologic, salinity and biological data collected to date on the conditions in this bay.

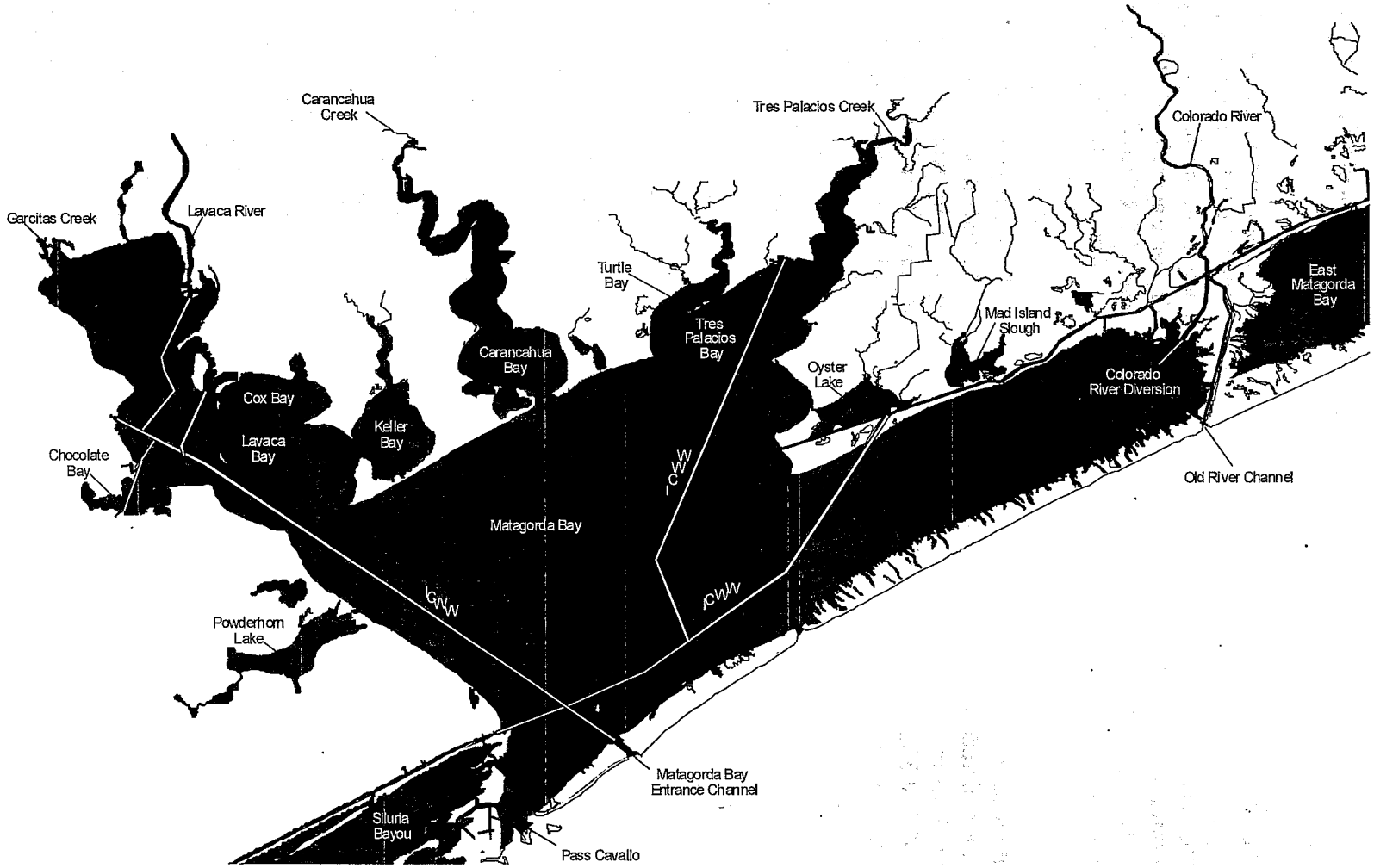


Figure 2-1. Major Tributary Streams, Passes and Bays in the Lavaca-Colorado Estuary

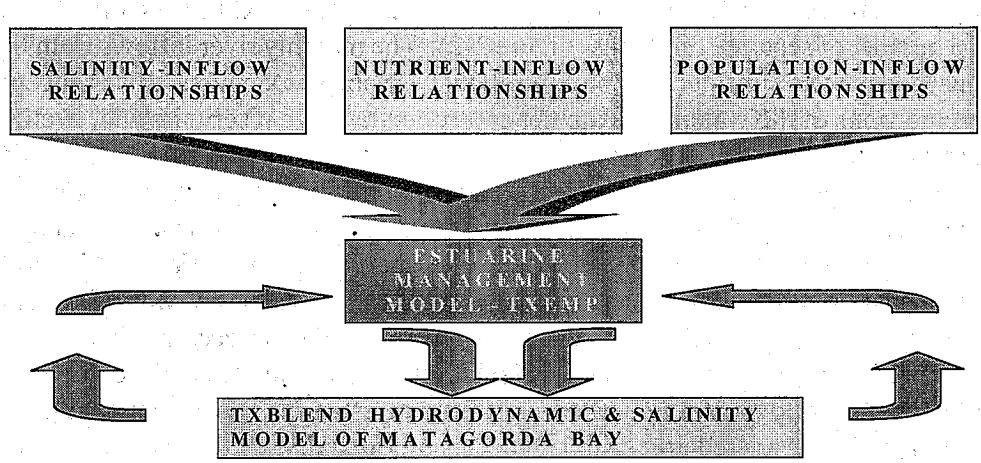
a. Methodology for Determining Freshwater Inflow Needs

In 1997, LCRA worked with TPWD, TWDB and TCEQ to estimate the freshwater inflow needs for Matagorda Bay, following as closely as possible the process developed by the TWDB and TPWD in their study of the Guadalupe Estuary (Longley, W.L., ed., TPWD AND TWDB 1994). This process involved a number of separate functions (Figure 2-2). The monthly river inflows from the Colorado and Lavaca Rivers were considered to be controllable variables. Of course, this is only partially true since large portions of the watersheds are not controlled by large reservoirs and, even where large impoundments exist, they have a limited storage capability to control floods. The salinity, productivity and nutrients are related to the river and total freshwater inflows by statistical equations. The unregulated inflows in the coastal basins contributing flow to the estuary are considered to be uncontrollable. However, these flows are affected by man's actions particularly in terms of return flows from irrigation. For this analysis, the inflows from the coastal basins were assumed to be in the same proportion to the inflows from the two major river basins as has occurred historically. The first major element is the development of statistical relationships for the varied and complex interactions between freshwater inflows and important indicators of estuarine ecosystem conditions. The key estuarine indicators considered are: salinity, species productivity, and nutrient inflows.

The second essential process involved using the statistical functions to compute optimal monthly and seasonal freshwater inflow needs. This was accomplished using the TWDB's Texas Estuarine Mathematical Programming (TXEMP) Model (Longley, W. L., ed., 1994). The TXEMP model estimates the long-term freshwater inflow needs of an estuary by representing mathematically the varied and complex interactions between freshwater inflows and salinity, species productivity, and nutrient inflows. Sediment inflows are excluded due to a lack of data concerning the volume of sediment needed to balance erosion and subsidence in the Colorado and Lavaca River delta.

The third major component of the process of developing inflow needs was the simulation of the salinity conditions throughout the estuary using the TXBLEND model developed by TWDB and modified by LCRA. The simulated salinity was then compared to desired salinity rangers over broad areas of the estuary. Where salinity was not within those ranges, then constraints in TXEMP were modified to achieve the desired salinity.

FIGURE 2-2. PROCESS FOR DETERMINING FRESHWATER INFLOW NEEDS



The application of the TWBD methodology and the resulting estimates of freshwater inflow needs are documented in Freshwater Inflow Needs of the Matagorda Bay System (LCRA: Martin, Q., Mosier, D., Patek, J., and Gorham-Test, C., 1997)

b. Freshwater Inflow Needs

The 1997 study estimated the freshwater inflow needs for the estuarine ecosystem associated with Matagorda Bay system for two levels of inflow needs: Target and Critical. The Target inflow needs are the long-term monthly and seasonal inflows that produced 98% of the maximum normalized population biomass for nine key estuarine fin fish and shellfish species while maintaining certain salinity, population density, and nutrient inflow conditions.

The salinity condition requires that estimated salinity fall within a predetermined range preferred by most species. The population density of any species has to be greater than 80% of its historical average. Finally, the total inflow of nutrients is at least equal to the natural nutrient losses from the ecosystem.

The Critical inflow needs were determined by finding the minimum the total annual inflow needed to keep salinity near the mouths of the Colorado and Lavaca Rivers at no more than 25 parts per thousand. These inflow needs were termed "critical" since they are believed sufficient to provide a fishery sanctuary habitat during droughts. From this sanctuary, the fin fish and shellfish species, particularly oysters, could be expected to recover and repopulate the bay when more normal weather conditions returned.

The Target inflow needs from all sources was calculated to be 2.0 million acre-feet per year. Inflow needs from the Lavaca and Colorado Rivers were estimated at 346,200 and 1,033,100 acre-feet annually, respectively. The remaining contributing areas are estimated to provide an additional 620,700 acre-feet annually.

A total annual freshwater inflow of about 287,400 thousand acre-feet was found to meet the Critical inflow need. Approximately 27,100 and 171,100 acre-feet annually would be provided from the Lavaca and Colorado River basins, respectively, with the remaining annual inflow of 89,200 acre-feet coming from the other contributing drainage basins.

The target and critical monthly freshwater inflow needs from the Colorado River are indicated in Table 2-2.

TABLE 2-2. TARGET AND CRITICAL FRESHWATER INFLOW NEEDS FOR THE MATAGORDA BAY SYSTEM FROM THE COLORADO RIVER

Month	Target Needs (1000 Acre-Feet)	Critical Needs (1000 Acre-Feet)
January	44.1	14.26
February	45.3	14.26
March	129.1	14.26
April	150.7	14.26
May	162.2	14.26
June	159.3	14.26
July	107.0	14.26
August	59.4	14.26
September	38.8	14.26
October	47.4	14.26
November	44.4	14.26
December	45.2	14.26

Month	Target Needs (1000 Acre-Feet)	Critical Needs (1000 Acre-Feet)
Total	1033.1	171.1

c. Revision of Freshwater Inflow Need from the Colorado River from Matagorda Bay

Based on additional data collection in Matagorda Bay since 1997, the statistical relationship between Colorado River flows and Matagorda Bay salinity has changed from what was developed and used in the 1997 study. The revised inflow-salinity relationship suggests that additional monthly inflows may be needed to maintain a salinity level of 25 ppt. However, because siltation and vegetation at the point where salinity is measured may have changed the morphology and stratification of sea water and freshwater at that location, additional study is warranted before further revisions are incorporated into the WMP.

Revising the critical FIN is not as simple as inserting the new salinity-inflow relationship. Indeed, there are a significant number of issues that must be considered in addition to the salinity threshold. The original FIN study used a very preliminary salinity limit of 25 ppt as the critical threshold value based solely on limited information about oyster impacts. It was never recognized as being a rigorous biological criterion for achieving conditions that would be truly critical for all the key plant and animal species in the bay near the mouth of the river.

At the time of the 1997 freshwater inflow needs (FIN) study, there was a clear intent to develop a much more complete set of criterion when the study was revised in the future. In light of these considerations, LCRA, TWDB, TPWD, and TCEQ entered into a Memorandum of Agreement in September 2002 to conduct a comprehensive study to revise all freshwater inflow need estimates for the Matagorda Bay system. Development of appropriate criteria for critical FIN will be considered in this study. Upon completion of this study, LCRA may propose changes to the WMP.

CHAPTER 3
DEVELOPMENT OF THE WATER MANAGEMENT PLAN

A. Introduction – The Significance of the Combined Firm Yield of Lakes Buchanan and Travis 3-2
B. Commitments Against Combined Firm Yield of Lakes Buchanan and Travis 3-2
1. O. H. Ivie Reservoir 3-3
2. City of Austin 3-3
3. Contracts for Use from Lakes Buchanan and Travis 3-3
4. LCRA Water Utilities and Facilities 3-4
5. Cooling Water for LCRA Power Plants 3-4
6. South Texas Project (STP) 3-4
7. Instream Flows and Bays and Estuaries 3-5
8. Summary 3-6
C. Annual Allocation of Firm and Interruptible Stored Water 3-6
1. Allocation of Firm Water 3-7
2. Allocation of Interruptible Stored Water 3-7
3. Priority Uses in the Allocation of Interruptible Stored Water 3-8
4. Use of Interruptible Stored Water for Recreation 3-10
5. Publication of Allocation of Firm and Interruptible Stored Water 3-11
6. Monthly and Quarterly Operations 3-12
D. Summary of LCRA's Water Conservation Plan and Programs 3-12
1. Wholesale Water Supplier Strategies 3-12
a. Water Measurement and Accounting 3-13
b. Monitoring and Records Management 3-13
c. Conservation-Oriented Rates 3-13
d. Contractual Requirements 3-13
e. Technical Assistance 3-14
f. School Education 3-14
g. Community Outreach 3-14
2. Irrigated Agriculture Conservation Strategies 3-15
a. Water Measurement 3-15
b. Canal Maintenance (Water Loss) Program 3-15
c. Customer Outreach 3-16
d. House Bill 1437 3-16
3. Industrial Water Conservation Strategies 3-17
a. Fayette Power Project 3-17
b. Sim Gideon Power Plant 3-17
c. Thomas C. Ferguson Power Plant 3-18

A. Introduction – The Significance of the Combined Firm Yield of Lakes Buchanan and Travis

One of the primary variables affecting the development of the WMP and allocation of water from Lakes Buchanan and Travis to various users is the Combined Firm Yield for Lakes Buchanan and Travis. This amount was determined in accordance with the Final Judgment and Decree, as explained more fully in Chapter 5 of this WMP, and is 535,812 acre-feet per year.

An essential criteria specified in the Final Judgment and Decree for the determination of the Combined Firm Yield was that all senior downstream water rights must be honored by LCRA by passing through inflows necessary to meet those senior water rights to their fullest extent. The senior water rights include those belonging to the City of Austin, Pierce Ranch[1] Irrigation Company, and the Garwood,[2] Lakeside, and Gulf Coast Irrigation operations owned by LCRA.

A full description of those water rights, the method used to determine their demand on a daily pass through basis, and the determination of Combined Firm Yield are found in Chapter 5. Honoring these senior water rights at their fully authorized diversion rate and annual demand has a major impact on the firm yield determination of Lakes Buchanan and Travis. The upstream reservoir demand for O. H. Ivie Reservoir of 90,546 acre-feet per year is considered in the calculation of the Combined Firm Yield based on the commitment for these upstream inflows to be withdrawn from the inflows prior to such flows going into Lake Buchanan.

B. Commitments Against Combined Firm Yield of Lakes Buchanan and Travis

The Combined Firm Yield of Lakes Buchanan and Travis represents the maximum average annual demand that could be met by these two lakes during a repetition of the most critical drought of record on the lower Colorado River. That drought period was from 1947 to 1957, an eleven-year period that was identified as the most severe drought occurring during the 105 years since data collection began in February 1898. The Combined Firm Yield was calculated while honoring all senior water rights to their fullest extent granted by the TCEQ.

A question of primary interest is how much of this firm supply of 535,812 acre-feet per year has LCRA committed to supply, and how much is remaining that can be devoted to future needs for firm water. The majority of the lakes' Combined Firm Yield has been committed to various users and purposes through contracts and Board resolutions. As of April 2003, 60,952 acre-feet of the lakes' Combined Firm Yield is not committed or held in reserve by the Board. This number excludes the increase in commitment of firm water for instream flows and freshwater inflows proposed by this filing. If this proposal is accepted, then the remaining Combined Firm Yield available for commitment would be reduced to 43,462 acre-feet. Agreements with the City of Austin and the Brazos River Authority (BRA) give LCRA the flexibility to meet its annual Combined Firm Yield allotments – 187,524 acre-feet for the City of Austin and 25,000 acre-feet for BRA – from any combination of sources. Currently, firm supply from Lakes Buchanan and

[1] LCRA now owns this water right.

[2] LCRA now owns 133,000 acre-feet of this right and the City of Corpus Christi owns the remaining 35,000 acre-feet of this right.

Travis are used as the source of the City of Austin and BRA firm water supplies through 2020. The remaining commitments that are expected to be needed beyond 2020 could be met from any source, including the Garwood water right, which is used primarily for irrigation at this time. Currently, the Garwood water right is not committed to any firm water user. The sources for the City of Austin and BRA water supplies may change periodically as LCRA determines the best method of filling all water commitments in LCRA's water service area at any given time.

Currently, there are seven groups of commitments that are considered as firm demands:

1. O. H. Ivie Reservoir

Permit No. 3676 authorizes O. H. Ivie Reservoir. Operation of the reservoir is under an operating agreement between LCRA and the Colorado River Municipal Water District (CRMWD) that called for a gradual filling of O. H. Ivie Reservoir. (See Appendix 1B, Volume II) This allows an incremental increase in O. H. Ivie Reservoir's firm demand as CRMWD's contractual commitments increase. The maximum impact of O. H. Ivie Reservoir on the Combined Firm Yield of Lakes Buchanan and Travis is 90,546 acre-feet per year.

2. City of Austin

Under the 1987 Comprehensive Water Settlement Agreement between the City of Austin and the Lower Colorado River Authority, LCRA agreed to make available to the City of Austin stored water from Lakes Buchanan and Travis as may be required from time to time to firm up or supplement the City's independent water rights to the extent of 290,156 acre-feet per year. Under the 1999 Amendment to the 1987 Agreement, the total amount of reserved water for the City was increased to 325,000 acre-feet. To fulfill this agreement, studies by LCRA show that a commitment of approximately 187,524 acre-feet per year from the Combined Firm Yield of Lakes Buchanan and Travis will be required. As stated above, at present the firm supply from Lakes Buchanan and Travis are used as the source of City of Austin firm water supplies through 2020, estimated as 122,084 acre-feet per year. The amount of water committed from Lakes Buchanan and Travis is less than in prior versions of the WMP because LCRA's 1999 Agreement with the City of Austin allows LCRA to meet the City's demands from any source. LCRA currently expects to meet the remaining committed supplies of 65,440 acre-feet that are estimated to be needed by the City of Austin beyond 2020 from other sources, including the Garwood water right, which is used primarily for irrigation at this time. The sources for the City of Austin water supplies may change periodically as LCRA determines the best method of filling all water commitments in LCRA's water service area at any given time.

3. Contracts for Use from Lakes Buchanan and Travis

As of April 2003, LCRA has committed through contracts for the diversion of water either directly from the Lakes Buchanan and Travis or releases to downstream customers a total of 119,838 acre-feet per year. These contracts are for municipal, industrial, and firm irrigation purposes and, because they call for a designated quantity of water each and every year with no other independent water rights available, they are considered to be a firm commitment for the supply of water. This estimate excludes commitments to LCRA utilities, facilities, and power plants, which are discussed below. As stated above, at present the firm supply from Lakes

Buchanan and Travis are used as the source of firm water supplies for the Brazos River Authority (BRA) through 2020, estimated as 10,000 acre-feet per year.[3] The remaining committed supplies of 15,000 acre-feet that are estimated to be needed by BRA beyond 2020 could be met from any source, including the Garwood water right, which is used primarily for irrigation at this time. The sources for BRA's water supplies may change periodically as LCRA determines the best method of filling all water commitments in LCRA's water service area at any given time.

4. LCRA Water Utilities and Facilities

As of April 2003, LCRA had committed through LCRA Board Resolution a total of 5,438 acre-feet per year for the diversion of water directly from the Lakes Buchanan and Travis for LCRA-owned utilities that provide potable water on a wholesale or retail basis. In addition, 1,473 acre-feet per year were reserved by the LCRA Board for purposes of landscape irrigation and cooling purposes at LCRA's office facilities in Austin and on Lake Buchanan. These commitments are subject to substantially the same terms and conditions of LCRA's standard contracts with other firm municipal customers.

5. Cooling Water for LCRA Power Plants

LCRA's power plants have a demand for cooling water and other plant uses that is considered to be a commitment against the Combined Firm Yield. By LCRA Board Resolution on January 22, 1987, the following commitments were made to each of the power plants:

Ferguson	15,000
Sim Gideon	10,750
Fayette	38,101
TOTAL	63,851 acre-feet per year

6. South Texas Project (STP)

LCRA currently has a contract in effect with Texas Genco, LP[4] to serve the South Texas Project (STP). STP Nuclear Operating Company[5] as project manager of STP, acts on behalf of, and for the benefit of, the participants in STP, which presently are: 1) the City Public Service Board of the City of San Antonio; 2) Central Power and Light Company; 3) the City of Austin; and 4) Texas Genco, LP, to supply cooling water for the South Texas Project in an amount up to 102,000 acre-feet per year. This water is to be made up of run-of-river water available and back-up stored water from Lakes Buchanan and Travis. To the extent that stored water is required to fulfill this commitment, it is considered a commitment against the Combined Firm Yield of Lakes Buchanan and Travis.

To determine what impact this commitment would have on the commitment of Combined Firm

[3] In October 2000, LCRA and BRA entered into a fifty (50) year contract wherein BRA agreed to purchase up to 25,000 acre-feet of water per annum from LCRA for use within designated areas within Williamson County.
[4] Texas Genco, LP has succeeded to the ownership interest formerly held by Houston Lighting and Power.
[5] STP Nuclear Operating Company succeeded Houston Lighting Power Company as operator of the South Texas Project.

Yield water, a simulated operation was conducted during the development of the initial WMP in 1989 that evaluated the critical drought period with a demand for cooling water generated by four units at the STP with a combined generating capacity of approximately 5,000 megawatts. This simulation showed that the STP would not require any water from storage as authorized under the LCRA/Texas Genco, LP contract to be released during most of the critical drought period.

However, the simulation through the critical drought period indicated a demand for stored water in one year of 51,700 acre-feet per year. Thus, an average of 5,680 acre-feet per year was included as the accumulated demand over the eleven year critical period to provide for this larger annual demand.[6]

7. Instream Flows and Bays and Estuaries

To honor the commitment towards environmental flow needs, both firm water supplies and interruptible stored water supplies are used. The classification of water allocated for environmental needs as firm or interruptible is based upon whether the interruptible stored water supplies are curtailed or not in the simulation for the four major irrigation operations.

Results of simulations conducted for the current revisions to the WMP showed that the total commitments of the Combined Firm Yield from Lakes Buchanan and Travis for instream flow maintenance will be an average of 27,380 acre-feet per year, with a maximum of:

- 51,100 acre-feet in any one year;
- 85,700 acre-feet in any two consecutive years;
- 114,200 acre-feet in any three consecutive years;
- 147,700 acre-feet in any four consecutive years;
- 184,500 acre-feet in any five consecutive years;
- 212,200 acre-feet in any six consecutive years;
- 245,600 acre-feet in any seven consecutive years; and
- 273,800 acre-feet in any eight to ten consecutive years.

Total commitments of the Combined Firm Yield from Lakes Buchanan and Travis for bays and estuaries (estuarine inflows) will be an average of 6,060 acre-feet per year, with a maximum of:

- 20,660 acre-feet in any one year;
- 23,570 in any two consecutive years;
- 23,680 acre-feet in any three consecutive years;
- 32,220 acre-feet in any four (4) consecutive years;

[6] LCRA is currently reevaluating the adequacy of this firm commitment. Initial indications are that this commitment should be revised upwards, perhaps significantly. When this analysis in complete, should a revision to the commitment be required, LCRA will submit an updated commitment for inclusion in this proposed revision of the WMP. Any revised number for the firm commitment to STP will have the effect of changing the amount of uncommitted water available for sale by LCRA, as discussed in this Chapter. It will not, however, affect any of the Drought Contingency Plan elements of this WMP contained in Chapter 4 of this WMP nor will it require any further revisions to Chapters 5 or 6 of this WMP.

- 40,800 acre-feet in any five consecutive years;
- 41,400 acre-feet in any six consecutive years;
- 47,800 acre-feet in any seven consecutive years; and
- 60,600 acre-feet in any eight to ten consecutive years.

The total firm stored water commitment for both purposes will be an average of 33,440 acre-feet per year. Estimated interruptible stored water supplied during the critical drought for both purposes will be an additional 23,030 acre-feet per year.

8. Summary

To supply the demands of the preceding commitments for firm water existing during a repetition of the critical drought would require an average of 442,350 acre-feet per year to be released or diverted from storage in Lakes Buchanan and Travis, assuming the proposed changes to firm commitments to instream flows and freshwater inflows to the bays and estuaries are accepted. This commitment is summarized below in Table 3-1.

Table 3-1. Existing Firm Water Commitments as of April 2003

O.H. Ivie Reservoir	90,546
City of Austin	122,084
Contracts from Lakes Buchanan and Travis	119,838
LCRA Water Utilities and Facilities	6,911
LCRA Power Plants	63,851
South Texas Project	5,680
Instream Flows/	27,380 (annual average)
Bays and Estuaries	6,060 (annual average)
TOTAL	442,350 acre-feet/year

Out of concern for the future needs of the many areas in LCRA's 35-county water service area, including areas now using ground water supplies that are becoming depleted or are of poor water quality, the LCRA Board committed to reserving 50,000 acre-feet of the remaining Combined Firm Yield.

This leaves an uncommitted balance of the Combined Firm Yield of 60,952 acre-feet per year with the commitments of firm supply to instream flows and freshwater inflows to the bays and estuaries as adopted by the TCEQ in 1999. Or, as indicated in Table 3-1, if the proposed changes to these commitments are accepted, the uncommitted balance of the Combined Firm Yield will drop to 43,462 acre-feet per year.

C. Annual Allocation of Firm and Interruptible Stored Water

Each year, LCRA will determine the amount of water that is available for interruptible commitments to supply the uses authorized under LCRA's Certificates of Adjudication.

No interruptible stored water will be supplied to cities or other industries that should be served on a firm basis. Interruptible stored water will be limited to irrigation or other similar uses where the value of water is well below firm water rates and the purchase is for one year only. New contracts for firm and interruptible stored water are subject to the Water Contract Rules as specified in Appendix 3 of Volume II.

In November of each year, LCRA determines the amount of water that is available in the following year to meet firm and interruptible demands in the system. LCRA manages the conservation storage of the reservoirs by using the interruptible stored waters to increase the average yield of the system.

Should an emergency occur that causes a demand for additional allocations of water to either firm or interruptible stored water contract holders, any interested party may petition the LCRA Board for such additional purchases.

1. Allocation of Firm Water

The amount of water required to meet the firm demand within the system for the preceding year will be calculated in early October. This amount will be compared to the projections for that year, and any variations will be noted and documented. LCRA will solicit information and projections of use from all of its firm supply contract holders and other firm uses provided for by resolution of the LCRA Board. This information will be used to develop a projection of firm demands for the coming year.

LCRA will assess the contents of Lakes Buchanan and Travis as of November 1 to project the storage levels for January 1 of the next year. Inflows into Lakes Buchanan and Travis from the upstream tributaries will be added to this preliminary storage level based on the minimum annual inflow from the period of drought.

This process will allow LCRA to reserve sufficient water in the system to meet all firm demands for one year beyond the year being considered for allocation.

Estimates for firm demand commitments for the next year will be subtracted from the total water supply available. The amount of water remaining will then be available for interruptible allocation for that year.

2. Allocation of Interruptible Stored Water

As part of the overall allocation process, every November LCRA will determine the amount of water that is available in the following year for interruptible contracts. LCRA may make commitments for interruptible stored water for terms in excess of one year. However, the allocation of interruptible stored water to be supplied under such commitments will be determined on an annual basis. All interruptible commitments are subject to full or partial curtailment.

3. Priority Uses in the Allocation of Interruptible Stored Water

In the allocation process, priority will be given to the irrigation operations (Lakeside, Gulf Coast, Garwood, and Pierce Ranch) to firm-up run-of-river water rights associated with individual irrigation operations. The LCRA Board will establish, by resolution, a Conservation Base number of acres determined by the historical (10-year) average acres that have been irrigated by Lakeside and Gulf Coast irrigation operations. The amount of surface water to be used for irrigation under this Conservation Base is based upon a limit of 5.25 acre-feet of water per acre irrigated (see Table 3-2). The priority allocation for Garwood irrigation operation is based on a contract that defines LCRA's commitment to supply interruptible stored water to the Garwood irrigation operation to the extent necessary to firm up the 133,000 acre-foot-per-year run-of-river water right associated with the Garwood irrigation operation. The priority allocation for Pierce Ranch is based on a contract that defines LCRA's commitment to supply interruptible stored water to Pierce Ranch. These contractual commitments to Garwood and Pierce Ranch are not based on a "Conservation Base acreage" calculation, but the 5.25 acre-foot-per-acre duty will apply to the acreage irrigated.

The Conservation Base acreage for the Lakeside and Gulf Coast irrigation operations will be served without charge for the amount of water designated under each operation's run-of-river rights. In years when the amount of run-of-river water is projected to be insufficient to serve the Conservation Base and the priority allocations for Garwood and Pierce Ranch, the annual allocation of interruptible stored water will provide back-up for those rights. The charge for the allocation of interruptible stored water shall be at the prevailing interruptible stored water rate set by the LCRA Board or, in the case of Garwood and Pierce Ranch, in accordance with their respective contracts with LCRA.

TABLE 3-2
CONSERVATION BASE ACREAGE OR OTHER PRIORITY ALLOCATION OF INTERRUPTIBLE STORED WATER

	LAKESIDE	GULF COAST	GARWOOD[1]	PIERCE[3]
Acres x Duty[2]=Ac. Ft.	26,000 x 5.25 = 136,500 acre-feet	24,300 x 5.25 = 127,575 acre-feet	32,000 with 100,000 acre-feet.	25,000 with 20,000 ac. ft. (Max. 30,000 ac. ft.)
Conservation Base[6] Or other Priority Allocation	see above	see above	see above	see above
% R-O-R Rts.[4]	44.6%	58.6%[7]	93.1%	0%[8]
% Stored Int.[5]	55.4%	41.4%[7]	6.9%	100%[8]

[1] Garwood Irrigation Company and LCRA entered into a contract dated December 10, 1987, which defines LCRA's commitment to supply interruptible stored water to Garwood and the terms for curtailment during periods of shortages. This contractual commitment to Garwood is not based on a "Conservation Base Acreage" calculation, but the 5.25 acre-foot-per-acre duty will apply to the acreage irrigated. In 1998, LCRA purchased the assets of Garwood Irrigation Company, including its water rights. Under the terms of the 1998 agreement, LCRA has committed to supply up to 100,000 acre-feet annually consisting of run-of-river under the LCRA-owned Garwood water rights and LCRA interruptible stored water.

[2] Duty set by TCEQ (5.25 Ac.Ft./Ac.) for rice irrigation.

[3] LCRA has entered into a contract with Pierce Ranch regarding LCRA's commitment to supply interruptible stored water to Pierce Ranch and the terms for curtailment during periods of shortage. This contractual commitment to Pierce Ranch of 20,000 acre-feet annually based on a rolling five-year average with a 30,000 acre-feet maximum in any calendar year is not based on a "Conservation Base Average" calculation, but the 5.25 acre-foot-per-acre duty will apply to the acreage irrigated. The Pierce Ranch operation needs may also still be met through exercise of Certificate of Adjudication No. 14-5477D.

[4] % of Conservation Base or other Priority Allocation likely to be supplied by run-of-river rights (*i.e.* estimated reliability of the water right)

[5] % of Conservation Base or other Priority Allocation expected to be supplied by Interruptible Stored Water based on reliability of run-of-river rights.

[6] LCRA purchased 55,000 acre-feet of water rights from Pierce Ranch and transferred these water rights for diversion and use within the Lakeside service area, which is currently 28,300 acres

[7] % based on water used for 37,000 acres (194,250 acre-feet)

[8] % based on water use for 7,200 acres (37,800 acre-feet)

4. Use of Interruptible Stored Water for Recreation

Interest groups around the Highland Lakes, such as marina owners and other tourist and recreation industry members represented by the Highland Lakes Tourist Association expressed the need for recreation to be given some priority in the allocation of interruptible stored water.

In developing the annual interruptible allocation process, LCRA has considered the needs of the recreation industry around the lakes and proposes establishing some use of the interruptible stored waters to maintain lake levels in Lakes Buchanan and Travis. These levels would be above the possible minimal drawdowns of the lakes under the operating rule curve and would be established in recognition of LCRA's public interest responsibilities.

The conflict between supplies of interruptible stored water being held in the lakes for recreation or being released and sent downstream for agricultural irrigation and public recreation is one of the most difficult issues for LCRA to balance. The rice farmers have a historic claim to a "first call" on the water used for rice farming as shown in Table 3-2. However, LCRA believes that the needs and interests of the recreation industry that has developed around the Highland Lakes must be heard and given due consideration.

Once the first priority allocation of interruptible stored water has been made to supply the Conservation Base of the Lakeside and Gulf Coast irrigation operations and LCRA's contractual commitments to the Garwood and Pierce Ranch irrigation operations, LCRA staff will make recommendations to the LCRA Board for the remainder of the interruptible stored water available for supplying other authorized uses under LCRA's water rights. In recognition of the economic benefits to the recreation industry in the Highland Lakes region, the WMP establishes a process to consider the levels of Lakes Buchanan and Travis.

LCRA will limit additional sales of interruptible stored water, other than for the four irrigation operations' Conservation Base or Priority Allocation acreages, based on the combined volume of water in Lakes Buchanan and Travis at certain times of the year. To provide for more flexibility to supply interruptible stored water in normal and wet years, the supply allocation formula is based on a semi-annual allocation process using the following policies:

1. Interruptible stored water supply available (other than to the four major irrigation operations) for January through June in any year is based on the minimum of the separate storage levels, as percent of maximum water conservation capacity) in Lakes Buchanan and Travis on January 1 of that year according to the schedule provided in Table 3-3.

2. Interruptible stored water supply available (other than to the four major irrigation operations) for July through December in any year would be based on the minimum for Lakes Buchanan and Travis of their separate maximum storage levels (as percentage of capacity) in April, May and June of that year. That is, the maximum percent full for each lake over April through June would be compared and the lower

of the two percentages selected. The water supply allocation for July through December is also given in Table 3-3.

3. Maximum supply available in any year is 30,000 acre-feet, with the semi-annual allocation based on a typical municipal monthly demand distribution.

TABLE 3-3. MAXIMUM INTERRUPTIBLE STORED WATER AVAILABLE FOR SALE, EXCLUSIVE OF SALES FOR THE CONSERVATION BASE OR PRIORITY ALLOCATION ACREAGE OF THE FOUR IRRIGATION OPERATIONS

Minimum of the Maximum Reservoir Storage for Either Lakes Travis or Buchanan Either on January 1 or over the months of April, May and June (As Percentage of Full Water Conservation Capacity)	Maximum Additional Interruptible Stored Water Available for Sale in January Through June (Acre-feet)	Maximum Additional Interruptible Stored Water Available for Sale in July Through December (Acre-feet)
≤94	0	0
95	2,170	2,830
96	4,330	5,670
97	6,500	8,500
98	8,670	11,330
99	10,830	14,170
100	13,000	17,000

No maintenance, except for emergencies that would require the lowering of Lakes LBJ, Marble Falls, and Inks, will be permitted if the refilling of those lakes would result in substantial loss of hydropower generation benefits or other costs. Periodic lowering and refilling of Lake Austin will be done when requested by the City of Austin and consistent with LCRA Board Policy 503-Lowering LCRA-Operated Lakes.

5. Publication of Allocation of Firm and Interruptible Stored Water

LCRA will publish the results of the allocation process and notify the LCRA Board, the firm supply contract holders, and any existing or potential interruptible contract holders of the results.

6. Monthly and Quarterly Operations

The operational rule curve will be applied to the system on a monthly basis to determine how the system is responding to current conditions as compared to historical operations. This will allow LCRA to optimize reservoir operations on a real time basis and to determine if adjustments to the amount of interruptible stored water should be considered. The monthly allocation model serves to continually evaluate inflows into the system, to evaluate risks, and to assess system reliability. The monthly analysis would detect early signs of drought and allow LCRA to develop and implement contingency measures in a timely fashion.

At minimum, a quarterly system operations report showing inflows to the system, monthly releases for firm and interruptible commitments, and important operating characteristics will be provided to the LCRA Board.

D. Summary of LCRA's Water Conservation Plan and Programs

Although LCRA has had extensive water conservation programs since the late 1980s, it did not formally adopt a water conservation plan until 1998. This plan was updated to reflect water conservation and drought contingency planning requirements under Senate Bill 1 and approved by the LCRA Board of Directors in April 2000. In March 2009, the LCRA Board of Directors approved water conservation goals and strategies that will be phased in over several years to reduce overall water use in the basin. The 2009 LCRA Raw Water Conservation Plan meets the requirements of Chapter 288 of the TCEQ rules as a wholesale water supplier for municipal, irrigation and industrial customers, as a retail supplier of water to irrigation operations, and as an industrial user of water at LCRA power plants. The Plan discusses separate water conservation strategies for municipal wholesale water customers, LCRA irrigation divisions, LCRA power plants, and other nonagricultural and agricultural irrigation, recreation and industrial uses. The following provides a summary of LCRA's plan.

1. Wholesale Municipal, Industrial and Other Firm Water Supply Strategies

Water conservation and reuse are viewed as important strategies for mitigating the effects of urban growth on the region's water resources, particularly in the Austin and surrounding areas. In addition to reducing future municipal water demands, municipal water conservation and reuse can make important contributions toward satisfying the water and wastewater service requirements of growing urban populations and economics.

LCRA's municipal water conservation programs are predicated on the fact that the implementation of conservation measures must occur in partnership with customers and stakeholders. Many water utilities have limited or no programs for water conservation, while the City of Austin (accounting for more than 70 percent of all municipal water use in LCRA's water service area) has one of the most aggressive conservation programs in Texas. As such, the focus of LCRA's programs is to increase water-use efficiency to reduce the waste of water throughout the water service area Strategies are listed below.

a. Water Measurement and Accounting

The LCRA Water Contract Rules impose requirements on LCRA's water customers to properly measure water diversions. One of the provisions specifically requires all meters to be accurate within +/- 5 percent of the indicated flow over the possible flow range. LCRA personnel read these meters on a monthly basis. Each customer is required to provide third-party verification of meter testing and calibration to LCRA staff each year. LCRA-owned and-operated water utilities must also follow these rules.

b. Monitoring and Records Management

LCRA maintains records of water distribution and sales through several monitoring and billing systems. A Windows-based system provides a central location for water billing information and an automated way to compile and present that information.

c. Conservation-Oriented Rates

LCRA's wholesale raw water rates were designed to encourage water conservation. The water rate is 42 cents per 1,000 gallons or $138 per acre-foot. However, any water used above the contracted amount increases to $262.20 per acre-foot. Customers also are allotted a reservation charge of $69 per acre-foot for water reserved but not used.

LCRA has also developed increasing block rates for all retail water utilities.

d. Contractual Requirements

According to LCRA Board Policy 509 - Water Conservation, all future water sales contracts and water utility agreements shall contain "appropriate conditions requiring conservation measures that are economically feasible." LCRA's Rules for Water Conservation are updated periodically to meet the requirements of Chapter 288 of TCEQ's rules for water conservation and drought contingency plans.

All plans must be reviewed and approved by LCRA staff before contracts are signed. Each customer agrees that, in the event that it furnishes water or water services to a third party that in turn will furnish the water or services to the ultimate consumer, the water conservation requirements shall be met through contractual agreements between it and the third party.

In April 2007, the LCRA Water Contract Rules were amended to clarify that LCRA will determine the reasonableness of the quantity of any raw water contract request. The reasonableness of the quantity requested is evaluated based on many factors, including the applicant's water conservation plan, delivery or system losses, and other factors. Agency and industry standards are used in LCRA's assessment, including but not limited to the TWDB Water Conservation Task Force Best Management Practices Guidebook. To the extent the applicant requests a water supply based on standards other than those commonly used, the applicant must submit a written justification describing the reasons these standards were not

employed and how the water supply needs were calculated.

e. Technical Assistance

LCRA has worked with communities and cities in its water service area for the past two decades to demonstrate the effectiveness of water conservation in reducing water consumption and wastewater flows. This effort ranges from providing sample water conservation programs, to developing conservation and drought contingency plans and landscape ordinances, to providing planning and equipment for plumbing retrofit programs.

f. Public Education and Outreach

LCRA began implementing the Water IQ program in Central Texas in 2006. The program uses a diverse set of tools to reach the public with water-saving tips and information, including television, radio, and print ads; billboards; electronic advertising; and community outreach with key audiences. In 2008, the City of Austin, LCRA, and the City of Cedar Park collaborated on the Water IQ: Know your Water campaign. Recognizing that water conservation outreach programs can be costly and consumers may become confused hearing mixed messages from water suppliers, LCRA and two cities pooled their resources on a shared outdoor water efficiency campaign. By reaching a consensus on a few key outdoor watering recommendations, the three entities were able to transmit a valuable regional message that reached a broad range of customers throughout the 10-county area.

Additional LCRA outreach and education efforts include the promotion of the Texas Hill Country Landscape Option to promote landscape best management practices, continued involvement in the Major Rivers education program, natural science education programs at LCRA nature parks, and the use of video tutorials and other water efficiency tips on the LCRA Web site. In 2008, TWDB and LCRA jointly updated the Major Rivers curriculum to correlate with the latest education standards and to add additional "hands-on" activities such as a new outdoor water use and conservation activity.

g. Future Conservation Strategies

In January 2009 LCRA staff proposed a comprehensive strategic plan for municipal, industrial and non-agricultural irrigation water conservation — based on results of the research and considering input from stakeholders and customers — to the LCRA Board. This comprehensive program will include a variety of strategies to save water, including incentive programs through which LCRA will partner with its customers to offer water-saving fixtures such as high-efficiency toilets; requirements that new construction meet standards for soil depth and irrigation systems; and expansion of LCRA's education outreach efforts to provide useful information to consumers. Elements of the program will be phased in over the next several years.

2. Irrigated Agriculture Conservation Strategies

As the largest user of water from the lower Colorado River system, irrigated agriculture provides the best opportunity for reducing the overall demand through conservation programs. Beginning in 1986, LCRA initiated a major program to increase irrigation water use efficiency in rice irrigation systems. Rice cultivation accounts for more than 90 percent of all irrigation in LCRA's water service area.

LCRA's efforts in irrigation water conservation have been and continue to be focused on promoting water conservation at its irrigation operations: Lakeside, Gulf Coast and Garwood. These systems, along with one other privately owned major irrigation company, account for approximately 65 percent of the surface water irrigation in Colorado, Wharton, and Matagorda counties. The LCRA irrigation operations do not provide water for other wholesale customers or public water suppliers.

Substantial water savings resulted from irrigation conservation programs implemented in the Lakeside and Gulf Coast Irrigation Operations. Combined between the two operations, LCRA saved about 41,500 acre-feet annually from 1989 to 1996. This savings is approximately 13 percent of the projected water use that would have occurred without conservation practices in place. Conservation strategies implemented in the operations include the following:

a. Water Measurement

From 1989 to 1997, LCRA invested about $1.3 million for improvements in the water delivery system, structure standardization, purchase of electronic measurement devices for daily measurements, and customer education. Starting in 1993, LCRA began selling irrigation water in the Lakeside and Gulf Coast systems at a price based on a mix of acreage and water use. Formerly, LCRA provided water to individual customers of the irrigation operations only on the basis of acreage irrigated. In 2009, the LCRA Board approved a project to complete similar improvements to the Garwood system to enable on-farm water measurement which include the purchase of in-canal check structures to improve water distribution as well as structure standardization. Initial funding of $250,000 was approved recently from HB1437 funds. This project began in the fall of 2009 and is anticipated to be complete by 2012. This strategy is anticipated to save at least 3,400 acre-feet per year and possibly as much as 10,000 acre-feet per year.

b. Canal Maintenance (Water Loss) Program

In 1987, LCRA initiated an irrigation canal rehabilitation project for improving canal conveyance efficiency, reducing power consumption, and improving canal system management. In this project, from 1987 to 1996, LCRA invested about $1.5 million for regrading and selectively removing high water-consuming trees and vegetation from about 210 miles of canal; replacing about 300 water control structures, and modifying pump utilization schedules. The large majority of effort was in the Gulf Coast system. Prior to the implementation of this project, canal water loss in the Gulf Coast system was about 55 percent and in the Lakeside system was

about 25 percent. Following the implementation, based on recent analysis, this loss has come down to about 30 percent in the Gulf Coast system and about 20 percent in the Lakeside system.

With the completion of the canal rehabilitation project, LCRA has implemented a routine preventive maintenance program. This effort is expected to maintain existing canal operation efficiencies within the Lakeside and Gulf Coast systems. The Garwood canal system is in relatively good shape, with losses running at about 20 percent, similar to that found in the Lakeside system.

c. Customer Outreach

To facilitate communication with irrigation customers, LCRA created the Lakeside and Gulf Coast Farmer Advisory Committees in 1984. Garwood Irrigation Operation customers formed a farmer advisory committee in 1999, shortly after LCRA acquired the system. These committees represent the interests of customers of the irrigation systems. They also provide forums for LCRA to inform the farming community on LCRA's water conservation programs and to stimulate discussion on potential farming practices that can reduce water use. The HB1437 program also has an advisory committee, as required by the legislation. This committee was reappointed in 2009 and is actively involved in reviewing HB1437 activities.

LCRA initiated agricultural water conservation efforts in the mid 1980s through funding $90,000 to the Texas A&M University Agricultural Research and Experiment Station for developing the "Less Water, More Rice" program. The emphasis of this program was to deliver water conservation messages to rice irrigators. Based on the preliminary results of "Less Water, More Rice," improved cultivation and management practices (e.g., precision land leveling, multiple inlet systems, etc.) can reduce on-farm water use by 25 to 30 percent.

d. House Bill 1437

In May 1999, the Texas Legislature passed House Bill 1437, which allows LCRA to sell up to 25,000 acre-feet of water from the Colorado River to public water suppliers in Williamson County. The HB 1437 legislation requires "no net loss" of water in the Colorado River watershed and authorizes an additional charge to be added to the base water rate to fund strategies to ensure that an equal amount of water is conserved, replaced or offset. Funds collected from the additional charges are to be used for the development of water resources or other water use strategies to replace or offset the amount of surface water transferred. In 2000, LCRA entered into a water supply contract with the Brazos River Authority to provide water to Williamson County communities. A 25 percent surcharge is applied to the standard water rate to provide income to the Agricultural Water Conservation (Ag) Fund. In 2004, the LCRA Board authorized an engineering study and public meetings to develop a plan for implementing the HB 1437 program. The results of this study lead to the revised LCRA Board Policy 501, which defined the term "no net loss," and the development of a short-term plan to implement conservation projects that would allow the water transfer to occur under the provisions of the HB 1437 legislation. This short-term implementation plan has been updated recently and was finalized in October 2009.

The HB 1437 Agricultural Water Conservation Program was developed in 2005 in order to provide grants from the fund to eligible producers to construct on-farm water conservation projects. From 2006-2009, this program has provided grant funding to precision level a little over 19,000 acres, saving an estimated 4,750 acre-feet of water each year, mostly in the Lakeside and Garwood Irrigation Divisions. An annual report is prepared yearly showing details of current demand projects, current planning efforts, program results (including volume conserved and available for transfer), financial details about the Ag Fund, and a program outlook for the next year. To date, approximately $1.875 million has been spent on this program. Recently, the LCRA Board authorized an additional $200,000 to fund precision land leveling cost-share projects in 2010 and $250,000 to begin the Garwood measurement project. In 2009, LCRA contracted with a PhD student at the University of Texas' LBJ School to complete a statistical model to verify water savings from the precision land leveling grant program. This work is expected to be completed in 2010.

3. Industrial Water Conservation Strategies

a. Fayette Power Project

The Fayette Power Project (FPP) has an extensive conservation and reuse program. The power plant conserves and reduces the amount of water diverted from the river. This helps maintain the integrity of the cooling reservoir dam by properly controlling the water level. FPP developed a plant water balance that indicates water usage. It was found that unique opportunities existed at FPP that do not exist at other plants, mainly because of its size and the reuse design from the no-discharge ponds. Highlights of reused water and wastewater include:

- Water reuse from the reclaim pond in the Unit 3 Flue Gas Desulfurization (FGD).
- Reverse osmosis reject water reused in the FGD or returned to the lake.
- Reuse of ash pond water for Units 1 & 2 bottom ash and economizer fly ash removal.
- Reuse of wastewater treatment plant effluent in the ash pond or reclaim pond.
- Reuse of the fly ash runoff pond water in the reclaim pond.
- Reuse of the coal runoff water in the ash pond in times of drought.

Additional conservation measures for FPP include converting the bottom ash system on Units 1 and 2 to a dry system, using reclaimed pond water in place of raw water for dust suppression, recycling stormwater from the coal pile runoff pond back to the reservoir, recycling stormwater from the reclaimed water pond to the reservoir, distributing information and training about water conservation and leak detection to employees, and revising the irrigation system to use wastewater or alternative water sources.

b. Lost Pines Power Park (includes Sim Gideon and Lost Pines 1 Power Plants)

The largest water conservation and cost reduction measure at the facility is the implementation of a Lake Bastrop elevation level management policy, whereby the lake level is managed to an elevation that is eight to 14 inches below the spillway for multiple reasons. By maintaining an

average 12-inch drop in elevation, there is a reduction in the surface area of Lake Bastrop from 915 surface acres to 875 acres. This is a 4.4 percent reduction in the natural evaporation loss rate. Another benefit is the opportunity this level provides to capture rainfall runoff and never incur any loss by overflowing the spillway. Additionally, all the water used at Sim Gideon in the production of high purity boiler water, such as blowdown, backwash, and reverse osmosis reject waters, are returned to Lake Bastrop for reuse, which reduces the power plant's water consumption from Lake Bastrop. Additional conservation strategies include seasonally managing the lake level to optimize rainfall capture and further minimize natural evaporation rates, converting old plumbing fixtures to high efficiency models, distributing of information and training about water conservation and leak detection to staff, and revising the irrigation system to use wastewater or an alternative water source such as rainfall.

c. Thomas C. Ferguson Power Plant

The Thomas C. Ferguson Power Plant currently reuses approximately 450,000 gallons of water from its demineralization process. The water is reused by mixing it with Lake LBJ water and using it as clarifier makeup. Reusing this water has eliminated a discharge outfall to the Colorado River. Additional conservation strategies include converting old plumbing fixtures to high efficiency models, distributing information and training about water conservation and leak detection to staff, and revising the irrigation system to use wastewater or an alternative water source such as rainfall.

CHAPTER 4
DROUGHT MANAGEMENT PLAN AND DROUGHT CONTINGENCY PLAN

A. Introduction 4-2
1. Background 4-2
2. The Lower Colorado River System 4-3
3. Major Water Rights Holders 4-3
4. Historic Operation of the Highland Lakes 4-4
5. Purpose and Legal Considerations 4-5
B. Water Users and Interest Groups 4-6
1. LCRA Firm Water Customers 4-6
2. Agricultural Interests 4-7
a. Historic Claims to the Waters of the Colorado River 4-7
b. Concerns of the Agricultural Interests 4-7
3. Recreation and Tourism Interests 4-8
4. Concerns for Instream Flows and Freshwater Inflows for the Bays and Estuaries 4-8
C. Projected 2010 Surface Water Demands During Droughts 4-9
1. Introduction 4-9
2. Projected Firm Water Demands 4-10
a. Municipal, Manufacturing, Steam-Electric, and Domestic Water Demand Projections 4-10
b. Instream Flow Demands 4-12
c. Freshwater Inflow Demands 4-14
3. Projected Interruptible Stored Water Demands 4-15
a. Interruptible Stored Water Customers 4-15
b. Projected Rice Irrigation Water Demands 4-16
c. Instream Flow and Estuarine Freshwater Inflow Water Demands 4-19
4. Summary 4-19
D. Projected Water Supplies 4-19
1. Water Supply Management Procedure 4-19
a. Systems Operation Concept 4-19
b. Critical Drought Period Concept 4-20
c. Procedures For Evaluating Water Availability 4-20
2. Supplies for Firm Demands 4-21
3. Supplies for Interruptible Stored Water Demands 4-21
E. Water Curtailment Policies 4-22
1. Triggering Conditions 4-22
2. Curtailment of Interruptible Stored Water Demands within Irrigation Districts and for Instream and Bay and Estuary Freshwater Inflows 4-22
a. Recommendation for Interruptible Stored Water Demand Curtailment for Irrigation and Environmental Needs 4-23
b. Irrigation Allocation Among the Irrigation Districts 4-27
c. Irrigation Allocation Within the Irrigation Districts 4-28

d. Drought More Severe Than Drought of Record 4-29
e. Termination of Water Allocation Policy 4-30
f. Procedures for Water Use Accounting 4-30
g. Transfer of Water Among Individual Users 4-30
h. Variances 4-30
i. Enforcement 4-31
3. Curtailment of Interruptible Stored Water Demands for Other than Irrigation Districts 4-31
4. Curtailment of Firm Water Demands 4-31
a. Policy Recommendation for Firm Water Demand Curtailment 4-32
b. Monitoring and Enforcement 4-33
c. Variances 4-33
d. Notification of TCEQ Executive Director 4-34
5. Declaration and Cancellation of a Drought More Severe Than the Drought of Record 4-34
6. Public Notice 4-35
7. Impacts of the Recommended Management Policy 4-35
a. Firm Water Demands and Supplies 4-35
b. Interruptible Stored Water Demands and Supplies 4-35
c. Lake Storage Levels 4-37
d. Flows in the Colorado River 4-37
F. Annual Implementation of Drought Management and Drought Contingency Plans 4-38
1. Annual Review and Revisions 4-38
2. Administration 4-38

Introduction

1. Background

On September 20, 1989, the Texas Water Commission, the predecessor agency to the TCEQ, issued its Order approving LCRA's Water Management Plan (see Appendix C, Volume I) for the Highland Lakes and the lower Colorado River. The Commission's Order included a requirement for LCRA to submit, within one year, a Drought Management Plan (DMP) with the Commission for its review and approval. On December 23, 1991, the Texas Water Commission issued its Order approving the DMP. (See Appendix D, Volume I). TCEQ subsequently adopted specific rules requiring water suppliers, such as LCRA, to develop a Drought Contingency Plan (DCP). LCRA's initial DCP was modeled after the most recent DMP approved by the Commission in 1999. As part of this WMP revision, LCRA proposes to fully incorporate into the WMP the LCRA's DCP, with modifications.

Chapter 4 describes the Lower Colorado River Authority's DMP, as required by the water rights granted to LCRA, as well as LCRA's DCP, as required by Commission rules (collectively DMP/DCP). Although the water resources available in the lower Colorado River are considered

as a system, only waters used under LCRA's water rights are addressed by this DMP/DCP.

LCRA recognizes that its responsibility and authority under this DMP/DCP is subject to and shall not conflict with the authority of any Watermaster operation the TCEQ may establish on the Colorado River. Moreover, LCRA recognizes that the Commission has jurisdiction to resolve any and all disputes regarding the allocation of stored water from Lakes Buchanan and Travis, not withstanding the procedures and guidelines set forth in this DMP/DCP.

2. The Lower Colorado River System

The lower Colorado River is considered to be the lower portion of the drainage basin of Colorado River beginning in San Saba County and continuing to Matagorda County on the Texas Gulf Coast (see Figure 1-1). The river flows through nine of the ten counties that make up LCRA's statutory water district.

The upper portion of LCRA's district is part of the Texas Hill Country. In the Hill Country, the river is largely controlled by a series of five dams and their reservoirs--Buchanan, Inks, Wirtz, Starcke, and Mansfield. Marked by steep slopes and shallow rocky soils with outcroppings of granite and limestone, the Hill Country ends abruptly in the Balcones Fault region near the edges of Austin. At Austin is the Tom Miller Dam that creates Lake Austin. From the eastern edges of Austin the river broadens out, snaking through the dark rich Blackland Prairie soils and then rolls gently downstream through the sand and shale of the coastal plains.

Water from the Colorado River and its tributaries is used for a variety of purposes to support the citizens and economy in the LCRA district. These uses include public water supply, manufacturing, cooling water for electric generating plants, irrigation, agriculture and mining. The water to supply these uses comes largely from the natural runoff into the Colorado River. However, the Colorado River Basin is subject to recurrent, severe droughts and devastating floods resulting in wide ranges of river flows. To provide an assured water supply and to relieve flooding, the LCRA, with the help of the Federal government, constructed the Highland Lakes reservoir system.

The development of LCRA's dams and reservoirs on the Colorado River, accomplished in the years from 1939 through 1951, changed Central Texas in many ways. Beginning by controlling the devastating floods on the river, using the river's power to generate electricity, and creating a secure and reliable water supply, LCRA has helped to stimulate the growth and development of the region. The lower Colorado River's water resources satisfy a wide variety of uses, many of which have changed and will continue to change in concert with the changes in the environment and the growth and development of the region.

3. Major Water Rights Holders

The largest water right holders in LCRA's water district also use the majority of the water (Table 4-1). LCRA holds the largest rights, with rights to use up to 1.5 million acre-feet per year from

Lakes Buchanan and Travis. Some of the other large water right holders downstream of Lakes Buchanan and Travis have priority dates earlier than that of LCRA's Highland Lakes permits. These rights belong to the City of Austin, Corpus Christi (portion of Garwood), LCRA for Pierce Ranch, and the LCRA's Garwood, Lakeside and Gulf Coast Irrigation Operations. These rights are considered as senior in time and superior to LCRA's right to store water in the Highland Lakes. Hence, any inflows to the Highland Lakes that need to be diverted for use under these rights must be passed through the Lakes for use downstream. There are also some large water rights downstream of Lakes Buchanan and Travis that have junior priority dates.

TABLE 4-1 MAJOR WATER RIGHTS AND AUTHORIZED RIGHTS IN THE LOWER COLORADO RIVER BASIN, LISTED IN ORDER OF PRIORITY (Acre-Feet/Year)

LCRA (GARWOOD)	133,000
CORPUS CHRISTI (GARWOOD)	35,000
CITY OF AUSTIN (LAKE AUSTIN)	250,150
LCRA (GULF COAST)	228,570
LCRA (LAKESIDE)	107,500
LCRA (PIERCE RANCH)	55,000
CITY OF AUSTIN (Remainder of Certificate of Adjudication No. 5471)	46,403
LCRA (Lakes Buchanan and Travis)	1,500,000
CITY OF AUSTIN (Certificate of Adjudication No. 5489)	35,456
STP NUCLEAR OPERATING COMPANY and LCRA	102,000
LCRA (Gulf Coast junior portion)	33,930
LCRA (Lakeside junior portion)	78,750
TOTAL	2,606,759

4. Historic Operation of the Highland Lakes

Lakes Buchanan and Travis serve as the water supply and flood control reservoirs in the Highland Lakes system. Since their construction in the late 1930s and early 1940s, the water storage in these lakes has fluctuated dramatically in response to extreme floods and droughts. The lakes were at their lowest levels in 1952 when Lake Buchanan was at 983 feet mean sea level (msl) and Lake Travis was at 614 feet msl. The highest water surface elevations were in 1991 for Lake Travis (710.4 feet msl) and in 1991 for Buchanan (1021.37 feet msl).

Operational management of the lakes has also changed over time. A major use of the dams in the 1940s and 1950s was for hydroelectric power generation. That use became secondary to water supply purposes when LCRA developed its fossil fuel electric generation stations. As a result of the Final Judgment and Decree for LCRA's water rights, the use of water for hydroelectric generation was formally subordinated to higher uses except during emergency shortages of electricity, and during other times to the extent that such releases will not impair

LCRA's ability to satisfy all existing and projected demands for water from Lakes Buchanan and Travis pursuant to all firm commitments and all non-firm, interruptible stored water commitments.

5. Purpose and Legal Considerations

The purpose of the DMP/DCP is to specify how LCRA will contract and supply firm and interruptible stored water supplies during a repetition of the critical Drought of Record. In managing the stored water from Lakes Buchanan and Travis, LCRA must

- Define the conditions under which water shortages exist, and
- Specify the actions to be taken by LCRA to mitigate the adverse effects of such shortages.

The overall goals of the DMP/DCP are to:

- Extend available water supplies.
- Preserve essential uses of water and protect public health and safety during extreme shortages of supplies.
- Equitably distribute among LCRA's water customers any adverse economic, social and environmental impacts associated with drought-induced water shortages.

The scope of the DMP/DCP must adhere to the findings of the State District Court's Final Judgment and Decree, adjudicating LCRA's water rights, as well as the 1989 Water Commission's Order approving the WMP and TCEQ rules concerning drought contingency plans. The scope of the DMP is limited to the curtailment of LCRA's interruptible stored water supplies to insure that there is sufficient firm water available to meet projected demands for such water through a repetition of the Drought of Record and also addresses how LCRA will provide water for environmental flow needs. Firm water is subject to curtailment only if it is determined that the drought in effect is worse than the Drought of Record. The DCP also addresses water use reduction goals required by TCEQ's Chapter 288 rules and establishes more detailed procedures for pro rata allocation of interruptible stored water during periods of curtailment.

In times of shortage of supply caused by drought or emergency, LCRA, in accordance with Section 11.039 of the Texas Water Code, will first curtail and distribute the available supply of interruptible stored water among all of its interruptible stored water supply customers on a pro rata basis, so that preference is given to no one and all interruptible stored water supply customers suffer alike. Although projected firm demands for stored water for the next ten years are significantly greater than demands included in the last revision to WMP, these projected needs are still significantly less than the total firm water supplies available.

If the shortage of supply caused by the drought is worse than the Drought of Record, then LCRA must curtail and distribute the available supply of firm water among all of its firm water supply customers on a pro rata basis, so that preference is given to no one and all firm water supply

customers suffer alike.

In the annual allocation of interruptible stored water supplies, LCRA follows the priority order of water use as specified in Section 11.024 of the Texas Water Code and the WMP.

Similarly, in making additional commitments of firm water supplies, LCRA must also follow the priority order of uses given in Section 11.024 of the Texas Water Code.

As noted above, a goal of the DMP/DCP is to determine how to allocate available water supplies when there is not sufficient supplies to meet projected water demands even after reasonable, cost-effective water conservation efforts have reduced the water demands. Therefore, the DMP/DCP does not emphasize water conservation practices that should occur all the time, not just in drought conditions. LCRA has major programs to encourage conservation in water use. These programs are summarized in Chapter 3 of this WMP.

As discussed previously, the WMP, and the DMP/DCP, require periodic revision to reflect changes in water demands. The last revision was completed by LCRA in February 1997 and approved by TCEQ in March 1999. Significant changes in demand, as discussed below, have necessitated the present revision.

The most noticeable changed condition over the last five years has been a significant increased projection of municipal and industrial (firm) water demands. The WMP approved in 1999 projected the ten-year future firm demands within LCRA's service area at about 280,000 acre-feet annually for 2005. Based on the analyses for Regional Plans pursuant to the Senate Bill 1, the ten-year projected demands are now projected to be about 360,100 acre-feet per year for 2010 (see Table 4-2). The primary reason for this increase is additional water needs to meet population and economic growth in the Austin area, including domestic water use around the Highland Lakes.

With this large projected increase in firm water demand, the WMP must be adjusted to give a compensating reduction in the interruptible stored water supplies available since firm needs take priority. This reduction can be achieved by revising the annual interruptible stored water supply curtailment policy adopted in the WMP.

Water Users and Interest Groups

1. LCRA Firm Water Customers

LCRA manages the Highland Lakes for the benefit of all users. LCRA supplies water under its water rights for the Highland Lakes to numerous municipal water supply systems, manufacturers, and power generating plants. As of May 2003, LCRA had over 110 contracts for firm water supplies. The total contractual commitments and reservations of firm water from Lakes Travis and Buchanan at the time was about 318,364 acre-feet per year. This number does not include any commitment to instream flows or freshwater inflows to the bays and estuaries or the amount

allocated to O. H. Ivie Reservoir. Annual use of firm stored water was about 35-36 percent of the 318,364 acre-foot amount.

The major concern of firm water customers is that sufficient supplies be allocated to insure that their demands for water are fully satisfied even during severe drought conditions. An additional concern for those customers pumping water directly from Lakes Buchanan and Travis is that the lake levels remain sufficiently high for them to continue to use their existing water intake structures. Extending intake facilities further into the lake to follow retreating shorelines can be very expensive. Most of the intakes can accommodate water levels at the historical low lake levels of 614 feet msl on Lake Travis and 983 feet msl on Lake Buchanan.

2. Agricultural Interests

a. Historic Claims to the Waters of the Colorado River

The waters of the Colorado River have served the rice farming industry of the Texas Gulf Coast counties of Colorado, Wharton and Matagorda counties since 1885 when the first rice crops were planted near Eagle Lake, Texas. When legislation creating LCRA was first proposed in the Texas Legislature in 1933, promises were given to the rice producers and other farmers that the waters stored behind the dams proposed for the LCRA system would be available to serve their needs when the natural flow of the river diminishes in dry years.

Rice is the major crop irrigated in the most downstream three counties in the LCRA water district. While some rice producers in the region irrigate their crops with pumped groundwater, the major source of water for irrigation is from the waters of the Colorado River, either under run-of-river water rights, or from releases of interruptible stored water from Lakes Buchanan and Travis. Approximately 40% of the water used to irrigate in the three counties comes from groundwater. The majority, 60%, is supplied from surface water. Approximately 379,300 acre-feet, which is about 56% of the annual water use of the Colorado River and the Highland Lakes, is used for rice farming. During an average year, about 30% of the total surface water used for irrigation comes from the interruptible stored water in Lakes Buchanan and Travis.

When LCRA has purchased irrigation operations (Gulf Coast in 1959, Lakeside in 1983, and Garwood in 1998) and their associated senior water rights from private firms, LCRA made certain commitments to the farmers to provide water from Lakes Buchanan and Travis as back-up to the run-of-river rights.

b. Concerns of the Agricultural Interests

The primary concern of the agricultural interests is how LCRA will curtail the interruptible stored water during times of shortage. The producers understand the interruptible concept because, in essence, the waters were always interruptible. The WMP formalizes the understanding of how the water supply--both run-of-river and stored water--is managed.

3. Recreation and Tourism Interests

The waters of the Colorado River and the Highland Lakes serve a variety of recreational and tourism interests in Central Texas. In the WMP, LCRA recognizes the economic interests of the tourism and recreation industry around the Highland Lakes through a commitment to limit its sales or commitments of interruptible stored water, other than to satisfy the four irrigation operations' Conservation Base acreage or Priority Allocation acreage, based on the volume of water in Lakes Buchanan and Travis, as described later in this Chapter.

While the WMP sets minimum projected reservoir storage levels for Lake Travis and for Lake Buchanan, the lakes will most likely have fallen below these levels during even a brief drought period. Economic hardship on the owners of the many marinas, small recreation businesses (bait stores, fishing camps, restaurants, campgrounds), and larger businesses, such as motels, could last much longer than the drought conditions. Many of the marinas on Lake Travis have the ability to move boat docks further out into deeper water and are willing to bear the added operational costs of such moves to stay in business. On Lake Buchanan, the shallow nature of the shoreline allows little flexibility in moving docks and other facilities. Some residents and other lake users have expressed concerns about the lack of access to the lakes during low elevations. Most of LCRA's boat ramp facilities and private boat ramps and launches become unusable when Lake Travis falls below 640 feet msl and Lake Buchanan falls below 1000 feet msl. Additionally, water hazards such as tree stumps and rock areas increase as reservoir levels recede, restricting more of the lake surface available for sail and power boating.

Lake area Chambers of Commerce, residents, and representatives of the tourism industry are also concerned about the elevation of the lakes area during low water periods even when a true drought is not in effect. There is a concern that first time visitors will not return to the area having once experienced low water levels in the reservoirs, thus dampening potential future economic growth.

River recreation interests downstream of the Highland Lakes are also concerned that drought conditions will leave stretches of almost dry riverbed and that water quality will deteriorate severely during drought periods.

4. Concerns for Instream Flows and Freshwater Inflows for the Bays and Estuaries

The Colorado River is the largest single source of freshwater flowing into the Lavaca-Tres Palacios estuary through channels in the Colorado River Delta. The Lavaca-Tres Palacios estuary is one of the largest of the seven major and three minor estuaries along the 370 miles of Texas Gulf shoreline. The bays and estuaries of this system provide a rich environment for wildlife, commercial seafood harvest, recreation, and aesthetic opportunities.

Average inflow to the bay has been 2.9 million acre-feet per year. Of that inflow, about 34 percent came from the Coastal Basins, 22 percent from the Lavaca River Basin, and 44 percent from the Colorado River. Freshwater inflows influence estuarine biological productivity by

lowering salinity, increasing nutrients, and providing sediments. In 1991, the U.S. Corps of Engineers re-routed the Colorado River into West Matagorda Bay to increase biological productivity by increasing the amount of freshwater entering the estuary. However, a storm blocked the new route until its channel could be dredged in 1992, when it became fully functional.

The Colorado River contributes freshwater to the estuary directly from the river and indirectly through return flows from rice fields irrigated from the river. Prior to the 1991 change, an average of 1.3 million acre-feet annually from the Colorado River entered the estuary at the mouth of the river, with about 150,000 acre-feet contributed through irrigation return flows. With the change in the Colorado River delta in 1991, the full average of 1.8 million acre-feet of annual flow of the Colorado River now enters Matagorda Bay.

Estuaries and their associated wetlands are a transition zone between the fresh water and marine environments and serve as the nurseries for over 97% of the fishery species in the Gulf of Mexico. Thus, the levels of salinity, nutrients, and sediments determined by freshwater inflows is critical for high estuarine production. Fluctuation of estuarine conditions from severe droughts, floods, and hurricanes results in a shift of the biological elements of the system and can directly affect the production and survival of many plant and animal species.

During the rice irrigation season, even under drought conditions, the instream flow needs should be satisfied as a result of natural inflows and return flows downstream of the Highland Lakes, pass-throughs of inflows to the Highland Lakes required to honor downstream senior water rights, and releases of interruptible stored water flowing downstream to the irrigation operations. Under current water demand conditions, it is in the winter months, when the portions of inflows required to be passed through the reservoirs to honor downstream senior rights are low and when downstream demands for stored water are also low, that it is most likely that instream flows will need to be supplemented with firm stored water releases. However, should interruptible stored water for irrigation be curtailed or cut off, the periods of low flow in the river would be extended and additional water would be demanded to serve these needs for periods of time.

While it is difficult to estimate the full effect of inadequate instream flows or inadequate inflow to the bays and estuaries, it is clear that many plant and animal species in the food chains would be severely stressed and that productivity would be lessened if the condition persisted for an extended period of time.

Projected 2010 Surface Water Demands During Droughts

1. Introduction

To properly allocate available water supplies in the DMP/DCP, LCRA must project the future water demand on those supplies. The DMP/DCP is based on conditions that may occur in the next decade. This ten year planning period was chosen because the critical drought period used to determine the Combined Firm Yield of Lakes Buchanan and Travis lasted approximately a

decade. Further, the estimates of future water demands are most accurate in the near future. If the critical drought were to repeat itself beginning now, the maximum demands during the drought period would be those in year 2010. Thus, a ten year planning period was used for the development of the DMP/DCP.

Total estimated surface water use in LCRA's 35 county water service area (Figure 1-1) in 2000 was approximately 675,800 acre-feet annually, including water released to maintain instream flows in the lower Colorado River. About 56% of water diverted was used for rice irrigation in the four major irrigation operations located in Colorado, Wharton and Matagorda Counties. The next largest demand for surface water is the City of Austin, with approximately 134,000 acre-feet yearly averaged over the last ten years for municipal use and steam-electric power generation. In general, City of Austin's use has been increasing steadily, with a use of 163,800 acre-feet for the year 2000.

LCRA supplies water to two general categories of water demands: firm and interruptible. Firm demands presently include the water for municipal, domestic, industrial, steam-electric power generation, some irrigation, and instream flow maintenance purposes. Currently, interruptible stored water is used almost entirely for agricultural irrigation, specifically rice irrigation, and for environmental needs. As noted earlier, the most noticeable changed condition over the last five years has been a significant increased projection of municipal and industrial water (firm) demands. With the large projected increase in firm water demand, the DMP/DCP must be adjusted to give a compensating reduction in the interruptible stored water supplies available since firm needs take priority.

Surface water demands in LCRA's water district over the next decade have been projected by LCRA staff based on drought-condition weather, population growth, water use patterns, and economic development, as outlined in the Senate Bill 1 regional water plan for Region K. The assumptions used in projecting 2010 demands are described in the following sections.

2. Projected Firm Water Demands

a. Municipal, Manufacturing, Steam-Electric, and Domestic Water Demand Projections

LCRA staff allocated Senate Bill 1 2010 projected demands using a 1996 water use distribution. Actual water use in 2000 and projected water demands for 2010 are shown in Table 4-2.

The water demand for STP and the Austin power plants may be met by using unregulated run-of-river flows under separate water rights associated with those facilities, supplemented as necessary with stored water. The arrangements for satisfying these demands at STP and at LCRA power plants are described in more detail in Finding 58 of the September 7, 1989 Order of the Texas Water Commission approving LCRA's WMP. The 2010 demands included in this WMP for these facilities reflect those provided to the Senate Bill 1 Regional Planning Group (Region K) by the City of Austin and the South Texas Project Nuclear Operating Company.

Today, LCRA has only a handful of firm water contracts for domestic water use. Unfortunately, most of this water is taken from the Highland Lakes by landowners that do not have contracts with LCRA. Absent a contract, most if not all of these diverters have no legal claim to the water they are diverting. At some point, LCRA may choose to pursue enforcement of its water rights to curtail these unauthorized diversions. Total domestic water use is projected to increase to 6,273 acre-feet by 2010. As water supplies become more and more scarce, many landowners are likely to realize the benefit of a firm water contract that better protects their water supply during drought conditions. Thus, for purposes of this WMP, LCRA has estimated that approximately 5,000 acre-feet of domestic water use will come under contract with LCRA over the next ten years.

TABLE 4-2. REPORTED 2000 AND PROJECTED 2010 ANNUAL FIRM SURFACE WATER DEMANDS UNDER DROUGHT CONDITIONS

Water Demand Category	2000 Reported Water Use (Acre-Feet)	Projected 2010 Water Demand (Acre-Feet)
Highland Lakes Municipal	23,100	37,200
Manufacturing (Excluding Austin)	8,500	11,500
City of Austin Municipal and Manufacturing	153,300	187,931
City of Austin Power Plants*	10,400	13,500
LCRA Power Plants	22,000	29,500
South Texas Project (STP)*	64,800	47,000
Instream Flow Maintenance & Estuarine Inflows	14,500	**33,440
Total	296,600	**360,071

*Firm water demands for STP and the City of Austin may be met from run-of-river flows, if they are available, under their existing water rights.

**Based on the 2003 revision resulting from the effect of the new trigger for curtailment of interruptible stored water supplies from Lakes Buchanan and Travis and freshwater inflow needs of the Matagorda Bay, as described in this Chapter.

b.Instream Flow Demands

LCRA completed the initial instream flow needs study in 1992. The study identified two sets of instream flow needs: critical flows and target flows. The recommended instream flows for the Colorado River downstream of Austin are in Table 2-1.

LCRA will continue with the reservoir operation procedure to release stored water from Lakes Buchanan and Travis to maintain daily river flows as follows:

1. LCRA will release stored water and pass storable inflows to maintain no less than the critical instream flow needs in all years as set forth in Table 2-1, including maintaining, on an instantaneous basis, instream flows of 46 cfs and 500 cfs critical flows as set forth in Table 2-1 during the times those respective flow values are in effect, and

2. In those years when the four major irrigation operations are not curtailed, LCRA will schedule the passage of inflows to lakes Buchanan and Travis that are legally available for storage, as measured at the upstream stream gages, to maintain the target flows as set forth in Table 2-1 as a daily average. Furthermore, during those times when target instream flow requirements are in effect and when such inflows are sufficient to allow LCRA to satisfy the daily target flow requirement at the Bastrop gage, LCRA will also schedule the passage of these inflows to maintain the following minimum flows, as measured at any time at the Bastrop gage:

Month	Minimum Flow (cfs) 100% of the time	Minimum Flow (cfs) 95% of the time
January	266	
February	269	
March	233	
April	244	287
May	492	579
June	355	418
July	295	347
August	165	
September	201	
October	208	
November	241	
December	264	

In rare instances, LCRA's ability to meet the instream flow requirements set forth in this WMP may be impaired by certain unavoidable constraints such as the capacity of its hydro-generation units and hydro-generation scheduling mandates as well as unforeseen diversions, unforeseen changes in flow conditions downstream, and adjustments to the ratings of the applicable gages.

This recommendation fully meets the most important instream flow needs at all times and meets the target flows during periods of normal or above normal streamflow conditions.

To fully honor this commitment, LCRA will use both firm water and interruptible stored water. Firm water is only supplied in years when the interruptible stored water supply is curtailed for the four major irrigation operations. The actual annual releases of stored water will vary from year to year depending on hydrologic conditions.

For the 2003 update, it is estimated that an annual average of about 27,380 acre-feet of firm water is needed to meet these instream flow commitments, with the remainder coming from interruptible stored water supplies. Therefore, the present annual commitment for instream flows of 12,860 acre-feet of firm water is recommended to be increased to 27,380 acre-feet per year. In addition to firm water, interruptible stored water will be provided to meet instream flow needs. The estimated interruptible stored water to be supplied during the critical drought will be an additional 8,590 acre-feet/year. Demands for both firm and interruptible stored water for instream flow needs were estimated from the simulated results of the water supply alternative that was recommended for the 2003 update of the WMP. The recommended water supply alternative represents a careful balance of environmental and irrigation impacts based on results from various scenarios that were considered.

The releases for instream flows generally, but not always, contribute to meeting the Critical or Target freshwater inflow needs of Matagorda Bay. However, the timing for these instream flow releases is independent of the monthly freshwater inflow needs for the bay.

c. Freshwater Inflow Demands

The water demands for maintaining the ecological balance of coastal bays and estuaries have been determined in 1997 by LCRA, in cooperation with TPWD, TWDB and TNRCC (predecessor to TCEQ). As indicated in Table 2-4, estimates of freshwater inflow needs (FIN) from the Colorado River at Bay City are 1.03 million acre-feet annually for the target needs and 171,000 acre-feet yearly to meet critical needs. Historically, an average of approximately 1,800,000 acre-feet flows annually in the Colorado River at Bay City.

For the 2003 WMP update, LCRA has recommended a change in the reservoir operation procedure for releasing stored water from Lakes Buchanan and Travis for estuarine needs after a careful balance of environmental and irrigation impacts from the results of various scenarios that were considered. LCRA will release stored water from Lakes Buchanan and Travis to maintain monthly estuarine inflows at:

1. the target inflow needs in those years when the combined storage in Lakes Buchanan and Travis on January 1 is greater than or equal to 1.7 million acre-feet, to the extent of storable inflows each month to Lakes Buchanan and Travis, as measured at the upstream stream gages;

2. one hundred and fifty percent of the critical inflow needs in all years when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1.7 million acre-feet and greater than 1.1 million acre-feet, to the extent of storable inflows each month to Lakes Buchanan and Travis, as measured at the upstream stream gages; and

3. the critical inflow needs in all years when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1.1 million acre-feet, to the extent of storable inflows each month to the Highland Lakes, as measured at the upstream stream gages.

With the recommended intermediate estuarine inflow reservoir operation procedure of increasing the release of stored water from Lakes Buchanan and Travis in years when the combined storage is between 1.1 and 1.7 million acre-feet, the estuarine ecosystem will receive more freshwater inflows during moderate droughts than it would have under the WMP as approved in 1999. For any given month, LCRA will compensate for any deficit in releasing stored water to meet freshwater inflow needs during the following month by releasing additional stored water from the Lakes Buchanan and Travis. LCRA will not account for the inflow in the following month in making such release to make up for the previous month's deficits.

The reservoir operation procedure of releasing stored water for the freshwater inflow needs are based on the following:

- both Target and Critical FIN are provided with stored water;
- Target FIN are used as the estuarine inflow demands during years of plentiful water;
- water supply needs for the four major irrigation operations from the interruptible stored water supply were balanced carefully with the environmental needs while assessing the impacts from the results of various scenarios that were considered;
- the frequency and duration of high salinity conditions in Matagorda Bay are kept relatively low; and
- the Critical FIN are met about 80 percent of the months during the critical drought.

This recommendation will require an estimated 205,060 acre-feet of stored water during the ten-year critical drought for estuarine inflows. However, not all of this is from the Combined Firm Yield of Lakes Buchanan and Travis. Similar to the instream flow demands, both firm water and interruptible stored water are used to meet the freshwater inflow needs. Firm water is only supplied in years when the interruptible stored water supply is curtailed for the four major irrigation operations. An annual average of about 6,060 acre-feet of firm water should be allocated, with the remainder coming from interruptible stored water supplies to meet freshwater inflow needs. The estimated annual interruptible stored water supplied during the critical drought will be an additional 14,450 acre-feet/year. The recommended changes are based on the alternative that was selected for the 2003 update based on a careful balance of environmental and irrigation impacts from the results of various scenarios that were considered.

For purposes of estimating required releases of water from Lakes Buchanan and Travis to meet the instream flow or freshwater inflow requirements of this WMP, LCRA will rely on stage data obtained from the gaging system jointly maintained and operated by the U.S. Geological Survey and LCRA for determining these requirements. If the ratings used to convert stage to flow published by LCRA and the USGS are not identical at the time required releases are estimated, LCRA will exercise its discretion to rely on the latest updated rating of the gage.

3. Projected Interruptible Stored Water Demands

a. Interruptible Stored Water Customers

LCRA presently supplies interruptible stored water to four major irrigation operations. These operations are: Pierce Ranch Irrigation Company, and LCRA's Garwood, Lakeside and Gulf Coast Irrigation Operations. These operations have associated with them very early run-of-river rights to divert surface water from the Colorado River, to the extent it is available, to satisfy customer needs up to their permitted amounts. These run-of-river rights are all senior to LCRA's water rights in the Highland Lakes. Thus, LCRA may impound only that portion of the inflows to the Highland Lakes remaining after passing through inflows to the extent needed to honor

these and any other downstream senior water rights.

These four operations are primarily concerned with the growing of rice although there are some turf and row-crops grown within these operations. Virtually all irrigation water is pumped from the Colorado River. Only the Lakeside Irrigation Division has the use of a small amount of groundwater for irrigation purposes.

b.Projected Rice Irrigation Water Demands

The projected average annual irrigation water demand for 2010 is about 438,200 acre-feet annually (Table 4-3). Water to supply that need will come from both interruptible stored water and run-of-river sources. Statistical analysis by LCRA staff indicates that agricultural water diversions at these operations are influenced by the number of acres planted, rainfall, and evaporation. Planted acreage is the strongest statistical predictor of agricultural water use, but is also the most difficult to forecast since annual acreage varies greatly. Rice acreage is largely governed by the federal farm support program, which is currently undergoing changes. It is premature to forecast the ultimate impact of these changes on the rice industry in LCRA's water district.

Because of the many variables that impact total water diversions at the irrigation operations, a conservative projection was made of future rice irrigation water acreage. First crop acreage for each operation was projected to be equal to the largest acreage cultivated over the last ten years. The projected first crop acreage, as well as 2000 actual first crop acreage, is given in Table 4-3. The Lakeside Irrigation Division has cultivated more acreage in the last ten years, but has used groundwater to meet the excess water needs.

The projections of second crop acreage are based on a fraction of the first crop acreage. The fraction used is the ratio of the second crop to first crop acreage in the year of greatest first crop acreage over the past ten years. These fractions are 0.44, 0.83, and 0.96, respectively, for Gulf Coast, Lakeside and Garwood. Second crop acreage for Pierce Ranch is taken as 6% of the total second crop acreage for Gulf Coast, Lakeside and Garwood.

The actual use of water for irrigation is highly variable, with relatively large differences from year to year. Water diversions projected for each irrigation operation, except Pierce Ranch, are calculated from predictive equations that consider rainfall and evaporation conditions, as well as acreage, during each irrigation season (Martin, 1990). These projected demands are based on rainfall and evaporation conditions expected during the duration of a repetition of the critical drought period experience from 1947 through 1956. The projected demands from Pierce Ranch are taken as 9% of the total projected demands of the other three major irrigation systems. This percentage reflects Pierce Ranch's historical proportion of total diversions over the past ten years adjusted for the major water reductions through water conservation.

TABLE 4-3. REPORTED YEAR 2000 AND PROJECTED ACREAGE AND SURFACE WATER DEMANDS FOR IRRIGATION				
Irrigation System	**Reported 2000 First Crop Acreage (Acres)**	**Reported 2000 Water Use (Acre-Feet)**	**Projected Year 2010 First Crop Acreage (Acres)**	**Projected Year 2010 Water Use (Acre-Feet)**
Gulf Coast	18,800	152,200	30,300	155,600
Lakeside	23,500*	117,800	27,500	135,600
Garwood	15,000**	83,200	21,200	109,000
Pierce Ranch	4,500**	26,100	4,740	36,000
Other Senior Rights	0	0	1,000	2,000
Total	61,800	379,300	84,740	438,200
* Includes acreage supplied from groundwater.				
** Estimated				

Adjustments are also made to the water demand estimates developed from the equations to reflect ongoing water use efficiency improvement programs. Aggressive water conservation efforts are projected to reduce the water diversions at the Gulf Coast Division by over 25% by 2010, from historical 1968-1986 period usage levels. The water demands for the other three major irrigation operations are expected to decline as well due to water conservation efforts, with 5% total cumulative reductions by 2010, from patterns of historical usage.

To estimate the demand for interruptible stored water supply for irrigation needs, a table of acreage was developed for the irrigation operations that included the likely allocation of various amounts of interruptible stored water between first and second rice crop. Such table was developed based on several assumptions.

Allocation of interruptible stored water supply to the individual irrigation operations was according to the following formula:

> Interruptible Stored Water Supply = 0.5*Average annual interruptible stored water usage over past 10 years + 0.5*Highest year of interruptible stored water usage within past 10 years.

Using the last ten years of interruptible stored water usage, it was found that each irrigation operation is entitled to the following percentages of interruptible stored water supplies available:

Gulf Coast	.425
Lakeside	.425
Garwood	.063
Pierce Ranch	.088

Pierce Ranch was not included in the acreage table since there is not a reasonably accurate predictive equation for water use at Pierce Ranch. To represent Pierce Ranch's needs, water use and acreage were assumed at 9 % and 6 %, respectively, of the combined water use and acreage, respectively, of the other three operations.

In developing the table of acreage, it was assumed that the hydrologic and meteorological conditions reflected a 1 in 5 dry year, or stated differently, the dry conditions that would be expected only 20% of the time.

The maximum annual demand for the interruptible stored water acreage projected for 2010, under a 1 in 5 dry year condition, was 273,000 acre-feet. Using that as the greatest interruptible stored water demand, a set of smaller interruptible stored water supplies were assumed to generate a set of first and second crop acreages expected to be cultivated by the three major operations. These acreages were assumed to be the maximum planting acreage that could be supported by the limited water supplies, both run-of-river and interruptible stored water. The allocation of the available interruptible stored water supplies for irrigation was based on the assumption that the demand for projected first crop acreage for rice (83,700 acres) will be fully met, with any acreage curtailments occurring in second crop.

The acreage level was set for each level of interruptible stored water supply using the following process:

1. The total interruptible stored water supply available was allocated to each of the three major operations according to the percentages given above.

2. The available interruptible stored water for each irrigation operation was used first to meet the needs of first crop rice.

3. The remaining interruptible stored water supply, after first crop, was used for second crop needs. If there was insufficient interruptible stored water supplies, then the maximum allowed second crop acreage was reduced in the same proportion as the ratio of the available to the maximum needed interruptible stored water supplies. For example, if there is only 50% of the interruptible stored water needed to meet the needs of the maximum second crop acreage allowed, the second crop acreage is set to 50% of the maximum second crop.

The table of acreage thus developed for the irrigation operations was used in simulations conducted with the RESPONSE model for this WMP update to define the planning decisions of allocating available interruptible stored water when curtailments were instituted. As noted

before, Pierce Ranch acreage and water demand were treated in the RESPONSE model as percentages of the combined acreage and water demand of the three other irrigation operations.

In addition to the senior water right holders and major irrigation operations, there are additional demands for surface water along the Colorado River. These demands, and their water rights, are junior in time to December 1, 1900 but senior to November 1, 1987. Consistent with LCRA's water rights for Lakes Buchanan and Travis, the WMP provides that LCRA will treat any of these rights junior to the water rights for Lakes Buchanan and Travis in the same manner as the users of interruptible stored water. The maximum amount of interruptible stored water to meet the demand of such junior water rights is about 4,700 acre-feet annually, however these demands are not likely to take place each and every year.

c. Instream Flow and Estuarine Freshwater Inflow Water Demands

As noted in the section on firm water demands, interruptible stored water is used to meet part of the environmental water demands for instream flow and estuarine freshwater inflows. During the critical drought, the average annual demand on interruptible stored water is estimated to be 23,030 acre-feet per year, with 8,600 acre-feet per year of that amount provided for instream flow maintenance.

4. Summary

Projected surface water demands in LCRA's ten-county water district during severe droughts total about 798,300 acre-feet annually in 2010. Firm water demands are projected to be approximately 360,100 acre-feet annually in 2010 (See Table 4-2). Surface water demands for irrigated agriculture under drought conditions are estimated to be 438,200 acre-feet annually. The projected irrigation demands, as well as reported use in 2000, are indicated in Table 4-3.

REFERENCES

Tex. Water Dev. Bd., WATER FOR TEXAS – 2002 VOLUME III (2002) (Region K Plan) (available online at http://www.twdb.state.tx.us/rwp/k/PDFs/).

Martin, Q. W. (1990). "Economic Evaluation of Alternative Rice Cropping Decisions," Open File Report, Water and Wastewater Utilities Program, Lower Colorado River Authority, Austin, TX.

Projected Water Supplies

1. Water Supply Management Procedure

a. Systems Operation Concept

A fundamental concept of the WMP is that Lakes Buchanan and Travis and the lower Colorado River are operated as a combined water supply system. Unregulated inflows entering the

Colorado River from drainage areas downstream of the Highland Lakes must be used to the maximum extent possible before inflows to the Lakes Buchanan and Travis are passed through or stored and subsequently released to satisfy downstream water needs.

Such a system concept requires a careful and extensive analysis of the interconnection of hydrologic conditions, water demands, and priority of water rights and uses. The WMP uses the following general guidelines for the storage and use of water in the Highland Lakes and the lower Colorado River.

b. Critical Drought Period Concept

A basic assumption in assessing water availability for the DMP/DCP is that all operational procedures must be evaluated as if the worst drought ever recorded for the lower Colorado River were to reoccur. This Drought of Record for the Highland Lakes was the 1947-1957 period, a period that was identified as the most severe occurring during the 105 years since data collection started in February 1898.

c. Procedures For Evaluating Water Availability

LCRA staff developed a computer program for evaluating water availability under a variety of management policies. This program is called "RESPONSE - Lower Colorado River Authority Reservoir System Simulation Computer Program." The evaluation of water availability proceeds on an annual basis. For each year, a three-stage process is executed:

1. water demands are estimated for each user or usage category for the coming year;
2. the daily flows are allocated among users based on legal priority or seniority; and
3. the operation of Lakes Buchanan and Travis is simulated on a monthly basis to reflect the storage of unused inflows, evaporation, and potential spills.

The demands for water in the next year are specified as either fixed annual amounts or demands that vary depending on water in storage. The firm demands are all held constant in each year of simulated hydrologic conditions. The irrigation demands change from year to year depending on: (1) the acres cultivated in each irrigation operation for first and second crop rice; (2) weather conditions (rainfall and evaporation) in that year; and (3) water held in storage in Lakes Buchanan and Travis at the beginning of the year. The water demand for first crop rice occurs only in the months of March through July, while second crop demands are in August through October. All annual water demands are distributed on a daily basis using historical water usage information.

The simulated allocation of inflows into Lakes Buchanan and Travis in the DMP/DCP among downstream senior water rights holders follows the same procedure used in developing the Combined Firm Yield of Lakes Buchanan and Travis for the WMP. It is important to note, however, that these simulated monthly operations do not necessarily reflect the actual day-to-day

operations of the reservoir system, which often requires the exercise of best professional judgment.

2. Supplies for Firm Demands

The annual dependable water supply that can be supplied from Lakes Buchanan and Travis during a repetition of the Drought of Record is referred to as the Combined Firm Yield. Based on the studies available to LCRA, the Combined Firm Yield has been calculated by LCRA to be 445,266 acre-feet per year, exclusive of the amount allocated to O.H. Ivie Reservoir. In addition to this Combined Firm Yield, water supplies are also available from the natural flow of the river downstream of the Highland Lakes to meet a major part of the City of Austin's and the South Texas Project's firm water demands.

Adding the other firm water demands to those of the City of Austin gives a projected drought-condition demand in the year 2010 of approximately 360,100 acre-feet annually, as described in Table 4-2. Portions of the demands of the City of Austin and of STP can be supplied from run-of-river flows under separate water rights, reducing the projected drought-condition demand for stored water in year 2010 to about 184,000 acre-feet annually. The estimate of drought-condition firm demand for stored water in 2005 is about 134,000 acre-feet annually. The firm demands for stored water over the next ten years are low relative to the firm supplies from the Combined Firm Yield. Thus, curtailment of firm demands is not likely in the next decade, even under a recurrence of extreme drought conditions. A large surplus in firm stored water supplies is therefore available to meet interruptible stored water needs without placing at risk the stored water needed for firm water users in the next decade.

3. Supplies for Interruptible Stored Water Demands

As specified by the WMP, the amount of interruptible stored water available for the next irrigation season is projected by LCRA staff in November of each year. The projected supply depends upon the amount expected to be in the combined storage in Lakes Buchanan and Travis on January 1, anticipated inflows for the subsequent months through the irrigation season, and the current demands for firm water.

Several procedures were evaluated to predict the likely supplies available, during a repetition of the Drought of Record, in the next year for interruptible stored water demand. Historical records of streamflow were examined, but were found to be highly variable and hence not accurate in estimating water availability for the next year. The most accurate indicator of water availability is the combined storage in Lakes Buchanan and Travis at the beginning of the year. Thus, for the DMP/DCP, the allocation of stored water supplies to meet interruptible stored water demands is based solely on the combined reservoir storage in Lakes Buchanan and Travis at the beginning of each year, and decisions to curtail interruptible stored water supplies in annual contracts are keyed to particular total January 1 storage levels.

At relatively full storage levels on January 1, the supply of interruptible stored water is sufficient

to meet all projected firm and interruptible stored water demands. However, at or below some storage levels, there are not sufficient supplies and the annual contracts for interruptible stored water must be reduced. At lower and lower January 1 storage levels, less and less interruptible stored water is available for allocation through the annual contracts. At some relatively low storage, there will be a total cutoff of water for interruptible stored water use in the coming year. Provisions will be made to revise the water supply estimates during the year to respond to significant changes in projected streamflow and storage due to rainfall in the basin.

The evaluation of expected hydrologic and water demand conditions during a repetition of the Drought of Record can only be simulated based on projected information. This projected information is subject to some uncertainty. LCRA has determined it prudent to designate some minimum storage level serving as a safety factor to insure that all firm demands are fully met during the critical drought. Under this conceptual operating plan, there would be a storage level which, when reached at any time during the year, would require the total cutoff of all water for interruptible stored water use. That storage level defines a Reserve Storage Pool for the system.

With the increase in projected firm water needs of about 50,000 acre-feet annually from Lakes Buchanan and Travis for 2010, there is less water for interruptible stored water supply from Lakes Buchanan and Travis since firm water needs take priority over interruptible stored water uses. To avoid shortages to firm water users, it is recommended that interruptible stored water supplies from Lakes Buchanan and Travis be reduced during the critical drought years from what is available under the WMP approved in 1999 by revising the annual interruptible stored water supply curtailment policy, as discussed below. This reduction in supplies impacts irrigation primarily since irrigation has the highest priority for use of interruptible stored water.

Water Curtailment Policies

1. Triggering Conditions

The DMP/DCP contains distinct triggering levels, as well as several associated cancellation measures, that are associated with the amount of water available in Lakes Buchanan and Travis. These responses range from voluntary conservation by firm water customers to total cutoff of interruptible stored water customers. This DMP/DCP fully meets the critical instream flow needs at all times and meets the target flows during periods of normal or above normal stream flow conditions.

2. Curtailment of Interruptible Stored Water Demands within Irrigation Operations and for Instream and Bay and Estuary Freshwater Inflows

Given the large demand for interruptible stored water for rice production, there will likely be a shortage of interruptible stored water at some time during the next decade. The curtailment policies considered in the DMP/DCP focus primarily on the reduction in interruptible stored water supplies through the annual contracting process. The impact of reducing supplies in the annual contracts is far less than forcing a curtailment or total cutoff during the year after the rice

farmers have made economic commitments based on the assumed availability of the water.

a. Recommendation for Interruptible Stored Water Demand Curtailment for Irrigation and Environmental Needs

To examine possible alternative policies for the 2003 update, LCRA staff reviewed with the Water Management Plan Revision Advisory Committee over thirty options for allocating water supply between irrigation and environmental needs.

In determining available interruptible stored water supplies, it is essential that firm water demands be fully protected during a repetition of the Drought of Record (DOR). This drought is the worst ever recorded on the lower Colorado River and occurred from 1947 through 1956. As noted earlier, projected firm water demands from Lakes Buchanan and Travis over the next ten years (to 2010) are estimated to increase by 50,000 acre-feet annually (24 percent) from the ten-year projections used in the 1999 version of the WMP (to 2005). Meeting those increased demands may only be achieved by decreasing the interruptible stored water supplies presently provided from Lakes Buchanan and Travis. This reduction in supplies impacts irrigation primarily since irrigation has the highest priority for use of interruptible stored water. The second factor affecting interruptible stored water supplies available for irrigation is the allocation of interruptible stored water supplies between irrigation and environmental protection. This allocation is always a delicate balancing between benefits and adverse impacts.

After examining the alternatives, LCRA recommends that interruptible stored water supplies be reduced from present levels and that additional water be provided for estuarine freshwater inflows. As more specifically described below, LCRA recommends that interruptible stored water supplies be reduced from the current levels with the initial storage curtailment threshold raised from the current value of 1.1 to 1.4 million acre-feet. The annual interruptible stored water supplies are determined based on beginning-of-year storage. As storage declines, there is a decline in annual interruptible stored water supplies available. For storage levels less than 1.4 million acre-feet, there would be progressive reductions in annual interruptible stored water supplies.

Further, LCRA recommends that an intermediate release schedule be provided for estuarine freshwater inflows that allows a slightly more gradual reduction of inflows to Matagorda Bay during low flow years. The recommended changes are deemed by LCRA as a balance between a modest incremental decrease in irrigation water supplies during drought conditions and modest increased inflow to Matagorda Bay during non-drought years to help maintain the ecological health of the Bay. Based on a balance of environmental and irrigation impacts, the recommended WMP changes include an increase of stored water released for estuarine freshwater inflow. This increase would be provided in years when the January 1 storage level in Lakes Buchanan and Travis is between 1.1 to 1.7 million acre-feet (55 and 86 percent full).

The recommendations for the current update are as follows:

1) Open Supply - If the total January 1 storage in Lakes Travis and Buchanan combined is equal to or greater than 1,400,000 acre-feet, then LCRA will supply all interruptible stored water demands. This assumes 273,000 acre-feet of interruptible storage water is sufficient to irrigate a total of 83,700 acres within the four irrigation operations, with seventy percent (70%) of that acreage being irrigated for a ratoon, or second, crop of rice.

2) Curtailment will begin if the total January 1 storage is less than 1,400,000 acre-feet and greater than 325,000 acre-feet. The available interruptible stored water supply when combined storage on January 1 is less than 1,400,000 acre-feet is shown in Figure 4-1. If combined storage on January 1 is between 1.4 million acre-feet and 1.15 million acre-feet, the interruptible stored water supply available will vary beginning at 273,000 acre-feet available at 1.4 million acre-feet of storage and decreasing at a rate of approximately 31,200 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 195,000 acre-feet available at a combined storage of 1.15 million acre-feet. When the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,150,000 acre-feet, the interruptible stored water supply available will vary beginning at 195,000 acre-feet available at 1.15 million acre-feet of storage and decreasing at a rate of approximately 4,250 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 160,000 acre-feet available at a combined storage of 325,000 acre-feet.

3) Cutoff of the interruptible stored water supply for the coming year will occur when the combined storage in Lakes Buchanan and Travis on January 1 is less than or equal to 325,000 acre-feet.

4) Reserve Storage Pool - If at any time during the year the total storage in Lakes Buchanan and Travis, combined, is less than or equal to 200,000 acre-feet then all use of interruptible stored water will be stopped.

5) During periods of curtailment or cutoff instituted on January 1, LCRA will cancel the curtailment of interruptible stored water for the irrigation operations at any time during the year prior to July 31, if the combined storage in Lakes Buchanan and Travis is projected to be equal to or greater than 1.4 million acre-feet anytime in July. Further, the remaining available interruptible stored water supplies for the year may be reallocated, at this time, between irrigation operations if such allocations do not adversely affect any irrigation operation.

6) During periods of curtailments, LCRA will allow each irrigation operation the option of either: (1) using up to a maximum authorized volume of interruptible stored water allocated to that operation, or (2) using sufficient water to cultivate a level of acreage agreed upon among the customers within each particular irrigation operation and LCRA.

Since the curtailment begins at a storage level more than one half full, curtailment of irrigation water supplies may occur during some relatively mild droughts, however such curtailment would be limited in scope and duration. Further, it is likely that the rice producers will only be

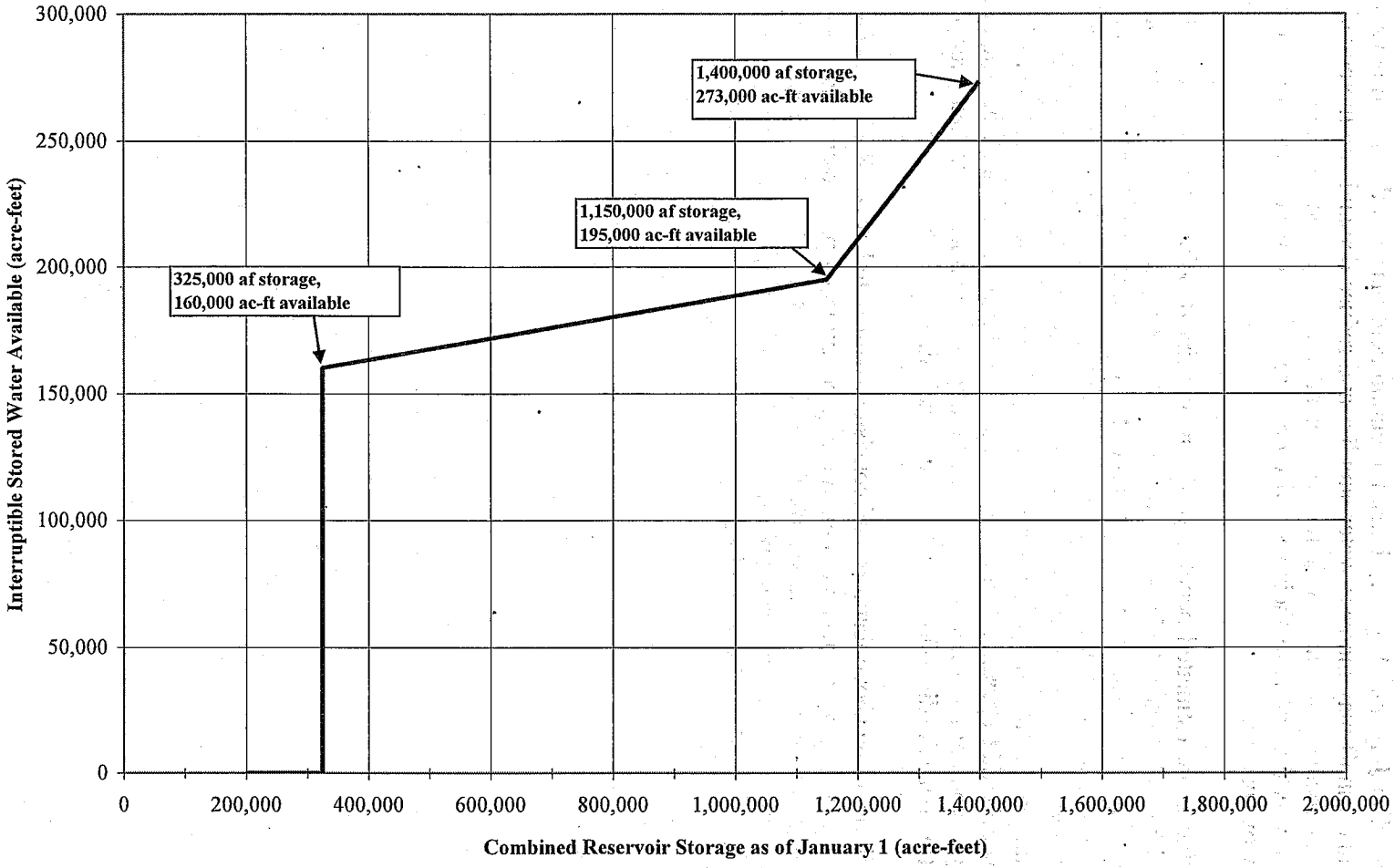
tentatively required to curtail second crop rice, which is cultivated after first crop rice is harvested in July and August. Thus, the curtailment plan has the added advantage that spring rains and runoff may increase water supplies and reduce demand and thereby allow an increase in the estimate of interruptible stored water available for second crop rice. Rice producers could relatively easily increase their second crop acres if they were aware of any increased water supply by June 15.

To achieve the estimated benefits of the management policy, it is necessary for the irrigation operations to reduce their water demands to correspond to reductions in the estimated interruptible stored water supplies, in accordance with the procedures in this WMP or the terms and conditions of contracts between LCRA and stored water users. Close coordination between LCRA and the operations will be needed. Should an operation choose not to reduce the acreage cultivated in response to the projected shortage of interruptible stored water supply, LCRA will only supply that operation with its estimated portion of the reduced interruptible stored water supply. No additional interruptible stored water will be released in that year for that irrigation operation once the diversion limit has been reached.

In addition to the above features, and consistent with state law, LCRA's customers must prepare and adopt a legally enforceable local drought contingency plan, which should include specifics concerning the actions to be taken to comply with LCRA's DMP/DCP regarding the curtailment of interruptible stored water supplies. LCRA staff is available to provide technical assistance with the preparation of required local plans.

FIGURE 4-1

Interruptible Stored Water Available During Curtailment
Based On January 1 Combined Storage in Lakes Buchanan and Travis



b.Irrigation Allocation Among the Irrigation Operations

As provided in Finding 25 of the September 7, 1989 Order of the Texas Water Commission approving LCRA's WMP, "the priority allocation and terms governing the interruption of supply of stored water for Garwood are based upon a contract between Garwood and LCRA."

LCRA has negotiated a contract with Pierce Ranch governing the interruption of the supply of stored water to Pierce Ranch. Interruption of the supply of stored water for other commitments similarly would be governed by contract or LCRA Board resolution.

There are many ways in which interruptible stored water demands may be curtailed through the annual contracts. The two most likely are a gradual curtailment with reductions indexed against beginning of year storage in Lakes Buchanan and Travis; or an abrupt total cutoff policy where the full demands are supplied if the beginning of year storage level in Lakes Buchanan and Travis was above a specific level, otherwise totally stop interruptible stored water sales for the next year.

The largest use for interruptible stored water is rice production. Rice producers must plan their crops for the next season based upon the projected interruptible stored water supply, even though more supply may actually be available in future months. The advantages of the gradual approach of curtailment are that the rice industry could use the water allocated to achieve the greatest benefit. Water could be used in first crop on the hope that conditions in the spring would refill the river and lakes. The disadvantage is that some curtailment would occur when it was not really necessary in years when the critical drought was not repeated. Lakes Buchanan and Travis would refill and spill because the drought ends before conditions become as severe as the critical Drought of Record.

The advantages of the "all or nothing" approach are that there would be more years when the full demands would be met and minor droughts would not affect available supplies. Disadvantages would be that in some years there would be no interruptible stored water and most rice producers would risk substantial or total loss of their crops if sufficient run-of-river water was not available throughout the growing season.

In years when there is not sufficient projected interruptible stored water available to meet all irrigation needs, the interruptible stored water will be allocated to the irrigation operations so that all operations have the same percentage shortage in their total interruptible stored water demand. The calculation of the annual demand of interruptible stored water will be based on a projection of relatively dry weather and low streamflow conditions in the next year.

The allocation of interruptible stored water supply to the individual irrigation operations is discussed above in Section C.3.b. Briefly, allocation of interruptible stored water supply to the individual irrigation operations for the 2003 update of the WMP is according to the following formula:

Interruptible Stored Water Supply = 0.5*Average annual interruptible stored water usage over past 10 years + 0.5*Highest year of interruptible stored water usage within past 10 years.

Using the last ten years of interruptible stored water usage, each irrigation operation was determined to be entitled to the following percentages of interruptible stored water supplies available:

Gulf Coast	.425
Lakeside	.425
Garwood	.063
Pierce Ranch	.088

Based on this allocation, a table of acreage was developed for the three major irrigation operations showing the likely allocation of various amounts of interruptible stored water between first and second rice crop. Pierce Ranch was not included in the table since there is not a reasonably accurate predictive equation for water use at Pierce Ranch. To represent Pierce Ranch's needs, water use and acreage were assumed at 9 and 6 %, respectively, of the combined water use and acreage, respectively, of the other three operations.

c. Irrigation Allocation Within the Irrigation Operations

Because Pierce Ranch has entered into a long-term interruptible stored water contract with LCRA, Pierce Ranch will determine how water will be allocated within its own operation. Within each LCRA irrigation operation, LCRA and its customers, through the advisory committees, will mutually determine which of the following allocation methods to follow:

Volumetric method – The total volume of water available to each operation will be divided by the operation's total recent base history to establish an amount available per acre, not to exceed 5.25 acre-feet. Each customer's actual first crop per acre usage for each landmass will then be subtracted from the per acre farm level availability and the balance, if any, will be made available to the customer for second crop production. Additional water made available due to any customers choosing not to irrigate either first or second crop will be equitably distributed to customers who irrigate other crops within the operation.

Acreage Method – The irrigation operation choosing this method would irrigate first crop acreage, but prior to the initial contracting process, would determine the maximum first crop acreage that could be irrigated with allocated water supplies. The first crop acreage for the particular irrigation operation would be determined by dividing the total water available to the particular irrigation operation by a first crop acre-foot per acre water use duty as agreed upon

between LCRA and the respective advisory committee. Contracted first crop acreage would be limited to this amount and would be made available to individual customers pro rata, based on their recent irrigation history as described below. For irrigation operations using volumetric measurement, any use of water in excess of the first crop acre-feet per acre duty would be subject to a surcharge. Prior to contracting for second crop water, the acreage available for second crop would be determined and contracted for on a pro rata basis, in a manner similar to that used for first crop, including a duty and surcharge. During a curtailment, water would be available for rice only, except at the Gulf Coast irrigation operation, where water would also be available for turf grass. Other supplemental agricultural interruptible demands within an operation would also be considered on a limited basis and only to the extent that water is available within the canal system which is not needed for rice irrigation.

Each customer's average base acreage history is to be determined based upon an averaging period agreed to by the farmer advisory committees. The averaging periods are as follows: Garwood – five (5) years; Gulf Coast – two (2) years; and Lakeside – six (6) years.

At the Lakeside and Garwood irrigation operations, the base acreage history shall be based upon the lands irrigated such that a customer shall not be entitled to irrigate lands in a curtailment year that were not previously irrigated by that customer, unless the current landowner of the land that contributed to the base acreage history grants express written consent, and such consent is provided to LCRA with customer's application. In the event that a customer no longer farms land which has a history of being farmed, that history shall be credited to the current landowner or a successor tenant farmer unless the landowner has granted consent for such base acreage to follow the customer to additional lands as described above.

At the Gulf Coast irrigation operation, the base acreage history shall follow the LCRA customer, and not be restricted to a particular landmass.

Allocation of curtailed interruptible stored water to the various users within the irrigation operation will be based on the amount of irrigated acreage on each landmass. This water use will be determined by accounting for established crop rotations during the defined averaging period and will include only those years during that same period that water was used on the landmass. Irrigation operations personnel will maintain this information for each irrigated landmass. Separate base acreage histories will be maintained for rice and turf grass. During periods of curtailment, irrigation customer contracts will be limited to the base acreage as determined by the method described above and any reductions necessary will be made from this base acreage.

d.Drought More Severe Than Drought of Record

In the event that the LCRA Board of Directors declares a drought to be more severe than the Drought of Record, limits would be placed on first crop production. If that occurred, the

following key elements of limiting first crop would stand:

- On Jan. 1 of each consecutive critical drought year, the projected run-of-river flow and interruptible stored water would be calculated and the water volume available to each operation would be projected.

- Each irrigation operation would decide with LCRA which allocation method to use, either the maximum acreage plan or the maximum volume plan.

- The application and contracting process would have a final deadline of February 15th of each year of the drought period that is more critical than the Drought of Record.

e. Termination of Water Allocation Policy

The water allocation model and water allocation plan for agricultural irrigation will terminate when the combined stored volume of Lakes Buchanan and Travis exceeds 1.4 million acre-feet.

The first crop water allocation process described here would terminate when LCRA reallocates interruptible stored water to the irrigation operations after the Board declares the drought worse than the Drought of Record to be over.

f. Procedures for Water Use Accounting

LCRA will employ its ordinary and standard water measurement procedures to account for water used during curtailment periods. During the implementation of the water allocation policies, LCRA will notify each customer of the amount of acreage for which LCRA will provide water. LCRA staff will perform actual field surveys to verify that each customer was not planting more than the allocated acreage. Customers planting excess acreage will be required to prevent irrigation waters from entering excess acreage through construction of appropriate outside levees enclosing only permitted acreage.

g. Transfer of Water Among Individual Users

Water allocation among individual users within individual operations is not a property right and there are no procedures or policies for individual users to obtain that right. All waters available during the critical drought would be allocated on a pro-rata basis to the landmasses contracted to irrigate during that critical drought year and either the maximum volume or maximum acreage for that irrigation operation would be consistent with that plan.

h. Variances

Within each LCRA irrigation operation, the LCRA General Manager or his designee is authorized, after consultation with the operation's advisory committee, to move and adjust the

averaging period for base acreages within farm service agency farms units to account for established field rotations and contemporary changes in management practices so long as such adjustments do not result in a net increase in acreage history.

i. Enforcement

All LCRA interruptible stored water contracts include a provision requiring that, in cases of a shortage of water resulting from drought, the water be distributed in accordance with LCRA's WMP and Texas Water Code section 11.039.

Interruptible stored water customers within the irrigation operations failing to comply with the pro-rata allocation requirements (curtailment plan) shall be subject to a civil action to enjoin the non-compliant customers for breach of contract. Additionally, the use of water in excess of the customer's per acre duty as described in section C.3.c above is subject to a surcharge.

3. Curtailment of Interruptible Stored Water Demands for Other than Irrigation Operations

LCRA will limit additional sales or commitments of interruptible stored water, other than for the four irrigation operations' Conservation Base acreage or other priority allocation, based on the combined volume of water in Lakes Buchanan and Travis at certain times of the year.

The supply of interruptible stored water made available outside the irrigation operations for the January through June period will be based on the January 1 storage levels in Lakes Buchanan and Travis taken separately. The supply for the July through December period for such sales will be based on the minimum of the maximum storage levels in April, May, and June in Lakes Buchanan and Travis, taken separately. No such sales will be allowed if either lake is less than 94% of its maximum conservation capacity. If both lakes are at their maximum conservation capacity as calculated above for either six-month period, then such interruptible stored water sales will be limited to a total of 30,000 acre-feet for that year. For projected lake volumes between 94% and 100% of conservation capacity, such interruptible stored water sales would be limited proportionately, based on the storage reservoir with the lowest percentage of capacity as calculated above.

4. Curtailment of Firm Water Demands

LCRA is required by TCEQ and the Texas Water Code to follow water supply allocation procedures to insure that there is no shortage or deficiency of stored water to meet firm demands during a repeat of the Drought of Record. Given the relatively small demand on firm water supplies at present, the possibility of a firm water shortage occurring is remote for the foreseeable future.

LCRA cannot determine with absolute certainty whether a particular drought event will be more or less severe than the Drought of Record. Therefore, LCRA will engage its customers in a public education campaign and seek voluntary reduction of firm demands from its firm

customers in the early stages of a drought, as more specifically described below.

LCRA cannot invoke mandatory curtailments of firm water demand unless a particular drought event is determined to be more severe than the Drought of Record or some other water emergency that drastically reduces the available firm water supply. LCRA Water Supply Planning staff has developed a simplified "drought monitoring procedure" for identifying a drought worse than the Drought of Record for the Highland Lakes watershed. Historical inflow data for the contributing watershed of the Highland Lakes were used in the development of this procedure.

a. Policy Recommendation for Firm Water Demand Curtailment

1) Recommendation 1: LCRA will ask its firm water customers to promote water conservation of five percent (5%) among their end users through implementation of voluntary water use reduction measures in their Drought Contingency Plans whenever the total storage in Lakes Buchanan and Travis drops below 1.6 million acre-feet. At such times, LCRA will also implement an aggressive public information campaign to provide up-to-date information on water supply conditions.

2) Recommendation 2: LCRA will further encourage promote water conservation and will ask its firm water customers to begin continue to implementing the voluntary water restriction componentsuse reduction measures of in their Drought Contingency Plans whenever the total storage in Lakes Buchanan and Travis is at or below 1.4 million acre-feet.

3) Recommendation 3: Whenever the total storage in Lakes Buchanan and Travis is at or below 900,000 acre-feet, LCRA will ask all its firm water customers to conserve ten to twenty-five percent (10-25%) of their demands through implementation of the mandatory water use reduction measures in their Drought Contingency Plans. LCRA will also begin discussions with firm water customers to develop a specific stored water curtailment plan, to be approved by the LCRA Board and TCEQ.

4) Recommendation 4: A mandatory pro rata curtailment of up to thirty-five percent (35%) of the LCRA's firm water customers' demands pursuant to Texas Water Code §11.039 will be implemented when the LCRA Board determines that the river system is experiencing a drought more severe than the Drought of Record. LCRA will curtail and distribute the available supply of firm water among all of its firm water supply customers on a pro rata basis according to the amount of firm water to which they are legally entitled under the terms of their contract and consistent with the curtailment plan approved by the LCRA Board and TCEQ. All uses of interruptible stored water will be totally cutoff prior to and during any mandatory pro rata curtailment of firm stored water supplies.

In addition to the above features, this curtailment policy for firm water demands, LCRA will require each of its firm water customers to prepare and adopt a legally enforceable local drought contingency plan that specifies the actions to be taken to comply with this DMP/DCP regarding

the curtailment of firm supplies. Such plans should be developed pursuant to LCRA guidelines and submitted for LCRA review and acceptance within a reasonable time.

b.Monitoring and Enforcement

LCRA will monitor customers' compliance with the required demand reduction goals and will take enforcement action as necessary against noncompliant customers. Monitoring and enforcement of water-use restrictions at the end-user level generally will be the customers' responsibility.

c.Variances

LCRA's General Manager or his designee may, in writing, grant a temporary variance to the pro rata water allocation requirement of this DMP/DCP if it is determined that failure to grant such a variance would cause an emergency condition adversely affecting the public health, welfare or safety and if one or more of the following conditions are met:

- Compliance with the plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the plan is in effect.

- Alternative methods can be implemented that will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of the DMP/DCP shall file a petition for variance with the LCRA General Manager or his designee within five (5) days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the LCRA Board of Directors and shall include the following:

- Name and address of the petitioner(s).

- Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the LCRA DMP/DCP adversely affects the petitioner or what damage or harm will occur to the petitioner or others if the petitioner complies with the pro rata reduction requirements of the plan.

- Description of the relief requested.

- Period of time for which the variance is sought.

- Alternative measures the petitioner is taking or proposes to take to meet the intent of the plan and the compliance date.

- Other pertinent information.

Variances granted by the LCRA Board of Directors shall be subject to the following conditions, unless waived or modified by the LCRA Board of Directors:

- Variances shall include a timetable for compliance.
- Variances granted shall expire when pro-rata reduction requirements are no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of the LCRA DMP/DCP occurring prior to the issuance of the variance(s).

d.Notification of TCEQ Executive Director

The LCRA General Manager or his designee will notify the TCEQ Executive Director within five (5) business days of implementation of any mandatory provisions in the DMP/DCP.

5. Declaration and Cancellation of a Drought More Severe Than the Drought of Record

The LCRA Board of Directors will declare a drought worse than the drought of record when the following three conditions are simultaneously met: (a) drought at least 24 consecutive months (24 months since both Lakes Buchanan and Travis were at their maximum allowable water conservation storage levels); and (b) the cumulative inflow deficit since the beginning of the drought exceeds the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; and (c) the combined storage in Lakes Buchanan and Travis is less than 600,000 acre-feet.

Curtailments of interruptible stored water due solely to the declaration of a drought worse than the drought of record of duration less than 36 months is only effective on the following January 1 or July 31, whichever occurs first following the declaration by the LCRA Board of Directors. Droughts more than 36 months in length have no restrictions as to when supply reductions can be implemented.

The LCRA Board of Directors will cancel such a declaration if any of the following conditions are met: (a) the cumulative inflow deficit since the beginning of the drought is less than the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; or (b) the combined storage in Lakes Buchanan and Travis is greater than 1.4 million acre-feet of water, which is simply the recommended threshold for curtailment of interruptible stored water during a repetition of the drought of record. Prior to declaring a drought worse than the drought of record, LCRA will re-evaluate this threshold level to determine if a more accurate conservation storage level in lieu of 1.4 million acre-feet can be determined.

6. Public Notice

LCRA will carry out a public information campaign that is appropriate to the particular curtailment contemplated. This could include some or all of the following efforts: (1) news releases, (2) news updates to area media, (3) interviews with local radio and television stations, (4) responses to requests for information, (5) distribution of water conservation education materials, (6) advertisements in local newspapers to inform the public about current water supply and usage and our water management planning strategies, (7) improvements to LCRA's automated telephone message system to provide information on lake levels, and (8) public service announcements on local radio stations.

7. Impacts of the Recommended Management Policy

a. Firm Water Demands and Supplies

All projected year 2010 demands for firm water are fully satisfied under these simulated critical drought conditions. The largest firm water demand is for the City of Austin. The majority of Austin's projected annual demand of 201,400 acre-feet is met from run-of-river flows diverted under its senior water rights.

Approximately 65% of the demand during the 1947-1956 critical drought years is estimated to be supplied by these flows with the remainder supplied by firm stored water.

b. Interruptible Stored Water Demands and Supplies

With the increase in projected firm water needs for 2010, there is less water for interruptible stored water supply from Lakes Buchanan and Travis since firm water needs take priority over interruptible stored water uses. To avoid shortages to firm water users, it is recommended that interruptible stored water supplies from Lakes Buchanan and Travis be reduced during the critical drought years from what is available under the WMP approved in 1999. This reduction in supplies primarily impacts irrigation.

Under the recommended management policy, all interruptible stored water available during a repetition of the Drought of Record is used by the four downstream irrigation operations, except for that portion committed to maintaining instream flows and estuarine freshwater inflows.

With the curtailment threshold raised from the current value of 1.1 to 1.4 million acre-feet, the projected first crop demand of 83,700 acres will be fully met under the proposed changes, as it is under the WMP approved in 1999. However, there will be a substantial reduction in the irrigation acreage supplied for second crop under the proposed curtailment policy. The WMP approved in 1999 provides sufficient water to irrigate an average of 56,500 acres of second crop each year during a repetition of the Drought of Record. The proposed plan would provide water only for an average of 32,700 acres of second crop under the same drought conditions. Approximately 92 percent (21,800 acres) of this decrease in acreage is due to the increased

projected municipal demands, with the remainder (2,000 acres) due to the proposed change in environmental releases for estuarine inflows. In spite of this reduction, irrigators would use, during a repeat of the Drought of Record, an average of 168,400 acre-feet annually, or 75 percent of all interruptible stored water used for irrigation and environmental protection.

The simulated acreage cultivated in first and second crops are given for all four operations combined and individually in Figures 4-2 thru 4-6, at the end of this Chapter. As noted previously, however, the actual interruptible stored water curtailments may differ from the values reflected by the cultivated acreage as shown in this simulation, depending on the facts as they then exist and the terms and conditions of the contracts between LCRA and users.

The recommendation concerning instream flows reflects the philosophy adopted in the initial WMP and continuation in the amendments to the WMP that instream flows be curtailed whenever there is a curtailment of interruptible stored water to the four major irrigation operations. Since the curtailment threshold for irrigation supplies is recommended to rise from 1.1 to 1.4 million acre-feet, LCRA has proposed that the curtailment storage threshold for instream flows also be revised upwards the same amount. By synchronizing these curtailment trigger points, the WMP reflects reduced supplies available to maintain instream flows, including both supplies released for irrigation that simultaneously benefit instream flows as well supplies dedicated to maintain streamflows for ecological benefit.

The recommended intermediate estuarine inflow policy would provide for releases of stored water from Lakes Buchanan and Travis of up to 256,700 acre-feet (150 percent of Critical FIN) annually to Matagorda Bay in years whenever the combined storage in Lakes Buchanan and Travis on January 1 is between 1.1 and 1.7 million acre-feet. By increasing the releases of stored water from Lakes Buchanan and Travis in years when the January 1 storage is within this given range, the estuarine ecosystem receives more freshwater inflows during moderate droughts than it would be under the present WMP.

The WMP, with the proposed revisions herein, will have essentially the same total stored water commitments for environmental purposes as currently provided in the present WMP. During a repetition of the DOR, the present WMP would provide an annual average of 56,000 acre-feet for both instream flows and estuarine inflows. With the proposed changes, the WMP would provide about 56,500 acre-feet annually during the same period and for the same purposes.

The proposed increase in the firm water allocated for environmental purposes from about 16,000 to 33,400 acre-feet is required to properly account for the stored water dedicated for environmental purposes. Whenever irrigation interruptible stored water supplies are curtailed, stored water used for environmental protection has be accounted as firm water since irrigation has priority use of available interruptible stored water supplies. Since the proposed storage threshold for curtailment of irrigation supplies is significantly greater than the present threshold, there will be more years in the DOR when irrigation supplies are curtailed, hence increasing the environmental flows that have to be assigned to firm water supplies.

The proposed additional 17,400 acre-feet firm water commitment for environmental purposes would be provided from the presently uncommitted firm yield of 60,952 acre-feet. The remaining firm yield available after this allocation would be 43,462 acre-feet. This amount is in addition to 50,000 acre-feet reserved by the Board for future uses. The total proposed firm water allocation of 33,400 acre-feet for environmental purposes represents 8 percent of the total firm supply from Lakes Buchanan and Travis.

c.Lake Storage Levels

For the simulated repetition of the Drought of Record, the total combined storage of Lakes Buchanan and Travis was reduced to very low levels in the worst drought years (Figure 4-8), even with the partial curtailment of interruptible stored water supplies. Approximately 200,000 acre-feet of stored water remains in Lakes Travis and Buchanan combined at the lowest storage content. The simulated lake water surface elevations and storage levels are given in Figures 4-9 and 4-10, for Lakes Buchanan and Travis, respectively. The minimum lake water surface levels during the simulation period are about 960 feet msl on Lake Buchanan and 578 feet msl on Lake Travis. The average lake water surface elevations (for the repetition of the 1941-1965 period hydrology) are projected to be 1005 feet msl on Lake Buchanan, and 657 feet msl on Lake Travis.

The simulated minimum water levels in Lakes Travis and Buchanan are lower than the historical low levels of 614 feet and 983 feet, respectively. The greater drawdown on the lakes in the simulated operation is largely because of greater water demands and lower storable inflows than occurred historically. The projected year 2010 water demands are significantly greater than those that occurred historically in the 1941-1965 period. Firm water demands during the actual drought of record were only a small fraction of those projected by year 2010. Additionally, the rice producers only cultivated one crop of rice prior to about 1963. The current practice of producing two crops each year has increased the water demands of irrigation over those of the 1947-1956 critical drought period.

The second factor causing the simulated storage levels to be lower than historical levels is a difference in the storable inflows. The simulated operation uses historical inflows adjusted for any flow reductions caused by water diverted for upstream water rights, particularly major reservoirs including O. H. Ivie Reservoir. Most of the large reservoirs upstream of the Highland Lakes were not in operation during the critical drought period. During any repetition of the Drought of Record, these upstream reservoirs would likely significantly reduce storable inflows.

d.Flows in the Colorado River

For a repetition of the hydrologic conditions in the 1947-1956 critical drought years, the estimated average flow of the Colorado River at Bay City is about 471,000 acre-feet annually with the projected 2010 demands. For a repetition of the 1941-1965 period, the simulated annual flow at Bay City averages 1.22 million acre-feet. Of this total, a portion of the flow consists of dedicated releases of stored water from Lakes Buchanan and Travis to meet the Target and

Critical freshwater inflow needs and a portion consists of stored water released to meet critical instream flow needs at several upstream locations.

The dedicated firm and interruptible stored water releases for the 1947-1956 critical period amount to an average of 56,500 acre-feet per year of which 36,000 acre-feet is for maintaining instream flows.

Annual Implementation of Drought Management and Drought Contingency Plans

1. Annual Review and Revisions

As part of the WMP, the DMP/DCP is subject to review each year. The DMP/DCP may be revised at any time subject to approval by the LCRA Board and the TCEQ. Changing water supply and demand conditions on the lower Colorado River will be reflected as necessary in future amendments to the WMP.

2. Administration

The curtailment of interruptible stored water supply will occur through the annual contracting process in November through January of each year. The curtailment of firm water will depend on storage levels and will be monitored continuously. Curtailment of interruptible stored water supply for Garwood and other entities supplied pursuant to long-term contracts will be accomplished pursuant to the terms of those contracts.

LCRA will monitor customer compliance with the required demand reduction goals and take enforcement action as necessary against noncompliant customers. Monitoring and enforcement of water use restrictions at the end-user level generally will be the customer's responsibility. At present, LCRA's ability to enforce curtailments of firm water demands is uncertain and may be limited to taking civil action to enjoin a non-compliant customer for breach of contract.

Figure 4-2: Simulated Irrigated Acreage - 4 Irrigation Operations Combined

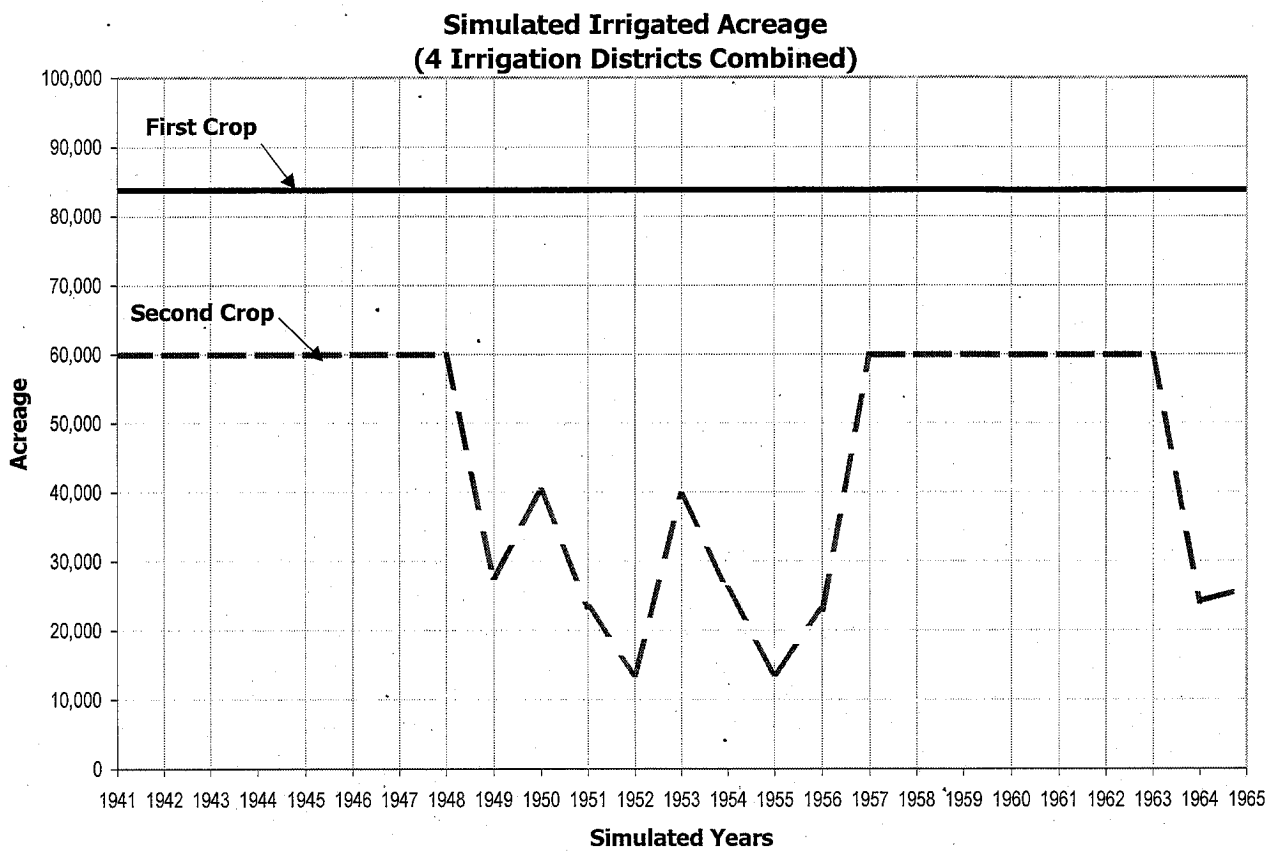


Figure 4-3: Simulated Irrigated Acreage - Gulf Coast

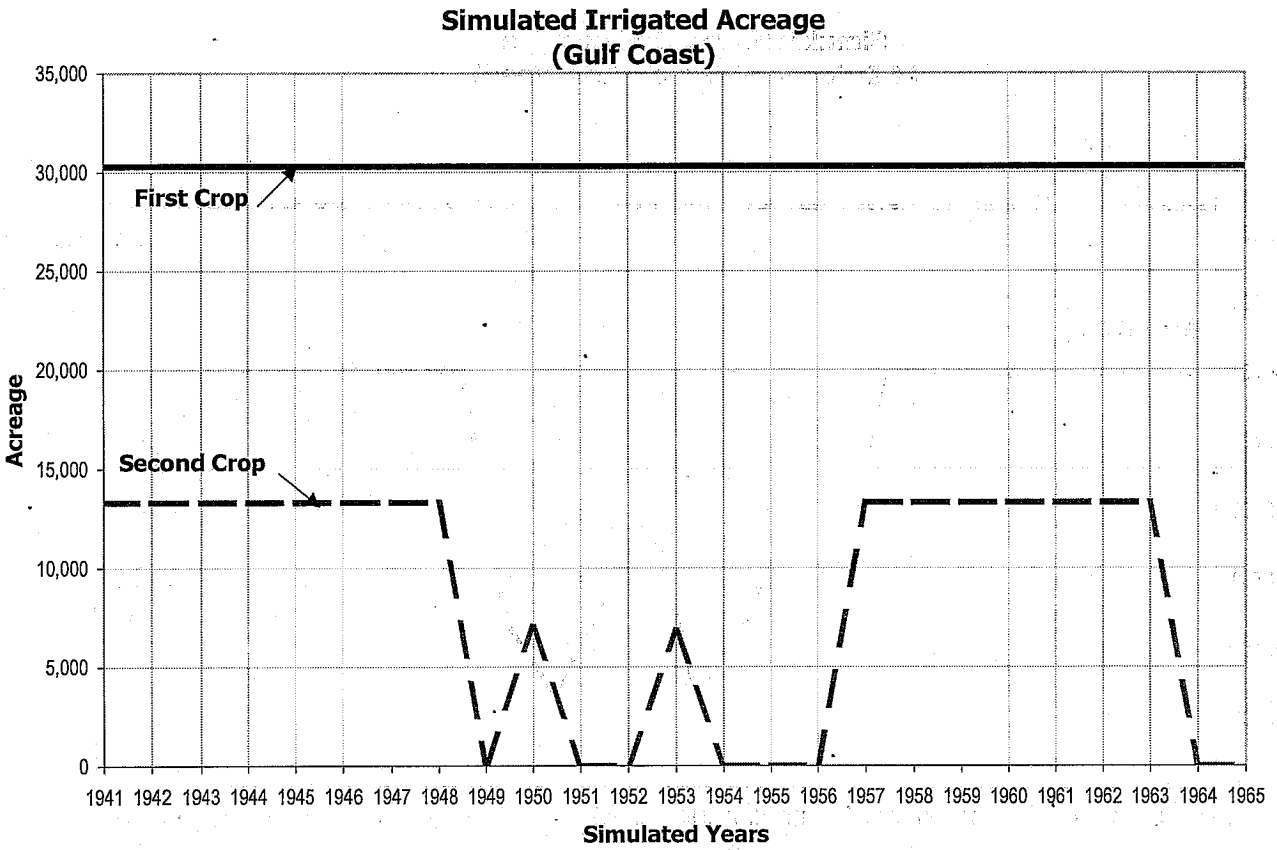


Figure 4-4: Simulated Irrigated Acreage - Lakeside

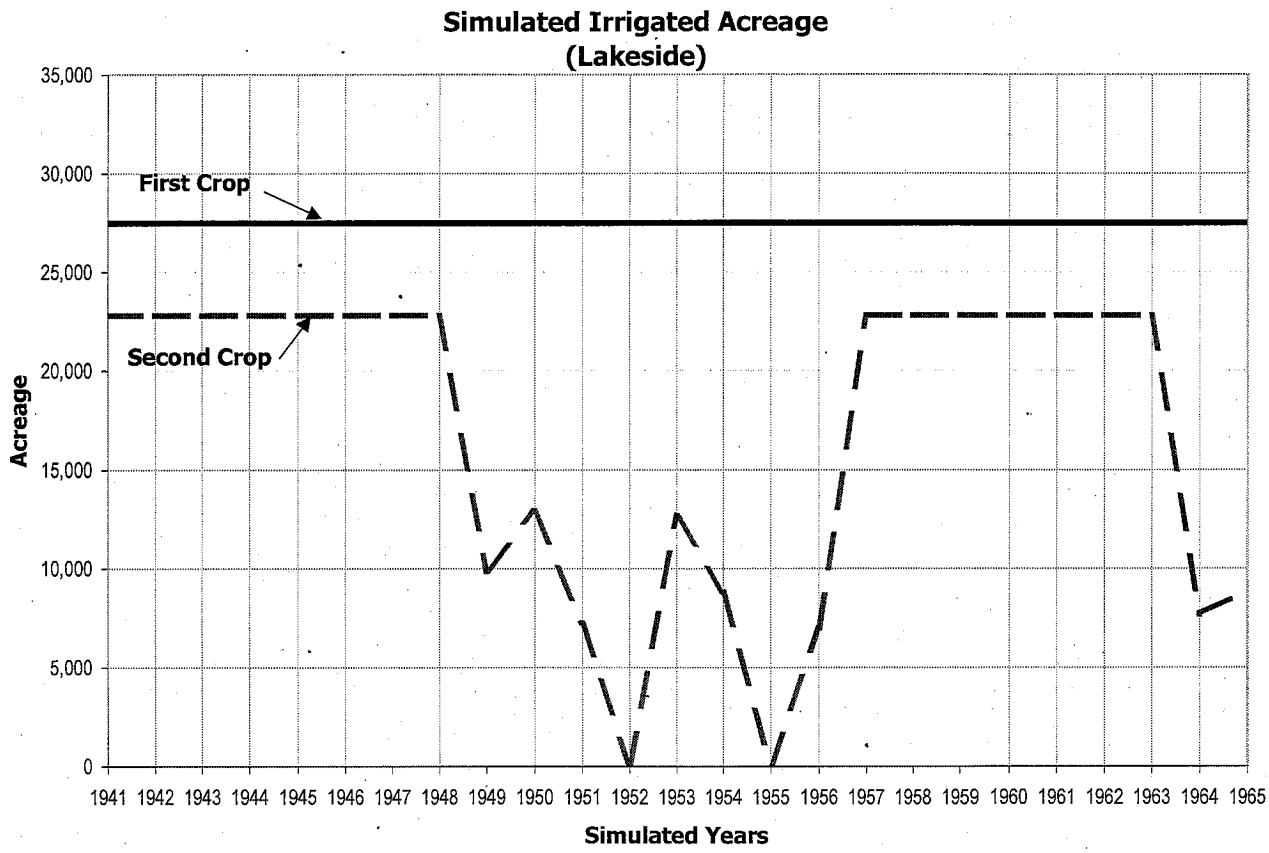


Figure 4-5: Simulated Irrigated Acreage - Garwood

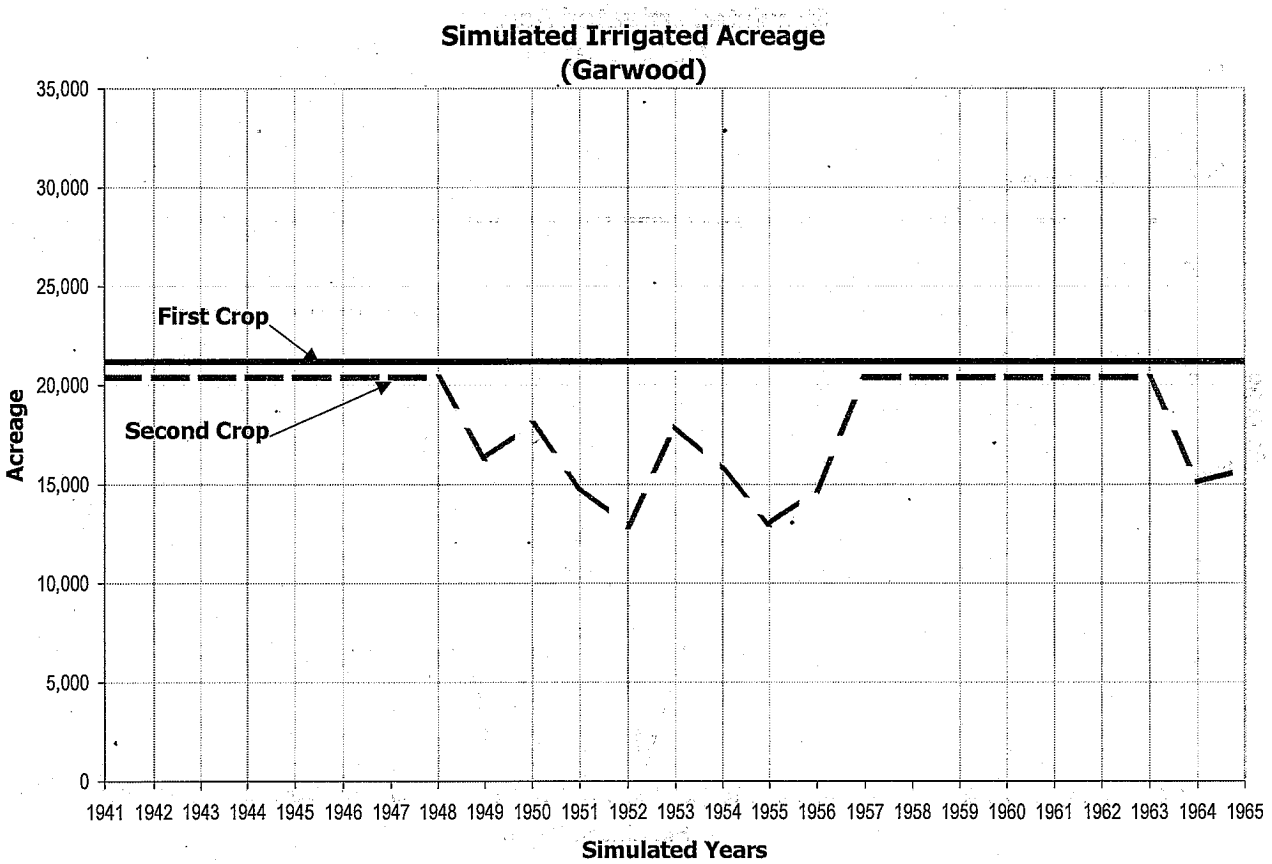


Figure 4-6: Simulated Irrigated Acreage - Pierce Ranch

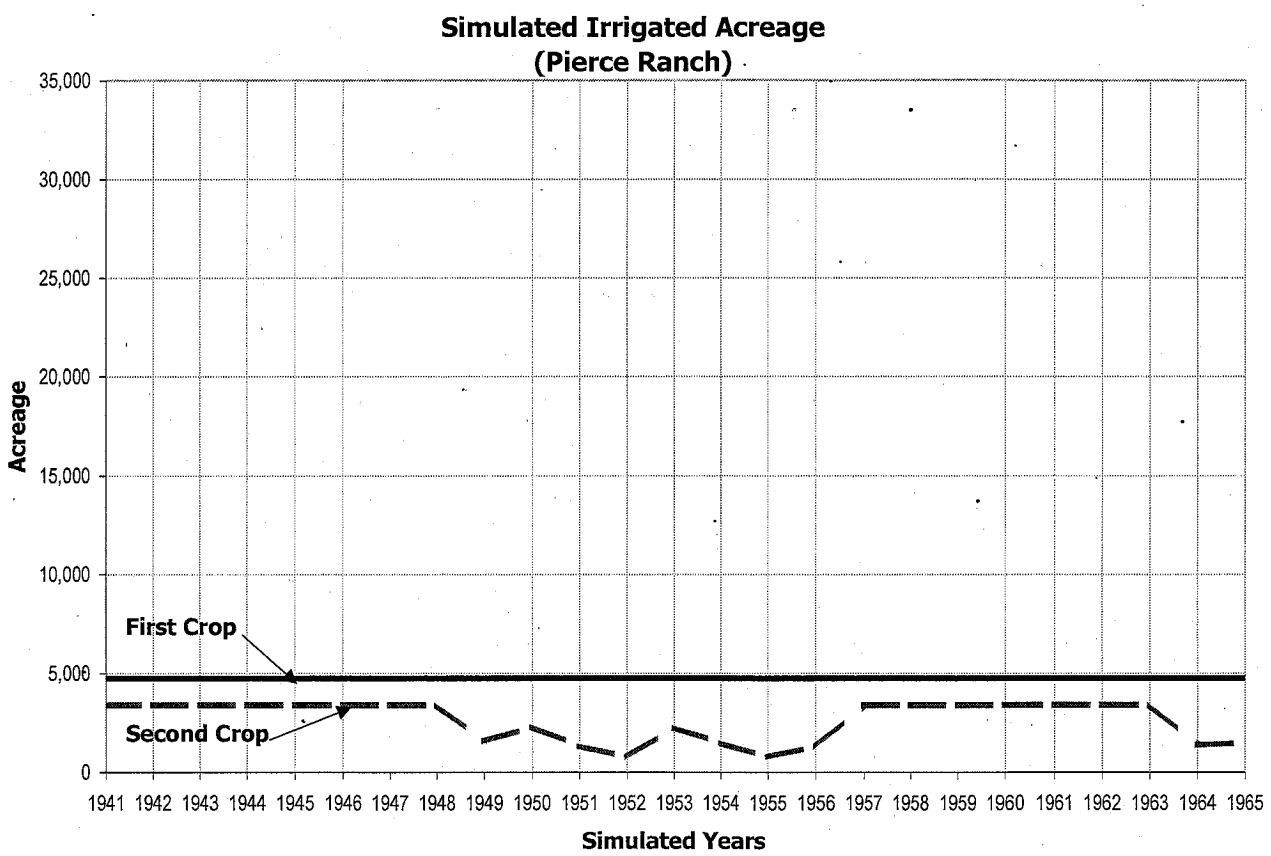


Figure 4-7: Simulated Travis and Buchanan Storage Condition

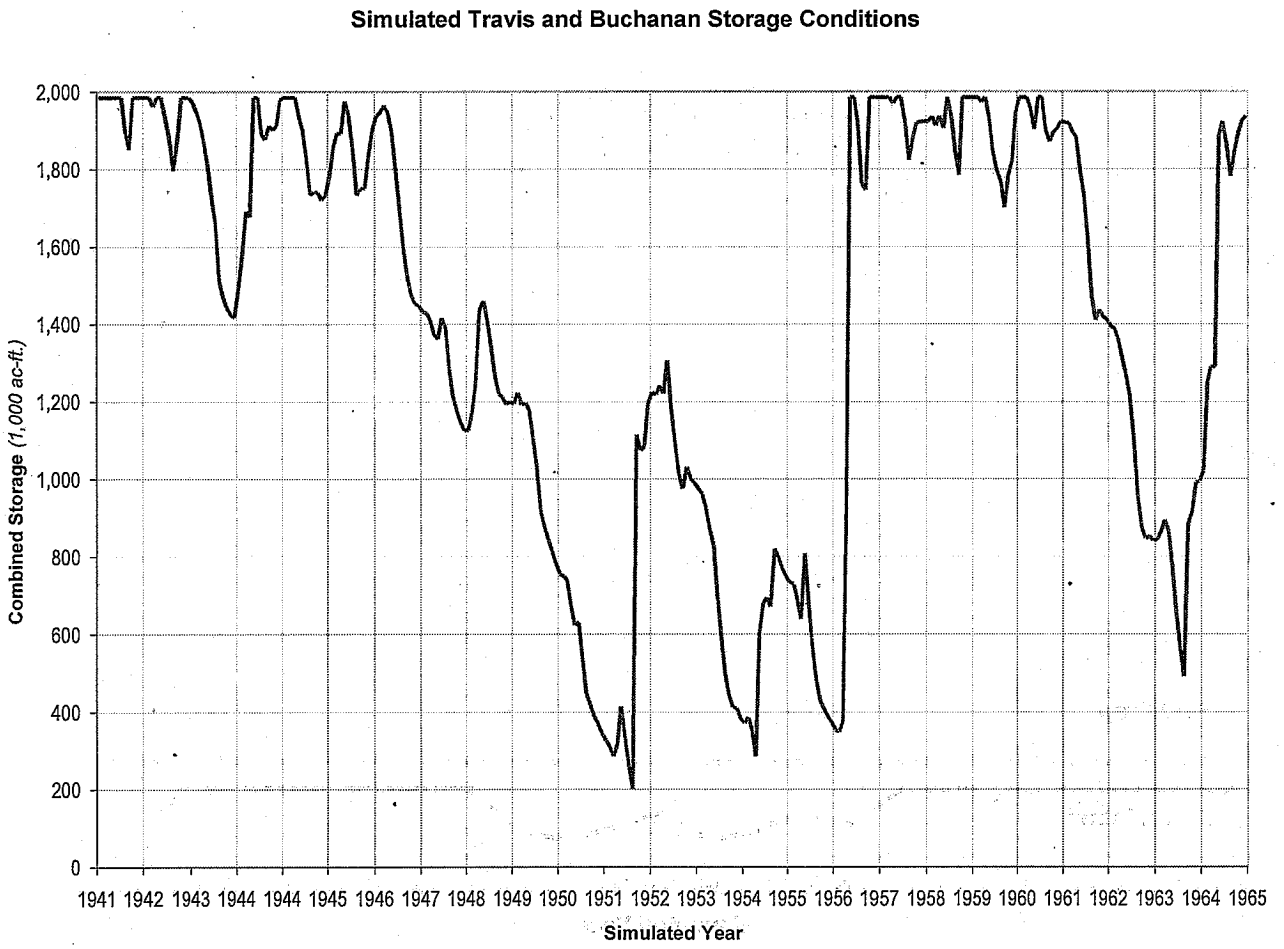


Figure 4-8: Lake Buchanan Simulated Elevation and Storage

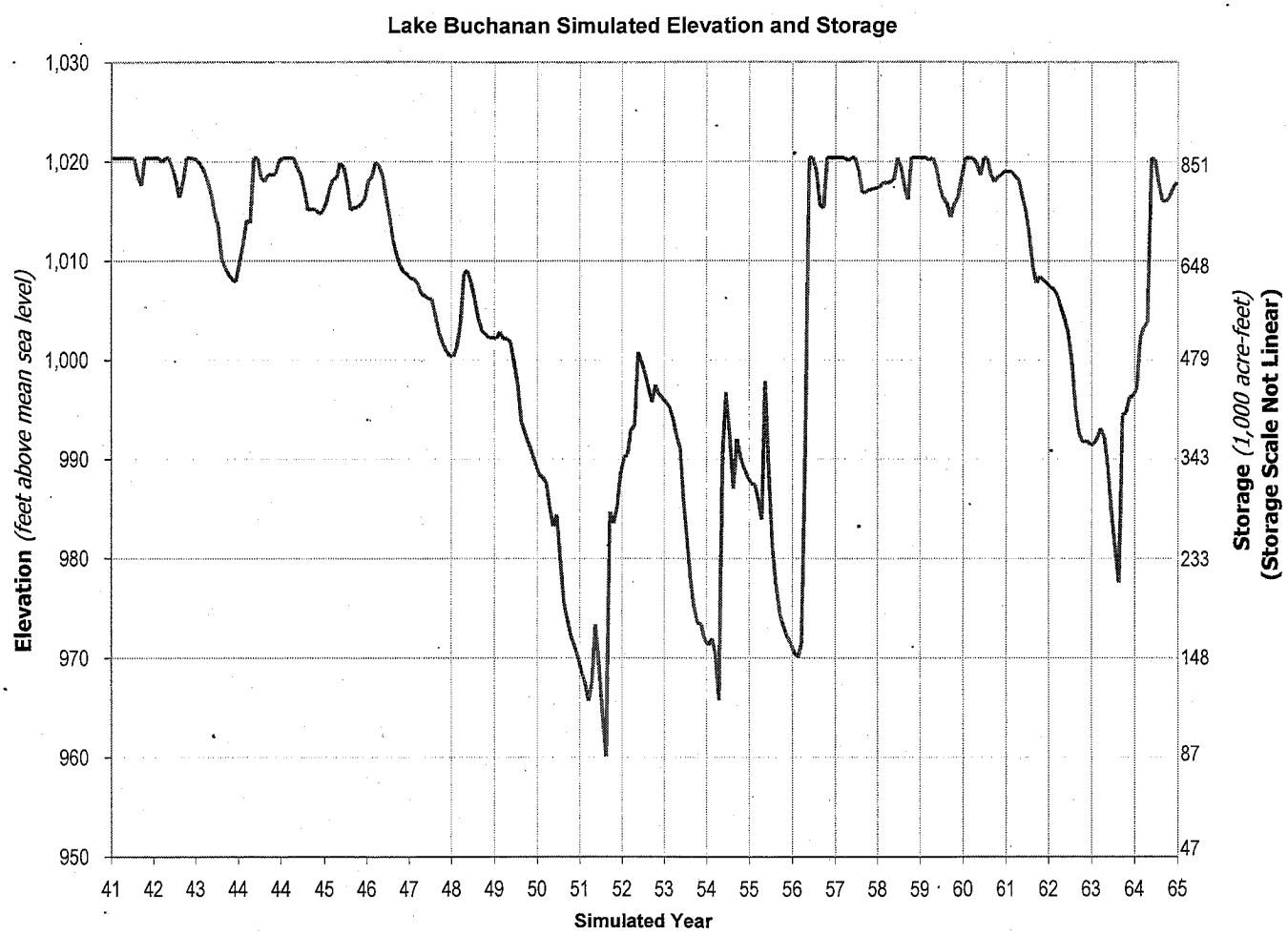
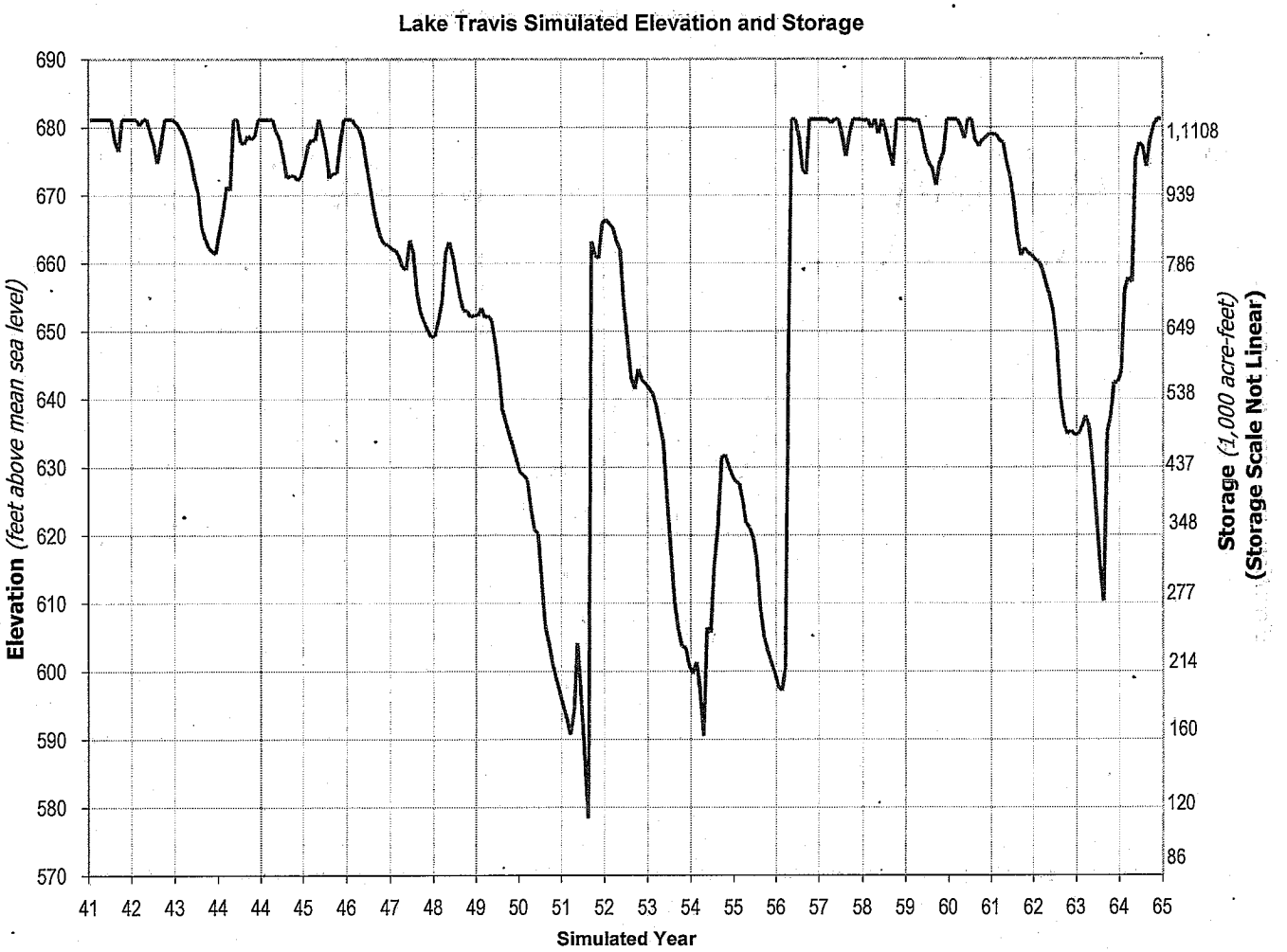


Figure 4-9: Lake Travis Simulated Elevation and Storage



CHAPTER 5
DETERMINATION OF THE COMBINED FIRM YIELD

A. Requirement of LCRA's Water Rights for the Lakes Buchanan and Travis 5-2
B. Reservoir Operation Models 5-2
1. O. H. Ivie Reservoir Firm Yield Model 5-3
2. Lakes Buchanan and Travis Combined Firm Yield Model 5-3
a. Downstream Senior Water Rights 5-5
b. Passage of Daily Reservoir Inflow 5-5
c. Operation of the Highland Lakes System 5-5
C. Downstream Senior Water Rights in the Lakes Buchanan and Travis Combined Firm Yield Model 5-6
1. Final Judgment and Decree 5-6
2. Development of Model 5-6
a. Daily Flow Routing Procedure 5-6
b. Demands of Downstream Senior Water Rights 5-8
c. Intervening Inflows And Channel Losses From Mansfield Dam To Bay City 5-11
(1) Natural Runoff and Springflow 5-12
(2) City of Austin Treated Wastewater Effluent Discharges 5-12
(3) Return Flows From Irrigation 5-14
d. Flow Routing Coefficients 5-14
e. Hydrologic Routing Relationships 5-15
(1) Mansfield to Austin Gage 5-16
(2) Austin Gage to Smithville Gage 5-16
(3) Smithville Gage to Columbus Gage 5-17
(4) Columbus Gage to Wharton Gage 5-17
(5) Wharton Gage to Bay City Gage 5-17
f. Resulting Downstream Deficit 5-18
D. Passage of Daily Reservoir Inflows in the Lakes Buchanan and Travis Combined Firm Yield Model 5-19
1. Solution Procedure 5-19
2. Required Input Data 5-20
3. Time of Travel for Flows 5-21
4. Channel Losses 5-21
5. Flow Routing Optimization Problem 5-22
a. Problem Statement 5-22
b. Linear Programming Optimization Technique 5-22
6. Simulation Results 5-23
a. Water Diversions 5-31
b. Channel Losses 5-31
c. Flows Past Bay City 5-31
d. Inflows Available for Storage 5-31

E. Operation of the Reservoir System in the Lakes Buchanan and Travis Combined Firm Yield Model 5-31
1. Description of Reservoir System 5-32
2. Hydrologic Significance of Firm Yield 5-33
3. Reservoir Inflow 5-34
a. Water Availability Model (pre-2003) 5-34
b. Future Considerations 5-34
4. Reservoir Evaporation 5-35
5. Local and Downstream Demand Distributions 5-35
6. Simulated Highland Lakes Operations 5-35
7. Demand Alternatives 5-38

A. Requirement of LCRA's Water Rights for the Lakes Buchanan and Travis

Two new reservoir yield terms and definitions were introduced in the Final Judgment and Decree. These terms, Combined Theoretical Yield, and Combined Firm Yield, each allowed Lakes Buchanan and Travis to be operated as a system. The Combined Theoretical Yield was defined as the yield of the lakes if no other impoundment occurred upstream, and no water had to be passed through for senior rights. The Combined Theoretical Yield has not been calculated within this study.

The Combined Firm Yield of Lakes Buchanan and Travis is that portion of the yield remaining after honoring the full extent of upstream and downstream senior water rights. An interim value of 500,000 acre-feet per year was specified, which was in effect until the Texas Water Commission (predecessor to TCEQ) approved the original Water Management Plan in 1989 and determined the Combined Firm Yield. The firm yield of O. H. Ivie Reservoir was calculated separately from the Combined Firm Yield of the Lakes Buchanan and Travis. The sum of the firm yield of O. H. Ivie Reservoir and the Combined Firm Yield of Lakes Buchanan and Travis is the total Combined Firm Yield for Lakes Buchanan and Travis. The determination of this value is required by Certificates of Adjudication 14-5478 and 14-5482 (previously Permits 1259 and 1260). This chapter describes the data, methodology, and models used to determine the Combined Firm Yield of Lakes Buchanan and Travis, including information on reservoir inflows, junior and senior water rights priorities and demands, reservoir evaporation data, return flows, and other critical information. In the Combined Firm Yield analysis, the three intermediate reservoirs (Inks Lake, Lake LBJ and Lake Marble Falls) are considered to remain at constant levels during the entire period of simulation. Lakes Buchanan and Travis are allowed to fluctuate down to empty.

B. Reservoir Operation Models

A reservoir operation model is used to determine the firm yield of a reservoir. It provides the ability to analyze a reservoir, or reservoir system, for its ability to supply water under numerous scenarios. Depending on the system in question, the model used can range from a simple, single reservoir operation to a complex, multiple reservoir operation. A reservoir operation model can also be used to

determine the firm yield, or the maximum annual supply of water that can be supplied from the reservoir during a repetition of the critical drought period. To establish the firm yield of O. H. Ivie Reservoir and the Combined Firm Yield of Lakes Buchanan and Travis, two different models were required.

1. O. H. Ivie Reservoir Firm Yield Model

The firm yield of O. H. Ivie Reservoir was determined using a standard single reservoir operation model. The model is based on a simple mass balance. The required inputs include inflow, net evaporation, a monthly water demand distribution, and an area/capacity curve for the reservoir. Both the inflow and the evaporation will be discussed in later sections. The demand distribution was extracted from a Texas Department of Water Resources memo of March 21, 1978 concerning the Stacy Dam permit application. The area/capacity curve was taken from the Freese and Nichols, Inc. report titled Engineering Report on Stacy Dam, 1977. These data are presented in Appendix 2D, Volume II.

2. Lakes Buchanan and Travis Combined Firm Yield Model

The Combined Firm Yield of Lakes Buchanan and Travis was analyzed using a multiple reservoir operation model developed by the staff of LCRA. This complex model considers the Highland Lakes and the downstream portion of the Colorado River as a system (Figure 5-1). Computations for this system are conducted in three components within this model.

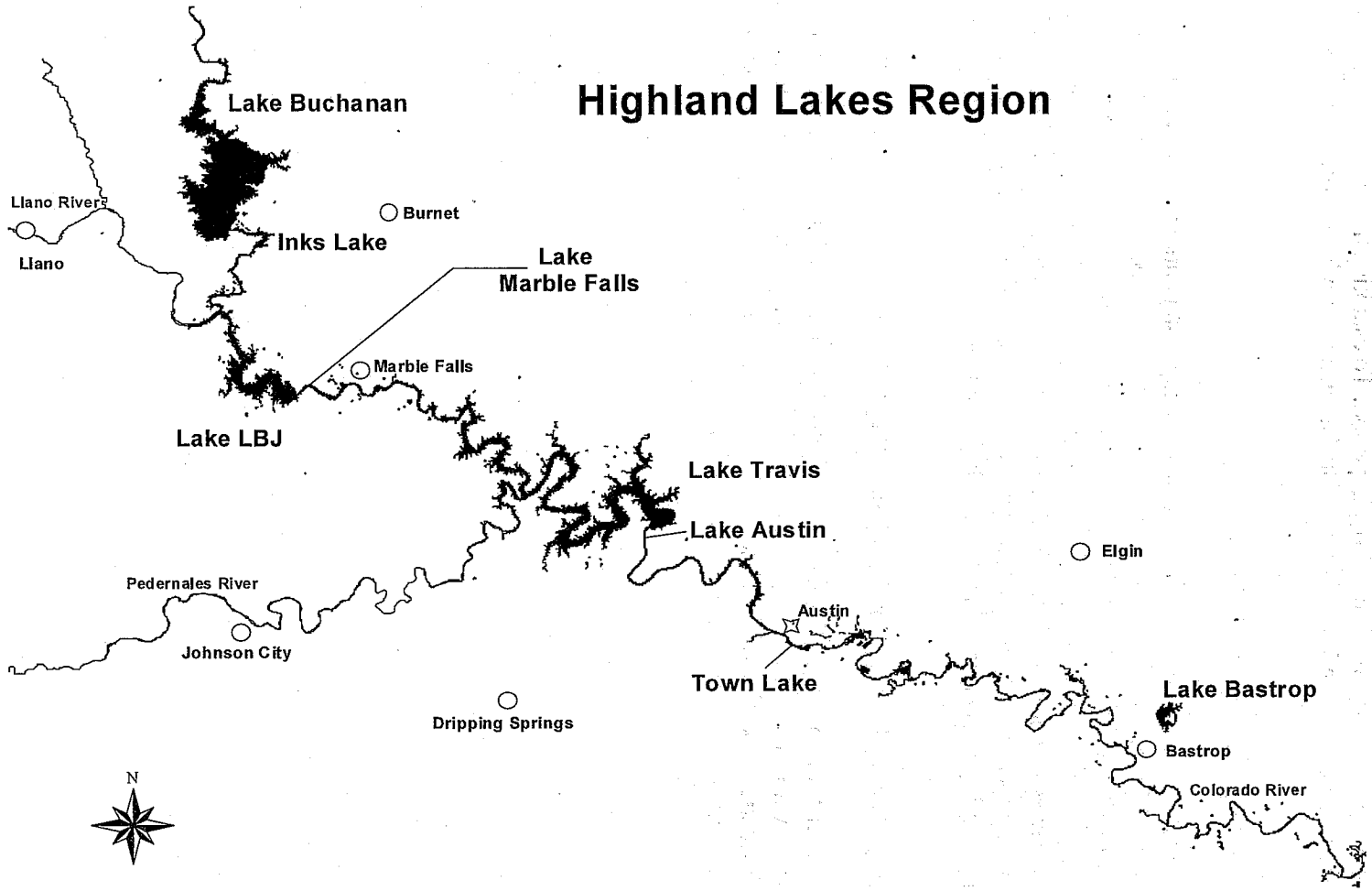


Figure 5-1.
(*In August 2007, Town Lake was renamed "Lady Bird Lake".)

a. Downstream Senior Water Rights

First, the Lakes Buchanan and Travis Combined Firm Yield model considers the senior water rights demands on the Colorado River downstream of Mansfield Dam (Lake Travis). On a daily basis, these demands are compared to the lateral inflow and return flow that enters the river downstream of Mansfield Dam. All unsatisfied demands are considered deficits that could require passage of daily reservoir inflow through the Highland Lakes system.

The information required for the first section of the Lakes Buchanan and Travis Combined Firm Yield model includes:

- daily lateral inflow entering the Colorado River from watersheds downstream of Mansfield Dam,
- appropriate return flow,
- coefficients for equations to describe the movement of water down the river, and
- daily water demands of senior water rights along the river.

b. Passage of Daily Reservoir Inflow

Second, the Lakes Buchanan and Travis Combined Firm Yield model uses an optimization procedure to calculate the minimum passage of daily reservoir inflow required to meet, to the extent possible, the deficits of the downstream senior water rights on the Colorado River. Additional information required for the second section is the daily reservoir inflow entering the Highland Lakes.

c. Operation of the Highland Lakes System

Third, the Lakes Buchanan and Travis Combined Firm Yield model addresses the operation of the Highland Lakes. Storable inflows are the daily reservoir inflows remaining after the calculated required amount passed to meet downstream senior water rights has been subtracted. The combined firm yield of Lakes Buchanan and Travis is calculated with a monthly mass balance using these storable inflows.

Inputs required for the third section, operation of the Highland Lakes system, include:

- storable portion of the reservoir inflows entering the Highland Lakes (storable inflows),
- monthly net evaporations,
- local annual water demands,
- monthly water demand distributions,
- minimum and maximum allowable contents, and
- area/capacity curves.

For a further description of the data requirements for each reservoir in the system, see Appendix 2C, Volume II.

In addition, an operations policy defining individual reservoir operation and a Lake Travis demand distribution for releases are required.

C. Downstream Senior Water Rights in the Lakes Buchanan and Travis Combined Firm Yield Model

1. Final Judgment and Decree

The Final Judgment and Decree requires that all water demands downstream of the Highland Lakes be satisfied to the maximum extent possible by inflows to the Colorado River downstream of those lakes. To determine the water available from these unregulated inflows, the flow conditions in the river must be determined on a daily basis.

2. Development of Model

This section first describes the mathematical procedure for routing streamflow down the Colorado River, and then estimates of the daily water demands are identified to fully satisfy the maximum authorized annual water diversion of each of the major senior water rights in the lower Colorado River Basin. Next, the daily flow conditions in the river from Mansfield Dam to Bay City are simulated using the daily unregulated inflows entering the river downstream of the Highland Lakes. Daily water demands at a specific location are satisfied to the extent that flow is available in the river at that point on that specific day. Daily water demands that are not satisfied by the unregulated runoff become deficits that could require passage of daily reservoir inflow through the Highland Lakes system.

a. Daily Flow Routing Procedure

The daily flow routing procedure is a simple mass balance. To properly analyze the downstream system, a multiple day flow routing relationship is required. This is due to the fact that flows routed between reaches attenuate as they move downstream. Part of the flow arrives at the next reach the very next day, while the rest arrives one or even two days later.

For each reach, a flow is computed that has two components. The first component is the flow being passed from the upstream reach and the second component is the incremental lateral inflow from within the reach. The following equation, which represents the first component, is the routing correlation of downstream to upstream discharges:

$$QD_t = [QU_t \times C_0] + [QU_{t-1} \times C_1] + [QU_{t-2} \times C_2] \qquad (1)$$

where:

QD and QU represent the downstream and the upstream discharges, respectively. The subscript t is the current day, t-1 is day prior to the current day, and t-2 is second day prior to the current day;

C = the routing coefficients for the reach, with subscript 0 corresponds to the current day, 1 corresponds to the day prior to the current day, and 2 corresponds to the second day prior to the current day.

The equation, which incorporates the second component, adds incremental lateral flow within the reach and subtracts diversions to meet demand at each diversion point within the reach:

$$QR_i = QR_{i-1} + (QL \times F_i) - D_i \qquad (2)$$

where:

QR_i = the flow remaining after the ith diversion within the reach (the value of i ranges from 1 to the number of diversions within the given reach), if i=1, then QR_{i-1} is QD_t as defined in the first equation,

QL = the incremental lateral inflow within the reach,

$F_i = (DA_i - DA_{i-1}) / A$, or the ratio of additional drainage are for the ith diversion within the reach,

DA_i = the drainage area at the current diversion point,

DA_{i-1} = the drainage area at the previous diversion point (zero if i=1),

A = the intervening drainage area between downstream and upstream ends of the reach., and

D = the demand for the ith diversion.

To simplify computations, it was assumed that the daily streamflow reflected at the upstream end of a reach would be routed to the downstream end before any extractions were made for local water rights. This action usually imposes an increased amount of conservatism into the routing. By routing the flows to the downstream end, additional attenuation is incurred that may not have physically occurred at each diversion point. This assumption will shift the time of diversion with respect to the pass through discharges in addition to causing additional discharges to potentially be required.

As can be seen by the second equation, it is assumed that only a proportionate amount of the lateral flow is available at any diversion point within the reach. Also, that this proportionate amount is based on the drainage area of the reach to the diversion point. The upstream flow is available to all diverters in the reach.

A review of the lateral inflows defined in a study published in TDWR Report LP-60, entitled "Present and Future Surface-Water Availability in the Colorado River Basin, Texas" (1978) will show a considerable number of negative flows. Records of these negative flows were maintained in the routing model. These values were not routed from reach to reach - rather, they were stored for each reach as a reach loss for the system. The model kept summary records of the unsatisfied

authorizations and the reach losses. These were then used in generating the required passage of reservoir inflow to assure that the downstream deficits were satisfied to the greatest extent possible.

The computation procedure of how much downstream deficit remains after accounting for local area flows is as follows:

(1) Compute the quantity of water available to the most upstream right. This requires that the daily lateral flows be adjusted by using a drainage area ratio and that the daily upstream flows be added to the result (note that the daily upstream flow has already been adjusted to reflect the attenuation that would result from passing it from the upstream to the downstream end of the reach);

(2) Extract the amount required to meet the noted water right. If the daily flow is insufficient, maintain a record of the reach deficit, otherwise make the remaining daily flow available to the next downstream water right;

(3) If all water rights in the reach have not been analyzed, return to step 1; otherwise, continue to step 4;

(4) Record reach daily water deficits for further analysis. Two values are maintained for this study. One is the amount of the daily unsatisfied right and the other is the daily stream flow loss that would need to be satisfied to allow flow to reach the additional reaches located downstream.

In this analysis, no distinction is made as to priority among the downstream water rights senior in priority to LCRA's Highland Lakes water rights. The purpose of this section is to describe the method used to estimate the deficits of all senior rights regardless of their relative priority.

b. Demands of Downstream Senior Water Rights

The Final Judgment and Decree found that water rights existed downstream of the Highland Lakes that are senior in priority to the water rights of the Highland Lakes. These downstream water rights, as adjudicated and amended, are summarized in Table 5-1.

TABLE 5-1
DOWNSTREAM WATER RIGHTS SENIOR TO THE HIGHLAND LAKES

OWNER (Certificate No.)	USES	DIVERSION (ac-ft/year)	PRIORITY DATE
Austin (14-5471B)	Municipal	250,000	6-30-1913[a]
	Irrigation	150	6-30-1913[a]
	Municipal	22,403	6-27-1914
	Industrial	24,000	6-27-1914
Several Smaller Rights[d]	various	1975	various
Lakeside [b] (14-5475A)	Irrigation	52,500[c]	01-04-1901
	Irrigation & Municipal	55,000	09-01-1907
Garwood [b] (14-5434C)	Municipal, Industrial, & Irrigation	133,000	11-01-1900
Corpus Christi (14-5434B)	Municipal, Industrial, & Irrigation	35,000	11-02-1900
Pierce Ranch [b] (14-5477D)	Municipal, Industrial, Irrigation, & Recreation	55,000	09-01-1907
Gulf Coast [b] (14-5476A)	Irrigation	228,570[c]	12-01-1900
TOTAL	All	857,598	

(a) Any water right owned by LCRA with a priority date junior to November 15, 1900 is specifically subordinated as to priority to this right.
(b) Water right owned by LCRA.
(c) Lakeside and Gulf Coast have additional authorized diversions for irrigation of 78,750 and 33,930 acre-feet/yr., respectively, with a junior priority date of November 1, 1987.
(d) Certificates 14-5379, 14-5382, 14-5384, 14-5396, and 14-5402.

Demands for these senior water rights were modeled on a daily time step. The main concern involved the development of a daily demand distribution that would be representative of those senior rights diversions. It was decided to define the required distributions using historical daily diversions. Two distributions were derived, one municipal and the other irrigation.

The municipal distribution (Figure 5-2) was derived using the historical City of Austin diversions recorded during the years 1976 through 1985. The same date diversions were totaled for all years

(i.e. all January 1st diversions for all years), and then an average daily percentage was derived.

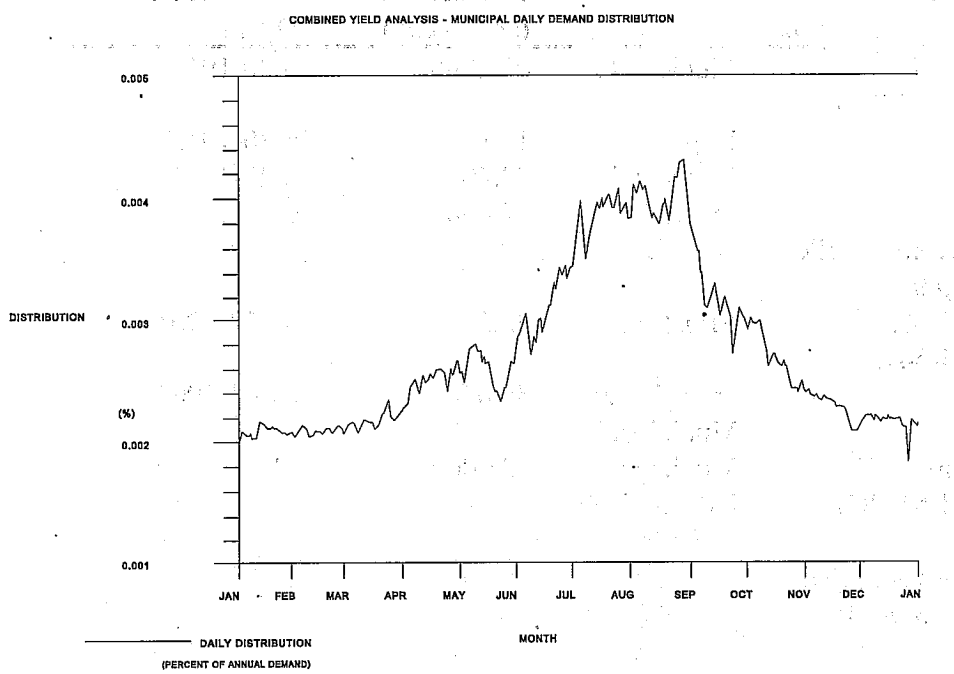


FIGURE 5-2
MUNICIPAL DAILY DEMAND DISTRIBUTION

The irrigation distribution (Figure 5-3) was derived similarly. The same period of record was used (1976-1985) as was the same date methodology for defining the daily percentages. The only difference was that the historical diversions for LCRA's Lakeside and Gulf Coast Irrigation Operations, Garwood Irrigation Company, and Pierce Ranch were totaled and used in lieu of the single City of Austin diversion. As a result, the distribution used for irrigation truly reflects the various irrigation practices of the largest downstream diverters. This distribution was used to simulate all irrigation diversions. The primary need for this assumption is that there were no daily diversion records available for the other simulated rights.

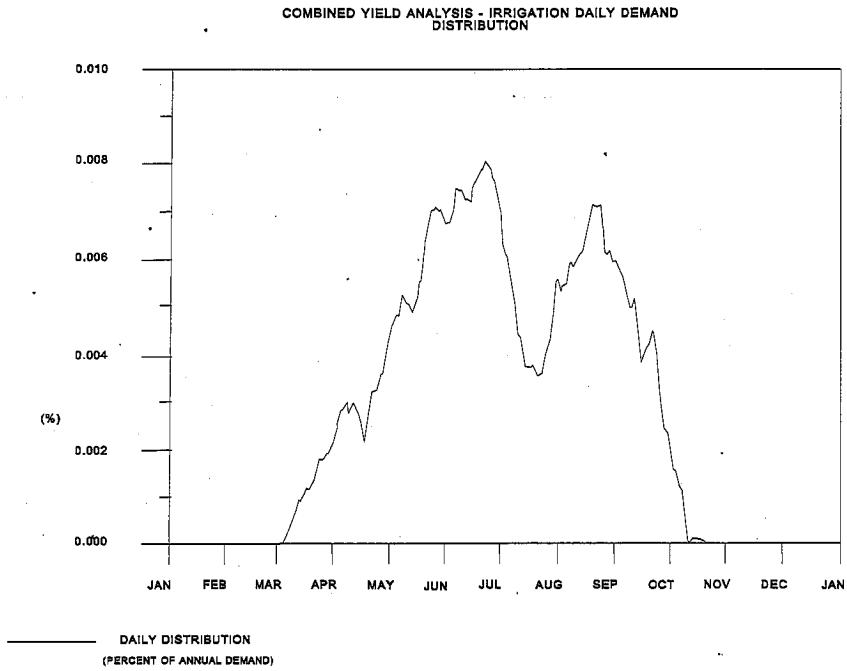


FIGURE 5-3
IRRIGATION DAILY DEMAND DISTRIBUTION

c. Intervening Inflows And Channel Losses From Mansfield Dam To Bay City

During years of average and high levels of rainfall, the Colorado River typically discharges large volumes of streamflow into the Gulf of Mexico and Matagorda Bay. On an annual average, this total flow is 1.7 million acre-feet, as measured at the Bay City gaging station. This average is for the period 1941-1984 and includes many years of drought, particularly the historic critical drought period of 1950-1957. While the Highland Lakes control most of the streamflow upstream of Mansfield Dam, the runoff in the lower Colorado River basin below Mansfield Dam is virtually uncontrolled.

The Colorado River downstream of Lake Travis has a drainage area of approximately 3,500 square miles.

Runoff from this area averages approximately 600 thousand acre-feet annually.

This water represents a significant water resource to the lower Colorado River basin and the adjacent coastal basins.

Since there is limited capacity to store runoff in the Colorado River basin below Austin, the dependability of this runoff is subject to the ability of users to divert and store the runoff when it does occur. Since the timing of this runoff is highly variable, it is important to consider its daily distribution.

(1) Natural Runoff and Springflow

The most extensive analysis of the daily runoff in the drainage basins of the Colorado River below Lake Travis was undertaken by the Texas Department of Water Resources (TDWR) as part of "Colorado Coastal Plains Study" of the U.S. Bureau of Reclamation, Department of the Interior. The results of the TDWR study were published in 1978 in TDWR Report LP-60, entitled "Present and Future Surface-Water Availability in the Colorado River Basin, Texas." The daily inflows to the Colorado River were analyzed in LP-60 for each of five stream segments: (1) Mansfield Dam to the Austin stream gage, (2) Austin to Smithville, (3) Smithville to Columbus, (4) Columbus to Wharton, and (5) Wharton to Bay City. Daily flow and diversion records, where available, were used to determine the incremental net daily inflow for the drainage areas for each of the five river segments for the period 1941-1965, inclusive. The net daily inflows represented the sum of the runoff from the drainage area contributing directly to the stream segment, spring flows, and any return flows, minus channel losses (seepage and evapotranspiration) and diversions by man.

Daily diversions for the major surface water irrigation users during the 1941-1965 period were not available. Thus, they were not used in the calculations of incremental net inflows in LP-60. Additionally, the City of Austin daily wastewater discharges for the same period were not available, and similarly were not used to adjust the gaged flow records. However, information is available on the annual Austin effluent discharges from 1949 to present. For the critical drought period of 1949-1957, the average annual return flow from the City of Austin was 12,500 acre-feet. This volume of return flow is thus included in the net daily inflows calculated in LP-60 for the Austin to Smithville river segment. Chapter 5 of LP-60 gives a complete description of the development of the incremental net daily inflows.

Not all the net daily inflows developed in LP-60 were used in this study. The net inflows from LP-60 for the three river segments from Mansfield Dam to Columbus were used without change. However, the net inflows for the Columbus to Bay City portion of the river were not used since they included the historical diversions for rice irrigation. Thus, they are not representative of the actual inflows and channel losses in the river. For the WMP analysis of the Combined Firm Yield of Lakes Buchanan and Travis, the net daily inflows from the drainage area between Columbus and Bay City are set to zero, which is a very conservative approach.

(2) City of Austin Treated Wastewater Effluent Discharges

Inflows to the Colorado River below the Highland Lakes include discharges of treated wastewater.

By far, the largest of these discharges is from the City of Austin wastewater treatment plants to the east and south of Austin. For the WMP Combined Firm Yield analysis, the City of Austin effluent discharges are projected to be 149,800 acre-feet per year. This projection is based upon Austin fully using its maximum authorized annual municipal use senior water right of 272,403 acre-feet and then returning all effluent derived from that water. The resulting wastewater flow is assumed to be equal to the historical percentage (55%) of municipal water diversions returning as wastewater. This estimate of return flow is 149,800 acre-feet per year. The water used under Austin's water rights for steam electric power cooling water is not included in the return flow estimates.

It is recognized that currently the City of Austin is not returning this amount of water to the river; however, the criteria established for determining the Combined Firm Yield dictates that all water right holders must be assumed to be using all the water to which they are entitled. For the City of Austin, this amounts to 272,403 acre-feet per year for municipal use under its senior water right. The assumption has also been made that wastewater from this use will return to the river at a rate equal to the historical percentage; however, Austin may find other uses or other methods of disposal of such wastewater, thereby reducing the percentage. Additionally, the percentage may be decreased by decreases in inflow and infiltration to the City's wastewater collection system.

The annual return flow is distributed on a monthly basis according to historical monthly discharge patterns for the years 1978 through 1987, inclusive (Table5-2). A uniform daily distribution is assumed for flow in any given month.

TABLE 5-2
MONTHLY DISTRIBUTION OF ANNUAL CITY OF AUSTIN RETURN FLOW, CALENDAR YEARS 1978 – 1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
%	8.06	7.52	8.47	8.09	9.00	9.14	8.30	8.07	8.10	9.09	7.60	8.56	100%

The net runoff data for the river segment between the Austin stream gage and the Smithville stream gage includes approximately 12,500 acre-feet of historical discharges for the City of Austin during the historical critical drought period. To avoid double accounting of this historical return flow, the volume of the City of Austin return flow added to the system for the purposes of flow simulation is considered to be 137,300 acre-feet annually (149,800 less 12,500 acre-feet). The monthly distribution of that return flow is given in Table 5-3.

TABLE 5-3
MONTHLY RETURN FLOWS FOR THE CITY OF AUSTIN ADJUSTED FOR HISTORICAL RETURN FLOWS
(1000 ACRE-FEET)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
11.1	10.3	11.6	11.1	12.4	12.5	11.4	11.1	11.1	12.5	10.4	11.8	137.3

Return flows from communities in the Colorado River Basin below Austin were not included as inflows to the river since the volume of projected inflows is very small compared to the natural inflows.

(3) Return Flows From Irrigation

Studies made by TDWR in the 1970s indicated that as much as 35 percent of the water applied for irrigation of rice returned to surface water streams and, eventually, to coastal bays and estuaries. This represents an important source of freshwater inflow to the estuaries. These inflows are estimated at about 150,000 acre-feet annually. Virtually none of this return flow reenters the Colorado River at or upstream of Bay City.

Because of the anticipated agricultural conservation measures, the estimated return flow percentage for the year 2030 will likely decrease from historical rates to a level of approximately 25 percent. These return flows must be considered in all estimates of total freshwater inflow to Texas bays and estuaries.

d. Flow Routing Coefficients

The downstream system was divided into five reaches (Table 5-4). To enable staff to utilize the incremental inflows developed by the Texas Department of Water Resources in their report LP-60, these reaches were defined using the same end point locations. Each reach required a set of routing coefficients. These coefficients were derived using the curve fitting program QFIT, which was developed by the Texas Water Development Board (Report VM-49).

TABLE 5-4
Downstream Reach Definition

REACH NUMBER	LOCATION
1	MANSFIELD DAM TO USGS AUSTIN GAGE
2	USGS AUSTIN GAGE TO OLD USGS SMITHVILLE GAGE
3	OLD USGS SMITHVILLE GAGE TO USGS COLUMBUS GAGE
4	USGS COLUMBUS GAGE TO USGS WHARTON GAGE
5	USGS WHARTON GAGE TO USGS BAY CITY GAGE

Historical daily gage station records were obtained for each of the selected sites to be used as input to QFIT. Hydrograph pairs were selected for each reach that represented discharges in the range of 500 to 3000 cfs (the typical flow regime encountered during the irrigation season). In addition, the hydrograph pairs selected each had to exhibit the classic hydrograph wave shape. The values in each hydrograph had to have enough change to allow discernment of the wave from the upstream to the

downstream gage.

After the hydrograph pairs were selected, QFIT was run under a variety of equation forms to test for the most reasonable curve fitting method. The specific coefficient calculation method resulting used only variable inflow coefficients, with outflow coefficients set to zero, and with the summation of all inflow coefficients equal to one. While runs were also made that allowed variable outflow coefficients, these were used for cross-checking only, with runs actually being applied only when the resulting outflow coefficients equaled zero.

For each hydrograph pair, the number of prior days to be used in the flow equation was varied to test this factor's influence on the resulting coefficients. The predicted and observed outflow values were examined, and any large deviations were noted. The percentage difference between total predicted and observed outflows, or average daily deviation, was also checked, and only runs with an average daily deviation of less than one percent were further applied.

The resulting values were compared to known travel times for potential elimination. Those that appeared reasonable were maintained. The final coefficients were then generated by taking the average of the remaining sets of coefficients. The values used in the daily analyses are found in Table5-5.

TABLE 5-5
DAILY FLOW ROUTING COEFFICIENTS

REACH NUMBER	DAY T	DAY T-1	DAY T-2
1	1.000	0.000	0.000
2	0.000	0.528	0.472
3	0.000	0.556	0.444
4	0.055	0.716	0.229
5	0.290	0.710	0.000

e. Hydrologic Routing Relationships

Basic to determining the optimum reservoir releases is the hydrologic flow routing relationships. Figure 5-4 indicates the location of stream gages and water diversion demands used in the routing. The equations used to predict the daily flow at various points on the lower Colorado River have been developed by LCRA's Water Resources Management staff. The flow routing relationships and equations are discussed separately for each river segment. The flow routing equations used to simulate the passage of daily unregulated inflows below Lake Travis are identical to those used in the calculation of daily reservoir inflow releases.

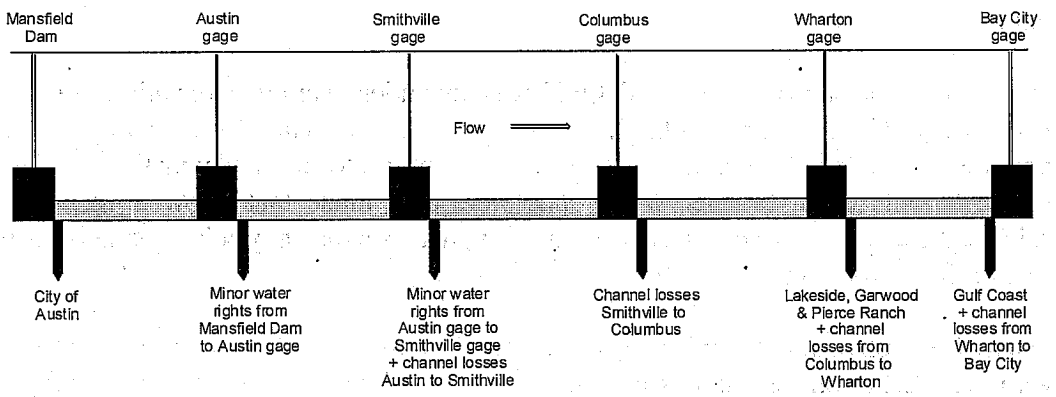


Figure 5-4.
Location of Stream Gages and Diversion Points for Routing of Reservoir Releases

(1) Mansfield to Austin Gage

This stream segment receives inflow on day t from releases and pass throughs from Lake Travis ($I_{1,t}$). The City of Austin has part of its diversion ($COA_{1,t}$) at the upstream end of the section (Lake Austin). The remainder of its diversion ($COA_{2,t}$) is at Lady Bird Lake. For this analysis, this downstream diversion is treated as if it occurs at the upstream end of the river section. Therefore, the net daily flow into the reach is

$$\text{Reach Net Inflow on day } t = I_{1,t} - COA_{1,t} - COA_{2,t} \geq 0 \qquad (3)$$

The flow travel time between Mansfield Dam and the Austin gage is only a few hours. Therefore, the daily outflow ($O_{1,t}$) at the Austin gage location is set equal to the inflow to the next downstream reach $I_{2,t}$.

The daily net incremental inflows for this reach are all non-negative.

Thus no channel loss will accumulate at the Austin gage.

(2) Austin Gage to Smithville Gage

This stream segment has minor daily water rights ($AS_{1,t}$) that are assumed to be withdrawn at the upstream end of the reach. Thus the net daily inflow to the reach is

$$\text{Reach Net Inflow on day } t = I_{2,t} = O_{1,t} - AS_{1,t} \geq 0 \qquad (4)$$

This inflow is then routed to give the outflow on day t ($O_{2,t}$) at the Smithville gage location using the following daily flow routing equation for that stream segment.

$$O_{2,t} = .528*I_{2,t-1} + .472*I_{2,t-2} \qquad (5)$$

(3) Smithville Gage to Columbus Gage

This stream segment has minor water rights on day t ($AC_{1,t}$) that are assumed to be withdrawn at the upstream end of the reach. The daily net incremental inflows for the Austin to Smithville river segment may be negative during certain periods. Any negative net incremental inflows on day t at the Smithville gage ($CL_{2,t} \leq 0$) calculated during the routing of uncontrolled inflows must be added to the deficit water rights diversions in determining the net reach inflow. Thus,

$$\text{Reach Net Inflow on day t} = I_{3,t} = O_{2,t} - AC_{1,t} + CL_{2,t} \geq 0 \qquad (6)$$

This inflow is then routed to give the daily outflow (O_3,t) at the Columbus gage location using the following daily flow routing equation for that stream segment.

$$O_{3,t} = .556*I_{3,t-1} + .444*I_{3,t-2} \qquad (7)$$

(4) Columbus Gage to Wharton Gage

This stream segment has major water rights demands on day t for the LCRA Lakeside Irrigation Operation (LK_t) and Garwood Irrigation Company (GW_t) that are assumed to be withdrawn at the upstream end of the Wharton to Bay City reach. The daily net incremental inflows for the Smithville to Columbus river segment may be negative during certain periods. Any negative net flows at the Columbus gage on day t ($CL_{3,t} \leq 0$) calculated during the routing of uncontrolled inflows must be added to the deficit water rights diversions in determining the net reach inflow. Thus,

$$\text{Reach Net Inflow on day t} = I_{4,t} = O_{3,t} + CL_{3,t} \geq 0 \qquad (8)$$

This inflow is then routed to give the daily outflow ($O_{4,t}$) at the Wharton gage location using the following daily flow routing equation for that stream segment.

$$O_{4,t} = .055*I_{4,t} + .716*I_{4,t-1} + .229*I_{4,t-2} \qquad (9)$$

(5) Wharton Gage to Bay City Gage

This stream segment has major water rights diversions for day t for Pierce Ranch (PR_t) and the LCRA Gulf Coast Irrigation Operation (GC_t). Pierce Ranch diversions are assumed to be withdrawn at the upstream end of the reach. Diversions for Bay City are assumed to be withdrawn at the downstream end. In addition, the Garwood and Lakeside diversions are assumed to be withdrawn at the upstream end of this river segment.

The daily net incremental inflows for the Columbus to Wharton river segment are assumed to be

zero. Thus,

$$\text{Reach Net Inflow on day } t = I_{5,t} = O_{4,t} - PR_t - LK_t - GW_t \geq 0 \qquad (10)$$

This inflow is then routed, using the following daily flow routing equation for this reach, to give the outflow in day t ($O_{5,t}$) of the reach prior to diversions for the Gulf Coast Operation.

$$O_{5,t} = .290*I_{5,t} + .710*I_{5,t-1} \qquad (11)$$

The diversions for the Gulf Coast Irrigation Operation are subtracted from the flow into the Bay City gage to obtain the resulting daily outflow. Thus,

$$\text{Reach Net Outflow on day } t = O_{6,t} = O_{5,t} - GC_t \geq 0 \qquad (12)$$

f. Resulting Downstream Deficit

The downstream area was divided into five reaches. The water demands associated with the full senior water rights in each reach are found in Table 5-6.

TABLE 5-6
MODELED REACH DEMANDS

REACH NUMBER	DIVERSION DEMAND (ACRE-FEET/YEAR)
1	296,403
2	2,192
3	0
4	330,500
5	228,570

The total modeled demand is 857,665 acre-feet per year. The first step in developing the pass-through values of the Highland Lakes inflow was to determine to what extent the downstream inflows could not satisfy the lower basin demands. The results of this analysis are as follows:

- Average annual unsatisfied demand was 520,657 acre-feet;
- Maximum annual unsatisfied demand was 674,095 acre-feet; and
- Minimum annual unsatisfied demand was 340,500 acre-feet.

These unsatisfied demands were then used as the input demands for determining the required pass

through of inflows from the Highland Lakes.

D. Passage of Daily Reservoir Inflows in the Lakes Buchanan and Travis Combined Firm Yield Model

Under the terms of the Final Judgment and Decree and for the purposes of determining the Combined Firm Yield, daily inflows into the Highland Lakes must be passed through to the extent necessary to meet any downstream water rights senior to those of LCRA for the Highland Lakes. Not all inflows on a given day need to be passed through Mansfield Dam. Only that portion of the inflows needed to satisfy demands of the senior water right holders must be passed through.

All surface water diversions for senior downstream water rights must first be satisfied by inflows to the Colorado River from drainage areas downstream of Mansfield Dam. Only that portion of the senior water rights that cannot be meet from inflows to the Colorado River downstream of Mansfield Dam become the downstream demands for which inflows are passed through the Highland Lakes.

In this analysis, no distinction is made as to priority among the downstream water rights senior to LCRA's rights. The purpose of this section is to describe the method used to estimate the required passed through amounts of reservoir inflows to meet all senior rights regardless of their relative priority.

Determining the required passed through amounts of reservoir inflow depends upon the results of the routing of the unregulated, daily inflows below Mansfield Dam. Similarly, the results of the reservoir inflow passed through calculations are used in the reservoir firm yield calculations.

An optimization procedure is used to calculate the minimum required pass through of daily inflows to meet the remaining downstream water demands, to the extent possible. The daily reservoir inflows remaining, after the calculated pass through flows are subtracted, are treated as storable inflows available for storage in the Highland Lakes and are used in the estimation of the Combined Firm Yield of Lakes Buchanan and Travis.

1. Solution Procedure

The basic method proposed to determine the minimum reservoir inflows allowed to move downstream is to simulate, on a daily basis, the hydrologic conditions in all reaches of the river below Mansfield Dam.

Steps in the Solution Process

The sequence of steps in the determination of the optimal pass through amount of reservoir inflow is indicated below.

Step 1. Read daily data for period of simulation: reservoir inflows, deficits in senior water right diversions, and channel losses not fully satisfied.

Step 2. Begin on initial day of simulation.

Step 3. Subtract the City of Austin water demand for the current day from the reservoir inflows for that day. If the resulting number is less than or equal to zero then set the inflow available for reservoir storage to zero for that day and go to Step 7. If the resulting number is greater than zero then inflow is potentially available to meet any senior water right demand deficits downstream. Go to Step 4.

Step 4. Calculate total deficiencies in downstream senior water rights diversions for next eight days, including current day. If there are no deficiencies then go to Step 7. If there are deficiencies then go to Step 5.

Step 5. Determine the minimum amount of inflows to pass through to meet downstream senior water rights. This minimum pass through amount is calculated by solving the Linear Programming Flow Routing Problem (described below) for eight day period beginning on current day. Go to Step 6.

Step 6. Store optimal reservoir outflow for current day. Also, store any remaining unsatisfied channel losses and senior water right demands. Go to Step 7.

Step 7. Consider next day. If the end of the simulation period is reached then stop. Otherwise, go to Step 3.

2. Required Input Data

- Linear daily flow routing equations for each river segment between Mansfield Dam, Austin gage, Smithville gage, Columbus gage, Wharton gage, and Bay City gage.
- Diversion requirements (deficits) for senior water rights for each river segment that could not be met from routing inflows below Mansfield Dam.
- Net channel losses upstream of diversion deficits. These must be fully satisfied on each river segment before any senior right diversion deficit is computed on that river segment or any downstream segment.
- Combined daily inflows to Lakes Buchanan and Travis.
- All data are for the period January 1, 1941 through December 31, 1965, inclusive.

3. Time of Travel for Flows

A flow release from Lake Travis takes a number of days to pass Bay City. Based upon the flow routing equations noted above, all flows released on a given day would have reached Bay City in eight days, beginning on the day of release. Therefore, eight days is considered sufficiently long to allow the influence of any reservoir release on a given day to pass completely through all river segments.

The simulated change in flow rates as water moves downstream is illustrated in Figure 5-5. A 1,000 cfs flow is assumed at Austin on day 1, with no flow at Austin for the remaining seven days. The flows in the river downstream of Austin are assumed to be zero on day 1.

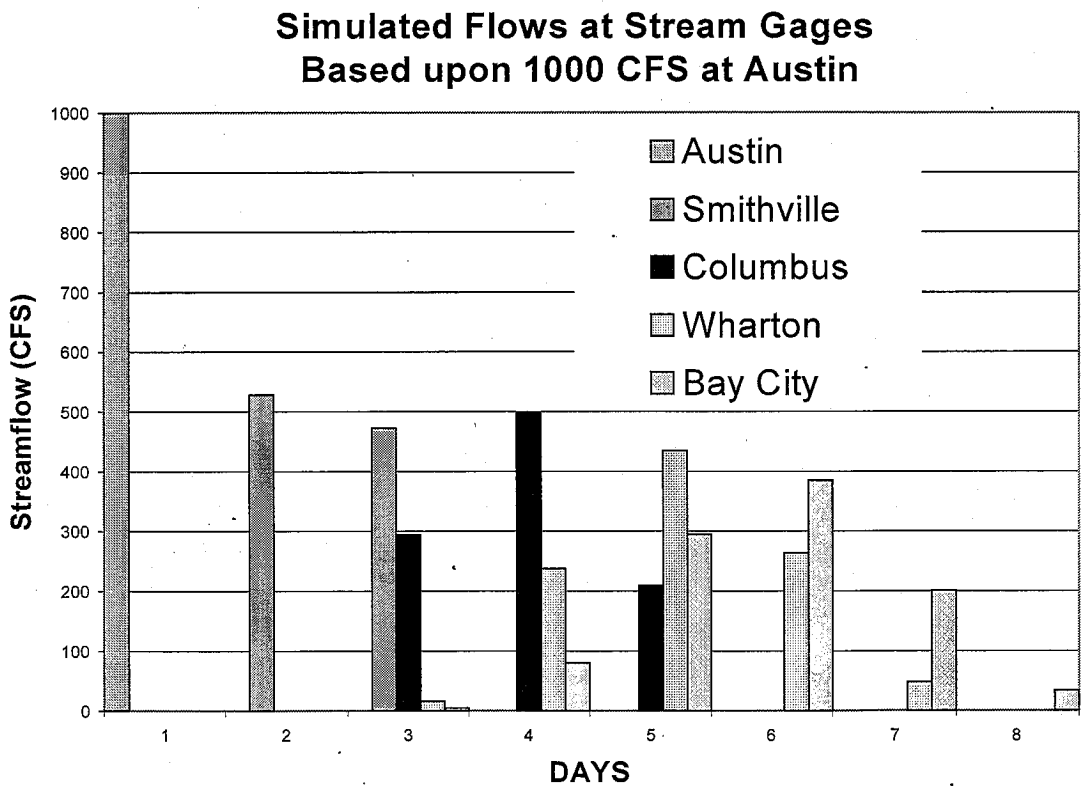


Figure 5-5. Simulation of Downstream Flow Rate Decreases

4. Channel Losses

Water flowing in the Colorado River is lost from plant evapotranspiration, surface evaporation and ground-water recharge. When these losses exceed the inflows from tributaries, ground-water seepage, and direct rainfall, then net channel losses occur.

The daily net incremental inflow data for the reaches below Lake Travis include many periods when channel losses (negative net incremental inflows) occur. In the flow routing of any reservoir releases, these negative inflows on a river segment act as "water demands" that must be fully satisfied before water can flow past that reach to a downstream senior water right holder. Therefore, to meet a downstream water right diversion demand requires the passage of reservoir inflows to the extent needed to fully satisfy the demand, up to the maximum amount of daily inflow to the reservoir. However, when there are no deficits in senior water rights diversions, then there is no need to pass through reservoir inflows just to satisfy channel losses below Lake Travis.

5. Flow Routing Optimization Problem

a. Problem Statement

Step 5 in the solution process determines the volume of reservoir inflows, on a given day, to pass downstream to meet the demands of senior water rights holders. This required passage of daily reservoir inflows is determined by finding the minimum reservoir pass throughs that satisfy, to the maximum extent possible, the water demands of senior water rights holders, while satisfying the following constraints:

The movement of water downstream in the lower Colorado River is governed by the set of linear flow routing equations (5), (7), (9) and (11).

The daily reservoir pass through cannot exceed the corresponding daily reservoir inflow.

Flow is conserved at all stream junctions as specified by equations (3), (4), (6), (8), (10) and (12).

Upstream channel flow losses must be satisfied fully before any downstream water rights diversion deficits can be satisfied.

All inflows to the Colorado River below Lake Travis have been used to the maximum extent possible to meet the maximum authorized diversion demands of downstream senior water rights holders.

All river flows and diversions are nonnegative.

b. Linear Programming Optimization Technique

The minimum daily pass through amounts may be found by solving a sequence of Linear Programming (LP) optimization problems, one for each day in the simulation period when inflows may satisfy diversion demands. Linear Programming is a mathematical solution technique that maximizes a linear function while satisfying a set of linear equality or inequality constraints. The Linear Programming formulation for the reservoir pass through problem is given as finding the value

of $I_{1,t}$ that maximizes, over days t through t+7, the total water demands met plus the total channel losses minus a penalty cost for water passing the Bay City gage. The solution must satisfy equations 3 through 12 for all eight days and must pass through no more than the inflow on day t.

The penalty cost is given by *a* times the total flows past Bay City in the eight days, where *a* is a constant coefficient. The penalty factor is needed to keep from passing through more water than is absolutely necessary to meet the downstream demands. Without a penalty for flows past Bay City, the Linear Programming solution can give a pass through in excess of the minimum needed. Such a pass through would give the same benefits of meeting all the diversions as the minimum pass through.

For example, suppose that 5,000 acre-feet of inflow occurs on a given day and that only 1,000 acre-feet is needed as a pass through to satisfy all demands downstream. Thus, any pass through value from 1,000 to 5,000 acre-feet is an alternative solution to satisfying all downstream demands. Without a penalty term, the Linear Programming solution may be larger than 1,000 acre-feet of pass through.

The 25 year simulation period is evaluated with a given constant value of *a*. The value of *a* is varied between these simulation to determine the penalty factor that gives the least pass through of inflows while meeting the maximum downstream demands.

6. Simulation Results

The solution process described above was used to determine the inflows needed to be passed to downstream water rights holders on a daily basis for the period 1941 through 1965, inclusive. Table 5-7 gives a summary of the inflows, demands, channel losses, and spills for the period using a variety of spill penalty values. The use of different penalty values allows an assessment of the tradeoffs between inflows available for storage and for downstream water diversions.

As would be expected, as the penalty value increases, there is a decrease in the water spilled past Bay City. However, as the spill penalty increases, the downstream water diversions remain essentially constant. The maximum water diversions possible are given when the penalty factor is zero.

An important result of the simulations is that storing inflow in the upstream reservoirs, instead of releasing it downstream, does not necessarily cause appreciable decreases in water diversions for water rights downstream. Table 5-7 illustrates this condition. The amount of downstream water diversions remains within 1% of the maximum possible diversion until the penalty coefficient value is between 1.0 and 2.0. However, the inflows available for storage increases by 4.6 million acre-feet over the 25-year period: from 15.2 million acre-feet (for α=0.) to 19.8 million acre-feet (for α =2.0). Further, the 25-year total volume of pass through amounts of reservoir inflows passing Bay City decreases by 4.4 million acre-feet: from 4.52 million acre-feet (for α =0.) to 127 thousand acre-feet (for α =2.0). Thus, the additional water available for storage is actually water that would otherwise spill from the Colorado River basin.

An α value of 2.0 appears to provide a reasonable penalty for spilling water past Bay City without unduly reducing the inflows passed through and actually diverted for downstream senior water right holders. Using this penalty value, the simulated water diversions are reduced about four percent from the maximum possible diversion volume of 4.63 million acre-feet (for $\alpha = 0.$) to 4.47 million acre-feet. This is a reduction of 160 thousand acre-feet over the entire 25-years of simulation.

Table 5-7
SUMMARY OF DOWNSTREAM FLOW RATE SIMULATION

CATEGORY	SIMULATED TOTAL VOLUMES FOR PERIOD 1941-1965 (1,000,000 ACRE-FEET)					
	SPILL PENALTY COEFFICIENT (∀)					
	.00	.10	.40	1.0	2.0	3.0
Reservoir Inflow	22.445	24.445	24.445	24.445	24.445	24.445
Water Diversion Demands	13.012	13.012	13.012	13.012	13.012	13.012
Channel Losses Met	.121	.121	.119	.119	.119	.105
Diversion Demands Met from Pass Through Reservoir Inflows	4.631	4.615	4.591	4.553	4.466	4.440
Flow Past Bay City Resulting from Pass Throughs of Inflows	4.524	1.723	.670	.458	.127	.075
Total Pass Throughs of Reservoir Inflows	9.276	6.459	5.380	5.131	4.712	4.621
Storable Inflow	15.169	17.986	19.065	19.314	19.733	19.824

TABLE 5-8
TOTAL DIVERSION DEMANDS FOR SENIOR WATER RIGHTS BELOW MANSFIELD DAM TO BE MET FROM PASS THROUGHS OF RESERVOIR INFLOWS
(ACRE-FEET)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	19136	16123	19308	20437	26966	28675	34930	93097	79584	25678	10499	5839	380272
1942	12203	7411	9216	17726	58917	129662	71108	118740	59903	23634	18107	17595	550631
1943	17028	15479	18059	48610	87445	123107	75828	121213	64930	17726	12226	13821	507337
1944	12671	6862	6388	27108	47579	93998	87352	109096	48771	23868	12968	8175	485791
1945	4920	6900	6249	2546	60811	79737	77785	93627	50375	20316	14580	10122	428923
1946	6894	4401	5081	19104	27426	48813	60609	117286	42117	13623	1253	4397	351004
1947	1543	10138	14495	20090	73121	121685	83304	97286	45027	19344	14737	13829	514599
1948	16998	17883	13851	46260	75126	127996	84074	108065	68127	18698	14196	14382	605656
1949	14797	13167	16133	26016	79475	109915	79046	114042	69862	21294	12518	11550	568265
1950	12387	9954	17131	26809	69392	90708	77347	120122	58375	21113	15080	17264	535682
1951	15770	13607	17317	53394	99812	94273	97135	124186	58629	20849	16510	16225	627707
1952	15608	14461	21944	44267	80395	120731	88605	126336	65124	20528	10848	13164	622011
1953	10910	12980	18146	42700	55623	129987	76589	119034	51908	19848	13101	9823	560649
1954	12853	11286	23554	51633	92017	136315	100538	117915	74303	20550	15695	17202	673861
1955	15870	13190	25066	50968	75132	104300	84950	115303	74433	21260	12371	16742	609585
1956	14928	12252	21805	52934	90904	127484	94716	122141	76736	20859	14951	16355	666065
1957	15749	13412	14513	22682	19489	17301	46306	112513	71377	5579	91	1349	340361
1958	1384	488	6929	15340	21331	76663	62610	109494	40788	8821	7619	11592	363059
1959	11390	8393	12534	15292	53033	97310	81716	108521	61249	4081	5041	7259	465819
1960	5807	3758	5916	15542	63609	108973	52900	94805	64404	13934	9741	3962	443351
1961	3770	4682	4464	18087	73739	56095	21766	92491	41013	14412	7320	8393	346232
1962	10763	13565	15128	32158	88929	100217	80167	119408	61303	16110	13589	12022	564314
1963	11608	11723	17514	43654	91983	127934	90779	127702	79320	20605	16365	15144	654331
1964	14418	13406	16189	58439	103577	117673	91947	125078	60585	18253	13692	13988	647245
1965	10703	3072	10200	26686	26420	48118	60676	114922	68319	15269	10162	4682	399229

TABLE 5-9

SIMULATED MONTHLY SENIOR WATER RIGHTS DIVERSIONS FROM RESERVOIR INFLOWS (ACRE-FEET)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	19136	16123	19312	20248	27069	26901	33691	29562	57388	24456	10499	5839	290224
1942	12203	7411	9107	16094	56359	99307	15132	37088	50499	23008	18107	17595	361908
1943	17000	12213	17139	21097	30181	46863	16768	1402	16975	13373	10404	12439	215853
1944	12671	6862	6388	15982	31780	62900	14041	14503	36586	17637	12968	8175	240493
1945	4920	690	6249	2546	45088	45676	33822	12228	18799	18178	14440	10122	218968
1946	6894	4401	5081	12719	25985	19024	5824	2197	26086	12855	1253	4397	126715
1947	1543	10138	14495	16923	38123	19830	4140	2330	268	728	6439	8774	123731
1948	8103	10977	7436	18070	32328	31068	50841	26202	10808	3348	1890	6418	207489
1949	11122	12855	15685	17943	57066	49779	14941	6646	12535	8252	9093	11485	227401
1950	12139	9954	1253	9547	32767	12481	7258	4549	7641	1620	1424	1946	102579
1951	2388	8343	9533	964	28701	41215	1997	728	5226	3510	3169	2911	108685
1952	3052	1481	2703	19565	35615	26935	8946	12579	26012	2836	6856	13107	159687
1953	10910	10527	15732	14495	27291	2729	6291	21551	7226	14991	5295	2049	139087
1954	5408	4865	607	2421	49759	4035	1485	2009	1692	2352	6414	1015	82063
1955	6574	11114	940	2521	29359	68541	40926	33761	18375	13003	2336	2921	230370
1956	5367	8365	748	8309	52910	2963	839	6617	12930	3711	4315	4942	112015
1957	1741	6804	11691	10379	15474	14757	21648	2853	16819	5253	91	1349	108859
1958	138	488	6929	15207	21244	44929	37399	19352	21347	8821	7619	11592	196312
1959	11390	8393	11672	12072	31939	48072	56407	17802	5737	4081	5041	7259	219866
1960	5807	3758	5916	14786	28280	5571	22443	39613	11216	12827	9741	3962	163920
1960	3770	4682	4464	16183	29319	28589	21463	35438	12976	14412	7320	8393	187009
1962	10763	13565	9097	19690	14620	26689	232	1854	5180	14914	10935	11544	139084
1963	10989	11118	10622	6531	35915	63006	4053	1126	4224	8486	13375	11891	181336
1964	12679	13406	16046	19985	20030	4933	16	6186	21081	18255	13692	13988	160296
1965	10703	3072	10200	19565	14873	35117	20634	2392	15156	15269	10162	4682	161824

TABLE 5-10

SIMULATED MONTHLY CHANNEL LOSSES SATISFIED BY RESERVOIR PASS THROUGHS (ACRE-FEET)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1941	0	0	0	454	9184	4805	101	232	817	192	0	0	15786
1942	0	0	54	0	2	3461	420	1890	5020	1677	0	0	12523
1943	0	0	1039	2183	129	1982	71	0	167	0	0	0	5570
1944	0	0	0	73	1949	1130	0	62	1083	30	0	0	4328
1945	0	0	0	0	204	196	3709	0	375	0	0	0	4485
1946	0	0	0	125	0	0	0	0	119	0	0	0	244
1947	0	0	0	0	155	0	0	0	0	0	0	0	155
1948	0	0	0	145	83	133	2378	16	0	182	0	0	2936
1949	0	0	157	0	0	206	0	0	156	0	0	0	519
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	1015	1085	0	0	0	0	0	0	2100
1952	0	0	0	0	133	2519	0	0	4395	0	0	0	7046
1953	0	0	0	505	1359	0	0	0	0	0	0	0	1864
1954	0	0	0	0	2997	0	0	0	0	0	0	0	2997
1955	0	0	0	0	6905	8860	3498	3046	8135	2259	0	0	32704
1956	0	0	0	0	5093	0	0	0	0	0	0	0	5093
1957	0	0	0	0	7295	6118	0	0	245	0	0	0	13657
1958	0	0	0	0	0	266	0	0	0	0	0	0	266
1959	0	0	0	0	0	0	2118	111	0	315	0	0	2544
1960	0	0	0	0	0	178	0	0	0	0	0	0	178
1961	0	0	0	0	112	658	0	0	0	0	0	0	771
1962	0	0	0	0	2	1126	0	0	0	0	0	0	1128
1963	0	0	0	0	40	0	0	0	0	0	0	0	40
1964	0	0	0	1018	557	59	0	0	288	0	0	0	1920
1965	0	0	0	89	0	0	0	0	0	0	0	0	89

TABLE 5-11
SIMULATED MONTHLY FLOWS PAST BAY CITY FROM RESERVOIR PASS THROUGHS
(ACRE-FEET)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1941	0	0	0	775	2955	2862	1485	0	1187	251	0	0	9515
1942	0	0	203	491	3987	3406	142	2290	4202	585	0	0	15307
1943	0	0	4	561	79	2054	537	0	1000	0	0	0	4235
1944	0	0	0	303	2333	3429	0	0	1286	118	0	0	7469
1945	0	0	0	1	2406	913	1737	0	70	1	0	0	5128
1946	0	0	0	244	2612	739	34	0	474	0	0	0	4104
1947	0	0	0	610	2007	0	63	0	0	0	0	0	2679
1948	0	0	3	617	1372	689	2016	536	156	47	0	0	5436
1949	0	0	211	168	2171	1168	47	0	0	0	0	0	3765
1950	0	0	0	0	726	482	18	0	16	0	0	0	1243
1951	0	0	0	0	2224	1645	0	0	2	0	0	0	3871
1952	0	0	0	910	1318	1033	0	0	1364	0	0	0	4625
1953	0	0	4	117	913	0	0	266	382	0	0	0	1681
1954	0	0	0	0	1139	51	0	0	0	0	0	0	1190
1955	0	0	0	0	3817	7750	2022	0	3219	733	0	0	17540
1956	0	0	0	130	3298	0	0	0	0	0	0	0	3428
1957	0	0	0	27	4754	3267	267	0	0	0	0	0	8316
1958	0	0	0	0	1939	3461	1009	0	520	0	0	0	6929
1959	0	0	25	318	746	2777	2483	0	0	210	0	0	6558
1960	0	0	0	389	82	0	227	1662	0	0	0	0	2360
1961	0	0	0	738	202	1117	1101	449	464	0	0	0	4073
1962	0	0	0	453	70	140	0	0	0	0	0	0	663
1963	0	0	0	0	794	977	0	0	0	0	0	0	1770
1964	0	0	163	883	0	0	0	0	180	1	0	0	1227
1965	0	0	46	614	871	1954	95	0	0	0	0	0	3580

TABLE 5-12
SIMULATED MONTHLY STORABLE INFLOWS
(ACRE-FEET)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1941	78213	213250	264511	422194	747597	380518	117806	3917	12309	162238	41931	32705	2477189
1942	25242	19467	18382	248336	233338	37215	4264	40728	87478	290136	83511	30986	1119082
1943	6336	3727	6501	7308	0	69894	7593	0	10085	16100	1926	3407	132421
1944	77131	84752	113052	14811	393515	51694	0	87106	67216	20966	14822	89298	1014363
1945	150148	154941	184864	250246	24865	28559	37994	0	59314	22014	6467	21776	941188
1946	57182	81404	44527	76811	133121	11294	0	341	31451	21857	93950	70330	622268
1947	203837	52150	67619	26686	10707	0	0	0	0	0	607	9749	371356
1948	24	6552	6866	7820	25509	151761	39361	791	6544	879	0	54	246160
1949	2788	46669	78337	185329	44489	3732	0	0	0	12300	184	8659	382486
1950	3375	24280	0	17787	5966	3750	1462	0	1426	0	0	0	58011
1951	0	0	2493	0	19352	54342	0	0	1717	0	0	0	77904
1952	0	0	0	54242	120077	2058	0	0	919291	0	18007	106962	1220638
1953	44003	3274	36106	11440	128739	0	0	2350	2082	71960	149	75	300179
1954	274	0	0	0	2659	0	0	0	0	589	12681	0	16203
1955	1854	18156	0	51	349086	103974	63065	0	172229	7226	0	0	715642
1956	0	3675	0	11201	214530	0	0	0	0	3560	2057	1327	236349
1957	0	363	32041	616597	1129879	481621	0	0	38214	697493	196589	84010	3276807
1958	100382	356619	221545	71611	224697	202295	3534	0	67457	56519	50197	23796	1378652
1959	16704	32693	14624	48158	5643	233663	64422	0	1222	668260	46788	109411	1241589
1960	206798	153416	69775	45812	10420	0	13006	72451	2120	80121	42202	147195	843317
1961	159820	279671	97389	16756	0	346163	68337	0	4460	44941	15033	22033	1054603
1962	10065	14471	0	7114	0	9355	0	0	0	45229	1172	1696	89101
1963	875	3018	292	335	6553	11059	0	0	0	4	19394	48	41577
1964	4962	24951	34839	14985	0	28	0	0	406673	43958	79034	10223	619653
1965	30706	225311	43628	13929	596289	53847	263	0	102408	51222	51607	87439	1256649

a. Water Diversions

Table 5-8 gives the monthly demands for all senior water rights holders downstream of Mansfield Dam after using all available inflows to the Colorado River downstream of Lake Travis. The monthly inflows used directly to satisfy these diversion demands of senior water rights, using $\alpha = 2.0$, are shown in Table 5-9.

b. Channel Losses

The monthly inflows required to meet channel losses, using $\alpha=2.0$ are, shown in Table 5-10.

c. Flows Past Bay City

The monthly inflows passing the Bay City stream gage, using $\alpha=2.0$, are shown in Table 5-11.

d. Inflows Available for Storage

The monthly inflows available for storage in the Highland Lakes, using $\alpha=2.0$, are shown in Table5-12.

E. Operation of the Reservoir System in the Lakes Buchanan and Travis Combined Firm Yield Model

The Combined Firm Yield of Lakes Buchanan and Travis was determined in accordance with the directives of the Final Judgment and is shown in Table 5-13.

TABLE 5-13
COMBINED FIRM YIELD
CERTIFICATES 14-5478 AND 14-5482
(ACRE-FEET/YEAR)

Highland Lakes	445,266
O. H. Ivie	90,546
Total	535,812

The essential criteria specified in the Final Judgment and Decree for the determination of the Combined Firm Yield was that all senior downstream water rights must be honored by LCRA by passing through inflows necessary to meet those senior water rights to their fullest extent. Those senior water rights include not only the City of Austin but also the water rights owned by LCRA – Pierce Ranch, Garwood, Lakeside, and Gulf Coast. Honoring these senior water rights at their fully authorized diversion rate and annual demand has a major impact on the Combined Firm Yield determination of Lakes Buchanan and Travis. In considering the Combined Firm Yield as calculated herein, it is important to recognize that current demands under the senior downstream water rights

are about 65 percent of the authorized total. Whether future demands will approach the authorized quantities is uncertain. Future contractual relationships with the senior downstream water rights holders may also have significant impact on the Combined Firm Yield of Lakes Buchanan and Travis.

1. Description of Reservoir System

The LCRA Highland Lakes system is comprised of five reservoirs that receive inflow from the Colorado River and two major tributaries. Figure 5-1 shows the respective location of each lake and river. Lake Buchanan, one of the two water supply storage reservoirs, is the upstream-most reservoir and receives inflow from the Colorado River. Downstream are Inks Lake, Lake LBJ (which receives inflow from the Llano River), and Lake Marble Falls. Lake Travis, the other water supply storage reservoir, is the downstream-most reservoir and receives inflow from the Pedernales River and the Colorado River.

LCRA's water rights associated with the Highland Lakes, as adjudicated and amended, are summarized in Table 5-14. To reduce the many findings into a single table, some of the context may have been lost in the summarization. The reader should reference the Final Judgment and Decree, as well as the Certificates of Adjudication, for a more complete understanding of these rights and their complex history.

TABLE 5-14
SUMMARY OF LCRA'S HIGHLAND LAKE WATER RIGHTS

Certificate of Adjudication (No.)	TYPE RIGHT	PRIORITY DATE	AUTHORIZED AMOUNT	USES
Buchanan (14-5478)	Impound	3/29/1926	992,475 ac-ft	Recreation
	Consume	3/7/1938[a]	1,500,000[b] ac-ft/y	Livestock, Recharge, Recreation, Domestic, Municipal, Industrial, Irrigation, Instream Flow, Mining, Bay/Estuary Inflow
	Divert	n/a	3,630 CFS	Hydroelectric generation
Inks (14-5479)	Impound	3/29/1926	17,545 ac-ft	Recreation
	Divert	n/a	2,600 CFS	Hydroelectric generation
LBJ (14-5480)	Impound	3/29/1926	138,500 ac-ft	Recreation
	Consume	8/24/1970	15,700 af/yr	Industrial
	Divert	n/a	9,000 CFS	Hydroelectric generation
Marble Falls(14-5481)	Impound	3/29/1926	8,760 ac-ft	Recreation
	Divert	n/a	8,120 CFS	Hydroelectric generation
Travis (14-5482)	Impound	3/29/1926	1,170,752 ac-ft	Recreation
	Consume	3/7/1938[a]	1,500,000[b] ac-ft/y	Livestock, Recharge, Recreation, Domestic, Municipal, Industrial, Irrigation, Instream Flow, Mining, Bay/Estuary Inflow
	Divert	n/a	5,530 CFS	Hydroelectric generation

Note: AC-FT is acre-feet of storage capacity,
AF/YR is acre-feet per year of consumption,
CFS is cubic feet per second of diversion rate.

a. Priority may not be imposed against any junior permanent water right with a priority date senior to 11/1/87, except to the extent that LCRA's right to divert and use water from Lakes Buchanan and Travis is limited to the Combined Firm Yield.

b. This amount includes both Lake Buchanan and Travis. The bed and banks of the Colorado River may be used for conveyance.

2. Hydrologic Significance of Firm Yield

The Combined Firm Yield as determined and used herein is based on a drought period (1947-57) identified as the most severe occurring during the 105-year period since data collection started in February 1898. Although firm yield of reservoirs is usually expressed as the minimum supply available in any single year, the cumulative effect of the drought period is the most influencing factor. For example, the minimum annual streamflow since 1898, at the Austin gaging station has been 358,880 acre-feet in 1917; whereas, the minimum annual streamflow at the station during the 1947-57 drought period was 558,080 acre-feet.

Statistical inference in hydrology is based on being able to array annual events in normal distributions. Therefore, computing the recurrence interval for variable-duration drought periods is

not practical with only a 105-year period of record. Moreover, the hydrologic considerations necessary in computing the Combined Firm Yield as defined herein, removes much of the natural hydrologic recurrence associated with drought periods.

3. Reservoir Inflow

LCRA is required to pass the water that flows into the Highland Lakes through the system of lakes to honor each of these rights up to the maximum authorized amount, if the water is needed and would have been available to those diverters had the dams not been built. The Final Judgment and Decree further ruled that LCRA could not include inflows passed through to honor these rights when calculating the Combined Firm Yield of Lakes Buchanan and Travis.

Because firm yield calculations for reservoirs are most always predicated upon the hydrologic recurrence of the most severe drought period for which data are available, the hydrologic setting for the time of recurrence has to be agreed upon. The most critical hydrologic factor in the calculations is the inflow to the reservoir(s). Ordinarily, it is agreed that the inflow that actually occurred during the drought period will be adjusted to simulate that for a future time period. For example: "Watershed conditions of 2030." Man's water-use activities in the watershed since the actual drought period occurred usually result in adjusted inflow values being considerably less than those that occurred.

a. Water Availability Model (pre-2003)

To aid in adjusting runoff to that expected if the drought period of record were to recur, the Texas Water Commission (predecessor agency of TCEQ) developed a computer model. The model basically takes monthly runoff data, adjusts it back to "virgin" runoff, then imposes demands on the runoff equal to the maximum water-use right authorized, or to the extent water is available. The resulting adjusted runoff becomes that available for appropriation under the Texas Water Code and usable in firm yield calculations. Adjusted monthly values of inflow to Lakes Buchanan and Travis for the period January 1940 to December 1972, were provided to LCRA by the Texas Water Commission for calculations of the Combined Firm Yield of the LCRA system. However, LCRA's analysis of daily flow conditions in the lower river considers the 25 year period from 1941 through 1965. This shorter period, which includes the worst drought of record in the lower Colorado River basin, was selected for this analysis. The reservoir inflow values are shown in Appendix 2C, Volume II.

b. Future Considerations

A new Water Availability Model (WAM) was being reviewed by Texas Commission on Environmental Quality (TCEQ) during the first half of 2002. Unlike the previous model, when water rights junior to a reservoir were encountered, the new WAM inflows should reflect that the upstream junior right was not allowed to divert any available flow unless the storage volume in the reservoir downstream is at or above maximum conservation storage. The reason for this is that by taking

water, the junior right could be impairing the reservoir's ability to supply its authorization if the critical drought is repeated. Firm yield analysis of Lakes Buchanan and Travis with inflow from this new WAM has not yet been conducted. New monthly inflow values should be obtained from TCEQ when available. Then, a new analysis could be done and an amended value for the Combined Firm Yield of Lakes Buchanan and Travis might be submitted at some future date.

4. Reservoir Evaporation

Evaporation data was taken from the Texas Department of Water Resources LP-60 Report entitled Present and Future Surface-Water Availability in the Colorado River Basin, Texas, dated June 1978. The following excerpt is taken from page V-26, "Reservoir Evaporation Rates":

> The monthly net evaporation rates, for the period 1941 through 1965, were determined for each reservoir project considered in the study area. TWDB Report 64, Monthly Evaporation Rates for Texas, 1940 through 1965, provided net reservoir evaporation data by each one degree quadrangle within the State of Texas. These data are based on available evaporation pan data and appropriate evaporation pan coefficients. To convert these data to project areas, the data by quadrangle were weighted inversely proportional to the distance from the project area to the center of the four adjacent quadrangles. An established computer program was used to transfer the data to project areas. The latitude and longitude for each project was selected (generally about 1/3 the distance from the dam to the headwaters of the reservoir) and the center of each quadrangle was assumed to be the focal point of the data for that quadrangle, thereby a computer routine was used to compute the appropriate distances for the horizontal and vertical variations.

The tables in Appendix 2B, Volume II show the monthly net reservoir evaporation rates, in feet, for each reservoir.

5. Local and Downstream Demand Distributions

The only monthly demand distribution utilized is reflected as a release from Lake Travis. This distribution was generated using records of diversions by the City of Austin and by the four major irrigators downstream. The resulting distribution is found in Table 5-15.

TABLE 5-15
LAKE TRAVIS ANNUAL DEMAND DISTRIBUTION (%)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6.4	6.1	6.8	7.6	8.1	9.5	12.0	12.4	9.4	8.2	6.8	6.7

6. Simulated Highland Lakes Operations

An operations simulation procedure defines how water would be released from each of the system's water supply storage reservoirs to meet the downstream demands. LCRA specifies the proportion of the demands to be satisfied from each reservoir based on current system storage contents and other hydrological conditions. The ultimate goal is the optimal use of the water supply from the system in accordance with LCRA Board Policy 501.

For the Combined Firm Yield analysis, an operations simulation procedure was developed to minimize the impacts of the losses due to evaporation and to spills. The two water supply storage reservoirs of the Highland Lakes are Buchanan and Travis. Lake Buchanan has a large surface area when it is at or near conservation storage capacity. This results in large losses due to evaporation. Lake Travis generally receives much more inflow than Lake Buchanan. As a result, it is more susceptible to spilling during normal operations.

The operations simulation procedure in the Combined Firm Yield analysis allows full utilization of Lake Travis until its storage drops below 850,000 acre-feet. At that point, the downstream demands are met at a rate of 65% directly from Lake Travis and 35% released from Lake Buchanan. When the storage in Lake Travis drops below 700,000 acre-feet, Lake Buchanan is called on to meet 90% of the downstream demand. When operations draw Lake Buchanan down to between 50,000 and 150,000 acre-feet, Lake Buchanan is then called on to meet only 35% of the demand. Finally, when the storage in Lake Buchanan drops below 50,000 acre-feet, Lake Travis is called on to meet all downstream demands. The process is shown in Table 5-16. This operation was derived through repetitive simulations and represents neither the optimal solution nor the actual operation that LCRA would follow when all hydrologic factors are considered.

TABLE 5-16
HIGHLAND LAKES OPERATIONS SIMULATION

LAKE TRAVIS END OF MONTH CONTENT (AF)	LAKE BUCHANAN RELEASE RATE (%)
GREATER THAN 850,000 (El.= 662 ft)	0
LESS THAN 850,000 AND GREATER THAN 700,000	35
LESS THAN 700,000 (El. = 651 ft)	90

LAKE BUCHANAN END OF MONTH CONTENT (AF)	LAKE BUCHANAN RELEASE RATE (%)
LESS THAN 150,000 AND (El. = 966 ft) GREATER THAN 50,000	35
LESS THAN 50,000 (El. = 948 ft)	0 [1]

[1] Releases made only for diverters from Lakes Inks, LBJ, and Marble Falls.

It should be noted that, during the entire period of operation, Lake Buchanan storage is used to meet any and all local area demands and evaporation losses from Inks Lake. Depending on inflows into Lake LBJ from the Llano River and into Lake Travis from the Pedernales River, Lake Buchanan storage may also be used to meet local area demands and evaporation losses from Lake LBJ, Lake Marble Falls, and Lake Travis. The ultimate purpose depends on the demands and the specified minimum allowable contents of the intermediate reservoirs (Inks, LBJ, and Marble Falls) (See Table 5-17).

TABLE 5-17
HIGHLAND LAKES ALLOWABLE OPERATIONS CONTENTS

	CONTENTS (AC-FT)	
RESERVOIR NAME	**MINIMUM**	**MAXIMUM**
BUCHANAN	0	918,000
INKS	17,540	17,540
LBJ	138,500	138,500
MARBLE FALLS	8,760	8,760
TRAVIS	0	1,170,069

7. Demand Alternatives

The Combined Firm Yield computed for Lakes Buchanan and Travis is based on passing through streamflow as required to satisfy downstream senior rights up to their maximum authorized annual amount. Actual operations under the WMP will see streamflow passed through to satisfy senior rights holder's actual demands. In many years the actual demands can be expected to be less than the maximum authorized rights. Of course, this is a major factor in being able to fulfill water supply demands in many years greater than the Combined Firm Yield.

CHAPTER 6
WATER OPERATIONS SYSTEM

A. Introduction 6-1
B. Hydrometeorological Data Acquisition System 6-1
C. Hydrologic Models 6-1
1. Daily Allocation Model 6-1
2. National Weather Service River Forecast System 6-2
D. Standard Operating Procedures for Lakes Buchanan and Travis 6-2
1. Daily Operations 6-2
a. Standard Operating Levels 6-3
b. Variances on Daily Operations Procedure 6-4
2. Flood Operations 6-4

A. Introduction

The Water Operations System is a network including remote data acquisition, central computers, and hydrologic models (Figure 6-1). It is being used on a daily basis to monitor the Colorado River and operate the Highland Lakes.

B. Hydrometeorological Data Acquisition System

LCRA has in operation a Hydrometerological Data Acquisition System (Hydromet) that allows remote interrogation of a networked system of one hundred self-reporting rainfall gages, fifty remotely monitored streamflow gages, and eleven reservoir elevation gages. All fifty of the streamflow gages also gather rainfall information, giving a total of one hundred fifty rainfall sites.

The Hydromet System is polled each hour, and all data is verified and stored in a real-time data base on the Central Computer System. Communications are a combination of microwave and LCRA's Trunked Radio System. The combination of a modernized Hydromet system and Trunked Radio will allow for future expansion necessary to improve streamflow forecasting, lake operations and public flood warning.

C. Hydrologic Models

Several specialized hydrologic models have been implemented to assist both routine daily allocation and emergency flood operations. Each of these models is further described below.

1. Daily Allocation Model

The Allocation model was developed to allocate daily inflows into the Colorado River in accordance with established priority water rights. This analysis enables LCRA to report the amount of stored water used from Lakes Buchanan and Travis by each major diverter. A provisional report is sent out

once a week, allowing each diverter to be kept apprised of stored water usage. At the end of each year, all stream flows are reconciled and diversion data is verified. The model reports are then provided to all diverters, as well as the TCEQ as part of LCRA's Annual Water Use Reports.

2. National Weather Service River Forecast System

LCRA and the National Weather Service (NWS) have pursued a joint project to share information and implement a system to forecast flow conditions along the Colorado River. LCRA routinely reports river data to the NWS River Forecast Center in Fort Worth, Texas. This allows the NWS to produce much more timely and accurate public information forecasts utilizing their River Forecast System. LCRA also receives processed radar data on an hourly basis, and has implemented a flood forecast modeling system as an operational tool to aid flood operations on the Highland Lakes. This model processes doppler radar, raingage, and stream gage data to forecast flood inflows to the Highland Lakes and resulting lake elevations, providing improved information for operational decisions.

D. Standard Operating Procedures for Lakes Buchanan and Travis

There are currently three modes of Standard Operating Procedures for Lakes Buchanan and Travis. The first is the daily operations mode, in which daily demands for water are met by releases from Lakes Buchanan and Travis and the intermediate reservoirs are maintained within normal operating levels. The second is flood control, which primarily concerns Lake Travis since it is the only reservoir with a dedicated flood pool. Incorporation of the WMP has added a third mode for drought contingency.

1. Daily Operations

Hydrology staff in the River Operations Center (ROC) coordinate with the System Operations Control Center (SOCC) and the Hydro Operations Control Center (HOCC) to make decisions regarding the daily operations of the river and the Highland Lakes. The SOCC and the HOCC provide Hydrology staff with information about electrical system load requirements and operational considerations at the hydro plants. Hydrology staff in the ROC incorporate these considerations along with other water release requirements into daily operational decisions. When making these decisions, ROC staff must also assess changing water use demands downstream, minimum flow requirements for aquatic life and flow constraints for special functions held on or near the river.

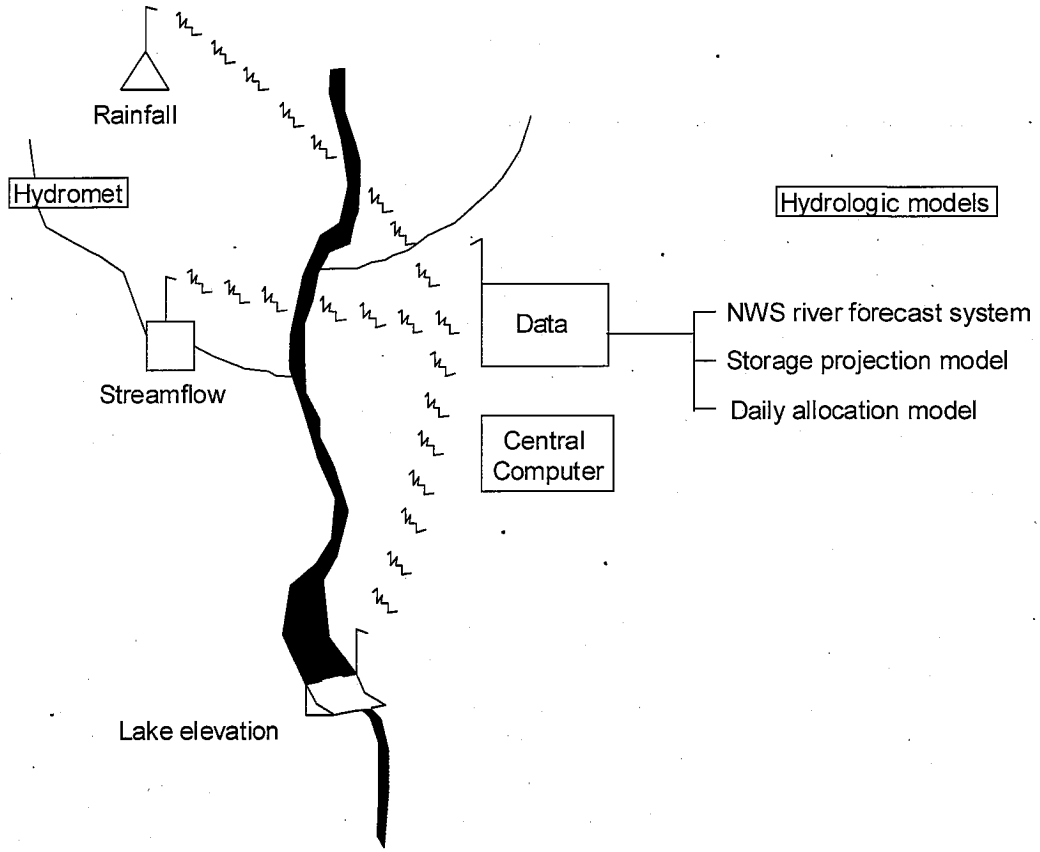


Figure 6-1.

a. Standard Operating Levels

Standard operating levels are as noted in Table 6-1.

TABLE 6-1
STANDARD OPERATING LEVELS FOR THE HIGHLAND LAKES

LAKE	TARGET ELEVATION RANGE (NGVD)
Lake Buchanan	1020.35 (1018 May - October)
Inks Lake	887.30 +/- 0.4
Lake LBJ	824.70 +/- 0.3
Lake Marble Falls	736.60 +/- 0.4
Lake Travis	681.00
Lake Austin	492.30 +/- 0.5

b. Variances on Daily Operations Procedure

From time to time, LCRA must deviate from normal operating procedures to perform necessary maintenance, or to honor the request of a public entity. Examples of this may be drawing down a lake preceding maintenance on a dam, in the interest of safety, or interrupting daily release operations for public events, such as the Austin Aqua Festival. LCRA retains the right to use its discretion in operating its reservoirs during such events, to protect its investments and the public safety, as a responsive public servant.

2. Flood Operations

The primary flood operations focus is on Lake Travis and the Army Corps of Engineers' *Plan of Regulation* for Lake Travis. The principal operating criteria in this manual are summarized in Appendix B2, Volume I.. During a flood event, any available storage in Lake Buchanan is used before releasing water to maintain the pool level. Following an operational agreement between LCRA and the Federal Emergency Management Agency (FEMA), Lake Buchanan is held two feet lower during the historically flood-prone months of May through October. (See Appendix B2, Volume I.)

Appendix A1
Board Policy 501
Water Resources Management

LCRA BOARD POLICY

501 - WATER RESOURCES MANAGEMENT

November 16, 2005

501.10 PURPOSE

This policy establishes directives and guidelines for Water Resource Management and planning within LCRA's Water Service Area.

501.20 DEFINITIONS

"Adverse Effects of the Transfer" means the reduction in availability of sufficient Surface Water to meet the needs of LCRA's irrigation customers within Colorado, Wharton, and Matagorda counties resulting from the interbasin transfer of Surface Water to New Customers in Williamson County pursuant to Texas Water Code § 222.029(a)(3)(B).

"Average Annual Volume" means the arithmetical average volume of water over a contiguous 3-year period.

"Conserved Water" means the Average Annual Volume of water made available under Texas Water Code § 222.029(a)(3)(B) from conservation projects and demand reduction projects within the water service areas of LCRA's irrigation districts. Conserved Water can be classified as firm, interruptible or any combination thereof.

"Conservation Charge" means the additional charge set by the Board pursuant to this policy and Texas Water Code § 222.029(c).

"Developed Water" means the Average Annual Volume of additional water made available for use within the water service areas of LCRA's Irrigation Districts under Texas Water Code § 222.029(a)(3)(B) that may include: (1) groundwater, or (2) surface water resources that are not presently under the control of LCRA. Such water may originate inside or outside the boundaries of the Colorado River basin and may be firm, interruptible or any combination thereof.

"LCRA's Water Service Area" means and includes: (a) the 10 counties that comprise LCRA's statutory district as described in Section 222.003 of the Texas Water Code; (b) the watershed that contributes to the flow of the Colorado River below the intersection of Coleman, Brown and McCulloch counties; (c) Williamson and Lampasas counties, as authorized by law, and (d) any area served by LCRA pursuant to Texas Water Code § 49.215.

"New Customer" means any person or entity within Williamson County that did not have a water sale contract with LCRA on or before May 1, 1997.

"**No Net Loss**" means a hydrologic condition where the volume of Transferred Water is equivalent to, or less than, the combined volume of Conserved Water, Developed Water, and Returned Water resulting in a reduced reliance on Surface Water for agricultural irrigation.

Transferred Water ≤ Conserved Water + Developed Water + Returned Water

"Returned Water" means the Average Annual Volume of water that is imported to the lower Colorado River basin with the specific intent to meet the condition of Texas Water Code § 222.029(a)(3)(B). Such water may be firm, interruptible or any combination thereof.

"Surface Water" means water from the Colorado River or Highland Lakes. This water can be classified as either firm, interruptible water, or any combination thereof.

"Transferred Water" means the Average Annual Volume of Surface Water exported from the lower Colorado River basin to Williamson County under Texas Water Code § 222.029(a)(3)(B).

"**Water Resource Management**" means maximizing the benefits of the waters of the lower Colorado River to customers, constituents and the public, while conserving water supplies and protecting ecosystems and environments associated with the lower Colorado River.

501.30 WATER RESOURCE PLANNING

LCRA will initiate appropriate programs and projects to control, store, preserve, use, and sell the waters under its jurisdiction.

LCRA will take the initiative in planning on all aspects of Water Resource Management to assure: (a) an adequate supply of water and optimal use thereof; (b) construction of reservoirs to control and store water; (c) construction of water treatment facilities; (d) construction of wastewater treatment facilities; (e) development of water quality programs and related activities; (f) consideration of regional planning alternatives and initiatives; (g) appropriate sales of water; and (h) reuse of wastewater.

In responding to the needs of its service area, LCRA will encourage, and may participate in, the financing, construction, and operation of water and wastewater supply and treatment facilities.

501.40 INTERBASIN TRANSFERS

LCRA opposes any sale of surface water rights for use outside LCRA's water service area.

501.401 Transfers Outside Colorado River Basin

LCRA opposes any interbasin transfer of surface water outside the Colorado River watershed, unless:

a. The interbasin transfer is within LCRA's Water Service Area; or

b. It is demonstrated to the satisfaction of the Board that:

   (i) the interbasin transfer will not detrimentally affect the public welfare or the interests of LCRA's Water Service Area;

   (ii) the receiving basin is prudently using and conserving its existing water resources and has aggressively planned and attempted to develop local sources of supply to meet current and future demand with no success; and

   (iii) the interbasin transfer is not permanent, but is made through a temporary water sales agreement.

501.402 Interbasin Transfers Outside LCRA's Water Service Area

The determination of whether an interbasin transfer will detrimentally affect the public welfare or the interests of LCRA's Water Service Area pursuant to Section 501.401(b) of this policy must include, but need not be limited to, consideration of the direct and indirect impacts of the interbasin transfer on the following, both at the time the interbasin transfer is initiated and in the future:

a. Existing water rights and obligations.

b. LCRA's contractual commitments.

c. Water supplies for environmental purposes and economic activities, including instream flows, inflows to the bays and estuaries, municipal and industrial uses, irrigation, recreation and tourism.

d. Water quality and aquatic ecosystems in the Highland Lakes, the lower Colorado River basin and associated bays and estuaries and LCRA's Water Service Area.

501.403 Interbasin Transfers to New Customers Within LCRA's Water Service Area

In accordance with Texas Water Code § 222.029:

1. New Customers shall pay an amount sufficient to cover LCRA's applicable water rate and the Conservation Charge.

2. The Conservation Charge shall be sufficient to cover the costs of mitigating Adverse Effects of the Transfer. The Conservation Charge shall be set at a percent of LCRA's applicable rates, including its water rates, inverted block rates and reservation fees.

3. LCRA shall deposit any money from the Conservation Charge, and may deposit any other money as the Board of Directors determines, into the Agricultural Water Conservation Fund ("Conservation Fund").

4. The following limitations shall apply to expenditures from the Conservation Fund:

   a. LCRA may use money from the Conservation Fund only for the development of water resources or other water use strategies to replace or offset the amount of Surface Water transferred to Williamson County. The Conservation Fund shall not be used to buy out the production of a second crop.

   b. The water resources developed or other water use strategies that are funded from the Conservation Fund must take into consideration the surface and groundwater needs of the Colorado River basin users affected by the transfers to Williamson County.

   c. The water resources developed or other water use strategies that are funded from the Conservation Fund shall benefit the water service areas of LCRA's irrigation operations.

   d. Prior to its determination of the use of money from the Conservation Fund, LCRA shall consult with an advisory committee appointed by the county judges of Matagorda, Wharton and Colorado counties to represent agricultural irrigation interests.

5. Prior to any diversion of water to New Customers in Williamson County, the means to conserve, develop, or return water to satisfy the No Net Loss condition shall be identified that would be sufficient based on an Average Annual Volume to conserve, develop or return the necessary volumes of water.

6. On or before the April Board meeting of each year, the General Manager shall submit to the Board a report summarizing the following information:

   a. Management of the Conservation Fund over the prior year, including revenue deposited in the fund, interest accrued, and expenditure from the fund;

   b. Activities completed during the prior year to achieve No Net Loss and mitigate the Adverse Effects of the Transfer;

   c. Updated projections of anticipated water demand from New Customers in Williamson County over the duration of any applicable water sale contracts; and

   d. The sufficiency of the Conservation Charge to implement the requirements of this Policy and applicable law; including recommendations for any necessary modification to the Conservation Charge.

7. In conjunction with the report submitted under subsection (6) the General Manager shall also submit to the Board a request for approval for all expected expenditures from the Conservation Fund for the upcoming year and any request for modification to the Conservation Charge that may be necessary to implement this Policy. No expenditure from the Conservation Fund shall be made without the prior approval of the Board.

8. Upon reasonable request, LCRA will make available to Williamson County customers records of all actions taken by the LCRA Board regarding the use of funds from the Conservation Fund.

501.404 Reuse of Surface Water Transferred Outside the Colorado River Basin

Wastewater originating as Surface Water diverted from the Colorado River basin pursuant to an LCRA water right shall not be reused outside of the Colorado River basin except pursuant to an interbasin transfer permit that expressly authorizes such reuse outside the Colorado River basin.

501.50 RESALE OF COMMITTED WATER

LCRA may contract with any of its raw water customers that have reserved at least a 25-year firm supply of water, and paid the associated reservation fee, to market and resell any portion of the customer's firm supply to another customer on a limited term basis for a management fee and under terms mutually acceptable to LCRA and the raw water customer.

501.60 AUTHORITY

Texas Water Code §§ 222.001, 222.004, 222.028, 222.029, and 222.030.

EFFECTIVE: Aug. 18, 1999. Amended June 21, 2000, Sept. 18, 2002, and Nov. 16, 2005.

Appendix A2
Board Policy 503
Lowering LCRA-Operated Lakes

LCRA BOARD POLICY

503 - LOWERING LCRA-OPERATED LAKES

October 20, 2004

503.10 PURPOSE

This policy establishes guidelines for responding to requests from the public to lower LCRA-operated lakes. Any lowering of an LCRA-operated lake that is not in compliance with this policy will require approval by the LCRA Board of Directors.

503.20 BACKGROUND

This policy consolidates all previous practices of lake lowering and applies to Inks Lake, Lake LBJ, Lake Marble Falls and Lake Austin. With the exception of Tom Miller Dam creating Lake Austin, LCRA owns the dams creating these lakes, as well as the associated water rights permits from the Texas Commission on Environmental Quality or its predecessor agencies. Tom Miller Dam is owned by the City of Austin. By contract with the city dated Feb. 5, 1938, which as amended has been extended to the year 2020, the city and LCRA have agreed to the following:

> The city will maintain "full control, use and enjoyment of the reservoir created by the Austin (Tom Miller) Dam" for "recreational purposes."

LCRA operates Tom Miller Dam pursuant to this contract so that the level of Lake Austin will "not be lowered more than three feet except in emergency when the water level may be lowered five feet." Any modification to operations under this contract requires the written approval of the City of Austin.

Requests for lowering of lakes Buchanan and Travis will not be considered under this policy due to the fact that they are water supply storage lakes according to LCRA's water rights permits and its Water Management Plan.

503.30 POLICY

The following criteria will be followed when responding to requests to lower LCRA-operated lakes.

1. All lowerings must be approved by the general manager.

2. LCRA will not approve requests that interfere with essential operations of LCRA such as flood control and water supply, and LCRA may terminate any approved lake lowering as determined by the general manager in his or her sole discretion.

3. Except as provided in section 503.403 below, LCRA will charge for any losses that occur resulting from lake lowering requests that are deemed reasonable by LCRA's general manager. If a lake-lowering request is consistent with LCRA's operations and involves no losses, there will be no charge.

4. Generally, requests for lowering any lake during the months of March through October, which are the peak "system demand" months for water supply and include prime fish-spawning months, will not be considered.

5. Any lake lowering conducted pursuant to this policy must be consistent with LCRA's Water Management Plan.

6. The general manager may delegate authority provided to the general manager by this policy to other LCRA officers and management staff members.

503.40 PROCEDURES

503.401 Response to Requests for Lowering. The following procedures will be followed when responding to and processing requests to lower LCRA-operated lakes:

1. Only written requests will be considered except in cases where the general manager is authorized to lower a lake pursuant to this policy. Requests must be addressed to the general manager and signed by an authorized agent of the requesting entity.

2. Requests must be received by LCRA at least 12 weeks prior to the proposed date for starting drawdown of any lake except in cases where the general manager is authorized to lower a lake pursuant to this policy.

3. All requests must explicitly state the number of feet the lake is requested to be lowered and the period of time the lake is desired to be down.

4. Requests for lake lowering will not be acted upon until both LCRA and the requesting party have agreed in writing to the terms, costs and conditions of the action.

5. LCRA will provide notice to the public through print and electronic media on the date, time and degree of lake levels at least two weeks in advance of any action.

503.402 Costs Related to Lowerings. The following procedures will be followed when obtaining reimbursement for LCRA losses when LCRA receives a request to lower a lake:

1. Hydropower Generation Related Costs. LCRA will be reimbursed by the requesting party according to the fuel replacement cost plus normal overhead of the hydropower generation capability lost due to the reduction in head level at the respective dam during lake drawdown. Any lost ancillary service capability resulting from the lowered level during the requested time period also will be reimbursed. Any costs related to power generation necessary to

maintain the requested lowered level during the requested time period also will be reimbursed. Reimbursement may be in the form of in-kind services.

2 Water Related Costs. Water released from Lake Austin is not recoverable for storage since it is downstream of LCRA's storage reservoirs. Therefore, any requestor who seeks to lower Lake Austin must pay LCRA for the amount of water released from storage in Lake Travis to refill Lake Austin at LCRA's then-current water rate, unless:

a. the level of Lake Travis is above 681 feet above mean sea level (i.e., water is available in excess of the conservation pool for Lake Travis);

b. Lake Austin refills due to rainfall on its watershed; or,

c. Lake Austin is lowered through the gradual release of water in amounts necessary: i) to supply downstream LCRA customers in accordance with their agreements with LCRA; and, ii) to meet instream flow or estuarine inflow requirements committed by LCRA's Water Management Plan. In this event, LCRA will store corresponding amounts of water in Lake Travis for use in refilling Lake Austin. In calculating the impact of the lowering of Lake Austin, any joint reduction in instream flow and estuarine inflow requirements by the same volume of water released from Lake Austin will only be considered as a reduction in either instream flow requirement or estuarine inflow requirement, but not in both.

503.403 LCRA-Sponsored Lowerings. Recognizing that the lowering of lakes owned and operated by LCRA provides benefits both to LCRA and the public in regard to maintenance of LCRA facilities, other public utility systems and other public facilities located on the lakes, the general manager is authorized to lower Inks Lake, Lake LBJ and Lake Marble Falls without formal request by a third party and without reimbursement for hydropower generation losses subject to the following requirements:

1. the general manager may not lower the same lake under this section more than once every four (4) years unless: a) the lowering is made in response to an emergency; b) the lowering is for the maintenance or repair of an LCRA facility; or, c) the general manager determines that a lowering is necessary to address matters related to the public health and safety following a flood event;

2. the lake lowering shall not exceed six weeks in duration; and,

3. the lake lowering may not result in any loss in the combined firm yield of the Highland Lakes system, as provided by the LCRA Water Management Plan.

503.404 Lowering of Lake Austin. Tom Miller Dam is owned by the City of Austin. By contract with the city dated Feb. 5, 1938, which as amended has been extended to the year 2020, the city and LCRA have agreed to the following:

The city will maintain "full control, use and enjoyment of the reservoir created by the Austin (Tom Miller) Dam" for "recreational purposes."

LCRA operates Tom Miller Dam pursuant to this contract so that the level of Lake Austin will "not be lowered more than three feet except in emergency when the water level may be lowered five feet." Any lowering of Lake Austin that is not in accordance with the contract between the city and LCRA will require the written approval of the City of Austin.

503.50 AUTHORIZATION

LCRA enabling legislation, Sections 222.004 and 222.011, Texas Water Code.

EFFECTIVE: Sept. 1986. Amended Nov. 1986, March 1987 (republished), Aug. 20, 1992, Oct. 20, 1999, Sept. 18, 2002 and Oct. 20, 2004.

Appendix A3
Board Policy 507
Water Quality Leadership

LCRA BOARD POLICY

507 – WATER QUALITY LEADERSHIP

December 13, 2000

507.10 PURPOSE

The purpose of this policy is to ensure that LCRA leads in the protection and improvement of the ground and surface water quality within the lower Colorado River watershed.

507.20 POLICY

LCRA will provide leadership in protecting water quality and, where possible, improving the quality of the surface and ground water within the lower Colorado River watershed.

LCRA will assess surface water quality to identify issues and impacts throughout the Colorado River watershed and will work with appropriate entities to solve problems that are identified.

LCRA will propose innovative and effective actions to achieve its water quality goals.

In exercising its leadership role, LCRA will strive to implement high water quality protection standards for its projects and facilities and, at a minimum, will maintain and implement state and federal water quality standards.

In its role as water quality leader, and to ensure the highest level of protection for the Colorado River and its tributaries, the General Manger or his designee will, from time to time, participate in proceedings before the Texas Natural Resource Conservation Commission or other administrative agencies charged with water quality protection authority. The General Manager will report such participation to the Board.

507.30 PROCEDURES

507.301 Stream Standards. LCRA will advocate before the Texas Natural Resource Conservation Commission and its successor agencies that the highest appropriate surface water quality standards be set for the Colorado River and its tributaries.

507.302 Discharges. Consistent with the Texas Natural Resource Conservation Commission's ban on new discharges, LCRA will oppose any new or expanded wastewater treatment plant permit for discharge into the Highland lakes, or any tributary within 10 stream miles of any dam pool levels or elevations described in the Texas Natural Resource Conservation Commission watershed protection rules.

LCRA will review all applications for point and nonpoint source discharges into the Highland Lakes, the lower Colorado River and its tributaries and will advocate solutions that support protection and improvement of water quality. LCRA staff may participate in the permit process, including, but not limited to, commenting and seeking party status, for any water quality application.

507.303 Wastewater. LCRA will encourage and support innovative approaches to wastewater treatment and disposal that are technically, economically and environmentally sound. LCRA will lead in developing and managing regional wastewater treatment facilities. Regional management may include planning, constructing, operating or managing centralized or decentralized wastewater treatment facilities.

507.304 Nonpoint Source Pollution Prevention and Control. LCRA will lead a comprehensive effort to promote prevention and control of nonpoint source pollution of the waters within the lower Colorado River watershed. In cooperation with other concerned public and private entities, LCRA will take actions appropriate to ensure nonpoint sources of water pollution are controlled to the fullest extent feasible throughout the watershed.

LCRA will control and manage nonpoint source pollution from projects on all LCRA owned and controlled lands to the fullest extent feasible.

LCRA will support research and consider actions that result in alternative and innovative technologies and improved management of private on-site sewage facilities.

LCRA will require appropriate and effective nonpoint source pollution control programs in all water sale contracts, in lease agreements for the use of LCRA properties, and in water and wastewater service agreements.

507.305 Ground Water. Consistent with LCRA's goal to protect the quality and to ensure the supply of ground water within LCRA's water service area and the state of Texas, LCRA will lead in the following activities as needed:

- Cooperate with other entities in developing projects, monitoring ground water, disseminating public information and providing technical assistance;

- Promote ground water conservation in recognition of the interrelationship of ground and surface water and the potential for water quality degradation as groundwater supplies diminish;

- Through ongoing assessments of ground water supplies, encourage and research conjunctive management and use of the ground and surface water supplies. LCRA may plan, develop and manage conjunctive use projects where economically feasible.

507.40 AUTHORITY

LCRA Act
Texas water Code, Chapters 26 and 30.
31 Tex. Admin. Code ch. 311.

EFFECTIVE: August 18, 1988. Amended June 27, 1991, Jan. 21, 1993 and Dec. 13, 2000.

Appendix A4
Board Policy 508
Water Pricing

LCRA BOARD POLICY

508 - Water Pricing

December 16, 1988

508.10 PURPOSE

The purpose of this policy is to establish the water pricing policy of LCRA for the waters managed by LCRA. It is intended that this policy will serve to assist in LCRA's leadership role in management of water supply and water quality.

508.20 POLICY

LCRA shall establish rates for the sale of water which are not prejudicial or unduly discriminatory, but are equitable and recover LCRA's cost of supplying such water.

508.201 Rate Setting Criteria

In setting rates, LCRA shall consider, but not be limited to, the following criteria:

Cost of Service - In pricing water, LCRA will consider the average cost and marginal cost of supplying water. LCRA's costs may include: the costs of operating existing reservoirs; the costs of developing future water supply including additional reservoirs and ground water recharge projects; the costs for protection, enhancement and conservation of the ground and surface water quality and supply in the 10-county statutory district; and such other future costs of service. Within this framework, cost variations will be considered by season, time and duration of use, degree of delivery reliability and quality of water delivered.

Value of Water Resources - In pricing water, LCRA will consider the market value of water as well as the relative value of varying degrees of delivery reliability to all classes of water customers, both current and potential. This value of service determination may consider variations by season, time and duration of use and quality of water.

Environmental Protection - The base pricing of water shall take into account the quality of the water provided, as well as the cost of protecting the ecological balance in the Colorado River Basin and the coastal bay/estuarine system. Such pricing may include the costs for maintenance of necessary instream flows and attainment or compliance with all applicable water quality

standards. Any enhancement in water quality by the actions of LCRA will be considered an additional cost of water resource management.

Conservation - The pricing of water will encourage water conservation practices which improve water use efficiency, increase re-use and recycling, or minimize water waste such that the available water supply is maximized for present and future uses.

508.202 Water Sales Contracts

All future water sale contracts shall contain conditions requiring such conservation and water quality measures that may be feasible and economical. Pursuant to LCRA's Certificate of Adjudication from the Texas Water Commission, LCRA shall not supply or commit to supply any water to any other party except pursuant to a written contract. In addition, LCRA will not supply water to itself except pursuant to resolution adopted by LCRA's Board of Directors that defines such commitment. All contracts and resolutions along with associated rates will be considered to be for firm uninterruptible water unless the contract specifically provides that such commitment is subject to interruption or curtailment.

508.203 Implementation

Implementation of this pricing policy shall be carried out within a time frame which attempts to minimize adverse impacts upon the customers of LCRA.

508.30 RESPONSIBILITIES

It shall be the responsibility of the General Manager to assure that all rates and rate changes are presented to the LCRA Board of Directors for approval, and that all water customers are afforded an opportunity to comment on such actions prior to the Board's approval.

508.40 AUTHORITY

Texas Water Code, Chapters 11 and 12.
LCRA Act, §§ 1, 9, 10 and 11.
LCRA Board Policies 301.00, 304.00 and 507.00.

EFFECTIVE: December 16, 1988.

Appendix A5
Board Policy 509
Water Conservation

LCRA BOARD POLICY

509 - WATER CONSERVATION

June 21, 2000

509.10 PURPOSE

This policy provides direction for LCRA's leadership role in assuring an adequate supply of clean water in LCRA's water service area for the future needs of municipal, agricultural, industrial, and recreational uses, by promoting the conservation of ground and surface waters.

For purposes of this policy, the LCRA water service area includes all areas in which the LCRA is authorized to control, store, preserve, conserve, use, distribute, transfer, or sell the waters of the Colorado River pursuant to the LCRA Act or other law.

509.20 POLICY

The LCRA shall exercise leadership in promoting and, where appropriate, requiring the conservation of ground and surface waters within LCRA's water service area. The LCRA shall meet or exceed Texas Natural Resource Conservation Commission and Texas Water Development Board water conservation and drought contingency requirements. The LCRA will develop conservation plans and programs consistent with the water plans approved by the Texas Water Development Board and the Region K Planning Group pursuant to the Texas Water Code, Chapter 16 (implementing Senate Bill 1 from the 1997 Texas Legislature).

LCRA's goals shall be to promote the development and application of practices and technologies that improve water use efficiency, increase the beneficial reuse and recycling of water, and minimize the waste of water such that water supplies are extended. The LCRA shall support and assist local, state, federal, and private-sector initiatives to develop, demonstrate and apply water conservation measures where appropriate. The LCRA shall implement technical assistance, demonstration projects, public information, and education programs on water conservation.

In the operation and management of LCRA facilities and properties, the LCRA shall use water efficiency measures and pursue opportunities to demonstrate and employ advanced water-conserving technology. All future water sales contracts and water utility service agreements shall contain appropriate conditions requiring conservation measures that are economically feasible.

509.201 Municipal and Industrial Water Efficiency Given LCRA's limited resources, LCRA's efforts in technical assistance shall focus on the development and implementation of local water conservation and drought contingency programs that encourage local initiative and achievement. The LCRA may assist local utilities and communities in the water service area with technical assistance in preparing water conservation and drought contingency plans.

509.202 LCRA Support of Research and Legislation The LCRA shall support research, regulatory initiatives and legislation that advance the conservation and beneficial reuse of water in the LCRA water service area. The LCRA also shall assist in the research and transfer of technology and information regarding cost-effective conservation measures for the benefit of water users within the LCRA water service area.

509.203 Corporate Water Conservation Initiatives
The LCRA shall integrate, as appropriate, water efficiency measures into the development and implementation of LCRA programs and projects. Such programs and projects shall include but not be limited to: water resources planning and demand forecasting; water and wastewater utility service studies, projects and service agreements; water rate design; and environmental programs.

509.204 Agricultural Water Efficiency The LCRA shall support and assist public and private-sector initiatives to develop, demonstrate, and apply cultivation and irrigation practices to improve on-farm water use efficiency.

The LCRA shall assist with the transfer of information and technology for improving on-farm water use efficiency from research to the producer.

The LCRA shall undertake, to the extent economically feasible, maintenance, rehabilitation and management practices to minimize water losses from LCRA irrigation water delivery systems.

509.30 AUTHORITY

LCRA Act, Section 2-, 26 and 27.

EFFECTIVE: October 20, 1988, Amended June 21, 2000

Appendix B1
Corps of Engineers Flood Control Regulation/ Code of Federal Regulations

§ 208.19 Marshall Ford Dam and Reservoir (Mansfield Dam and Lake Travis), Colorado River, Tex.

The Secretary of the Interior, through his agent, the Lower Colorado River Authority (LCRA) shall operate the Marshall Ford Dam and Reservoir in the interest of flood control as follows:

(a) *Water Control Plan*—(1) *General objectives.* The objectives of the Marshall Ford Reservoir (Lake Travis) are the improvement of navigation, flood control, stream regulation, generation of power, irrigation, water supply, and recreation uses.

(2) *Overall plan for water control.* Within the Colorado River Basin, four Federal projects provide flood control protection: Twin Buttes, O. C. Fisher, Hords Creek, Marshall Ford Reservoir. The considerable distance (328 river miles) and large intervening area (19,990 square miles) separating Marshall Ford Reservoir and the three upper basin flood-control projects prevent realizing any significant benefits from coordinating releases to control the inflow into Marshall Ford. Marshall Ford Reservoir is the fifth project in a tandem of six lakes operated and controlled by the Lower Colorado River Authority for the generation of hydroelectric power. These six projects in downstream order are: Lake Buchanan, Lake Inks, Lake Lyndon B. Johnson (Alvin Wirtz Dam), Lake Marble Falls (Max Starcke Dam), Marshall Ford Reservoir (Lake Travis and Mansfield Dam) and Lake Austin (Tom Miller Dam). The releases from each of the six projects are closely coordinated by the LCRA System Operation Control Center. Three of the projects (Lake Inks, Lake Marble Falls, and Lake Austin) are run-of-the-river projects. The capabiity of the four upstream lakes to control the inflow of flood water into Marshall Ford depends on their antecedent lake elevations. The majority of inflows to Marshall Ford are comprised of the mainstream flows of the Colorado River, the tributary flows of the Llano River (entering the Colorado River between Lakes Inks and Lyndon B. Johnson) and the unregulated tributary flows of the Pedernales River (entering between Lake Marble Falls and Marshall Ford Reservoir). During flood conditions, the following upstream U.S. Geological Survey gaging stations are used as indicators of the magnitude of the inflows to Marshall Ford Reservoir:

(i) Colorado River near San Saba (08147000).

(ii) Pedernales River near Johnson City (08153500).

(iii) Llano River at Llano (08151500).

(3) *Standing instructions to dam tender.* During normal conditions, the dam tender will regulate the project in accordance with instructions received from the LCRA System Operator. During flood conditions, when the Marshall Ford Reservoir level is within the flood control zone, the LCRA System Operator will regulate the project in accordance with instructions received from the Corps of Engineers. In the event of a communication outage, the LCRA System Operator will rely on the Emergency Release Schedule, to make changes in the rate of releases from the lake.

(4) *Flood control regulation*—(i) *General.* At all times, releases shall be coordinated such that the Colorado River, Texas, will be controlled when possible, to remain below control stages at downstream official U.S. Geological Survey (USGS) gaging stations; except that no curtailment of normal hydroelectric turbine releases shall result thereby at any time. The USGS river stations and their control stages are as follows:

KEY DOWNSTREAM CONTROL POINTS

Station	Control stage (feet)	Equivalent cubic feet per second (c.f.s.)
Austin (08158000)	20.5	30,000
	[1] 24.8	[1] 50,000
Bastrop (08159200)	25.1	45,000
	[1] 26.7	[1] 50,000
Columbus (08161000)	25.5	50,000

[1] Control stage when elevation 710 is forecast to be exceeded.

Forecasted reservoir inflows and the upstream USGS gaging stations Pedernales River near Johnson City (08153500), Llano River at Llano (08151500), and Colorado River near San Saba (08147000) will be considered when scheduling flood releases.

(ii) *Flood control release schedule.* Marshall Ford will be regulated to reduce

flooding on the Colorado River below the dam. This plan of regulation will govern flood control releases from Marshall Ford Dam as follows:

(A) *Elevation 681–683.* If the reservoir level is forecast to rise above elevation 681 feet, m.s.l. (top of conservation pool) but not to exceed elevation 683 feet, m.s.l., the releases shall be increased to 3,000 c.f.s. and maintained until the reservoir level recedes to elevation 681 feet, m.s.l. These release rates may need to be reduced due to excessive downstream runoff to prevent exceeding the control stages specified in paragraph (a)(4)(i) of this section.

(B) *Elevation 683–685.* If the reservoir elevation is forecast to rise above elevation 683 feet, m.s.l. but not to exceed elevation 685 the releases shall be increased to 5,000 c.f.s. and maintained until the reservoir level recedes below 683 feet, m.s.l. These release rates may need to be reduced due to excessive downstream runoff to prevent exceeding the control stages specified in paragraph (a)(4)(i) of this section.

(C) *Elevation 685–691.* Seasonal. (*1*) During the months of January through April, July through August, and November through December: If the reservoir elevation is forecast to rise above elevation 685 feet, m.s.l. but not to exceed elevation 691, the releases shall be increased to 5,000 c.f.s. and maintained until the reservoir level recedes below 683 feet, m.s.l. These release rates may need to be reduced due to excessive downstream runoff to prevent exceeding the control stages specified in paragraph (a)(4)(i) of this section.

(*2*) During the months of May, June, September, and October: Should the reservoir elevation be forecast to exceed 685 feet, m.s.l. but not to exceed elevation 691 feet, m.s.l: Releases will be made at 30,000 c.f.s. from the project or at a rate such that, when combined with local inflows below the dam, will equal but not exceed downstream control stages on the Colorado River as specified in paragraph (a)(4)(i) of this section. These release rates will be maintained until the reservoir level falls below elevation 685 feet, m.s.l.

(D) *Elevation 691–710.* Should the reservoir elevation be forecast to exceed 691 feet, m.s.l. (the top of the joint use pool) but not to exceed elevation 710 feet, m.s.l: Releases will be made at 30,000 c.f.s. from the project or at a rate such that, when combined with local inflows below the dam, will equal but not exceed downstream control stages on the Colorado River as specified in paragraph (a)(4)(i) of this section. These release rates will be so controlled until the reservoir level falls below elevation 691 feet, m.s.l.

(E) *Elevation 710–714.* If the reservoir level is forecast to exceed 710 feet, m.s.l. but not to exceed elevation 714 feet, m.s.l: Releases will be made at 50,000 c.f.s. from the project or at a rate such that, when combined with local inflows below the dam, will equal but not exceed the downstream control stages on the Colorado River as specified in paragraph (a)(4)(i) of this section. These release rates will be maintained until the reservoir level falls below elevation 710 feet, m.s.l.

(F) *Elevation 714–722.* If the reservoir level is forecast to exceed 714 feet, m.s.l. but not to exceed 722 feet, m.s.l: Releases will be made at 90,000 c.f.s. from the project. Releases shall not exceed the associated peak flood reservoir inflow.

(G) *Elevation 722 and above.* If the reservoir level is forecast to exceed elevation 722 feet, m.s.l., the Bureau of Reclamation will schedule releases as required for the safety of the structure.

(iii) *Normal flood control regulation schedule.* The following table, Flood Control Regulation Schedule, summarizes the flood control releases schedule for given reservoir levels and river conditions:

MARSHALL FORD DAM AND RESERVOIR NORMAL FLOOD CONTROL REGULATION SCHEDULE

Condition	Reservoir level	Flood control release	Control points
Pool Rising	Forecast: 681–683[1]	3,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	Forecast: 683–685	5,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.

MARSHALL FORD DAM AND RESERVOIR NORMAL FLOOD CONTROL REGULATION SCHEDULE—Continued

Condition	Reservoir level	Flood control release	Control points
Do	Forecast: 685–691:.		
	(a) During January, February, March, April, July, August, November, December.	5,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
	(b) During May, June, September, October.	30,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	Forecast: 691–710	30,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	Forecast: 710–714	50,000 c.f.s	50,000 c.f.s. (24.8 ft.) at Austin. 50,000 c.f.s. (26.7 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	Forecast: 714–722[2]	90,000 c.f.s	No controls.
Do	Forecast: above 722	The Bureau of Reclamation will specify the releases for safety of the structure.	
Pool Falling	Above 722	.....do.	
Do	722–714[2]	90,000 c.f.s	No controls.
Do	714–710	50,000 c.f.s	50,000 c.f.s. (24.8 ft.) at Austin. 50,000 c.f.s. (26.7 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	710–691	30,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	691–685:	30,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin.
	(a) During May, June, September, October.		45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
	(b) During January, February, March, April, July, August, November, December.	5,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	685–683	5,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.
Do	683–681	3,000 c.f.s	30,000 c.f.s. (20.5 ft.) at Austin. 45,000 c.f.s. (25.1 ft.) at Bastrop. 50,000 c.f.s. (25.5 ft.) at Columbus.

[1] During flood conditions, when the reservoir level is below elevation 681 ft., m.s.l., the Corps of Engineers will provide recommendations to the Lower Colorado River Authority on flood control releases.
[2] Releases shall not exceed the associated peak flood reservoir inflow.

NOTE: No curtailment of normal hydroelectric turbine releases shall be required due to flood control operations.

(5) *Deviation from normal regulation.* (i) There are occasions when it is necessary or desirable to deviate from the water control plan for short periods of time as indicated in the following paragraphs:

(A) The water control plan is subject to temporary modification by the Corps of Engineers, if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the project owner and shall include justification for the action.

(B) The project owner may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same

day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Chief of Engineers, or his duly authorized representative.

(C) Advance approval of the Chief of Engineers, or this duly authorized representative, is required prior to any deviation from the plan of regulation prescribed or approved by the Corps of Engineers in the interest of flood control and/or navigation, except in emergency situations provided for in paragraph (a)(5)(i)(B) of this section. When conditions appear to warrant a prolonged deviation from the approved plan, the project owner and the Corps of Engineers will jointly investigate and evaluate the proposed deviation to insure that the overall intergrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigations and evaluations have been conducted to the extent deemed necessary by the Chief of Engineers, or his designated representative, to fully substantiate the deviations.

(ii) The Fort Worth District Corps of Engineers will serve as the LCRA contact point for any deviation from or modification of the water control plan. The communication network will be described in the Water Control Manual. The Fort Worth District will notify the Division Engineer, Southwestern Division, Corps of Engineers of any deviations or modifications of the water control plan and request his approval. The Division Engineer has been designated as the authorized representative of the Chief of Engineers in matters relating to projects within the Southwestern Division which are subject to provisions of Section 7 of the 1944 Flood Control Act.

(b) *Reports to the Corps of Engineers.* (1) The Authority shall furnish the District Engineer, Fort Worth District, U.S. Army Corps of Engineers, by 0900 hours daily, with the following:

(i) Project information.

(A) Lake elevations at midnight and 0800 hours.

(B) Uncontrolled spillway, flood-control conduits, and turbine releases: Cubic feet per second at 0800 hours, and day-second-feet average for the previous 24 hours, ending at midnight.

(C) Computed average inflow, in day-second-feet for the previous 24 hours, ending at midnight.

(D) Total precipitation in inches for the previous 24 hours at the dam, ending at 0800 hours.

(E) Summary of streamflow and channel conditions at gages named in paragraphs (a)(2) and (a)(4)(i) of this section.

(ii) Lake Buchanan Pool elevation at 0800 hours.

(2) Whenever flood conditions are imminent, or stages of 16 feet (20,000 c.f.s.) or more at the Austin gage have been reached, the Authority shall report at once to the District Engineer by the fastest means of communications available. Data listed in paragraph (b)(1) of this section shall be reported to, and at intervals prescribed by the District Engineer for the duration of flood surveillance and control operations.

(Sec. 7, Pub. L. 78-534, 58 Stat. 890 (33 U.S.C. 709))

[44 FR 24552, Apr. 26, 1979; 44 FR 29050, May 18, 1979]

§208.22 Twin Buttes Dam and Reservoir, Middle and South Concho Rivers, Tex.

The Bureau of Reclamation, or its designated agent, shall operate the Twin Buttes Dam and Reservoir in the interest of flood control as follows:

(a) Whenever the Twin Buttes Reservoir level is between elevations 1,940.2 (top of conservation pool) and elevation 1,969.1 (top of flood control pool) the flood control discharge facilities shall be operated under the direction of the District Engineer, Corps of Engineers, Department of the Army, in charge of the locality, so as to reduce as much as practicable the flood damage below the reservoir. All flood control releases shall be made in amounts which, when combined with releases from San Angelo Reservoir on the North Concho River and local inflow below the dam, will not produce flows in excess of bankful capacities on the South Concho and Concho Rivers downstream of the reservoir. In order to accomplish this purpose, flows shall not exceed a 22.5-foot stage (25,000 c.f.s.) on

Appendix B2
Agreement By and Between LCRA
and
Federal Emergency Management Agency

C120560

AGREEMENT BY AND BETWEEN

LOWER COLORADO RIVER AUTHORITY

AND

FEDERAL EMERGENCY MANAGEMENT AGENCY

This Agreement made by and between the Lower Colorado River Authority, an agency of the State of Texas, hereinafter called LCRA, and the Federal Emergency Management Agency, an agency of the Federal Government, hereinafter called FEMA.

WHEREAS, FEMA is statutorily charged with and has a direct interest in reducing flood losses in the United States;

WHEREAS, FEMA is statutorily charged with delineating the areas of the United States containing special flood hazards;

WHEREAS, FEMA has, pursuant to its statutory mandate, defined areas of special flood hazards as those areas subject to a one-percent chance of inundation in any given year (100-year frequency flood);

WHEREAS, significant areas of Burnet and Llano Counties, Texas, have been delineated by FEMA as containing special flood hazards;

WHEREAS, operation by LCRA of Buchanan, Roy Inks, Alvin Wirtz, and Max Starcke Dams on the Colorado River, Texas, licensed to LCRA under Certificates of Adjudication issued by the Texas Water Commission, in a manner consistent with the terms contained herein will render many of the areas presently designated as special flood hazard areas as no longer subject to a one-percent chance of flooding in any given year;

WHEREAS, in those areas removed by FEMA from the special flood hazard area designation, the federal requirements to purchase flood insurance and to develop so as to protect against the 100-year frequency flood will no longer apply thus leaving property owners in those areas vulnerable to the 100-year flood unless LCRA performs in a manner consistent with the terms contained herein;

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Now, therefore, the parties agree as follows:

1. To induce FEMA to enter into this agreement, LCRA has represented to FEMA that it will provide for the regulation of the flow of flood waters past Buchanan, Roy Inks, Alvin Wirtz, and Max Starcke Dams, on the Colorado River in Burnet and Llano Counties, Texas, by operating as follows:

   a. Lake Buchanan Operations Procedure

      i) Flood flows into Lake Buchanan will be estimated utilizing the USGS gage station Colorado River near San Saba (USGS Gage Number 08147000). These will be continuously monitored by LCRA's Hydrometeorological Data Acquisition System and verified by LCRA personnel observation.

      ii) Lake Buchanan will be maintained at or below elevation 1018.00 feet ngvd during the flood season (May through October). During all other months, the water surface elevation will be maintained at or below the top of the defined conservation pool (1020.35 feet ngvd).

      iii) During flood season, releases will be made under the following guidelines:

      <u>RISING LIMB OF HYDROGRAPH</u>

      Gaged Inflow<22,000 cfs Outflow<22,000 cfs
      Gaged Inflow>22,000 cfs Outflow=.85x(Gaged Inflow)

      <u>FALLING LIMB OF HYDROGRAPH</u>

      Outflow<=Maximum Outflow (until lake returns to the conservation pool)

      After gage inflows exceed 22,000 cfs, at no time later shall the peak release during the event exceed the instantaneous peak discharge of the inflow hydrograph.

      iv) The total number of 33'x15.5' gates open shall be limited to 20 unless the forecast elevation for the lake exceeds 1021.3 feet ngvd. Should higher elevation be forecast, additional gates will then be opened as necessary.

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b. Lake Inks Operations Procedure

i) As Inks Dam's primary discharge structure for a flood event is an uncontrolled spillway, no special operations apply.

c. Lake LBJ Operations Procedure

i) Flood flows into Lake LBJ will be estimated utilizing the USGS gage station Llano River at Llano (USGS Gage Number 08151500). These will be continuously monitored by LCRA's Hydrometeorological Data Acquisition System and verified by LCRA personnel observation.

ii) Lake LBJ will be maintained between 824.40 and 825.00 feet ngvd under normal operating conditions. When a potential exists for flood inflow, the lake will be maintained at elevation 824.70 feet ngvd. Thereafter, the lake will be maintained, as possible, between the elevations 822.00 and 825.00 feet ngvd.

iii) During passage of flood peaks equal to or smaller than the 100-year flood, the lake will not exceed elevation 828.00 feet ngvd.

d. Lake Marble Falls Operations Procedure

i) Lake Marble Falls will be maintained between 736.20 and 737.00 feet ngvd under normal operating conditions. When a potential exists for flood inflow, the lake will be maintained at elevation 736.20 feet ngvd. Thereafter, elevations will be maintained, as possible, below 737.00 feet ngvd.

2. LCRA shall continue to use this operating plan until modified by order of an appropriate regulatory agency. If a regulatory agency issues an order modifying this operating plan, FEMA will be notified and may, at the discretion of the Federal Insurance Administrator, modify the Flood Insurance Rate Maps for Burnet and Llano Counties, Texas, accordingly.

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3. In consideration of the obligations and duties undertaken by LCRA pursuant to the terms of Section 1 of this agreement and in exchange therefor, FEMA shall modify its Flood Insurance Rate Maps for Burnet and Llano Counties, Texas, and any successor maps to reflect the flood protection afforded by LCRA's regulation of Buchanan, Roy Inks, Alvin Wirtz, and Max Starcke Dams on the Colorado River Reservoir system set out in Section 1 of this agreement.

4. It is recognized by and between the parties hereto that the terms of the agreement have been bargained for and given in exchange and as inducement for each other.

In Witness Whereof, the parties have executed this instrument on the dates noted below.

Lower Colorado River Authority

By: _____ 3-8-90
Mark Rose BEW
Deputy General Manager
Date

Federal Emergency Management Agency

By: _____ 2-28-90
Harold T. Duryee
Federal Insurance Administrator
Date

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Appendix C
Order Approving LCRA's Water Management Plan
and
Amending Certificate of Adjudication
Nos. 14-5478 and 14-5482,
dated September 20, 1989

TEXAS WATER COMMISSION

IN RE: CONSIDERATION OF THE LOWER COLORADO RIVER AUTHORITY'S WATER MANAGEMENT PLAN AND AMENDMENTS TO CERTIFICATES OF ADJUDICATION NOS. 14-5478 AND 14-5482	$ $ $ $ $ $ $	BEFORE THE TEXAS WATER COMMISSION

ORDER APPROVING LOWER COLORADO RIVER AUTHORITY'S WATER MANAGEMENT PLAN AND AMENDING CERTIFICATES OF ADJUDICATION NOS. 14-5478 AND 14-5482

On the 7th day of September, 1989, the Texas Water Commission ("Commission") held a public hearing to consider the Lower Colorado River Authority's Water Management Plan and applications to amend Certificates of Adjudication Nos. 14-5478 and 14-5482. At the hearing, the following were named as parties: the Lower Colorado River Authority; the Texas Parks and Wildlife Department; the City of Austin; the Garwood Irrigation Company; the Sierra Club, Lone Star Chapter; the Texas Farm Bureau; the Matagorda County Water Council; Houston Lighting and Power Company as Project Manager for the South Texas Project; Clear, Clean Colorado River Association; Pierce Ranch; the Village of Lakeway; the Executive Director of the Texas Water Commission; and the Public Interest Counsel of the Texas Water Commission. Having considered the evidence and arguments presented, the Commission makes the following Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

1. Notice of the adjudicative public hearing was published on July 26, 1989, in the Blanco County News, Austin American-Statesman and the Colorado County Citizen, newspapers regularly published and generally circulated in Blanco, Travis and Colorado Counties, Texas, respectively; on July 27, 1989, in the San Saba News and Star, Llano News, Highlander and the Bay City Daily, newspapers regularly published and generally circulated in San Saba, Llano, Burnet, and Matagorda Counties, Texas, respectively; on July 28, 1989, in the Fayette County Record, a newspaper regularly published and generally circulated in Fayette County, Texas; on July 29, 1989, in the Wharton Journal-Spectator, a newspaper regularly published and generally circulated in Wharton County, Texas, and on July 31, 1989 in the Bastrop Advisor, a newspaper regularly published and generally circulated in Bastrop County, Texas, the only counties in which persons reside who may be affected by action taken as a result of the hearing. Said notice was published not less than thirty days before the date of the hearing.

2. On July 26, 1989, notice of the public hearing was sent by first-class mail to persons who may be affected by action taken as a result of the hearing and to each person as required by law.

3. The Lower Colorado River Authority (LCRA) is requesting approval of its Water Management Plan for the Lower Colorado River, Colorado River Basin in accordance with the Court's Final Judgment and Decree entered in Cause No. 115,414 A-1, 264th Judicial District, In Re: The Exceptions of the Lower Colorado River Authority and the City of Austin to the Adjudication of Water Rights in the Lower Colorado River Segment of the Colorado River Basin, and is further requesting approval of amendments to Certificates of Adjudication Nos. 14-5478 and 14-5482 to authorize LCRA to divert, release and use the water in Lakes Buchanan and Travis for additional beneficial uses including domestic, recreation, instream flow and bays/estuary purposes.

4. LCRA's Water Management Plan consists of two volumes. Volume I, Policies and Operations, describes the issues and conflicts in the demands on the Colorado River system and lays out the policies and management actions LCRA will use to accommodate the variety of demands on the system. Volume II, Technical Report, describes the models and data sources and the process used for the determination of the Combined Firm Yield and the Annual Rule Curve methodology. Volume II includes a set of Appendices consisting of the Court's Final Judgment and Decree, and the detailed data used to support the recommendations and conclusions discussed in Volumes I and II.

5. The Highland Lakes Reservoirs are operated by LCRA as a system for flood control and water supply. Mansfield Dam is the only structure with a dedicated flood pool and is operated during flooding according to flood-control regulations as published in the Code of Federal Regulations and under the supervision of the U.S. Corps of Engineers.

6. LCRA has a remote data acquisition system referred to as "Hydromet." The Hydromet allows for remote interrogation of a networked system of twenty-one self-reporting rainfall gages, twenty-two remotely monitored streamflow gages and six reservoir elevation gages. Twenty of the streamflow gages also gather rainfall information, giving a total of forty-one rainfall sites. The network is polled each hour, and all data is verified and stored in a real-time data base on a central computer system. Communications are a combination of microwave and UHF radio. The relational data provided by the Hydromet monitors flows above and below the lakes.

7. LCRA has a central computer system that is composed of two Digital Equipment Corporation MicroVAX II mini computers, one

of which is designated as an operations system located at the LCRA System Operations Control Center, and the other designated as a development system located at the Water Resources office. Real time data is logged and maintained on an on-line historical data base for one year. This is available for access by operations models, historical analyses, or other needs.

8. LCRA has developed several hydrologic models that are models used for routine operations of the system. Each model was developed to meet specific operational needs. The Daily Operations Model, analyzes the downstream inflow and demands by accessing streamflow data, totalling demands, and making multiple computer runs of the Model. The Flood Management Model is a user oriented operation tool which accesses real-time data and routes flood flows through the Highland Lakes. The Storage Projection Model uses historical inflow data to estimate the reliability of reservoir system storage subject to storage conditions and water demands.

9. The Daily Allocation Model will determine the extent to which releases from storage are diverted. It will perform a water balance every twenty-four hours at each river gage below Tom Miller Dam, and will allocate the natural flow of the river (whether or not it originated upstream or downstream of the lakes) to major water rights holders to the extent it is available. The remaining portion, if any, of each diversion is assumed to have been from water released from storage. Each amount is then totaled for the week, month and year to determine the total demand on storage.

10. Daily Operations are a joint effort between the System Operations Control Center (SOCC), Hydro Operations personnel located at the dams, and Water Operations personnel located at the Central Office complex. Water Operations personnel determine the required release by contacting downstream customers, operating the Daily Operations Model, and posting the daily release schedule. The SOCC then determines the optimum time and during the day to release the water based on the daily power peak demand, and orders the hydro generation units to begin and end at the necessary times. Hydro Operations personnel at each dam determine which unit to run at each dam.

11. The standard operating levels for the Highland Lakes are: Lake Buchanan, 1020.35 feet; Inks Lake, 887.30 +/- 0.4; Lake LBJ, 824.70 +/- 0.3; Lake Marble Falls, 736.60 +/- 0.4; Lake Travis, 681.00; and Lake Austin, 492.30 +/- 0.5. All levels are referenced to mean sea level.

12. The U. S. Corps of Engineers is evaluating potential flood damages to areas both upstream and downstream of Mansfield

Management Plan including, without limitation, any findings, conclusions and conditions contained in this Order that are also contained within the September 7, 1989 Order.

b. The Drought Management Plan shall be subject to the continuing right of supervision of the Commission, and the Commission, on its own motion, may reconsider any element of the plan at any time in the future.

c. LCRA's responsibility and authority under the Drought Management Plan is limited to operational control of the Highland Lakes and LCRA's facilities downstream, and is limited by the terms of this Order and the Commission's September 7, 1989 Order.

d. LCRA is required to pass all inflows to the Highland Lakes to the extent necessary to satisfy the demands of all downstream senior rights, and nothing in the Drought Management Plan or this order shall be construed to modify or impair this obligation.

e. LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1992, a report which documents compliance with the approved Drought Management Plan and any special conditions thereto during the previous year. Such report shall be in a form approved by the Executive Director.

f. After the instream study by LCRA and TPWD is completed, but in any event not later than March, 1992, LCRA shall submit an application to amend its Water Management Plan and its Drought Management Plan to reflect the results of the instream flow studies and the studies and evaluations referenced in Findings of Fact Nos. 73, 74, and 75 of the Commission's September 7, 1989 Order. Such application shall also propose conditions for implementing or cancelling the declaration of a drought to be worse than the drought of record. LCRA shall do all things necessary to ensure that such application is administratively and technically complete within six months of submission. The Commission agrees to hold a hearing within one year of the date of LCRA's submission to consider the amendments of the Plans, or if the studies are not complete, to determine why such studies are not complete.

and at Buchanan Dam. Additionally, public discussions during LCRA Board meetings were held in March, April and May 1989. LCRA formally adopted the Plan in May 1989.

21. LCRA's proposed Water Management Plan was filed with the Commission on July 7, 1989. The Commission acknowledged receipt of LCRA's proposed Plan on July 18, 1989.

22. LCRA's Water Management Plan has essentially four criteria. One is that the Highland Lakes and the Colorado River downstream will be managed together as a single system for downstream water supply purposes. The second is that the beneficial use of the water derived from inflows below the Highland Lakes will be maximized. The third is that LCRA will stretch and conserve the waters stored in the Highland Lakes and advance water quality. The fourth is that adequate flows will be provided to maintain, and where reasonably possible, improve, fish, wildlife, and recreation resources in the Lower Colorado River and to maintain a proper ecological environment and health of related living marine resources in the Lavaca-Tres Palacios Estuary, to the extent it is affected by the lower Colorado River watershed.

23. LCRA will follow five guidelines in implementing its Water Management Plan including:

    a. All demands for water from the Colorado River downstream of the Highland Lakes will be satisfied to the extent possible by run-of-river flows of the Colorado River;

    b. Inflows will be passed through the Highland Lakes to honor downstream senior water rights only when those rights cannot be satisfied by the flow in the river below the Highland Lakes;

    c. The firm, uninterruptible commitments of water from Lakes Travis and Buchanan will not exceed the Combined Firm Yield;

    d. Water from Lakes Travis and Buchanan will be available on an interruptible basis only as long as LCRA's ability to meet the demand for uninterruptible water is not impaired;

    e. Water shall not be released through any dam solely for hydroelectric generation, except during emergency shortages of electricity, and during other times that such releases will be needed for another beneficial purpose.

24. LCRA has the ability to constantly monitor the amount of water in the river available to meet demands through the Hydromet

System which should allow full utilization of the flows originating below Lake Travis prior to making any releases from storage or passing inflows through the reservoirs.

25. Under the Water Management Plan the four downstream irrigation operations (Gulf Coast, Lakeside, Garwood, and Pierce Ranch) will have first priority for the interruptible water in the annual allocation process. This priority will be set by establishing a Conservation Base for LCRA's two irrigation districts. LCRA intends to negotiate a contract which will include a Conservation Base acreage with Pierce Ranch. The Conservation Base acreage for Gulf Coast, Lakeside and Pierce Ranch was determined on the basis of a ten-year (1976-1985) historical average of actual production acreage. The allocation of water for these three users is based on a duty of 5.25 acre-feet of water per acre irrigated. The priority allocation and terms governing the interruption of supply of stored water for Garwood are based upon a contract between Garwood and LCRA. The 5.25 acre-foot-per-acre duty also applies to Garwood irrigated acreage. In the annual allocation process Lakeside has a priority to interruptible stored water in an amount necessary to firm up run-of-river rights to 136,500 acre-feet per year; Gulf Coast an amount necessary to firm up run-of-river rights to 194,250 acre-feet per year and Garwood an amount necessary to firm up run-of-river rights to 168,000 acre-feet per year.

26. When the federal allocation for the number of acres of rice that can be grown exceeds the Conservation Base acreage of Lakeside and Gulf Coast, then in that year LCRA will provide back up stored water for up to 28,300 acres at Lakeside and 42,800 acres at Gulf Coast. These limits represent the maximum number of acres served by each of the two divisions during the 10 year historic period that was used to establish the Conservation Base. For the Lakeside Division, any acreage over 25,000 and up to 28,300 can be served from an alternate source.

27. Lake levels follow an annual cycle--that of filling the conservation storage space in the winter and spring months of the year to be drawn down by larger water uses during the summer months.

28. Because these multiple purpose reservoirs were not constructed for recreational use, the demands for stability in the reservoir levels by recreation interests present conflicts which are extremely difficult to accommodate. If limits are to be placed on how far down the reservoirs' water levels are allowed to decline, a corresponding limitation on the amount of water that is available to supply the other demands on the reservoir system must also be agreed to.

29. To the extent that the annual analysis of the amount of water in storage reveals that there are interruptible water supplies available after meeting the demands of the irrigation operations, interruptible water may be held in the reservoirs to better ensure the security of supply or to maintain lake levels.

30. If additional sales of interruptible water exceed the Conservation Base amounts and the priority allocation for Garwood would draw the lakes below these minimum levels the LCRA Board will not declare any additional interruptible water available for sale in that year. Those levels are 660 feet msl for Lake Travis and 1012 feet msl for Lake Buchanan. LCRA is not guaranteeing minimum lake levels.

31. Another item to help keep the levels of Lakes Buchanan and Travis as high as possible is the agreement that no maintenance, except for emergencies, which would require the lowering of Lakes LBJ, Marble Falls, and Inks will be permitted if the refilling of those lakes would draw the levels of Lakes Travis and Buchanan below the minimum levels. Periodic lowering and refilling of Lake Austin will be done pursuant to the Settlement Agreement (December 10, 1988) between LCRA and the City of Austin.

32. Downstream recreation interests may be enhanced by LCRA's commitment to maintain minimum instream flows. LCRA will develop additional boat launches and recreation areas on the river through LCRA's 10-county district in order to give the public better access to the Colorado River.

33. Hydroelectric power plants located in each of the dams owned and operated by LCRA total 242 megawatts of capacity. Hydropower generally has been subordinated to be a by-product of the release of water for other purposes. LCRA retains the right to make releases solely for hydropower production in times of emergency as part of the Water Management Plan operating policies.

34. LCRA and Texas Parks and Wildlife Department (TPWD) have entered into a Memorandum of Understanding (MOU), wherein the LCRA and TPWD have agreed that LCRA's Water Management Plan would have a goal of maintaining, and where reasonably possible, improving fish, wildlife, and recreation resources in the Lower Colorado Watershed and of maintaining a proper ecological environment and health of related living marine resources in the Lavaca-Tres Palacios Estuary, to the extent that it is affected by that watershed. Some of the provisions addressed in the MOU have been included in LCRA's Water Management Plan.

35. LCRA and TPWD currently are studying the instream flow issue. These studies are scheduled for completion in March 1991.

36. Until the instream flow studies are complete, LCRA will commit to maintaining a minimum monthly mean flow of 200 cfs throughout the lower basin. This flow may, at times, be satisfied from inflows into the river channel and releases made by LCRA to satisfy the demands of downstream users. To assure that sufficient water will be available to satisfy this instream flow demand, LCRA has allocated 25,000 acre-feet of firm water supply to back up this demand on the system and the demand for inflows into the bays and estuaries.

37. Fresh water inflows are essential to maintenance of the productivity of the bays and estuaries. Preliminary data indicate that the amount of inflows needed for the Lavaca-Tres Palacios Estuary may represent the largest single demand on the system. TPWD and the Texas Water Development Board (TWDB) are currently studying the issue of how much fresh water is necessary to maintain the productivity of the bays and estuaries. The study is scheduled for completion by the end of 1989 with public review scheduled during 1990.

38. Until the bays and estuaries study is completed, LCRA has committed to a minimum monthly mean flow of 200 cfs, a minimum seasonal mean flow of 375 cfs, and a minimum annual flow of 272,121 acre-feet for the bays and estuaries. Measurements are to be made at the USGS gage at Bay City. This flow may at times be satisfied from inflows into the river channel, releases of stored water by LCRA for downstream uses and runoff or tailwaters from the rice irrigation operations. These flows will be backed up with 25,000 acre-feet of firm supply water which is also available for instream flow demands.

39. The Texas Water Development Board (TWDB) and the U.T. Bureau of Economic Geology are currently studying the Carrizo-Wilcox and Gulf Coast Aquifers. LCRA is studying the feasibility of the use of groundwater resources in conjunction with interruptible surface water supplies including the evaluation of artificial recharge of depleted aquifer storage space.

40. Under the existing LCRA <u>Water Pricing Policy</u> the rates for purchasing water must recover the costs associated with the Water Management Plan including necessary funds for water quality and conservation activities.

41. The water to be captured by the Stacy Reservoir are waters that otherwise would have flowed into Lake Buchanan. LCRA determined that the appropriate approach at this time was to calculate the firm yield of the Stacy reservoir separately

from the Highland Lakes, then add it back in, to give the total combined firm yield for Lakes Buchanan and Travis.

42. LCRA used a standard single reservoir operation model to determine the firm yield of the Stacy Reservoir. Inputs to the model included: inflow, net evaporation, monthly water demand distribution, and area/capacity curve for the reservoir.

43. LCRA used a multiple reservoir operations model to determine the combined firm yield of Lakes Buchanan and Travis. User defined local water demands were assumed at each of the reservoirs. Inputs to the model included: inflows, net evaporation, local water demands, monthly water demand distribution, minimum and maximum allowable contents, and area/capacity curves for each reservoir.

44. The period of 1941-1965 was used in the determination of the combined firm yield which includes the worst drought of record encountered.

45. Hydrologic data was related to reservoir inflow. The inflow that actually occurred in the record drought was adjusted to simulate a future time period. The monthly values of inflow to Lakes Buchanan and Travis for the period of January 1940 through December 31, 1972 provided to LCRA by TWC water availability model were adjusted. Under the approach used at this time by LCRA to determine the combined firm yield, the simulated operations of Stacy Reservoir did not pass flow to fulfill downstream senior run-of-the-river water rights.

46. LCRA determined how much water was necessary to satisfy daily water demands at a specific location to the extent that flow is available in the river at that point on that specific day. LCRA found that the average annual unsatisfied demand was 520,657 acre-feet; the maximum annual unsatisfied demand was 674,095 acre-feet; and minimum annual unsatisfied demand was 340,500 acre-feet.

47. LCRA determined that the firm yield of the Stacy Reservoir is 90,546 acre-feet. The combined firm yield of Lakes Buchanan and Travis without inflow from upstream of Stacy Reservoir is 445,266 acre-feet/year. Adding the firm yield of Stacy Reservoir results in the combined firm yield for Lakes Buchanan and Travis of 535,812 acre-feet/year which represents the maximum average annual demand that can be met by these two lakes during a repetition of the most critical drought of record on the lower Colorado River. The combined firm yield may also be expressed as a total of 2,679,060 acre-feet over any five consecutive calendar-year period.

48. LCRA developed a rule curve which defines the ability of Lakes Buchanan and Travis to meet annual demands in excess of the combined firm yield, while reserving an adequate supply to meet firm demands.

49. Starting with the reservoirs full, various demands ranging from .781 million acre-feet to 1.5 million acre-feet were placed on the system for the period. It was found that even at a demand of 1.5 million acre-feet per year 100% of the demand was met in 46% of the years; 75% of the demand was met in 63% of the years; and the amount of .781 million acre-feet was met in 80% of the years.

50. This annual rule curve is considered conservative to the degree that the effect of a critical short-term drought equal to or less severe than historical will be negligible only if total firm demands are less than the combined firm yield.

51. The annual operations rule curve will analyze projected annual demands and based on October 1 lake levels will guarantee the supply of water for firm demands and identify an annual amount of water which may be used for non-firm purposes. It will be modified as firm demands increase, and as hydrologic conditions change in the Colorado River Basin.

52. The operational rule curve will be applied to the system on a monthly basis to determine how the system is responding to current conditions as compared to historical operations. This will allow LCRA to optimize reservoir operations on a real time basis and to determine if adjustments to the amount of interruptible water are necessary. This monthly analysis will help LCRA detect early signs of drought and allow LCRA to timely develop and implement drought contingency measures.

53. The amount of water required to meet the firm demand within the system for the preceding year will be calculated in early October. This amount will be compared to the projections for that year, and any variations will be noted and documented. LCRA will solicit information and projections of use from all of its firm supply contract holders and other firm uses provided for by resolution of the LCRA Board. This information will be used to develop a projection of firm demands for the coming year.

54. LCRA will assess the contents of Lakes Travis and Buchanan as of October 1 to project the storage levels for January 1 of the next year. Inflows into Lakes Travis and Buchanan from the upstream tributaries will be added to this preliminary storage level based on the minimum annual inflow from the period of drought. This process will allow LCRA to reserve sufficient water in the system to meet all firm demands for one year beyond the year being considered for allocations.

Estimates for firm demand commitments for the next year will be subtracted from the total water supply available. The amount of water remaining will then be available for interruptible allocation for that year.

55. In October, LCRA will publish the results of the allocation process, notify the LCRA Board, firm contract holders, the Texas Parks & Wildlife Department and any existing or potential interruptible contract holders. During the October LCRA Board meeting information will be presented to the Board and discussed.

56. The recommended annual allocation plan will be published and LCRA will consider public comments and will take into account any significant water events that may have occurred up to the date of publication. The annual allocation plan will be submitted as a recommendation for LCRA Board approval in November of each year.

57. The portion of the combined firm yield that is not yet committed and the firm uninterruptible water that is committed but not yet being used increases the interruptible water that is available each year. The water that is captured and stored from flood flows also adds to the amount of interruptible water that is available. Over time, as the current contracts draw fully on their commitments and the remainder of the firm yield is contracted for, there will be less interruptible water available on an annual basis.

58. LCRA has committed the following amounts out of the combined firm yield amount:

    a. Stacy Reservoir - the maximum impact of Stacy Reservoir on the firm yield of Lakes Travis and Buchanan is an average of 90,546 acre-feet per year.

    b. City of Austin - LCRA has agreed to firm up or supplement Austin's independent water rights to the extent of 290,156 acre-feet per year. A commitment of an average of 148,300 acre-feet per year of stored water is necessary to meet this demand.

    c. Highland Lakes Water Sale Contracts - municipal and industrial contracts total 104,754 acre-feet per year.

    d. Cooling Water for LCRA Power Plants - LCRA Board Resolution of January 22, 1987 committed 15,000 acre-feet for Ferguson; 10,750 acre-feet for Sim Gideon and 38,101 acre-feet for Fayette Power Project for a total of 63,851 acre-feet per year.

e. South Texas Project (STP) - LCRA has a contract to supply industrial water to STP in an amount up to 102,000 acre-feet per year. The commitment is met first by run-of-river water, firmed-up by stored water from Lakes Buchanan and Travis. Simulated operations through the drought of record showed a demand for stored water in one year of 51,700 acre-feet. A commitment of an average of 5,680 acre-feet per year of stored water is necessary to meet this demand.

f. Instream Flows and Bay/Estuary Needs - LCRA is also committing (reserving) 25,000 acre-feet out of the combined firm yield to meet instream flows and bay and estuaries' needs.

59. LCRA is reserving 50,000 acre-feet of the remaining combined firm yield for future uses under LCRA's certificates of adjudication. This reservation will be until water supply and demand assessments for LCRA's 10-county district are completed or within three years whichever is sooner.

60. The uncommitted balance of the combined firm yield of Lakes Buchanan and Travis is 47,681 acre-feet per year.

61. LCRA is in the process of developing a drought management plan and will be submitting the plan to the Commission in 1990.

62. LCRA is conducting county-by-county assessments of alternative water supply sources. This data will be useful in the development of local drought management plans.

63. The goal of LCRA's conservation programs is to promote the development and application of practices and technologies that will improve water use efficiency, increase the beneficial re-use of water, and minimize the waste of water.

64. LCRA's water conservation programs are directed at the two largest users of water, irrigated agriculture and municipal.

65. LCRA's goal for conservation of water used by irrigated agriculture is to reduce agricultural demands for stored water from the Highland Lakes and reduce costs associated with the operation of LCRA-owned irrigation water delivery systems in Colorado, Wharton and Matagorda Counties.

66. LCRA's current irrigated agriculture conservation programs consist of activities aimed at improving the operating efficiency of irrigation water delivery systems and improving on-farm water use efficiency.

67. The major elements of the irrigation canal rehabilitation program include: improved operational control and management

of the system; vegetation removal and control; improved hydraulics characteristics of canals; installation of water control and measurement structures; and automation of water diversion facilities.

68. The irrigated canal rehabilitation program is expected to reduce water use by 30 percent within the Gulf Coast canal system. Preventive maintenance at Lakeside is expected to maintain canal efficiency.

69. The major elements of the on-farm water conservation program include: Direct support through funding and staff for the Cooperative Rice Water Management Research Program; assistance with the transfer of information from the research arena to the rice producer; conservation demonstrations such as the development and testing of an automated levee gate; and the inclusion of water conservation stipulations in LCRA's standard irrigation water sale contract.

70. Preliminary results indicate that on-farm water use can be reduced by 25 to 30 percent.

71. LCRA's municipal water conservation programs are directed towards implementation of urban water conservation and water re-use. Focus is towards encouraging and supporting local level initiatives by more than 300 public water utility systems within LCRA's statutory district.

72. The five major elements of LCRA's municipal water conservation programs are:

    a. Direct technical assistance with the development and implementation of local water conservation programs including public awareness and education; water efficiency standards and guidelines for new construction (e.g., plumbing fixture efficiency standards); retrofit programs to improve water efficiency in existing developments; conservation-oriented water rates and other economic incentives; low-water-use landscaping (i.e., Xeriscape); and water re-use and recycling.

    b. Distribution system audit and leak detection services for local water utilities serving fewer than 10,000 connections.

    c. Integration of water conservation and re-use measures, as appropriate, with other LCRA programs and projects including LCRA water sale contracts; water resource planning and demand forecasting; water and wastewater utility service studies, projects, and service agreements; water rate design; environmental programs; and energy conservation programs.

d. Public awareness and education on the water conservation opportunities, benefits, and measures. On-going activities include distribution of brochures, fact sheets, and videos on water conservation; media promotion (e.g., news articles, public service announcements, talk shows, etc.); presentations to civic and service organizations; and workshops, seminars, and special events.

e. Demonstrations of advanced water conservation and re-use technologies and low-water-use landscaping techniques.

73. LCRA will no later than December 31, 1991 reference and summarize existing information on point and nonpoint pollution sources and loading on the Colorado River including inputs of nutrients, metals, pesticides, oxygen demanding substances and other contaminants that may affect water quality, fish wildlife and recreation resources in accordance with the MOU with TPWD.

74. LCRA will no later than December 31, 1991 identify new data needed to determine the effect of water quality on revision of minimum flow schedule and as soon as reasonably possible will modify its existing monitoring programs or new programs to collect such new data.

75. LCRA is evaluating the potential problems associated with anoxic hypolimnetic releases from reservoirs and the potential for related fish kills due to resulting low dissolved oxygen levels downstream. LCRA will no later than December 31, 1991 reference and summarize this evaluation.

76. LCRA has also applied to the Commission for an amendment to the Certificates of Adjudication Nos. 14-5478 and 14-5482 relating to Lakes Buchanan and Travis.

77. Certificates of Adjudication Nos. 14-5478 (Lake Buchanan) and 14-5482 (Lake Travis) authorize LCRA to divert and use water from Lakes Buchanan and Travis for municipal, industrial, irrigation and mining purposes. LCRA is authorized to use the water impounded in Lakes Buchanan and Travis for recreation purposes with no right of diversion or release. LCRA is authorized to use the bed and banks of the Colorado River, below Lakes Buchanan and Travis to convey water released from Lakes Buchanan and Travis for use by LCRA or others entitled to use such water in the amounts and for the purposes authorized in the Certificates. LCRA is also authorized to divert and use water through Buchanan Dam and Mansfield Dam for the purpose of hydroelectric power generation.

78. The Water Management Plan submitted by LCRA to the Commission for its consideration includes proposed reservoir operating

procedures whereby LCRA will divert or release waters stored in Lakes Buchanan and Travis for several additional purposes of use including domestic, recreation, instream flow and bays/estuary purposes.

79. In order to manage Lakes Buchanan and Travis as proposed in the Water Management Plan, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482 need to be amended to authorize LCRA to divert, release and use the water in Lakes Buchanan and Travis for additional beneficial uses including domestic, recreation, instream flow and bay/estuary purposes.

80. As part of these amendments, LCRA is not requesting an additional amount of water. The proposed amendments will not result in an additional consumptive use of state water.

81. A "firm" demand is a contractual obligation or other commitment of LCRA's which must be met 100% of the time through the drought of record. Total firm demands will need to be less than or equal to the combined firm yield to be protected throughout recurrence of the drought of record.

82. Interruptible or "nonfirm" demands are LCRA's contractual obligations or other commitments for stored water which contractually do not have to be met 100% of the time. They will be met to the extent additional water is available each year after firm demands are satisfied.

83. LCRA has formally adopted standard water sale contract forms, and procedures and rules for administering water sale contracts. Existing contracts are written for firm supply of water, subject only to the general laws of availability. A second standard form contract for interruptible supply is presently being developed.

84. LCRA currently has no contracts upstream from the Highland Lakes, except those with upstream reservoirs with junior rights to the Highland Lakes which are more or less operation agreements.

85. Existing upstream operating agreements should be considered firm contracts, and their effect on the combined firm yield should be quantified as was Stacy Reservoir's effect.

86. Junior rights senior to November 1, 1987, will be honored as required by the Court's Judgment and Decree with interruptible supplies. Their diversions will be allocated similar to downstream senior rights.

87. A report which documents LCRA's compliance with the Water Management Plan during the previous year will contain information regarding the adequacy of the hydrologic and

hydraulic data monitoring system as to intensity and accuracy; accuracy of reported or monitored activities; adequacy of the operating rule curve and the adequacy of the daily allocation model and any additional information the Executive Director may request.

88. Under the approach used by LCRA at this time, the combined firm yield of Lakes Buchanan & Travis is 535,812 acre-feet/year. This amount may also be expressed as an average of a total of 2,679,060 acre-feet per year over any five consecutive calendar-year period.

89. LCRA's proposed Water Management Plan does not presently propose any new projects taking, storing or diverting water in excess of 5,000 acre-feet per year.

90. The use of an operational rule curve, as developed by LCRA, is an acceptable approach to insure utilization of the lakes' storage while at the same time guaranteeing that firm demands will be met dependably year after year.

91. LCRA's procedures and guidelines for the allocation of firm water and interruptible water supplies are acceptable, with the understanding that the allocation procedures may be amended at a later time to reflect the results of the instream flow and bay/estuary studies; provided, however, that the Commission shall retain jurisdiction to resolve all disputes regarding allocation of stored water that may arise in the future.

92. LCRA's initiatives regarding point and non-point sources of pollution are commendable.

93. The priorities in LCRA's Water Management Plan for interruptible water are subject to changes after the completion of the studies on the instream flows and bays/estuaries.

94. LCRA's proposed system operations under LCRA's Water Management Plan are consistent with the special conditions set forth in the Court's Final Judgment and Decree regarding LCRA's rights to use the waters of Lakes Buchanan and Travis.

CONCLUSIONS OF LAW

1. The public hearing was held under the authority and in accordance with Chapter 11 of the Texas Water Code, as amended and the Texas Water Commission Permanent Rules.

2. The Texas Water Commission has jurisdiction to consider LCRA's proposed Water Management Plan and applications to amend its Certificates of Adjudication.

3. LCRA's proposed Water Management Plan recognizes the necessity of beneficial inflows from the Colorado River into the Lavaca-Tres Palacios Estuary consistent with Section 11.147 of the Texas Water Code.

4. LCRA's proposed Water Management Plan recognizes the necessity of providing for the protection of fish and wildlife habitats and the water quality of the river as required by Section 11.147 of the Texas Water Code.

5. LCRA's proposed Water Management Plan recognizes the Commission's statutory authority to require water conservation and provides for water conservation consistent with Section 11.134(b)(4) of the Texas Water Code.

6. LCRA's applications to amend its Certificates of Adjudication Nos. 14-5478 and 14-5482 authorizing LCRA to use the waters of Lakes Buchanan and Travis for additional beneficial purposes do not contemplate an additional consumptive use of state water or an increased rate or period of diversion.

7. In order to effectuate the policies of this State relating to the conservation and best utilization of the water resources of this State as set forth in Chapter 11 of the Texas Water Code, LCRA's proposed Water Management Plan should be approved and LCRA's applications to amend Certificates of Adjudication Nos. 14-5478 and 14-5482 should be granted.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS WATER COMMISSION THAT:

1. LCRA's proposed Water Management Plan is approved with the following conditions:

   a. The Water Management Plan shall be subject to the continuing right of supervision of the Commission, and the Commission, on its own motion, may reconsider any element of the plan at any time in the future.

   b. LCRA's responsibility and authority under the Water Management Plan is limited to operational control of the Highland Lakes and LCRA's facilities downstream, and is limited by the terms of this Order.

   c. LCRA's responsibility and authority under the Water Management Plan is subject to and shall not conflict with the authority of any watermaster operation the Commission may establish on the Colorado River.

   d. LCRA shall make available to the Commission all real-time, historical or allocated streamflow data collected by LCRA.

e. LCRA shall supply interruptible water, in accordance with the provisions and conditions specified in the Final Judgement and Decree, to any downstream water right with a priority date junior to December 1, 1900 and senior to November 1, 1987 that authorizes the diversion of not more than 3000 acre-feet of water per year. Priority shall be given to these water rights in the same manner that LCRA allocates water to the major irrigation operations downstream (Lakeside, Gulf Coast, Garwood and Pierce Ranch).

f. All sales, agreements or LCRA Board commitments for the use of water in or from the Highland Lakes shall be submitted to the Commission within 45 days of the effective date of the document.

g. LCRA shall submit a drought contingency plan within one year from the date the Commission signs this order approving the Water Management Plan. Such plan shall be subject to the review and approval of the Commission.

h. LCRA shall allocate 25,000 acre-feet per annum of its firm water supply to supplement and maintain a minimum monthly mean flow of 200 cfs throughout the lower Colorado River measured at the USGS gage at Bastrop for instream flow purposes and a minimum monthly mean flow of 200 cfs, a minimum seasonal mean flow of 375 cfs and a minimum annual flow of 272,121 acre-feet measured at the USGS gage at Bay City for freshwater inflow to the Lavaca-Tres Palacios estuarine system.

i. Prior to any diversion of surface water for recharge purposes, LCRA shall obtain the necessary authorizations from the Commission.

j. LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1990, a report which documents compliance with the approved Water Management Plan and any special conditions thereto during the previous year. Such report shall be in a form approved by the Executive Director.

k. After the instream study by LCRA and TPWD is completed, but in any event no later than March, 1992, LCRA will submit an application to amend its Water Management Plan to reflect the results of the instream flow studies and the studies and evaluations referenced in Findings of fact #73, 74, & 75 above. LCRA shall do all things necessary to ensure that such application is administratively and technically complete within 6 months of submission. The Commission agrees to hold a hearing within one year of the date of LCRA's submission to

consider the amendments of the Plan, or, if the studies are not complete, to determine why such studies are not complete.

l. After completion of the TWDB and TPWD study on freshwater inflows into the bays and estuaries, as applicable to the Lavaca-Tres Palacios Estuary, and in any event no later than March, 1993, LCRA will submit an application to amend its Water Management Plan to reflect the results of the bays/estuary study. LCRA shall do all things necessary to ensure that such application is administratively and technically complete within 6 months of submission. The Commission agrees to hold a hearing within one year of the date of LCRA's submission to consider the amendments of the Plan, or, if the studies are not complete, to determine why such studies are not complete.

m. The combined firm yield as found by the Commission in this Order is subject to adjustment and refinement from time to time as additional studies and simulations are developed that more accurately reflect assumptions and operations as required by law.

n. The Commission retains jurisdiction to resolve any and all disputes regarding the allocation of stored water from Lakes Travis and Buchanan, notwithstanding the procedures and guidelines set forth in the Water Management Plan.

2. LCRA's applications to amend Certificates of Adjudication Nos. 14-5478 and 14-5482 are granted with the following conditions:

a. LCRA's certificates of adjudication shall reflect the combined annual firm yield of Lakes Travis and Buchanan to be as found by the Commission in this Order, and as may be modified by the Commission from time to time.

b. For purposes of perfection, LCRA's authorization to divert, release or use water for recreation purposes is limited to that quantity of water actually sold for that purpose whether used in, or released, or diverted from Lakes Buchanan and Travis.

3. The Chief Clerk of the Texas Water Commission forward a copy of this Order, subject to the filing of motions for rehearing, to all parties.

4. If any provision, sentence, clause or phrase of this Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remaining portions of the Order.

5. Nothing in the Water Management Plan or this Order shall be construed to impair, or to authorize LCRA or any other person or entity to impair, senior or superior water rights in the Colorado River Basin.

Signed this 20th day of September, 1989.

TEXAS WATER COMMISSION

Buck J. Wynne, III, Chairman

(SEAL)

Brenda W. Foster, Chief Clerk

Appendix D
Order Approving LCRA's Drought Management Plan, dated December 23, 1991

TEXAS WATER COMMISSION

THE STATE OF TEXAS
COUNTY OF TRAVIS
I certify that this is a true and correct copy of a Texas Water Commission document, the original of which is filed in the permanent records of the Commission.
Given under my hand and the seal of office on JAN 6 1992
Gloria A. Vasquez, Chief Clerk
Texas Water Commission

CONSIDERATION OF THE	§	BEFORE THE
LOWER COLORADO RIVER	§	TEXAS WATER COMMISSION
AUTHORITY'S DROUGHT	§	
MANAGEMENT PLAN	§	

ORDER APPROVING LOWER COLORADO
RIVER AUTHORITY'S DROUGHT MANAGEMENT PLAN

On the 18th day of December, 1991, the Texas Water Commission ("Commission") held a public hearing to consider the Lower Colorado River Authority's ("LCRA") proposed Drought Management Plan. At the hearing, the following were named as parties: the Lower Colorado River Authority; the Texas Parks and Wildlife Department ("TPWD"); the City of Austin; Garwood Irrigation Company; the Sierra Club, Lone Star Chapter; the Matagorda County Water Council; Houston Lighting and Power Company as Project Manager for the South Texas Project; the Executive Director of the Texas Water Commission; and the Public Interest Counsel of the Texas Water Commission. Having considered the proposed agreed order of the parties, the Commission makes the following Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

1. Notice of the public hearing was published on October 10, 1991 in the Blanco County Record Courier, a newspaper regularly published and generally circulated in Blanco County, Texas; October 9, 1991 in the Austin American-Statesman, a newspaper regularly published and generally circulated in Travis County, Texas; on October 9, 1991 in the Colorado County Citizen, a newspaper regularly published and generally circulated in Colorado County, Texas; on October 10, 1991 in the San Saba News and Star, a newspaper regularly published and generally circulated in San Saba County, Texas; on October 10, 1991 in the Llano News, a newspaper regularly published and generally circulated in Llano County, Texas; on October 10, 1991 in the Highlander, a newspaper regularly published and generally circulated in Burnet County, Texas; on October 10, 1991 in the Bay City Daily Tribune, a newspaper regularly published and generally circulated in Matagorda County, Texas; on October 8, 1991 in the Fayette County Record, a newspaper regularly published and generally circulated in Fayetta County, Texas; on October 5, 1991 in the El Campo Leader-News, a newspaper regularly published and generally circulated in Wharton County, Texas; and on October 7, 1991 in the Bastrop Advertiser, a newspaper regularly published and generally circulated in Bastrop County, Texas. These ten counties are

the only counties in which persons reside who may be affected by action taken as result of the hearing. Said notice was published not less than thirty (30) days before the date of the hearing.

2. On September 26, 1991, notice of the public hearing was sent by first-class mail to persons who may be affected by action taken as a result of the hearing and to each person as required by law.

3. LCRA is requesting approval of its Drought Management Plan for the Lower Colorado River, Colorado River Basin, in accordance with the Commission's September 7, 1989 Order approving LCRA's Water Management Plan and amending Certificates of Adjudication Nos. 14-5478 and 14-5482. LCRA's Water Management Plan was developed and submitted by LCRA in accordance with the Final Judgment and Decree entered by the court in Cause No. 115,414 A-1, 264th Judicial District, In Re: The Exceptions of the Lower Colorado River Authority and the City of Austin to the Adjudication of Water Rights in the Lower Colorado River Segment of the Colorado River Basin.

4. LCRA's proposed Drought Management Plan was filed with the Commission on October 19, 1990.

5. LCRA's procedures and guidelines set forth in the Water Management Plan and the Drought Management Plan for the allocation of firm water and interruptible water supplies are acceptable as conditioned by the provisions of this Agreed Order and with the understanding that the allocation procedures may be amended by the Commission at a later time for any justifiable reason including, but not limited to, an amendment to reflect the results of the instream flow and bay and estuary studies; provided, however, that the Commission shall retain jurisdiction to resolve all disputes regarding allocation of stored water that may arise in the future.

6. The priorities in LCRA's Water Management Plan and Drought Management Plan for interruptible water are subject to change after the completion of the studies on the instream flows and bays and estuaries required by conditions (k) and (l) of the September 7, 1989 Order.

7. Because of the water-availability and water-demand conditions that presently exist, it appears that 25,000 acre-feet of stored water per year probably will be adequate in the near future to firm up the minimum flows for instream flows and bays and estuaries set forth in condition (h) of the Commission's September 7, 1989 Order. Pursuant to conditions (k) and (l) of the Commission's September 7, 1989 Order, LCRA is required to submit applications to amend the Water Management Plan and the Drought Management Plan following completion of studies on instream flows and bays and estuaries

required by March 1992, and March 1993, respectively. Accordingly, it is unnecessary for the Commission to determine at this time whether the Commission, by its September 7, 1989 Order or otherwise, intended to give LCRA the authority or impose upon it the obligation to release more than 25,000 acre-feet of stored water in any one year to firm up those minimum flows.

8. Based on available studies and information, it is uncertain whether LCRA's proposed plan to begin curtailment of interruptible stored water supplies at a January 1 trigger level of 1.4 million acre-feet of water in storage is appropriate, in that it may provide more protection to firm supplies of stored water than is necessary. However, because of the water-availability and water-demand conditions that presently exist, it is likely that such level will not be reached in the near future. Accordingly, it is unnecessary for the Commission to determine at this time whether, or to what extent, such trigger level provides more protection to firm supplies than is necessary.

9. LCRA asserts that nothing in the Drought Management Plan should be construed to modify or impair in any way any contractual obligation of LCRA to supply water.

CONCLUSIONS OF LAW

1. The public hearing was held under the authority and in accordance with Chapter 11 of the Texas Water Code, as amended and the Texas Water Commission Permanent Rules.

2. The Texas Water Commission has jurisdiction to consider and take action on LCRA's proposed Drought Management Plan.

3. It is unnecessary at this time to determine whether the Commission, by its September 7, 1989 Order or otherwise intended to give LCRA the authority or impose upon it the obligation to release more than 25,000 acre-feet of stored water in any one year for instream flows and bays and estuaries. By approving the Drought Management Plan and entering this Order, the Commission specifically is not deciding these issues.

NOW, THEREFORE, BE IT ORDERED BY HE TEXAS WATER COMMISSION THAT:

1. LCRA's proposed Drought Management Plan is approved with the following conditions:

   a. LCRA's Drought Management Plan is subject to LCRA's Water Management Plan and all findings, conclusions and conditions contained within the Commission's September 7, 1989 Order approving the Water

Management Plan including, without limitation, any findings, conclusions and conditions contained in this Order that are also contained within the September 7, 1989 Order.

b. The Drought Management Plan shall be subject to the continuing right of supervision of the Commission, and the Commission, on its own motion, may reconsider any element of the plan at any time in the future.

c. LCRA's responsibility and authority under the Drought Management Plan is limited to operational control of the Highland Lakes and LCRA's facilities downstream, and is limited by the terms of this Order and the Commission's September 7, 1989 Order.

d. LCRA is required to pass all inflows to the Highland Lakes to the extent necessary to satisfy the demands of all downstream senior rights, and nothing in the Drought Management Plan or this order shall be construed to modify or impair this obligation.

e. LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1992, a report which documents compliance with the approved Drought Management Plan and any special conditions thereto during the previous year. Such report shall be in a form approved by the Executive Director.

f. After the instream study by LCRA and TPWD is completed, but in any event not later than March, 1992, LCRA shall submit an application to amend its Water Management Plan and its Drought Management Plan to reflect the results of the instream flow studies and the studies and evaluations referenced in Findings of Fact Nos. 73, 74, and 75 of the Commission's September 7, 1989 Order. Such application shall also propose conditions for implementing or cancelling the declaration of a drought to be worse than the drought of record. LCRA shall do all things necessary to ensure that such application is administratively and technically complete within six months of submission. The Commission agrees to hold a hearing within one year of the date of LCRA's submission to consider the amendments of the Plans, or if the studies are not complete, to determine why such studies are not complete.

g. After completion of the Texas Water Development Board ("TWDB") and TPWD study on freshwater inflows into the bays and estuaries, as applicable to the Lavaca-Tres Palacios Estuary, and in any event not later than March, 1993, LCRA shall submit an application to amend its Water Management Plan and its Drought Management Plan to reflect the results of the bays/estuary study. LCRA shall do all things necessary to ensure that such application is administratively and technically complete within six months of submission. The Commission agrees to hold a hearing within one year of the date of LCRA's submission to consider the amendments of the Plans, or, if the studies are not complete, to determine why such studies are not complete.

h. The combined firm yield as found by the Commission in Finding of Fact No. 47 of its September 7, 1989 Order is subject to adjustment and refinement from time to time as additional studies and simulations are developed that more accurately reflect assumptions and operations as required by law.

i. LCRA's proposed plan to begin curtailment of interruptible stored water at a January 1 trigger level of 1.4 million acre-feet of water in storage, and other aspects of LCRA's proposed curtailment plan, are subject to adjustment from time to time as additional studies and simulations may be developed that more accurately address the need to curtail interruptible supplies.

j. The Commission retains jurisdiction to resolve any and all disputes regarding the allocation of stored water from Lakes Travis and Buchanan, notwithstanding the procedures and guidelines set forth in the Water Management Plan and/or the Drought Management Plan.

2. The Chief Clerk of the Texas Water Commission shall forward a copy of this Order subject to the filing of motions for rehearing, to all parties.

3. If any provision, sentence, clause or phrase of this Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remaining portions of the Order.

4. Nothing in the Drought Management Plan or this Order shall be construed to impair, or to authorize LCRA or any other person or entity to impair, senior or superior water rights in the Colorado River Basin.

Issued: DEC 2 3 1991

TEXAS WATER COMMISSION

John Hall, Chairman

ATTEST:

Gloria A. Vasquez, Chief Clerk

Appendix E
Agreed Order Approving Amendments
to
LCRA's Water Management and Drought Management Plan, dated December 18, 1992

THE STATE OF TEXAS
COUNTY OF TRAVIS

TEXAS WATER COMMISSION

I hereby certify that this is a true and correct copy of a Texas Water Commission document which is filed in the permanent records of the Commission.
Given under my hand and the seal of office on

JAN 11 '99

Gloria A. Vasquez, Chief Clerk
Texas Water Commission

CONSIDERATION OF THE LOWER COLORADO RIVER AUTHORITY'S APPLICATION TO AMEND ITS WATER MANAGEMENT PLAN AND DROUGHT MANAGEMENT PLAN	§ § § §	BEFORE THE TEXAS WATER COMMISSION

AGREED ORDER APPROVING AMENDMENTS TO LOWER COLORADO RIVER AUTHORITY'S WATER MANAGEMENT PLAN AND DROUGHT MANAGEMENT PLAN

On the 2nd day of December, 1992, the Texas Water Commission ("Commission") considered the Lower Colorado River Authority's ("LCRA") application to amend its Water Management Plan and Drought Management Plan, and having heard evidence and arguments concerning the proposed order, the Commission makes the following Findings of Fact and Conclusions of Law:

Findings of Fact

1) Notice of the public hearing was published on September 3, 1992, in the Johnson City Record-Courier, a newspaper regularly published and generally circulated in Blanco County, Texas; on August 23, 1992 in the Austin American-Statesman, a newspaper regularly published and generally circulated in Travis County, Texas; on August 26, 1992 in the Colorado County Citizen, a newspaper regularly published and generally circulated in Colorado County, Texas; on August 27, 1992 in the San Saba News & Star, a newspaper regularly published and generally circulated in San Saba County, Texas; on September 3, 1992 in the Llano News, a newspaper regularly published and generally circulated in Llano County, Texas; on August 27, 1992 in the Marble Falls Highlander, a newspaper regularly published and generally circulated in Burnet County, Texas; on

August 25, 1992 in the Bay City Daily Tribune, a newspaper regularly published and generally circulated in Matagorda County, Texas; on August 25, 1992 in the Fayette County Record, a newspaper regularly published and generally circulated in Fayette County, Texas; on August 22, 1992 in the El Campo Leader-News, a newspaper regularly published and generally circulated in Wharton County, Texas; and on August 27, 1992 in the Bastrop Advertiser, a newspaper regularly published and generally circulated in Bastrop County, Texas. These ten counties are the only counties in which persons reside who may be affected by action taken as a result of the hearing. Said notice was published not less than thirty (30) days before the date of the hearing.

2) On August 11, 1992, notice of the public hearing was sent by first-class mail to persons who may be affected by action taken as a result of the hearing and to each person as required by law.

3) LCRA's Application to Amend its Water Management Plan and Drought Management Plan ("Application") was received by the Commission on May 29, 1992 and July 15, 1992.

4) LCRA's Application was accepted by the Commission as administratively complete on July 23, 1992.

5) The Lake Travis Chamber of Commerce requested LCRA to amend its Water Management Plan to change the trigger level of Lake Travis from 660 feet msl to 667 feet msl; to limit new interruptible water contracts to the volume of water saved in the rice irrigation conservation program; and to revise the description of the lake's economy.

6) In response to the request by the Lake Travis Chamber of Commerce, LCRA proposes to amend the Water Management Plan to

eliminate the trigger levels of 660 feet msl for Lake Travis and 1012 feet msl for Lake Buchanan; to limit sales of interruptible stored water, other than for the four major irrigation districts' Conservation Base or Priority Allocation acreage, based on the projected volume of water in Lakes Buchanan and Travis as of January 1, of each year. No such sales would occur if either lake is less than 94% of its maximum conservation capacity. If both lakes are projected to be at their maximum conservation capacity on January 1, then such interruptible water sales would be limited to a total of 80,000 acre-feet for that year. For projected lake volumes between 94% and 100% of the conservation capacity, such interruptible water sales would be limited proportionately, based on the storage reservoir with the lowest projected percentage of capacity on January 1. LCRA also proposes to increase the Conservation Base acreage for the Gulf Coast Irrigation Division from 37,000 acres to 50,000 acres and set the Priority Allocation acreage for Pierce Ranch at 10,476 acres.

7) LCRA's Drought Management Plan presently allows for the cancellation of curtailments of interruptible stored water to the four major irrigation districts if the combined storage of Lakes Buchanan and Travis is at least 1.4 million acre-feet on July 1.

8) LCRA proposes to amend LCRA's Drought Management Plan to provide that curtailment of interruptible stored water for the four major irrigation districts may be cancelled at any time during the year prior to July 31. The criteria for cancelling the curtailments is that the combined storage of Lakes Buchanan and Travis is projected to be equal to or greater than 1.4 million acre-feet of water anytime in July.

9) LCRA's Water Management Plan presently allows LCRA to reserve 50,000 acre-feet of the remaining combined firm yield of Lakes Buchanan and Travis for future uses under LCRA's certificates of adjudication. This reservation will be until water supply and demand assessments for LCRA's 10-county statutory district are completed or within three years, whichever is sooner.

10) LCRA has completed the water supply and demand assessments for its 10-county statutory district. The results of these studies indicate new surface water demands of approximately 39,000 acre-feet annually by the year 2013.

11) LCRA is presently in the process of updating these water supply and demand assessments to include the results of the 1990 federal census. To allow LCRA additional time to complete such updated assessments, it is reasonable to allow LCRA to continue to reserve 50,000 acre-feet of the remaining combined firm yield of Lakes Buchanan and Travis for future uses under its certificate of adjudication, through December 31, 1993.

12) The Commission's September 7, 1989 Order approving LCRA's Water Management Plan, directed LCRA in accordance with Findings of Fact No. 73, 74, and 75, to reference and summarize information on point and non-point pollution sources and loading on the Colorado River, identify new data needed to determine water quality effects on revision of the minimum flow schedule, and evaluate potential problems associated with anoxic hypolimnetic releases from reservoirs and the potential for related fish kills due to resulting low dissolved oxygen levels downstream. LCRA has completed these studies and evaluations. The instream flow schedule set forth in this Agreed Order was developed in response to those studies and evaluations.

13) The Commission's December 23, 1991 Order approving LCRA's Drought Management Plan directed LCRA to propose conditions for implementing and cancelling a declaration of a drought worse than the drought of record.

14) LCRA proposes that its Drought Management Plan be amended to provide that the LCRA Board of Directors will declare a drought worse than the drought of record when the following three conditions are simultaneously met:

(a) drought at least 36 consecutive months (36 months since both Lakes Buchanan and Travis were last full); and

(b) the cumulative inflow deficit since the beginning of the drought exceeds the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; and

(c) the combined storage of Lakes Buchanan and Travis is less than 600,000 acre-feet.

The LCRA Board of Directors will cancel such a declaration if any of the following conditions are met:

(d) the cumulative inflow deficit since the beginning of the drought is less than the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; or

(e) the combined storage in Lakes Buchanan and Travis is greater than 1.4 million acre-feet of water.

15) LCRA and TPWD have completed their instream flow needs study for the lower Colorado River. Based upon this study LCRA proposes that LCRA's Water Management Plan and Drought Management Plan be amended as follows:

(a) LCRA's existing commitment of 25,000 acre-feet of firm yield water supply, to supplement and maintain instream flows, be increased to an average of 31,800 acre-feet annually during any 10 consecutive year period.

(b) LCRA will maintain the daily river flows below the City of Austin's Longhorn Dam at no less than the subsistence/critical flows in all years.

(c) When the combined storage of Lakes Buchanan and Travis is projected to be above 1.4 million acre-feet of water on January 1, or if interruptible stored water curtailments are cancelled, LCRA will maintain during that calendar year or portion thereof target flows to the extent of inflows each day to the Highland Lakes as measured by upstream gages.

(d) Interruptible water contracts will be totally cutoff when the minimum January 1 storage of Lakes Buchanan and Travis is at or below 325,000 acre-feet of water.

16) The schedule of instream flows for the Colorado River downstream of the City of Austin's Longhorn Dam is as follows:

	Subsistence/ Critical Flows (cfs)		Target Flows (cfs)		
Month	Austin	Bastrop	Bastrop	Eagle Lake	Egypt
January	46[c]	120	370	300	240
February	46[c]	120	430	340	280
March	46[c]	500[b]	560	500[a]	360
April	46[c]	500[b]	600	500[a]	390
May	46[c]	500[b]	1030	820	670
June	46[c]	120	830	660	540
July	46[c]	120	370	300	240
August	46[c]	120	240	200	160
September	46[c]	120	400	320	260
October	46[c]	120	470	380	310
November	46[c]	120	370	290	240
December	46[c]	120	340	270	220

[a] Since target flow at Eagle Lake (based on overall community habitat availability) were insufficient to meet Blue Sucker (Cycleptus elongatus) spawning requirements during March and April target flows were superseded by critical flow recommendations for this reach.

[b] This flow should be maintained for a continuous period of not less than six weeks during these months. A flow of 120 cfs will be maintained on all days not within the six week period.

[c] LCRA will maintain a mean daily flow of 100 cfs at the Austin gage at all times, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, until the combined storage of Lakes Buchanan and Travis reaches 1.4 million acre-feet of water. A mean daily flow of 75 cfs, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, will

then be maintained until the combined storage of Lakes Buchanan and Travis reaches 1.0 million acre-feet of water. When the combined storage of Lakes Buchanan and Travis is reduced below 1.0 million acre-feet of water, then a subsistence/critical flow of 46 cfs will be maintained at all times regardless of inflows.

In addition, if the subsistence/critical flow of 46 cfs should occur for an extended period of time, then operational releases will be made by LCRA to temporarily alleviate the subsistence/critical flow conditions. Specifically, should the flow at the Austin gage be below a 65 cfs daily average for a period of 21 consecutive days, LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release condition persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days.

17) The priorities in LCRA's Water Management Plan and Drought Management Plan for use of interruptible water are subject to change after the completion of the studies on bay and estuary inflows referenced in condition (1) of the September 7, 1989 Order Approving LCRA's Water Management Plan.

18) Until such time that the Commission amends the requirement for freshwater inflows into the Lavaca Tres-Palacios Estuary as a result of the completion of the Texas Water Development Board and Texas Parks and Wildlife Department study on freshwater inflows LCRA shall continue to maintain a minimum monthly mean flow of 200 cfs, a minimum seasonal mean flow of 375 cfs and a minimum annual flow of 272,121 acre-feet measured at the USGS gage at Bay City for freshwater inflow to the Lavaca-Tres Palacios estuarine system.

Conclusions of Law

1) The Commission considered this Agreed Order under the authority and in accordance with Chapter 11 of the Texas Water Code, as amended and 31 Texas Administrative Code ("TAC") § 295 et. al.

2) The Texas Water Commission has jurisdiction to consider and take action on LCRA's application to amend its Water Management Plan and Drought Management Plan.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS WATER COMMISSION THAT:

1) LCRA's proposed amended Water Management Plan and Drought Management Plan are approved with the following conditions:

   a) LCRA's amended Water Management Plan is subject to all findings, conclusions, and conditions contained in the Commission's September 7, 1989 Order approving the Plan, except to the extent specifically provided otherwise by this Agreed Order.

   b) LCRA's amended Drought Management Plan is subject to all findings, conclusions, and conditions, contained in the Commission's December 23, 1991 Order approving the Plan, except to the extent specifically provided otherwise by this Agreed Order.

   c) Nothing in this Agreed Order shall be construed to impair any party's right to contest or seek clarification of, at anytime, any issue in connection with LCRA's Water Management Plan and Drought Management Plan. The Commission takes notice that the Sierra Club has contested the issue of priority of use of interruptible water and that contest has been remanded for hearing.

Nothing in this Agreed Order shall be construed as deciding that issue. Furthermore, if in that hearing, the priority of use for interruptible water, as it relates to instream flows, is determined by the Commission to be different than that set forth in those Plans, any party shall have the express right to reopen the issue of instream flow requirements by submitting a written request for hearing to the Office of Hearings Examiners.

2) The Chief Clerk of the Texas Water Commission shall forward a copy of this Agreed Order subject to the filing of motions for rehearing, to all parties.

3) If any part of this Agreed Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remainder of the Agreed Order.

4) Nothing in LCRA's Water Management Plan and Drought Management Plan or this Agreed Order shall be construed to impair, or to authorize LCRA or any other person or entity to impair, senior or superior water rights in the Colorado River Basin.

ISSUED: DEC 1 8 1992

TEXAS WATER COMMISSION

John Hall, Chairman

ATTEST:

Gloria A. Vasquez, Chief Clerk

BW12\05

Appendix F
Agreed Order Approving Amendments
to
LCRA's Water Management and Drought Management Plan, dated March 1, 1999

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

THE STATE OF TEXAS
COUNTY OF TRAVIS
I hereby certify that this is a true and correct copy of a Texas Natural Resource Conservation Commission document, which is filed in the permanent records of the Commission.
Given under my hand and the seal of office on
MAR 04 1999
La Donna Castañuela, Chief Clerk
Texas Natural Resource
Conservation Commission

DOCKET NO. 98-1387-WR

CONSIDERATION OF THE	§	BEFORE THE
LOWER COLORADO RIVER AUTHORITY'S	§	TEXAS NATURAL RESOURCE
APPLICATION TO AMEND ITS WATER	§	CONSERVATION COMMISSION
MANAGEMENT PLAN INCLUDING ITS	§	
DROUGHT MANAGEMENT	§	
PLAN	§	

ORDER APPROVING AMENDMENTS TO LOWER COLORADO RIVER AUTHORITY'S WATER MANAGEMENT PLAN INCLUDING ITS DROUGHT MANAGEMENT PLAN

On the 24th day of February, 1999, the Texas Natural Resource Conservation Commission ("Commission") considered the Lower Colorado River Authority's ("LCRA") application to amend its Water Management Plan including its amended Drought Management Plan ("WMP"), and having heard evidence and arguments concerning the proposed order, the Commission makes the following Findings of Fact and Conclusions of Law:

Findings of Fact

1) Notice of the public comment meeting and notice of the Commission's Agenda Date on proposed amendments to LCRA's WMP was published on December 17, 1998, in the Johnson City Record-Courier, a newspaper regularly published and generally circulated in Blanco County, Texas; on December 18, 1998 in the Austin American-Statesman, a newspaper regularly published and generally circulated in Travis County, Texas; on December 23, 1998 in the Colorado County Citizen, a newspaper regularly published and

generally circulated in Colorado County, Texas; on December 17, 1998 in the San Saba News & Star, a newspaper regularly published and generally circulated in San Saba County, Texas; on December 17 and 24, 1998 in the Llano News, a newspaper regularly published and generally circulated in Llano County, Texas; on December 18, 1998 in the Marble Falls Highlander, a newspaper regularly published and generally circulated in Burnet County, Texas; on December 20, 1998 in the Bay City Daily Tribune, a newspaper regularly published and generally circulated in Matagorda County, Texas; on December 18, 1998 in the Fayette County Record, a newspaper regularly published and generally circulated in Fayette County, Texas; on December 19, 1998 in the El Campo Leader-News, a newspaper regularly published and generally circulated in Wharton County, Texas; and on December 19, 1998 in the Bastrop Advertiser, a newspaper regularly published and generally circulated in Bastrop County, Texas. These ten counties are the only counties in which persons reside who may be affected by action taken by the Commission on the proposal amendments. Said notice was published not less than thirty (30) days before the Commission's Agenda Date.

2) On December 16 , 1998, notice of the public comment meeting and the Commission's Agenda Date was sent by first-class mail to persons who may be affected by action taken by the Commission and to each person as required by law.

3) By Commission order of September 20, 1989, the Commission conditionally approved LCRA's WMP. By Commission order of December 23, 1991, the Commission conditionally approved LCRA's Drought Management Plan, which is included as part of LCRA's WMP. Amendments to the plans were conditionally approved by Commission agreed order of December 18, 1992. These prior orders of the Commission required LCRA to submit an application to amend its WMP to reflect the results of a bay/estuary study to be completed

by Texas Water Development Board (TWDB) and Texas Parks & Wildlife Department (TPWD). In 1993, LCRA, TWDB, TPWD, and TNRCC entered into a cooperative agreement to complete the study. The study was completed in 1997 and LCRA filed its proposed amendments to the WMP to reflect the results of the study.

4) LCRA's application to Amend its WMP including its Drought Management Plan ("Application") was received by the Commission on May 29, 1997; addenda were received December 29, 1997 and September 29, 1998.

5) LCRA's Application was accepted by the Commission as administratively complete on November 13, 1998.

6) On January 5, 1999 the Commission held a public comment meeting. One person presented oral comments, which were not in opposition to the proposed amendments. No written public comments were provided by any person.

7) No protests and no requests for a contested case hearing have been filed with the Commission regarding the proposed amendments.

8) LCRA's WMP currently requires LCRA to meet an interim freshwater inflow need to the Lavaca-Tres Palacios Estuary, also known as the Lavaca-Colorado Estuary or the Matagorda Bay System of 272,000 acre-feet annually, as measured at the USGS Bay City gage.

9) LCRA's proposed amendments to the WMP would require LCRA to:

   (a) release monthly inflows otherwise available for storage in the Highland Lakes to meet monthly target freshwater inflow needs of the Matagorda Bay System totaling 1.03 million acre-feet per year, as measured at the USGS Bay City gage, if January 1 storage levels in Lakes Travis and Buchanan combined is greater than 1.7 million acre-feet;

(b) release monthly inflows otherwise available for storage in the Highland Lakes to meet monthly critical freshwater inflow needs of the Matagorda Bay System totaling 171,100 acre-feet per year, as measured at the USGS Bay City gage, in all years; and

(c) stored water releases will be a combination of firm and interruptible stored water supplies. Firm water will be supplied in years when the four major irrigation districts' stored water supplies are curtailed. Interruptible stored water will be supplied in all other years.

10) LCRA's WMP currently requires LCRA to use up to a maximum of 318,000 acre-feet of firm stored water over any ten (10) consecutive years for instream flows and freshwater inflow needs of the Matagorda Bay System. The WMP currently provides for a total commitment of 31,800 acre-feet per year from the Combined Firm Yield of Lakes Travis and Buchanan for instream flows and freshwater inflow needs of the Matagorda Bay System.

11) LCRA's proposed amendments to the WMP are as follows:

(a) total commitments of the Combined Firm Yield from the Highland Lakes for instream flow maintenance will be an <u>average</u> of 12,860 acre-feet per year, with a <u>maximum</u> of 36,720 acre-feet in any one year; 58,700 acre-feet in any two consecutive years; 76,800 acre-feet in any three or four consecutive years; 106,100 acre-feet in any five consecutive years and 128,600 acre-feet in any six to ten consecutive years. Total commitments of the Combined Firm Yield from the Highland Lakes for freshwater inflows to the Matagorda Bay System will be an <u>average</u> of 3,090 acre-feet per year, with a <u>maximum</u> of 11,200 acre-feet in any one year; 19,700 in any two consecutive years; 24,200 acre-feet in any three or four consecutive years; 28,200 acre-feet in any five consecutive years and 30,900 acre-

feet in any six to ten consecutive years. The total firm stored water commitment for both purposes will be an average of 15,950 acre-feet per year. Estimated interruptible stored water supplied during the critical drought for both purposes will be an average of an additional 40,060 acre-feet per year.

12) Currently under the WMP the LCRA Board of Directors will declare a drought worse than the drought of record when three (3) conditions are simultaneously met. First, a drought of at least 36 consecutive months since both Lakes Travis and Buchanan were last full. Second, the cumulative inflow deficit since the beginning of the drought exceeds the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months. Third, the combined storage of Lakes Travis and Buchanan is less than 600,000 acre-feet.

13) Because of the severity of the 1996 drought LCRA proposes the following amendments to the WMP:

(a) reduce the 36 month minimum to 24 months;

(b) curtailments of interruptible stored water due solely to the declaration of a drought to be worse than drought of record of less than 36 months in duration is only effective on the following January 1 or July 31, whichever occurs first following the declaration by the LCRA Board of Directors. Droughts more than 36 months in length have no restrictions as to when supply reductions can be implemented;

(c) prior to implementing curtailment of firm water supplies during droughts worse than drought of record, LCRA will meet with its firm water customers and develop a specific stored water curtailment plan approved by the LCRA Board of Directors and the Commission.

(d) Such a declaration will be canceled when the combined storage in Lakes Travis and Buchanan is greater than 1.1 million acre-feet of water, which is simply the recommended threshold for curtailment of interruptible water during a repetition of the drought of record. Prior to declaring a drought worse than the drought of record, the LCRA will re-evaluate this threshold level to determine if a more accurate cancellation storage level in lieu of 1.1 million acre-feet can be determined.

14) LCRA's WMP currently states that the storage level for initial curtailment of interruptible stored water for the four (4) major irrigation districts (Lakeside, Gulf Coast, Garwood and Pierce Ranch) will commence when the combined storage in Lakes Travis and Buchanan is less than or equal to 1.4 million acre-feet projected on January 1.

15) LCRA's proposed amendment reduces the combined storage level from 1.4 to 1.1 million acre-feet projected on January 1.

16) LCRA's WMP currently provides that the allocation of interruptible stored water to users other than the four (4) major irrigation districts is made annually based on projected January 1 storage levels in Lakes Travis and Buchanan taken separately. The maximum supply of interruptible stored water available currently under the WMP is 80,000 acre-feet per year.

17) LCRA's proposed amendments will change the allocation of interruptible stored water to users other than the four (4) major irrigation districts to a semiannual allocation as follows:

(a) the supply for January through June is based on January 1 storage levels in Lakes Travis and Buchanan taken separately;

(b) the supply for July through December is based on the minimum of the maximum storage levels in April, May and June in Lakes Travis and Buchanan taken separately.

(c) maximum supply available under LCRA's proposed amendments is 30,000 acre-feet per year.

18) LCRA's WMP currently provides that the LCRA Board of Directors has committed to reserving 50,000 acre feet of the remaining Combined Firm Yield of the Highland Lakes through December 31, 1993 for future uses within LCRA's service area.

19) LCRA's proposed amendment is to reserve 50,000 acre-feet of water of the remaining Combined Firm Yield of the Highland Lakes for future uses within LCRA's service area indefinitely, as reflected in current LCRA Board of Directors policy.

20) On March 29, 1996 the Commission issued its Order severing a portion of the water rights authorized by Certificate No. 14-2564 (Hudson et ux) and combining it with all of the water rights authorized by LCRA's Certificate No. 14-5478, (Lake Buchanan) as amended. Certificate No. 14-5478C was issued to LCRA on the same date and authorizes LCRA to transfer downstream 532 acre-feet of water for use by LCRA out of Lake Buchanan with consumption use limited to 500 acre-feet per year.

21) Because the priority date of the water severed from Certificate No. 14-2564 and purchased by LCRA is 1929, senior to the 1938 Lake Buchanan priority date, LCRA is requesting that the WMP be amended to reflect an increase of 500 acre-feet in the Combined Firm Yield of Lakes Buchanan and Travis from 535,812 acre-feet to 536,312 acre-feet.

22) On June 2, 1997, the Commission issued its Order severing the water rights authorized by Certificate No. 14-5477B from Certificate No. 14-5477(Pierce Ranch), as amended, and combined it with LCRA's water rights authorized by Certificate No. 14-5475. (LCRA's Lakeside Irrigation Service Area)

23) LCRA proposed amendments to the WMP reflect the Commission's June 2, 1997 Order.

24) LCRA is proposing throughout the current WMP several non-substantive amendments to reflect factual changes that have occurred during the period 1993-1997 relating to water demands, both actual and projected; changes to models; operations procedures; LCRA Board Policy and general background information. All of these proposed non-substantive amendments to the current WMP are detailed in mark-ups of the current WMP dated May 28, 1997, December 29, 1997 and September 29, 1998 that have been filed with the Commission by the LCRA.

CONCLUSIONS OF LAW

1) The Commission considered this Order under the authority and in accordance with Chapter 11 of the Texas Water Code, as amended, and 30 Texas Administrative Code ("TAC") § 295 et. al.

2) The Commission has jurisdiction to consider and take action on LCRA's application to amend its Water Management Plan.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS NATURAL CONSERVATION COMMISSION THAT:

1) LCRA's proposed amended Water Management Plan, which includes LCRA's amended Drought Management Plan as reflected in LCRA's detailed mark-ups of the current WMP dated May 28, 1997, December 29, 1997 and September 29, 1998, is approved with the following conditions:

   a) LCRA's amended Water Management Plan is subject to all findings, conclusions, and conditions contained in the Commission's September 20, 1989 Order approving the Plan, except to the extent specifically provided otherwise by this Order.

   b) LCRA's amended Drought Management Plan is subject to all findings, conclusions, and conditions, contained in the Commission's December 23, 1991 Order approving the Plan, except to the extent specifically provided otherwise by this Order.

   c) LCRA's amended Water Management Plan, including LCRA's amended Drought Management Plan, is subject to all findings, conclusions, and conditions contained

in the Commission's December 18, 1992 Agreed Order approving amendments to the Plans, except to the extent specifically provided otherwise by this Order.

d) Any party shall have the right, at any time, to petition the Commission to seek to amend or clarify any issue in connection with LCRA's amended Water Management Plan, which includes LCRA's amended Drought Management Plan. Nothing in this Order shall be construed to impair any party's right to contest or seek clarification of, at anytime, any issue in connection with LCRA's amended Water Management Plan, which includes LCRA's amended Drought Management Plan.

e) The Commission takes notice that in 1993 the Sierra Club contested the issue of priority of use of interruptible water and that contest has been remanded to the State Office of Administrative Hearings ("SOAH") for hearing and is still pending.

f) Nothing in this Order shall be construed as deciding the issue pending at SOAH. Furthermore, if as a result of that hearing, the priority of use for interruptible water, as it relates to instream flows, is determined by the Commission to be different than that set forth in these Plans, any party shall have the express right to reopen the issue of instream flow and bay and estuary inflow requirements by submitting a written request for hearing to the Commission.

2) The Chief Clerk of the Texas Natural Resource Conservation Commission shall forward a copy of this Order subject to the filing of motions for rehearing, to all parties.

3) If any part of this Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remainder of the Order.

4) If the Texas Parks and Wildlife Department, the Texas Water Development Board, or the Commission, acting on their own motion or as a result of a petition filed by any party, shall

VOLUME II

INDEX OF APPENDICES

Appendix 1A	Final Judgment and Decree – Texas Water Commission
Appendix 1B	Documents Reflecting Agreement between LCRA And the Colorado River Municipal Water District regarding O.H. Ivie Reservoir
Appendix 2A	Technical Data on LCRA's Dams
Appendix 2B	Highland Lakes Monthly Net Evaporation Rates
Appendix 2C	Highland Lakes Firm Yield Output
Appendix 2D	Stacy Reservoir Firm Yield Output
Appendix 3	LCRA Raw Water Contract Administrative Rules and Standard Form Municipal Water Sale Contract

Volume II – Technical Report
Appendices

Appendix 1A
Final Judgment and Decree –
Texas Water Commission

NO. 115,414-A-1

IN RE: THE EXCEPTIONS OF THE LOWER COLORADO RIVER AUTHORITY AND THE CITY OF AUSTIN TO THE ADJUDICATION OF WATER RIGHTS IN THE LOWER COLORADO RIVER SEGMENT OF THE COLORADO RIVER BASIN	$ $ $ $ $ $ $	IN THE DISTRICT COURT OF BELL COUNTY, TEXAS 264TH JUDICIAL DISTRICT

FINAL JUDGMENT AND DECREE

BE IT REMEMBERED that on the 20 day of April, 1988 came on to be heard the Joint Motion to Enter Final Judgment and Decree of the Texas Water Commission (the "Commission"), the Lower Colorado River Authority ("LCRA"), and the City of Austin (the "City"), and the Court being of the opinion that said motion should be granted, it is therefore,

ORDERED, ADJUDGED AND DECREED as follows:

I.

The City's water rights are defined by the findings of fact and conclusions of law found on pages 21-23 of the Final Determination entered by the Commission on July 29, 1985 in this matter (the "Final Determination"). These findings and conclusions are hereby modified in their entirety to read as set forth in Attachment No. 1 hereto.

EXHIBIT "A"

II.

LCRA's water rights with respect to the Highland Lakes are defined by the findings and conclusions found on pages 89-96 of the Final Determination. The findings and conclusions found on pages 90-91 relating to the Highland Lakes generally are hereby deleted in their entirety, and the remaining findings and conclusions relating to each of the Highland Lakes specifically are hereby modified in their entirety to read as set forth in Attachment No. 2 hereto.

III.

LCRA's water rights with respect to its Lakeside Water Division are defined by the findings and conclusions found on pages 76-77 of the Final Determination. These findings and conclusions are hereby modified in their entirety to read as set forth in Attachment No. 3 hereto.

IV.

LCRA's water rights with respect to its Gulf Coast Water Division are defined by the findings and conclusions found on pages 82-84 of the Final Determination. These findings and conclusions are hereby modified in their entirety to read as set forth in Attachment No. 4 hereto.

V.

All other portions of the Final Determination which define water rights of the City and LCRA are hereby affirmed.

VI.

This Final Judgment and Decree is final and conclusive as to all water rights and claims to water rights of the City and LCRA in the Lower Colorado River Segment, Colorado River Basin, as adjudicated herein. This Judgment is without prejudice to any further permits or amendments to the water rights of the City and LCRA issued by the Texas Water Commission after January 1, 1983. Such amendments shall be treated as if issued under § 11.336 of the Texas Water Code. All claims of water rights of the City and LCRA as of January 1, 1983 which were made under § 11.303 or § 11.307 of the Texas Water Code and which are not recognized herein or in other orders of the Court are hereby denied.

VI.

The Texas Water Commission is directed to take such action as is required by the Texas Water Rights Adjudication Act, §§ 11.301 et seq., Texas Water Code, to implement this Final Judgment and Decree.

SIGNED this 20 day of April, 1988.

/s/ J. F. Clawson
JUDGE PRESIDING

MODIFIED FINDINGS AND CONCLUSIONS
DEFINING THE CITY OF AUSTIN'S WATER RIGHTS

DIVERSION POINTS NOS: 0160, 0180, 0190, 0200, 0290, 0300, 0310, 0320, 0322, 0350, 0360, 0370, 0470, 0480, 1158 and 1160

TRACT NO: 0095

OWNERSHIP: City of Austin

IR: 14-15, 17-18, 23 and 25
APP: 3, 4, 7 and 8
III SF 145-230; V SF 2-177; Contest VI SF 180-392

SECTION 11.307 CLAIM: Under 1891 Texas Special Laws, Chapter 22 at 101, Certified Filing No. 330, Permits Nos. 1379, 1379A, 1379B, 1379C and 1942, and §11.303 Claims Nos. 5548 and 2403, four impoundments are claimed: Lake Austin on the Colorado River, with a capacity of 21,000 acre-feet; Town Lake on the Colorado River, with a capacity of 3520 acre-feet; Lake Walter E. Long on Decker Creek, with a capacity of 33,940 acre-feet; and Barton Springs Pool on Barton Creek, with a capacity of 10.48 acre-feet. Also claimed are various rights to divert and use water from Lake Austin, Town Lake, Lake Water E. Long and the Colorado River for domestic, municipal, industrial and hydropower purposes. Recreation use is claimed for all of the impoundments. (Exh. 1533)

FINDINGS:

1. Claimant (hereinafter "Austin") claims rights under 1891 Texas Special Laws, Chapter 22 at 101 (the "1891 Act"), which provides in part at paragraph 46 of Section 57 that the City shall have the power:

> To erect, construct, build and operate a water and electric light system to supply the city and its inhabitants with water and electric light by constructing and maintaining a reservoir of water in and about the channel of the Colorado River, within and without the city limits, by erecting a dam across the same where such dam is now being constructed, to serve as a reservoir and to furnish power to operate an electric light system and to build such other reservoirs as may be necessary at such an elevated point within or without the limits of the city as may be necessary to supply the higher portion of the city with water.

2. Austin is the owner of Certified Filing No. 330 (hereinafter CF-330) which is derived from two affidavits, the first of which was filed with the County Clerk of Travis County on June 30, 1913 by the mayor of Austin. The affidavit declared an intent to appropriate water from the Colorado River by means of a dam to be built at a site (D-0200) formerly occupied by the "Austin Dam"

which would be 1100 feet long, 65 feet high and would have an impounding capacity of 3,500,000,000 cubic feet (80,349 acre-feet) "for the purpose of the construction of a waterworks for the City of Austin, Texas for the purpose of supplying the inhabitants thereof with water, light, and power . . . ." (Exh. 23F)

3. The second affidavit comprising CF-330 was filed with the County Clerk of Travis County on June 27, 1914, by the mayor of Austin. This affidavit stated that construction of a dam across the Colorado River had begun prior to July 1, 1913, at the site of the old Austin Dam, and that the 1913 affidavit had been filed to appropriate the waters of the Colorado River, to store the storm and rain waters of the river and to use this water for hydropower purposes and for "ordinary domestic uses and for general municipal and state purposes." Ordinary flow and storm and rain water were also to be diverted at or near the dam "for the purpose of supplying said inhabitants with water for domestic uses and for general municipal and state purposes." The affidavit further stated that water was currently being diverted from the Colorado River for the purpose of supplying water, light and power by means of pumps and a filtration system in the river bed and that when the dam was completed, it was to be used and operated in connection with the existing system. It was the intention of Austin, the affidavit stated, at the time of the filing of the 1913 affidavit to include the "diversion and taking of water at the points where said filtration system is located" (D-0322). The affidavit stated that the present needs of Austin "for domestic purposes and for general municipal and state uses" were about six million gallons of water per day and that "it is the purpose and intention of Austin and will become the necessity to increase the volume of water to be taken from said Colorado River at said places to twenty million gallons of water per day of twenty-four hours" (22,403 acre-feet per year). (Exh. 26)

4. An Additional Statement of Work Done under CF-330 was executed by the mayor of Austin on June 30, 1914, and filed with the Board of Water Engineers. (Exh. 27)

5. A sworn claim of water right based upon CF-330 was filed in 1918 by Austin under the Water Rights Adjudication Act of 1917 (1917 Tex. Gen. Laws, Ch. 88, at 211). (Exh. 28)

6. Austin is also the holder of Permit No. 1379, which authorized the diversion and use of 456,000 acre-feet of water per year from a described point on the Colorado River (D-0322) at a maximum diversion rate of 650 cfs for domestic, municipal and industrial purposes. Application No. 1477 for the permit was accepted for filing by the Board of Water Engineers on August 20, 1945, and Permit No. 1379 was issued on October 15, 1945. (Exh. 23B)

7. Permit No. 1379A was issued to Austin on January 14, 1960. This amendment authorized six additional diversion points on the north or left bank of the Colorado River. (Exh. 23B)

8. Permit No. 1379B was issued by the Commission on December 16, 1965. This amendment authorized a 33,940 acre-foot capacity reservoir on Decker Creek, tributary of Gilleland Creek, tributary of the Colorado River. The water impounded in the reservoir was authorized to be used for industrial purposes (power plant cooling) and for recreational purposes. The amendment further authorized diversion of water authorized by Permit No. 1379 at an additional diversion point (D-0470) on the Colorado River at a maximum diversion rate of 28.5 cfs into the reservoir for the initial filling of the reservoir and up to 16,156 acre-feet per year thereafter. The amendment further authorized the impoundment and use of waters of Decker Creek in the reservoir, provided that the total amount of water used from Decker Creek and the Colorado River does not exceed 16,156 acre-feet per year. The maximum consumptive use of water was limited to 16,156 acre-feet per year. The application for the amendment was filed with the Commission on February 23, 1965. (Exh. 23B)

9. Permit No. 1379C was issued to Austin on December 2, 1966. This amendment added diversion point D-0180 on Lake Austin and the diversion and use of 50,000 acre-feet of water per year for municipal purposes, previously authorized by Permit No. 1379, as amended. (Exh. 23B)

10. Austin is the holder of Permit No. 1942, which authorized a dam (Longhorn Dam) on the Colorado River creating a 3,520 acre-foot capacity reservoir (Town Lake). The permit also authorized the diversion and use of water appropriated under Permit No. 1379 for industrial purposes (power plant cooling) at a described diversion point (D-0360) on the perimeter of the reservoir. Application No. 2115 for the permit was accepted for filing by the Board of Water Engineers on March 5, 1959, and Permit No. 1942 was issued on December 16, 1959. (Exh. 23B)

11. Austin is the owner of §11.303 Claim No. 2403 which asserted a riparian right and rights under Article 7500a and prescription to use water from Barton Creek for recreation (swimming pool), irrigation and municipal purposes and declared no diversion and use of water during the period 1963-1967, inclusive. An "upper dam" and "lower dam" and 46 acre-foot capacity reservoir were also claimed. The date of first beneficial use of water within the claim area was declared to be 1918. (Exh. 164)

12. The Lower Colorado River Authority (LCRA) is the owner of §11.303 Claim No. 5548 which asserted various rights to use State water for various purposes. The claim declared a date of first beneficial use of water of "1940 and prior thereto

as to predecessors-in-title under whom Authority claims." The impounding capacity of Lake Austin was declared to be 21,000 acre-feet at normal maximum operating level. (Exh. 38)

13. In 1938, Austin and the LCRA entered into an agreement by which LCRA leased from Austin Tom Miller Dam and Austin's hydropower rights at Tom Miller Dam. The agreement provided among other things that the LCRA was to reconstruct the dam and powerhouse, install hydropower generating equipment, and operate the dam and hydroelectric facilities for the term of the agreement. (Exh. 31)

14. After 1938, Austin and the LCRA entered into other agreements. In 1966, an agreement was signed which extended the 1938 agreement and some of the intervening agreements until December 31, 2007. (Exh. 30)

15. The first "Austin Dam" was constructed at the present site (D-0200) of Tom Miller Dam in 1891-1893. Hydropower was first generated at the dam in 1895. The dam broke in 1900. Between 1912 and 1915, a private group reconstructed the dam but it washed out during two severe floods in 1915. The LCRA began building Tom Miller Dam in 1938 on the remains of the old dam and completed construction in March, 1940. (Exhs. 23E, 37; III SF 185-186, 201, 209-210)

16. Tom Miller Dam was constructed to an elevation of 517 feet msl and a height of 89 feet. Normal maximum operating level is 492.8 feet msl and the impounding capacity of the reservoir at that level is 21,000 acre-feet. Nine gates in the dam are used for emergency releases only and there is a gravity flow spillway section at 492.8 feet msl. The lake is operated essentially as a "constant level" lake and the lake level rarely varies as much as the three feet permitted by the 1938 and 1966 contracts. Water in Lake Austin is used for nonconsumptive recreation purposes. (III SF 195, 197-198, 208, 211-213; V SF 167)

17. Two hydropower turbines are located in Tom Miller Dam, each with generating capacities of seven megawatts. The maximum turbine release capability is 2,000,000 acre-feet per year or 3045 cfs. (III SF 195-196, 206, 213-214)

18. The maximum amount of water diverted and used for hydropower purposes at Tom Miller Dam was 1,713,300 acre-feet in 1958. Water used for hydropower purposes is not consumed. (Exh. 37)

19. Austin maintains a dam (Longhorn Dam) on the Colorado River at the site (D-0370) authorized by Permit No. 1942. Construction of the dam and reservoir (Town Lake) was completed in 1960. Town Lake has an impounding capacity of approximately 3,520 acre-feet of water and is used for municipal, industrial and recreation purposes. (Exh. 23E; V SF 54-56)

20. Austin maintains a dam on Decker Creek at the site (D-1160) authorized by Permit No. 1379B. The dam and reservoir (Lake Walter E. Long or Decker Lake) were constructed in the 1960's and the reservoir was filled in 1969. Lake Long has an impounding capacity of approximately 33,940 acre-feet of water. The maximum amount of water diverted at D-0470 into Lake Long was 6456 acre-feet in 1977. (Exhs. 23E and 1536; V SF 50, 72; Contest VI SF 225)

21. Water was first diverted for municipal purposes from Lake Austin in 1895. Water was first diverted in 1895 for municipal purposes at D-0322 on the Colorado River near the present pumping plants for the Green water treatment plant (D-0320) and Seaholm power plant (D-0310). In 1897-1899, filtering trenches were installed at D-0322 which were used in the city's municipal water supply system. (Contest VI SF 251-257, 262-278, 319)

22. Austin presently maintains three water treatment plants which treat the water used in its municipal supply system:

    a. The oldest plant is the Green water treatment plant, which went into operation in 1924 and which replaced the filtering trench system which was being used at that location (D-0322). Water is diverted at diversion point D-0320 on Town Lake. (Exh. 23E; V SF 117-118, 150, 154-155)

    b. The Davis water treatment plant went into operation in 1954. Water is diverted from diversion point D-0160 on Lake Austin. (Exh. 23E; V SF 118)

    c. The Ullrich water treatment plant went into operation in 1969. Water is diverted at diversion point D-0180 on Lake Austin. (Exh. 23E; V SF 118)

23. Water is diverted at D-0480 into the Hornsby Bend wastewater stabilization ponds. (Exh. 23E; V SF 119-120)

24. Austin has three electrical power generating plants which use water from the Colorado River for cooling purposes:

    a. The Seaholm power plant began operation in 1950. It replaced another power plant which had been used at the same site since 1906. Water is diverted at diversion point D-0310 on Town Lake by a pumping plant consisting of ten pumps with a combined pumping capacity of 298.44 cfs. (Exh. 23E; V SF 48-49)

    b. The Holly power plant began operation in 1960. Water is diverted from diversion point D-0360 on Town Lake by a pumping plant consisting of four pumps with a combined pumping capacity of 599.11 cfs. Another

pumping plant is located at diversion point D-0350 on Town Lake and consists of four pumps with a combined pumping capacity of 311.8 cfs. No records of the water consumed at the Holly plant are maintained by Austin. (Exhs. 23B, 23E; V SF 49-50, 66-69, 78-79; Exh. 7 at page 3)

c. The Decker power plant went into operation in 1970. Water is diverted from authorized diversion point D-0470 on the Colorado River by a pumping plant consisting of two pumps with a combined pumping capacity of 30.06 cfs. (Exhs. 23B, 23E; V SF 50-51, 56, 73-76, 106, 111)

25. There are no intervening appropriators between D-0310, D-0350 and D-0360. All three points are located on the perimeter of Town Lake. Diversions for once-through cooling purposes at any one of the three points is the same hydrologically as diversions at any one of the other two. Hydrologically, D-0310, D-0350 and D-0360 are the same diversion point. (Exh. 7 at page 3; Contest VI SF 279-280)

26. There are no intervening appropriators between diversion points D-0310 and D-0320 and diversion point D-0322. (Exh. 7 at page 3)

27. Water used by Austin for municipal purposes and industrial purposes (power plant cooling) was reported under CF-330 through 1946. After 1946, all water diverted and used by Austin for such purposes was reported under Permit No. 1379, as amended, and Permit No. 1942. (Exhs. 33, 34, 37)

28. The maximum amount of state water diverted and used from Lake Austin for municipal purposes in any calendar year is 77,811 acre-feet, diverted in 1963. The maximum amount diverted and used during the period 1963-1967, inclusive, is 33,885 acre-feet, diverted in 1967. (Contest VI SF 228-230, 260)

29. The maximum amount of state water diverted and used from the Colorado River (Town Lake) at diversion point D-0320 for municipal purposes in any calendar year is 19,473 acre-feet, diverted in 1982. (Contest VI SF 229, 260)

30. Austin's demands for water for municipal purposes have grown continuously as its population and service area have grown. Austin now supplies water for municipal purposes outside the Colorado River Basin.

31. The maximum amount of state water diverted and used from the Colorado River (Town Lake) at diversion point D-0310 for industrial (once-through cooling) purposes in any calendar year is 200,939 acre-feet, diverted in 1956. The maximum rate of diversion at D-0310 has been 275.5 cfs (124,000 gpm). (Contest VI SF 234-235, 246)

32. The maximum amount of state water diverted and used from Town Lake at diversion points D-0350 and D-0360 for industrial (once-through cooling) purposes in any calendar year is 472,672 acre-feet, diverted in 1978. The maximum combined rate of diversion at D-0350 and D-0360 has been 913.25 cfs.

33. The maximum amount of state water diverted and used from Town Lake at diversion points D-0310, D-0350 and D-0360 for industrial (once-through cooling) purposes in any calendar year was 575,685 acre-feet, diverted in 1977. (Contest VI SF 235, 246, 250)

34. At the present time, approximately three percent of the water diverted and used from diversion points D-0310, D-0350 and D-0360 is consumptively used for industrial purposes. (Contest VI SF 280-282, 381)

35. The maximum amount of state water diverted and used from the Colorado River at diversion point D-0470, and diverted and consumptively used from Decker Lake for industrial (once-through cooling) purposes in any calendar year since the issuance of Permit No. 1379B, is 6456 acre-feet, diverted and consumed in 1977. (Exh. 1536)

36. Austin diverts water at diversion point D-0190 on Lake Austin onto Municipal Golf Course (T-0095) for irrigation of the greens and fairways. A maximum of 150 acre-feet has been diverted and used to irrigate a maximum of 54 acres in any one year. (Exh. 23E; III SF 203; V SF 123-124, 138-140)

37. Barton Springs Pool is a municipal swimming pool which was created in 1928 by the construction of a dam at D-0290 on Barton Creek in Abstract No. 14, Travis County. The impounding capacity of the reservoir does not exceed 10.7 acre-feet. Another dam was constructed in 1929 upstream of the pool to keep debris from entering the pool. A bypass was later constructed at the upstream dam to divert the flow of Barton Creek around the pool so that only spring water is impounded in the pool. Water impounded in the pool was used for recreation purposes during the period 1963-1967, inclusive. (V SF 126-140; Contest VI SF 224)

38. Austin is justified in any nonuse of water for municipal and industrial (power plant cooling) purposes because its demands for water and power have increased as its population has grown. (Contest VI SF 228-244, 260)

39. Austin has a bona fide intent to use the amounts of water recognized herein within the reasonably foreseeable future. (Contest VI SF 238-244)

40. Austin's hydroelectric right at Tom Miller Dam under C.F. 330 should include conditions that generally subordinate such right to all present and future upstream rights to use the waters of

the Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the release of water through such dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments. Austin is willing to accept such conditions, provided that the extent to which additional water is made available for purposes other than hydroelectric generation from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259, respectively, because of such conditions, together with other consideration, if any, be taken into account in any future evaluation or determination of the consideration given, or to be given, by Austin for water from such Lakes under such Permits.

CONCLUSIONS:

1. Austin is recognized a right under Certified Filing No. 330 to maintain Tom Miller Dam and Lake Austin at D-0200 on the Colorado River and to impound therein 21,000 acre-feet of water for municipal, the generation of hydroelectric power, and recreation purposes, with a priority date set forth in Conclusion 5, below.

2. Austin is recognized a right under Certified Filing No. 330 to divert and use water through Tom Miller Dam at a maximum rate of 3045 cfs for the generation of hydroelectric power, with a priority date set forth in Conclusion 5, below, subject to the following conditions:

   (a) Austin shall not release water through Tom Miller Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

   (b) To the extent that water is released through Tom Miller Dam solely for the purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise.

(c) The extent to which additional water is made available for purposes other than hydroelectric generation from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259, respectively, because of Austin's acceptance of conditions (a) and (b), above, shall, together with other consideration, if any, be taken into account in any evaluation or determination of the consideration given, or to be given, by Austin for water from such Lakes under such Permits.

3. Austin is recognized a right under Certified Filing No. 330 to divert and use from Lake Austin 77,811 acre-feet of water per annum for municipal purposes, and 150 acre-feet of water for irrigation, with a priority date set forth in Conclusion 5, below.

4. Austin may continue diligent development of its rights under Certified Filing No. 330 to a total diversion and use of not to exceed 250,000 acre-feet of water per annum for municipal purposes from Lake Austin, with no limitation as to rate of diversion or the number or location of points of diversion on Lake Austin, with a priority date set forth in Conclusion 5, below.

5. The priority date of Austin's rights under Certified Filing No. 330 to impound water in Lake Austin and to divert and use water from Lake Austin, set forth in Conclusions 1-4, above (Austin's "Lake Austin Rights"), shall be June 30, 1913, subject to the following conditions, to which LCRA has agreed:

   (a) Any existing water right with a priority date junior to November 15, 1900 that is presently owned by LCRA is specifically subordinated, as to priority, to Austin's Lake Austin Rights under Certified Filing No. 330.

   (b) Any existing water right with a priority date junior to November 15, 1900 that may in the future be acquired by LCRA shall, upon acquisition by LCRA and thereafter, be specifically subordinated, as to priority, to Austin's Lake Austin Rights under Certified Filing No. 330.

   (c) Any evaluation or determination of the consideration given, or to be given, by Austin for stored water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259, respectively, shall be based upon studies which assume that Austin's Lake Austin Rights under Certified Filing No. 330 have a priority date of November 15, 1900.

6. Austin is recognized a right under Certified Filing No. 330 to divert and use 19,473 acre-feet of water per annum from Town Lake for municipal purposes, with a priority date of June 27, 1914.

7. Austin may continue diligent development of its rights under Certified Filing No. 330 to a total diversion and use of not to exceed 22,403 acre-feet of water per annum from Town Lake for municipal purposes, with no limitation as to rate of diversion or the number or location of points of diversion on Town Lake, with a priority date of June 27, 1914.

8. Austin is recognized a right under Certified Filing No. 330 to divert, circulate and recirculate water from Town Lake for industrial (cooling) purposes, with no limitation as to annual amount or rate of diversion or the number or location of points of diversion on Town Lake, provided that not more than 24,000 acre-feet of water per year may be consumptively used by such use, with a priority date of June 27, 1914. Austin is further recognized the right under Certified Filing No. 330 to the flow of the Colorado River and its tributaries with a priority date of June 27, 1914, to the extent that such flow is needed to be impounded in Town Lake, and/or to the extent that it is necessary to pass such flow through Town Lake to reduce the temperature of the water in Town Lake, to allow the City to use such water for industrial (cooling) purposes at all times to the full extent authorized herein.

9. Austin is recognized the right under Certified Filing No. 330 to transfer treated water from the Colorado River Basin for municipal use in areas outside such Basin.

10. Austin is recognized a right under Permit No. 1379, as amended, to maintain an existing dam and reservoir at D-1160 on Decker Creek, tributary of Cilleland Creek, tributary of the Colorado River, to impound therein not to exceed 33,940 acre-feet of water, to use the impounded water for recreation purposes, and to divert, circulate and recirculate the impounded water for industrial purposes (power plant cooling), with a priority date of February 23, 1965, provided that not more than 16,156 acre-feet of water per year may be consumptively used for industrial purposes (power plant cooling). This right is subject to the conditions set out in Permit No. 1379B.

11. Austin is recognized a right under Permit No. 1379, as amended, to divert and use not to exceed 6456 acre-feet of water per annum from the Colorado River at diversion point D-0470 for industrial (power plant cooling) purposes, with a priority of August 20, 1945.

12. Austin may continue diligent development of its rights under Permit No. 1379, as amended, to divert and use water from the Colorado River at diversion point D-0480 for municipal purposes at a maximum diversion rate of 28 cfs, and to a total diversion and use of not to exceed 16,156 acre-feet per annum from the Colorado River at diversion point D-0470 for industrial (power plant cooling) purposes with no limitation as to rate of

diversion, with a priority date of August 20, 1945.

13. Austin is recognized a right under Permit No. 1942 to maintain a dam at D-0370 (Longhorn Dam) and reservoir (Town Lake) on the Colorado River and to impound therein not to exceed 3520 acre-feet of water and to use the impounded water for industrial and recreation purposes, with a priority date of March 5, 1959.

14. Austin is recognized a right under §11.303 Claim No. 2403 based upon former Article 7500a to maintain a dam and reservoir at D-0290 on Barton Creek and to impound therein not to exceed 10.7 acre-feet of water and to use the impounded water for recreation purposes (swimming pool), with a priority date of December 31, 1928.

MODIFIED FINDINGS AND CONCLUSIONS DEFINING LCRA'S WATER RIGHTS WITH RESPECT TO THE HIGHLAND LAKES

WATER RIGHT CLAIMS

OF THE

LOWER COLORADO RIVER AUTHORITY (LCRA)

IN

THE HIGHLAND LAKES

LOWER COLORADO RIVER

SEGMENT ADJUDICATION

ATTACHMENT NO. 2 TO JUDGMENT
IN CAUSE NO. 115,414-A-1

DIVERSION POINTS NOS. (MCRS): 2280 and 2290 (Lake Buchanan)
TRACT NO: None

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR. (MCRS): 250-252
APP. (MCRS): 25-26
XII/II SF 1-1128
(MCRS) II Contest SF 95-138
(LCRS) Contest SF Vols. III, IV, V and VII

SECTION 11.307 CLAIM: Under Permits Nos. 954 and 1259 and Section 11.303 Claim No. 5550 to maintain a dam and 992,475 acre-foot capacity reservoir on the Colorado River (Lake Buchanan) and to impound, divert and use therefrom 1,391,530 acre-feet of water per year at a maximum diversion rate of 3630 cfs for "hydroelectric, municipal, domestic, industrial, etc." purposes, with a priority date of June 29, 1913 and prior. (Exh. J8)

FINDINGS:

1. The LCRA is the owner of Permit No. 1259, which authorized the construction and maintenance of a dam and approximately 1,000,000-acre-foot capacity reservoir on the Colorado River in Llano and Burnet Counties and the impoundment, diversion and use therefrom of 1,391,530 acre-feet of the ordinary and storm and flood flows of the Colorado River for domestic, municipal, (industrial), irrigation, mining and hydroelectric power purposes. (Exh. 10a)

2. A special condition in Permit No. 1259 authorizes the LCRA to use the bed and banks of the Colorado River for the purpose of conveying the impounded water to diversion points downstream for the uses authorized. (Exh. J10a)

3. Another special condition in the permit concerns Permit No. 954:

> The dam for which this permit is granted has been constructed by virtue and under the terms of Permit No. 954, heretofore granted by the Board to the Syndicate Power Company of Dallas, Texas, and the alterations and modifications thereof heretofore set out by declarations filed with the Board, as prescribed by Statute, and this permit shall be cumulative of and in addition to said Permit No. 954, and of the rights covered by said permit; provided that the total quantity of water to be impounded, diverted and appropriated shall not exceed the quantity set out in paragraph four of this permit.

(Exh. J10a)

4. Paragraph four of Permit No. 1259 recites that of the 1,391,530 acre-feet authorized to be appropriated by the permit, ". . . 1,225,700 acre-feet per annum have heretofore been granted under Permit

No. 954, the total amount to be appropriated under both permits not to exceed. . .1,391,530 acre-feet per annum." (Exh. J10a)

5. Application No. 1345 for Permit No. 1259 was filed with the Board of Water Engineers on March 7, 1938, and the permit was issued on May 25, 1938. (Exh. J10a)

6. The LCRA is the owner of Permit No. 954, which authorized the construction and maintenance of a dam and 831,020 acre-foot capacity reservoir on the Colorado River in Llano and Burnet Counties and the impoundment, diversion and use therefrom of 1,225,700 acre-feet of water per year for "power development" (hydroelectric) purposes. (Exh. J13a)

7. Application No. 1024 for Permit No. 954 was filed with the Board of Water Engineers on March 29, 1926, and the permit was issued on May 15, 1926. (Exh. J13a)

8. Lake Buchanan is located on the Colorado River in Burnet and Llano Counties. Buchanan Dam is located at diversion point D-2280 on the Colorado River in Survey No. 32, Burnet County, and Survey No. 12, Llano County, at the site authorized by Permit No. 1259 and approximately 4.5 miles upstream of the site authorized by Permit No. 954. (Exhs. 7 at p. 26, J10a, J13a; SF 105-106, 110-111)

9. Construction was commenced on Buchanan Dam about April, 1931, and was completed in 1938 with the first deliberate impoundment of water on May 20, 1937. The first hydropower generating unit was placed in operation in January, 1938. (Exhs. J13d-e, J90; SF 361, 379-381)

10. The impounding capacity of Lake Buchanan, as constructed, was approximately 992,000 acre-feet. (Exhs. J87, J90, 1231; SF 106-114, 293-294; Contest SF 105-106)

11. Permit No. 1259 authorized a dam 160 feet high and 11,000 long. Permit No. 954 authorized a dam 165 feet high and 2,500 feet long. (Exhs. J10a, J13a)

12. Buchanan Dam is 145.5 to 150.5 feet high and approximately 11,200 feet long. (Exhs. J90, J120; SF 106)

13. A "Statement of Proposed Alteration of Plans under Permits to Appropriate Public Waters of the State of Texas," dated April 25, 1931, was filed with the Board of Water Engineers by the Emery, Peck and Rockwood Development Company, transferee of several permits, including Permit No. 954, from the Syndicate Power Company. The statement purported to be filed under TEX. REV. CIV. STAT. ANN. article 7495, repealed, Tex. Laws 1971, ch. 58 at 658. The statement proposed to construct the dam authorized under Permit No. 954 at a location on the Colorado River different from

that specified by the permit. The dam was proposed to be built at a height of 137 feet and length of 9,000 feet and having a storage capacity of 1,000,000 acre-feet. The statement further proposed to construct another dam approximately 70 feet high at the location specified by Permit No. 954. The statement recited that construction had begun on the larger dam; that a plan of the construction had been filed with the statement; and that additional detailed plans would be filed with the Board showing the size, location and character of the two additional dams to be constructed under Permits Nos. 954 and 955. (Exh. J13d)

14. On some date subsequent to November 3, 1936, the LCRA filed a request for extension of time for commencing or completing work under Permits Nos. 951, 952, 953, 954, 955 and 998. In this request, it was stated that construction of Buchanan Dam had begun about the month of April, 1931, and was nearing completion. It was further declared that Buchanan Dam had been built to a height of approximately 160 feet and a length of approximately 11,000 feet and would impound approximately 1,000,000 acre-feet of water. The location of the dam was shown on an attached plat. The request stated that complete plans and specifications of Buchanan Dam were on file with the Board of Water Engineers and that construction was nearing completion of a dam at the original site authorized by Permit No. 954, which was being called Inks Dam. (Exh. J13e)

15. Lake Buchanan is a variable level lake which was constructed primarily for hydropower generation and water supply, rather than flood control. There are three hydropower turbines located at Buchanan Dam with a discharge capacity of 1210 cfs each and a maximum hydropower generation capability of 36 megawatts. Due to the limited capacity of the Inks Dam turbines, normal operation is the generation of 24 megawatts with a 2420 cfs discharge rate through the turbines. (SF 323-328, 356, 375, 776-778, 785, 852)

16. There is a pump-back unit installed at diversion point D-2290 on Inks Lake just downstream from Buchanan Dam. The purpose of this unit is to pump water from Inks Lake back into Lake Buchanan to be reused for hydroelectric purposes. There are no interjacent appropriators between Buchanan Dam and D-2290. LCRA is authorized to use water at Buchanan and Inks Dams for hydroelectric generation and to use the bed and banks of the Colorado River to convey water for that purpose, among others. (Exhs. 7 at 25, J10a, J11, J13a, J13d-e; SF 110-111, 828-829)

17. The maximum amount of water used for hydropower purposes at Buchanan Dam was 1,679,300 acre-feet in 1958. (Exhs. J51a-jj, J136)

18. Permit 1259B, granted April 25, 1985, is a contractual amendment to Permit 1259 authorized under

the Texas Water Commission's Rules. Permit 1259B authorizes the Colorado River Municipal Water District (CRMWD) to divert at Stacy Reservoir water to which LCRA would otherwise be entitled under Permit 1259. Permit 1259B authorizes the diversion of 88,000 acre-feet per year for domestic and municipal use, and 25,000 acre-feet per year for industrial purposes. Permit 1259B was issued pursuant to a Settlement Agreement dated February 26, 1985 between CRMWD and LCRA, and the authorization to divert water at Stacy Reservoir shall remain effective only so long as the Settlement Agreement remains in effect. Permit 1259B contains the following language (paragraph 1(b)).

> Under Permit No. 1259 and this amendment, the maximum combined diversions of LCRA at or below Lake Buchanan for domestic, municipal, industrial, irrigation, mining and hydroelectric generation purposes and that of CRMWD at Stacy Reservoir for domestic, municipal and industrial purposes shall not exceed 1,391,530 acre-feet of water per annum, or such amount as may be finally determined in the proceedings of adjudication of all claims of water rights in the Lower Colorado River Segment.

Permit No. 1259, as amended by Permit No. 1259B, is hereinafter referred to as "Permit No. 1259."

19. The Highland Lakes and the Colorado River above and below the Highland Lakes should be managed together as a single system for water supply purposes. Major goals in the management of the system include maximizing the beneficial use of water derived from inflows below the Highland Lakes, and stretching and conserving the water stored in the Highland Lakes. In order to achieve these goals, the system should be managed in accordance with the following general guidelines:

    a. To the extent allowed by law, all demands for water from the Colorado River downstream of the Highland Lakes should be satisfied first pursuant to water rights to the run-of-river flow of the Colorado River.

    b. Inflows should be passed through the Highland Lakes to honor downstream senior water rights only to the extent that demands under those rights cannot be satisfied by the inflows below the Highland Lakes.

    c. Water should be released from conservation storage in Lakes Travis and Buchanan to satisfy downstream demands for authorized purposes (municipal, industrial, irrigation and mining) only to the extent that such demands cannot be satisfied pursuant to independent run-of-river water rights.

    d. Firm, uninterruptible commitments of water from conservation storage in Lakes Travis and

Buchanan should not exceed the Combined Firm Yield of such lakes (hereinafter defined).

e. Water from conservation storage in Lakes Travis and Buchanan may be available for supply on an interruptible basis at any time that the actual demand for stored water under firm, uninterruptible commitments is less than the Combined Firm Yield. To the extent that a demand for water may exist on a non-firm, interruptible basis, such stored water should be made available.

f. The supply of stored water pursuant to non-firm, interruptible commitments should be interrupted or curtailed to the extent necessary to allow LCRA to satisfy all existing and projected demands for stored water pursuant to all firm, uninterruptible commitments.

g. Water should not be released through any dam solely for hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for stored water from Lakes Travis and Buchanan pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

20. Water is supplied from conservation storage in Lakes Travis and Buchanan by the direct diversion of stored water from such lakes, the release of stored water from such lakes for downstream delivery, and the impoundment, diversion or use of the flows of the Colorado River and its tributaries upstream of such lakes pursuant to subordination and other agreements. Under the basic system management plan outlined above, the demand for stored water from Lakes Travis and Buchanan will be erratic. The demand for such water will vary greatly from year to year, depending upon the climatic conditions and the locations, amounts and distributions of demands during each year. It is currently estimated that the peak annual demand for stored water in the reasonably foreseeable future will not exceed 1,500,000 acre-feet in any year. Such a demand may occur during years in which the inflows below the Highland Lakes are very low. Such a demand may also occur in other years, if a large demand for water on a non-firm, interruptible basis should develop.

21. The amount of water that the Highland Lakes/Colorado River system can supply each year on a firm basis through a repeat of the drought of record will vary greatly from time to time in the future, depending upon factors such as the locations of points of diversion and the demand for water at each diversion point. Generally, in order to provide a firm supply of water for a given annual demand, less stored water is needed to firm up the run-of-river supply as the point of diversion is

moved farther downstream. Assuming that large municipal, industrial and irrigation demands will continue to exist downstream of the Highland Lakes, the firm yield of the entire system will exceed the Combined Firm Yield of Lakes Travis and Buchanan.

22. The Combined Firm Yield is less than the Combined Theoretical Yield. The "Combined Theoretical Yield" is the amount of water that could be supplied from conservation storage in Lakes Travis and Buchanan during each year of a simulated rep at of the drought of record, as calculated pursuant to studies that assume the following:

    a. Inflows to Lakes Travis and Buchanan are those flows that would occur in the Colorado River at the site of Mansfield Dam if the Highland Lakes did not exist and there were no other impoundment, diversion or use of the flows of the Colorado River and its tributaries upstream of that point.

    b. No portion of the inflows will be passed through Mansfield Dam to honor downstream senior water rights.

    c. Lakes Travis and Buchanan will be operated together as a system so as to maximize the yield of that system.

    The "Combined Firm Yield" is that portion of the Combined Theoretical Yield remaining after it is assumed that inflows will be reduced by honoring upstream senior water rights and/or passed through Mansfield Dam to honor downstream senior water rights, in accordance with the relative priorities of such rights, except to the extent that the holder of any such right may agree otherwise. In determining the Combined Firm Yield, it is assumed that each senior water right will be exercised to the full extent authorized, except to the extent that the holder of such right may agree otherwise, or unless the Commission otherwise approves. The Combined Firm Yield may be expressed as a constant amount of water annually, or as an average annual amount of water over a defined period of years. The Combined Firm Yield cannot be determined until after the Adjudication is final, and such yield may change from time to time in the future. However, at the present time it is estimated that the Combined Firm Yield is not less than 500,000 acre-feet of water per year. As discussed above, this amount may also be expressed as an average of 500,000 acre-feet per year over any five consecutive calendar-year period, or a total of 2,500,000 acre-feet over any such period. The Commission will determine the Combined Firm Yield, and whether such yield is expressed as an average annual amount of water over a defined period of years, in its adoption of a Management Plan (hereinafter defined).

23. Subordination of hydroelectric rights will greatly increase the amount of water that LCRA has

available to supply from Lakes Travis and Buchanan for other purposes of use. LCRA in the past has subordinated its own hydroelectric rights to its rights to store and use water for other purposes. The City of Austin's early-priority hydroelectric right at Tom Miller Dam under C.F. 330 is the only hydroelectric right in the basin that is senior to Permit Nos. 1260 and 1259 for Lakes Travis and Buchanan, other than those held by LCRA. The City leased such right to LCRA pursuant to the 1938 and 1966 Agreements between the City and LCRA. LCRA in the past has also subordinated the C.F. 330 hydroelectric right that it leased from the City to LCRA's rights to store and use water for other purposes.

24. The extent to which additional stored water will be available in any year, after satisfying all existing and projected demands for stored water pursuant to all firm, uninterruptible commitments, can be defined at the beginning of that year pursuant to a rule curve or other analysis based on conditions that exist at that time. The availability of such additional stored water can be confirmed or redefined at other times during that year by one or more additional analyses at other times during that year based on conditions that exist at such times.

25. LCRA's right to use water from Lakes Travis and Buchanan for purposes other than hydroelectric generation, and the initial conditions for the commitment and supply of such water, should be defined as follows:

> LCRA is recognized a right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan for municipal, industrial, irrigation and mining purposes, with a priority date of March 7, 1938. LCRA may diligently develop such right to a maximum aggregate diversion and use of water for such purposes from Lakes Travis and Buchanan of not to exceed 1,500,000 acre-feet in peak-use years, with a priority date of March 7, 1938, subject to the following conditions:
>
> (a) LCRA shall prepare and submit to the Commission, on or before December 31, 1988, a proposed reservoir operation plan which shall include such studies and other information as may be required by the Commission to determine the Combined Firm Yield of Lakes Travis and Buchanan (as defined in Finding 22, above) and demonstrate LCRA's compliance with, and its ability to comply with, these special conditions (the "Management Plan"). In making its decision on the adoption of an Management Plan, the Commission shall consider all relevant public policies including, without limitation, the following:

(1) recognition of the necessity of beneficial inflows from the Colorado River into the Lavaca-Tres Palacios Estuary consistent with § 11.147 of the Texas Water Code;

(2) protection of fish and wildlife habitats consistent with § 11.147 of the Texas Water Code;

(3) consideration of the effects, if any, on existing instream uses and water quality consistent with § 11.147 of the Texas Water Code;

(4) mitigation of adverse impacts, if any, on wildlife habitats inundated by new reservoir construction;

(5) mitigation of adverse environmental impacts, if any, caused by new projects taking, storing or diverting in excess of 5,000 acre-feet per year consistent with § 11.152 of the Texas Water Code; and

(6) recognition of the Commission's statutory authority to require water conservation under § 11.134(b)(4).

The Commission shall consider LCRA's proposal prior to adopting the initial Management Plan. The Management Plan may be amended from time to time upon the request of LCRA or on the Commission's own motion. The initial proceeding to consider the adoption of the Management Plan, and any major amendment thereof, shall be pursuant to contested case procedures. Any proceeding to consider the adoption or major amendment of the Management Plan shall be preceded by notice and opportunity to request a hearing in accordance with the Commission's regulations applicable to water rights permitting proceedings. The Texas Parks and Wildlife Department, at its option, may be a party in any such proceeding, in the same manner as it would be a party to a proceeding before the Commission incident to an application for a permit governed by Section 11.147 of the Texas Water Code. The Commission shall name as other parties persons that establish a justiciable interest in the proceeding. In making a final decision on the adoption of a Management Plan and any amendment thereof, the Commission, in addition to other information, evidence, and testimony presented, shall consider all information, evidence, and testimony presented by the Texas Parks and Wildlife Department, including, without

limitation, any memorandum of understanding between LCRA and Texas Parks and Wildlife Department relating to the management of the Highland Lakes.

(b) LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1990, a report which documents compliance with the Management Plan and these special conditions during the previous year. Such report shall be in a form approved by the Executive Director.

(c) Except as provided in Special Condition (i), below, LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to any other party except pursuant to a written contract between LCRA and such party that defines such commitment.

(d) LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to itself for use by itself or other parties except pursuant to resolution adopted by LCRA's Board of Directors that defines such commitment.

(e) Each commitment by LCRA to supply water under Permits Nos. 1260 or 1259 shall be considered to be on a firm, uninterruptible basis unless the contract, resolution or special condition defining such commitment specifically provides that such commitment "is subject to interruption or curtailment."

(f) LCRA shall not commit to supply water under Permits Nos. 1260 and 1259 on a firm, uninterruptible basis in excess of the Combined Firm Yield of Lakes Travis and Buchanan. During the period beginning as of January 1, 1988 until such time as the Management Plan is submitted and approved by the Commission, LCRA shall not enter into any contract or adopt any resolution by which it commits to supply any water under Permits Nos. 1260 or 1259 on a firm, uninterruptible basis, unless:

(1) the aggregate of all firm, uninterruptible commitments of water under Permits Nos. 1260 or 1259, including the commitment made pursuant to such contract or resolution, does not exceed 2,500,000 acre-feet over any five consecutive calendar-year period; or

(2) the commitment made pursuant to such contract or resolution is for municipal use, and such commitment does not exceed 10,000 acre-feet of water per year; or

(3) such contract or resolution is specifically approved by either the Executive Director or the Commission pursuant to this special condition (f).

(g) LCRA shall interrupt or curtail the supply of water under Permits Nos. 1260 and 1259 pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demands for water under such permits pursuant to all firm, uninterruptible commitments. Commitments to supply water on a non-firm, interruptible basis may be interrupted or curtailed as necessary either on a pro-rata basis or in accordance with a system of priorities, as may be set forth in the various contracts and resolutions that define such commitments.

(h) LCRA shall not impose its priority under Permits Nos. 1260 and 1259 against any junior permanent water right with a priority date senior to November 1, 1987, except to the extent that:

(1) LCRA would have the right to impose such priority against such water right if LCRA's right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan were limited to the Combined Firm Yield of such lakes; or

(2) the holder of such water right has agreed, or in the future agrees, otherwise.

(i) LCRA shall supply water under Permits Nos. 1260 and 1259 to or for the benefit of any downstream water right with a priority date junior to December 1, 1900 and senior to November 1, 1987 that authorizes the diversion of not more than 3000 acre-feet of water per year, to the extent that:

(1) the holder of such water right applies to the Commission for release of such water; and

(2) the Commission finds that, but for the exercise of priority claims under Certified Filings Nos. 44, 107, 330 and 376:

[a] water would be available for diversion from the natural flow of the Colorado River or tributary thereof at an

authorized point of diversion under such water right; and

(b) applicant's water right would entitle him to divert such water;

provided, however, that LCRA shall not be obligated to supply more than 20,000 acre-feet of water in any year pursuant to this Special Condition (i); that this commitment is subject to interruption or curtailment pro rata with other long-term interruptible commitments of LCRA; and that LCRA shall not be obligated to supply water under this special condition to or for the benefit of a temporary or term permit beyond the initial term thereof.

(j) LCRA may from time to time apply to the Commission for amendment of the above special conditions pursuant to Commission rules.

Additionally, LCRA's rights to use water for hydroelectric generation should include conditions that generally subordinate such rights to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the release of water through its dams solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

CONCLUSIONS:

1. The alterations in the location and specifications of Buchanan Dam and Lake Buchanan from those originally authorized by Permit No. 954 were authorized by the substantial compliance with TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658.

2. LCRA is recognized a right under Permits Nos. 954 and 1259 to maintain an existing dam (Buchanan Dam) at diversion point D-2280 on the Colorado River in Survey No. 32, Burnet County, and Survey No. 12, Llano County, creating a reservoir (Lake Buchanan) with an impounding capacity of 992,475 acre-feet and to use the impounded water for recreation purposes without right of diversion, with a priority date of March 29, 1926.

3. LCRA is recognized a right under Permits Nos. 954 and 1259 to divert and use water through Buchanan

Dam at a maximum rate of 3630 cfs for the purpose of hydroelectric generation, with a priority date of March 29, 1926, subject to the following conditions:

(a) Such right is subordinated to the extent set forth in TEX. REV. CIV. STAT. ANN. art. 8280-107, as amended, Tex. Laws 1975, ch. 74 at 179, as such act may be amended from time to time (the "LCRA Act").

(b) Such right is further subordinated, to the extent that it may not be subordinated pursuant to the LCRA Act, as follows:

(1) LCRA shall not release water through Buchanan Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments; and

(2) To the extent that water is released through Buchanan Dam solely for the purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise.

4. LCRA is recognized a right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan for municipal, industrial, irrigation and mining purposes, with a priority date of March 7, 1938. LCRA may diligently develop such right to a maximum aggregate diversion and use of water for such purposes from Lakes Travis and Buchanan of not to exceed 1,500,000 acre-feet in peak-use years, with a priority date of March 7, 1938, subject to the following conditions:

(a) LCRA shall prepare and submit to the Commission, on or before December 31, 1988, a proposed reservoir operation plan which shall include such studies and other information as may be required by the Commission to determine the Combined Firm Yield of Lakes Travis and Buchanan (as defined in Finding 22, above) and demonstrate LCRA's compliance with, and its ability to comply with, these special conditions (the

"Management Plan"). In making its decision on the adoption of an Management Plan, the Commission shall consider all relevant public policies including, without limitation, the following:

(1) recognition of the necessity of beneficial inflows from the Colorado River into the Lavaca-Tres Palacios Estuary consistent with § 11.147 of the Texas Water Code;

(2) protection of fish and wildlife habitats consistent with § 11.147 of the Texas Water Code;

(3) consideration of the effects, if any, on existing instream uses and water quality consistent with § 11.147 of the Texas Water Code;

(4) mitigation of adverse impacts, if any, on wildlife habitats inundated by new reservoir construction;

(5) mitigation of adverse environmental impacts, if any, caused by new projects taking, storing or diverting an excess of 5,000 acre-feet per year consistent with § 11.152 of the Texas Water Code, and

(6) recognition of the Commission's statutory authority to require water conservation under § 11.134(b)(4).

The Commission shall consider LCRA's proposal prior to adopting the initial Management Plan. The Management Plan may be amended from time to time upon the request of LCRA or on the Commission's own motion. The initial proceeding to consider the adoption of the Management Plan, and any major amendment thereof, shall be pursuant to contested case procedures. Any proceeding to consider the adoption or major amendment of the Management Plan shall be preceded by notice and opportunity to request a hearing in accordance with the Commission's regulations applicable to water rights permitting proceedings. The Texas Parks and Wildlife Department, at its option, may be a party in any such proceeding, in the same manner as it would be a party to a proceeding before the Commission incident to an application for a permit governed by Section 11.147 of the Texas Water Code. The Commission shall name as other parties persons that establish a justiciable interest in the proceeding. In making a final decision on the adoption of a

Management Plan and any amendment thereof, the Commission, in addition to other information, evidence, and testimony presented, shall consider all information, evidence, and testimony presented by the Texas Parks and Wildlife Department, including, without limitation, any memorandum of understanding between LCRA and Texas Parks and Wildlife Department relating to the management of the Highland Lakes.

(b) LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1990, a report which documents compliance with the Management Plan and these special conditions during the previous year. Such report shall be in a form approved by the Executive Director.

(c) Except as provided in Special Condition (i), below, LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to any other party except pursuant to a written contract between LCRA and such party that defines such commitment.

(d) LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to itself for use by itself or other parties except pursuant to resolution adopted by LCRA's Board of Directors that defines such commitment.

(e) Each commitment by LCRA to supply water under Permits Nos. 1260 or 1259 shall be considered to be on a firm, uninterruptible basis unless the contract, resolution or special condition defining such commitment specifically provides that such commitment "is subject to interruption or curtailment."

(f) LCRA shall not commit to supply water under Permits Nos. 1260 and 1259 on a firm, uninterruptible basis in excess of the Combined Firm Yield of Lakes Travis and Buchanan. During the period beginning as of January 1, 1988 until such time as the Management Plan is submitted and approved by the Commission, LCRA shall not enter into any contract or adopt any resolution by which it commits to supply any water under Permits Nos. 1260 or 1259 on a firm, uninterruptible basis, unless:

(1) the aggregate of all firm, uninterruptible commitments of water under Permits Nos. 1260 or 1259, including the commitment made pursuant to such contract or resolution, does not exceed 2,500,000 acre-feet over

any five consecutive calendar-year period; or

(2) the commitment made pursuant to such contract or resolution is for municipal use, and such commitment does not exceed 10,000 acre-feet of water per year; or

(3) such contract or resolution is specifically approved by either the Executive Director or the Commission pursuant to this special condition (f).

(g) LCRA shall interrupt or curtail the supply of water under Permits Nos. 1260 and 1259 pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demands for water under such permits pursuant to all firm, uninterruptible commitments. Commitments to supply water on a non-firm, interruptible basis may be interrupted or curtailed as necessary either on a pro-rata basis or in accordance with a system of priorities, as may be set forth in the various contracts and resolutions that define such commitments.

(h) LCRA shall not impose its priority under Permits Nos. 1260 and 1259 against any junior permanent water right with a priority date senior to November 1, 1987, except to the extent that:

(1) LCRA would have the right to impose such priority against such water right if LCRA's right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan were limited to the Combined Firm Yield of such lakes; or

(2) the holder of such water right has agreed, or in the future agrees, otherwise.

(i) LCRA shall supply water under Permits Nos. 1260 and 1259 to or for the benefit of any downstream water right with a priority date junior to December 1, 1900 and senior to November 1, 1987 that authorizes the diversion of not more than 3000 acre-feet of water per year, to the extent that:

(1) the holder of such water right applies to the Commission for release of such water; and

(2) the Commission finds that, but for the exercise of priority claims under Certified Filings Nos. 44, 307, 330 and 376:

[a] water would be available for diversion from the natural flow of the Colorado River or tributary thereof at an authorized point of diversion under such water right; and

[b] applicant's water right would entitle him to divert such water;

provided, however, that LCRA shall not be obligated to supply more than 20,000 acre-feet of water in any year pursuant to this Special Condition (i); that this commitment is subject to interruption or curtailment pro rata with other long-term interruptible commitments of LCRA; and that LCRA shall not be obligated to supply water under this special condition to or for the benefit of a temporary or term permit beyond the initial term thereof.

(j) LCRA may from time to time apply to the Commission for amendment of the above special conditions pursuant to Commission rules.

The rights recognized in this Conclusion 4 are duplicative of, and are not in addition to, those rights recognized in Conclusion 6 relating to LCRA's rights in Lake Travis, below.

5. LCRA is recognized a right to use the bed and banks of the Colorado River to convey water released from Lake Buchanan for use by LCRA or others entitled to use such water in the amounts and for the purposes recognized herein.

6. LCRA is recognized a right to maintain and operate its existing pump-back unit at diversion point D-2290, as an aid in utilizing the water authorized in Permits Nos. 954 and 1259 for hydroelectric purposes.

DIVERSION POINTS NOS. (MCRS): 2290 and 2380 (Inks Lake)
TRACT NO: None

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR. (MCRS): 260-261
APP. (MCRS): 25-26
XII/II SF 1-1128
(MCRS) II Contest SF 95-138
(LCRS) Contest SF Vols. III, IV, V and VII

SECTION 11.307 CLAIM: Under Permit No. 1259A and Section 11.303 Claim No. 5549 to maintain a dam and a 17,645 acre-foot capacity reservoir on the Colorado River and to impound, divert and use therefrom 1,391,530 acre-feet of water per year at a maximum diversion rate of 2600 cfs for hydroelectric purposes at an unspecified diversion rate, with a priority date of June 29, 1913 and prior. (Exh. J8)

FINDINGS:

1. The LCRA is the owner of Permit No. 1259A, which authorized the construction and maintenance of a 16,400 acre-foot capacity reservoir on the Colorado River in Llano and Burnet Counties and the impoundment, diversion and use therefrom of 1,391,530 acre-feet of water per year for hydroelectric power purposes.

2. A special condition in the permit concerns Permit No. 954:

> The dam for which this permit is granted has been constructed by virtue and under the terms of Permit No. 954, heretofore granted by the Board to the Syndicate Power Company of Dallas, Texas, and the alterations and modifications thereof heretofore set out by declarations filed with this Board, as prescribed by Statute, and this permit shall be cumulative of and in addition to said Permit No. 954, and of the rights covered by said permit; provided that the total quantity of water to be impounded, diverted and appropriated shall not exceed the quantity set out in paragraph four hereof.

(Exh. J11)

3. Paragraph four of Permit No. 1259A declares that of the 1,391,530 acre-feet authorized to be appropriated, ". . . 1,225,700 acre-feet of water per annum have heretofore been granted under Permit No. 954, the total amount to be appropriated under both such permits not to exceed . . . 1,391,530 acre-feet per annum." (Exh. J11)

4. Application No. 1345 for Permit No. 1259A was filed with the Board of Water Engineers on March 7, 1938, and the permit was issued on May 25, 1938. (Exh. J11)

5. The LCRA is the owner of Permit No. 954, which authorized the construction and maintenance of a dam and 831,020 acre-foot capacity reservoir on the Colorado River in Llano and Burnet Counties and the impoundment, diversion and use therefrom of 1,225,700 acre-feet of water per year for "power development" (hydropower) purposes. (Exh. J13a)

6. Application No. 1024 for the permit was filed with the Board of Water Engineers on March 29, 1926, and Permit No. 954 was issued on May 15, 1926. (Exh. J13a)

7. Inks Lake is located on the Colorado River in Llano and Burnet Counties. Inks Dam is located at diversion point D-2380 on the Colorado River in Survey No. 531, Burnet County, and Survey No. 8, Llano County, at the site authorized by Permit No. 1259A and approximately 1.5 miles upstream of the site authorized by Permit No. 954. (Exhs. 7, p. 26, J11, J13a; SF 114-117)

8. Construction of Inks Dam began in 1936 and was completed in 1938 with the first deliberate impoundment of water in 1938. Hydropower generation began in June, 1938. (Exh. J90; SF 361-362)

9. The impounding capacity of Inks Lake is approximately 17,545 acre-feet. (Exh. J90, SF 114-117)

10. Permit No. 1259A authorized a dam 102 feet high and 1500 feet long. Permit No. 954 authorized a dam 165 feet high and 2500 feet long. (Exhs. J11, J13a)

11. Inks Dam is 98.5 feet to 100 feet high and 1550 feet long. (Exh. J90; SF 115-116)

12. A "Statement of Proposed Alteration of Plans under Permits to Appropriate Public Waters of the State of Texas" dated April 25, 1931, was filed with the Board of Water Engineers by the Emery, Peck and Rockwood Development Company, transferee of several permits including Permit No. 954, from the Syndicate Power Company. The statement purported to be filed under TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658. The statement proposed to construct the dam authorized under Permit No. 954 at another location upstream (Buchanan Dam) and to construct another dam at the location authorized by Permit No. 954. This dam would be approximately 70 feet in height. The statement further proposed to reduce the capacity of a reservoir authorized under Permit No. 955 (cancelled on February 7, 1967) so as not to result in an increased appropriation of water. The statement further declared that additional detailed plans would be filed with the Board showing the size, location and character of the two additional dams to be constructed under Permits Nos. 954 and 955. (Exh. J13d)

13. On some date subsequent to November 3, 1936, the LCRA filed a request for extension of time for

commencing or completing work under Permits Nos. 951, 952, 953, 954, 955 and 998. In this request, it was stated that construction had begun by the LCRA on Inks Dam at the site described in Permit No. 954. It was stated that the dam would be built to a height of approximately 102 feet and a length of approximately 1500 feet, creating a reservoir with a surface area of approximately 830 acres and storage capacity of approximately 16,400 acre-feet. The request stated that complete plans and specifications of Inks Dam were on file with the Board of Water Engineers. (Exh. J13e)

14. There are two turbines located at Inks Dam with a discharge capacity of 1300 cfs each and a maximum hydropower generation capability of 24 megawatts. Normal operation is a generation of 24 megawatts with a 2600 cfs discharge rate through the turbines. Operation at Inks Dam is coordinated closely with operation at Buchanan Dam, with Inks functioning primarily as a pass-through of flows released from Buchanan Dam and is essentially a limiting factor on releases from Buchanan Dam. Excess flows are routed through a gravity section in the dam. (SF 776-782, 852)

15. The maximum amount of water used for hydropower purposes at Inks Dam was 1,015,400 acre-feet in 1946. (Exhs. J52a-jj, J136)

16. LCRA's rights to use water for hydroelectric generation should include conditions that generally subordinate such rights to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the release of water through its dams solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

CONCLUSIONS:

1. The alterations in the location and specifications of Inks Dam and Inks Lake from those authorized by Permit No. 954 were authorized by the substantial compliance with TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658.

2. LCRA is recognized a right under Permits Nos. 954 and 1259A to maintain an existing dam (Inks Dam) at diversion point D-2380 on the Colorado River in Survey No. 531, Burnet County, and Survey No. 8, Llano County, creating a reservoir (Inks Lake) with an impounding capacity of 17,545 acre-feet of water and to use the impounded water for nonconsumptive recreation with no right of diversion or release for this purpose, with a priority date of March 29, 1926.

3. LCRA is recognized a right under Permits Nos. 954 and 1259A to divert and use water through Inks Dam at a maximum rate of 2600 cfs for the purpose of hydroelectric generation, with a priority date of March 29, 1926, subject to the following conditions:

(a) Such right is subordinated to the extent set forth in TEX. REV. CIV. STAT. ANN. art. 8280-107, as amended, Tex. Laws 1975, ch. 74 at 179, as such act may be amended from time to time (the "LCRA Act").

(b) Such right is further subordinated, to the extent that it may not be subordinated pursuant to the LCRA Act, as follows:

(1) LCRA shall not release water through Inks Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments; and

(2) To the extent that water is released through Inks Dam solely for the purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise.

DIVERSION POINT NO. (MCRS): 2650 (Lake Lyndon B. Johnson)
TRACT NO: None

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR. (MCRS): 301-302
APP. (MCRS): 26
XII/II SF 1-1128
(MCRS) II Contest SF 95-138
(LCRS) Contest SF Vols. III, IV, V and VII

SECTION 11.307 CLAIM: Under Permits Nos. 953 and 953A and Section 11.303 Claim No. 5547 to maintain a 138,460 acre-foot capacity reservoir on the Colorado River and to impound, divert and use therefrom 1,305,000 acre-feet of water per year for hydroelectric purposes at a maximum diversion rate of 9,000 cfs and to divert 68,400 acre-feet and consume 15,700 acre-feet of water per year for industrial purposes at a maximum diversion rate of 5270 cfs. Claimed priority date is June 29, 1913 and prior. (Exh. J8)

FINDINGS:

1. The LCRA is the owner of Permit No. 953, which authorizes the construction and maintenance of a dam and 28,750 acre-foot capacity reservoir on the Colorado River in Llano and Burnet Counties and the impoundment, diversion and use therefrom of 1,305,000 acre-feet of water per year for power development (hydroelectric) purposes. The permit authorized the construction of the dam at about the southwest corner of Survey No. 509, Burnet County, at a height of 40 feet. (Exh. J19a)

2. The maximum rate of flow set out in Permit No. 953 for water through the turbines for generation of hydroelectric power is 1810 cfs (814,500 gpm). (Exh. J19a)

3. Application No. 1023 for Permit No. 953 was filed with the Board of Water Engineers on March 29, 1926, and the permit was issued on May 15, 1926. (Exh. J19a)

4. The LCRA is the owner of Permit No. 953A, which amends Permit No. 953 to authorize a point of diversion on Lake Lyndon B. Johnson and the diversion of an unspecified amount of water at this diversion point at a maximum diversion rate of 5270 cfs (2,370,000 gpm) for the circulation and recirculation of cooling water in the operation of a thermal-electric power plant. (Exh. J23a)

5. Application No. 1023A for Permit No. 953A was filed with the Commission on August 24, 1970, and the permit amendment was issued on September 22, 1970. (Exh. J23a)

6. Lake Lyndon B. Johnson is located on the Colorado River in Llano and Burnet Counties. Wirtz Dam is located at diversion point D-2650 on the Colorado River in Surveys Nos. 18 and 4, Burnet County, approximately 6.5 miles downstream of the site

authorized by Permit No. 953. (Exhs. 7 at p. 26, J19a; SF 117-122)

7. Construction began on Wirtz Dam and Lake Lyndon B. Johnson in September, 1948 and was completed in 1951, with the first impoundment of water in May, 1951. Hydroelectric generation commenced on June 25, 1951. (Exh. J90; SF 362)

8. The impounding capacity of Lake Lyndon B. Johnson, as-built, was approximately 138,500 acre-feet. (Exh. J90; SF 122)

9. Permit No. 953 authorized a dam 40 feet high and 1200 feet long. (Exh. J19a)

10. Wirtz Dam is 100 to 127.5 feet high, and its length consists of 1,146 feet of concrete plus 3,670 feet of rolled earth and rock with a concrete core. (Exh. J90; SF 118)

11. By order dated December 11, 1970, the Texas Water Rights Commission approved modifications in Wirtz Dam pertaining to (1) alteration of the spillway gates to provide for the installation of stop logs, and (2) construction of a new gated overflow section in the south abutment of the dam. The order did not mention the location, size or impounding capacity of the dam. (Exh. 1230)

12. There are two hydroelectric turbines located at Wirtz Dam with a total discharge capacity of 9000 cfs and a maximum hydropower generation capability of 52 megawatts. When operating proportionally with flows released from Inks Dam, 20 megawatts are generated. Excess flows are routed through floodgates in the dam. (SF 781-784)

13. The maximum amount of water used for hydropower purposes at Wirtz Dam was 1,533,300 acre-feet in 1957. (Exhs. J53a-jj, J136)

14. The thermal-electric plant, known as the Ferguson Plant, on Lake Lyndon B. Johnson went into operation in 1974. There are three circulating water pumps in the plant which pump 92,000 gpm each of condenser water. There are three half-capacity cooling water pumps for plant cooling water which pump 3500 gpm each, with two being operated at any one time. Each year approximately 68,400 acre-feet of water is diverted out of Lake Lyndon B. Johnson at a maximum diversion rate of 630 cfs (283,000 gpm), with 15,000 to 15,700 acre-feet of water being consumed in this process by forced evaporation. (Exhs. J8, J23d, J55jj; SF 119, 1004-1007)

15. LCRA's rights to use water for hydroelectric generation should include conditions that generally subordinate such rights to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the

release of water through its dams solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

CONCLUSIONS:

1. The alterations in the location and impounding capacity of Wirtz Dam and Lake Lyndon B. Johnson, as-built, from the location and impounding capacity set out in Permit No. 953 are substantial and required approval by the Board of Water Engineers pursuant to TEX. REV. CIV. STAT. ANN. art. 7492, repealed, Tex. Laws 1971, ch. 58 at 658. (Supp. 1984-1985)

2. By issuing Permit 953A and its subsequent order dated December 11, 1970, the Texas Water Rights Commission approved the alterations in the location and impounding capacity of Wirtz Dam and Lake Lyndon B. Johnson as they presently exist.

3. LCRA is recognized a right under Permits Nos. 953 and 953A to maintain the existing Wirtz Dam and Lake Lyndon B. Johnson on the Colorado River, with a capacity of 138,500 acre-feet, and to use the impounded water for recreation purposes with no right of diversion or release for this purpose, with a priority date of March 29, 1926.

4. LCRA is recognized a right under Permit No. 953 to divert and use water through Wirtz Dam at a maximum rate of 9000 cfs for the purpose of hydroelectric generation, with a priority date of March 29, 1926, subject to the following conditions:

   (a) Such right is subordinated to the extent set forth in TEX. REV. CIV. STAT. ANN. art. 8280-107, as amended, Tex. Laws 1975, ch. 74 at 179, as such act may be amended from time to time (the "LCRA Act").

   (b) Such right is further subordinated, to the extent that it may not be subordinated pursuant to the LCRA Act, as follows:

      (1) LCRA shall not release water through Wirtz Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments; and

(2) To the extent that water is released through Wirtz Dam solely for the purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise.

5. LCRA is recognized the right under Permit No. 953A to divert, circulate and recirculate water for industrial (power plant cooling) purposes from Lake Lyndon B. Johnson at its Ferguson Power Plant at a maximum diversion rate of 5270 cfs, and to consumptively use not to exceed 15,700 acre-feet of such water per annum in forced evaporation, with a priority date of August 24, 1970.

DIVERSION POINT NO. (MCRS): 3060 (Lake Marble Falls)
TRACT NO: None

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR. (MCRS): 315-316
APP. (MCRS): 28
XII/II SF 1-1128
(MCRS) II Contest SF 95-138
(LCRS) Contest SF Vols. III, IV, V and VII

SECTION 11.307 CLAIM: Under Permit No. 998 and Section 11.303 Claim No. 5546 to maintain a dam and 8,760 acre-foot capacity reservoir on the Colorado River and to impound, divert and use therefrom 1,305,000 acre-feet of water per year at a maximum diversion rate of 9600 cfs for hydroelectric purposes with a priority date of June 29, 1913 and prior. (Exh. J8)

FINDINGS:

1. The LCRA is the owner of Permit No. 998 which authorizes the construction and maintenance of a dam and 23,640 acre-foot capacity reservoir and a 6723 acre-foot capacity reservoir on the Colorado River in Burnet County and the impoundment, diversion and use therefrom of 1,305,000 acre-feet per year of the ordinary and storm and flood flow of the Colorado River for power development (hydroelectric) purposes. (Exh. J26a)

2. The maximum rate of flow set out in Permit No. 998 for water through the turbines for hydropower purposes is 1800 cfs (810,000 gpm). (Exh. J26a)

3. Application No. 1022 for Permit No. 998 was filed with the Board of Water Engineers on March 29, 1926 and the permit was issued on November 4, 1927. (Exh. J26a)

4. Lake Marble Falls is located on the Colorado River in Burnet County. Starcke Dam is located at diversion point D-3060 on the Colorado River in Surveys Nos. 606 and 15, Burnet County, at the site authorized by Permit No. 998. (Exhs. 7 at p. 26, J26a; SF 126-127)

5. Construction began on Starcke Dam and Lake Marble Falls in November, 1949, and was completed in October, 1951. Deliberate impoundment of water began in July, 1951, and power generation commenced on September 25, 1951. (Exh. J90; SF 362)

6. The impounding capacity of Lake Marble Falls as built was approximately 8760 acre-feet. (Exh. J90; SF 127-128)

7. Permit No. 998 authorized a dam 70 feet high and 748 feet long. (Exh. J26a)

8. Starcke Dam is 98 to 100 feet high and 860 feet long. (Exh. J90; SF 127)

9. The record does not reflect that any statement and plans of the alterations in the specifications of Starcke Dam and Lake Marble Falls from those specified in Permit No. 998 were ever filed with the Board of Water Engineers or its successor agencies. (Exhs. J124, J125)

10. The alterations of Starcke Dam and Lake Marble Falls from the specifications authorized by Permit No. 998 resulted in a smaller storage capacity of the reservoir from that authorized in the permit.

11. There are two hydropower generating turbines located at Starcke Dam with a total discharge capacity of 8120 cfs and a maximum generating capacity of 32 megawatts. When operating proportionally with flows released from Inks Dam, the turbines generate approximately 10 megawatts. The power generation at Starcke Dam is coordinated closely with that at Wirtz Dam and the additional flows of the Llano River through Wirtz Dam are released through the turbines at Starcke Dam. Excess flows are routed through floodgates in the dam. (Exh. J90; SF 781-785)

12. The maximum amount of water used for hydropower purposes at Starcke Dam was 1,409,700 acre-feet in 1957. (Exh. J55a-jj, J136)

13. LCRA's rights to use water for hydroelectric generation should include conditions that generally subordinate such rights to all present and future upstream rights to use the waters of the

Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the release of water through its dams solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

CONCLUSIONS:

1. The alterations of Starcke Dam and Lake Marble Falls from the specifications authorized by Permit No. 998 were insubstantial and did not result in an increased appropriation of State water.

2. Starcke Dam and Lake Marble Falls were constructed in substantial compliance with Permit No. 998.

3. LCRA is recognized a right under Permit No. 998 to maintain an existing dam (Starcke Dam) at diversion point D-3060 on the Colorado River in Surveys Nos. 606 and 15, Burnet County, creating a reservoir (Lake Marble Falls) with an impounding capacity of 8760 acre-feet of water and to use the impounded water for nonconsumptive recreation with no right of diversion or release for this purpose, with a priority date of March 29, 1926.

4. LCRA is recognized a right under Permit No. 998 to divert and use water through Starcke Dam at a maximum rate of 6120 cfs for the purpose of hydroelectric generation, with a priority date of March 29, 1926, subject to the following conditions:

   (a) Such right is subordinated to the extent set forth in TEX. REV. CIV. STAT. ANN. art. 8280-107, as amended, Tex. Laws 1975, ch. 74 at 179, as such act may be amended from time to time (the "LCRA Act").

   (b) Such right is further subordinated, to the extent that it may not be subordinated pursuant to the LCRA Act, as follows:

      (1) LCRA shall not release water through Starcke Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments; and

      (2) To the extent that water is released through Starcke Dam solely for the

purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise,

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DIVERSION POINTS NOS. (MCRS): 9999 (Lake Travis)
TRACT NO: None

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR. (MCRS): 341-344
APP. (MCRS): 34-35
XII/II SF 1-112B
II Contest SF 95-138

SECTION 11.307 CLAIM: Under Permits Nos. 951, 952 and 1260 and Section 11.303 Claim No. 5551 to maintain a dam and 1,170,752 acre-foot capacity reservoir on the Colorado River (Lake Travis) and to impound, divert and use therefrom 1,500,000 acre-feet of water per year at a maximum diversion rate of 5529 cfs for "hydroelectric, municipal, domestic, industrial, etc." purposes, with a priority date of June 29, 1913 and prior. (Exh. J8)

FINDINGS:

1. The LCRA is the owner of Permit No. 1260, which authorizes the construction and maintenance of a dam and 600,000 acre-foot capacity reservoir on the Colorado River in Travis County and the impoundment, diversion and use therefrom of 1,500,000 acre-feet per year of the ordinary and storm and flood flows of the Colorado River for domestic, municipal, (industrial), irrigation, mining and hydroelectric power purposes. (Exh. J41a)

2. A special condition in Permit No. 1260 authorizes the LCRA to use the bed and banks of the Colorado River for the purpose of conveying impounded water to diversion points downstream for the uses authorized. (Exh. J41a)

3. Another special condition in the permit concerns Permits Nos. 951 and 952:

> The dam for which this permit is granted is being constructed by virtue and under the terms of Permits Nos. 951 and 952,

heretofore granted by this Board to the Syndicate Power Company of Dallas, Texas, and the alterations and modifications thereof heretofore set out by declarations filed with this Board, as prescribed by Statute, and this permit shall be cumulative of and in addition to Permits Nos. 951 and 952 and of the rights covered by said permits; provided, that the total quantity of water to be impounded, diverted and appropriated shall not exceed the quantity set out in paragraph four of this permit.

(Exh. J41a)

4. Paragraph four of Permit No. 1260 recites that of the 1,500,000 acre-feet authorized by the permit to be appropriated, ". . . 1,391,530 acre-feet have heretofore been granted under Permits Nos. 951 and 952, the total amount to be appropriated under all such permits not to exceed . . . 1,500,000 acre-feet per annum." (Exh. J41A)

5. Application No. 1346 for the permit was filed with the Board of Water Engineers on March 7, 1938, and Permit No. 1260 was issued on May 25, 1938. (Exh. J41a)

6. The LCRA is the owner of Permit No. 951 which authorized the construction and maintenance of a dam and 196,708 acre-foot capacity reservoir on the Colorado River and the impoundment, diversion and use therefrom of 1,391,530 acre-feet of water per year for "power development" (hydropower) purposes. (Exh. J36a)

7. Application No. 1020 for the permit was filed with the Board of Water Engineers on March 29, 1926, and Permit No. 951 was issued on May 15, 1926. (Exh. J36a)

8. The LCRA is the owner of Permit No. 952, which authorized the construction and maintenance of a dam and 718,429 acre-foot capacity reservoir on the Colorado River and the impoundment, diversion and use therefrom of 1,391,530 acre-feet of water per year for power development (hydropower) purposes. (Exh. J31a)

9. Application No. 1021 for the permit was filed with the Board of Water Engineers on March 29, 1926, and Permit No. 952 was issued on May 15, 1926.

10. Lake Travis is located on the Colorado River in Travis and Burnet Counties, Texas. Mansfield Dam is located at diversion point D-9999 on the Colorado River in Surveys Nos. 461 and 192, Travis County, at the site authorized by Permit No. 1260 and approximately one mile downstream of the site authorized by Permit No. 952. (Exhs. 7 at p. 34-35, J41a, J36a, J31a; SF 135-136)

11. Construction began on Mansfield Dam in March, 1937. The first stages of the dam were completed

in July, 1939. After the flood of 1938, the LCRA decided to extend the dam to its present height to provide additional flood control capacity. The present structure was completed May 17, 1942. Deliberate impoundment of water began on September 9, 1940 and the first hydroelectric generation unit was placed in operation on July 27, 1941. (Exh. J90a; SF 357-360, 382)

12. The impounding capacity of Lake Travis as constructed was approximately 1,170,752 acre-feet at normal maximum operating level (681 feet above m.s.l.). (Exh. J90; SF 136-137)

13. Permit No. 1260 authorized a dam 180 feet high and 2,325 feet long. Permit No. 951 authorized a dam 75 feet high and 1,102 feet long. Permit No. 952 authorized a dam 125 feet high and 3,200 feet long. (Exhs. J41a, J36a, J31a)

14. Mansfield Dam is 239.5 to 278 feet high and 2,423 feet long. (Exh. J90; SF 136)

15. On some date subsequent to November 3, 1936, the LCRA filed a request for an extension of time to commence or complete the construction of works authorized by Permits Nos. 951-955 and 998, including a request to extend the time for completion of Mansfield Dam. The request declared that construction had begun on the dam. The location and specifications of the dam and reservoir were the same as those which were later set out in Permit No. 1260. (Exhs. J13e, J41a)

16. By letter dated October 2, 1941, the LCRA sent to the Board of Water Engineers several construction plans. One plan clearly depicted Mansfield Dam at the height at which it was later constructed. (Exh. 1232, J122; Contest SF 112-113)

17. The LCRA secured federal funding to construct Mansfield Dam to its present height. In a March 13, 1941 contract, the Secretary of the Interior designated the LCRA as his agent to operate and maintain the dam upon its completion, solely for the purposes of regulating the flow of the Colorado River below the dam and controlling the floods of the river. The agreement further required that when there was no flood in progress in the river system above the dam, the storage capacity in the reservoir above elevation 681 feet m.s.l. would be available primarily for flood control and stream regulation and such capacity below this elevation would be primarily for power production; provided that the water surface elevation in the reservoir must never, under ordinary conditions when no flood is in progress, exceed elevation 691 feet m.s.l. The LCRA was further obligated by this agreement to release water impounded in the reservoir in anticipation of floods originating in the watershed above the dam and to be responsible for the time and manner of releasing stored waters in anticipation of floods, giving due regard to channel capacities of the river below the dam in making such releases.

Other agreements were later made between the parties concerning construction costs. (Exhs. J62a-c; SF 357-359)

18. Federal regulation of the flood control function of Mansfield Dam eventually passed to the U.S. Army Corps of Engineers. In regulations effective from May 15, 1951 to April 1, 1976, when the surface water elevation of Lake Travis was below 681 feet m.s.l., the LCRA was not permitted to make releases which would result in a flow at Columbus, Texas in excess of 50,000 cfs, provided that no curtailment of normal hydropower releases were required. During periods when the surface water elevation in Lake Travis was above elevation 681 feet m.s.l., a minimum release of 5,000 cfs was required. Above elevation 691 feet m.s.l., releases were required at the maximum possible discharge rate without exceeding a flow of 50,000 cfs at Columbus, provided that no curtailment of normal hydropower operation would result thereby. Above elevation 722 feet m.s.l., the LCRA was authorized to discharge water at the rate necessary to protect the dam and appurtenances from major damage. (Exh. J131; SF 359)

19. At the time of the adjudication hearing, the LCRA was operating Mansfield Dam pursuant to interim regulations adopted by the Corps of Engineers on April 1, 1976. These regulations were similar to the 1951 regulations except that the minimum release rate of water from Lake Travis between surface water elevation 681 and 683 feet m.s.l. was reduced to 3,000 cfs. (Exh. J130; SF 359-360, 377, 786-787, 816-822, 1091-1096)

20. Mansfield Dam is the only significant flood control structure in the Highland Lakes. There are 40 floodgates in the dam with a gravity section at elevation 714 feet m.s.l. The maximum surface water elevation of Lake Travis to date is 707 feet m.s.l., which occurred July, 1963. The capacity of the flood pool between elevation 681 feet and 691 feet m.s.l. is approximately 780,000 acre-feet. All discharges from Mansfield Dam are through the hydropower turbines unless the turbines are not capable of routing the excess flows. (Exh. J90; SF 786-787, 816-822)

21. There are three hydropower generating turbines located at Mansfield Dam with a total discharge capacity of 5530 cfs and a maximum generating capability of 84 megawatts. When operating proportionally with flows released through the other Highland Lakes, the turbines generate approximately 20 megawatts. The variable lake level of Lake Travis permits 24-hour-a-day operation of the turbines. (Exh. J90; SF 783, 785-786)

22. The maximum amount of water used for hydropower purposes at Mansfield Dam was 2,063,185 acre-feet in 1968. (Exhs. J55a-jj, J136)

23. Permit No. 4007, which was issued to the City of Cedar Park, Texas on August 23, 1983, authorizes

firm, uninterruptible commitments is less than the Combined Firm Yield. To the extent that a demand for water may exist on a non-firm, interruptible basis, such stored water should be made available.

f. The supply of stored water pursuant to non-firm, interruptible commitments should be interrupted or curtailed to the extent necessary to allow LCRA to satisfy all existing and projected demands for stored water pursuant to all firm, uninterruptible commitments.

g. Water should not be released through any dam solely for hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for stored water from Lakes Travis and Buchanan pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

27. Water is supplied from conservation storage in Lakes Travis and Buchanan by the direct diversion of stored water from such lakes, the release of stored water from such lakes for downstream delivery, and the impoundment, diversion or use of the flows of the Colorado River and its tributaries upstream of such lakes pursuant to subordination and other agreements. Under the basic system management plan outlined above, the demand for stored water from Lakes Travis and Buchanan will be erratic. The demand for such water will vary greatly from year to year, depending upon the climatic conditions and the locations, amounts and distributions of demands during each year. It is currently estimated that the peak annual demand for stored water in the reasonably foreseeable future will not exceed 1,500,000 acre-feet in any year. Such a demand may occur during years in which the inflows below the Highland Lakes are very low. Such a demand may also occur in other years, if a large demand for water on a non-firm, interruptible basis should develop.

28. The amount of water that the Highland Lakes/Colorado River system can supply each year on a firm basis through a repeat of the drought of record will vary greatly from time to time in the future, depending upon factors such as the locations of points of diversion and the demand for water at each diversion point. Generally, in order to provide a firm supply of water for a given annual demand, less stored water is needed to firm up the run-of-river supply as the point of diversion is moved farther downstream. Assuming that large municipal, industrial and irrigation demands will continue to exist downstream of the Highland Lakes, the firm yield of the entire system will exceed the Combined Firm Yield of Lakes Travis and Buchanan.

the City of Cedar Park to transfer from the Colorado River Basin not to exceed 7000 acre-feet per annum from the perimeter of Lake Travis on the Colorado River at a maximum diversion rate of 21,700 gpm (48.4 cfs) to the environs of the City of Cedar Park for municipal purposes, pursuant to the water supply contract dated May 24, 1983 between LCRA and the City of Cedar Park. (Exh. No. 1406)

24. Special Conditions in Permit No. 4007 provide that (1) water diverted to the City under the authority of Permit No. 4007, but not consumed, shall be returned at a designated point on Brushy Creek in the Brazos River Basin; and (2) that the authorization for the transbasin diversion is contingent upon the existence of a valid permit between LCRA and the City of Cedar Park. (Exh. No. 1406)

25. The City of Cedar Park will require all water authorized under Permit No. 4007 to meet future water demands, based on projected growth in the city over the next thirty years. (III Contest 21-27)

26. The Highland Lakes and the Colorado River above and below the Highland Lakes should be managed together as a single system for water supply purposes. Major goals in the management of the system include maximizing the beneficial use of water derived from inflows below the Highland Lakes, and stretching and conserving the water stored in the Highland Lakes. In order to achieve these goals, the system should be managed in accordance with the following general guidelines:

a. To the extent allowed by law, all demands for water from the Colorado River downstream of the Highland Lakes should be satisfied first pursuant to water rights to the run-of-river flow of the Colorado River.

b. Inflows should be passed through the Highland Lakes to honor downstream senior water rights only to the extent that demands under those rights cannot be satisfied by the inflows below the Highland Lakes.

c. Water should be released from conservation storage in Lakes Travis and Buchanan to satisfy downstream demands for authorized purposes (municipal, industrial, irrigation and mining) only to the extent that such demands cannot be satisfied pursuant to independent run-of-river water rights.

d. Firm, uninterruptible commitments of water from conservation storage in Lakes Travis and Buchanan should not exceed the Combined Firm Yield of such lakes (hereinafter defined).

e. Water from conservation storage in Lakes Travis and Buchanan may be available for supply on an interruptible basis at any time that the actual demand for stored water under

29. The Combined Firm Yield is less than the Combined Theoretical Yield. The "Combined Theoretical Yield" is the amount of water that could be supplied from conservation storage in Lakes Travis and Buchanan during each year of a simulated repeat of the drought of record, as calculated pursuant to studies that assume the following:

a. Inflows to Lakes Travis and Buchanan are those flows that would occur in the Colorado River at the site of Mansfield Dam if the Highland Lakes did not exist and there were no other impoundment, diversion or use of the flows of the Colorado River and its tributaries upstream of that point.

b. No portion of the inflows will be passed through Mansfield Dam to honor downstream senior water rights.

c. Lakes Travis and Buchanan will be operated together as a system so as to maximize the yield of that system.

The "Combined Firm Yield" is that portion of the Combined Theoretical Yield remaining after it is assumed that inflows will be reduced by honoring upstream senior water rights and/or passed through Mansfield Dam to honor downstream senior water rights, in accordance with the relative priorities of such rights, except to the extent that the holder of any such right may agree otherwise. In determining the Combined Firm Yield, it is assumed that each senior water right will be exercised to the full extent authorized, except to the extent that the holder of such right may agree otherwise, or unless the Commission otherwise approves. The Combined Firm Yield may be expressed as a constant amount of water annually, or as an average annual amount of water over a defined period of years. The Combined Firm Yield cannot be determined until after the Adjudication is final, and such yield may change from time to time in the future. However, at the present time it is estimated that the Combined Firm Yield is not less than 500,000 acre-feet of water per year. As discussed above, this amount may also be expressed as an average of 500,000 acre-feet per year over any five consecutive calendar-year period, or a total of 2,500,000 acre-feet over any such period. The Commission will determine the Combined Firm Yield, and whether such yield is expressed as an average annual amount of water over a defined period of years, in its adoption of a Management Plan (hereinafter defined).

30. Subordination of hydroelectric rights will greatly increase the amount of water that LCRA has available to supply from Lakes Travis and Buchanan for other purposes of use. LCRA in the past has subordinated its own hydroelectric rights to its rights to store and use water for other purposes. The City of Austin's early-priority hydroelectric right at Tom Miller Dam under C.F. 330 is the only hydroelectric right in the basin that is senior to

Permit Nos. 1260 and 1259 for Lakes Travis and Buchanan, other than those held by LCRA. The City leased such right to LCRA pursuant to the 1938 and 1966 Agreements between the City and LCRA. LCRA in the past has also subordinated the C.F. 330 hydroelectric right that it leased from the City to LCRA's rights to store and use water for other purposes.

31. The extent to which additional stored water will be available in any year, after satisfying all existing and projected demands for stored water pursuant to all firm, uninterruptible commitments, can be defined at the beginning of that year pursuant to a rule curve or other analysis based on conditions that exist at that time. The availability of such additional stored water can be confirmed or redefined at other times during that year by one or more additional analyses at other times during that year based on conditions that exist at such times.

32. LCRA's right to use water from Lakes Travis and Buchanan for purposes other than hydroelectric generation, and the initial conditions for the commitment and supply of such water, should be defined as follows:

LCRA is recognized a right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan for municipal, industrial, irrigation and mining purposes, with a priority date of March 7, 1938. LCRA may diligently develop such right to a maximum aggregate diversion and use of water for such purposes from Lakes Travis and Buchanan of not to exceed 1,500,000 acre-feet in peak-use years, with a priority date of March 7, 1938, subject to the following conditions:

(a) LCRA shall prepare and submit to the Commission, on or before December 31, 1988, a proposed reservoir operation plan which shall include such studies and other information as may be required by the Commission to determine the Combined Firm Yield of Lakes Travis and Buchanan (as defined in Finding 29, above) and demonstrate LCRA's compliance with, and its ability to comply with, these special conditions (the "Management Plan"). In making its decision on the adoption of an Management Plan, the Commission shall consider all relevant public policies including, without limitation, the following:

(1) recognition of the necessity of beneficial inflows from the Colorado River into the Lavaca-Tres Palacios Estuary consistent with § 11.147 of the Texas Water Code;

(2) protection of fish and wildlife habitats consistent with § 11.147 of the Texas Water Code;

(3) consideration of the effects, if any, on existing instream uses and water quality consistent with § 11.147 of the Texas Water Code;

(4) mitigation of adverse impacts, if any, on wildlife habitats inundated by new reservoir construction;

(5) mitigation of adverse environmental impacts, if any, caused by new projects taking, storing or diverting in excess of 5,000 acre-feet per year consistent with § 11.152 of the Texas Water Code: and

(6) recognition of the Commission's statutory authority to require water conservation under § 11.134(b)(4).

The Commission shall consider LCRA's proposal prior to adopting the initial Management Plan. The Management Plan may be amended from time to time upon the request of LCRA or on the Commission's own motion. The initial proceeding to consider the adoption of the Management Plan, and any major amendment thereof, shall be pursuant to contested case procedures. Any proceeding to consider the adoption or major amendment of the Management Plan shall be preceded by notice and opportunity to request a hearing in accordance with the Commission's regulations applicable to water rights permitting proceedings. The Texas Parks and Wildlife Department, at its option, may be a party in any such proceeding, in the same manner as it would be a party to a proceeding before the Commission incident to an application for a permit governed by Section 11.147 of the Texas Water Code. The Commission shall name as other parties persons that establish a justiciable interest in the proceeding. In making a final decision on the adoption of a Management Plan and any amendment thereof, the Commission, in addition to other information, evidence, and testimony presented, shall consider all information, evidence, and testimony presented by the Texas Parks and Wildlife Department, including, without limitation, any memorandum of understanding between LCRA and Texas Parks and Wildlife Department relating to the management of the Highland Lakes.

(b) LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1990, a report which documents compliance with the Management Plan and these special conditions during the previous year. Such report shall be in a form approved by the Executive Director.

(c) Except as provided in Special Condition (i), below, LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to any other party except pursuant to a written contract between LCRA and such party that defines such commitment.

(d) LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to itself for use by itself or other parties except pursuant to resolution adopted by LCRA's Board of Directors that defines such commitment.

(e) Each commitment by LCRA to supply water under Permits Nos. 1260 or 1259 shall be considered to be on a firm, uninterruptible basis unless the contract, resolution or special condition defining such commitment specifically provides that such commitment "is subject to interruption or curtailment."

(f) LCRA shall not commit to supply water under Permits Nos. 1260 and 1259 on a firm, uninterruptible basis in excess of the Combined Firm Yield of Lakes Travis and Buchanan. During the period beginning as of January 1, 1988 until such time as the Management Plan is submitted and approved by the Commission, LCRA shall not enter into any contract or adopt any resolution by which it commits to supply any water under Permits Nos. 1260 or 1259 on a firm, uninterruptible basis, unless:

(1) the aggregate of all firm, uninterruptible commitments of water under Permits Nos. 1260 or 1259, including the commitment made pursuant to such contract or resolution, does not exceed 2,500,000 acre-feet over any five consecutive calendar-year period; or

(2) the commitment made pursuant to such contract or resolution is for municipal use, and such commitment does not exceed 10,000 acre-feet of water per year; or

(3) such contract or resolution is specifically approved by either the Executive Director or the

Commission pursuant to this special condition (f).

(g) LCRA shall interrupt or curtail the supply of water under Permits Nos. 1260 and 1259 pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demands for water under such permits pursuant to all firm, uninterruptible commitments. Commitments to supply water on a non-firm, interruptible basis may be interrupted or curtailed as necessary either on a pro-rata basis or in accordance with a system of priorities, as may be set forth in the various contracts and resolutions that define such commitments.

(h) LCRA shall not impose its priority under Permits Nos. 1260 and 1259 against any junior permanent water right with a priority date senior to November 1, 1987, except to the extent that:

(1) LCRA would have the right to impose such priority against such water right if LCRA's right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan were limited to the Combined Firm Yield of such lakes; or

(2) the holder of such water right has agreed, or in the future agrees, otherwise.

(i) LCRA shall supply water under Permits Nos. 1260 and 1259 to or for the benefit of any downstream water right with a priority date junior to December 1, 1900 and senior to November 1, 1987 that authorizes the diversion of not more than 3000 acre-feet of water per year, to the extent that:

(1) the holder of such water right applies to the Commission for release of such water; and

(2) the Commission finds that, but for the exercise of priority claims under Certified Filings Nos. 44, 107, 330 and 376:

(a) water would be available for diversion from the natural flow of the Colorado River or tributary thereof at an authorized point of diversion under such water right; and

[b] applicant's water right would entitle him to divert such water;

provided, however, that LCRA shall not be obligated to supply more than 20,000 acre-feet of water in any year pursuant to this Special Condition (i); that this commitment is subject to interruption or curtailment pro rata with other long-term interruptible commitments of LCRA; and that LCRA shall not be obligated to supply water under this special condition to or for the benefit of a temporary or term permit beyond the initial term thereof.

(j) LCRA may from time to time apply to the Commission for amendment of the above special conditions pursuant to Commission rules.

Additionally, LCRA's rights to use water for hydroelectric generation should include conditions that generally subordinate such rights to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, irrigation or industrial purposes. Such conditions should specifically prohibit the release of water through its dams solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments.

CONCLUSIONS:

1. The alterations in the location and specifications of Mansfield Dam and Lake Travis as set out in Permit No. 1260 from those authorized by Permits Nos. 951 and 952 were authorized by the substantial compliance with TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658.

2. A plan of alterations of Mansfield Dam from the specifications set out in Permit No. 1260 was filed with the Board of Water Engineers in substantial compliance with TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658.

3. The construction of Mansfield Dam to its present height and impounding capacity was authorized by the substantial compliance with TEX. REV. CIV. STAT. ANN. art. 7495, repealed, Tex. Laws 1971, ch. 58 at 658.

4. LCRA is recognized a right under Permits Nos. 951, 952 and 1260 to maintain a dam (Mansfield Dam) at Diversion Point No. 9999 on the Colorado River in Surveys Nos. 461 and 192, Travis County, creating a reservoir (Lake Travis) with an impounding capacity of 1,170,752 acre-feet and to use the impounded water for recreation purposes without right of diversion, with a priority date of March 29, 1926.

5. LCRA is recognized a right under Permits Nos. 951, 952 and 1260 to divert and use water through Mansfield Dam at a maximum rate of 5,530 cfs for the purpose of hydroelectric generation, with a priority date of March 29, 1926, subject to the following conditions:

   (a) Such right is subordinated to the extent set forth in TEX. REV. CIV. STAT. ANN. art. 8280-107, as amended, Tex. Laws 1975, ch. 74 at 179, as such act may be amended from time to time (the "LCRA Act").

   (b) Such right is further subordinated, to the extent that it may not be subordinated pursuant to the LCRA Act, as follows:

      (1) LCRA shall not release water through Mansfield Dam solely for the purpose of hydroelectric generation, except during emergency shortages of electricity, and during other times to the extent that such releases will not impair LCRA's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan under Permits Nos. 1260 and 1259 pursuant to all firm, uninterruptible commitments and all non-firm, interruptible commitments; and

      (2) To the extent that water is released through Mansfield Dam solely for the purpose of hydroelectric generation, such right is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity, and during other times to the extent that the holder of any such upstream right has agreed, or in the future agrees, otherwise.

6. LCRA is recognized a right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan for municipal, industrial, irrigation and mining purposes, with a priority date of March 7, 1938. LCRA may diligently develop such right to a maximum aggregate diversion and use of water for such purposes from Lakes Travis and Buchanan of not to exceed 1,500,000 acre-feet in peak-use years, with a priority date of March 7, 1938, subject to the following conditions:

(a) LCRA shall prepare and submit to the Commission, on or before December 31, 1988, a proposed reservoir operation plan which shall include such studies and other information as may be required by the Commission to determine the Combined Firm Yield of Lakes Travis and Buchanan (as defined in Finding 29, above) and demonstrate LCRA's compliance with, and its ability to comply with, these special conditions (the "Management Plan"). In making its decision on the adoption of an Management Plan, the Commission shall consider all relevant public policies including, without limitation, the following:

(1) recognition of the necessity of beneficial inflows from the Colorado River into the Lavaca-Tres Palacios Estuary consistent with § 11.147 of the Texas Water Code;

(2) protection of fish and wildlife habitats consistent with § 11.147 of the Texas Water Code;

(3) consideration of the effects, if any, on existing instream uses and water quality consistent with § 11.147 of the Texas Water Code;

(4) mitigation of adverse impacts, if any, on wildlife habitats inundated by new reservoir construction;

(5) mitigation of adverse environmental impacts, if any, caused by new projects taking, storing or diverting in excess of 5,000 acre-feet per year consistent with § 11.152 of the Texas Water Code; and

(6) recognition of the Commission's statutory authority to require water conservation under § 11.134(b)(4).

The Commission shall consider LCRA's proposal prior to adopting the initial Management Plan. The Management Plan may be amended from time to time upon the request of LCRA or on the Commission's own motion. The initial proceeding to consider the adoption of the Management Plan, and any major amendment thereof, shall be pursuant to contested case procedures. Any proceeding to consider the adoption or major amendment of the Management Plan shall be preceded by notice and opportunity to request a hearing in accordance with the Commission's regulations applicable to water rights permitting proceedings. The Texas Parks and Wildlife Department, at

its option, may be a party in any such proceeding, in the same manner as it would be a party to a proceeding before the Commission incident to an application for a permit governed by Section 11.147 of the Texas Water Code. The Commission shall name as other parties persons that establish a justiciable interest in the proceeding. In making a final decision on the adoption of a Management Plan and any amendment thereof, the Commission, in addition to other information, evidence, and testimony presented, shall consider all information, evidence, and testimony presented by the Texas Parks and Wildlife Department, including, without limitation, any memorandum of understanding between LCRA and Texas Parks and Wildlife Department relating to the management of the Highland Lakes.

(b) LCRA shall prepare and submit to the Commission, on or before March 1 of each year beginning with March 1, 1990, a report which documents compliance with the Management Plan and these special conditions during the previous year. Such report shall be in a form approved by the Executive Director

(c) Except as provided in Special Condition (i), below, LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to any other party except pursuant to a written contract between LCRA and such party that defines such commitment.

(d) LCRA shall not supply or commit to supply any water under Permits Nos. 1260 or 1259 to itself for use by itself or other parties except pursuant to resolution adopted by LCRA's Board of Directors that defines such commitment.

(e) Each commitment by LCRA to supply water under Permits Nos. 1260 or 1259 shall be considered to be on a firm, uninterruptible basis unless the contract, resolution or special condition defining such commitment specifically provides that such commitment "is subject to interruption or curtailment."

(f) LCRA shall not commit to supply water under Permits Nos. 1260 and 1259 on a firm, uninterruptible basis in excess of the Combined Firm Yield of Lakes Travis and Buchanan. During the period beginning as of January 1, 1988 until such time as the Management Plan is submitted and approved by the Commission, LCRA shall not enter into any contract or adopt any resolution by which it commits to supply any water under Permits

Nos. 1260 or 1259 on a firm, uninterruptible basis, unless:

(1) the aggregate of all firm, uninterruptible commitments of water under Permits Nos. 1260 or 1259, including the commitment made pursuant to such contract or resolution, does not exceed 2,500,000 acre-feet over any five consecutive calendar-year period; or

(2) the commitment made pursuant to such contract or resolution is for municipal use, and such commitment does not exceed 10,000 acre-feet of water per year; or

(3) such contract or resolution is specifically approved by either the Executive Director or the Commission pursuant to this special condition (f).

(g) LCRA shall interrupt or curtail the supply of water under Permits Nos. 1260 and 1259 pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demands for water under such permits pursuant to all firm, uninterruptible commitments. Commitments to supply water on a non-firm, interruptible basis may be interrupted or curtailed as necessary either on a pro-rata basis or in accordance with a system of priorities, as may be set forth in the various contracts and resolutions that define such commitments.

(h) LCRA shall not impose its priority under Permits Nos. 1260 and 1259 against any junior permanent water right with a priority date senior to November 1, 1987, except to the extent that:

(1) LCRA would have the right to impose such priority against such water right if LCRA's right under Permits Nos. 1260 and 1259 to divert and use water from Lakes Travis and Buchanan were limited to the Combined Firm Yield of such lakes; or

(2) the holder of such water right has agreed, or in the future agrees, otherwise.

(i) LCRA shall supply water under Permits Nos. 1260 and 1259 to or for the benefit of any downstream water right with a priority date junior to December 1, 1900 and senior to November 1, 1987 that

authorizes the diversion of not more than 3000 acre-feet of water per year, to the extent that:

(1) the holder of such water right applies to the Commission for release of such water; and

(2) the Commission finds that, but for the exercise of priority claims under Certified Filings Nos. 44, 307, 330 and 376:

[a] water would be available for diversion from the natural flow of the Colorado River or tributary thereof at an authorized point of diversion under such water right; and

[b] applicant's water right would entitle him to divert such water;

provided, however, that LCRA shall not be obligated to supply more than 20,000 acre-feet of water in any year pursuant to this Special Condition (i); that this commitment is subject to interruption or curtailment pro rata with other long-term interruptible commitments of LCRA; and that LCRA shall not be obligated to supply water under this special condition to or for the benefit of a temporary or term permit beyond the initial term thereof.

(j) LCRA may from time to time apply to the Commission for amendment of the above special conditions pursuant to Commission rules.

The rights recognized in this Conclusion 6 are duplicative of, and are not in addition to, those rights recognized in Conclusion 4 relating to LCRA's rights in Lake Buchanan, above.

7. LCRA is recognized a right to use the bed and banks of the Colorado River to convey water released from Lake Travis for use by LCRA or others entitled to use such water in the amounts and for the purposes recognized herein.

MODIFIED FINDINGS AND CONCLUSIONS
DEFINING LCRA'S WATER RIGHTS WITH RESPECT
TO ITS LAKESIDE WATER DIVISION

DIVERSION POINTS NOS: 4030 and 4040
TRACTS NOS: 1970 and 1980

OWNERSHIP: Lower Colorado River Authority

IR: 275-276
APP: 21 and 22
XIV SF 248-368

SECTION 11.307 CLAIM: Under Certified Filing No. 376 and Permit No. 1493 to divert and use not to exceed 173,250 acre-feet of water per year from the Colorado River (D-4030) and Eagle Lake (D-4040) at maximum diversion rates of 700 cfs (D-4030) and 425 cfs (D-4040) for the irrigation of 33,000 acres of land with a priority date of November, 1899. A natural impoundment known as Eagle Lake with a capacity of 9,600 acre-feet on Moore's Branch "and other drainage courses" is also claimed. (Exh. 944; SF 249-250)

FINDINGS:

1. Claimant (hereinafter "LCRA") is the owner of Certified Filing No. 376 (hereinafter CF-376) which is derived from an affidavit filed on January 4, 1901, with the County Clerk of Colorado County by Eagle Lake Rice Irrigation Company. The affidavit declared an intent to appropriate water from the Colorado River for milling, stock raising and for the irrigation of 10,000 acres of land. One branch of the main canal was to run to Moore's Branch and then to Eagle Lake, from which water was again to be diverted. (Exhs. 945, 946)

2. An Additional Statement of Work Done under Certified Filing No. 376 was filed with the Board of Water Engineers on June 29, 1914. This statement declared that "the whole canal system, as shown by said filing, has been completed and in addition thereto there has been acquired and constructed a mile more of canals." The holding capacity of Eagle Lake was declared to be approximately 418,176,000 cubic feet (9,600 acre-feet). It was further declared that in each year during the period 1900-1913, inclusive, 5,544,000,000 gallons of water (1701 acre-feet) had been diverted for rice irrigation on 4500 acres of land. (Exh. 947)

3. A sworn claim of a water right based upon Certified Filing No. 376 was filed in 1918 by Lakeside Irrigation Company, Inc. (Lakeside), LCRA's immediate predecessor, under the Water Rights Adjudication Act of 1917 (1917 Tex. Gen. Laws, Ch. 88, at 211). In this claim, Lakeside declared that construction of the canals and pumping plant had commenced in November, 1899, and water had first been used for irrigation purposes in May, 1890. It was further declared that a "final enlargement of pumping facilities" was being conducted to increase the pumping capacity at the Colorado River to 100,000 gpm (222.8 cfs) and at

Eagle Lake by 18,000 gpm (40.10 cfs). It was further stated that 7500 acres had been irrigated in 1917 and that 8500 acres would be irrigated in 1918 and 10,000 acres in 1919. It was also noted that "from the very beginning, in 1899 the idea of bettering the system working towards the final watering of 10,000 acres has been constantly in mind and striven for." There was no mention of any use of water for mining or stock raising purposes. (Exh. 955)

4. The 1918 water right claim described the diversion facilities existing at that time and declared that a "final enlargement of pumping facilities" was being conducted to increase the pumping capacity of the Colorado River plant to 100,000 gpm (222.8 cfs) and the Eagle Lake plant by 18,000 gpm (40.10 cfs). The claim further stated that a new 24-inch slow speed pump with a diversion capacity of 18,000 gpm (40.10 cfs) was to be added to the existing Eagle Lake Plant which consisted of a 24-inch slow speed pump and a 30-inch slow speed pump. The total diversion rate at the enlarged Eagle Lake plant would have been about 54,000 gpm (120.3 cfs). (Exh. 955)

5. LCRA is the holder of Permit No. 1493 which authorizes the diversion and use from the Colorado River of not to exceed 60,000 acre-feet of water per year delivered from storage in Lake Buchanan and Lake Travis at a maximum diversion rate of 600 cfs for the irrigation of 25,000 acres of land out of a 111,592.6-acre tract located in Colorado and Wharton Counties and designated as T-1980. The permit further authorizes the use of the bed and banks of the Colorado River to transport water from storage in Lakes Buchanan and Travis to LCRA's pumping plant on the Colorado River. The permit was issued to Lakeside to be exercised in accordance with a contract dated October 2, 1937, between LCRA and Lakeside and in furtherance of Lakeside's rights under CF-376. Application No. 1600 for the permit was filed with the Board of Water Engineers on January 13, 1949, and Permit No. 1493 was issued on May 2, 1949. (Exhs. 949, 951)

6. On December 18, 1975, the Commission issued Permit No. 1493A to Lakeside. This amendment changed the description of the diversion facilities to authorize an additional pump without any increase in the authorized diversion rate. On January 28, 1980, the Commission issued Permit No. 1493B. This amendment was a corrected version of Permit No. 1493A, which was withdrawn. (Permits Nos. 1493A, 1493B)

7. On August 24, 1983, the Commission issued Permit No. 1493C which authorizes an increase in the diversion rate at the Colorado River diversion point (D-4030) from 600 cfs to 700 cfs (314,200 gpm), with a time priority of April 18, 1983. (Exh. 1513)

8. On December 20, 1982, the Commission entered an order pursuant to Section 2 of the Lower Colorado River Authority Act, Texas Laws 1975, Chapter 74, authorizing LCRA to use water for irrigation purposes under Certified Filing No. 376 and Permit No. 1493 upon transfer of the certified filing and permit from Lakeside to LCRA. (Exh. 1496)

9. On March 21, 1983, the Commission entered an order pursuant to Section 2 of the Lower Colorado River Authority Act, Texas Laws 1975, Chapter 74, approving the transfer of Certified Filing No. 376 and Permit No. 1493 from Lakeside to LCRA and authorizing LCRA to use water for irrigation purposes under the certified filing and permit. (Exh. 1497)

10. The service area under CF-376 and Permit No. 1493 (T-1980) consists of 111,592.6 acres. The Lakeside Canal System service area also includes 10,863.1 acres of land located outside of T-1980. (Exhs. 956, 957; SF 270, 274-275, 284-285, 288, 355-357)

11. LCRA maintains a pumping plant at diversion point D-4030 on the left, or east, bank of the Colorado River, at the point authorized by CF-376. The maximum diversion rate at D-4030 has been 600 cfs when the river was at normal elevation or slightly below normal elevation. When the river is at a high elevation, the maximum diversion rate has been 720 cfs. (SF 270-271, 281-282, 291-292)

12. A pumping plant is also maintained at D-4040 on Eagle Lake, a 9600 acre-foot natural impoundment on Moore's Branch, tributary of the Colorado River. Water is pumped from D-4030 on the Colorado River into Moore's Branch which flows into Eagle Lake and is subsequently diverted from Eagle Lake at a maximum diversion rate of 425 cfs into canals for irrigation use. At least 95% of the water diverted from Eagle Lake is water pumped from the Colorado River. (SF 271-272, 283-284, 351, 361-363)

13. The Lakeside Canal System consists of unlined canals and ditches located about as described in the 1901 affidavit. The carrying capacity of the main canal is 1000-1200 cfs. A relift pump and canal is used to supply water to the northern portion of the service area. In recent years, 80 to 84 farmers have been serviced by the canal system each year. Payment to the company for the water is based upon the acreage irrigated. Prior to LCRA's acquisition of the Canal System, Lakeside instituted measures to prevent waste of water in the system, including the use of "canal riders" and patrolling aircraft. (SF 271-171, 278-280, 284, 295-297, 301, 331)

14. Rice has been the principal crop grown within the Lakeside Canal System service area since 1900. The practice of growing two crops of rice each year began in 1962 and since 1963, most of the water diverted into the system has been for the

irrigation of two rice crops each year. The rice planted in recent years has been a high yield variety which requires more water than previously grown varieties. The usual practice is to grow rice on a particular tract every three years, letting the tract remain fallow in between years of rice plantings. LCRA anticipates that alternative crops such as soybeans and maize will be grown on the tracts in between rice plantings. To date, 300-400 acres of alternative crops have been watered in any one year. (Exh. 958; SF 289-298, 308-310, 318-319, 341-342)

15. The maximum number of acres irrigated in any one year in the Lakeside Canal System service area since the double-cropping of rice began is 28,233 acres in 1980. (Exh. 1503)

16. Beginning in 1958, Lakeside's annual water use reports proportioned the total water diverted into its irrigation system as two-fifths under Certified Filing No. 376 and three-fifths under Permit No. 1493. (Exhs. 954, 1499-1505; SF 322-324, 351-352)

17. The maximum amount of water diverted from the Colorado River at D-4030 and used for irrigation in any one year was 139,326 acre-feet in 1982. (Exh. 1505)

18. Lakeside supplied water to two sugar mills in the early 1920's. The amount of water supplied was not determined. There was no evidence of any water ever having been used for stock raising (feedlot) purposes, which is classified as an industrial use and which had been interpreted by Lakeside to mean the irrigation of pasture. (SF 332-333, 353-355, 359-361)

19. 5.25 acre-feet of water per annum per irrigated acre of land is the maximum amount of water that can be reasonably and diligently used without waste for the irrigation of double crops of rice along the Texas Gulf Coast. (Exh. 1548)

CONCLUSIONS:

1. The priority date of Certified Filing No. 376 is not entitled to relate back under §7 of the 1895 Irrigation Act (1895 Tex. Gen. Laws, Ch. 21) to the time of commencement of construction of the canal system since the appropriation affidavit was not filed with the county clerk within 90 days of such commencement or within 90 days after the effective date of the Act (March 21, 1895) as required by §6 of the Act.

2. LCRA is recognized a right under Certified Filing No. 376 to divert and use not to exceed 131,250 acre-feet of water per year from diversion point D-4030 on the Colorado River at a maximum diversion rate of 700 cfs for the irrigation of 25,000 acres of land within T-1980 in Colorado and Wharton Counties, with a priority date of January 4, 1901, subject to the following conditions:

(a) LCRA shall not impose its priority with respect to 78,750 acre-feet of water per year under such right (the difference between 131,250 and 52,500 acre-feet per year) against any junior water right with a priority date senior to November 1, 1987.

(b) The entire amount of water under such right is specifically subordinated, as to priority, to the City of Austin's Lake Austin Rights under Certified Filing No. 330 (as such Lake Austin Rights are defined in Conclusion 5 of the findings and conclusions defining the City of Austin's water rights).

3. LCRA is further recognized a right under Certified Filing No. 376 to store water diverted from the Colorado River at D-4030 in a 9,600 acre-foot capacity natural lake known as Eagle Lake, and to divert such water from such lake at D-4040 at a maximum diversion rate of 120.3 cfs, for use to the extent authorized herein.

4. Permit No. 1493 is essentially a "contractual permit" based upon Permit No. 1259 and Permit No. 1260 held by the LCRA and it did not authorize a new appropriation of state water.

MODIFIED FINDINGS AND CONCLUSIONS
DEFINING LCRA'S WATER RIGHTS WITH RESPECT
TO ITS GULF COAST WATER DIVISION

DIVERSION POINTS NOS: 4270, 4460, 4470, 4480, 4490, 4500, 4510, 4520, 4530, 4540, 4560 and 4570

TRACTS NOS: 2150, 2240, 2250, 2260, 2270, 2290, 2300, 2310, 2320 and 2340

OWNERSHIP: Lower Colorado River Authority (LCRA)

IR: 298-299, 312-316, 318-322, 325
APP: 26, 29-32
XV SF 1-272; Contest Volumes IV-VII

SECTION 11.307 CLAIM: Under Permit No. 1292, Certified Filings Nos. 51, 722, 238, 44, 89, 747, 810, 430, 831 and 83 (hereinafter, collectively "the certified filings") and §11.303 Claim No. 1558 to divert and use not to exceed 1,500,000 acre-feet of water per year from the three diversion points located on the Colorado River at maximum diversion rates of 400 cfs, 435 cfs and 500 cfs for the irrigation of 375,000 acres of land, with a priority date of "1900 and prior." A dam and 2028 acre-foot capacity reservoir on the Colorado River is also claimed. (Exh. 967)

FINDINGS:

1. a. Claimant (hereinafter "LCRA") is the owner of Certified Filing No. 44 (hereinafter "CF-44"), which is derived from an affidavit filed on December 1, 1900 with the County Clerk of Matagorda County by the Matagorda County Rice and Irrigation Company. The affidavit declared an intent to appropriate water from the Colorado River for the irrigation of about 40,000 acres of land. It was further declared that work began on the canal on February 1, 1900. (Exh. 969)

   b. An Additional Statement of Work Done under CF-44 was filed with the Board of Water Engineers on March 27, 1914, by the Matagorda Canal Company. This statement declared that the canal was able to irrigate 1200 to 1500 acres of land, and that water was being diverted by means of a 50,000 gpm pump and a 60,000 gpm pump and a 65,000 gpm pump was in possession but was not being used. Irrigation was reported for each year 1900-1913 with a maximum diversion and use of 18,750 acre-feet of water to irrigate 14,423 acres in 1904. (Exh. 970)

   c. In 1918, a sworn claim of a water right based upon CF-44 was filed under the Water Rights Adjudication Act of 1917 by the Matagorda Canal Company. The claim stated that the construction of the ditch or diversion works was begun in December 1900, and completed in 1906, with first use of water for irrigation in 1901. It was also claimed that prior to 1906, water had been diverted by a pump with

a 65,000 gpm capacity and since 1906 by two pumps with capacities of 50,000 gpm and 60,000 gpm. It was further stated that 1500 to 7500 acres of land were irrigated each year and that two acre-feet of water per acre was needed to irrigate 4000 acres for the rice season, "or 32,000 gpm." (Exh. 971)

2. a. The LCRA is the owner of Certified Filing No. 51 (hereinafter "CF-51") which is derived from an affidavit filed on March 5, 1902 with the County Clerk of Matagorda County by the Tres Palacios Rice and Irrigation Company. The affidavit declared an intent to appropriate water from the Colorado River for the irrigation of approximately 75,000 acres of land. (Exh. 972)

   b. An Additional Statement of Work Done under CF-51 was filed with the Board of Water Engineers on April 2, 1914, by the Texas Irrigation Company as successor to the Tres Palacios Rice and Irrigation Company. This statement declared that 32.65 miles of canals and laterals had been constructed which were capable of irrigating 16,000 acres of land by means of a pumping plant with a rated capacity of 120,000 gpm. Irrigation was reported for each year 1903-1905 and 1907-1913, with a maximum diversion rate of 70,000 gpm in 1909 and 1910. (Exh. 974; SF 12-15)

   c. A Statement of Information Relating to Pumping under CF-55 was also filed with the Board of Water Engineers on April 2, 1914. This statement declared that 3500 to 10,000 acres of land had been irrigated in any one year and that the maximum rate of diversion of water at the plant had been 80,000 gpm. (Exh. 975)

   d. A water service report for the year 1925 was filed by the Texas Canal Company, as a subsidiary of the Markam Irrigation Company. This report stated that 9222 acres of land had been irrigated by means of the Texas Canal Company's canal, using two pumps with rated capacities of 35,000 gpm and that two acre-feet of water was being used for each acre of rice irrigated. (Exh. 975A)

3. a. The LCRA is the owner of Certified Filing No. 83 (hereinafter "CF-83"), which is derived from an affidavit filed on October 12, 1901 with the County Clerk of Matagorda County by the Colorado Canal Company. The affidavit declared an intent to appropriate water from the Colorado River for the irrigation of approximately 40,000 acres of land. It was further declared that work began on the ditch on September 15, 1901. (Exh. 976)

   b. An Additional Statement of Work Done under CF-83 was filed with the Board of Water

Engineers on April 28, 1914, by the Colorado Canal Company. This statement declared that 19 miles of canals and laterals had been constructed and in operation for 12 years. Irrigation was reported for each year 1907-1914, with a maximum irrigation of 11,000 acres in 1907. It was declared that 38 inches of water per acre were used each rice growing season. (Exh. 977)

c. A Statement of Information Relating to Pumping under CF-83 was also filed with the Board of Water Engineers on April 28, 1914. This statement declared that construction of the original canal had commenced on December 15, 1901 and ended in 1902, except that the canal had been extended by four miles in 1904. It further declared that the installed capacity of the pumping plant was 130,000 gpm and that 10,000 to 11,000 acres of rice had been irrigated in 1907-1908. (Exh. 978)

4. a. The LCRA is the owner of Certified Filing No. 89 (hereinafter "CF-89") which is derived from an affidavit filed on March 1, 1901 with the County Clerk of Matagorda County by the Moore-Cortes Canal Company. The affidavit declared an intent to appropriate water from a natural lake at the confluence of the Colorado River and Jennings Creek for the irrigation of approximately 30,000 acres of land. It was further declared that work on the canal had commenced on December 1, 1900. (Exh. 979)

b. An Additional Statement of Work Done under CF-89 was filed with the Board of Water Engineers on April 24, 1914 by the Markam Irrigation Company. This statement declared that all canals and laterals had been completed and that water was being diverted at 300 cfs. Irrigation was reported for each year 1901-1913, with a maximum of 12,000 acres irrigated in 1903. (Exh. 980)

c. A Statement of Information Relating to Pumping under CF-89 was also filed with the Board of Water Engineers on April 24, 1914. This statement declared that the installed capacity at the pumping plant was 100,000 gpm, consisting of four pumps with rated capacities of 25,000 gpm, and that water was diverted at 100,000 gpm. It was further declared that 10,200 acres of rice had been irrigated in 1913 and that work had commenced on December 1, 1900. (Exh. 981)

d. Water Service Reports filed by the Markam Irrigation Company for the years 1917, 1918 and 1919 reported a maximum irrigation of 21,085 acres of rice in 1918 and stated that Markam Irrigation Company and the Northern Irrigation Company had been consolidated in March of 1918. (Exhs. 982-984)

5. a. The LCRA is the owner of Certified Filing No. 238 (hereinafter "CF-238"), which is derived from an affidavit filed on January 8, 1910 with the County Clerk of Matagorda County by the Collegeport Canal Company. The affidavit declared an intent to appropriate water from the Colorado River "for the purpose of irrigation, milling and stock raising, and for the purposes named in its charter." It was declared that approximately 20,000 acres of land would be irrigated in any one year "but that the canal will reach and cover approximately 35,000 acres of land which can be watered therefrom when its capacity is increased, as it may be." Construction was declared to have commenced on December 1, 1909. (Exh. 985)

b. An Additional Statement of Work Done under CF-238 was filed with the Board of Water Engineers on June 26, 1914 by the Collegeport Irrigation Company. The statement declared that the canal system and pumping plant had been completed in 1912 and the maximum diversion of water had been 52 cfs. Irrigation was reported for each year 1911-1913, with a maximum of 3000 acres irrigated in 1911. (Exh. 987)

c. A water service report for the year 1925 was filed by the Texas Irrigation Company, as a subsidiary of the Markam Irrigation Company. This report stated that 7525 acres of rice had been irrigated that year by means of the Collegeport canal, using two pumps with rated capacities of 35,000 gpm and two acre-feet of water being used for each acre of rice irrigated. (Exh. 975A)

6. a. The LCRA is the owner of Certified Filing No. 430 (hereinafter "CF-430"), which is derived from an affidavit filed on March 8, 1902 with the County Clerk of Matagorda County by the Sexton Rice and Irrigation Company. The affidavit declared an intent to appropriate water from the Colorado River for the irrigation of 30,000 acres of land. It further declared that work began on the canal on December 10, 1901. (Exh. 988)

b. An Additional Statement of Work Done under CF-430 was filed with the Board of Water Engineers on June 30, 1914 by the Security Rice and Irrigation Company. This statement declared that the construction of canals was completed and that water was being diverted at 2.4 cfs. Irrigation was reported for each year 1902-1914, with a maximum irrigation of 6400 acres in 1908. (Exh. 991)

c. A Statement of Information Relating to Pumping under CF-430 was filed with the Board of Water Engineers on June 30, 1914 by the Security Rice and Irrigation Company. This statement declared that the installed

(a) LCRA shall not impose its priority with respect to 78,750 acre-feet of water per year under such right (the difference between 131,250 and 52,500 acre-feet per year) against any junior water right with a priority date senior to November 1, 1987.

(b) The entire amount of water under such right is specifically subordinated, as to priority, to the City of Austin's Lake Austin Rights under Certified Filing No. 330 (as such Lake Austin Rights are defined in Conclusion 5 of the findings and conclusions defining the City of Austin's water rights).

3. LCRA is further recognized a right under Certified Filing No. 376 to store water diverted from the Colorado River at D-4030 in a 9,600 acre-foot capacity natural lake known as Eagle Lake, and to divert such water from such lake at D-4040 at a maximum diversion rate of 120.3 cfs, for use to the extent authorized herein.

4. Permit No. 1493 is essentially a "contractual permit" based upon Permit No. 1259 and Permit No. 1260 held by the LCRA and it did not authorize a new appropriation of state water.

Leagues Nos. 18, 20 and 14 were being irrigated in 1914. (Exh. 999)

c. A Statement of Information Relating to Pumping under CF-747 was filed with the Board of Water Engineers on June 30, 1914 by the Peyton Creek Irrigation District. This statement declared that the installed capacity of the pumping plant was 70,000 gpm and that water was being pumped at 6000 gpm. It further declared that the pumping plant was built in 1912 and 1913. (Exh. 1000)

9. a. The LCRA is the owner of Certified Filing No. 810 (hereinafter "CF-810"), which is derived from an affidavit filed on with the County Clerk of Matagorda County on April 4, 1902 by the Planters Irrigation Company. The affidavit declared an intent to appropriate water from the Colorado River to irrigate an unspecified number of acres by means of a canal with a carrying capacity of 280 cfs. It further declared that work began on the canal on January 12, 1902. (Exh. 1001)

b. CF-810 is also derived from an affidavit filed with the County Clerk of Matagorda County on November 5, 1902 by the Northern Irrigation Company. This affidavit declared an intent to divert and use water from the Colorado River for the irrigation of approximately 25,000 acres of land by means of a canal with a carrying capacity of 700 cfs. It was further declared that work began on the canal on August 11, 1902. (Exh. 1002)

c. A "sworn statement" by A. J. Harty, as owner of the Northern Irrigation Company, successor of the Planters Irrigation Company, was filed with the Board of Water Engineers on January 23, 1915. This statement declared an intent to divert and use water from the Colorado River for the irrigation of approximately 25,000 acres of land, being the same land as the Northern Irrigation Company appropriation affidavit. Diversion was to be from a headgate, described in the Northern Irrigation Canal Company's appropriation affidavit, into a canal with a carrying capacity of 3600 cfs. It was further stated that work commenced on the canal on August 11, 1902, and on the Planters Irrigation Company canal on January 12, 1902. There was no evidence that this sworn statement was ever filed with a county clerk. (Exh. 1003)

d. A "supplemental sworn statement" was filed with the Board of Water Engineers on January 23, 1915 by A. J. Harty as owner of the Northern Canal, successors to the Northern Irrigation Company. This statement declared that the Northern Irrigation Company's canal, plant and intake had been completed and in use since 1902 and that the greatest amount

of water used in any one year was "approximately 140,000 gallons per minute." It further stated that the canal had a carrying capacity of 3600 cfs and approximately 11,000 acres of rice had been irrigated in any one year since 1902. (Exh. 1004)

e. In 1918, a sworn claim of water based upon CF-810 was filed under the Water Rights Adjudication Act of 1917 by A. M. Marty, as owner of the Northern Canal. The claim stated that work began on the Planters Irrigation Company canal on January 12, 1902, and that the canal had a carrying capacity of 280 cfs. It further stated that work began on the Northern Irrigation Company canal on August 11, 1902 was completed in 1903, and had a carrying capacity of 700 cfs. The claim stated that the Planters Irrigation Company canal was intended to irrigate 2000 acres and the Northern Irrigation Company canal was intended to irrigate 25,000 acres. It further stated that 5000 to 14,000 acres had been irrigated each year with 24 to 32 inches of water on each acre irrigated. According to this claim, the Northern Irrigation Company's canal was an enlargement of the Planters Irrigation Company's canal which took place in the later part of 1902 and the early part of 1903. (Exh. 1005)

f. A water service report under CF-810 for the year 1917 reported the irrigation of 7226 acres of land in that year. Diversion was by a canal with a capacity of 300 cfs from a reservoir with a capacity of 12,000 acre-feet. The pumping plant consisted of two pumps rated at 60,000 gpm. (Exh. 1006)

10. a. LCRA is the owner of Certified Filing No. 831 (hereinafter CF-831) which is derived from an affidavit filed on October 29, 1900 with the County Clerk of Wharton County by J. Lane. The affidavit declared an intent to appropriate water from the Colorado River for the irrigation of approximately 50,000 acres of land, and for milling and stock raising.

b. CF-831 is also derived from an appropriation affidavit filed on June 29, 1914, with the County Clerk of Wharton County by the Southern Irrigation Company, Jonathon Lane, President. This affidavit declared an intent to divert and use water from the Colorado River for the irrigation of approximately 50,000 acres of land by means of 45 miles of canal with a carrying capacity of 140,000 gpm. The capacity of the pumping plant was declared to be 140,000 gpm. It was further stated that work commenced on the canal in December, 1900. (Exh. 1008)

c. An Additional Statement of Work Done under CF-831 was filed with the Board of Water

Engineers on June 29, 1915 by the Southern Irrigation Company. This statement declared that all canals in the pumping plant had been completed and that the capacity of the pumping plant was 140,000 gpm. Irrigation was reported for each year 1901-1913, with a maximum of 15,000 acres irrigated in 1913. (Exh. 1009)

d. In 1918, a sworn claim of water right based upon CF-831 was filed under the Water Rights Adjudication Act of 1917 by the Southern Irrigation Company. A right to irrigate 50,000 acres of land was claimed, and it was stated that work began on January 1, 1901, within 90 days of the original filing. Irrigation was reported for the years 1902-1918, with the maximum of 16,000 acres irrigated in 1913. (Exh. 1010)

11. The LCRA is the owner of Permit No. 1292, which was issued to the Gulf Coast Water Company and authorizes a collapsible dam on the Colorado River 8-1/4 feet high creating a reservoir with a storage capacity of 78 acre-feet. Permittee is authorized to impound not to exceed 78 acre-feet in the reservoir to supply water for use under CF-51, CF-89, CF-238 and CF-810. Application No. 1383 for the permit was filed with the Board of Water Engineers on November 8, 1939, and Permit No. 1292 was issued on March 30, 1940. (Exh. 1030)

12. The LCRA is the owner of Permit No. 390, which was issued to the Gulf Coast Irrigation Company on May 6, 1919 and authorized an increase in the diversion rate and amount of water to be used for mining and domestic purposes under Permit No. 391. Permit No. 391, issued to the Texas Gulf Sulphur Company, was cancelled after mining operations were abandoned in 1935. The canal is now used for rice irrigation purposes. (Exh. 1011; SF 143-144, 219)

13. The LCRA is the owner of §11.303 Claim No. 1558, which asserted a right under Article 8280-107, Vernon's Texas Statutes, prescription, limitation, riparian or "other sources except under the Authority's permits or certified filings" to use water from the Colorado River for irrigation purposes and declared a maximum diversion and use in any calendar year during the period 1963-1967, inclusive, of 296,042 acre-feet of water and the irrigation of 36,805 acres of land. The pumping plants were claimed with installed capacities of 80,000 gpm, 216,000 gpm and 260,000 gpm. The date of first beneficial use of water was declared to be 1900 or before.

14. The service areas of the individual certified filings comprise a total of 239,334 acres in Matagorda and Wharton Counties, covering almost all of Matagorda County between Tres Palacios Creek on the west and Caney Creek on the east. About 18,199 acres are overlapped by more than one

certified filing service area, leaving 221,135 different acres located within at least one service area. The service area of the LCRA's Gulf Coast Water Division consists of 205,983 acres located in the same general area as the individual certified filing service areas. (Exhs. 7, 967, 1034, 1035; SF 86-89, 98, 108-109)

15. The LCRA purchased all of the certified filings and Permit No. 1292 from the Gulf Coast Water Company (hereinafter "GCWC") on December 31, 1959, for the sum of $1,900,000. GCWC had acquired all of the certified filings by 1931 and consolidated them into a single irrigation system. Water was diverted from the same diversion points now used by the LCRA. (SF 121-122, 137-138, 209-210)

16. The LCRA uses three diversion points on the Colorado River to supply water into its canal system. D-4270 is the most upstream point and is near Lane City. This plant is used to supply water to the upper portion of the service area east of the Colorado River. D-4480 is also located near Bay City and is used to supply water to the lower portion of the service area east of the river. D-4490 is located about one mile downstream of D-4480 and is used to supply water to the entire service area west of the river. (Exhs. 7. 1034; SF 99-100)

17. The pumping plant at D-4270 consists of five pumps with a combined maximum effective diversion rate of 510 cfs at normal river elevation and 561 cfs at a high river elevation. One of the pumps was added in 1970 and another in 1975 or 1976. The pumping plant at D-4480 consists of two pumps with a combined maximum effective diversion rate of 132 cfs at normal river elevation and 145.2 cfs at a high river elevation. The pumping plant at D-4490 consists of four pumps with a combined maximum effective diversion rate of 510 cfs at normal river elevation and 561 cfs at a high river elevation. Two of the four pumps were added to the plant during the period 1964-1966. All of the installed pumps have been operated together occasionally. (SF 104-105, 189-191, 258)

18. The LCRA's present irrigation system consists of approximately 372 miles of earthen canals and is similar to the canal system used by GCWC. The LCRA owns or has easements on most of the canals. However, other canals are used through a "prescriptive right" which is claimed by virtue of years of use. The irrigation system is capable of irrigating a maximum of 40,000 to 42,000 acres in any one year. (SF 121, 160, 168, 197, 208-210)

19. Until 1959, the principal crop grown within the certified filing service areas was a single crop of rice during each year. The practice of growing two crops of rice each year began in 1960, the first year of operation of the system by the LCRA. Since 1962, almost all of the water diverted into the system has been for the irrigation of two crops of rice each year. A very small percentage

of the total water diverted into this system has been used for irrigating crops other than rice. (Exh. 1036; SF 229)

20. 5.25 acre-feet of water per annum per irrigated acre of land is the maximum amount of water that can be reasonably and diligently used without waste for the irrigation of double crops of rice along the Texas Gulf Coast. (Exh. 1548)

21. The maximum acreage irrigated within the certified filing areas since April 28, 1975 is 43,573 acres in 1980. (Exh. 1515)

22. LCRA intends to irrigate up to 50,000 acres in any one year within the certified filing areas.

23. The maximum amount of water diverted from the Colorado River at D-4270, D-4480 and D-4490 and used for irrigation in any one year was 302,364 acre-feet in 1981. (Exh. 1515)

24. The LCRA has instituted various measures to control waste of water in the system, including a canal maintenance program and the use of "water bosses." In recent years, airplane patrols have also been used. The LCRA has not attempted to determine the amounts of water lost in the system through seepage, evaporation and transpiration. (SF 183-189, 211, 231-232)

25. Although the high yield of rice crops which are now being grown require more water than the rice crops that were grown 20 years ago, land leveling and the use of herbicides have reduced the amount of water needed for each rice crop. (SF 139, 141-142, 147-148, 231, 237-238, 244, 252)

26. A "fabradam" authorized by Permit No. 1292 had been constructed and used by GCWC. The existing dam consists of a concrete slab level with the river bed and topped with metal gates to allow the use of flash boards which raise the water level a maximum of six feet. The original fabradam consisted of a collapsible structure which was inflated with water and air and which washed away in 1974. The impounding capacity of the present structure is located at D-4500, which is apparently near the location authorized by Permit No. 1292. The fabradam was used to raise the level of the river for pumping at D-4480 and D-4490. (Exh. 1022; SF 100, 105-107, 191-193, 195, 199)

CONCLUSIONS:

1. Certified Filings Nos. 44, 51, 83, 89, 238, 430, 722, 747, 810 and 831 have been consolidated and merged into one water right, hereinafter designated "Certified Filing No. 44," with a priority date of December 1, 1900.

2. The LCRA is recognized a right under Certified Filing No. 44 to divert and use not to exceed 262,500 acre-feet of water per year from diversion

points D-4270, D-4480 and D-4490 on the Colorado River at maximum diversion rates of 561 cfs, 145.2 cfs and 561 cfs, respectively, to irrigate 50,000 acres of land located within the Gulf Coast Water Division service area in various surveys in Matagorda and Wharton Counties, with a priority date of December 1, 1900, subject to the following conditions:

(a) LCRA shall not impose its priority with respect to 33,930 acre-feet of water per year under such right (the difference between 262,500 and 228,570 acre-feet per year) against any junior water right with a priority date senior to November 1, 1987.

(b) The entire amount of water under such right is specifically subordinated, as to priority, to the City of Austin's Lake Austin Rights under Certified Filing No. 330 (as such Lake Austin Rights are defined in Conclusion 5 of the findings and conclusions defining the City of Austin's water rights).

3. The LCRA is recognized a right under Permit No. 1292 to maintain a dam at D-4500 on the Colorado River and to impound therein not to exceed 78 acre-feet of water to be used for irrigation purposes to the extent authorized herein, with a priority date of November 8, 1939.

4. The LCRA is not recognized any right under Permit No. 390 since it was essentially an amendment to Permit No. 391 which has been totally cancelled.

STATE OF TEXAS

COUNTY OF BELL

CERTIFIED TO BE A TRUE AND CORRECT COPY

OF THE ORIGINAL IN MY CUSTODY.

GIVEN UNDER MY HAND AND SEAL OF OFFICE

DATED: May 2 AD. 1988

DAFFY CARPENTER D. Carpenter

DISTRICT CLERK OF BELL COUNTY

BY _____ DEPUTY

II.

This Final Judgment and Decree is final and conclusive as to all water rights and claims to water rights of the Owners of the Pierce Ranch Water Right in the Lower Colorado River Segment, Colorado River Basin, as adjudicated herein. All claims of water rights of the Owners of the Pierce Ranch Water Right which were made under § 11.303 or § 11.307 of the Texas Water Code and which are not recognized herein are hereby denied.

III.

The Texas Water Commission is directed to take such action as is required by the Texas Water Rights Adjudication Act, §§ 11.301 et seq., Texas Water Code, to implement this Final Judgment and Decree.

SIGNED this 20 day of April, 1988.

/s/ J. F. Clawson
JUDGE PRESIDING

MODIFIED FINDINGS AND CONCLUSIONS
DEFINING RIGHTS UNDER THE PIERCE RANCH WATER RIGHT
CERTIFIED FILING NO. 107

DIVERSION POINT NO.: 4250
TRACT NO. 2130

OWNERSHIP: Testamentary Trusts created under the Will and Codicils of Lacy Withers Armour, Deceased, and the Laurance H. Armour Jr. 1979 Revocable Trust d/b/a Pierce Ranch

IR: 296
APP: 26 and 27
IX SF 56-303, Contest VI SF 3-179, VIII SF 3-191

SECTION 11.307 CLAIM: Under Certified Filing No. 107 to divert and use "the maximum volume of water which is or may become necessary to irrigate 30,000 acres of land, but not less than 195,000 acre-feet per annum, and also the right to divert water from the Colorado River at a rate of 400 cubic feet per second," with a priority date of 1907. (Exhs. 1217, 1218).

FINDINGS:

1. Claimants are the owners of Certified Filing No. 107 which is derived from an affidavit filed with the County Clerk of Wharton County on December 27, 1910, by the Estate of A. H. Pierce, Deceased. The affidavit declared an intent to appropriate "for the Estate of A. H. Pierce for irrigation purposes the unappropriated waters of the ordinary flow and underflow of the Colorado river and the storm and rain water of said river" for the irrigation of approximately 30,000 acres of land. A diversion point on the west bank of the Colorado River is described, and the carrying capacity of the main canal is declared to be 400 cfs. Attached to the affidavit is "a map marked Exhibit A showing the various surveys within the scope of the territory (sic) tributary to said canal, the route and location of said canal, and laterals and the projected extensions of said canals or laterals." (Exhs. 1219, 1220)

2. An Additional Statement of Work Done under Certified Filing No. 107 was filed with the Board of Water Engineers on May 16, 1914, by the Estate of A. H. Pierce, Deceased. This statement describes a pumping plant consisting of two 36 inch centrifugal pumps "with all structures completed together with 2.5 miles of canals and laterals together with all necessary main ditches, flumes, siphons, etc., and about 9000 acres put under irrigation in rice, blue print attached shows completed construction in continuous lines and projected construction in dotted lines, all within scope of original appropriation." Paragraph 3 states that "All constructed and in use, save ditches or broken lines on blueprint and these will be very shortly constructed. Paragraph 4 declares that water was being diverted at 155.6 cfs for 100 days and was being used mainly for rice irrigation and

NO. 115,414-A-2

IN RE: THE EXCEPTIONS OF THE OWNERS OF THE PIERCE RANCH WATER RIGHT TO THE ADJUDICATION OF WATER RIGHTS IN THE LOWER COLORADO RIVER SEGMENT OF THE COLORADO RIVER BASIN	§ § § § § § § §	IN THE DISTRICT COURT OF BELL COUNTY, TEXAS 264TH JUDICIAL DISTRICT

FINAL JUDGMENT AND DECREE

BE IT REMEMBERED that on the 20 day of April, 1988 came on to be heard the Joint Motion to Enter Final Judgment and Decree of the Texas Water Commission (the "Commission") and the Owners of Certified Filing No. 107 (referred to as the "Pierce Ranch Water Right"), and the Court being of the opinion that said motion should be granted, it is therefore,

ORDERED, ADJUDGED AND DECREED as follows:

I.

The Rights under Certified Filing No. 107 are defined by the findings of fact and conclusions of law found on page 81 of the Final Determination entered by the Commission on July 29, 1985 in this matter (the "Final Determination"). These findings and conclusions are hereby modified in their entirety to read as set forth in Attachment No. 1 hereto.

for stock raising. Amounts of water declared to have been diverted or used during the period 1910-1913 are as follows: 11,150 acre-feet in 1910, 11,160 acre-feet in 1911, 13,000 acre-feet in 1912 and 19,330 acre-feet in 1913. Paragraph 6 states that about 9000 acres were being irrigated. Paragraph 7 declares that the water diverted was being "exclusively used by Estate for irrigating our lands and stock raising by said estate." (Exh. 1221).

3. A Statement of Information Relating to Pumping under Certified Filing No. 107 was also filed with the Board on May 16, 1914, by the Estate of A. H. Pierce, Deceased. This statement describes two 36 inch centrifugal pumps with a rated capacity of 35,000 gpm each and a combined installed capacity of 70,000 gpm with an additional overload capacity of 50 gpm per pump. The pumps were powered by four boilers rated at 250 horsepower each. The statement also declares that about 7500 acres of rice were being irrigated. (Exh. 1222)

4. Claimants are the owners of a 32,051.237-acre tract of land known as Pierce Ranch. Tract No. T-2130 includes all of Pierce Ranch plus some adjoining land not owned by Claimants and is located in the following abstracts in Wharton County: 10, 14, 23, 25, 39, 40, 47, 49, 51, 65, 108, 115, 138, 147, 148, 157, 158, 181, 194, 218, 221, 222, 224, 230, 368, 397, 405, 412, 418, 441, 447, 451, 453, 454, 468, 538, 558, 626, 640, 641, 642, 675, 678, 679, 693, 856, 877, 878, 894, 895, 921, and 948. (Exhs. 1220, 1224A, 1230, SF 75-77, 90-91, 103-104)

5. A pumping plant is located at authorized diversion point D-4250 on the Colorado River. Construction on the original pumping plant began in September, 1907, and was completed in 1910. Each of the original pumps diverted water at 78 cfs (35,000 gpm) or a total of 156 cfs (70,000 gpm). In 1955 the original engines and pumps were replaced with two new 36-inch pumps having a rated capacity of 127 cfs (57,000 gpm) each and a combined capacity of 236 cfs (106,000 gpm). The engines are rated at 800 horsepower each. Since 1910, normal irrigation practice within Pierce Ranch has been to run both pumps together during most of the irrigation season. (Exhs. 1222, 1223; SF 98, 108, 119-120, 130-133, 210-211)

6. The canal system as presently maintained by Pierce Ranch consists of 49 miles of earthen canal and several additional miles of laterals. This canal system is similar in direction to the original and proposed canals depicted on the 1910 map (Exh. 1220) but is much more extensive. The southern end of the canal system reaches seven miles below the ranch property. The present carrying capacity, like the declared original carrying capacity, is 400 cfs. At present, the canal system is routed to 23,800 acres of irrigable land within the ranch. (Exhs. 1220, 1230, 1232R; SF 106, 120, 122, 129, 136, 156, 140, 159-161, 280-281)

7. Water has been applied to 25,000 different acres within Pierce Ranch since 1910. Pierce Ranch supplied water to irrigate up to 2300 acres located seven miles below the southern boundary of the ranch from 1937 until 1973 or 1974. This land was originally leased by the ranch and then share-cropped beginning in 1956. (Exhs. 1225, 1231, 1233; SF 137, 155-156, 203-207, 247)

8. The maximum number of acres of land irrigated in any one year with water diverted at D-4250 was in 1956 when 21,910.2 acres were irrigated. (Exh. 1231; SF 203-207)

9. Crops irrigated within Pierce Ranch include rice, cotton, milo, soybeans, vegetables and feed and grain crops. The maximum number of acres in rice was in 1946 when 10,250 acres were irrigated. In addition, up to 16,515 acres in pasture have been watered, with this largest amount occurring in 1956. The maximum amount of water used in any year for all crops other than rice was 23,030 acre-feet in 1958, assuming a 30% distribution loss. (Exh. 1231; SF 143-151, 222-223)

10. The practice of cutting two crops of rice in a year began in 1956 or 1958. Two cuttings of rice are taken from 35 to 96 percent of the rice fields planted in any given year. (Exh. 1231; SF 144, 187-189, 212-228)

11. The maximum amount of water diverted at D-4250 for irrigation purposes in any one year was 76,720 acre-feet to irrigate 21,910.2 acres of land in 1956. Some of this water was diverted for the irrigation of a maximum of 2300 acres located seven miles below the ranch property. (Exh. 1225, 1231; SF 153, 164-165, 204-207, 220)

12. The tracts irrigated by the canal system are comprised of slow absorbing, low permeability type soil. The average rainfall in this area is 40 inches per year. As little as 17.6 inches of rain has fallen on the Pierce Ranch during a growing season. (SF 141-142, 153)

13. Claimants intend to expand their irrigation system. The evidence establishes that 96,265 acre-feet of water will be required to irrigate 25,000 acres in a year of normal rainfall and 110,000 acre-feet in a very dry year. Clearing woodlands located in the southeast portion of the ranch land and extending the canal system to those lands would permit the irrigation of a total of 28,500 acres which would require 150,000 acre-feet of water per year. The extension of a canal system into lands outside of the ranch property would permit the irrigation of a total of 30,000 acres which would require 195,000 acre-feet of water per year. These extensions would be subject to economic conditions, government regulations, operating costs and water availability. (Exh. 1234; SF 169-176, 179-182, 226-227, 231-235, 241-242, 260, 269-272)

14. Some land improvements have already been completed on approximately 6000 acres within the ranch. This has resulted in intensification of row crop irrigation within this acreage. (Exh. 1235; SF 250-252, 265-269)

15. Claimants rights under Certified Filing No. 107 have not been fully developed because of the use of good conservation and management practices, economic factors, the unknown extent of their water rights claims and government restrictions since 1954 on the acreage of certain crops. (SF 156-157, 182, 248-250, 286-288)

CONCLUSIONS:

1. Certified Filing No. 107 evidenced an intention to appropriate from the Colorado River at a maximum diversion rate of 400 cfs an amount of water which was reasonably necessary for the irrigation of up to 30,000 acres of land within the boundaries of the Estate of A. H. Pierce, Deceased (Pierce Ranch).

2. Claimants have a bona fide intent to irrigate 25,000 acres of land within the Pierce Ranch boundaries rather than the maximum 21,910.2 acres irrigated in one year in the past and to use more water than the 76,720 acre-feet per annum used in the past.

3. Claimants have been justified in their failure to develop their right under Certified Filing No. 107 beyond the irrigation of 25,000 acres of land and in not using more than 76,720 acre-feet of water in one year.

4. The priority date of Certified Filing No. 107 is entitled to relate back to September 1, 1907 the time of commencement of construction of the canal system.

5. Claimants are recognized a right under Certified Filing No. 107 to divert and use not to exceed 110,000 acre-feet of water per year from diversion point D-4250 on the Colorado River at a maximum diversion rate of 400 cfs for the irrigation of 25,000 acres of land within the boundaries of Pierce Ranch in area T-2130 located in Abstracts Nos. 10, 14, 23, 25, 39, 40, 47, 49, 51, 65, 108, 115, 138, 147, 148, 157, 158, 181, 194, 218, 221, 222, 224, 230, 368, 397, 405, 412, 418, 441, 447, 451, 453, 454, 468, 538, 558, 626, 640, 641, 642, 675, 678, 679, 693, 856, 877, 878, 894, 895, 921 and 948, Wharton County, with a priority date of September 1, 1907.

6. Claimants are not recognized any right to develop the appropriation of water beyond the extent recognized herein.

STATE OF TEXAS

COUNTY OF BELL

CERTIFIED TO BE A TRUE AND CORRECT COPY

OF THE ORIGINAL IN MY CUSTODY.

GIVEN UNDER MY HAND AND SEAL OF OFFICE

DATED May 2 AD, 19 88

DAFFY CARPENTER D. Carpenter

DISTRICT CLERK OF BELL COUNTY

BY _____ DEPUTY

TECHNICAL REPORT FOR A WATER MANAGEMENT PLAN FOR THE LOWER COLORADO RIVER

Appendix 1B

Stacy Permit 3676 and Operations Settlement Agreement

determine that there is a need for any updates to the freshwater inflow needs as a result of a new study for the Matagorda Bay System, the LCRA shall amend its amended Water and Drought Management Plans and submit these proposed amendments to the Commission for review and approval within one (1) year of completion of such new studies. Any party may reopen the issue of bay and estuary inflows by submitting a written request for hearing to the Commission within thirty (30) days of receiving notice of the filing of the new studies or any proposed amendment to the Plans.

5) Nothing in LCRA's Amended Water Management Plan and Amended Drought Management Plan or this Order shall be construed to impair, or to authorize LCRA or any other person or entity to impair, senior or superior water rights in the Colorado River Basin.

ISSUED: MAR 01 1999

TEXAS NATURAL RESOURCE

CONSERVATION COMMISSION

Robert J. Huston, Chairman

Volume II – Technical Report
Appendices

Appendix 1B
Documents Reflecting Agreement between LCRA
and
the Colorado River Municipal Water District
regarding O.H. Ivie Reservoir

PERMIT TO
APPROPRIATE STATE WATER

APPLICATION NO. 3866 PERMIT NO. 3676 TYPE: SEC. 11.121

Permittee:	COLORADO RIVER MUNICIPAL WATER DISTRICT	Address:	P.O. Box 869 Big Spring, Texas 79720
Received:	October 11, 1977	Filed:	February 21, 1978
Granted:	April 25, 1985	Counties:	Coleman, Concho and Runnels
Watercourse:	Colorado River	Watershed:	Colorado River Basin

WHEREAS, the Texas Water Commission finds that jurisdiction of the application is established; and

WHEREAS, a public hearing has been held and an order entered by the Texas Water Commission;

NOW, THEREFORE, this permit to impound, appropriate and use State water is issued to the Colorado River Municipal Water District (hereinafter CRMWD), subject to the following terms and conditions:

1. IMPOUNDMENT

Permittee is authorized to construct, and before acquiring any right hereunder, shall construct, a dam and reservoir on the Colorado River to be known as Stacy dam and reservoir and impound therein in accordance with the terms and conditions of this permit not to exceed 554,340 acre-feet of State water at a normal maximum operating elevation of 1551.5 feet above mean sea level. The dam shall be located in Fort Bend County School Land Survey No. 224, Abstract No. 192, Coleman County, Texas; H. Schaefer Survey No. 1720, Abstract No. 772, Concho County, Texas; H. C. Kuhfuss Survey No. 1847, Abstract No. 581, Concho County, Texas; H. Luckenbach Survey No. 1840, Abstract No. 591, Concho County, Texas; B.S. & F. Survey No. 1, Abstract No. 87, Concho County, Texas; and F. J. McCarthy Survey No. 2, Abstract No. 1449, Concho County, Texas. Station 10 + 47 on the centerline of the dam bears N 77° 40' E, 5,230 feet from the southwest corner of the H. C. Kuhfuss Survey No. 1847, Abstract No. 581, Concho County, Texas, approximately 24 miles southeast of Ballinger, Texas.

2. USE

(a) Pursuant to the terms and conditions of Permit No. 1259B of the Lower Colorado River Authority (hereinafter LCRA), permittee is authorized to divert and use from Stacy reservoir not to exceed 88,000 acre-feet of water per annum for municipal and domestic purposes, and not to exceed 25,000 acre-feet of water per annum for industrial purposes.

(b) Permittee is authorized to use impounded water for nonconsumptive recreational purposes.

(c) Permittee is authorized to divert and use not to exceed 200 acre-feet of water per annum from the Colorado River for construction purposes during construction of the reservoir.

3. DIVERSION

(a) Point of Diversion: By means of stationary pumps to be located at a point on the reservoir, N 80° 54' W, 4,920 feet from the northeast corner of M. Sander Survey No. 200, Abstract No. 749, Concho County, Texas.

(b) Maximum Diversion Rate: 160.4 cfs (72,000 gpm) for municipal use and 40 cfs (17,953 gpm) for industrial use.

4. POINTS OF RETURN

Return Water: Water diverted hereunder but not consumed as a result of use shall be returned at the wastewater treatment plants of the customers of CRMWD.

5. TIME LIMITATIONS

Construction or installation of all works herein authorized or required shall be in accordance with plans approved by the Department and shall be commenced within two years and completed within five years from date of issuance of this permit. Failure to commence or complete construction of the dam and related facilities within the time stated in the time limitations shall cause this permit to expire and become null and void, unless permittee applies for an extension of time to commence and/or complete construction prior to the respective deadlines for commencement and completion, and the application is subsequently granted.

6. SPECIAL CONDITIONS

(a) Releases from Stacy reservoir.

1. In order to protect LCRA's water rights, including the right to store water in the Highland Lakes, to the maximum extent possible consistent with the construction and operation of Stacy dam, CRMWD shall release water from Stacy reservoir upon the call of LCRA in accordance with the following terms.

a. Release Provision No. 1. When the surface elevation of Stacy reservoir stands between 1530.5 and 1543 feet above mean sea level and Buchanan and Travis reservoirs shall have reached sixty-five percent (65%) (1,400,000 acre-feet) or less, as calculated by LCRA from its existing official area-capacity curves for said reservoirs, LCRA shall be entitled to call for a release of water equal to 50% of the net volume of water impounded in Stacy subsequent to the last LCRA spill or release whichever is the later to occur; but the right of release under Release Provision No. 1 shall not require the release of water so as to reduce the level of Stacy reservoir below the higher of (i) the level of storage necessary to meet the demonstrated demand on Stacy or (ii) 1530.5 feet elevation.

b. Release Provision No. 2. In addition to LCRA's rights under Release Provision No. 1, LCRA shall be entitled to call for a release of all water impounded in Stacy reservoir above 1543 feet above mean sea level when LCRA has combined empty storage

space in Buchanan reservoir below elevation 1018 mean sea level and in Travis reservoir below elevation 678 mean sea level, to impound the amount of water to be released. Provided, however, that the triggering elevation of this Release Provision No. 2 (1543 feet) should be adjusted upward when a greater level of storage is necessary to meet the demonstrated municipal demand on Stacy.

2. LCRA may exercise its right to call for releases under Release Provisions Nos. 1 and 2 whenever the conditions are met, without regard to the length of time elapsed since the last LCRA spill or release whichever is the later to occur or the number of times LCRA has exercised its right to call for releases since the last LCRA spill or release whichever is the later to occur.

3. The following definitions and rules of calculation apply to special condition (a).

   a. An LCRA spill occurs whenever (i) the water level of Lake Buchanan reaches 1020 feet above mean sea level or the water level of Lake Travis reaches 681 feet above mean sea level, and (ii) LCRA has begun releasing water at that dam, either through the hydroelectric turbines or through the flood gates.

   b. The demonstrated demand is one-third (1/3) rounded to the nearest 1,000 of the diversions of water in acre-feet from Stacy reservoir for CRMWD's water-supply customers during the preceding three (3) calendar years, as stated in the annual report sworn and filed with the Texas Department of Water Resources or its successors on or before January 31 of each year. To this end, (i) CRMWD will operate its system so as to take as much of its water requirements from the J. B. Thomas reservoir (constructed pursuant to Permit No. 1394) and the Spence reservoir (constructed pursuant to Permit No. 2179) as is feasible and consistent with reasonable operating requirements and shall take not less than 20,000 acre-feet of the water required to supply its uses during each year from the J. B. Thomas reservoir, provided that the total storage in such reservoir is not less than 100,000 acre-feet at anytime during such year; and (ii) CRMWD will route through the Stacy reservoir without detention all water which reaches Stacy reservoir which is required to be released from the Spence reservoir pursuant to Permit No. 2179.

   c. The level of storage necessary to meet the demonstrated demand on Stacy reservoir shall be determined by reference to the table comparing storage level to "Adopted Yield," for this purpose only, which is attached to the Settlement Agreement as Exhibit "A" and which shall be contained

in the operations manual required by this permit.

d. Net water impounded is defined as the amount of impounded water, including return flows, less inadvertent losses such as evaporation, seepage and transpiration, but excluding (i) diversions by pumpage from Stacy reservoir above elevation 1530.5 mean sea level and below elevation 1543.0 mean sea level subsequent to the last spill or release whichever is the later to occur and (ii) releases from Stacy reservoir which may be required for environmental purposes which exceed both 5,000 acre-feet per annum and 5,000 acre-feet since the last LCRA spill.

4. Unless otherwise agreed by LCRA and CRMWD, all releases under special condition (a) shall be made at the rate of 5,000 cubic feet per second.

(b) Permittee shall provide the facilities necessary to pass inflows through the dam authorized hereunder at all times, including the period of construction and initial filling of the reservoir.

(c) To provide for and protect domestic, livestock and other existing water rights between Stacy dam and Lake Buchanan, to the extent there is flow into Stacy reservoir, permittee shall maintain a flow in the Colorado River below Stacy dam of not less than 8.0 cfs during the months April through September and 2.5 cfs during other months, or, to the extent there is flow into Stacy reservoir, in such greater quantities as the Commission may from time to time determine and order.

(d) Whenever CRMWD is impounding any water that the holders of water rights in the Colorado River above Lake Buchanan which are junior to Permit No. 1259 but were issued prior to March 11, 1985 could have lawfully diverted and beneficially used except for the fact that this permit authorizes water to be diverted from Stacy Reservoir rather than Lake Buchanan, CRMWD shall release such water.

(e) Permittee shall install measuring devices approved by the Department and shall measure and keep the following daily records which shall be compiled monthly and reported annually, or more frequently as the Department may from time to time order, to the Department in such form and manner as the Department may from time to time prescribe:

(1) Inflows to the reservoir herein authorized from the watershed upstream of the dam, including rainfall on the reservoir water surface;

(2) Continuous reservoir stage and contents;

(3) Total consumptive use of water;

(4) Blowdown or other controller releases past the dam.

(f) This permit is issued subject to all superior and senior water rights in the Colorado River Basin, and any impoundment hereunder is subject to all such rights. Whenever the Commission finds that permittee is im-

AMENDMENT TO
PERMIT TO
APPROPRIATE STATE WATER

APPLICATION NO. 3866A PERMIT NO. 3676A TYPE: Amendment--Water Code Sections 11.122 and 11.085

Permittee : COLORADO RIVER MUNICIPAL WATER DISTRICT

Address : P. O. Box 869
Big Spring, Texas
79721-0869

Filed : July 9, 1985

Granted : September 4, 1985

Counties : Coleman, Concho, Runnels, Jones and Taylor

Watercourse: Colorado River

Watershed: Colorado and Brazos River Basins

WHEREAS, the Texas Water Commission finds that jurisdiction of the application is established; and

WHEREAS, Permit No. 3676, issued May 14, 1985, authorizes permittee to construct and maintain a dam and reservoir on the Colorado River (Stacy Dam) and to divert and use from the reservoir not to exceed 88,000 acre-feet of water per annum for municipal and domestic purposes and 25,000 acre-feet per annum for industrial purposes in the Colorado River Basin; and

WHEREAS, applicant has requested an amendment to Permit No. 3676 to authorize a change in the purpose of use of 15,000 of the 25,000 acre-feet of water authorized per annum for industrial purposes to municipal purposes, to authorize the interwatershed transfer of the 15,000 acre-feet of water from the Colordo River Basin to the Brazos River Basin for use by the City of Abilene and its customers in Taylor and Jones Counties, to add a diversion point on the reservoir, and to increase the maximum diversion rate authorized for municipal use by 30.94 cfs; and

WHEREAS, the permittee anticipates the sale of municipal water to the West Central Texas Municipal Water District for use by the City of Abilene and its customers; and

WHEREAS, the City of Abilene and its customers are located in Taylor and Jones Counties and the Brazos River Basin; and

NOW, THEREFORE, this amendment to Permit No. 3676 is issued to permittee, subject to the following terms and conditions:

1. USE

In lieu of Paragraph 2(a) of Permit No. 3676, pursuant to the terms and conditions of Permit No. 1259B of the Lower Colorado River Authority, permittee is authorized to divert and use from Stacy Reservoir not to exceed 103,000 acre-feet of water per annum for municipal and domestic purposes, and not to exceed 10,000 acre-feet of water per annum for industrial purposes.

2. DIVERSION

In addition to the authorizations of paragraph 3 of Permit No. 3676, permittee is authorized the following:

(a) Point of Diversion: At a point on the reservoir in Coleman County, N 84° E, 1750 feet from the southeast corne of the Brazoria County School Land Survey, Abstract No. 17 Coleman County, Texas.

(b) Maximum Diversion Rate for Municipal Use: 30.94 cfs (13,889 gpm).

3. INTERWATERSHED DIVERSION

Permittee is authorized to divert not to exceed 15,000 acre-feet per annum out of the 103,000 acre-feet authorized to be diverted for municipal purposes from the Colorado River Basin to the Brazos River Basin.

4. POINT OF RETURN

Water diverted from the Colorado River Basin to the Brazos River Basin and not consumed shall be returned to the Brazos River Basin at the wastewater treatment plants of the City of Abilene and/or the plants of the City's customers.

This amendment is issued subject to all terms, conditions and provisions contained in Permit No. 3676, except as herein amended.

This amendment is issued subject to all superior and senior water rights in the Colorado River Basin.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this amendment.

All other matters requested in the application which are not specifically granted by this amendment are denied.

This amendment is issued subject to the Rules of the Texas Water Commission and to the right of continual supervision of Stat water resources exercised by the Commission.

TEXAS WATER COMMISSION

/s/ Paul Hopkins
Paul Hopkins, Chairman

/s/ Ralph Roming
Ralph Roming, Commissioner

Date Issued:

September 4, 1985

Attest:

/s/ Mary Ann Hefner
Mary Ann Hefner, Chief Clerk

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

AMENDMENT TO
WATER USE PERMIT

APPLICATION NO. 3866D PERMIT NO. 3676D TYPE : 11.122

Owner	:	Colorado River Municipal Water District	Address	:	P.O. Box 869 Big Spring, Texas 79721-0869
Filed	:	November 3, 1998	Granted	:	NOV 13 1998
			Counties	:	Coleman & Concho
Watercourse:		Colorado River	Watershed	:	Colorado River Basin

WHEREAS, Permit No. 3676 (Application No. 3866) issued on May 14, 1985 includes a Special Condition 6.(a). requiring releases of water from Stacy (now O.H. Ivie) Reservoir (Colorado River, Colorado River Basin, Coleman and Concho Counties) to Lake Buchanan and Lake Travis per a 1985 agreement with the Lower Colorado River Authority (LCRA); and

WHEREAS, pursuant to an amendment to this agreement, LCRA has recently agreed to the removal of Special Condition 6.(a). which will result in applicant not having to release water from storage; and

WHEREAS, an application was received from the Colorado River Municipal Water District seeking removal of Special Condition 6.(a). from Permit No. 3676 (Application No. 3866), as amended; and

WHEREAS, as no entity other than the LCRA will be affected by this amendment and they have agreed to the amendment, no notice was required for this application; and

WHEREAS, the Texas Natural Resource Conservation Commission finds that jurisdiction over the application is established; and

WHEREAS, the Commission has complied with the requirements of the Texas Water Code and Rules of the Texas Natural Resource Conservation Commission in issuing this amendment; and

NOW, THEREFORE, this amendment to Permit No. 3676 (Application No. 3866), as amended, is issued to the Colorado River Municipal Water District subject to the following terms and conditions:

Special Condition 6.(a). contained in Permit No. 3676 (Application No. 3866), as amended, is hereby deleted.

This amendment is issued subject to all terms, conditions and provisions contained in Permit No. 3676 (Application No. 3866), as amended, except as specifically amended herein.

This amendment is issued subject to all superior and senior water rights in the Colorado River Basin.

All other matters requested in the application which are not specifically granted by this amendment are denied.

This amendment is issued subject to the Rules of the Texas Natural Resource Conservation Commission and to the right of continuing supervision of State water resources exercised by the Commission.

TEXAS NATURAL RESOURCE
CONSERVATION COMMISSION

For the Commission

Date Issued: NOV 13 1998

ATTEST:

LaDonna Castañuela, Acting Chief Clerk
Texas Natural Resource Conservation Commission

AMENDMENT TO PERMIT
TO APPROPRIATE STATE WATER

APPLICATION NO. 1345A PERMIT NO. 1259B TYPE: Amendment

Permittee: LOWER COLORADO RIVER AUTHORITY Address: P. O. Box 220 Austin, Texas 78767

Filed: March 11, 1985

Granted: April 25, 1985 Counties: Burnet, Llano, Coleman, Concho & Runnels

Watercourse: Colorado River Watershed: Colorado River Basin

WHEREAS, the Texas Water Commission finds that jurisdiction of the application is established; and

WHEREAS, a public hearing has been held and an order entered by the Commission.

NOW, THEREFORE, this amendment to Permit No. 1259, as amended, is issued to the Lower Colorado River Authority (hereinafter LCRA), subject to the following terms and conditions:

1. USE

(a) Subject to Special Condition (3a), and pursuant to a water supply agreement styled "Settlement Agreement," dated February 26, 1985, between LCRA and the Colorado River Municipal Water District (hereinafter CRMWD), CRMWD is authorized to divert from Stacy Reservoir and use not to exceed 88,000 acre-feet of water per annum for domestic and municipal purposes and to divert and use not to exceed 25,000 acre-feet per annum of water for industrial purposes.

(b) Under Permit No. 1259 and this amendment, the maximum combined diversions of LCRA at or below Lake Buchanan for domestic, municipal, industrial, irrigation, mining and hydroelectric generation purposes and that of CRMWD at Stacy Reservoir for domestic, municipal and industrial purposes shall not exceed 1,391,530 acre-feet of water per annum, or such amount as may be finally determined in the proceedings of adjudication of all claims of water rights in the Lower Colorado River Segment.

2. DIVERSION

(a) CRMWD is authorized to divert water authorized for municipal purposes by means of a stationary pump located on Stacy Reservoir at a point N 80° 50' W, 4920 feet from the northeast corner of the M. Sander Survey No. 200, Abstract No. 749, Concho County, at a maximum diversion rate of 160.4 cfs (72,000 gpm).

(b) CRMWD is authorized to divert water authorized for industrial purposes by means of a stationary pump located on Stacy Reservoir at a point on the perimeter of the reservoir to be approved by the Commission prior to diversion at a maximum diversion rate of 40 cfs (17,953 gpm).

3. SPECIAL CONDITIONS

(a) The authorizations herein granted to CRMWD to divert at Stacy Reservoir and use water for domestic, municipal and industrial purposes shall

remain effective only so long as the "Settlement Agreement" dated February 26, 1985 remains in effect. Upon termination of the "Settlement Agreement", the rights herein granted to CRMWD shall revert to LCRA, to be exercised pursuant to the terms of Permit No. 1259, as it existed prior to the issuance of this amendment.

(b) To provide for and protect domestic, livestock and other existing water rights between Stacy dam and Lake Buchanan, to the extent there is flow into Stacy reservoir, CRMWD shall maintain a flow in the Colorado River below Stacy dam of not less than 8.0 cfs during the months April through September and 2.5 cfs during other months, or, to the extent there is flow into Stacy reservoir, in such greater quantities as the Commission may from time to time determine and order.

(c) Whenever the Commission finds that CRMWD is diverting any water to which holders of senior and superior water rights in the Colorado River below Stacy dam are entitled, CRMWD shall release such water when required to do so by the Commission.

(d) Whenever CRMWD is impounding any water that the holders of water rights in the Colorado River above Lake Buchanan which are junior to Permit No. 1259 but were issued prior to March 11, 1985 could have lawfully diverted and beneficially used except for the fact that this permit authorizes water to be diverted from Stacy Reservoir rather than Lake Buchanan, CRMWD shall release such water.

4. PRIORITY

The time priority of this amendment is March 7, 1938.

This amendment is issued subject to all terms, conditions and provisions contained in Permit No. 1259, except as herein amended.

This amendment is issued subject to all superior and senior water rights in the Colorado River Basin.

LCRA and CRMWD agree to be bound by the terms, conditions and provisions contained herein and such agreement is a condition precedent to the granting of this amendment.

All other matters requested in the application which are not specifically granted by this amendment are denied.

This amendment is issued subject to the Rules of the Texas Department of Water Resources and to the right of continual supervision of State water resources exercised by the Department.

TEXAS WATER COMMISSION

Paul Hopkins

Paul Hopkins, Chairman

DATE ISSUED:

May 14, 1985

Lee B.M. Biggart

Lee B.M. Biggart, Commissioner

ATTEST:

Mary Ann Hefner

Mary Ann Hefner, Chief Clerk

Ralph Roming

Ralph Roming, Commissioner

STATE OF TEXAS)

COUNTY OF TRAVIS)

SETTLEMENT AGREEMENT

This settlement agreement ("the Settlement Agreement") by and between the Lower Colorado River Authority ("LCRA") and the Colorado River Municipal Water District ("CRMWD") hereinafter sometimes collectively referred to as ("Parties"), WITNESSETH:

WHEREAS, CRMWD and LCRA have for several years been engaged in several controversies revolving around CRMWD's proposed Stacy dam and reservoir and LCRA's water rights; and

WHEREAS, LCRA and CRMWD now wish to settle their differences in a way that allows CRMWD the opportunity to build Stacy dam and to operate the reservoir to meet the needs of its municipal customers, while preserving LCRA's water rights, including the right to store water in Highland Lakes, to the maximum extent possible consistent with the construction and operation of Stacy dam;

NOW, THEREFORE, LCRA and CRMWD agree to settle their differences on the terms and for the consideration set forth below.

095907

Section I: Water Rights and Applications for Permits

1. The LCRA hereby contracts, effective on the date of this Settlement Agreement and continuing during the entire useful life of Stacy reservoir, with CRMWD to allow CRMWD to divert, from waters which would otherwise flow into Lake Buchanan to be stored therein and used by LCRA pursuant to its water appropriation Permit 1259, not to exceed 113,000 acre feet per annum of the waters of the Colorado River at a diversion point and diversion rate as follows:

a. Municipal Use Point of Diversion: By means of stationary pumps to be located at a point on the reservoir N 80° 50' W, 4,920 feet from the northeast corner of M. Sander Survey No. 200, Abstract No. A-749, Concho County, Texas.

b. Maximum Diversion Rate: 160.4 cfs (72,000 gpm) for municipal use and 40 cfs (17,953 gpm) for industrial use.

2. In order to obtain the permits necessary to effectuate this Settlement Agreement, CRMWD and LCRA agree to take the following steps:

a. Upon remand of its pending application for an appropriation permit, CRMWD shall amend its application to remove therefrom its request for a permit to divert water from the Colorado River. Instead, LCRA shall provide

095907

CRMWD with sufficient water not to exceed 113,000 acre-feet of water annually appropriated by and diverted under LCRA Permit No. 1259 (Buchanan reservoir) to accommodate the Stacy dam and reservoir project on the Colorado River in Coleman, Concho and Runnels Counties, Texas. In all other respects, the permit applied for by CRMWD shall remain the same; that is, CRMWD will seek a permit to construct Stacy dam and reservoir and to store therein up to 554,340 acre-feet of water, all as previously set forth in the permit previously issued to CRMWD. LCRA will agree and amend from time to time this agreement to authorize additional diversion points as required to meet future conditions.

b. Pursuant to the Rules of the Texas Water Development Board, Texas Administrative Code §§ 303.111 - 303.120, and based upon this Settlement Agreement, LCRA will apply for a contractual amendment to its Permit 1259 to allow CRMWD to divert, at a point or points at the Stacy reservoir site to be designated by CRMWD, up to 113,000 acre-feet of water per year for municipal purposes, except that up to 25,000 acre-feet per year, may be diverted by CRMWD for industrial purposes. LCRA agrees in the future not to oppose any application filed by CRMWD with the Texas Department of Water Resources which has as its purpose converting not

095907

to exceed 15,000 acre-feet per annum of the above-described 25,000 acre-feet of industrial use water to municipal use for the use and benefit of the City of Abilene, Texas, by and through the West Central Texas Municipal Water District.

c. CRMWD and LCRA shall jointly move the Texas Water Commission to consolidate for hearings and decision the two applications described above, and CRMWD and LCRA shall each join in supporting the other's application and urge its adoption.

Section II: Releases from Stacy Reservoir

1. In order to provide for the water needs throughout the Colorado River basin and to protect LCRA's water rights, including the right to store water in the Highland Lakes, to the maximum extent possible consistent with the construction and operation of Stacy dam, CRMWD agrees to release water from Stacy reservoir upon the call of LCRA in accordance with the following terms.

a. Release Provision No. 1. When the surface elevation of Stacy reservoir stands between 1530.5 and 1543 feet above mean sea level and Buchanan and Travis reservoirs shall have reached sixty-five percent (65%) (1,400,000

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acre-feet) or less, as calculated by LCRA from its existing official area-capacity curves for said reservoirs, LCRA shall be entitled to call for a release of water equal to 50% of the net volume of water impounded in Stacy subsequent to the last LCRA spill or release whichever is the later to occur; but the right of release under this Section II.1.a. shall not require the release of water so as to reduce the level of Stacy reservoir below the higher of (i) the level of storage necessary to meet the demonstrated demand on Stacy or (ii) 1530.5 feet elevation.

b. Release Provision No. 2. In addition to LCRA's rights under Release Provision No. 1, LCRA should be entitled to call for a release of all water impounded in Stacy reservoir above 1543 feet above mean sea level when LCRA has combined empty storage space in Buchanan reservoir below elevation 1018 mean sea level and in Travis reservoir below elevation 678 mean sea level, to impound the amount of water to be released. Provided, however, that the triggering elevation of this Release Provision No. 2 (1543 feet) should be adjusted upward when a greater level of storage is necessary to meet the demonstrated municipal demand on Stacy.

095907

2. CRMWD and LCRA agree that LCRA may exercise its right to call for releases under Release Provisions Nos. 1 and 2 whenever the conditions are met, without regard to the length of time elapsed since the last LCRA spill or release whichever is the later to occur or the number of times LCRA has exercised its right to call for releases since the last LCRA spill or release whichever is the later to occur.

3. The following definitions and rules of calculation apply to Section II of this Agreement.

a. An LCRA spill occurs whenever (i) the water level of Lake Buchanan reaches 1020 feet above mean sea level or the water level of Lake Travis reaches 681 feet above mean sea level (ii) LCRA has begun releasing water at that dam, either through the hydroelectric turbines or through the flood gates.

b. The demonstrated demand is one-third (1/3) rounded to the nearest 1,000 of the diversions of water in acre-feet from Stacy reservoir for CRMWD's water-supply customers during the preceding three (3) calendar years, as stated in the annual report sworn and filed with the Texas Department of Water Resources or its successors on or before January 31 of each year. To this end, (i) CRMWD will operate its system so as to take as much of its water

095907

requirements from the J. B. Thomas reservoir (constructed pursuant to Permit No. 1394) and the Spence reservoir (constructed pursuant to Permit No. 2179) as is feasible and consistent with reasonable operating requirements and shall take not less than 20,000 acre-feet of the water required to supply its uses during each year from the J. B. Thomas reservoir, provided that the total storage in such reservoir is not less than 100,000 acre-feet at anytime during such year; and (ii) CRMWD will route through the Stacy reservoir without detention all water required to be released from the Spence reservoir pursuant to Permit No. 2179.

c. The level of storage necessary to meet the demonstrated demand on Stacy reservoir shall be determined by reference to the table comparing storage level to "Adopted Yield", for this purpose only, attached to this Settlement Agreement as Exhibit "A". and which shall be contained in operations manual ("Operations Manual") referred to in Section III.3. and incorporated herein by reference.

d. Net water impounded being defined as the amount of impounded water, including return flows, less inadvertent losses such as evaporation, seepage and transpiration, but excluding (i) diversions by pumpage from Stacy reservoir

095907

above elevation 1,530.5 mean sea level and below elevation 1,543.0 mean sea level subsequent to the last spill or release whichever is the later to occur and (ii) releases from Stacy which may be required by or for the benefit of the Parks and Wildlife Commission of the State of Texas or any other agency of the State or Federal Government for environmental purposes which exceed both 5,000 acre feet per annum and 5,000 acre feet since the last LCRA spill.

3. Unless otherwise agreed by both parties, all releases under this Section shall be made at the rate of 5,000 cubic feet per second.

Section III: General Agreements

1. LCRA and CRMWD will operate their respective reservoirs in a coordinated manner in order to enhance the ability of both parties to impound the maximum amount of water available for beneficial use within their respective water-service areas. CRMWD agrees to operate Stacy dam and reservoir in a reasonable and prudent manner in connection with CRMWD's other sources of water supply so as to conserve water and prevent waste. CRMWD agrees that it will operate the Stacy dam and reservoir project in accordance with this Settlement Agreement and in accordance with any permit issued to CRMWD to build and operate the Stacy dam and reservoir project. CRMWD agrees to use all water available to it from Stacy reservoir for

municipal, industrial and dam construction purposes only and to never use or sell or permit to be sold any water from Stacy reservoir for secondary recovery purposes or for filling Spence reservoir. Neither Party hereto shall manipulate by contract or otherwise, its use, disposition or pattern of use of water from any of its reservoirs, or other sources of water supply, in such a manner as to adversely effect the terms of this Agreement.

2. It is the intent of the Parties hereto to cooperate and to coordinate their future water supply and related development activities in order to provide for the maximum conservation of state water from all uses within the Colorado River basin and with due regard to the environmental well-being of the basin. Parties shall provide each other such reports, records and documents as Parties may reasonably request from time to time for the purpose of monitoring the circumstances and events relative to LCRA's release rights and for the purpose of enforcing such rights. The required reports, records and documents shall be delivered in accordance with the notice provisions set forth below. In addition, both Parties shall be entitled to inspect the records and facilities of the other for the purpose of monitoring and assuring compliance with the terms of such release provision.

3. CRMWD agrees, as an aid in administrating state water of the Colorado River and the provisions of this Settlement Agreement and any permit issued to CRMWD to construct Stacy dam and

reservoir and, prior to the date of deliberate impoundment of water in Stacy reservoir, to prepare in cooperation with and with the approval of LCRA, the Operations Manual describing the methods and procedures to be used by CRMWD to accomplish the provisions of this Settlement Agreement and any other special conditions which may be contained in the Stacy permit.

Section IV: Additional Provisions

1. The effectiveness of this Agreement shall be conditioned upon:

a. The approval of this Agreement by the Texas Water Commission;

b. Issuance of a permit by the Texas Water Commission which authorizes construction of Stacy dam and reservoir substantially in accordance with the applicable and appropriate provisions of this Settlement Agreement.

c. Compliance of LCRA with the requirements of Texas Administrative Code §§ 303.111 - 303.120 and approval by the Texas Water Commission of a contractual amendment to LCRA Permit No. 1259 accommodating the terms of this Agreement.

095907

2. In consideration of the right to divert granted by the terms of this Agreement, CRMWD agrees:

a. To dismiss with prejudice its opposition to the adjudication of LCRA's water rights in the amounts claimed for such rights by LCRA in the currently pending adjudication of the Middle and Lower Colorado River segments of the Colorado River; and

b. Not to support, directly or indirectly, any challenge to the water permits of LCRA or to LCRA's statutory organization or authority by any action to be taken before any administrative agency of the State of Texas or by or before the Legislature of the State of Texas; provided CRMWD's obligation under Section IV 2.b. is conditioned upon the obligation of LCRA not to introduce, directly or indirectly, any legislation relating to the organization or authority of CRMWD without the consent of CRMWD.

3. This Settlement Agreement shall be null and void if CRMWD has not completed construction of the Stacy dam and reservoir project within ten (10) years after the date of this Settlement Agreement; provided, however, if construction of the Stacy dam and reservoir project is required to be delayed by order of a court of competent jurisdiction or any governmental agency having jurisdiction over

CRMWD the period of such delay shall be added to the time within which CRMWD is required to complete construction of the project hereunder.

4. All notices and other documents required or permitted to be given pursuant to this Agreement shall be made by delivery to the party to whom sent at the following addresses:

For Lower Colorado River Authority, to
3700 Lake Austin Boulevard
Austin, Texas 78703

For Colorado River Municipal Water District, to
400 East 24th Street
Big Spring, Texas 79720

095907

IN WITNESS WHEREOF, the parties, acting under authority of their respective governing bodies, have caused this Settlement Agreement to be duly executed in several counterparts, each of which shall constitute an original, all as of the day and year below written, which is the date of this Settlement Agreement.

LOWER COLORADO RIVER AUTHORITY

DATE: February 22, 1985

By: Elof H. Soderberg
GENERAL MANAGER

ATTEST:

John E. Bagley, Jr.
ASSISTANT SECRETARY

COLORADO RIVER MUNICIPAL WATER DISTRICT

DATE: February 26, 1985

By: John T. Hayes
PRESIDENT, BOARD OF DIRECTORS

ATTEST:

SECRETARY, BOARD OF DIRECTORS

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EXHIBIT "A"

STACY RESERVOIR

MSL ELEVATION	STORAGE IN ACRE-FEET	ADOPTED YIELD IN ACRE-FEET
1551.50	554,340	90,700
1548.50	498,728	87,000
1548.00	489,772	85,000
1545.50	446,903	80,000
1545.00	438,584	75,000
1543.00	406,579	67,000
1542.00	391,198	61,000
1539.00	347,446	59,000
1536.00	307,188	55,000
1533.00	270,326	54,000
1530.50	242,186	53,000

095907

1ST AMENDMENT TO SETTLEMENT AGREEMENT

This 1st Amendment to that certain Settlement Agreement dated February 22, 1985 and February 26, 1985 ("Settlement Agreement") by and between the Lower Colorado River Authority ("LCRA") and the Colorado River Municipal Water District ("CRMWD") made this 17th day of September 1998 by and between LCRA and CRMWD, to-wit:

WITNESSETH:

WHEREAS, LCRA and CRMWD entered into a Settlement Agreement relating to the construction and operation of Stacy dam and reservoir (now called O.H. Ivie Reservoir) and the protection of LCRA's downstream senior water rights; and

WHEREAS, LCRA and CRMWD agree that amendments to the Settlement Agreement are now appropriate to facilitate cooperation between the parties relating to planning and reservoir operations; and

WHEREAS, LCRA and CRMWD entered into a Letter Agreement dated March 26, 1998 ("Letter Agreement") wherein the parties set forth each party's understanding and initial agreement regarding planning, reservoir operations, and pending litigation; and

WHEREAS, the parties agree that following amendments to the Settlement Agreement are consistent and in accordance with the Letter Agreement.

NOW THEREFORE, in mutual consideration of the premises and the provisions hereinafter contained, the parties hereby agree as follows:

1. Section II: Releases from Stacy Reservoir, is deleted in its entirety.

2. Section III: General Agreements Paragraph 1, is amended to read as follows:

> "1. LCRA and CRMWD will operate their respective reservoirs in a coordinated manner in order to enhance the ability of both parties to impound the maximum amount of water available for beneficial use within their respective water-service areas. CRMWD agrees to operate Stacy dam and reservoir in a reasonable and prudent manner in connection with CRMWD's other sources of water supply so as to conserve water and prevent waste. CRMWD agrees that it will operate the Stacy dam and

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reservoir project in accordance with this Settlement Agreement and in accordance with any permit issued to CRMWD to build and operate the Stacy dam and reservoir project. Neither Party hereto shall manipulate by contract or otherwise, its use, disposition or pattern of use of water from any of its reservoirs, or other sources of water supply, in such a manner as to adversely effect the terms of this Agreement."

3. Section III: General Agreements Paragraph 2, is amended to read as follows:

"2. It is the intent of the Parties hereto to cooperate and to coordinate their future water supply and related development activities in order to provide for the maximum conservation of state water from all uses within the Colorado River basin and with due regard to the environmental well-being of the basin."

4. Exhibit A to the Settlement Agreement is deleted in its entirety.

IN WITNESS WHEREOF, the parties acting under authority of their respective governing bodies have caused this 1ST AMENDMENT TO THE SETTLEMENT AGREEMENT to be duly executed in several counterparts, each of which shall constitute an original, all as of day and year above written.

LOWER COLORADO RIVER AUTHORITY

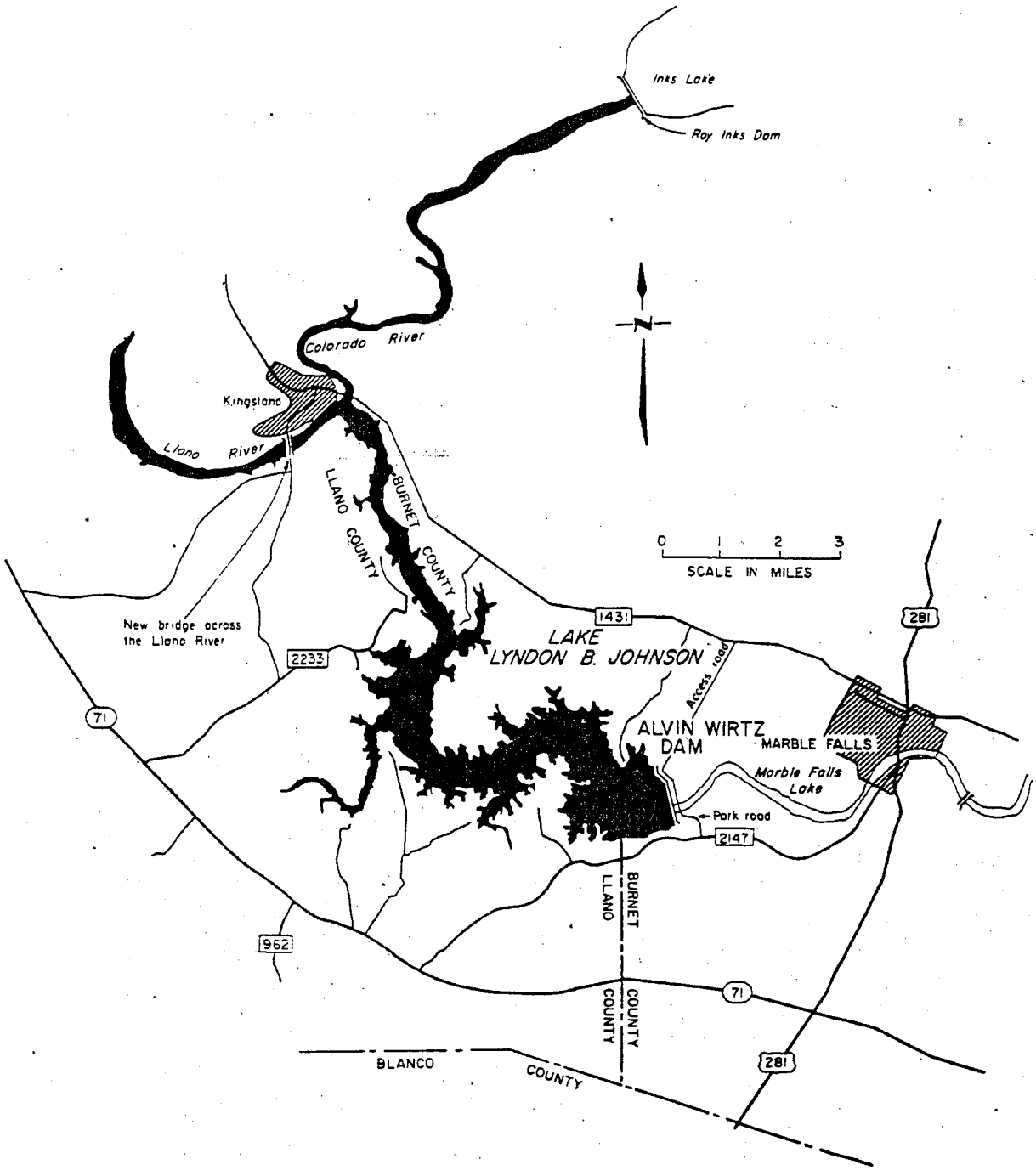
By: _____
Joseph J. Beal, P.E.
Manager, WaterCo

COLORADO RIVER MUNICIPAL WATER DISTRICT

By: _____
John Currie
President, Board of Directors

Volume II – Technical Report
Appendices

Appendix 2A
Technical Data on LCRA's Dams



ALVIN WIRTZ DAM AND LAKE LYNDON B. JOHNSON

Alvin Wirtz Dam and Lake Lyndon B. Johnson

OWNER

Lower Colorado River Authority.

ENGINEER

Fargo Engineering Company.

LOCATION

On the Colorado River in Burnet County 5 miles west of Marble Falls.
Lake shoreline is in Burnet and Llano Counties.

DRAINAGE AREA

36,290 square miles, of which 11,900 square miles is probably noncontributing. River flow is regulated by upstream storage and plant operation.

DAM

Type	Concrete and earthfill
Length	5,491.4 ft
Height	118.29 ft
Top width of earth section	26.0 ft

SPILLWAY

Type	Concrete ogee
Length (net)	450 ft
Crest elevation	796.0 ft above msl
Control	9 tainter gates, each 50 by 30 ft

OUTLET WORKS

None. Water releases are made through turbine operation.

POWER FEATURES

Two generating units, each 25,000 kw capacity.

STATE AUTHORIZATION

Permit No. 953 (Application No. 1023) May 15,1926, allocates 1,305,000 acre-feet of water for conservation, irrigation, and power generation uses. Several other water rights are included in this permit.

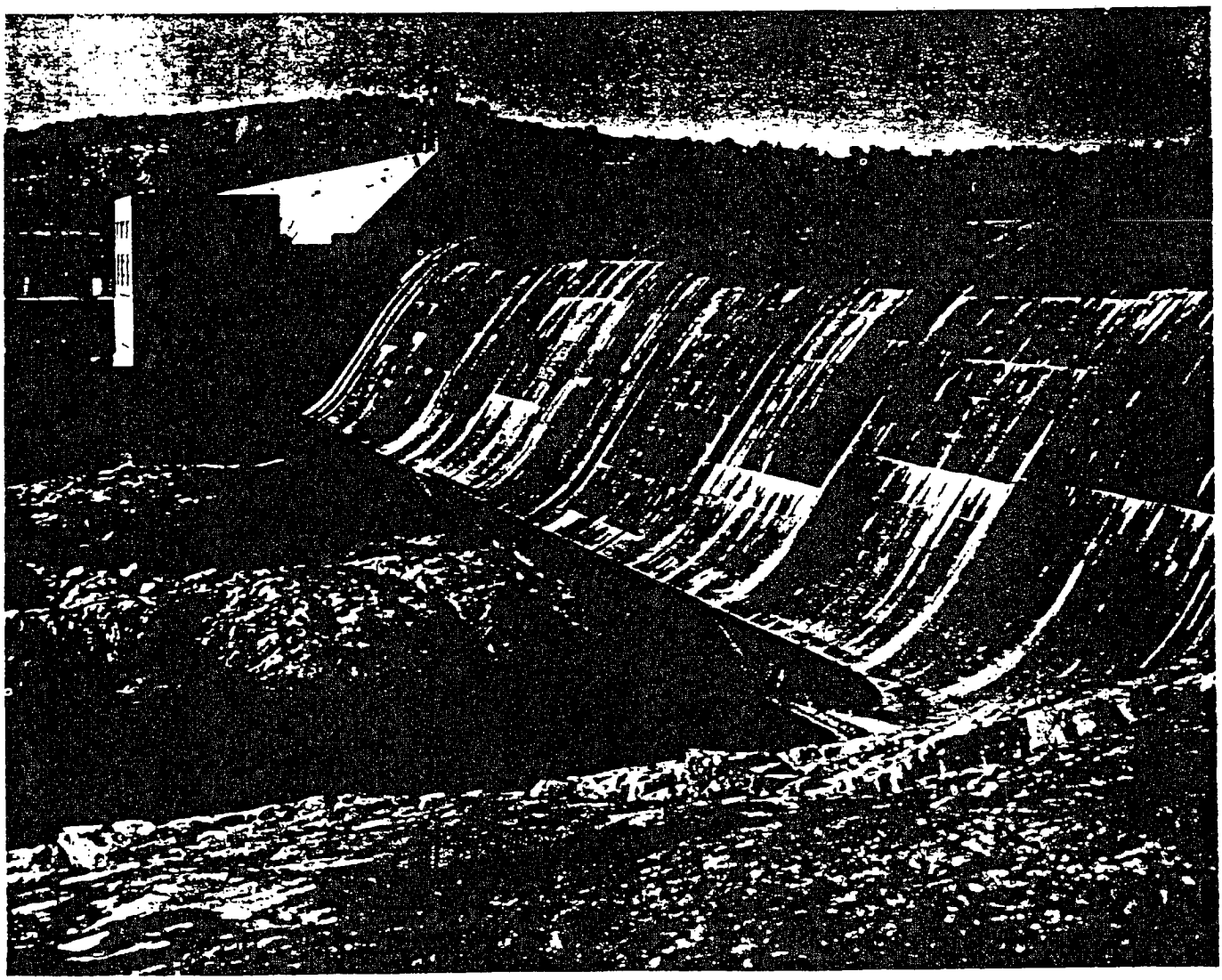
RESERVOIR DATA (Lower Colorado River Authority Survey 1949)

Capacity at operating elevation	825.0 ft above msl	138,500 acre-feet
Area at operating elevation	825.0 ft above msl	6,375 acres
Invert to penstock elevation	793.0 ft above msl	

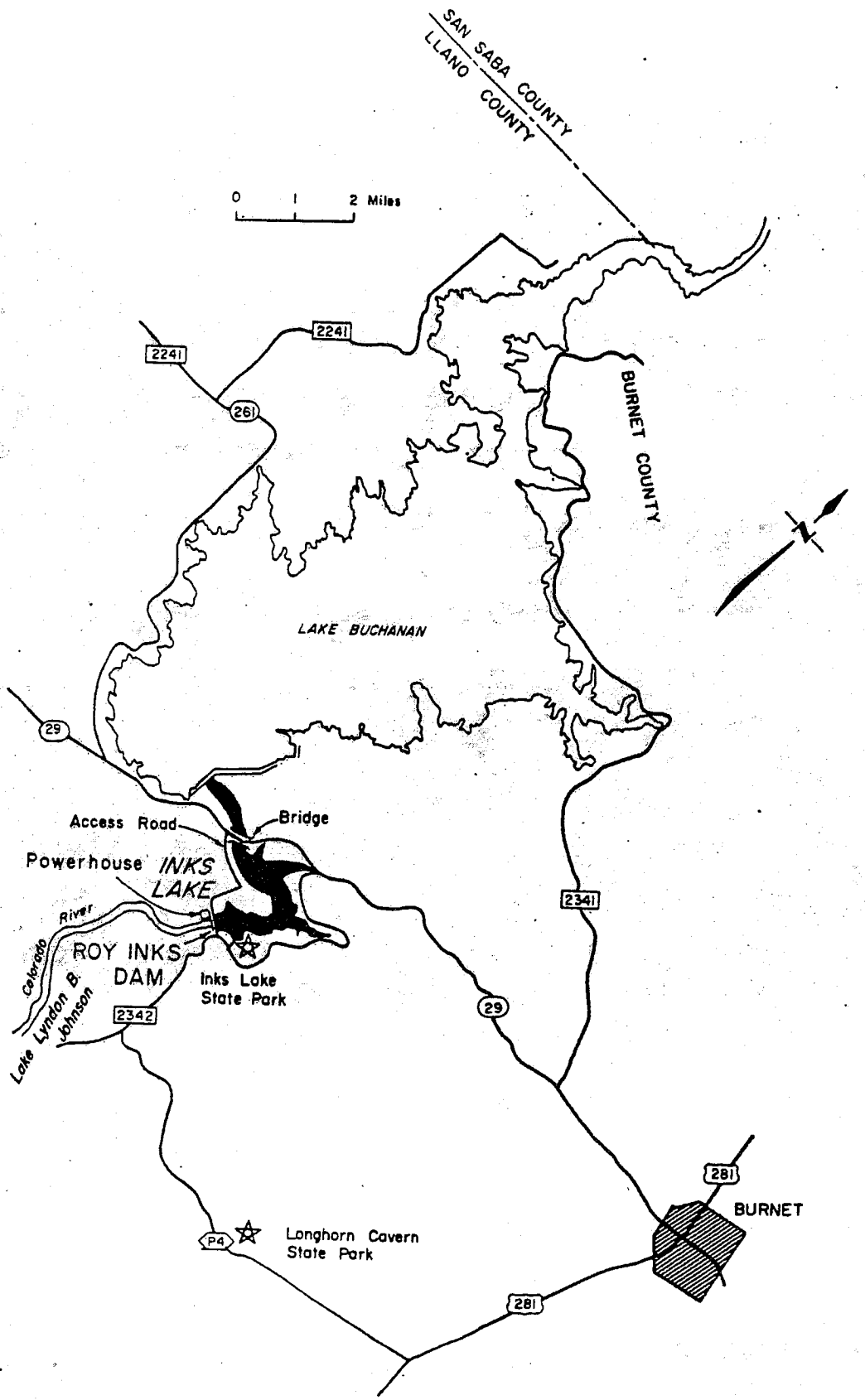
GENERAL

Construction started	September 1949
Deliberate impoundment of water began	May 1951
Power unit in operation	June 27, 1951
Dam Completed	November 1951
General contractor	Brown & Root, Inc.
Estimated cost of the project	$9,725,934

Information courtesy of the Lower Colorado River Authority



View of Spillway
1960



ROY INKS DAM AND INKS LAKE

Roy Inks Dam and Inks Lake

OWNER

Lower Colorado River Authority.

ENGINEER (Design)

Fargo Engineering Company.
Lower Colorado River Authority.

LOCATION

On the Colorado River in Burnet County, 12 miles west of Burnet. Lake shoreline is in Burnet and Llano counties.

DRAINAGE AREA

31,290 square miles, of which 11,900 square miles is probably noncontributing. Flow is regulated by Buchanan Powerplant Operation.

DAM

Type	Concrete gravity
Length	1,547.5 ft
Height	96.5 ft ±
Width at the top of non-overflow section	16.5 ft

SPILLWAY

Type	Uncontrolled gravity section of dam
Crest length	871.0 ft
Crest elevation	888.5 ft above msl

OUTLET WORKS

None. Water is released through the turbine.

POWER FEATURES

1 generating unit of 12,000 kw capacity. This unit is operated by remote control from Buchanan Plant.

STATE AUTHORIZATION

Permit No. 1259A (Application No. 1345) May 28, 1938, authorizes use of 1,391,530 acre-feet of water for hydroelectric power production. Several earlier water rights are included in this permit.

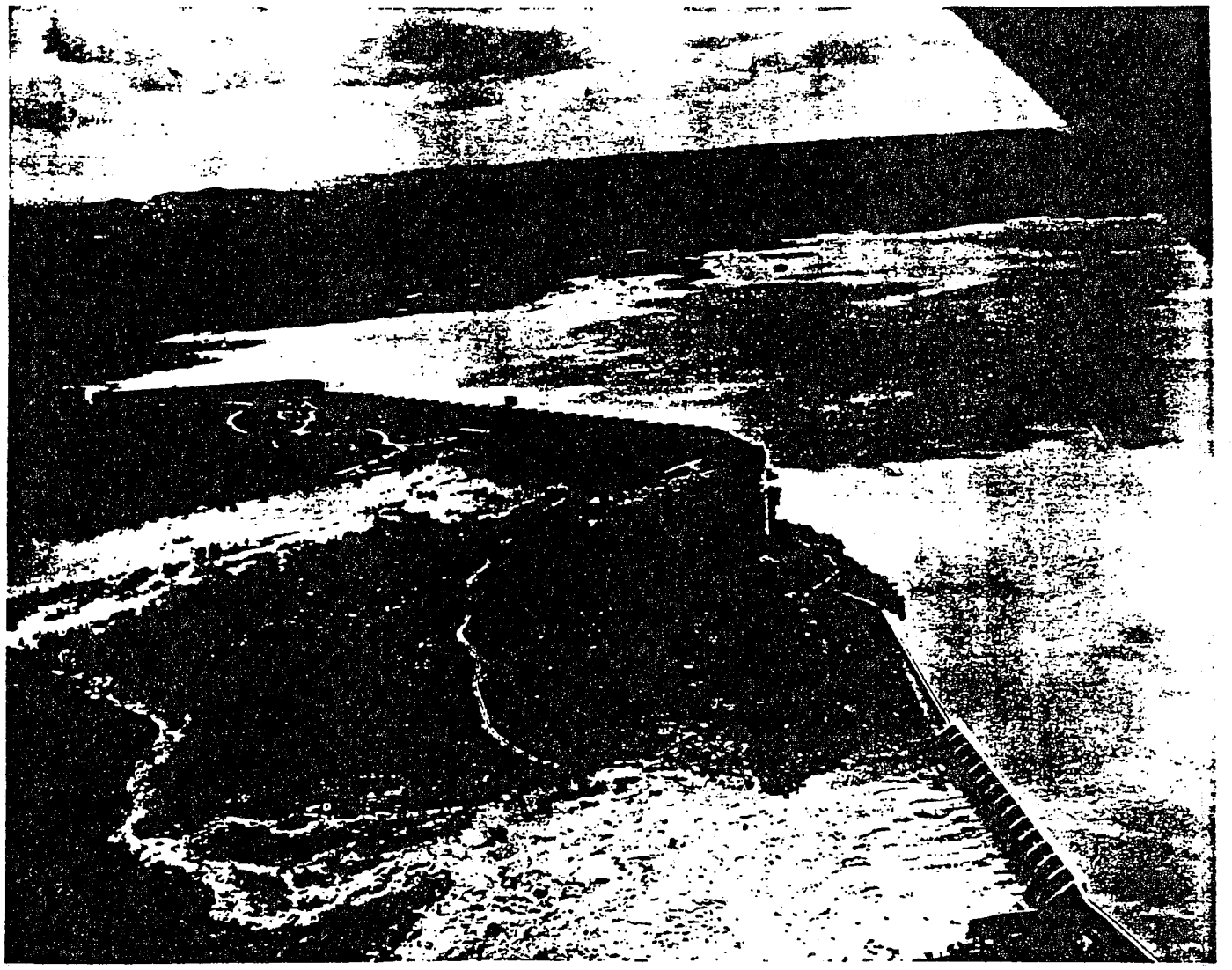
RESERVOIR DATA

Capacity at spillway elevation	888.5 ft above msl	17,540 acre-feet
Area at spillway elevation	888.5 ft above msl	803 acres
Invert to penstock elevation	844.5 ft above msl	

GENERAL

Project started	1936
Dam completed	June 1938
Power unit in operation	June 1938
General contractor	Morrison-Knudsen Company for the dam Lower Colorado River Authority for the power features
Estimated cost of the project	$2,079,738

Information courtesy of the Lower Colorado River Authority



Dam and Lake
May 1957

Buchanan Dam and Lake Buchanan

OWNER

Lower Colorado River Authority.

ENGINEER (Design)

Fargo Engineering Company.
U.S. Bureau of Reclamation.
Lower Colorado River Authority.

LOCATION

On the Colorado River in Burnet County, 13 miles west of Burnet. Lake shoreline is in Burnet, Llano, and San Saba Counties.

DRAINAGE AREA

31,250 square miles of which 11,900 square miles is probably noncontributing.

DAM

Type	Multiple concrete arch, gated and gravity sections
Length	10,987 ft plus 1,700 ft of natural ground
Height	145.5 ft
Top width*	Varies, with the maximum 33.8 ft

SPILLWAY

Type	3 sections with tainter gates
Section 1 (near left or north end)	
Crest elevation	1005.5 ft above msl
Control	16 gates, each 33 by 15.5 ft
Section 2 (center)	
Crest elevation	1005.5 ft above msl
Control	14 gates, each 33 by 15.5 ft
Section 3 (nearest powerhouse)	
Crest elevation	995.5 ft above msl
Control	7 gates, each 40 by 25.5 ft
Section 4 (overflow no control far left or north end)	
Crest elevation	1020.5 ft above msl
Crest length	1,100 ft

OUTLET WORKS

None. Water is released through turbines.

POWER FEATURES

3 generating units, each 12,667 kw capacity.

SPECIAL FEATURES

A pump-back unit with a capacity of 840 cfs returns water from Inks Lake to Lake Buchanan during off-peak power demand periods. The vertical pump is driven by a 13,500 hp motor.

STATE AUTHORIZATION

Permit No. 954 (Application No. 1024) May 15, 1926,
Permit No. 1259 (Application No. 1345) May 25, 1938, and other permits cover this and other sites on the Colorado River with water rights.

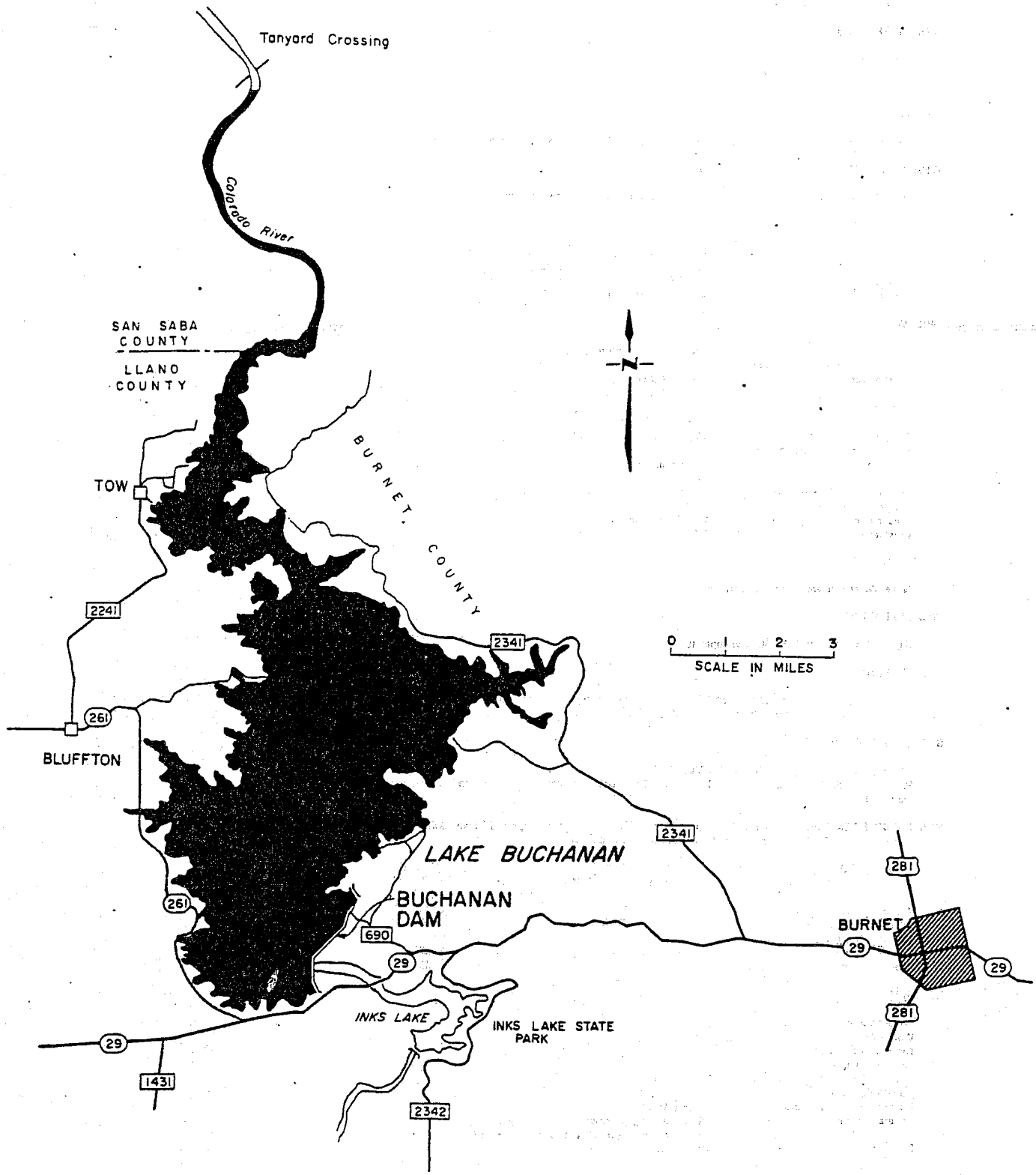
RESERVOIR DATA (Based on U.S. Geological Survey 1925 topographic maps and Lower Colorado River Authority 1939, with 1965 U.S. Geological Survey corrected msl datum)

FEATURE	ELEVATION (FEET ABOVE MSL)	CAPACITY (ACRE-FEET)	AREA (ACRES)
Top of gravity overflow	1020.5	992,000	23,060
Sill of 15-ft gates	1005.5	678,000	18,770
Sill of 25-ft gates	995.5	505,000	15,820
Invert to penstocks	937.5	36,800	2,100
Usable capacity	–	955,200	–

GENERAL

Project started	April 1931
Work stopped	April 20,1932
Reconstruction started	1935
Deliberate impoundment of water began	May 20, 1937
Dam Completed	1938
First generator in operation	January 1938
General contractor	Started by: Fegles Construction Company Completed by: Lower Colorado River Authority
Estimated total project cost	$10,397,475

Information courtesy of the Lower Colorado River Authority



BUCHANAN DAM AND LAKE BUCHANAN

CALENDAR YEAR 1965

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	660.	0.	4570.	0.	0.19	870.	83477.	4580.
2	2181.	0.	3656.	0.	0.81	3506.	78496.	4328.
3	745.	0.	5483.	0.	0.30	1211.	72547.	4038.
4	663.	0.	7311.	0.	0.38	1398.	64501.	3679.
5	95877.	0.	7311.	0.	-0.14	-781.	153847.	5578.
6	21872.	0.	10967.	0.	0.42	3218.	161535.	7661.
7	16777.	0.	13709.	0.	0.94	7278.	157325.	7743.
8	1252.	0.	13709.	0.	0.74	5336.	139532.	7211.
9	5447.	0.	7311.	0.	0.63	4250.	133418.	6746.
10	4046.	0.	7311.	0.	0.31	2018.	128134.	6511.
11	1843.	0.	4570.	0.	0.25	1575.	123833.	6299.
12	1089.	0.	4570.	0.	0.11	672.	119681.	6108.

CALENDAR YEAR 1962

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2459.	0.	4570.	0.	0.23	3230.	346526.	14044.
2	1385.	0.	3656.	0.	0.33	4577.	339678.	13871.
3	301.	0.	5483.	0.	0.38	5177.	329318.	13625.
4	196.	0.	7311.	0.	0.39	5190.	317013.	13307.
5	5.	0.	7311.	0.	0.73	9411.	300295.	12892.
6	1036.	0.	10967.	0.	0.39	4846.	285518.	12426.
7	5074.	0.	13709.	0.	0.68	8119.	268765.	11940.
8	268.	0.	13709.	0.	0.94	10611.	244713.	11288.
9	877.	0.	7311.	0.	0.33	3553.	234726.	10766.
10	14532.	0.	7311.	0.	0.38	4051.	237896.	10659.
11	1857.	0.	4570.	0.	0.28	2973.	232211.	10619.
12	1134.	0.	4570.	0.	0.18	1880.	226895.	10443.

CALENDAR YEAR 1963

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1221.	0.	4570.	0.	0.20	2054.	221493.	10269.
2	363.	0.	3656.	0.	0.22	2219.	215981.	10088.
3	93.	0.	5483.	0.	0.47	4617.	205974.	9824.
4	106.	0.	7311.	0.	0.40	3782.	194987.	9455.
5	28716.	0.	7311.	0.	0.17	1634.	214757.	9611.
6	12721.	0.	10967.	0.	0.43	4262.	212250.	9911.
7	500.	0.	13709.	0.	0.99	9377.	189664.	9472.
8	1521.	0.	13709.	0.	0.76	6589.	170888.	8669.
9	257.	0.	7311.	0.	0.60	4799.	159035.	7999.
10	159.	0.	7311.	0.	0.57	4248.	147634.	7453.
11	1138.	0.	4570.	0.	0.20	1415.	142787.	7077.
12	446.	0.	4570.	0.	0.16	1102.	137561.	6888.

CALENDAR YEAR 1964

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	374.	0.	4570.	0.	0.18	1203.	132163.	6683.
2	1471.	0.	3656.	0.	0.28	1815.	128163.	6484.
3	449.	0.	5483.	0.	0.34	2120.	121008.	6236.
4	13237.	0.	7311.	0.	0.39	2400.	124534.	6154.
5	2870.	0.	7311.	0.	0.49	2972.	117120.	6066.
6	4706.	0.	10967.	0.	0.69	3932.	106928.	5698.
7	619.	0.	13709.	0.	0.84	4402.	89436.	5241.
8	13185.	0.	13709.	0.	0.78	3631.	85281.	4655.
9	24861.	0.	7311.	0.	0.23	1179.	101652.	5127.
10	1173.	0.	7311.	0.	0.43	2247.	93266.	5225.
11	5943.	0.	4570.	0.	0.19	974.	93666.	5127.
12	462.	0.	4570.	0.	0.27	1302.	88257.	4821.

CALENDAR YL 1959

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	460.	0.	4570.	0.	0.24	3909.	427746.	16288.
2	231.	0.	3656.	0.	0.12	1938.	422382.	16154.
3	5.	0.	5483.	0.	0.52	8256.	408648.	15877.
4	0.	0.	7311.	0.	0.40	6185.	395152.	15462.
5	1859.	0.	7311.	0.	0.34	5148.	384552.	15140.
6	35671.	0.	10967.	0.	0.21	3210.	406046.	15285.
7	23773.	0.	13709.	0.	0.29	4541.	411570.	15659.
8	225.	0.	13709.	0.	0.81	12452.	385634.	15373.
9	0.	0.	7311.	0.	0.62	9185.	369137.	14814.
10	146293.	0.	7311.	0.	0.02	328.	507791.	16423.
11	7431.	0.	4570.	0.	0.24	4346.	506306.	18108.
12	3704.	0.	4570.	0.	0.09	1625.	503815.	18061.

CALENDAR YEAR 1960

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	16896.	0.	4570.	0.	-0.01	-182.	516323.	18178.
2	5522.	0.	3656.	0.	0.18	3295.	514895.	18306.
3	2439.	0.	5483.	0.	0.32	5820.	506030.	18187.
4	14652.	0.	7311.	0.	0.38	6874.	506497.	18089.
5	4655.	0.	7311.	0.	0.49	8800.	495041.	17960.
6	2496.	0.	10967.	0.	0.85	14912.	471657.	17544.
7	50.	0.	13709.	0.	0.69	11691.	446308.	16944.
8	571.	0.	13709.	0.	0.65	10622.	422548.	16342.
9	108.	0.	7311.	0.	0.70	11066.	404278.	15809.
10	11784.	0.	7311.	0.	0.28	4348.	404404.	15527.
11	2408.	0.	4570.	0.	0.41	6320.	395922.	15415.
12	2040.	0.	4570.	0.	-0.05	-764.	394156.	15278.

CALENDAR YEAR 1961

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	7275.	0.	4570.	0.	-0.10	-1531.	398393.	15311.
2	6310.	0.	3656.	0.	0.11	1692.	399355.	15381.
3	997.	0.	5483.	0.	0.39	5949.	388920.	15254.
4	18.	0.	7311.	0.	0.57	8498.	373128.	14909.
5	12194.	0.	7311.	0.	0.43	6313.	371698.	14682.
6	25339.	0.	10967.	0.	0.06	891.	385179.	14842.
7	10627.	0.	13709.	0.	0.47	6997.	375101.	14886.
8	941.	0.	13709.	0.	0.80	11543.	350791.	14428.
9	24045.	0.	7311.	0.	0.43	6122.	361402.	14238.
10	11011.	0.	7311.	0.	0.34	4886.	360216.	14370.
11	2817.	0.	4570.	0.	0.14	2002.	356462.	14301.
12	2669.	0.	4570.	0.	0.19	2695.	351866.	14184.

CALENDAR YEAR 1956

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1.	0.	4570.	0.	0.19	1676.	180941.	8822.
2	266.	0.	3656.	0.	0.16	1376.	176176.	8599.
3	2.	0.	5483.	0.	0.50	4144.	166551.	8287.
4	2653.	0.	7311.	0.	0.39	3079.	158813.	7895.
5	99057.	0.	7311.	0.	0.39	3720.	246839.	9538.
6	0.	0.	10967.	0.	0.88	9390.	226482.	10671.
7	1197.	0.	13709.	0.	1.07	10656.	203314.	9959.
8	866.	0.	13709.	0.	1.11	10134.	180338.	9130.
9	49.	0.	7311.	0.	0.99	8257.	164819.	8340.
10	30070.	0.	7311.	0.	0.60	5033.	182545.	8388.
11	4804.	0.	4570.	0.	0.65	5624.	177156.	8652.
12	3052.	0.	4570.	0.	0.18	1525.	174113.	8472.

CALENDAR YEAR 1957

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	132.	0.	4570.	0.	0.27	2231.	167445.	8262.
2	0.	0.	3656.	0.	0.07	561.	163228.	8016.
3	7740.	0.	5483.	0.	0.33	2611.	162874.	7912.
4	48078.	0.	7311.	0.	-0.09	-793.	204433.	8806.
5	418099.	0.	7311.	63705.	-0.19	-2825.	554340.	14867.
6	166230.	0.	10967.	147825.	0.39	7438.	554340.	19071.
7	2295.	0.	13709.	0.	0.92	17337.	525589.	18845.
8	1587.	0.	13709.	0.	1.00	18186.	495281.	18186.
9	17690.	0.	7311.	0.	0.57	10165.	495495.	17833.
10	291947.	0.	7311.	221911.	0.21	3880.	554340.	18476.
11	11250.	0.	4570.	5724.	0.05	957.	554340.	19139.
12	3868.	0.	4570.	0.	0.29	5534.	548104.	19084.

CALENDAR YEAR 1958

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	4485.	0.	4570.	0.	0.04	760.	547259.	19009.
2	6908.	0.	3656.	0.	0.00	0.	550512.	19035.
3	6056.	0.	5483.	0.	0.05	953.	550131.	19065.
4	2183.	0.	7311.	0.	0.20	3793.	541209.	18967.
5	14449.	0.	7311.	0.	0.24	4536.	543811.	18900.
6	6590.	0.	10967.	0.	0.65	12187.	527247.	18750.
7	501.	0.	13709.	0.	0.93	16951.	497089.	18226.
8	422.	0.	13709.	0.	0.78	13689.	470113.	17550.
9	3611.	0.	7311.	0.	0.25	4280.	462132.	17122.
10	1403.	0.	7311.	0.	0.23	3887.	452337.	16900.
11	855.	0.	4570.	0.	0.28	4667.	443955.	16669.
12	493.	0.	4570.	0.	0.25	4114.	435764.	16458.

CALENDAR YEAR 1953

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	78.	0.	4570.	0.	0.32	612.	24821.	1912.
2	1.	0.	3656.	0.	0.23	348.	20818.	1514.
3	12782.	0.	5483.	0.	0.15	246.	27871.	1640.
4	8.	0.	7311.	0.	0.36	576.	19991.	1601.
5	12101.	0.	7311.	0.	0.41	597.	24184.	1455.
6	5.	0.	10967.	0.	0.84	997.	12225.	1187.
7	1819.	0.	13709.	0.	0.71	336.	0.	473.
8	37709.	0.	13709.	0.	0.62	503.	23498.	811.
9	1532.	0.	7311.	0.	0.76	994.	16724.	1309.
10	19508.	0.	7311.	0.	0.31	464.	28457.	1496.
11	1107.	0.	4570.	0.	0.28	514.	24481.	1834.
12	83.	0.	4570.	0.	0.31	449.	19545.	1449.

CALENDAR YEAR 1954

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	58.	0.	4570.	0.	0.19	212.	14821.	1116.
2	15.	0.	3656.	0.	0.36	317.	10864.	881.
3	126.	0.	5483.	0.	0.39	228.	5278.	585.
4	65197.	0.	7311.	0.	0.11	245.	62919.	2228.
5	85444.	0.	7311.	0.	0.25	1327.	139725.	5308.
6	9599.	0.	10967.	0.	0.72	4861.	133496.	6751.
7	2139.	0.	13709.	0.	1.08	6723.	115204.	6225.
8	269.	0.	13709.	0.	1.03	5601.	96163.	5438.
9	0.	0.	7311.	0.	0.95	4550.	84302.	4789.
10	4.	0.	7311.	0.	0.66	2796.	74199.	4236.
11	132.	0.	4570.	0.	0.45	1712.	68049.	3805.
12	1.	0.	4570.	0.	0.42	1475.	62006.	3511.

CALENDAR YEAR 1955

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	0.	0.	4570.	0.	0.15	490.	56947.	3264.
2	727.	0.	3656.	0.	0.20	615.	53403.	3074.
3	18.	0.	5483.	0.	0.44	1259.	46679.	2861.
4	0.	0.	7311.	0.	0.50	1285.	38082.	2571.
5	125966.	0.	7311.	0.	0.18	939.	155798.	5214.
6	59039.	0.	10967.	0.	0.54	4619.	199251.	8554.
7	37403.	0.	13709.	0.	0.74	7181.	215765.	9704.
8	2646.	0.	13709.	0.	0.75	7255.	197447.	9673.
9	26013.	0.	7311.	0.	0.55	5272.	210877.	9586.
10	6572.	0.	7311.	0.	0.66	6400.	203737.	9697.
11	2.	0.	4570.	0.	0.41	3862.	195307.	9420.
12	0.	0.	4570.	0.	0.39	3552.	187186.	9107.

CALENDAR 1950

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1369.	0.	4570.	0.	0.19	1731.	188831.	9109.
2	2389.	0.	3656.	0.	0.20	1791.	185774.	8953.
3	3.	0.	5483.	0.	0.41	3570.	176723.	8708.
4	1505.	0.	7311.	0.	0.27	2253.	168664.	8345.
5	6171.	0.	7311.	0.	0.17	1379.	166145.	8110.
6	1668.	0.	10967.	0.	0.61	4715.	152131.	7729.
7	777.	0.	13709.	0.	0.65	4556.	134644.	7009.
8	1000.	0.	13709.	0.	0.84	5278.	116657.	6284.
9	13659.	0.	7311.	0.	0.37	2212.	120793.	5979.
10	929.	0.	7311.	0.	0.62	3631.	110780.	5856.
11	137.	0.	4570.	0.	0.56	3076.	103272.	5492.
12	197.	0.	4570.	0.	0.26	1375.	97524.	5288.

CALENDAR YEAR 1951

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	228.	0.	4570.	0.	0.33	1703.	91479.	5162.
2	214.	0.	3656.	0.	0.18	855.	87183.	4750.
3	4.	0.	5483.	0.	0.29	1298.	80405.	4476.
4	3.	0.	7311.	0.	0.37	1503.	71594.	4063.
5	31804.	0.	7311.	0.	0.22	980.	95107.	4452.
6	27346.	0.	10967.	0.	0.31	1653.	109833.	5332.
7	11.	0.	13709.	0.	0.76	4028.	92107.	5300.
8	5513.	0.	13709.	0.	0.85	3902.	80010.	4590.
9	1299.	0.	7311.	0.	0.70	2829.	71169.	4041.
10	11.	0.	7311.	0.	0.53	1900.	61969.	3585.
11	1.	0.	4570.	0.	0.34	1105.	56295.	3249.
12	0.	0.	4570.	0.	0.33	991.	50735.	3002.

CALENDAR YEAR 1952

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	0.	0.	4570.	0.	0.28	781.	45385.	2788.
2	0.	0.	3656.	0.	0.33	858.	40871.	2600.
3	0.	0.	5483.	0.	0.36	857.	34531.	2382.
4	8704.	0.	7311.	0.	0.36	813.	35110.	2259.
5	29556.	0.	7311.	0.	0.31	838.	56517.	2704.
6	9514.	0.	10967.	0.	0.79	2409.	52655.	3049.
7	0.	0.	13709.	0.	0.79	2104.	36843.	2663.
8	0.	0.	13709.	0.	1.15	2285.	20850.	1987.
9	34381.	0.	7311.	0.	0.43	954.	46965.	2219.
10	156.	0.	7311.	0.	0.72	1853.	37956.	2574.
11	1413.	0.	4570.	0.	0.19	440.	34360.	2317.
12	498.	0.	4570.	0.	0.17	364.	29924.	2140.

CALENDAR YE 1947

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2917.	0.	4570.	0.	0.11	974.	183527.	8854.
2	1743.	0.	3656.	0.	0.25	2179.	179435.	8718.
3	1077.	0.	5483.	0.	0.10	852.	174177.	8523.
4	2948.	0.	7311.	0.	0.35	2888.	166925.	8252.
5	53350.	0.	7311.	0.	0.18	1624.	211339.	9025.
6	13887.	0.	10967.	0.	0.66	6452.	207808.	9775.
7	183.	0.	13709.	0.	0.99	9216.	185066.	9309.
8	0.	0.	13709.	0.	0.85	7165.	164193.	8429.
9	66.	0.	7311.	0.	0.80	6122.	150826.	7653.
10	15587.	0.	7311.	0.	0.53	3941.	155160.	7436.
11	1274.	0.	4570.	0.	0.31	2296.	149569.	7405.
12	8278.	0.	4570.	0.	0.09	661.	152616.	7343.

CALENDAR YEAR 1948

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1911.	0.	4570.	0.	0.17	1245.	148713.	7322.
2	1353.	0.	3656.	0.	0.11	787.	145624.	7151.
3	2270.	0.	5483.	0.	0.40	2792.	139619.	6980.
4	1970.	0.	7311.	0.	0.49	3283.	130994.	6701.
5	6243.	0.	7311.	0.	0.50	3213.	126713.	6426.
6	5019.	0.	10967.	0.	0.70	4271.	116494.	6101.
7	45784.	0.	13709.	0.	0.65	4222.	144348.	6495.
8	3596.	0.	13709.	0.	0.99	6659.	127576.	6726.
9	3296.	0.	7311.	0.	0.66	4084.	119477.	6188.
10	2928.	0.	7311.	0.	0.43	2523.	112571.	5866.
11	1002.	0.	4570.	0.	0.46	2572.	106431.	5592.
12	769.	0.	4570.	0.	0.30	1608.	101023.	5359.

CALENDAR YEAR 1949

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1803.	0.	4570.	0.	-0.02	-105.	98362.	5273.
2	2301.	0.	3656.	0.	0.03	157.	96851.	5228.
3	20119.	0.	5483.	0.	0.24	1285.	110201.	5355.
4	83380.	0.	7311.	0.	-0.06	-433.	186703.	7212.
5	83458.	0.	7311.	0.	0.14	1437.	261412.	10264.
6	8632.	0.	10967.	0.	0.48	5430.	253648.	11312.
7	420.	0.	13709.	0.	0.80	8686.	231673.	10858.
8	3101.	0.	13709.	0.	0.70	7155.	213910.	10222.
9	1843.	0.	7311.	0.	0.53	5163.	203278.	9742.
10	13325.	0.	7311.	0.	0.21	2021.	207271.	9626.
11	569.	0.	4570.	0.	0.43	4107.	199163.	9552.
12	566.	0.	4570.	0.	0.15	1397.	193763.	9310.

CALENDAR YEAR 1944

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2077.	0.	4570.	0.	-0.06	-834.	343210.	13898.
2	2702.	0.	3656.	0.	0.01	139.	342118.	13858.
3	2172.	0.	5483.	0.	0.31	4258.	334549.	13734.
4	244.	0.	7311.	0.	0.54	7250.	320232.	13425.
5	24386.	0.	7311.	0.	0.17	2283.	335023.	13432.
6	1684.	0.	10967.	0.	0.76	10159.	315581.	13367.
7	1172.	0.	13709.	0.	0.84	10714.	292331.	12754.
8	7689.	0.	13709.	0.	0.80	9734.	276577.	12168.
9	15400.	0.	7311.	0.	0.48	5740.	278926.	11959.
10	24694.	0.	7311.	0.	0.39	4755.	291554.	12192.
11	749.	0.	4570.	0.	0.21	2580.	285153.	12287.
12	1519.	0.	4570.	0.	0.10	1212.	280890.	12124.

CALENDAR YEAR 1945

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2219.	0.	4570.	0.	0.15	1799.	276741.	11992.
2	2010.	0.	3656.	0.	0.09	1070.	274026.	11884.
3	1710.	0.	5483.	0.	0.23	2700.	267552.	11740.
4	10256.	0.	7311.	0.	0.22	2561.	267936.	11641.
5	1304.	0.	7311.	0.	0.63	7203.	254726.	11433.
6	5923.	0.	10967.	0.	0.59	6521.	243161.	11052.
7	51794.	0.	13709.	0.	0.34	3875.	277371.	11398.
8	1190.	0.	13709.	0.	0.82	9509.	255344.	11596.
9	396.	0.	7311.	0.	0.76	8371.	240057.	11015.
10	7526.	0.	7311.	0.	0.29	3112.	237160.	10732.
11	1341.	0.	4570.	0.	0.45	4751.	229180.	10559.
12	1731.	0.	4570.	0.	0.28	2895.	223447.	10339.

CALENDAR YEAR 1946

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1945.	0.	4570.	0.	-0.01	-102.	220924.	10202.
2	2407.	0.	3656.	0.	0.22	2223.	217453.	10103.
3	480.	0.	5483.	0.	0.34	3367.	209083.	9903.
4	0.	0.	7311.	0.	0.42	4015.	197756.	9560.
5	44164.	0.	7311.	0.	0.26	2589.	232020.	9959.
6	3625.	0.	10967.	0.	0.63	6488.	218190.	10299.
7	8.	0.	13709.	0.	1.06	10239.	194250.	9660.
8	1544.	0.	13709.	0.	1.07	9414.	172672.	8798.
9	24316.	0.	7311.	0.	0.37	3197.	186479.	8641.
10	3809.	0.	7311.	0.	0.42	3685.	179292.	8775.
11	5764.	0.	4570.	0.	0.23	1981.	178505.	8614.
12	12656.	0.	4570.	0.	0.05	438.	186154.	8752.

CALENDAR YEAR 1941

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1181.	0.	4570.	0.	0.16	3053.	547898.	19081.
2	4794.	0.	3656.	0.	0.03	571.	548466.	19020.
3	6688.	0.	5483.	0.	0.11	2092.	547579.	19016.
4	43010.	0.	7311.	27222.	0.09	1715.	554340.	19060.
5	140367.	0.	7311.	130952.	0.11	2104.	554340.	19127.
6	96312.	0.	10967.	80380.	0.26	4965.	554340.	19097.
7	8777.	0.	13709.	0.	0.64	12141.	537268.	18970.
8	12180.	0.	13709.	0.	0.59	11005.	524734.	18653.
9	6694.	0.	7311.	0.	0.37	6819.	517297.	18431.
10	49905.	0.	7311.	5739.	-0.01	-188.	554340.	18756.
11	7625.	0.	4570.	0.	0.33	6297.	551098.	19083.
12	4589.	0.	4570.	0.	0.21	3998.	547119.	19039.

CALENDAR YEAR 1942

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	3150.	0.	4570.	0.	0.24	4544.	541155.	18935.
2	2583.	0.	3656.	0.	0.27	5077.	535006.	18805.
3	1798.	0.	5483.	0.	0.44	8189.	523131.	18611.
4	28683.	0.	7311.	0.	-0.02	-374.	544877.	18717.
5	50481.	0.	7311.	27253.	0.34	6454.	554340.	18982.
6	1822.	0.	10967.	0.	0.55	10419.	534776.	18944.
7	1451.	0.	13709.	0.	0.78	14384.	508135.	18441.
8	13308.	0.	13709.	0.	0.41	7397.	500337.	18042.
9	13118.	0.	7311.	0.	0.32	5744.	500400.	17950.
10	25521.	0.	7311.	0.	0.05	908.	517702.	18155.
11	3172.	0.	4570.	0.	0.40	7302.	509003.	18254.
12	3652.	0.	4570.	0.	0.11	1993.	506092.	18120.

CALENDAR YEAR 1943

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2570.	0.	4570.	0.	0.23	4143.	499950.	18013.
2	2146.	0.	3656.	0.	0.38	6780.	491660.	17842.
3	1528.	0.	5483.	0.	0.25	4411.	483293.	17644.
4	938.	0.	7311.	0.	0.53	9197.	467723.	17353.
5	4603.	0.	7311.	0.	0.34	5799.	459216.	17055.
6	525.	0.	10967.	0.	0.65	10842.	437932.	16680.
7	2120.	0.	13709.	0.	0.73	11810.	414534.	16177.
8	1.	0.	13709.	0.	1.05	16170.	384656.	15400.
9	252.	0.	7311.	0.	0.40	5934.	371663.	14835.
10	328.	0.	7311.	0.	0.52	7523.	357157.	14468.
11	0.	0.	4570.	0.	0.29	4102.	348485.	14146.
12	115.	0.	4570.	0.	-0.06	-838.	344869.	13973.

***** STACY DAM FIRM YIELD
***** ANALYSIS FROM 1941 TO 1965 *** FIRM YIELD = 91391. ***

MONTHLY DEMAND DISTRIBUTION

0.050	0.040	0.060	0.080	0.080	0.120	0.150	0.150	0.080	0.080	0.050	0.050

AREA VALUES USED

0.	10.	21.	33.	46.	55.	64.	73.
82.	92.	102.	112.	122.	132.	142.	153.
164.	176.	188.	201.	215.	230.	246.	263.
281.	300.	320.	341.	364.	388.	413.	439.
466.	494.	523.	553.	586.	622.	622.	704.
749.	797.	849.	905.	964.	1002.	1040.	1120.
1200.	1280.	1360.	1480.	1600.	1759.	1918.	2014.
2110.	2207.	2305.	2404.	2504.	2605.	2707.	2810.
2915.	3045.	3181.	3326.	3475.	3645.	3826.	4036.
4257.	4487.	4718.	4929.	5140.	5359.	5579.	5819.
6066.	6346.	6632.	6892.	7156.	7518.	7880.	8246.
8611.	8966.	9322.	9661.	10000.	10337.	10674.	11012.
11350.	11725.	12100.	12475.	12850.	13225.	13600.	13995.
14393.	14784.	15175.	15587.	16100.	16425.	16850.	17275.
17700.	18123.	18546.	18948.	19350.	19850.	20350.	20837.
21325.	21812.	22300.	22767.	23235.	23817.	24400.	24975.
25550.	26125.	26700.	27300.	27900.	28509.	29118.	29745.
30375.	31012.	31650.	32325.	33000.	33675.	34350.	35065.
35785.							

CAPACITY VALUES USED

0.	5.	21.	48.	87.	137.	197.	265.
343.	430.	527.	634.	751.	878.	1015.	1162.
1321.	1491.	1673.	1867.	2075.	2298.	2536.	2790.
3062.	3352.	3662.	3993.	4345.	4721.	5121.	5547.
6000.	6480.	6988.	7526.	8096.	8700.	9342.	10023.
10749.	11521.	12344.	13221.	14156.	15139.	16160.	17240.
18400.	19640.	20960.	22380.	23920.	25600.	27438.	29404.
31466.	33624.	35880.	38235.	40689.	43243.	45899.	48657.
51520.	54500.	57613.	60866.	64267.	67827.	71562.	75493.
79635.	84006.	88609.	93433.	93468.	103718.	109187.	114886.
120828.	127034.	133523.	140285.	147309.	154646.	162345.	170408.
178836.	187624.	196768.	206260.	216090.	226258.	236764.	247607.
258788.	270326.	282238.	294526.	307188.	320226.	333638.	347436.
361630.	376218.	391198.	406579.	422372.	438584.	455222.	472284.
489772.	507684.	526018.	544765.	563914.	583514.	603614.	624208.
645289.	666858.	688914.	711448.	734449.	757975.	782084.	806772.
832034.	857872.	884284.	911284.	938884.	967088.	995902.	1025334.
1055394.	1086088.	1117419.	1149406.	1182068.	1215406.	1249418.	1284126.
1319551.							

TECHNICAL REPORT FOR A WATER MANAGEMENT PLAN FOR THE LOWER COLORADO RIVER

Appendix 2D

Stacy Reservoir Firm Yield Output

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

OPERATION SUMMARY

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	9294576.	0.	9294576.	0.	3638907.	4512902.	8151809.	1305570.
2	0.	8151809.	8151809.	0.	531376.	7553230.	8084605.	67203.
3	6477424.	8084605.	14562030.	0.	348894.	13680633.	14029526.	532504.
4	0.	14029526.	14029526.	0.	325868.	13639075.	13964943.	64584.
5	3961387.	13964943.	17926332.	0.	11131651.	6467181.	17598832.	538300.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

MINIMUM CAPACITY SUMMARY

RESERVOIR	MINIMUM CAPACITY	MONTH/YEAR
LAKE BUCHANAN	17.	8/1952
LAKE INKS	17540.	0/ 0
LAKE LBJ	138500.	0/ 0
LAKE MARBLE FALLS	8760.	0/ 0
LAKE TRAVIS	0.	7/1952

RESER\ OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR _AR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	771.	28531.	29302.	0.	21373.	0.	21373.	0.01	76.	681247.	7606.
2	45281.	125929.	171210.	0.	20482.	0.	20482.	-0.19	-1456.	833430.	7662.
3	3929.	28243.	32172.	0.	26271.	0.	26271.	0.14	1219.	838112.	8710.
4	831.	12786.	13617.	0.	35176.	0.	35176.	0.13	1136.	815417.	8739.
5	76894.	151834.	228728.	0.	47198.	0.	47198.	-0.27	-2321.	999269.	8597.
6	15440.	10258.	25698.	0.	56549.	0.	56549.	0.35	3478.	964940.	9936.
7	0.	0.	0.	0.	56104.	0.	56104.	0.61	5904.	902932.	9679.
8	0.	0.	0.	0.	62783.	0.	62783.	0.67	6174.	833976.	9215.
9	74972.	32049.	107021.	0.	45417.	0.	45417.	0.47	4095.	891485.	8713.
10	17766.	19161.	36927.	0.	28942.	0.	28942.	0.15	1369.	898100.	9130.
11	11021.	18241.	29262.	0.	22709.	0.	22709.	0.12	1101.	903552.	9179.
12	49417.	27456.	76873.	0.	22263.	0.	22263.	-0.12	-1106.	959268.	9220.
TOTAL	296322.	454490.	750812.	0.	445266.	0.	445266.		19671.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	591473.	0.	591473.	0.	102451.	0.	102451.	43086.
2	0.	102451.	102451.	0.	9302.	91447.	100748.	1702.
3	368854.	100748.	469602.	0.	1014.	455137.	456151.	13451.
4	0.	456151.	456151.	0.	0.	454490.	454490.	1661.
5	296322.	454490.	750812.	0.	445266.	0.	445266.	19671.

the manual shall neither increase nor decrease the provisions, terms and conditions of this permit, nor change or alter same in any way. The above described manual shall not limit the jurisdiction of the Department in any manner.

Permittee agrees to be bound by the terms, conditions and provisions contained herein and in Permit No. 1259B issued to LCRA, and such agreement is a condition precedent to the granting of this permit and Permit No. 1259B.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Department of Water Resources and to the right of continual supervision of State water resources exercised by the Department.

TEXAS WATER COMMISSION

Paul Hopkins

Paul Hopkins, Chairman

DATE ISSUED:

May 14, 1985

Lee B. M. Biggart

Lee B. M. Biggart, Commissioner

ATTEST:

Mary Ann Hefner

Mary Ann Hefner, Chief Clerk

Ralph Roming

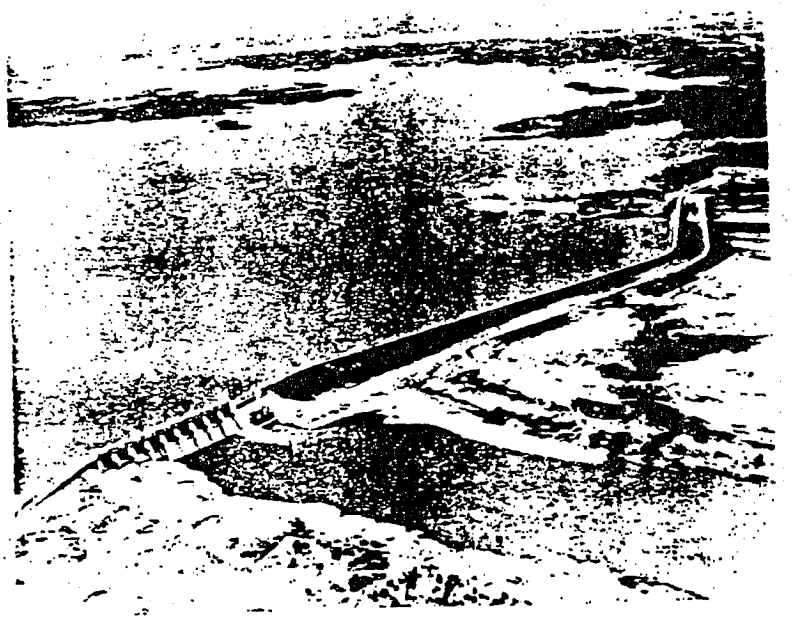
Ralph Roming, Commissioner

pounding any water to which holders of superior and senior water rights in the Colorado River below Stacy I are entitled, the permittee shall release such water wh required to do so by the Commission.

(g) Permittee shall operate its system so as to take as much of its water requirements from the reservoirs constructed under Permit No. 1394 (Lake J. B. Thomas) and Permit No. 2179 (Lake Spence) as is feasible and consistent with reasonable operating requirements. To this end permittee shall take not less than 20,000 acre-feet of the water required to supply its users during each calendar year from Lake J. B. Thomas; provided that the total storage in such reservoir is not less than 100,000 acre-feet at any time during such year.

(h) Permittee shall on or before January 31st of each year file a sworn report with the Department stating the amount of water that has been diverted under Permit No. 1394 and under Permit No. 2179, as amended, and supplied to users during the preceding 3 calendar years, and 1/3 of such amount (rounded off to the nearest 1,000) shall be the "Annual Use for Current Year" for the purposes of the impounding schedule set forth in Permit No. 2179, as amended. To provide such "Annual Use for Current Calendar Year" there is a "Maximum Storage Authorized in Permit No. 2179, as amended." When at any time during such calendar year the amount of water in Spence reservoir exceeds the maximum storage authorized for that year, permittee shall, upon receiving written request from the operator at that time of Lake Buchanan and Lake Travis, release water from time to time during such year as specified in such written request at a rate not less than 1,000 cfs and not more than 5,000 cfs until the level of Spence reservoir has been reduced to the maximum storage authorized for the year; provided, however, the then operator of Lakes Buchanan and Travis will request releases of water only to the extent it has sufficient combined empty storage space in Lake Buchanan below 1,018 feet elevation and in Lake Travis below 67[illegible] feet elevation, to receive and capture the amount water requested to be released when and as it reaches such reservoirs. All water released from Spence reservoir under this provision (g), reaching Stacy reservoir, shall be routed through Stacy reservoir without detention, and included in the above described report.

(i) As an aid to the Department in administering the public waters of the Colorado River and the provisions of this permit, permittee shall, prior to the date of deliberate impoundment of water in Stacy reservoir, prepare in cooperation with and with the approval of the LCRA, and submit to the Department an operations manual describing the methods and procedures to be used to accomplish the provisions of the Settlement Agreement, the conditions of this permit, and the operation of the reservoir in conjunction with other sources of water developed by permittee. The manual shall include, but not be limited to: (1) diversions from Stacy reservoir and other sources; (2) incremental initial filling of Stacy reservoir with consideration of the Settlement Agreement as well as downstream water rights; (3) criteria for timing and rates of releases from Stacy reservoir to satisfy obligations under the Settlement Agreement, downstream water rights, and to minimize channel losses; (4) operation of Stacy, Spence and J. B Thomas reservoirs during flood periods to maximize the amount of water to be stored in the reservoirs of permittee and downstream interests; provided, however,



View of Dam and Lake
February 1953

ALVIN WIRTZ DAM AND LAKE LYNDON B. JOHNSON

Max Starcke Dam and Marble Falls Lake

OWNER

Lower Colorado River Authority.

ENGINEER (Design)

Fargo Engineering Company.

LOCATION

On the Colorado River in Burnet County, near Marble Falls.

DRAINAGE AREA

36,325 square miles of which 11,900 square miles is probably noncontributing. River flow is regulated by upstream storage and powerplant operation.

DAM

Type	Concrete with roof-weir gates
Length	860 ft including the powerhouse
Height	98.8 ft to top of the control piers

SPILLWAY

Type	Ogee section
Length (net)	608.3 ft
Crest elevation	725.0 ft above msl
Control	10 roof-weir gates, each 60.83 by 13 ft

OUTLET WORKS

None. Water releases made through turbine operation.

POWER FEATURES

Two generating units, each 15,000 kw capacity.

STATE AUTHORIZATION

Permit No. 998 (Application No. 1022) November 4, 1927, allocates 1,305,000 acre-feet of water for conservation, irrigation and hydroelectric power generation uses. Several other water rights are included in this permit.

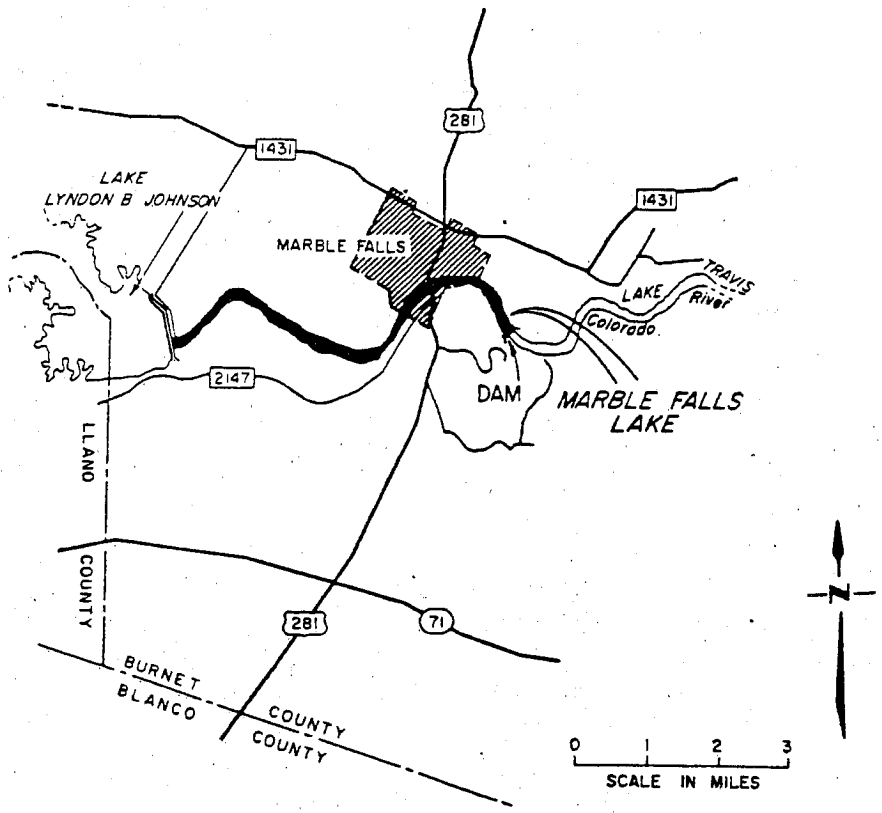
RESERVOIR DATA (Lower Colorado River Authority Survey 1964)

Capacity at operating elevation	738.0 ft above msl	8,760 acre-feet
Area at operating elevation	738.0 ft above msl	780 acres
Invert to penstock elevation	710.0 ft above msl	

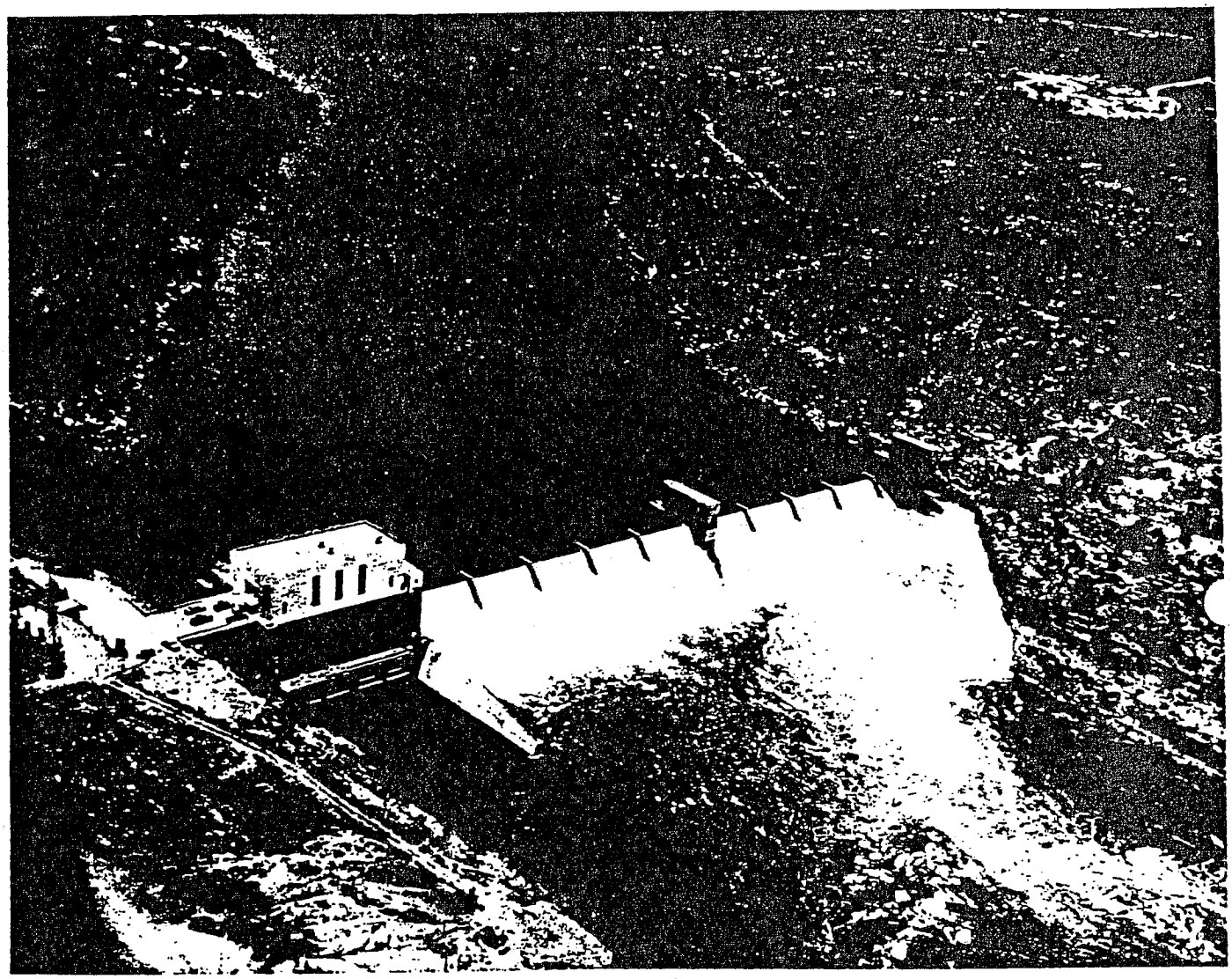
GENERAL

Construction started	November 6, 1949
Deliberate impoundment began	July 1951
Power generating started	September 25, 1951
Dam completed	October 1951
General contractor	Brown & Root, Inc.
Estimated total project cost	$6,768,395

Information courtesy of the Lower Colorado River Authority



MAX STARCKE DAM AND MARBLE FALLS LAKE



View Showing Flood Water Discharge
May 1957

MAX STARCKE DAM AND MARBLE FALLS LAKE

Max Starcke Dam and Marble Falls Lake

OWNER

Lower Colorado River Authority.

ENGINEER (Design)

Fargo Engineering Company.

LOCATION

On the Colorado River in Burnet County, near Marble Falls.

DRAINAGE AREA

36,325 square miles of which 11,900 square miles is probably noncontributing. River flow is regulated by upstream storage and powerplant operation.

DAM

Type	Concrete with roof-weir gates
Length	860 ft including the powerhouse
Height	98.8 ft to top of the control piers

SPILLWAY

Type	Ogee section
Length (net)	608.3 ft
Crest elevation	725.0 ft above msl
Control	10 roof-weir gates, each 60.83 by 13 ft

OUTLET WORKS

None. Water releases made through turbine operation.

POWER FEATURES

Two generating units, each 15,000 kw capacity.

STATE AUTHORIZATION

Permit No. 998 (Application No. 1022) November 4, 1927, allocates 1,305,000 acre-feet of water for conservation, irrigation and hydroelectric power generation uses. Several other water rights are included in this permit.

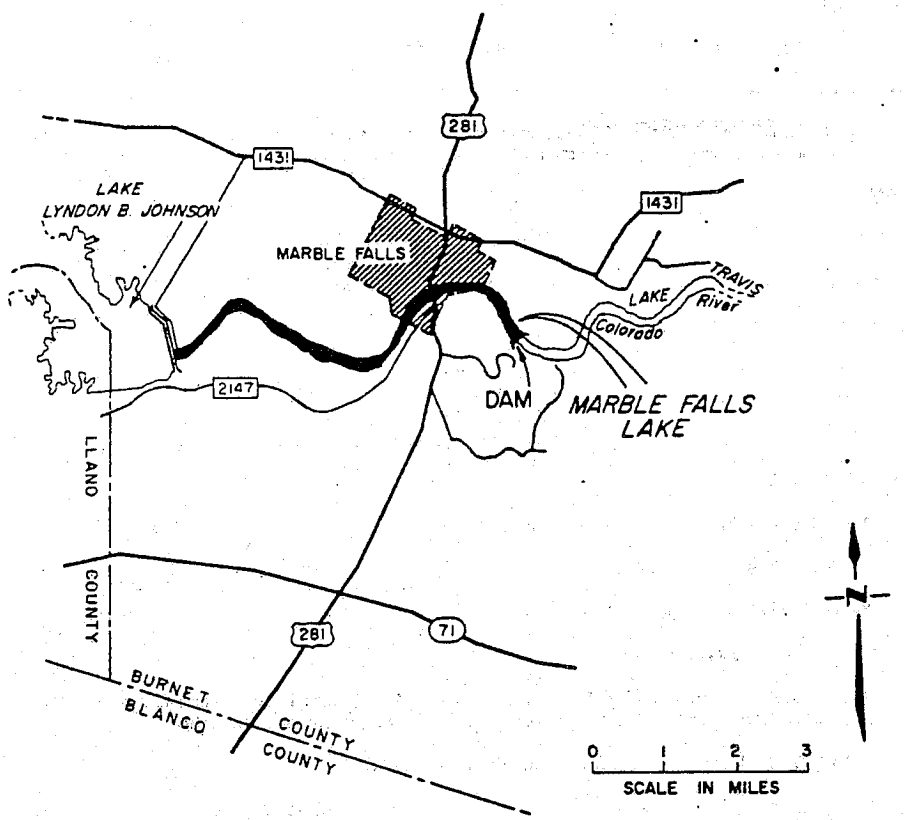
RESERVOIR DATA (Lower Colorado River Authority Survey 1964)

Capacity at operating elevation	738.0 ft above msl	8,760 acre-feet
Area at operating elevation	738.0 ft above msl	780 acres
Invert to penstock elevation	710.0 ft above msl	

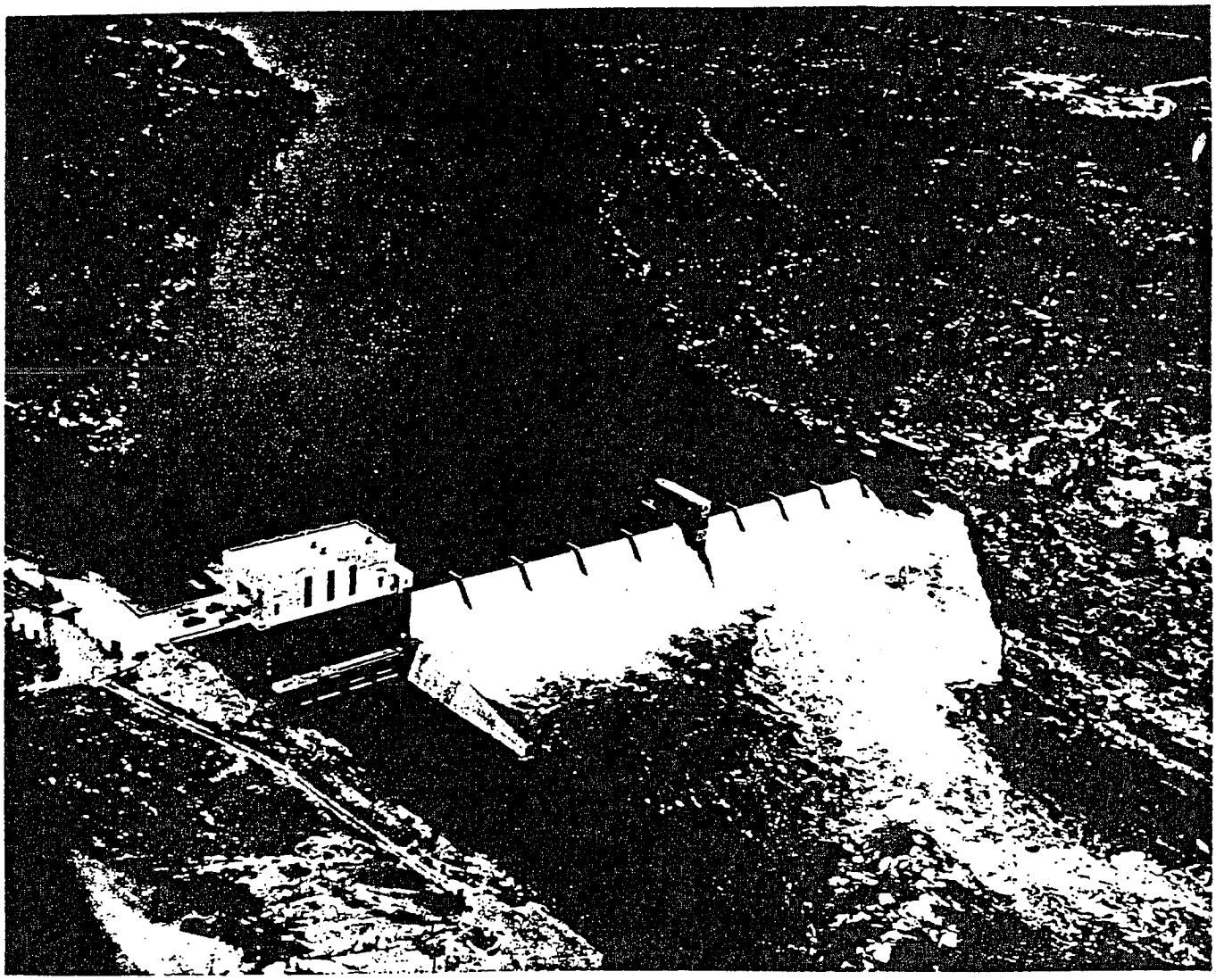
GENERAL

Construction started	November 6, 1949
Deliberate impoundment began	July 1951
Power generating started	September 25, 1951
Dam completed	October 1951
General contractor	Brown & Root, Inc.
Estimated total project cost	$6,768,395

Information courtesy of the Lower Colorado River Authority



MAX STARCKE DAM AND MARBLE FALLS LAKE



View Showing Flood Water Discharge
May 1957

MAX STARCKE DAM AND MARBLE FALLS LAKE

Mansfield Dam and Lake Travis

OWNER

Lower Colorado River Authority.

ENGINEER (Design)

U.S. Bureau of Reclamation for the flood control and conservation features. Lower Colorado River Authority for the powe generating features.

LOCATION

On the Colorado River in Travis County, 13 miles northwest of Austin.

DRAINAGE AREA

38,130 square miles, of which 11,900 is probably noncontributing. Runoff is partly regulated by upstream storage and powe plant operation.

DAM

Type	Concrete gravity, earth and rock fill
Length	7,098 ft
Height to roadway	266 ft
Top width	20 ft
Roadway width	28.5 ft

SPILLWAY

Type	Concrete ogee
Length (net)	700 ft
Crest elevation	714.1 ft above msl
Control	None

OUTLET WORKS

Type	8.5-ft diameter conduits
Number	24
Control	Double gated ring-follower type gates
Invert elevation	535.9 ft above msl

POWER FEATURES

Three units with a total generating capacity of 100,000 kw.

STATE AUTHORIZATION

Permit No. 1260 (Application No. 1346) May 25, 1938, grants the right to appropriate 1,500,000 acre-feet of water annually fo municipal, irrigation, mining, recreation, and hydroelectric power use. Several other water rights are included in this permit.

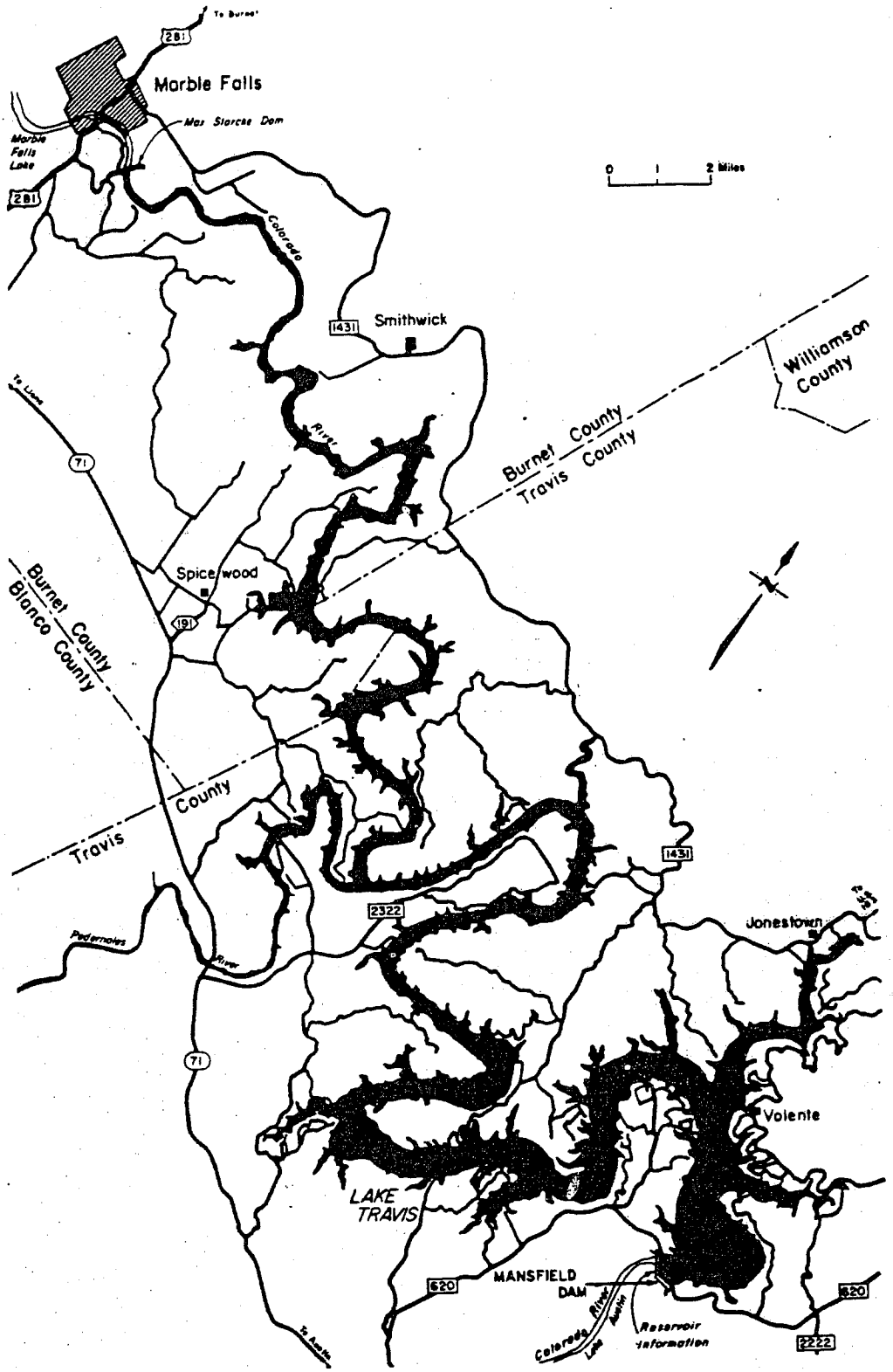
RESERVOIR DATA (Based on 1939 survey by U.S. Bureau of Reclamation)

FEATURE	ELEVATION (FEET ABOVE MSL)	CAPACITY (ACRE-FEET)	AREA (ACRES)
Top of dam (roadway)	750.1	–	–
Maximum design flood	748.9	3,223,000	44,448
Spillway crest	714.1	1,954,000	29 000
Top of power storage	681.1	1,172,600	18,930
Invert of 3 penstocks, each 16 ft diameter	552.1	54,800	1,900
Invert of 8.5-ft outlets	535.9	28,500	1,200
Usable storage below	681.1	1,144,100	–

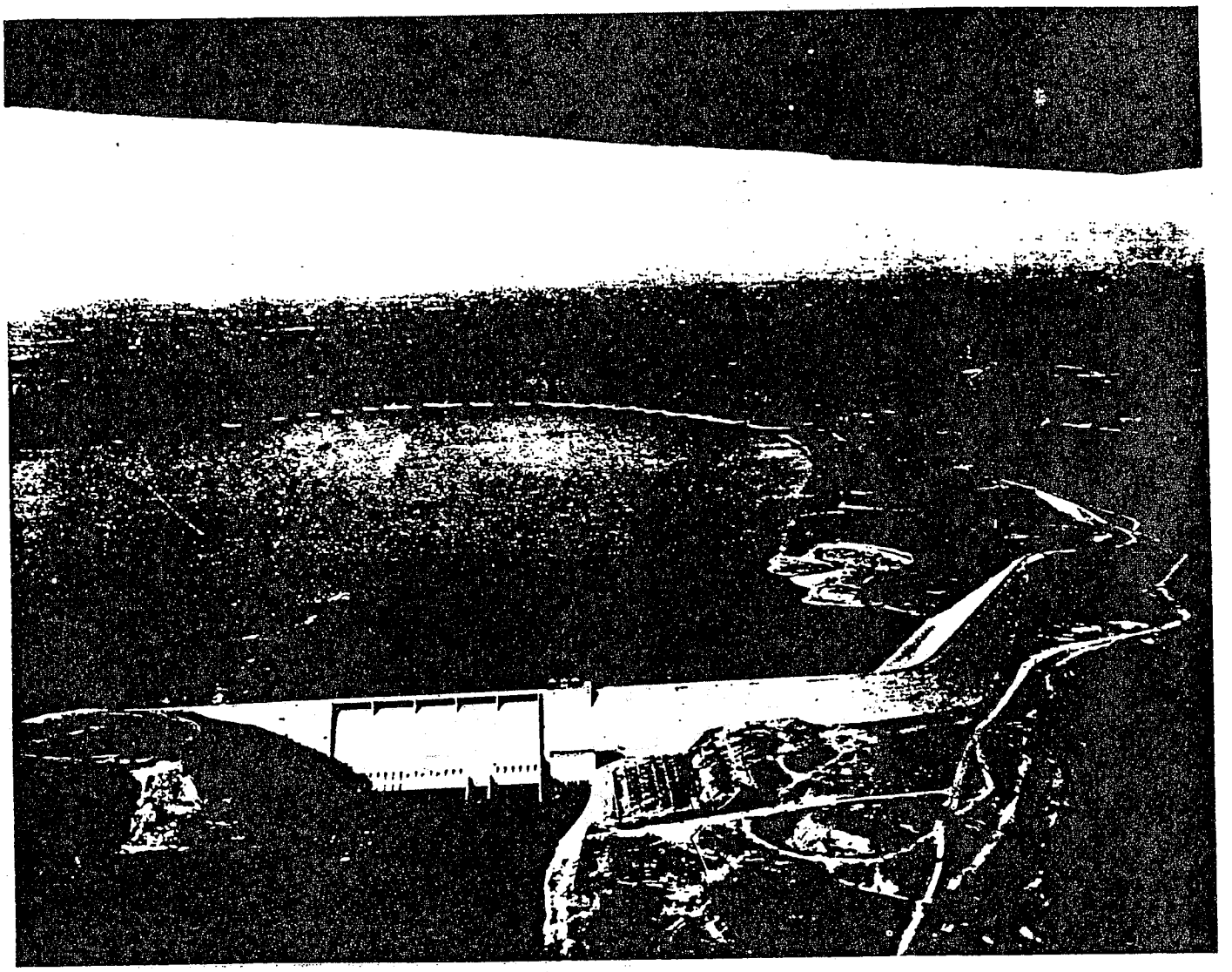
GENERAL

Construction started	February 19, 1937
Deliberate impoundemnt began	September 9, 1940
First power unit in operation	January 27, 1941
Dam completed	May 1942
General Contractor	The Marshall Ford Co.
Estimated cost of the project	$27,700,578

Information courtesy of the Lower Colorado River Authority



MANSFIELD DAM AND LAKE TRAVIS



Dam and Reservoir
1947

Photographs courtesy of the Lower Colorado River Authority

Tom Miller Dam and Lake Austin

OWNER

City of Austin. Built and operated by the Lower Colorado River Authority under lease expiring December 31, 2007.

ENGINEER (Design)

Lower Colorado River Authority.
Moran, Proctor and Freeman were consultants.

LOCATION

On the Colorado River in Travis County, inside the western city limits of Austin.

DRAINAGE AREA

38,240 square miles, of which 11,900 is probably noncontributing. Runoff is largely regulated by upstream storage and power-plant operation.

DAM

Type	Concrete gravity overflow, piers and slab with gated spillway, and rock fill sections
Length	1,590 ft
Height (top non-overflow section)	85 ft
Height (top of bridge)	100 ft

SPILLWAY (uncontrolled)

Type	Concrete ogee
Length	458 ft
Crest elevation	492.8 ft above msl

SPILLWAY (gated)

Type	Concrete ogee
Length (net)	459 ft
Crest elevation	480.8 ft above msl for the 12-ft gates
Control	5 tainter gates, each 51 by 12 ft
	4 tainter gates, each 51 by 18 ft
	Actual vertical dimension of gates are 14.7 and 19.85 ft

OUTLET WORKS

None. Water releases made through turbine operation.

POWER FEATURES

Two generating units each, 7,500 kw capacity.
The turbines are automatic adjustable blade propeller-type.

STATE AUTHORIZATION

Certified Filing No. 330 June 30, 1914. Prior rights were said to extend back to 1890 when the first Austin Dam was started.

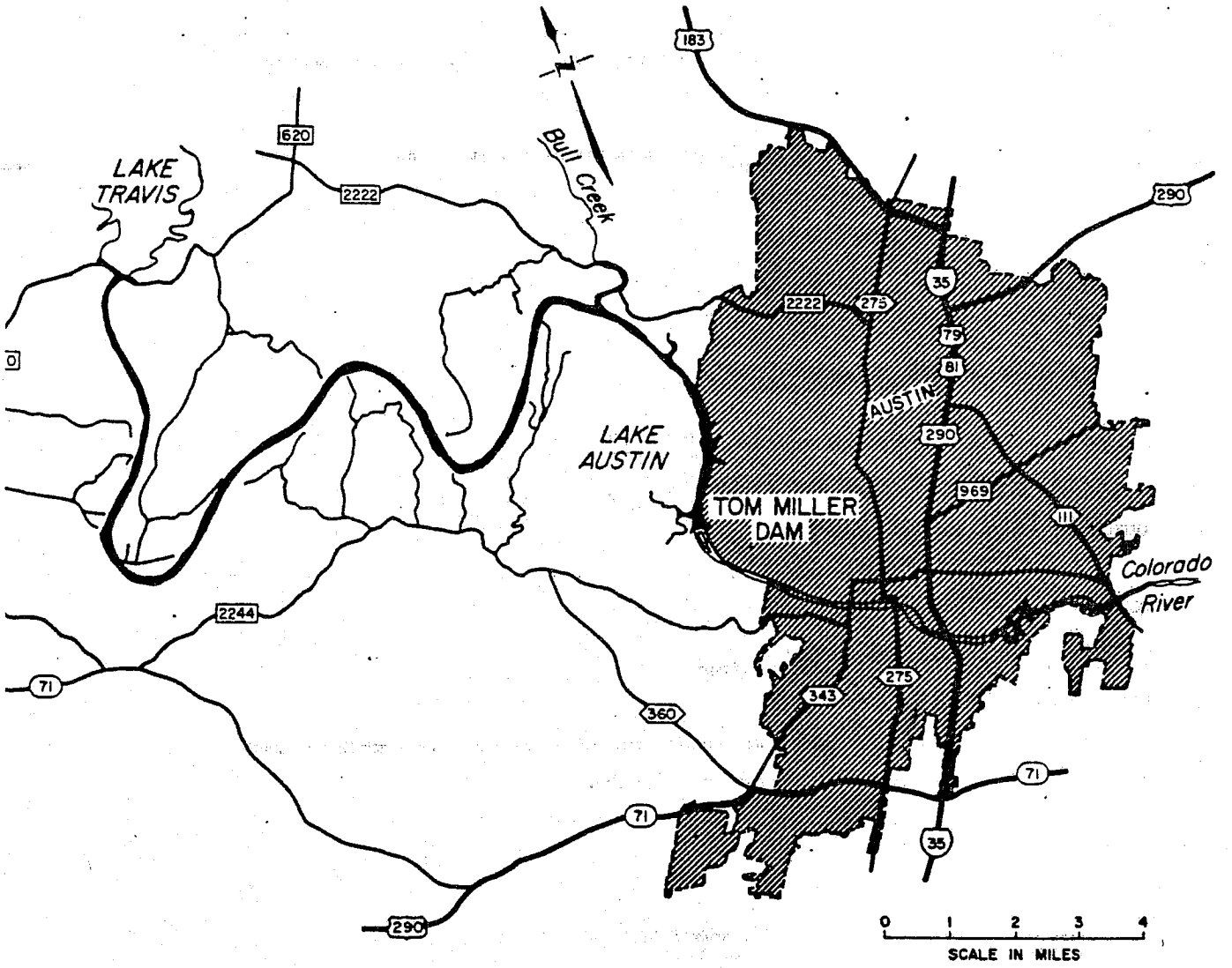
RESERVOIR DATA (Based on Lower Colorado River Authority survey made in 1939)

Capacity at elevation 492.8 ft above msl 21,000 acre-feet
Area at elevation 492.8 ft above msl 1,830 acres
Invert to penstock 462± ft above msl

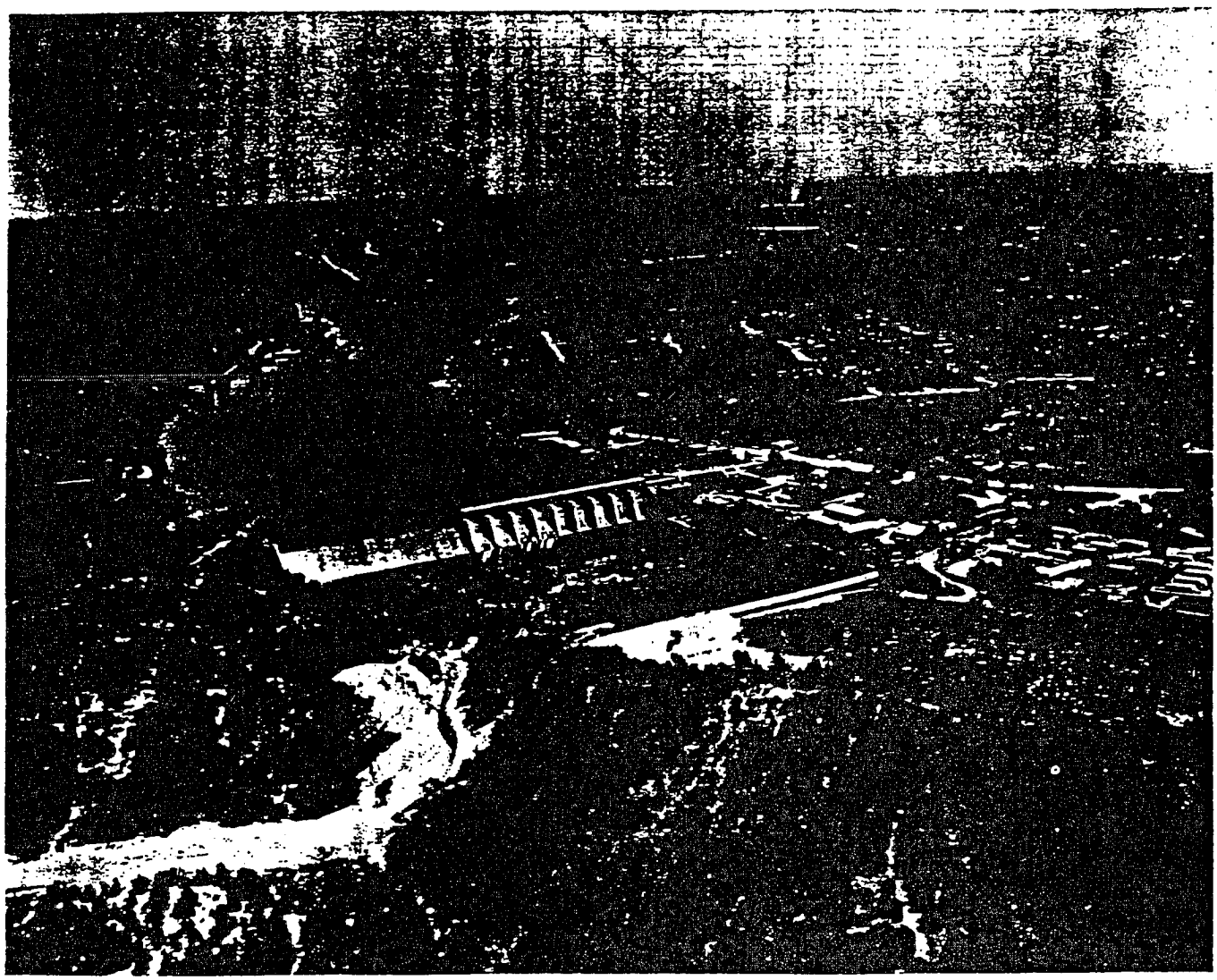
GENERAL

Construction started original dam	November 5, 1890
Construction started present dam	July 5, 1938
Present dam completed	1939
Deliberate impoundment of water began	1939
Power unit in operation	March 31, 1940
Present dam dedicated	April 6, 1940
General contractor	Lower Colorado River Authority
Estimated cost of the project	$3,479,309

Information courtesy of the Lower Colorado River Authority



TOM MILLER DAM AND LAKE AUSTIN



LAKE AND DAM
1951

TOM MILLER DAM AND LAKE AUSTIN

Volume II – Technical Report
Appendices

Appendix 2B
Highland Lakes Monthly Net Evaporation Rates

NET EVAPORATION

LAKE TRAVIS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	.07	-.12	-.11	-.11	.01	-.03	.39	.60	.40	.07	.21	.11
1942	.11	.19	.28	-.19	.06	.34	.20	.45	.01	-.02	.19	.11
1943	.11	.25	.16	.34	.21	.44	.34	.76	.19	.41	.14	.02
1944	-.22	-.09	.01	.29	-.20	.42	.71	.46	.40	.39	-.13	-.11
1945	-.03	-.06	.04	.01	.43	.28	.49	.49	.38	.19	.26	.06
1946	-.08	.02	.10	.06	.06	.27	.74	.48	.00	.21	-.01	.04
1947	-.14	.18	.08	.13	.20	.56	.73	.43	.66	.53	.20	.02
1948	.06	-.05	.20	.25	.21	.54	.58	.65	.46	.38	.30	.18
1949	-.13	-.08	.11	-.30	.34	.28	.57	.58	.49	.05	.36	-.03
1950	.10	-.02	.30	-.03	.17	.29	.61	.77	.32	.46	.42	.30
1951	.28	-.02	.19	.30	.08	.31	.79	.90	.37	.46	.25	.23
1952	.22	.14	.16	.03	.11	.44	.56	.94	.09	.59	-.02	-.12
1953	.25	.06	.16	.10	.21	.67	.76	.53	.37	.04	.24	.08
1954	.14	.29	.30	.18	.31	.63	.79	.85	.71	.44	.29	.30
1955	.06	-.04	.25	.33	.18	.34	.67	.47	.49	.61	.38	.17
1956	.13	.13	.38	.39	.34	.68	.87	.86	.72	.47	.33	.12
1957	.20	.02	.01	-.47	-.14	.19	.82	.85	.08	-.04	-.08	.15
1958	-.04	-.18	.07	.10	.04	.24	.59	.59	.01	.02	.17	.12
1959	.15	-.07	.31	.01	.20	.22	.45	.29	.44	-.05	.18	.02
1960	.04	.05	.10	.16	.35	.32	.40	.36	.52	-.23	.10	-.12
1961	.02	-.10	.20	.31	.39	-.04	.17	.67	.25	.26	.07	.09
1962	.10	.18	.25	-.01	.40	.15	.77	.79	.27	.24	.17	.03
1963	.17	.05	.31	.21	.34	.46	.74	.79	.55	.47	.14	.11
1964	.02	.07	.09	.16	.25	.38	.76	.62	.17	.38	.14	.14
1965	.01	-.19	.14	.13	-.27	.35	.61	.67	.47	.15	.12	-.12

NET EVAPORATION

LAKE MARBLE FALLS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	.12	-.16	-.10	-.05	.06	.03	.46	.64	.49	.08	.18	.13
1942	.18	.17	.32	-.27	.03	.34	.52	.42	.08	-.03	.23	.14
1943	.15	.30	.16	.36	.20	.50	.42	.81	.19	.43	.20	.03
1944	-.20	-.12	.06	.28	-.29	.47	.76	.54	.46	.42	-.04	-.08
1945	-.01	-.06	.04	-.04	.46	.28	.49	.58	.37	.29	.29	.08
1946	-.05	.04	.16	.13	.04	.37	.85	.76	.16	.26	.10	.08
1947	-.19	.20	.08	.15	.26	.61	.81	.55	.66	.56	.25	.03
1948	.06	-.02	.20	.22	.20	.60	.61	.70	.54	.46	.35	.18
1949	-.11	-.07	.09	-.28	.27	.32	.67	.65	.56	.15	.40	.05
1950	.09	-.08	.35	-.03	.13	.36	.66	.85	.35	.51	.48	.32
1951	.28	-.00	.22	.26	.06	.34	.84	.96	.46	.51	.33	.28
1952	.24	.21	.17	-.04	.05	.47	.60	1.03	.14	.67	.05	-.12
1953	.25	.10	.13	.12	.12	.71	.72	.62	.41	.12	.29	.17
1954	.15	.30	.27	.17	.28	.66	.89	.94	.74	.49	.28	.32
1955	.08	.00	.28	.29	.14	.31	.67	.48	.43	.62	.45	.19
1956	.14	.13	.43	.41	.32	.71	.94	.94	.81	.51	.35	.13
1957	.15	.04	.03	-.55	-.26	.22	.86	.90	.29	-.04	-.06	.19
1958	.01	-.14	.06	.09	.02	.24	.73	.63	.17	.13	.21	.16
1959	.17	-.03	.35	.07	.20	.09	.41	.31	.51	-.09	.27	.03
1960	.03	.08	.11	.21	.34	.41	.40	.47	.57	-.07	.10	-.15
1961	-.01	-.14	.20	.36	.40	.03	.18	.78	.36	.30	.16	.12
1962	.15	.19	.27	.01	.41	.17	.79	.89	.38	.24	.21	.07
1963	.19	.12	.28	.23	.25	.46	.84	.85	.60	.51	.14	.14
1964	.00	.08	.06	.10	.24	.42	.79	.63	.22	.38	.09	.17
1965	.04	-.16	.13	.12	-.38	.36	.61	.69	.48	.14	.16	-.06

NET EVAPORATION

LAKE LBJ

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	.13	-.17	-.12	-.05	.08	.04	.48	.65	.47	.07	.20	.14
1942	.20	.16	.33	-.25	.05	.38	.53	.39	.08	-.05	.23	.15
1943	.14	.30	.16	.36	.20	.50	.40	.82	.17	.44	.19	.04
1944	-.21	-.12	.07	.29	-.32	.46	.76	.53	.45	.41	-.03	-.08
1945	-.01	-.06	.06	-.02	.47	.27	.50	.61	.33	.31	.28	.07
1946	-.05	.04	.18	.12	.04	.36	.87	.78	.17	.25	.11	.08
1947	-.20	.20	.08	.17	.29	.62	.83	.56	.65	.55	.25	.03
1948	.05	-.01	.20	.21	.21	.62	.63	.68	.55	.44	.34	.17
1949	-.09	-.07	.09	-.30	.28	.33	.68	.66	.55	.16	.39	.06
1950	.10	-.08	.34	-.03	.13	.38	.68	.85	.36	.51	.48	.32
1951	.28	-.00	.21	.25	.05	.37	.85	.95	.47	.54	.35	.28
1952	.24	.22	.18	-.04	.05	.46	.59	1.05	.03	.65	.08	-.13
1953	.24	.10	.14	.12	.14	.73	.74	.63	.40	.15	.31	.19
1954	.15	.30	.26	.17	.27	.66	.90	.95	.73	.49	.29	.32
1955	.08	.01	.29	.31	.15	.32	.68	.50	.44	.61	.45	.19
1956	.15	.14	.43	.43	.33	.71	.94	.94	.80	.51	.36	.13
1957	.14	.04	.04	-.56	-.29	.22	.89	.91	.30	-.02	-.06	.20
1958	.00	-.15	.05	.10	-.03	.19	.75	.63	.18	.12	.21	.16
1959	.17	-.03	.35	.07	.21	.07	.42	.33	.53	-.12	.27	.04
1960	.03	.08	.10	.21	.35	.42	.37	.47	.57	-.08	.13	-.14
1961	.01	-.15	.20	.37	.40	.05	.17	.82	.37	.30	.17	.12
1962	.15	.20	.27	-.00	.41	.18	.81	.91	.41	.25	.22	.07
1963	.21	.11	.27	.23	.24	.46	.87	.87	.60	.51	.14	.14
1964	-.01	.08	.05	.09	.24	.45	.81	.64	.26	.38	.09	.17
1965	.05	-.17	.12	.10	-.38	.35	.60	.70	.49	.13	.19	-.07

NET EVAPORATION

LAKE INKS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	.13	-.15	-.09	-.05	.06	.04	.47	.63	.51	.08	.17	.14
1942	.18	.17	.33	-.28	.02	.33	.53	.43	.09	-.03	.24	.14
1943	.15	.30	.16	.36	.19	.50	.44	.82	.20	.43	.21	.03
1944	-.19	-.12	.07	.28	-.28	.49	.76	.56	.47	.43	-.02	-.08
1945	-.00	-.06	.03	-.04	.46	.28	.49	.59	.39	.28	.30	.09
1946	-.05	.05	.16	.14	.04	.38	.85	.78	.16	.27	.11	.09
1947	-.18	.20	.07	.15	.26	.61	.81	.57	.68	.57	.25	.03
1948	.06	-.03	.21	.22	.20	.60	.60	.72	.54	.47	.35	.19
1949	-.11	-.06	.09	-.27	.29	.31	.68	.65	.57	.15	.41	.05
1950	.08	-.07	.35	-.03	.13	.36	.65	.85	.35	.52	.49	.32
1951	.28	.01	.23	.26	.07	.32	.83	.96	.46	.50	.33	.28
1952	.24	.21	.17	-.03	.04	.48	.61	1.03	.19	.69	.04	-.12
1953	.25	.11	.13	.13	.11	.71	.71	.63	.43	.12	.29	.17
1954	.15	.31	.27	.18	.28	.66	.91	.94	.75	.49	.28	.32
1955	.08	.00	.28	.29	.13	.31	.66	.48	.42	.62	.46	.20
1956	.14	.13	.43	.40	.32	.71	.95	.94	.82	.51	.35	.14
1957	.15	.04	.03	-.55	-.25	.24	.85	.90	.30	-.04	-.05	.19
1958	.02	-.12	.06	.09	.04	.27	.74	.65	.18	.14	.21	.16
1959	.17	-.02	.35	.08	.20	.09	.40	.32	.51	-.09	.27	.04
1960	.03	.08	.12	.21	.34	.41	.42	.47	.57	-.05	.09	-.16
1961	-.02	-.14	.20	.36	.40	.03	.19	.77	.37	.30	.16	.12
1962	.15	.19	.27	.01	.42	.17	.78	.90	.38	.25	.21	.08
1963	.19	.12	.28	.23	.24	.45	.84	.85	.60	.52	.14	.14
1964	.00	.08	.06	.11	.25	.42	.79	.63	.21	.38	.09	.17
1965	.03	-.15	.14	.13	-.39	.36	.62	.68	.48	.14	.14	-.06

NET EVAP. .TION

LAKE BUCHANAN

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	.13	-.15	-.08	-.05	.06	.04	.47	.63	.52	.09	.15	.14
1942	.19	.18	.33	-.28	.02	.32	.53	.44	.09	-.02	.25	.14
1943	.15	.30	.16	.36	.19	.50	.45	.82	.20	.44	.22	.03
1944	-.19	-.12	.07	.27	-.27	.49	.75	.57	.48	.44	-.02	-.08
1945	-.00	-.06	.03	-.04	.46	.28	.48	.59	.41	.28	.31	.10
1946	-.05	.05	.16	.15	.04	.39	.85	.79	.16	.28	.11	.09
1947	-.17	.21	.07	.15	.25	.61	.81	.57	.68	.57	.25	.02
1948	.06	-.03	.21	.22	.19	.60	.60	.73	.55	.48	.36	.19
1949	-.11	-.06	.09	-.26	.30	.31	.68	.65	.57	.15	.41	.05
1950	.08	-.07	.36	-.03	.13	.36	.64	.85	.35	.52	.49	.32
1951	.28	.01	.24	.27	.07	.30	.83	.97	.46	.50	.33	.28
1952	.24	.21	.17	-.03	.04	.48	.62	1.03	.23	.70	.03	-.11
1953	.26	.11	.12	.13	.11	.71	.70	.63	.44	.12	.28	.17
1954	.15	.32	.28	.18	.28	.66	.91	.94	.75	.49	.27	.32
1955	.08	.00	.27	.29	.12	.31	.65	.47	.41	.63	.46	.21
1956	.14	.13	.43	.40	.31	.71	.96	.94	.83	.51	.35	.14
1957	.16	.04	.03	-.54	-.25	.25	.84	.91	.31	-.04	-.05	.19
1958	.02	-.11	.06	.08	.06	.29	.74	.65	.18	.14	.22	.16
1959	.17	-.02	.35	.08	.20	.09	.40	.32	.50	-.08	.28	.04
1960	.03	.08	.13	.22	.34	.42	.44	.47	.57	-.04	.07	-.16
1961	-.03	-.13	.20	.37	.39	.03	.20	.76	.37	.29	.15	.12
1962	.16	.19	.28	.02	.42	.17	.77	.90	.37	.25	.21	.08
1963	.19	.13	.28	.23	.24	.44	.83	.84	.60	.52	.13	.14
1964	.00	.08	.07	.11	.25	.41	.78	.63	.20	.37	.09	.17
1965	.03	-.14	.14	.13	-.40	.37	.62	.67	.48	.15	.13	-.05

Volume II – Technical Report
Appendices

Appendix 2C
Highland Lakes Firm Yield Output

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

OPERATION CRITERIA

RESERVOIR	CAPACITIES(AF)		DEMANDS(AF/YR)	
	MINIMUM	MAXIMUM	LOCAL	RELEASE
LAKE BUCHANAN	0.	918777.	0.	0.
LAKE INKS	17540.	17540.	0.	0.
LAKE LBJ	138500.	138500.	0.	0.
LAKE MARBLE FALLS	8760.	8760.	0.	0.
LAKE TRAVIS	0.	1170069.	0.	445266.

TOTAL SYSTEM DEMAND = 445266. AF/YR

THE TOTAL SYSTEM DEMAND IS EQUAL TO THE SUM OF THE LOCAL DIVERSIONS
PLUS THE RELEASE FROM THE DOWNSTREAM MOST RESERVOIR - LAKE TRAVIS

RELEASES FROM LAKE BUCHANAN
RELEASES ARE MADE BASED ON THE END OF MONTH CONTENT AT LAKE TRAVIS
AND ARE MADE AT A RATE PROPORTIONAL TO THE RELEASES FROM LAKE TRAVIS

LAKE TRAVIS EOM CONTENT	LAKE BUCHANAN RELEASE RATE
GREATER THAN 850000.	0.0
LESS THAN 850000. AND GREATER THAN 700000.	.350
LESS THAN 700000.	.900

LAKE BUCHANAN EOM CONTENT	LAKE BUCHANAN RELEASE RATE
LESS THAN 150000. AND GREATER THAN 50000.	.350
LESS THAN 50000.	.000 **

** RELEASES MADE FOR SHORTAGES ONLY

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

AREA/CAPACITY CURVES FOR SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN			LAKE INKS			LAKE LBJ		
ELEVATION (FT MSL)	AREA (AC)	CAPACITY (AF)	ELEVATION (FT MSL)	AREA (AC)	CAPACITY (AF)	ELEVATION (FT MSL)	AREA (AC)	CAPACITY (AF)
907.0	0.	0.	824.0	0.	0.	760.0	0.	0.
914.5	202.	562.	830.0	17.	75.	765.0	150.	500.
925.5	818.	5613.	835.0	38.	200.	770.0	250.	1500.
935.0	1740.	17449.	840.0	63.	425.	775.0	400.	2800.
941.5	2495.	30917.	845.0	98.	790.	780.0	690.	5900.
945.5	3179.	42219.	850.0	148.	1400.	785.0	1000.	10000.
957.5	5348.	93603.	855.0	205.	2275.	790.0	1450.	15500.
965.5	7089.	142897.	860.0	270.	3450.	795.0	1900.	23900.
979.0	10225.	260099.	865.0	342.	4950.	800.0	2490.	35000.
989.0	12597.	374143.	870.0	420.	6800.	805.0	3100.	48500.
997.0	14574.	482794.	875.0	508.	9075.	810.0	3775.	65000.
1003.0	16519.	575390.	880.0	603.	11990.	815.0	4500.	85000.
1006.5	17919.	635655.	885.0	734.	15200.	820.0	5300.	109000.
1010.5	19488.	710525.	888.5	803.	17540.	825.0	6375.	138500.
1015.5	21167.	812162.	0.0	0.	0.	0.0	0.	0.
1020.3	22795.	918777.	0.0	0.	0.	0.0	0.	0.
0.0	0.	0.	0.0	0.	0.	0.0	0.	0.
0.0	0.	0.	0.0	0.	0.	0.0	0.	0.
0.0	0.	0.	0.0	0.	0.	0.0	0.	0.
0.0	0.	0.	0.0	0.	0.	0.0	0.	0.

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

AREA/CAPACITY CURVES FOR SIMULATED 1980 RESERVOIR CONDITIONS

LAKE MARBLE FALLS

ELEVATION (FT MSL)	AREA (AC)	CAPACITY (AF)
678.0	0.	0.
680.0	8.	25.
685.0	28.	190.
690.0	48.	375.
695.0	62.	625.
700.0	75.	950.
705.0	95.	1350.
710.0	116.	1875.
715.0	142.	2500.
720.0	173.	3275.
725.0	198.	4180.
730.0	273.	5250.
735.0	530.	6990.
738.0	780.	8760.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.

LAKE TRAVIS

ELEVATION (FT MSL)	AREA (AC)	CAPACITY (AF)
480.0	0.	0.
494.2	200.	1000.
517.9	690.	10000.
532.0	1097.	24573.
573.3	3375.	110000.
592.5	5200.	195000.
602.2	6250.	250000.
611.6	7300.	315000.
622.2	8500.	400000.
625.0	8784.	422653.
637.8	10690.	550000.
647.1	12060.	655000.
660.1	14190.	825000.
670.9	16450.	990000.
681.1	18930.	1170069.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.
0.0	0.	0.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

UNREGULATED INFLOW

LAKE BUCHANAN

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	SUM
1941	12553.	42149.	57391.	159486.	345273.	197135.	51562.	3917.	12309.	83719.	12366.	9019.	986879.
1942	12366.	9019.	6315.	180905.	233338.	37215.	4264.	39942.	60246.	120981.	13282.	10985.	728858.
1943	6336.	3272.	6501.	7308.	0.	38359.	1806.	0.	10085.	16100.	1926.	3407.	95100.
1944	41712.	43905.	48407.	13308.	222099.	48946.	0.	12240.	25720.	20966.	14822.	56756.	548881.
1945	47165.	56756.	68832.	91629.	24865.	28559.	37994.	0.	14766.	7779.	6467.	21776.	406588.
1946	17930.	30214.	22148.	5005.	32404.	4903.	0.	341.	31451.	14981.	33625.	14596.	207598.
1947	33625.	14596.	29680.	17697.	10707.	0.	0.	0.	0.	0.	607.	9749.	116661.
1948	24.	6552.	6866.	5382.	25509.	6530.	9645.	791.	6544.	879.	0.	54.	68776.
1949	2788.	15208.	61631.	129214.	44489.	3732.	0.	0.	0.	12300.	184.	8659.	278205.
1950	3375.	18927.	0.	12178.	5966.	3750.	1426.	0.	1426.	0.	0.	0.	47048.
1951	0.	0.	2493.	0.	19352.	54342.	0.	0.	514.	0.	0.	0.	76701.
1952	0.	0.	0.	30133.	120077.	2058.	0.	0.	198122.	0.	18007.	5495.	373892.
1953	23219.	3274.	35555.	8037.	104679.	0.	0.	2350.	2082.	58130.	149.	75.	237550.
1954	274.	0.	0.	0.	2659.	0.	0.	0.	0.	589.	2023.	0.	5545.
1955	1854.	10880.	0.	51.	275906.	103974.	63065.	0.	129968.	7226.	0.	0.	592924.
1956	0.	3675.	0.	11201.	214530.	0.	0.	0.	0.	3560.	1346.	1327.	235639.
1957	0.	363.	19291.	213243.	784849.	117904.	0.	0.	8720.	199235.	25997.	84010.	1453612.
1958	25997.	100500.	73362.	25204.	106521.	47579.	3534.	0.	4949.	7269.	6436.	9425.	410776.
1959	6436.	9425.	5091.	5352.	5643.	157299.	64422.	0.	617.	231344.	46788.	50049.	582466.
1960	111009.	50049.	18784.	11951.	10420.	0.	3804.	2492.	2120.	25569.	42202.	83489.	361889.
1961	61362.	83489.	29764.	8260.	0.	155469.	38826.	0.	4295.	40116.	6942.	7024.	435547.
1962	6942.	7024.	0.	7114.	0.	3712.	0.	0.	0.	45229.	1172.	1696.	72889.
1963	875.	3018.	292.	335.	6553.	11059.	0.	0.	0.	4.	3936.	48.	26120.
1964	3936.	13793.	17016.	14985.	0.	28.	0.	0.	239623.	33090.	20265.	10223.	352959.
1965	20265.	73864.	19672.	11788.	387112.	25637.	263.	0.	7399.	13357.	21009.	11107.	591473.

RESERVL . OPERATION FOR THE HIGHLAND LAKES SYSTEM

UNREGULATED INFLOW

LAKE INKS

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	SUM
1941	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1942	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1943	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1944	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1945	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1946	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1947	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1948	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1949	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1950	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1951	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1952	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1953	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1954	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1955	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1956	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1957	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1958	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1959	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1960	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1961	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1962	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1963	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1964	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1965	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

UNREGULATED INFLOW

LAKE LBJ

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	SUM
1941	37347.	78604.	103299.	143518.	221130.	110847.	43945.	0.	0.	59766.	22580.	17745.	838781.
1942	9834.	7827.	8930.	54986.	0.	0.	0.	516.	23302.	80414.	55579.	15556.	256944.
1943	0.	0.	0.	0.	0.	28541.	4246.	0.	0.	0.	0.	0.	32787.
1944	31706.	35740.	48642.	1208.	75653.	1982.	0.	6820.	20724.	0.	0.	19571.	242046.
1945	59182.	59048.	40069.	71169.	0.	0.	0.	0.	5193.	5919.	0.	0.	240580.
1946	20496.	29940.	11122.	48335.	67197.	3271.	0.	0.	0.	4145.	33932.	25886.	244324.
1947	95741.	17442.	23204.	4361.	0.	0.	0.	0.	0.	0.	0.	0.	140748.
1948	0.	0.	0.	936.	0.	143720.	28349.	0.	0.	0.	0.	0.	173005.
1949	0.	28142.	14169.	43162.	0.	0.	0.	0.	0.	0.	0.	0.	85473.
1950	0.	4566.	0.	5066.	0.	0.	0.	0.	0.	0.	0.	0.	9632.
1951	0.	0.	0.	0.	0.	0.	0.	0.	864.	0.	0.	0.	864.
1952	0.	0.	0.	18491.	0.	0.	0.	0.	274498.	0.	0.	66467.	359456.
1953	13952.	0.	297.	1227.	22122.	0.	0.	0.	0.	8258.	0.	0.	45856.
1954	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7294.	0.	7294.
1955	0.	3278.	0.	0.	61637.	0.	0.	0.	36327.	0.	0.	0.	101242.
1956	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	675.	0.	675.
1957	0.	0.	6643.	235338.	294498.	259274.	0.	0.	9044.	445627.	123208.	0.	1373632.
1958	53724.	198439.	106324.	31968.	71107.	73342.	0.	0.	38557.	24738.	28546.	8651.	635396.
1959	6698.	14006.	5851.	15119.	0.	53646.	0.	0.	371.	197654.	0.	30722.	324067.
1960	58185.	53496.	25056.	22216.	0.	0.	7008.	66714.	0.	22066.	0.	34468.	289209.
1961	69388.	106144.	42796.	5493.	0.	170129.	25708.	0.	122.	3958.	6588.	12178.	442504.
1962	2543.	6042.	0.	0.	0.	2433.	0.	0.	0.	0.	0.	0.	11018.
1963	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	10357.	0.	10357.
1964	687.	7827.	9007.	0.	0.	0.	0.	0.	160302.	10430.	54427.	0.	242680.
1965	9670.	106166.	20027.	1310.	132283.	12770.	0.	0.	20037.	20099.	19577.	26915.	368854.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

UNREGULATED INFLOW

LAKE MARBLE FALLS

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	SUM
1941	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1942	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1943	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1944	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1945	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1946	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1947	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1948	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1949	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1950	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1951	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1952	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1953	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1954	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1955	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1956	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1957	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1958	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1959	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1960	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1961	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1962	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1963	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1964	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1965	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

UNREGULATED INFLOW

LAKE TRAVIS

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	SUM
1941	28313.	92497.	103821.	119190.	181194.	72536.	22299.	0.	0.	18753.	6985.	5941.	651529.
1942	3042.	2621.	3137.	12445.	0.	0.	0.	270.	3930.	88741.	14650.	4445.	133281.
1943	0.	0.	0.	0.	0.	2994.	1541.	0.	0.	0.	0.	0.	4535.
1944	3713.	5107.	16003.	295.	95763.	766.	0.	68046.	20772.	0.	0.	12971.	223436.
1945	43801.	39137.	75963.	87448.	0.	0.	0.	0.	39355.	8316.	0.	0.	294020.
1946	18756.	21250.	11257.	23471.	33520.	3120.	0.	0.	0.	2731.	26393.	29848.	170346.
1947	74471.	20112.	14735.	4628.	0.	0.	0.	0.	0.	0.	0.	0.	113946.
1948	0.	0.	0.	1502.	0.	1511.	1367.	0.	0.	0.	0.	0.	4380.
1949	0.	3319.	2537.	12953.	0.	0.	0.	0.	0.	0.	0.	0.	18809.
1950	0.	787.	0.	543.	0.	0.	0.	0.	0.	0.	0.	0.	1330.
1951	0.	0.	0.	0.	0.	0.	0.	0.	339.	0.	0.	0.	339.
1952	0.	0.	0.	5618.	0.	0.	0.	0.	446671.	0.	0.	35000.	487289.
1953	6832.	0.	254.	2176.	1938.	0.	0.	0.	0.	5572.	0.	0.	16772.
1954	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3364.	0.	3364.
1955	0.	3998.	0.	0.	11543.	0.	0.	0.	5934.	0.	0.	0.	21475.
1956	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	36.	0.	36.
1957	0.	0.	6107.	168016.	50532.	104443.	0.	0.	20450.	52631.	47384.	0.	449563.
1958	20661.	57680.	41859.	14439.	47069.	81374.	0.	0.	23951.	24512.	15215.	5720.	332480.
1959	3570.	9262.	3682.	27687.	0.	22718.	0.	0.	234.	239262.	0.	28640.	335055.
1960	37604.	49871.	25935.	11645.	0.	0.	2194.	3245.	0.	32486.	0.	29238.	192218.
1961	29070.	90038.	24829.	3003.	0.	20565.	3803.	0.	43.	867.	1503.	2831.	176552.
1962	580.	1405.	0.	0.	0.	3210.	0.	0.	0.	0.	0.	0.	5195.
1963	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5101.	0.	5101.
1964	339.	3331.	8816.	0.	0.	0.	0.	0.	6748.	438.	4342.	0.	24014.
1965	771.	45281.	3929.	831.	76894.	15440.	0.	0.	74972.	17766.	11021.	49417.	296322.

RESERv OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1941 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	12553.	0.	12553.	0.	0.	9590.	9590.	0.13	2963.	918777.	22795.
2	42149.	0.	42149.	0.	0.	45568.	45568.	-0.15	-3419.	918777.	22795.
3	57391.	0.	57391.	0.	0.	59215.	59215.	-0.08	-1824.	918777.	22795.
4	159486.	0.	159486.	0.	0.	160626.	160626.	-0.05	-1140.	918777.	22795.
5	345273.	0.	345273.	0.	0.	343905.	343905.	0.06	1368.	918777.	22795.
6	197135.	0.	197135.	0.	0.	196223.	196223.	0.04	912.	918777.	22795.
7	51562.	0.	51562.	0.	0.	40848.	40848.	0.47	10714.	918777.	22795.
8	3917.	0.	3917.	0.	5149.	0.	5149.	0.63	14286.	903259.	22677.
9	12309.	0.	12309.	0.	3788.	0.	3788.	0.52	11717.	900063.	22534.
10	83719.	0.	83719.	0.	0.	62966.	62966.	0.09	2039.	918777.	22652.
11	12366.	0.	12366.	0.	0.	8947.	8947.	0.15	3419.	918777.	22795.
12	9019.	0.	9019.	0.	0.	5828.	5828.	0.14	3191.	918777.	22795.
TOTAL	986879.	0.	986879.	0.	8937.	933715.	942652.		44227.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	9590.	9590.	0.	0.	9485.	9485.	0.13	104.	17540.	803.
2	0.	45568.	45568.	0.	0.	45689.	45689.	-0.15	-120.	17540.	803.
3	0.	59215.	59215.	0.	0.	59287.	59287.	-0.09	-72.	17540.	803.
4	0.	160626.	160626.	0.	0.	160666.	160666.	-0.05	-40.	17540.	803.
5	0.	343905.	343905.	0.	0.	343857.	343857.	0.06	48.	17540.	803.
6	0.	196223.	196223.	0.	0.	196191.	196191.	0.04	32.	17540.	803.
7	0.	40848.	40848.	0.	0.	40471.	40471.	0.47	377.	17540.	803.
8	0.	5149.	5149.	0.	4643.	0.	4643.	0.63	506.	17540.	803.
9	0.	3788.	3788.	0.	3378.	0.	3378.	0.51	410.	17540.	803.
10	0.	62966.	62966.	0.	0.	62902.	62902.	0.08	64.	17540.	803.
11	0.	8947.	8947.	0.	0.	8810.	8810.	0.17	137.	17540.	803.
12	0.	5828.	5828.	0.	0.	5715.	5715.	0.14	112.	17540.	803.
TOTAL	0.	942652.	942652.	0.	8021.	933073.	941094.		1558.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1941 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	37347.	9485.	46832.	0.	0.	46003.	46003.	0.13	829.	138500.	6375.
2	78604.	45689.	124293.	0.	0.	125376.	125376.	-0.17	-1084.	138500.	6375.
3	103299.	59287.	162586.	0.	0.	163351.	163351.	-0.12	-765.	138500.	6375.
4	143518.	160666.	304184.	0.	0.	304503.	304503.	-0.05	-319.	138500.	6375.
5	221130.	343857.	564987.	0.	0.	564477.	564477.	0.08	510.	138500.	6375.
6	110847.	196191.	307038.	0.	0.	306783.	306783.	0.04	255.	138500.	6375.
7	43945.	40471.	84416.	0.	0.	81356.	81356.	0.48	3060.	138500.	6375.
8	0.	4643.	4643.	0.	499.	0.	499.	0.65	4144.	138500.	6375.
9	0.	3378.	3378.	0.	382.	0.	382.	0.47	2996.	138500.	6375.
10	59766.	62902.	122668.	0.	0.	122221.	122221.	0.07	446.	138500.	6375.
11	22580.	8810.	31390.	0.	0.	30115.	30115.	0.20	1275.	138500.	6375.
12	17745.	5715.	23460.	0.	0.	22568.	22568.	0.14	893.	138500.	6375.
TOTAL	838781.	941094.	1779876.	0.	881.	1766754.	1767636.		12240.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	46003.	46003.	0.	0.	45910.	45910.	0.12	94.	8760.	780.
2	0.	125376.	125376.	0.	0.	125501.	125501.	-0.16	-125.	8760.	780.
3	0.	163351.	163351.	0.	0.	163429.	163429.	-0.10	-78.	8760.	780.
4	0.	304503.	304503.	0.	0.	304542.	304542.	-0.05	-39.	8760.	780.
5	0.	564477.	564477.	0.	0.	564430.	564430.	0.06	47.	8760.	780.
6	0.	306783.	306783.	0.	0.	306760.	306760.	0.03	23.	8760.	780.
7	0.	81356.	81356.	0.	0.	80997.	80997.	0.46	359.	8760.	780.
8	0.	499.	499.	0.	0.	0.	0.	0.64	499.	8760.	780.
9	0.	382.	382.	0.	0.	0.	0.	0.49	382.	8760.	780.
10	0.	122221.	122221.	0.	0.	122159.	122159.	0.08	62.	8760.	780.
11	0.	30115.	30115.	0.	0.	29975.	29975.	0.18	140.	8760.	780.
12	0.	22568.	22568.	0.	0.	22466.	22466.	0.13	101.	8760.	780.
TOTAL	0.	1767636.	1767636.	0.	0.	1766169.	1766169.		1466.		

RESER OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1941 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	28313.	45910.	74223.	0.	21373.	52070.	73443.	0.07	780.	1170069.	11147.
2	92497.	125501.	217998.	0.	20482.	198854.	219336.	-0.12	-1338.	1170069.	11147.
3	103821.	163429.	267250.	0.	26271.	242205.	268476.	-0.11	-1226.	1170069.	11147.
4	119190.	304542.	423732.	0.	35176.	389782.	424958.	-0.11	-1226.	1170069.	11147.
5	181194.	564430.	745624.	0.	47198.	698315.	745513.	0.01	111.	1170069.	11147.
6	72536.	306760.	379296.	0.	56549.	323081.	379630.	-0.03	-334.	1170069.	11147.
7	22299.	80997.	103296.	0.	56104.	42845.	98949.	0.39	4347.	1170069.	11147.
8	0.	0.	0.	0.	62783.	0.	62783.	0.60	6688.	1100598.	11147.
9	0.	0.	0.	0.	45417.	0.	45417.	0.40	4278.	1050904.	10694.
10	18753.	122159.	140912.	0.	28942.	0.	28942.	0.07	723.	1162151.	10323.
11	6985.	29975.	36960.	0.	22709.	4003.	26711.	0.21	2330.	1170069.	11095.
12	5941.	22466.	28407.	0.	22263.	4918.	27181.	0.11	1226.	1170069.	11147.
TOTAL	651529.	1766169.	2417698.	0.	445266.	1956073.	2401339.		16359.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1941 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	986879.	0.	986879.	0.	8937.	933715.	942652.	44227.
2	0.	942652.	942652.	0.	8021.	933073.	941094.	1558.
3	838781.	941094.	1779876.	0.	881.	1766754.	1767636.	12240.
4	0.	1767636.	1767636.	0.	0.	1766169.	1766169.	1466.
5	651529.	1766169.	2417698.	0.	445266.	1956073.	2401339.	16359.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1942 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	12366.	0.	12366.	0.	0.	8035.	8035.	0.19	4331.	918777.	22795.
2	9019.	0.	9019.	0.	0.	4916.	4916.	0.18	4103.	918777.	22795.
3	6315.	0.	6315.	0.	265.	0.	265.	0.33	7519.	917308.	22784.
4	180905.	0.	180905.	0.	0.	185816.	185816.	-0.28	-6379.	918777.	22784.
5	233338.	0.	233338.	0.	0.	232882.	232882.	0.02	456.	918777.	22795.
6	37215.	0.	37215.	0.	0.	29921.	29921.	0.32	7294.	918777.	22795.
7	4264.	0.	4264.	0.	4210.	0.	4210.	0.53	12033.	906798.	22704.
8	39942.	0.	39942.	0.	0.	17974.	17974.	0.44	9990.	918777.	22704.
9	60246.	0.	60246.	0.	0.	58194.	58194.	0.09	2052.	918777.	22795.
10	120981.	0.	120981.	0.	0.	121437.	121437.	-0.02	-456.	918777.	22795.
11	13282.	0.	13282.	0.	0.	7583.	7583.	0.25	5699.	918777.	22795.
12	10985.	0.	10985.	0.	0.	7794.	7794.	0.14	3191.	918777.	22795.
TOTAL	728858.	0.	728858.	0.	4475.	674551.	679026.		49832.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	8035.	8035.	0.	0.	7890.	7890.	0.18	145.	17540.	803.
2	0.	4916.	4916.	0.	0.	4779.	4779.	0.17	137.	17540.	803.
3	0.	265.	265.	0.	0.	0.	0.	0.33	265.	17540.	803.
4	0.	185816.	185816.	0.	0.	186041.	186041.	-0.28	-225.	17540.	803.
5	0.	232882.	232882.	0.	0.	232866.	232866.	0.02	16.	17540.	803.
6	0.	29921.	29921.	0.	0.	29656.	29656.	0.33	265.	17540.	803.
7	0.	4210.	4210.	0.	3784.	0.	3784.	0.53	426.	17540.	803.
8	0.	17974.	17974.	0.	0.	17628.	17628.	0.43	345.	17540.	803.
9	0.	58194.	58194.	0.	0.	58122.	58122.	0.09	72.	17540.	803.
10	0.	121437.	121437.	0.	0.	121461.	121461.	-0.03	-24.	17540.	803.
11	0.	7583.	7583.	0.	0.	7391.	7391.	0.24	193.	17540.	803.
12	0.	7794.	7794.	0.	0.	7681.	7681.	0.14	112.	17540.	803.
TOTAL	0.	679026.	679026.	0.	3784.	673515.	677300.		1726.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1942 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	9834.	7890.	17724.	0.	0.	16449.	16449.	0.20	1275.	138500.	6375.
2	7827.	4779.	12606.	0.	0.	11586.	11586.	0.16	1020.	138500.	6375.
3	8930.	0.	8930.	0.	0.	6826.	6826.	0.33	2104.	138500.	6375.
4	54986.	186041.	241027.	0.	0.	242620.	242620.	-0.25	-1594.	138500.	6375.
5	0.	232866.	232866.	0.	0.	232547.	232547.	0.05	319.	138500.	6375.
6	0.	29656.	29656.	0.	0.	27233.	27233.	0.38	2423.	138500.	6375.
7	0.	3784.	3784.	0.	406.	0.	406.	0.53	3379.	138500.	6375.
8	516.	17628.	18144.	0.	0.	15658.	15658.	0.39	2486.	138500.	6375.
9	23302.	58122.	81424.	0.	0.	80914.	80914.	0.08	510.	138500.	6375.
10	80414.	121461.	201875.	0.	0.	202194.	202194.	-0.05	-319.	138500.	6375.
11	55579.	7391.	62970.	0.	0.	61503.	61503.	0.23	1466.	138500.	6375.
12	15556.	7681.	23237.	0.	0.	22281.	22281.	0.15	956.	138500.	6375.
TOTAL	256944.	677300.	934244.	0.	406.	919813.	920219.		14025.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	16449.	16449.	0.	0.	16309.	16309.	0.18	140.	8760.	780.
2	0.	11586.	11586.	0.	0.	11454.	11454.	0.17	133.	8760.	780.
3	0.	6826.	6826.	0.	0.	6577.	6577.	0.32	250.	8760.	780.
4	0.	242620.	242620.	0.	0.	242831.	242831.	-0.27	-211.	8760.	780.
5	0.	232547.	232547.	0.	0.	232524.	232524.	0.03	23.	8760.	780.
6	0.	27233.	27233.	0.	0.	26968.	26968.	0.34	265.	8760.	780.
7	0.	406.	406.	0.	0.	0.	0.	0.52	406.	8760.	780.
8	0.	15658.	15658.	0.	0.	15330.	15330.	0.42	328.	8760.	780.
9	0.	80914.	80914.	0.	0.	80852.	80852.	0.08	62.	8760.	780.
10	0.	202194.	202194.	0.	0.	202217.	202217.	-0.03	-23.	8760.	780.
11	0.	61503.	61503.	0.	0.	61324.	61324.	0.23	179.	8760.	780.
12	0.	22281.	22281.	0.	0.	22172.	22172.	0.14	109.	8760.	780.
TOTAL	0.	920219.	920219.	0.	0.	918557.	918557.		1661.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1942 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	3042.	16309.	19351.	0.	21373.	0.	21373.	0.11	1226.	1166821.	11147.
2	2621.	11454.	14075.	0.	20482.	0.	20482.	0.19	2114.	1158300.	11126.
3	3137.	6577.	9714.	0.	26271.	0.	26271.	0.28	3100.	1138643.	11070.
4	12445.	242831.	255276.	0.	35176.	190753.	225929.	-0.19	-2079.	1170069.	10942.
5	0.	232524.	232524.	0.	47198.	184657.	231855.	0.06	669.	1170069.	11147.
6	0.	26968.	26968.	0.	56549.	0.	56549.	0.34	3790.	1136698.	11147.
7	0.	0.	0.	0.	56104.	0.	56104.	0.20	2186.	1078409.	10929.
8	270.	15330.	15600.	0.	62783.	0.	62783.	0.45	4738.	1026489.	10528.
9	3930.	80852.	84782.	0.	45417.	0.	45417.	0.01	101.	1065752.	10140.
10	88741.	202217.	290958.	0.	28942.	157908.	186850.	-0.02	-209.	1170069.	10434.
11	14650.	61324.	75974.	0.	22709.	51147.	73856.	0.19	2118.	1170069.	11147.
12	4445.	22172.	26617.	0.	22263.	3128.	25391.	0.11	1226.	1170069.	11147.
TOTAL	133281.	918557.	1051838.	0.	445266.	587592.	1032858.		18980.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1942 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	728858.	0.	728858.	0.	4475.	674551.	679026.	49832.
2	0.	679026.	679026.	0.	3784.	673515.	677300.	1726.
3	256944.	677300.	934244.	0.	406.	919813.	920219.	14025.
4	0.	920219.	920219.	0.	0.	918557.	918557.	1661.
5	133281.	918557.	1051838.	0.	445266.	587592.	1032858.	18980.

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1943 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	6336.	0.	6336.	0.	0.	2917.	2917.	0.15	3419.	918777.	22795.
2	3272.	0.	3272.	0.	2387.	0.	2387.	0.30	6825.	912837.	22750.
3	6501.	0.	6501.	0.	1273.	0.	1273.	0.16	3635.	914430.	22716.
4	7308.	0.	7308.	0.	2865.	0.	2865.	0.36	8172.	910701.	22700.
5	0.	0.	0.	0.	1584.	0.	1584.	0.19	4299.	904818.	22627.
6	38359.	0.	38359.	0.	0.	13056.	13056.	0.50	11344.	918777.	22688.
7	1806.	0.	1806.	0.	353.	0.	353.	0.45	10228.	910002.	22728.
8	0.	0.	0.	0.	6518.	0.	6518.	0.82	18426.	885058.	22471.
9	10085.	0.	10085.	0.	1393.	0.	1393.	0.20	4462.	889288.	22312.
10	16100.	0.	16100.	0.	10130.	0.	10130.	0.44	9819.	885440.	22315.
11	1926.	0.	1926.	0.	7948.	0.	7948.	0.22	4885.	874533.	22203.
12	3407.	0.	3407.	0.	7792.	0.	7792.	0.03	662.	869486.	22081.
TOTAL	95100.	0.	95100.	0.	42243.	15973.	58216.		86176.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	2917.	2917.	0.	0.	2796.	2796.	0.15	120.	17540.	803.
2	0.	2387.	2387.	0.	2147.	0.	2147.	0.30	241.	17540.	803.
3	0.	1273.	1273.	0.	1145.	0.	1145.	0.16	128.	17540.	803.
4	0.	2865.	2865.	0.	2576.	0.	2576.	0.36	289.	17540.	803.
5	0.	1584.	1584.	0.	1431.	0.	1431.	0.19	153.	17540.	803.
6	0.	13056.	13056.	0.	0.	12655.	12655.	0.50	402.	17540.	803.
7	0.	353.	353.	0.	0.	0.	0.	0.44	353.	17540.	803.
8	0.	6518.	6518.	0.	5859.	0.	5859.	0.82	658.	17540.	803.
9	0.	1393.	1393.	0.	1232.	0.	1232.	0.20	161.	17540.	803.
10	0.	10130.	10130.	0.	0.	9785.	9785.	0.43	345.	17540.	803.
11	0.	7948.	7948.	0.	0.	7779.	7779.	0.21	169.	17540.	803.
12	0.	7792.	7792.	0.	0.	7768.	7768.	0.03	24.	17540.	803.
TOTAL	0.	58216.	58216.	0.	14389.	40783.	55172.		3043.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1943 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	2796.	2796.	0.	0.	1904.	1904.	0.14	893.	138500.	6375.
2	0.	2147.	2147.	0.	234.	0.	234.	0.30	1913.	138500.	6375.
3	0.	1145.	1145.	0.	125.	0.	125.	0.16	1020.	138500.	6375.
4	0.	2576.	2576.	0.	281.	0.	281.	0.36	2295.	138500.	6375.
5	0.	1431.	1431.	0.	156.	0.	156.	0.20	1275.	138500.	6375.
6	28541.	12655.	41196.	0.	0.	38008.	38008.	0.50	3188.	138500.	6375.
7	4246.	0.	4246.	0.	0.	1696.	1696.	0.40	2550.	138500.	6375.
8	0.	5859.	5859.	0.	632.	0.	632.	0.82	5228.	138500.	6375.
9	0.	1232.	1232.	0.	148.	0.	148.	0.17	1084.	138500.	6375.
10	0.	9785.	9785.	0.	0.	6980.	6980.	0.44	2805.	138500.	6375.
11	0.	7779.	7779.	0.	0.	6568.	6568.	0.19	1211.	138500.	6375.
12	0.	7768.	7768.	0.	0.	7513.	7513.	0.04	255.	138500.	6375.
TOTAL	32787.	55172.	87959.	0.	1576.	62669.	64244.		23715.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	1904.	1904.	0.	0.	1787.	1787.	0.15	117.	8760.	780.
2	0.	234.	234.	0.	0.	0.	0.	0.30	234.	8760.	780.
3	0.	125.	125.	0.	0.	0.	0.	0.16	125.	8760.	780.
4	0.	281.	281.	0.	0.	0.	0.	0.36	281.	8760.	780.
5	0.	156.	156.	0.	0.	0.	0.	0.20	156.	8760.	780.
6	0.	38008.	38008.	0.	0.	37618.	37618.	0.50	390.	8760.	780.
7	0.	1696.	1696.	0.	0.	1368.	1368.	0.42	328.	8760.	780.
8	0.	632.	632.	0.	0.	0.	0.	0.81	632.	8760.	780.
9	0.	148.	148.	0.	0.	0.	0.	0.19	148.	8760.	780.
10	0.	6980.	6980.	0.	0.	6644.	6644.	0.43	335.	8760.	780.
11	0.	6568.	6568.	0.	0.	6412.	6412.	0.20	156.	8760.	780.
12	0.	7513.	7513.	0.	0.	7490.	7490.	0.03	23.	8760.	780.
TOTAL	0.	64244.	64244.	0.	0.	61319.	61319.		2925.		

RESER\ OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1943 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	1787.	1787.	0.	21373.	0.	21373.	0.11	1226.	1149257.	11147.
2	0.	0.	0.	0.	20482.	0.	20482.	0.25	2753.	1126022.	11011.
3	0.	0.	0.	0.	26271.	0.	26271.	0.16	1738.	1098014.	10860.
4	0.	0.	0.	0.	35176.	0.	35176.	0.34	3630.	1059208.	10675.
5	0.	0.	0.	0.	47198.	0.	47198.	0.21	2181.	1009829.	10385.
6	2994.	37618.	40612.	0.	56549.	0.	56549.	0.44	4407.	989486.	10015.
7	1541.	1368.	2909.	0.	56104.	0.	56104.	0.34	3353.	932938.	9863.
8	0.	0.	0.	0.	62783.	0.	62783.	0.76	7174.	862981.	9440.
9	0.	0.	0.	0.	45417.	0.	45417.	0.19	1694.	815870.	8916.
10	0.	6644.	6644.	0.	28942.	0.	28942.	0.41	3526.	790046.	8599.
11	0.	6412.	6412.	0.	22709.	0.	22709.	0.14	1180.	772570.	8430.
12	0.	7490.	7490.	0.	22263.	0.	22263.	0.02	166.	757630.	8306.
TOTAL	4535.	61319.	65854.	0.	445266.	0.	445266.		33027.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1943 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	95100.	0.	95100.	0.	42243.	15973.	58216.	86176.
2	0.	58216.	58216.	0.	14389.	40783.	55172.	3043.
3	32787.	55172.	87959.	0.	1576.	62669.	64244.	23715.
4	0.	64244.	64244.	0.	0.	61319.	61319.	2925.
5	4535.	61319.	65854.	0.	445266.	0.	445266.	33027.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1944 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	41712.	0.	41712.	0.	7480.	0.	7480.	-0.19	-4244.	907961.	22336.
2	43905.	0.	43905.	0.	7169.	28646.	35815.	-0.12	-2725.	918777.	22712.
3	48407.	0.	48407.	0.	9195.	37617.	46811.	0.07	1596.	918777.	22795.
4	13308.	0.	13308.	0.	0.	7153.	7153.	0.27	6155.	918777.	22795.
5	222099.	0.	222099.	0.	0.	228254.	228254.	-0.27	-6155.	918777.	22795.
6	48946.	0.	48946.	0.	0.	37776.	37776.	0.49	11170.	918777.	22795.
7	0.	0.	0.	0.	6048.	0.	6048.	0.75	16964.	895764.	22619.
8	12240.	0.	12240.	0.	450.	0.	450.	0.57	12789.	894766.	22436.
9	25720.	0.	25720.	0.	377.	0.	377.	0.48	10819.	909290.	22539.
10	20966.	0.	20966.	0.	3287.	0.	3287.	0.44	9992.	916978.	22709.
11	14822.	0.	14822.	0.	0.	13478.	13478.	-0.02	-456.	918777.	22781.
12	56756.	0.	56756.	0.	0.	58580.	58580.	-0.08	-1824.	918777.	22795.
TOTAL	548881.	0.	548881.	0.	34006.	411504.	445509.		54080.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7480.	7480.	0.	0.	7633.	7633.	-0.19	-153.	17540.	803.
2	0.	35815.	35815.	0.	0.	35911.	35911.	-0.12	-96.	17540.	803.
3	0.	46811.	46811.	0.	0.	46755.	46755.	0.07	56.	17540.	803.
4	0.	7153.	7153.	0.	0.	6929.	6929.	0.28	225.	17540.	803.
5	0.	228254.	228254.	0.	0.	228478.	228478.	-0.28	-225.	17540.	803.
6	0.	37776.	37776.	0.	0.	37383.	37383.	0.49	393.	17540.	803.
7	0.	6048.	6048.	0.	5438.	0.	5438.	0.76	610.	17540.	803.
8	0.	450.	450.	0.	0.	0.	0.	0.56	450.	17540.	803.
9	0.	377.	377.	0.	0.	0.	0.	0.47	377.	17540.	803.
10	0.	3287.	3287.	0.	2941.	0.	2941.	0.43	345.	17540.	803.
11	0.	13478.	13478.	0.	0.	13494.	13494.	-0.02	-16.	17540.	803.
12	0.	58580.	58580.	0.	0.	58644.	58644.	-0.08	-64.	17540.	803.
TOTAL	0.	445509.	445509.	0.	8379.	435227.	443606.		1903.		

RESER OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1944 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	31706.	7633.	39339.	0.	0.	40678.	40678.	-0.21	-1339.	138500.	6375.
2	35740.	35911.	71651.	0.	0.	72416.	72416.	-0.12	-765.	138500.	6375.
3	48642.	46755.	95397.	0.	0.	94951.	94951.	0.07	446.	138500.	6375.
4	1208.	6929.	8137.	0.	0.	6288.	6288.	0.29	1849.	138500.	6375.
5	75653.	228478.	304131.	0.	0.	306171.	306171.	-0.32	-2040.	138500.	6375.
6	1982.	37383.	39365.	0.	0.	36432.	36432.	0.46	2933.	138500.	6375.
7	0.	5438.	5438.	0.	593.	0.	593.	0.76	4845.	138500.	6375.
8	6820.	0.	6820.	0.	0.	3441.	3441.	0.53	3379.	138500.	6375.
9	20724.	0.	20724.	0.	0.	17855.	17855.	0.45	2869.	138500.	6375.
10	0.	2941.	2941.	0.	328.	0.	328.	0.41	2614.	138500.	6375.
11	0.	13494.	13494.	0.	0.	13685.	13685.	-0.03	-191.	138500.	6375.
12	19571.	58644.	78215.	0.	0.	78725.	78725.	-0.08	-510.	138500.	6375.
TOTAL	242046.	443606.	685652.	0.	920.	670643.	671564.		14089.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	40678.	40678.	0.	0.	40834.	40834.	-0.20	-156.	8760.	780.
2	0.	72416.	72416.	0.	0.	72510.	72510.	-0.12	-94.	8760.	780.
3	0.	94951.	94951.	0.	0.	94904.	94904.	0.06	47.	8760.	780.
4	0.	6288.	6288.	0.	0.	6069.	6069.	0.28	218.	8760.	780.
5	0.	306171.	306171.	0.	0.	306398.	306398.	-0.29	-226.	8760.	780.
6	0.	36432.	36432.	0.	0.	36066.	36066.	0.47	367.	8760.	780.
7	0.	593.	593.	0.	0.	0.	0.	0.76	593.	8760.	780.
8	0.	3441.	3441.	0.	0.	3020.	3020.	0.54	421.	8760.	780.
9	0.	17855.	17855.	0.	0.	17496.	17496.	0.46	359.	8760.	780.
10	0.	328.	328.	0.	0.	0.	0.	0.42	328.	8760.	780.
11	0.	13685.	13685.	0.	0.	13717.	13717.	-0.04	-31.	8760.	780.
12	0.	78725.	78725.	0.	0.	78787.	78787.	-0.08	-62.	8760.	780.
TOTAL	0.	671564.	671564.	0.	0.	669801.	669801.		1763.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1944 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	3713.	40834.	44547.	0.	21373.	0.	21373.	-0.22	-1804.	782608.	8201.
2	5107.	72510.	77617.	0.	20482.	0.	20482.	-0.09	-754.	840496.	8377.
3	16003.	94904.	110907.	0.	26271.	0.	26271.	0.01	88.	925045.	8754.
4	295.	6069.	6364.	0.	35176.	0.	35176.	0.29	2720.	893513.	9381.
5	95763.	306398.	402161.	0.	47198.	80236.	127434.	-0.20	-1829.	1170069.	9145.
6	766.	36066.	36832.	0.	56549.	0.	56549.	0.42	4682.	1145670.	11147.
7	0.	0.	0.	0.	56104.	0.	56104.	0.71	7801.	1081765.	10988.
8	68046.	3020.	71066.	0.	62783.	0.	62783.	0.46	4855.	1085194.	10554.
9	20772.	17496.	38268.	0.	45417.	0.	45417.	0.40	4232.	1073814.	10579.
10	0.	0.	0.	0.	28942.	0.	28942.	0.39	4093.	1040779.	10494.
11	0.	13717.	13717.	0.	22709.	0.	22709.	-0.13	-1332.	1033119.	10247.
12	12971.	78787.	91758.	0.	22263.	0.	22263.	-0.11	-1121.	1103735.	10189.
TOTAL	223436.	669801.	893237.	0.	445266.	80236.	525502.		21630.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1944 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	548881.	0.	548881.	0.	34006.	411504.	445509.	54080.
2	0.	445509.	445509.	0.	8379.	435227.	443606.	1903.
3	242046.	443606.	685652.	0.	920.	670643.	671564.	14089.
4	0.	671564.	671564.	0.	0.	669801.	669801.	1763.
5	223436.	669801.	893237.	0.	445266.	80236.	525502.	21630.

RESERVO. OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1945 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	47165.	0.	47165.	0.	0.	47165.	47165.	0.00	0.	918777.	22795.
2	56756.	0.	56756.	0.	0.	58124.	58124.	-0.06	-1368.	918777.	22795.
3	68832.	0.	68832.	0.	0.	68148.	68148.	0.03	684.	918777.	22795.
4	91629.	0.	91629.	0.	0.	92541.	92541.	-0.04	-912.	918777.	22795.
5	24865.	0.	24865.	0.	0.	14379.	14379.	0.46	10486.	918777.	22795.
6	28559.	0.	28559.	0.	0.	22176.	22176.	0.28	6383.	918777.	22795.
7	37994.	0.	37994.	0.	0.	27052.	27052.	0.48	10942.	918777.	22795.
8	0.	0.	0.	0.	4815.	0.	4815.	0.59	13367.	900595.	22656.
9	14766.	0.	14766.	0.	313.	0.	313.	0.41	9248.	905799.	22557.
10	7779.	0.	7779.	0.	225.	0.	225.	0.28	6330.	907024.	22606.
11	6467.	0.	6467.	0.	2252.	0.	2252.	0.31	7004.	904234.	22594.
12	21776.	0.	21776.	0.	0.	4965.	4965.	0.10	2268.	918777.	22684.
TOTAL	406588.	0.	406588.	0.	7605.	334551.	342156.		64432.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	47165.	47165.	0.	0.	47165.	47165.	0.00	0.	17540.	803.
2	0.	58124.	58124.	0.	0.	58172.	58172.	-0.06	-48.	17540.	803.
3	0.	68148.	68148.	0.	0.	68124.	68124.	0.03	24.	17540.	803.
4	0.	92541.	92541.	0.	0.	92573.	92573.	-0.04	-32.	17540.	803.
5	0.	14379.	14379.	0.	0.	14010.	14010.	0.46	369.	17540.	803.
6	0.	22176.	22176.	0.	0.	21952.	21952.	0.28	225.	17540.	803.
7	0.	27052.	27052.	0.	0.	26659.	26659.	0.49	393.	17540.	803.
8	0.	4815.	4815.	0.	4341.	0.	4341.	0.59	474.	17540.	803.
9	0.	313.	313.	0.	0.	0.	0.	0.39	313.	17540.	803.
10	0.	225.	225.	0.	0.	0.	0.	0.28	225.	17540.	803.
11	0.	2252.	2252.	0.	2011.	0.	2011.	0.30	241.	17540.	803.
12	0.	4965.	4965.	0.	0.	4893.	4893.	0.09	72.	17540.	803.
TOTAL	0.	342156.	342156.	0.	6352.	333547.	339899.		2256.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1945 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	59182.	47165.	106347.	0.	0.	106411.	106411.	-0.01	-64.	138500.	6375.
2	59048.	58172.	117220.	0.	0.	117602.	117602.	-0.06	-383.	138500.	6375.
3	40069.	68124.	108193.	0.	0.	107811.	107811.	0.06	383.	138500.	6375.
4	71169.	92573.	163742.	0.	0.	163869.	163869.	-0.02	-128.	138500.	6375.
5	0.	14010.	14010.	0.	0.	11014.	11014.	0.47	2996.	138500.	6375.
6	0.	21952.	21952.	0.	0.	20230.	20230.	0.27	1721.	138500.	6375.
7	0.	26659.	26659.	0.	0.	23471.	23471.	0.50	3188.	138500.	6375.
8	0.	4341.	4341.	0.	452.	0.	452.	0.61	3889.	138500.	6375.
9	5193.	0.	5193.	0.	0.	3089.	3089.	0.33	2104.	138500.	6375.
10	5919.	0.	5919.	0.	0.	3943.	3943.	0.31	1976.	138500.	6375.
11	0.	2011.	2011.	0.	226.	0.	226.	0.28	1785.	138500.	6375.
12	0.	4893.	4893.	0.	0.	4447.	4447.	0.07	446.	138500.	6375.
TOTAL	240580.	339899.	580479.	0.	679.	561887.	562566.		17914.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	106411.	106411.	0.	0.	106419.	106419.	-0.01	-8.	8760.	780.
2	0.	117602.	117602.	0.	0.	117649.	117649.	-0.06	-47.	8760.	780.
3	0.	107811.	107811.	0.	0.	107779.	107779.	0.04	31.	8760.	780.
4	0.	163869.	163869.	0.	0.	163901.	163901.	-0.04	-31.	8760.	780.
5	0.	11014.	11014.	0.	0.	10655.	10655.	0.46	359.	8760.	780.
6	0.	20230.	20230.	0.	0.	20012.	20012.	0.28	218.	8760.	780.
7	0.	23471.	23471.	0.	0.	23089.	23089.	0.49	382.	8760.	780.
8	0.	452.	452.	0.	0.	0.	0.	0.58	452.	8760.	780.
9	0.	3089.	3089.	0.	0.	2801.	2801.	0.37	289.	8760.	780.
10	0.	3943.	3943.	0.	0.	3717.	3717.	0.29	226.	8760.	780.
11	0.	226.	226.	0.	0.	0.	0.	0.29	226.	8760.	780.
12	0.	4447.	4447.	0.	0.	4384.	4384.	0.08	62.	8760.	780.
TOTAL	0.	562566.	562566.	0.	0.	560405.	560405.		2161.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1945 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	43801.	106419.	150220.	0.	21373.	62834.	84207.	-0.03	-321.	1170069.	10714.
2	39137.	117649.	156786.	0.	20482.	136973.	157455.	-0.06	-669.	1170069.	11147.
3	75963.	107779.	183742.	0.	26271.	157026.	183296.	0.04	446.	1170069.	11147.
4	87448.	163901.	251349.	0.	35176.	216061.	251237.	0.01	111.	1170069.	11147.
5	0.	10655.	10655.	0.	47198.	0.	47198.	0.43	4793.	1128732.	11147.
6	0.	20012.	20012.	0.	56549.	0.	56549.	0.28	3046.	1089150.	10877.
7	0.	23089.	23089.	0.	56104.	0.	56104.	0.49	5198.	1050937.	10609.
8	0.	0.	0.	0.	62783.	0.	62783.	0.49	5058.	983097.	10323.
9	39355.	2801.	42156.	0.	45417.	0.	45417.	0.38	3730.	976105.	9815.
10	8316.	3717.	12033.	0.	28942.	0.	28942.	0.19	1855.	957341.	9763.
11	0.	0.	0.	0.	22709.	0.	22709.	0.26	2502.	932130.	9622.
12	0.	4384.	4384.	0.	22263.	0.	22263.	0.06	566.	913685.	9434.
TOTAL	294020.	560405.	854425.	0.	445266.	572894.	1018160.		26315.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1945 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	406588.	0.	406588.	0.	7605.	334551.	342156.	64432.
2	0.	342156.	342156.	0.	6352.	333547.	339899.	2256.
3	240580.	339899.	580479.	0.	679.	561887.	562566.	17914.
4	0.	562566.	562566.	0.	0.	560405.	560405.	2161.
5	294020.	560405.	854425.	0.	445266.	572894.	1018160.	26315.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1946 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	17930.	0.	17930.	0.	0.	19070.	19070.	-0.05	-1140.	918777.	22795.
2	30214.	0.	30214.	0.	0.	29074.	29074.	0.05	1140.	918777.	22795.
3	22148.	0.	22148.	0.	0.	18501.	18501.	0.16	3647.	918777.	22795.
4	5005.	0.	5005.	0.	0.	1586.	1586.	0.15	3419.	918777.	22795.
5	32404.	0.	32404.	0.	0.	31492.	31492.	0.04	912.	918777.	22795.
6	4903.	0.	4903.	0.	305.	0.	305.	0.39	8877.	914498.	22762.
7	0.	0.	0.	0.	6892.	0.	6892.	0.85	19151.	888455.	22531.
8	341.	0.	341.	0.	6192.	0.	6192.	0.79	17501.	865103.	22154.
9	31451.	0.	31451.	0.	1337.	0.	1337.	0.16	3549.	891668.	22178.
10	14981.	0.	14981.	0.	217.	0.	217.	0.28	6285.	900147.	22446.
11	33625.	0.	33625.	0.	0.	12504.	12504.	0.11	2492.	918777.	22653.
12	14596.	0.	14596.	0.	0.	12544.	12544.	0.09	2052.	918777.	22795.
TOTAL	207598.	0.	207598.	0.	14942.	124771.	139713.		67885.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19070.	19070.	0.	0.	19110.	19110.	-0.05	-40.	17540.	803.
2	0.	29074.	29074.	0.	0.	29034.	29034.	0.05	40.	17540.	803.
3	0.	18501.	18501.	0.	0.	18372.	18372.	0.16	128.	17540.	803.
4	0.	1586.	1586.	0.	0.	1473.	1473.	0.14	112.	17540.	803.
5	0.	31492.	31492.	0.	0.	31460.	31460.	0.04	32.	17540.	803.
6	0.	305.	305.	0.	0.	0.	0.	0.38	305.	17540.	803.
7	0.	6892.	6892.	0.	6209.	0.	6209.	0.85	683.	17540.	803.
8	0.	6192.	6192.	0.	5565.	0.	5565.	0.78	626.	17540.	803.
9	0.	1337.	1337.	0.	1209.	0.	1209.	0.16	128.	17540.	803.
10	0.	217.	217.	0.	0.	0.	0.	0.27	217.	17540.	803.
11	0.	12504.	12504.	0.	0.	12415.	12415.	0.11	88.	17540.	803.
12	0.	12544.	12544.	0.	0.	12472.	12472.	0.09	72.	17540.	803.
TOTAL	0.	139713.	139713.	0.	12983.	124337.	137320.		2393.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1946 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)								
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	20496.	19110.	39606.	0.	0.	39925.	39925.	-0.05	-319.	138500.	6375.
2	29940.	29034.	58974.	0.	0.	58719.	58719.	0.04	255.	138500.	6375.
3	11122.	18372.	29494.	0.	0.	28347.	28347.	0.18	1148.	138500.	6375.
4	48335.	1473.	49808.	0.	0.	49043.	49043.	0.12	765.	138500.	6375.
5	67197.	31460.	98657.	0.	0.	98402.	98402.	0.04	255.	138500.	6375.
6	3271.	0.	3271.	0.	0.	976.	976.	0.36	2295.	138500.	6375.
7	0.	6209.	6209.	0.	663.	0.	663.	0.87	5546.	138500.	6375.
8	0.	5565.	5565.	0.	593.	0.	593.	0.78	4973.	138500.	6375.
9	0.	1209.	1209.	0.	125.	0.	125.	0.17	1084.	138500.	6375.
10	4145.	0.	4145.	0.	0.	2551.	2551.	0.25	1594.	138500.	6375.
11	33932.	12415.	46347.	0.	0.	45646.	45646.	0.11	701.	138500.	6375.
12	25886.	12472.	38358.	0.	0.	37848.	37848.	0.08	510.	138500.	6375.
TOTAL	244324.	137320.	381644.	0.	1381.	361457.	362838.		18806.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)								
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	39925.	39925.	0.	0.	39964.	39964.	-0.05	-39.	8760.	780.
2	0.	58719.	58719.	0.	0.	58688.	58688.	0.04	31.	8760.	780.
3	0.	28347.	28347.	0.	0.	28222.	28222.	0.16	125.	8760.	780.
4	0.	49043.	49043.	0.	0.	48942.	48942.	0.13	101.	8760.	780.
5	0.	98402.	98402.	0.	0.	98371.	98371.	0.04	31.	8760.	780.
6	0.	976.	976.	0.	0.	687.	687.	0.37	289.	8760.	780.
7	0.	663.	663.	0.	0.	0.	0.	0.85	663.	8760.	780.
8	0.	593.	593.	0.	0.	0.	0.	0.76	593.	8760.	780.
9	0.	125.	125.	0.	0.	0.	0.	0.16	125.	8760.	780.
10	0.	2551.	2551.	0.	0.	2348.	2348.	0.26	203.	8760.	780.
11	0.	45646.	45646.	0.	0.	45568.	45568.	0.10	78.	8760.	780.
12	0.	37848.	37848.	0.	0.	37786.	37786.	0.08	62.	8760.	780.
TOTAL	0.	362838.	362838.	0.	0.	360576.	360576.		2262.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1946 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	18756.	39964.	58720.	0.	21373.	0.	21373.	-0.08	-744.	951776.	9296.
2	21250.	58688.	79938.	0.	20482.	0.	20482.	0.02	192.	1011040.	9581.
3	11257.	28222.	39479.	0.	26271.	0.	26271.	0.10	1002.	1023246.	10024.
4	23471.	48942.	72413.	0.	35176.	0.	35176.	0.06	607.	1059876.	10116.
5	33520.	98371.	131891.	0.	47198.	0.	47198.	0.06	623.	1143945.	10390.
6	3120.	687.	3807.	0.	56549.	0.	56549.	0.27	2964.	1088240.	10977.
7	0.	0.	0.	0.	56104.	0.	56104.	0.74	7845.	1024291.	10602.
8	0.	0.	0.	0.	62783.	0.	62783.	0.48	4859.	956649.	10123.
9	0.	0.	0.	0.	45417.	0.	45417.	0.00	0.	911232.	9617.
10	2731.	2348.	5079.	0.	28942.	0.	28942.	0.21	1948.	885421.	9277.
11	26393.	45568.	71961.	0.	22709.	0.	22709.	-0.01	-91.	934764.	9084.
12	29848.	37786.	67634.	0.	22263.	0.	22263.	0.04	378.	979756.	9453.
TOTAL	170346.	360576.	530922.	0.	445266.	0.	445266.		19585.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1946 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	207598.	0.	207598.	0.	14942.	124771.	139713.	67885.
2	0.	139713.	139713.	0.	12983.	124337.	137320.	2393.
3	244324.	137320.	381644.	0.	1381.	361457.	362838.	18806.
4	0.	362838.	362838.	0.	0.	360576.	360576.	2262.
5	170346.	360576.	530922.	0.	445266.	0.	445266.	19585.

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1947 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	33625.	0.	33625.	0.	0.	37500.	37500.	-0.17	-3875.	918777.	22795.
2	14596.	0.	14596.	0.	0.	9809.	9809.	0.21	4787.	918777.	22795.
3	29680.	0.	29680.	0.	0.	28084.	28084.	0.07	1596.	918777.	22795.
4	17697.	0.	17697.	0.	0.	14278.	14278.	0.15	3419.	918777.	22795.
5	10707.	0.	10707.	0.	0.	5008.	5008.	0.25	5699.	918777.	22795.
6	0.	0.	0.	0.	4918.	0.	4918.	0.61	13818.	900041.	22652.
7	0.	0.	0.	0.	6573.	0.	6573.	0.81	18080.	875388.	22321.
8	0.	0.	0.	0.	4457.	0.	4457.	0.57	12542.	858390.	22003.
9	0.	0.	0.	0.	5205.	0.	5205.	0.68	14770.	838415.	21720.
10	0.	0.	0.	0.	4401.	0.	4401.	0.57	12221.	821793.	21441.
11	607.	0.	607.	0.	7948.	0.	7948.	0.25	5304.	809148.	21218.
12	9749.	0.	9749.	0.	7792.	0.	7792.	0.02	423.	810682.	21130.
TOTAL	116661.	0.	116661.	0.	41294.	94680.	135973.		88783.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	37500.	37500.	0.	0.	37645.	37645.	-0.18	-145.	17540.	803.
2	0.	9809.	9809.	0.	0.	9648.	9648.	0.20	161.	17540.	803.
3	0.	28084.	28084.	0.	0.	28028.	28028.	0.07	56.	17540.	803.
4	0.	14278.	14278.	0.	0.	14157.	14157.	0.15	120.	17540.	803.
5	0.	5008.	5008.	0.	0.	4799.	4799.	0.26	209.	17540.	803.
6	0.	4918.	4918.	0.	4428.	0.	4428.	0.61	490.	17540.	803.
7	0.	6573.	6573.	0.	5923.	0.	5923.	0.81	650.	17540.	803.
8	0.	4457.	4457.	0.	3999.	0.	3999.	0.57	458.	17540.	803.
9	0.	5205.	5205.	0.	4659.	0.	4659.	0.68	546.	17540.	803.
10	0.	4401.	4401.	0.	3943.	0.	3943.	0.57	458.	17540.	803.
11	0.	7948.	7948.	0.	0.	7747.	7747.	0.25	201.	17540.	803.
12	0.	7792.	7792.	0.	0.	7768.	7768.	0.03	24.	17540.	803.
TOTAL	0.	135973.	135973.	0.	22952.	109793.	132745.		3228.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1947 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	95741.	37645.	133386.	0.	0.	134661.	134661.	-0.20	-1275.	138500.	6375.
2	17442.	9648.	27090.	0.	0.	25815.	25815.	0.20	1275.	138500.	6375.
3	23204.	28028.	51232.	0.	0.	50722.	50722.	0.08	510.	138500.	6375.
4	4361.	14157.	18518.	0.	0.	17435.	17435.	0.17	1084.	138500.	6375.
5	0.	4799.	4799.	0.	0.	2951.	2951.	0.29	1849.	138500.	6375.
6	0.	4428.	4428.	0.	476.	0.	476.	0.62	3953.	138500.	6375.
7	0.	5923.	5923.	0.	632.	0.	632.	0.83	5291.	138500.	6375.
8	0.	3999.	3999.	0.	429.	0.	429.	0.56	3570.	138500.	6375.
9	0.	4659.	4659.	0.	515.	0.	515.	0.65	4144.	138500.	6375.
10	0.	3943.	3943.	0.	437.	0.	437.	0.55	3506.	138500.	6375.
11	0.	7747.	7747.	0.	0.	6154.	6154.	0.25	1594.	138500.	6375.
12	0.	7768.	7768.	0.	0.	7577.	7577.	0.03	191.	138500.	6375.
TOTAL	140748.	132745.	273493.	0.	2488.	245314.	247802.		25691.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	134661.	134661.	0.	0.	134809.	134809.	-0.19	-148.	8760.	780.
2	0.	25815.	25815.	0.	0.	25659.	25659.	0.20	156.	8760.	780.
3	0.	50722.	50722.	0.	0.	50660.	50660.	0.08	62.	8760.	780.
4	0.	17435.	17435.	0.	0.	17318.	17318.	0.15	117.	8760.	780.
5	0.	2951.	2951.	0.	0.	2748.	2748.	0.26	203.	8760.	780.
6	0.	476.	476.	0.	0.	0.	0.	0.61	476.	8760.	780.
7	0.	632.	632.	0.	0.	0.	0.	0.81	632.	8760.	780.
8	0.	429.	429.	0.	0.	0.	0.	0.55	429.	8760.	780.
9	0.	515.	515.	0.	0.	0.	0.	0.66	515.	8760.	780.
10	0.	437.	437.	0.	0.	0.	0.	0.56	437.	8760.	780.
11	0.	6154.	6154.	0.	0.	5959.	5959.	0.25	195.	8760.	780.
12	0.	7577.	7577.	0.	0.	7553.	7553.	0.03	23.	8760.	780.
TOTAL	0.	247802.	247802.	0.	0.	244705.	244705.		3097.		

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1947 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	74471.	134809.	209280.	0.	21373.	0.	21373.	-0.14	-1371.	1169034.	9790.
2	20112.	25659.	45771.	0.	20482.	22249.	42731.	0.18	2005.	1170069.	11140.
3	14735.	50660.	65395.	0.	26271.	38232.	64503.	0.08	892.	1170069.	11147.
4	4628.	17318.	21946.	0.	35176.	0.	35176.	0.13	1449.	1155389.	11147.
5	0.	2748.	2748.	0.	47198.	0.	47198.	0.20	2210.	1108729.	11051.
6	0.	0.	0.	0.	56549.	0.	56549.	0.56	6018.	1046162.	10747.
7	0.	0.	0.	0.	56104.	0.	56104.	0.73	7510.	982549.	10287.
8	0.	0.	0.	0.	62783.	0.	62783.	0.43	4219.	915547.	9811.
9	0.	0.	0.	0.	45417.	0.	45417.	0.66	6144.	863986.	9310.
10	0.	0.	0.	0.	28942.	0.	28942.	0.53	4730.	830314.	8924.
11	0.	5959.	5959.	0.	22709.	0.	22709.	0.20	1738.	811826.	8690.
12	0.	7553.	7553.	0.	22263.	0.	22263.	0.02	171.	796945.	8574.
TOTAL	113946.	244705.	358651.	0.	445266.	60481.	505747.		35716.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1947 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	116661.	0.	116661.	0.	41294.	94680.	135973.	88783.
2	0.	135973.	135973.	0.	22952.	109793.	132745.	3228.
3	140748.	132745.	273493.	0.	2488.	245314.	247802.	25691.
4	0.	247802.	247802.	0.	0.	244705.	244705.	3097.
5	113946.	244705.	358651.	0.	445266.	60481.	505747.	35716.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1948 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	24.	0.	24.	0.	7480.	0.	7480.	0.06	1264.	801961.	21071.
2	6552.	0.	6552.	0.	7169.	0.	7169.	-0.03	-630.	801975.	20999.
3	6866.	0.	6866.	0.	9195.	0.	9195.	0.21	4398.	795248.	20943.
4	5382.	0.	5382.	0.	12312.	0.	12312.	0.22	4574.	783744.	20793.
5	25509.	0.	25509.	0.	16519.	0.	16519.	0.19	3940.	788793.	20739.
6	6530.	0.	6530.	0.	50894.	0.	50894.	0.60	12188.	732241.	20314.
7	9645.	0.	9645.	0.	19636.	0.	19636.	0.60	11800.	710449.	19667.
8	791.	0.	791.	0.	21974.	0.	21974.	0.73	13956.	675310.	19118.
9	6544.	0.	6544.	0.	15896.	0.	15896.	0.55	10200.	655758.	18545.
10	879.	0.	879.	0.	10130.	0.	10130.	0.48	8713.	637795.	18152.
11	0.	0.	0.	0.	20438.	0.	20438.	0.36	6357.	611000.	17657.
12	54.	0.	54.	0.	20037.	0.	20037.	0.19	3245.	587773.	17076.
TOTAL	68776.	0.	68776.	0.	211679.	0.	211679.		80006.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7480.	7480.	0.	0.	7432.	7432.	0.06	48.	17540.	803.
2	0.	7169.	7169.	0.	0.	7193.	7193.	-0.03	-24.	17540.	803.
3	0.	9195.	9195.	0.	0.	9026.	9026.	0.21	169.	17540.	803.
4	0.	12312.	12312.	0.	0.	12135.	12135.	0.22	177.	17540.	803.
5	0.	16519.	16519.	0.	0.	16359.	16359.	0.20	161.	17540.	803.
6	0.	50894.	50894.	0.	0.	50412.	50412.	0.60	482.	17540.	803.
7	0.	19636.	19636.	0.	0.	19154.	19154.	0.60	482.	17540.	803.
8	0.	21974.	21974.	0.	0.	21396.	21396.	0.72	578.	17540.	803.
9	0.	15896.	15896.	0.	0.	15462.	15462.	0.54	434.	17540.	803.
10	0.	10130.	10130.	0.	0.	9752.	9752.	0.47	377.	17540.	803.
11	0.	20438.	20438.	0.	0.	20157.	20157.	0.35	281.	17540.	803.
12	0.	20037.	20037.	0.	0.	19884.	19884.	0.19	153.	17540.	803.
TOTAL	0.	211679.	211679.	0.	0.	208363.	208363.		3316.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1948 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7432.	7432.	0.	0.	7114.	7114.	0.05	319.	138500.	6375.
2	0.	7193.	7193.	0.	0.	7257.	7257.	-0.01	-64.	138500.	6375.
3	0.	9026.	9026.	0.	0.	7751.	7751.	0.20	1275.	138500.	6375.
4	936.	12135.	13071.	0.	0.	11732.	11732.	0.21	1339.	138500.	6375.
5	0.	16359.	16359.	0.	0.	15020.	15020.	0.21	1339.	138500.	6375.
6	143720.	50412.	194132.	0.	0.	190180.	190180.	0.62	3953.	138500.	6375.
7	28349.	19154.	47503.	0.	0.	43487.	43487.	0.63	4016.	138500.	6375.
8	0.	21396.	21396.	0.	0.	17061.	17061.	0.68	4335.	138500.	6375.
9	0.	15462.	15462.	0.	0.	11956.	11956.	0.55	3506.	138500.	6375.
10	0.	9752.	9752.	0.	0.	6947.	6947.	0.44	2805.	138500.	6375.
11	0.	20157.	20157.	0.	0.	17989.	17989.	0.34	2168.	138500.	6375.
12	0.	19884.	19884.	0.	0.	18801.	18801.	0.17	1084.	138500.	6375.
TOTAL	173005.	208363.	381368.	0.	0.	355294.	355294.		26074.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7114.	7114.	0.	0.	7067.	7067.	0.06	47.	8760.	780.
2	0.	7257.	7257.	0.	0.	7272.	7272.	-0.02	-16.	8760.	780.
3	0.	7751.	7751.	0.	0.	7595.	7595.	0.20	156.	8760.	780.
4	0.	11732.	11732.	0.	0.	11561.	11561.	0.22	172.	8760.	780.
5	0.	15020.	15020.	0.	0.	14864.	14864.	0.20	156.	8760.	780.
6	0.	190180.	190180.	0.	0.	189712.	189712.	0.60	468.	8760.	780.
7	0.	43487.	43487.	0.	0.	43011.	43011.	0.61	476.	8760.	780.
8	0.	17061.	17061.	0.	0.	16515.	16515.	0.70	546.	8760.	780.
9	0.	11956.	11956.	0.	0.	11535.	11535.	0.54	421.	8760.	780.
10	0.	6947.	6947.	0.	0.	6589.	6589.	0.46	359.	8760.	780.
11	0.	17989.	17989.	0.	0.	17716.	17716.	0.35	273.	8760.	780.
12	0.	18801.	18801.	0.	0.	18660.	18660.	0.18	140.	8760.	780.
TOTAL	0.	355294.	355294.	0.	0.	352096.	352096.		3198.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1948 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7067.	7067.	0.	21373.	0.	21373.	0.06	509.	782130.	8478.
2	0.	7272.	7272.	0.	20482.	0.	20482.	-0.05	-419.	769339.	8374.
3	0.	7595.	7595.	0.	26271.	0.	26271.	0.20	1657.	749006.	8284.
4	1502.	11561.	13063.	0.	35176.	0.	35176.	0.25	2035.	724858.	8140.
5	0.	14864.	14864.	0.	47198.	0.	47198.	0.21	1674.	690850.	7970.
6	1511.	189712.	191223.	0.	56549.	0.	56549.	0.54	4174.	821350.	7730.
7	1367.	43011.	44378.	0.	56104.	0.	56104.	0.58	5008.	804617.	8634.
8	0.	16515.	16515.	0.	62783.	0.	62783.	0.65	5544.	752806.	8529.
9	0.	11535.	11535.	0.	45417.	0.	45417.	0.46	3757.	715167.	8167.
10	0.	6589.	6589.	0.	28942.	0.	28942.	0.38	3002.	689811.	7901.
11	0.	17716.	17716.	0.	22709.	0.	22709.	0.30	2317.	682501.	7722.
12	0.	18660.	18660.	0.	22263.	0.	22263.	0.18	1381.	677518.	7671.
TOTAL	4380.	352096.	356476.	0.	445266.	0.	445266.		30637.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1948 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	68776.	0.	68776.	0.	211679.	0.	211679.	80006.
2	0.	211679.	211679.	0.	0.	208363.	208363.	3316.
3	173005.	208363.	381368.	0.	0.	355294.	355294.	26074.
4	0.	355294.	355294.	0.	0.	352096.	352096.	3198.
5	4380.	352096.	356476.	0.	445266.	0.	445266.	30637.

RESER\ OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1949 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	2788.	0.	2788.	0.	19235.	0.	19235.	-0.11	-1830.	573155.	16637.
2	15208.	0.	15208.	0.	18434.	0.	18434.	-0.06	-987.	570916.	16449.
3	61631.	0.	61631.	0.	9195.	0.	9195.	0.09	1531.	621822.	17006.
4	129214.	0.	129214.	0.	12312.	0.	12312.	-0.26	-4915.	743640.	18906.
5	44489.	0.	44489.	0.	16519.	0.	16519.	0.30	6065.	765545.	20216.
6	3732.	0.	3732.	0.	19792.	0.	19792.	0.31	6266.	743219.	20212.
7	0.	0.	0.	0.	50493.	0.	50493.	0.68	13261.	679464.	19501.
8	0.	0.	0.	0.	56504.	0.	56504.	0.65	11779.	611181.	18122.
9	0.	0.	0.	0.	40875.	0.	40875.	0.57	9556.	560750.	16765.
10	12300.	0.	12300.	0.	26048.	0.	26048.	0.15	2406.	544595.	16042.
11	184.	0.	184.	0.	20438.	0.	20438.	0.41	6393.	517949.	15592.
12	8659.	0.	8659.	0.	20037.	0.	20037.	0.05	759.	505812.	15185.
TOTAL	278205.	0.	278205.	0.	309883.	0.	309883.		50283.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19324.	19324.	-0.11	-88.	17540.	803.
2	0.	18434.	18434.	0.	0.	18482.	18482.	-0.06	-48.	17540.	803.
3	0.	9195.	9195.	0.	0.	9122.	9122.	0.09	72.	17540.	803.
4	0.	12312.	12312.	0.	0.	12528.	12528.	-0.27	-217.	17540.	803.
5	0.	16519.	16519.	0.	0.	16286.	16286.	0.29	233.	17540.	803.
6	0.	19792.	19792.	0.	0.	19543.	19543.	0.31	249.	17540.	803.
7	0.	50493.	50493.	0.	0.	49947.	49947.	0.68	546.	17540.	803.
8	0.	56504.	56504.	0.	0.	55982.	55982.	0.65	522.	17540.	803.
9	0.	40875.	40875.	0.	0.	40418.	40418.	0.57	458.	17540.	803.
10	0.	26048.	26048.	0.	0.	25928.	25928.	0.15	120.	17540.	803.
11	0.	20438.	20438.	0.	0.	20108.	20108.	0.41	329.	17540.	803.
12	0.	20037.	20037.	0.	0.	19997.	19997.	0.05	40.	17540.	803.
TOTAL	0.	309883.	309883.	0.	0.	307667.	307667.		2216.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1949 . SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19324.	19324.	0.	0.	19898.	19898.	-0.09	-574.	138500.	6375.
2	28142.	18482.	46624.	0.	0.	47070.	47070.	-0.07	-446.	138500.	6375.
3	14169.	9122.	23291.	0.	0.	22718.	22718.	0.09	574.	138500.	6375.
4	43162.	12528.	55690.	0.	0.	57603.	57603.	-0.30	-1913.	138500.	6375.
5	0.	16286.	16286.	0.	0.	14502.	14502.	0.28	1785.	138500.	6375.
6	0.	19543.	19543.	0.	0.	17439.	17439.	0.33	2104.	138500.	6375.
7	0.	49947.	49947.	0.	0.	45612.	45612.	0.68	4335.	138500.	6375.
8	0.	55982.	55982.	0.	0.	51775.	51775.	0.66	4208.	138500.	6375.
9	0.	40418.	40418.	0.	0.	36911.	36911.	0.55	3506.	138500.	6375.
10	0.	25928.	25928.	0.	0.	24908.	24908.	0.16	1020.	138500.	6375.
11	0.	20108.	20108.	0.	0.	17622.	17622.	0.39	2486.	138500.	6375.
12	0.	19997.	19997.	0.	0.	19614.	19614.	0.06	383.	138500.	6375.
TOTAL	85473.	307667.	393140.	0.	0.	375672.	375672.		17468.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19898.	19898.	0.	0.	19983.	19983.	-0.11	-86.	8760.	780.
2	0.	47070.	47070.	0.	0.	47125.	47125.	-0.07	-55.	8760.	780.
3	0.	22718.	22718.	0.	0.	22648.	22648.	0.09	70.	8760.	780.
4	0.	57603.	57603.	0.	0.	57821.	57821.	-0.28	-218.	8760.	780.
5	0.	14502.	14502.	0.	0.	14275.	14275.	0.29	226.	8760.	780.
6	0.	17439.	17439.	0.	0.	17190.	17190.	0.32	250.	8760.	780.
7	0.	45612.	45612.	0.	0.	45090.	45090.	0.67	523.	8760.	780.
8	0.	51775.	51775.	0.	0.	51268.	51268.	0.65	507.	8760.	780.
9	0.	36911.	36911.	0.	0.	36475.	36475.	0.56	437.	8760.	780.
10	0.	24908.	24908.	0.	0.	24791.	24791.	0.15	117.	8760.	780.
11	0.	17622.	17622.	0.	0.	17310.	17310.	0.40	312.	8760.	780.
12	0.	19614.	19614.	0.	0.	19575.	19575.	0.05	39.	8760.	780.
TOTAL	0.	375672.	375672.	0.	0.	373551.	373551.		2122.		

RESE... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1949 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19983.	19983.	0.	21373.	0.	21373.	-0.13	-993.	677121.	7635.
2	3319.	47125.	50444.	0.	20482.	0.	20482.	-0.08	-611.	707693.	7633.
3	2537.	22648.	25185.	0.	26271.	0.	26271.	0.11	863.	705744.	7848.
4	12953.	57821.	70774.	0.	35176.	0.	35176.	-0.30	-2350.	743693.	7835.
5	0.	14275.	14275.	0.	47198.	0.	47198.	0.34	2755.	708015.	8103.
6	0.	17190.	17190.	0.	56549.	0.	56549.	0.28	2198.	666458.	7851.
7	0.	45090.	45090.	0.	56104.	0.	56104.	0.57	4308.	651136.	7557.
8	0.	51268.	51268.	0.	62783.	0.	62783.	0.58	4321.	635301.	7449.
9	0.	36475.	36475.	0.	45417.	0.	45417.	0.49	3595.	622763.	7337.
10	0.	24791.	24791.	0.	28942.	0.	28942.	0.05	362.	618249.	7242.
11	0.	17310.	17310.	0.	22709.	0.	22709.	0.36	2594.	610257.	7205.
12	0.	19575.	19575.	0.	22263.	0.	22263.	-0.03	-214.	607783.	7141.
TOTAL	18809.	373551.	392360.	0.	445266.	0.	445266.		16828.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1949 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	278205.	0.	278205.	0.	309883.	0.	309883.	50283.
2	0.	309883.	309883.	0.	0.	307667.	307667.	2216.
3	85473.	307667.	393140.	0.	0.	375672.	375672.	17468.
4	0.	375672.	375672.	0.	0.	373551.	373551.	2122.
5	18809.	373551.	392360.	0.	445266.	0.	445266.	16828.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1950 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	3375.	0.	3375.	0.	19235.	0.	19235.	0.08	1190.	488761.	14878.
2	18927.	0.	18927.	0.	18434.	0.	18434.	-0.07	-1030.	490284.	14715.
3	0.	0.	0.	0.	23644.	0.	23644.	0.36	5201.	461439.	14448.
4	12178.	0.	12178.	0.	31658.	0.	31658.	-0.03	-420.	442379.	14012.
5	5966.	0.	5966.	0.	42478.	0.	42478.	0.13	1754.	404113.	13490.
6	3750.	0.	3750.	0.	50894.	0.	50894.	0.36	4562.	352407.	12672.
7	1426.	0.	1426.	0.	50493.	0.	50493.	0.64	7397.	295943.	11558.
8	0.	0.	0.	0.	56504.	0.	56504.	0.85	8748.	230691.	10292.
9	1426.	0.	1426.	0.	40875.	0.	40875.	0.35	3104.	188137.	8869.
10	0.	0.	0.	0.	26048.	0.	26048.	0.52	4106.	157983.	7896.
11	0.	0.	0.	0.	20438.	0.	20438.	0.49	3514.	134031.	7172.
12	0.	0.	0.	0.	7792.	0.	7792.	0.32	2112.	124127.	6601.
TOTAL	47048.	0.	47048.	0.	388495.	0.	388495.		40239.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION.	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19171.	19171.	0.08	64.	17540.	803.
2	0.	18434.	18434.	0.	0.	18490.	18490.	-0.07	-56.	17540.	803.
3	0.	23644.	23644.	0.	0.	23363.	23363.	0.35	281.	17540.	803.
4	0.	31658.	31658.	0.	0.	31683.	31683.	-0.03	-24.	17540.	803.
5	0.	42478.	42478.	0.	0.	42374.	42374.	0.13	104.	17540.	803.
6	0.	50894.	50894.	0.	0.	50605.	50605.	0.36	289.	17540.	803.
7	0.	50493.	50493.	0.	0.	49971.	49971.	0.65	522.	17540.	803.
8	0.	56504.	56504.	0.	0.	55822.	55822.	0.85	683.	17540.	803.
9	0.	40875.	40875.	0.	0.	40594.	40594.	0.35	281.	17540.	803.
10	0.	26048.	26048.	0.	0.	25631.	25631.	0.52	418.	17540.	803.
11	0.	20438.	20438.	0.	0.	20044.	20044.	0.49	393.	17540.	803.
12	0.	7792.	7792.	0.	0.	7535.	7535.	0.32	257.	17540.	803.
TOTAL	0.	388495.	388495.	0.	0.	385283.	385283.		3212.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1950 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19171.	19171.	0.	0.	18534.	18534.	0.10	638.	138500.	6375.
2	4566.	18490.	23056.	0.	0.	23566.	23566.	-0.08	-510.	138500.	6375.
3	0.	23363.	23363.	0.	0.	21195.	21195.	0.34	2168.	138500.	6375.
4	5066.	31683.	36749.	0.	0.	36940.	36940.	-0.03	-191.	138500.	6375.
5	0.	42374.	42374.	0.	0.	41545.	41545.	0.13	829.	138500.	6375.
6	0.	50605.	50605.	0.	0.	48182.	48182.	0.38	2423.	138500.	6375.
7	0.	49971.	49971.	0.	0.	45636.	45636.	0.68	4335.	138500.	6375.
8	0.	55822.	55822.	0.	0.	50403.	50403.	0.85	5419.	138500.	6375.
9	0.	40594.	40594.	0.	0.	38299.	38299.	0.36	2295.	138500.	6375.
10	0.	25631.	25631.	0.	0.	22379.	22379.	0.51	3251.	138500.	6375.
11	0.	20044.	20044.	0.	0.	16984.	16984.	0.48	3060.	138500.	6375.
12	0.	7535.	7535.	0.	0.	5495.	5495.	0.32	2040.	138500.	6375.
TOTAL	9632.	385283.	394915.	0.	0.	369160.	369160.		25755.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	18534.	18534.	0.	0.	18464.	18464.	0.09	70.	8760.	780.
2	0.	23566.	23566.	0.	0.	23629.	23629.	-0.08	-62.	8760.	780.
3	0.	21195.	21195.	0.	0.	20922.	20922.	0.35	273.	8760.	780.
4	0.	36940.	36940.	0.	0.	36963.	36963.	-0.03	-23.	8760.	780.
5	0.	41545.	41545.	0.	0.	41444.	41444.	0.13	101.	8760.	780.
6	0.	48182.	48182.	0.	0.	47902.	47902.	0.36	281.	8760.	780.
7	0.	45636.	45636.	0.	0.	45121.	45121.	0.66	515.	8760.	780.
8	0.	50403.	50403.	0.	0.	49740.	49740.	0.85	663.	8760.	780.
9	0.	38299.	38299.	0.	0.	38026.	38026.	0.35	273.	8760.	780.
10	0.	22379.	22379.	0.	0.	21981.	21981.	0.51	398.	8760.	780.
11	0.	16984.	16984.	0.	0.	16610.	16610.	0.48	374.	8760.	780.
12	0.	5495.	5495.	0.	0.	5246.	5246.	0.32	250.	8760.	780.
TOTAL	0.	369160.	369160.	0.	0.	366047.	366047.		3112.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1950 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	18464.	18464.	0.	21373.	0.	21373.	0.10	712.	604162.	7121.
2	787.	23629.	24416.	0.	20482.	0.	20482.	-0.02	-142.	608237.	7091.
3	0.	20922.	20922.	0.	26271.	0.	26271.	0.30	2137.	600751.	7124.
4	543.	36963.	37506.	0.	35176.	0.	35176.	-0.03	-212.	603293.	7064.
5	0.	41444.	41444.	0.	47198.	0.	47198.	0.17	1204.	596335.	7084.
6	0.	47902.	47902.	0.	56549.	0.	56549.	0.29	2038.	585649.	7028.
7	0.	45121.	45121.	0.	56104.	0.	56104.	0.61	4234.	570433.	6942.
8	0.	49740.	49740.	0.	62783.	0.	62783.	0.77	5251.	552140.	6819.
9	0.	38026.	38026.	0.	45417.	0.	45417.	0.32	2135.	542614.	6671.
10	0.	21981.	21981.	0.	28942.	0.	28942.	0.46	3033.	532620.	6594.
11	0.	16610.	16610.	0.	22709.	0.	22709.	0.42	2736.	523786.	6513.
12	0.	5246.	5246.	0.	22263.	0.	22263.	0.30	1933.	504835.	6442.
TOTAL	1330.	366047.	367377.	0.	445266.	0.	445266.		25059.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1950 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	47048.	0.	47048.	0.	388495.	0.	388495.	40239.
2	0.	388495.	388495.	0.	0.	385283.	385283.	3212.
3	9632.	385283.	394915.	0.	0.	369160.	369160.	25755.
4	0.	369160.	369160.	0.	0.	366047.	366047.	3112.
5	1330.	366047.	367377.	0.	445266.	0.	445266.	25059.

RESERVO OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1951 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	7480.	0.	7480.	0.28	1754.	114893.	6263.
2	0.	0.	0.	0.	7169.	0.	7169.	0.01	60.	107664.	5972.
3	2493.	0.	2493.	0.	9195.	0.	9195.	0.24	1369.	99594.	5702.
4	0.	0.	0.	0.	12312.	0.	12312.	0.27	1434.	85848.	5311.
5	19352.	0.	19352.	0.	16519.	0.	16519.	0.07	355.	88326.	5073.
6	54342.	0.	54342.	0.	19792.	0.	19792.	0.30	1722.	121153.	5741.
7	0.	0.	0.	0.	19636.	0.	19636.	0.83	4887.	96630.	5888.
8	0.	0.	0.	0.	21974.	0.	21974.	0.97	4764.	69892.	4911.
9	514.	0.	514.	0.	15896.	0.	15896.	0.46	1833.	52678.	3984.
10	0.	0.	0.	0.	10130.	0.	10130.	0.50	1686.	40862.	3371.
11	0.	0.	0.	0.	2754.	0.	2754.	0.33	985.	37124.	2984.
12	0.	0.	0.	0.	2228.	0.	2228.	0.28	778.	34117.	2780.
TOTAL	76701.	0.	76701.	0.	145085.	0.	145085.		21626.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7480.	7480.	0.	0.	7256.	7256.	0.28	225.	17540.	803.
2	0.	7169.	7169.	0.	0.	7161.	7161.	0.01	8.	17540.	803.
3	0.	9195.	9195.	0.	0.	9010.	9010.	0.23	185.	17540.	803.
4	0.	12312.	12312.	0.	0.	12103.	12103.	0.26	209.	17540.	803.
5	0.	16519.	16519.	0.	0.	16463.	16463.	0.07	56.	17540.	803.
6	0.	19792.	19792.	0.	0.	19535.	19535.	0.32	257.	17540.	803.
7	0.	19636.	19636.	0.	0.	18970.	18970.	0.83	666.	17540.	803.
8	0.	21974.	21974.	0.	0.	21203.	21203.	0.96	771.	17540.	803.
9	0.	15896.	15896.	0.	0.	15527.	15527.	0.46	369.	17540.	803.
10	0.	10130.	10130.	0.	0.	9728.	9728.	0.50	402.	17540.	803.
11	0.	2754.	2754.	0.	2489.	0.	2489.	0.33	265.	17540.	803.
12	0.	2228.	2228.	0.	2003.	0.	2003.	0.28	225.	17540.	803.
TOTAL	0.	145085.	145085.	0.	4492.	136955.	141447.		3638.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1951 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7256.	7256.	0.	0.	5471.	5471.	0.28	1785.	138500.	6375.
2	0.	7161.	7161.	0.	0.	7161.	7161.	0.00	0.	138500.	6375.
3	0.	9010.	9010.	0.	0.	7671.	7671.	0.21	1339.	138500.	6375.
4	0.	12103.	12103.	0.	0.	10509.	10509.	0.25	1594.	138500.	6375.
5	0.	16463.	16463.	0.	0.	16144.	16144.	0.05	319.	138500.	6375.
6	0.	19535.	19535.	0.	0.	17176.	17176.	0.37	2359.	138500.	6375.
7	0.	18970.	18970.	0.	0.	13551.	13551.	0.85	5419.	138500.	6375.
8	0.	21203.	21203.	0.	0.	15147.	15147.	0.95	6056.	138500.	6375.
9	864.	15527.	16391.	0.	0.	13394.	13394.	0.47	2996.	138500.	6375.
10	0.	9728.	9728.	0.	0.	6286.	6286.	0.54	3443.	138500.	6375.
11	0.	2489.	2489.	0.	257.	0.	257.	0.35	2231.	138500.	6375.
12	0.	2003.	2003.	0.	218.	0.	218.	0.28	1785.	138500.	6375.
TOTAL	864.	141447.	142311.	0.	476.	112510.	112986.		29325.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	5471.	5471.	0.	0.	5252.	5252.	0.28	218.	8760.	780.
2	0.	7161.	7161.	0.	0.	7161.	7161.	0.00	0.	8760.	780.
3	0.	7671.	7671.	0.	0.	7500.	7500.	0.22	172.	8760.	780.
4	0.	10509.	10509.	0.	0.	10306.	10306.	0.26	203.	8760.	780.
5	0.	16144.	16144.	0.	0.	16098.	16098.	0.06	47.	8760.	780.
6	0.	17176.	17176.	0.	0.	16911.	16911.	0.34	265.	8760.	780.
7	0.	13551.	13551.	0.	0.	12896.	12896.	0.84	655.	8760.	780.
8	0.	15147.	15147.	0.	0.	14398.	14398.	0.96	749.	8760.	780.
9	0.	13394.	13394.	0.	0.	13036.	13036.	0.46	359.	8760.	780.
10	0.	6286.	6286.	0.	0.	5888.	5888.	0.51	398.	8760.	780.
11	0.	257.	257.	0.	0.	0.	0.	0.33	257.	8760.	780.
12	0.	218.	218.	0.	0.	0.	0.	0.28	218.	8760.	780.
TOTAL	0.	112986.	112986.	0.	0.	109445.	109445.		3541.		

RESERVC OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1951 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	5252.	5252.	0.	21373.	0.	21373.	0.28	1761.	486954.	6289.
2	0.	7161.	7161.	0.	20482.	0.	20482.	-0.02	-123.	473755.	6125.
3	0.	7500.	7500.	0.	26271.	0.	26271.	0.19	1140.	453844.	5999.
4	0.	10306.	10306.	0.	35176.	0.	35176.	0.30	1743.	427231.	5809.
5	0.	16098.	16098.	0.	47198.	0.	47198.	0.08	444.	395686.	5555.
6	0.	16911.	16911.	0.	56549.	0.	56549.	0.31	1629.	354420.	5254.
7	0.	12896.	12896.	0.	56104.	0.	56104.	0.79	3806.	307406.	4818.
8	0.	14398.	14398.	0.	62783.	0.	62783.	0.90	3882.	255139.	4313.
9	339.	13036.	13375.	0.	45417.	0.	45417.	0.37	1388.	221708.	3752.
10	0.	5888.	5888.	0.	28942.	0.	28942.	0.46	1561.	197093.	3393.
11	0.	0.	0.	0.	22709.	0.	22709.	0.25	767.	173617.	3070.
12	0.	0.	0.	0.	22263.	0.	22263.	0.23	634.	150720.	2757.
TOTAL	339.	109445.	109784.	0.	445266.	0.	445266.		18633.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1951 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	76701.	0.	76701.	0.	145085.	0.	145085.	21626.
2	0.	145085.	145085.	0.	4492.	136955.	141447.	3638.
3	864.	141447.	142311.	0.	476.	112510.	112986.	29325.
4	0.	112986.	112986.	0.	0.	109445.	109445.	3541.
5	339.	109445.	109784.	0.	445266.	0.	445266.	18633.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1952 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	1910.	0.	1910.	0.24	627.	31581.	2612.
2	0.	0.	0.	0.	1735.	0.	1735.	0.21	518.	29327.	2469.
3	0.	0.	0.	0.	1417.	0.	1417.	0.17	400.	27510.	2355.
4	30133.	0.	30133.	0.	0.	0.	0.	-0.03	-96.	57739.	3196.
5	120077.	0.	120077.	0.	16519.	0.	16519.	0.04	236.	161060.	5906.
6	2058.	0.	2058.	0.	50894.	0.	50894.	0.48	3269.	108956.	6810.
7	0.	0.	0.	0.	31619.	0.	31619.	0.62	3261.	74076.	5260.
8	0.	0.	0.	0.	71107.	0.	71107.	1.03	2952.	17.	2866.
9	198122.	0.	198122.	0.	153.	0.	153.	0.23	1269.	196718.	5516.
10	0.	0.	0.	0.	26048.	0.	26048.	0.70	5673.	164996.	8105.
11	18007.	0.	18007.	0.	20438.	0.	20438.	0.03	229.	162336.	7645.
12	5495.	0.	5495.	0.	20037.	0.	20037.	-0.11	-817.	148611.	7426.
TOTAL	373892.	0.	373892.	0.	241876.	0.	241876.		17523.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	1910.	1910.	0.	1717.	0.	1717.	0.24	193.	17540.	803.
2	0.	1735.	1735.	0.	1566.	0.	1566.	0.21	169.	17540.	803.
3	0.	1417.	1417.	0.	1280.	0.	1280.	0.17	137.	17540.	803.
4	0.	0.	0.	0.	0.	24.	24.	-0.03	-24.	17540.	803.
5	0.	16519.	16519.	0.	0.	16487.	16487.	0.04	32.	17540.	803.
6	0.	50894.	50894.	0.	0.	50508.	50508.	0.48	385.	17540.	803.
7	0.	31619.	31619.	0.	31129.	0.	31129.	0.61	490.	17540.	803.
8	0.	71107.	71107.	0.	70280.	0.	70280.	1.03	827.	17540.	803.
9	0.	153.	153.	0.	0.	0.	0.	0.19	153.	17540.	803.
10	0.	26048.	26048.	0.	0.	25494.	25494.	0.69	554.	17540.	803.
11	0.	20438.	20438.	0.	0.	20406.	20406.	0.04	32.	17540.	803.
12	0.	20037.	20037.	0.	0.	20133.	20133.	-0.12	-96.	17540.	803.
TOTAL	0.	241876.	241876.	0.	105972.	133053.	239025.		2851.		

RESER... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1952 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	1717.	1717.	0.	187.	0.	187.	0.24	1530.	138500.	6375.
2	0.	1566.	1566.	0.	164.	0.	164.	0.22	1403.	138500.	6375.
3	0.	1280.	1280.	0.	133.	0.	133.	0.18	1148.	138500.	6375.
4	18491.	24.	18515.	0.	0.	18770.	18770.	-0.04	-255.	138500.	6375.
5	0.	16487.	16487.	0.	0.	16169.	16169.	0.05	319.	138500.	6375.
6	0.	50508.	50508.	0.	0.	47576.	47576.	0.46	2933.	138500.	6375.
7	0.	31129.	31129.	0.	27368.	0.	27368.	0.59	3761.	138500.	6375.
8	0.	70280.	70280.	0.	63586.	0.	63586.	1.05	6694.	138500.	6375.
9	274498.	0.	274498.	0.	0.	274307.	274307.	0.03	191.	138500.	6375.
10	0.	25494.	25494.	0.	0.	21350.	21350.	0.65	4144.	138500.	6375.
11	0.	20406.	20406.	0.	0.	19896.	19896.	0.08	510.	138500.	6375.
12	66467.	20133.	86600.	0.	0.	87429.	87429.	-0.13	-829.	138500.	6375.
TOTAL	359456.	239025.	598481.	0.	91437.	485496.	576934.		21548.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	187.	187.	0.	0.	0.	0.	0.24	187.	8760.	780.
2	0.	164.	164.	0.	0.	0.	0.	0.21	164.	8760.	780.
3	0.	133.	133.	0.	0.	0.	0.	0.17	133.	8760.	780.
4	0.	18770.	18770.	0.	0.	18801.	18801.	-0.04	-31.	8760.	780.
5	0.	16169.	16169.	0.	0.	16130.	16130.	0.05	39.	8760.	780.
6	0.	47576.	47576.	0.	0.	47209.	47209.	0.47	367.	8760.	780.
7	0.	27368.	27368.	0.	26900.	0.	26900.	0.60	468.	8760.	780.
8	0.	63586.	63586.	0.	62783.	0.	62783.	1.03	803.	8760.	780.
9	0.	274307.	274307.	0.	0.	274198.	274198.	0.14	109.	8760.	780.
10	0.	21350.	21350.	0.	0.	20828.	20828.	0.67	523.	8760.	780.
11	0.	19896.	19896.	0.	0.	19857.	19857.	0.05	39.	8760.	780.
12	0.	87429.	87429.	0.	0.	87523.	87523.	-0.12	-94.	8760.	780.
TOTAL	0.	576934.	576934.	0.	89682.	484545.	574227.		2707.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1952 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	21373.	0.	21373.	0.22	539.	128808.	2451.
2	0.	0.	0.	0.	20482.	0.	20482.	0.14	302.	108023.	2159.
3	0.	0.	0.	0.	26271.	0.	26271.	0.16	301.	81452.	1882.
4	5618.	18801.	24419.	0.	35176.	0.	35176.	0.03	46.	70649.	1528.
5	0.	16130.	16130.	0.	47198.	0.	47198.	0.11	152.	39428.	1384.
6	0.	47209.	47209.	0.	56549.	0.	56549.	0.44	423.	29666.	961.
7	0.	26900.	26900.	0.	56104.	0.	56104.	0.56	462.	0.	825.
8	0.	62783.	62783.	0.	62783.	0.	62783.	0.94	0.	0.	0.
9	446671.	274198.	720869.	0.	45417.	0.	45417.	0.09	0.	675451.	0.
10	0.	20828.	20828.	0.	28942.	0.	28942.	0.59	4496.	662840.	7621.
11	0.	19857.	19857.	0.	22709.	0.	22709.	-0.02	-151.	660139.	7532.
12	35000.	87523.	122523.	0.	22263.	0.	22263.	-0.12	-902.	761300.	7513.
TOTAL	487289.	574227.	1061516.	0.	445266.	0.	445266.		5670.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1952 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	373892.	0.	373892.	0.	241876.	0.	241876.	17523.
2	0.	241876.	241876.	0.	105972.	133053.	239025.	2851.
3	359456.	239025.	598481.	0.	91437.	485496.	576934.	21548.
4	0.	576934.	576934.	0.	89682.	484545.	574227.	2707.
5	487289.	574227.	1061516.	0.	445266.	0.	445266.	5670.

RESER... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1953 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	23219.	0.	23219.	0.	7480.	0.	7480.	0.26	1931.	162419.	7427.
2	3274.	0.	3274.	0.	7169.	0.	7169.	0.11	830.	157694.	7548.
3	35555.	0.	35555.	0.	9195.	0.	9195.	0.12	939.	183115.	7825.
4	8037.	0.	8037.	0.	12312.	0.	12312.	0.13	1052.	177788.	8094.
5	104679.	0.	104679.	0.	16519.	0.	16519.	0.11	1011.	264937.	9189.
6	0.	0.	0.	0.	19792.	0.	19792.	0.71	7096.	238049.	9995.
7	0.	0.	0.	0.	50493.	0.	50493.	0.70	6213.	181342.	8876.
8	2350.	0.	2350.	0.	56504.	0.	56504.	0.63	4619.	122569.	7331.
9	2082.	0.	2082.	0.	15896.	0.	15896.	0.44	2675.	106080.	6080.
10	58130.	0.	58130.	0.	10130.	0.	10130.	0.12	795.	153285.	6622.
11	149.	0.	149.	0.	20438.	0.	20438.	0.28	1978.	131019.	7063.
12	75.	0.	75.	0.	7792.	0.	7792.	0.17	1107.	122195.	6514.
TOTAL	237550.	0.	237550.	0.	233720.	0.	233720.		30246.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7480.	7480.	0.	0.	7280.	7280.	0.25	201.	17540.	803.
2	0.	7169.	7169.	0.	0.	7080.	7080.	0.11	88.	17540.	803.
3	0.	9195.	9195.	0.	0.	9090.	9090.	0.13	104.	17540.	803.
4	0.	12312.	12312.	0.	0.	12207.	12207.	0.13	104.	17540.	803.
5	0.	16519.	16519.	0.	0.	16431.	16431.	0.11	88.	17540.	803.
6	0.	19792.	19792.	0.	0.	19222.	19222.	0.71	570.	17540.	803.
7	0.	50493.	50493.	0.	0.	49923.	49923.	0.71	570.	17540.	803.
8	0.	56504.	56504.	0.	0.	55998.	55998.	0.63	506.	17540.	803.
9	0.	15896.	15896.	0.	0.	15551.	15551.	0.43	345.	17540.	803.
10	0.	10130.	10130.	0.	0.	10033.	10033.	0.12	96.	17540.	803.
11	0.	20438.	20438.	0.	0.	20205.	20205.	0.29	233.	17540.	803.
12	0.	7792.	7792.	0.	0.	7656.	7656.	0.17	137.	17540.	803.
TOTAL	0.	233720.	233720.	0.	0.	230677.	230677.		3043.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1953 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	13952.	7280.	21232.	0.	0.	19702.	19702.	0.24	1530.	138500.	6375.
2	0.	7080.	7080.	0.	0.	6443.	6443.	0.10	638.	138500.	6375.
3	297.	9090.	9387.	0.	0.	8495.	8495.	0.14	893.	138500.	6375.
4	1227.	12207.	13434.	0.	0.	12669.	12669.	0.12	765.	138500.	6375.
5	22122.	16431.	38553.	0.	0.	37661.	37661.	0.14	893.	138500.	6375.
6	0.	19222.	19222.	0.	0.	14568.	14568.	0.73	4654.	138500.	6375.
7	0.	49923.	49923.	0.	0.	45206.	45206.	0.74	4718.	138500.	6375.
8	0.	55998.	55998.	0.	0.	51982.	51982.	0.63	4016.	138500.	6375.
9	0.	15551.	15551.	0.	0.	13001.	13001.	0.40	2550.	138500.	6375.
10	8258.	10033.	18291.	0.	0.	17335.	17335.	0.15	956.	138500.	6375.
11	0.	20205.	20205.	0.	0.	18229.	18229.	0.31	1976.	138500.	6375.
12	0.	7656.	7656.	0.	0.	6444.	6444.	0.19	1211.	138500.	6375.
TOTAL	45856.	230677.	276533.	0.	0.	251734.	251734.		24799.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19702.	19702.	0.	0.	19507.	19507.	0.25	195.	8760.	780.
2	0.	6443.	6443.	0.	0.	6365.	6365.	0.10	78.	8760.	780.
3	0.	8495.	8495.	0.	0.	8393.	8393.	0.13	101.	8760.	780.
4	0.	12669.	12669.	0.	0.	12576.	12576.	0.12	94.	8760.	780.
5	0.	37661.	37661.	0.	0.	37567.	37567.	0.12	94.	8760.	780.
6	0.	14568.	14568.	0.	0.	14014.	14014.	0.71	554.	8760.	780.
7	0.	45206.	45206.	0.	0.	44644.	44644.	0.72	562.	8760.	780.
8	0.	51982.	51982.	0.	0.	51499.	51499.	0.62	484.	8760.	780.
9	0.	13001.	13001.	0.	0.	12681.	12681.	0.41	320.	8760.	780.
10	0.	17335.	17335.	0.	0.	17242.	17242.	0.12	94.	8760.	780.
11	0.	18229.	18229.	0.	0.	18002.	18002.	0.29	226.	8760.	780.
12	0.	6444.	6444.	0.	0.	6312.	6312.	0.17	133.	8760.	780.
TOTAL	0.	251734.	251734.	0.	0.	248801.	248801.		2933.		

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1953 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	6832.	19507.	26339.	0.	21373.	0.	21373.	0.25	2057.	764209.	8227.
2	0.	6365.	6365.	0.	20482.	0.	20482.	0.06	495.	749597.	8247.
3	254.	8393.	8647.	0.	26271.	0.	26271.	0.16	1303.	730671.	8144.
4	2176.	12576.	14752.	0.	35176.	0.	35176.	0.10	801.	709445.	8011.
5	1938.	37567.	39505.	0.	47198.	0.	47198.	0.21	1651.	700101.	7861.
6	0.	14014.	14014.	0.	56549.	0.	56549.	0.67	5223.	652344.	7795.
7	0.	44644.	44644.	0.	56104.	0.	56104.	0.76	5668.	635217.	7458.
8	0.	51499.	51499.	0.	62783.	0.	62783.	0.53	3889.	620045.	7337.
9	0.	12681.	12681.	0.	45417.	0.	45417.	0.37	2671.	584637.	7220.
10	5572.	17242.	22814.	0.	28942.	0.	28942.	0.04	277.	578231.	6934.
11	0.	18002.	18002.	0.	22709.	0.	22709.	0.24	1652.	571873.	6882.
12	0.	6312.	6312.	0.	22263.	0.	22263.	0.08	546.	555375.	6831.
TOTAL	16772.	248801.	265573.	0.	445266.	0.	445266.		26232.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1953 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	237550.	0.	237550.	0.	233720.	0.	233720.	30246.
2	0.	233720.	233720.	0.	0.	230677.	230677.	3043.
3	45856.	230677.	276533.	0.	0.	251734.	251734.	24799.
4	0.	251734.	251734.	0.	0.	248801.	248801.	2933.
5	16772.	248801.	265573.	0.	445266.	0.	445266.	26232.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1954 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	274.	0.	274.	0.	7480.	0.	7480.	0.15	932.	114056.	6214.
2	0.	0.	0.	0.	7169.	0.	7169.	0.32	1891.	104996.	5910.
3	0.	0.	0.	0.	9195.	0.	9195.	0.28	1557.	94244.	5561.
4	0.	0.	0.	0.	12312.	0.	12312.	0.18	917.	81015.	5096.
5	2659.	0.	2659.	0.	16519.	0.	16519.	0.28	1259.	65896.	4498.
6	0.	0.	0.	0.	19792.	0.	19792.	0.66	2448.	43656.	3709.
7	0.	0.	0.	0.	7162.	0.	7162.	0.91	2700.	33793.	2968.
8	0.	0.	0.	0.	7544.	0.	7544.	0.94	2239.	24009.	2382.
9	0.	0.	0.	0.	5833.	0.	5833.	0.75	1428.	16748.	1904.
10	589.	0.	589.	0.	3899.	0.	3899.	0.49	748.	12689.	1527.
11	2023.	0.	2023.	0.	225.	0.	225.	0.27	385.	14103.	1424.
12	0.	0.	0.	0.	2547.	0.	2547.	0.32	436.	11120.	1363.
TOTAL	5545.	0.	5545.	0.	99678.	0.	99678.		16942.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7480.	7480.	0.	0.	7360.	7360.	0.15	120.	17540.	803.
2	0.	7169.	7169.	0.	0.	6920.	6920.	0.31	249.	17540.	803.
3	0.	9195.	9195.	0.	0.	8978.	8978.	0.27	217.	17540.	803.
4	0.	12312.	12312.	0.	0.	12167.	12167.	0.18	145.	17540.	803.
5	0.	16519.	16519.	0.	0.	16295.	16295.	0.28	225.	17540.	803.
6	0.	19792.	19792.	0.	0.	19262.	19262.	0.66	530.	17540.	803.
7	0.	7162.	7162.	0.	6432.	0.	6432.	0.91	731.	17540.	803.
8	0.	7544.	7544.	0.	6789.	0.	6789.	0.94	755.	17540.	803.
9	0.	5833.	5833.	0.	5231.	0.	5231.	0.75	602.	17540.	803.
10	0.	3899.	3899.	0.	3506.	0.	3506.	0.49	393.	17540.	803.
11	0.	225.	225.	0.	0.	0.	0.	0.28	225.	17540.	803.
12	0.	2547.	2547.	0.	2290.	0.	2290.	0.32	257.	17540.	803.
TOTAL	0.	99678.	99678.	0.	24248.	70981.	95229.		4449.		

RESER OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1954 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	7360.	7360.	0.	0.	6404.	6404.	0.15	956.	138500.	6375.
2	0.	6920.	6920.	0.	0.	5007.	5007.	0.30	1913.	138500.	6375.
3	0.	8978.	8978.	0.	0.	7320.	7320.	0.26	1658.	138500.	6375.
4	0.	12167.	12167.	0.	0.	11083.	11083.	0.17	1084.	138500.	6375.
5	0.	16295.	16295.	0.	0.	14573.	14573.	0.27	1721.	138500.	6375.
6	0.	19262.	19262.	0.	0.	15055.	15055.	0.66	4208.	138500.	6375.
7	0.	6432.	6432.	0.	694.	0.	694.	0.90	5738.	138500.	6375.
8	0.	6789.	6789.	0.	733.	0.	733.	0.95	6056.	138500.	6375.
9	0.	5231.	5231.	0.	577.	0.	577.	0.73	4654.	138500.	6375.
10	0.	3506.	3506.	0.	382.	0.	382.	0.49	3124.	138500.	6375.
11	7294.	0.	7294.	0.	0.	5445.	5445.	0.29	1849.	138500.	6375.
12	0.	2290.	2290.	0.	250.	0.	250.	0.32	2040.	138500.	6375.
TOTAL	7294.	95229.	102523.	0.	2636.	64888.	67524.		34999.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	6404.	6404.	0.	0.	6287.	6287.	0.15	117.	8760.	780.
2	0.	5007.	5007.	0.	0.	4773.	4773.	0.30	234.	8760.	780.
3	0.	7320.	7320.	0.	0.	7110.	7110.	0.27	211.	8760.	780.
4	0.	11083.	11083.	0.	0.	10951.	10951.	0.17	133.	8760.	780.
5	0.	14573.	14573.	0.	0.	14355.	14355.	0.28	218.	8760.	780.
6	0.	15055.	15055.	0.	0.	14540.	14540.	0.66	515.	8760.	780.
7	0.	694.	694.	0.	0.	0.	0.	0.89	694.	8760.	780.
8	0.	733.	733.	0.	0.	0.	0.	0.94	733.	8760.	780.
9	0.	577.	577.	0.	0.	0.	0.	0.74	577.	8760.	780.
10	0.	382.	382.	0.	0.	0.	0.	0.49	382.	8760.	780.
11	0.	5445.	5445.	0.	0.	5227.	5227.	0.28	218.	8760.	780.
12	0.	250.	250.	0.	0.	0.	0.	0.32	250.	8760.	780.
TOTAL	0.	67524.	67524.	0.	0.	63242.	63242.		4282.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1954 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	6287.	6287.	0.	21373.	0.	21373.	0.14	938.	539352.	6697.
2	0.	4773.	4773.	0.	20482.	0.	20482.	0.29	1905.	521738.	6568.
3	0.	7110.	7110.	0.	26271.	0.	26271.	0.30	1928.	500649.	6426.
4	0.	10951.	10951.	0.	35176.	0.	35176.	0.18	1126.	475298.	6255.
5	0.	14355.	14355.	0.	47198.	0.	47198.	0.31	1864.	440590.	6014.
6	0.	14540.	14540.	0.	56549.	0.	56549.	0.63	3580.	395001.	5683.
7	0.	0.	0.	0.	56104.	0.	56104.	0.79	4146.	334752.	5248.
8	0.	0.	0.	0.	62783.	0.	62783.	0.85	3916.	268054.	4607.
9	0.	0.	0.	0.	45417.	0.	45417.	0.71	2763.	219874.	3891.
10	0.	0.	0.	0.	28942.	0.	28942.	0.44	1484.	189447.	3373.
11	3364.	5227.	8591.	0.	22709.	0.	22709.	0.29	861.	174469.	2968.
12	0.	0.	0.	0.	22263.	0.	22263.	0.30	830.	151375.	2768.
TOTAL	3364.	63242.	66606.	0.	445266.	0.	445266.		25340.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1954 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	5545.	0.	5545.	0.	99678.	0.	99678.	16942.
2	0.	99678.	99678.	0.	24248.	70981.	95229.	4449.
3	7294.	95229.	102523.	0.	2636.	64888.	67524.	34999.
4	0.	67524.	67524.	0.	0.	63242.	63242.	4282.
5	3364.	63242.	66606.	0.	445266.	0.	445266.	25340.

RESERVO OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1955 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	1854.	0.	1854.	0.	637.	0.	637.	0.08	103.	12234.	1290.
2	10880.	0.	10880.	0.	0.	0.	0.	0.00	0.	23114.	1753.
3	0.	0.	0.	0.	2292.	0.	2292.	0.27	534.	20288.	1978.
4	51.	0.	51.	0.	2435.	0.	2435.	0.29	527.	17377.	1818.
5	275906.	0.	275906.	0.	104.	0.	104.	0.12	889.	292289.	7408.
6	103974.	0.	103974.	0.	50894.	0.	50894.	0.31	3537.	341832.	11410.
7	63065.	0.	63065.	0.	50493.	0.	50493.	0.65	7784.	346621.	11975.
8	0.	0.	0.	0.	56504.	0.	56504.	0.47	5349.	284767.	11381.
9	129968.	0.	129968.	0.	40875.	0.	40875.	0.41	4762.	369097.	11615.
10	7226.	0.	7226.	0.	26048.	0.	26048.	0.63	7696.	342579.	12216.
11	0.	0.	0.	0.	20438.	0.	20438.	0.46	5369.	316772.	11672.
12	0.	0.	0.	0.	20037.	0.	20037.	0.21	2346.	294389.	11171.
TOTAL	592924.	0.	592924.	0.	270758.	0.	270758.		38897.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	637.	637.	0.	572.	0.	572.	0.08	64.	17540.	803.
2	0.	0.	0.	0.	0.	0.	0.	0.00	0.	17540.	803.
3	0.	2292.	2292.	0.	2067.	0.	2067.	0.28	225.	17540.	803.
4	0.	2435.	2435.	0.	2202.	0.	2202.	0.29	233.	17540.	803.
5	0.	104.	104.	0.	0.	0.	0.	0.13	104.	17540.	803.
6	0.	50894.	50894.	0.	0.	50645.	50645.	0.31	249.	17540.	803.
7	0.	50493.	50493.	0.	0.	49963.	49963.	0.66	530.	17540.	803.
8	0.	56504.	56504.	0.	0.	56119.	56119.	0.48	385.	17540.	803.
9	0.	40875.	40875.	0.	0.	40538.	40538.	0.42	337.	17540.	803.
10	0.	26048.	26048.	0.	0.	25550.	25550.	0.62	498.	17540.	803.
11	0.	20438.	20438.	0.	0.	20068.	20068.	0.46	369.	17540.	803.
12	0.	20037.	20037.	0.	0.	19876.	19876.	0.20	161.	17540.	803.
TOTAL	0.	270758.	270758.	0.	4842.	262760.	267602.		3156.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1955 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	572.	572.	0.	62.	0.	62.	0.08	510.	138500.	6375.
2	3278.	0.	3278.	0.	0.	3214.	3214.	0.01	64.	138500.	6375.
3	0.	2067.	2067.	0.	218.	0.	218.	0.29	1849.	138500.	6375.
4	0.	2202.	2202.	0.	226.	0.	226.	0.31	1976.	138500.	6375.
5	61637.	0.	61637.	0.	0.	60681.	60681.	0.15	956.	138500.	6375.
6	0.	50645.	50645.	0.	0.	48605.	48605.	0.32	2040.	138500.	6375.
7	0.	49963.	49963.	0.	0.	45628.	45628.	0.68	4335.	138500.	6375.
8	0.	56119.	56119.	0.	0.	52931.	52931.	0.50	3188.	138500.	6375.
9	36327.	40538.	76865.	0.	0.	74060.	74060.	0.44	2805.	138500.	6375.
10	0.	25550.	25550.	0.	0.	21661.	21661.	0.61	3889.	138500.	6375.
11	0.	20068.	20068.	0.	0.	17200.	17200.	0.45	2869.	138500.	6375.
12	0.	19876.	19876.	0.	0.	18665.	18665.	0.19	1211.	138500.	6375.
TOTAL	101242.	267602.	368844.	0.	507.	342646.	343153.		25691.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	62.	62.	0.	0.	0.	0.	0.08	62.	8760.	780.
2	0.	3214.	3214.	0.	0.	3214.	3214.	0.00	0.	8760.	780.
3	0.	218.	218.	0.	0.	0.	0.	0.28	218.	8760.	780.
4	0.	226.	226.	0.	0.	0.	0.	0.29	226.	8760.	780.
5	0.	60681.	60681.	0.	0.	60572.	60572.	0.14	109.	8760.	780.
6	0.	48605.	48605.	0.	0.	48363.	48363.	0.31	242.	8760.	780.
7	0.	45628.	45628.	0.	0.	45106.	45106.	0.67	523.	8760.	780.
8	0.	52931.	52931.	0.	0.	52557.	52557.	0.48	374.	8760.	780.
9	0.	74060.	74060.	0.	0.	73725.	73725.	0.43	335.	8760.	780.
10	0.	21661.	21661.	0.	0.	21178.	21178.	0.62	484.	8760.	780.
11	0.	17200.	17200.	0.	0.	16849.	16849.	0.45	351.	8760.	780.
12	0.	18665.	18665.	0.	0.	18517.	18517.	0.19	148.	8760.	780.
TOTAL	0.	343153.	343153.	0.	0.	340080.	340080.		3073.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1955 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	21373.	0.	21373.	0.06	148.	129855.	2460.
2	3998.	3214.	7212.	0.	20482.	0.	20482.	-0.04	-87.	116672.	2173.
3	0.	0.	0.	0.	26271.	0.	26271.	0.25	499.	89902.	1997.
4	0.	0.	0.	0.	35176.	0.	35176.	0.33	541.	54185.	1640.
5	11543.	60572.	72115.	0.	47198.	0.	47198.	0.18	210.	78891.	1164.
6	0.	48363.	48363.	0.	56549.	0.	56549.	0.34	508.	70198.	1494.
7	0.	45106.	45106.	0.	56104.	0.	56104.	0.67	923.	58277.	1378.
8	0.	52557.	52557.	0.	62783.	0.	62783.	0.47	573.	47479.	1219.
9	5934.	73725.	79659.	0.	45417.	0.	45417.	0.49	526.	81194.	1074.
10	0.	21178.	21178.	0.	28942.	0.	28942.	0.61	930.	72500.	1524.
11	0.	16849.	16849.	0.	22709.	0.	22709.	0.38	535.	66105.	1408.
12	0.	18517.	18517.	0.	22263.	0.	22263.	0.17	225.	62133.	1323.
TOTAL	21475.	340080.	361555.	0.	445266.	0.	445266.		5531.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1955 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	592924.	0.	592924.	0.	270758.	0.	270758.	38897.
2	0.	270758.	270758.	0.	4842.	262760.	267602.	3156.
3	101242.	267602.	368844.	0.	507.	342646.	343153.	25691.
4	0.	343153.	343153.	0.	0.	340080.	340080.	3073.
5	21475.	340080.	361555.	0.	445266.	0.	445266.	5531.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1956 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	19235.	0.	19235.	0.14	1501.	273653.	10723.
2	3675.	0.	3675.	0.	18434.	0.	18434.	0.13	1344.	257550.	10339.
3	0.	0.	0.	0.	23644.	0.	23644.	0.43	4207.	229699.	9784.
4	11201.	0.	11201.	0.	31658.	0.	31658.	0.40	3636.	205606.	9089.
5	214530.	0.	214530.	0.	42478.	0.	42478.	0.31	3362.	374295.	10846.
6	0.	0.	0.	0.	50894.	0.	50894.	0.71	8508.	314894.	11982.
7	0.	0.	0.	0.	50493.	0.	50493.	0.96	10303.	254097.	10732.
8	0.	0.	0.	0.	62352.	0.	62352.	0.94	8569.	183176.	9116.
9	0.	0.	0.	0.	51807.	0.	51807.	0.83	6135.	125234.	7392.
10	3560.	0.	3560.	0.	33001.	0.	33001.	0.51	3005.	92788.	5892.
11	1346.	0.	1346.	0.	24847.	0.	24847.	0.35	1674.	67614.	4782.
12	1327.	0.	1327.	0.	23306.	0.	23306.	0.14	529.	45106.	3776.
TOTAL	235639.	0.	235639.	0.	432150.	0.	432150.		52772.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19123.	19123.	0.14	112.	17540.	803.
2	0.	18434.	18434.	0.	0.	18330.	18330.	0.13	104.	17540.	803.
3	0.	23644.	23644.	0.	0.	23298.	23298.	0.43	345.	17540.	803.
4	0.	31658.	31658.	0.	0.	31337.	31337.	0.40	321.	17540.	803.
5	0.	42478.	42478.	0.	0.	42221.	42221.	0.32	257.	17540.	803.
6	0.	50894.	50894.	0.	0.	50324.	50324.	0.71	570.	17540.	803.
7	0.	50493.	50493.	0.	0.	49730.	49730.	0.95	763.	17540.	803.
8	0.	62352.	62352.	0.	61597.	0.	61597.	0.94	755.	17540.	803.
9	0.	51807.	51807.	0.	51149.	0.	51149.	0.82	658.	17540.	803.
10	0.	33001.	33001.	0.	32591.	0.	32591.	0.51	410.	17540.	803.
11	0.	24847.	24847.	0.	24566.	0.	24566.	0.35	281.	17540.	803.
12	0.	23306.	23306.	0.	23193.	0.	23193.	0.14	112.	17540.	803.
TOTAL	0.	432150.	432150.	0.	193097.	234364.	427461.		4690.		

RESE... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1956 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19123.	19123.	0.	0.	18167.	18167.	0.15	956.	138500.	6375.
2	0.	18330.	18330.	0.	0.	17437.	17437.	0.14	893.	138500.	6375.
3	0.	23298.	23298.	0.	0.	20557.	20557.	0.43	2741.	138500.	6375.
4	0.	31337.	31337.	0.	0.	28596.	28596.	0.43	2741.	138500.	6375.
5	0.	42221.	42221.	0.	0.	40118.	40118.	0.33	2104.	138500.	6375.
6	0.	50324.	50324.	0.	0.	45798.	45798.	0.71	4526.	138500.	6375.
7	0.	49730.	49730.	0.	0.	43738.	43738.	0.94	5993.	138500.	6375.
8	0.	61597.	61597.	0.	55605.	0.	55605.	0.94	5993.	138500.	6375.
9	0.	51149.	51149.	0.	46049.	0.	46049.	0.80	5100.	138500.	6375.
10	0.	32591.	32591.	0.	29340.	0.	29340.	0.51	3251.	138500.	6375.
11	675.	24566.	25241.	0.	22946.	0.	22946.	0.36	2295.	138500.	6375.
12	0.	23193.	23193.	0.	22365.	0.	22365.	0.13	829.	138500.	6375.
TOTAL	675.	427461.	428136.	0.	176304.	214410.	390714.		37421.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	18167.	18167.	0.	0.	18058.	18058.	0.14	109.	8760.	780.
2	0.	17437.	17437.	0.	0.	17336.	17336.	0.13	101.	8760.	780.
3	0.	20557.	20557.	0.	0.	20222.	20222.	0.43	335.	8760.	780.
4	0.	28596.	28596.	0.	0.	28276.	28276.	0.41	320.	8760.	780.
5	0.	40118.	40118.	0.	0.	39868.	39868.	0.32	250.	8760.	780.
6	0.	45798.	45798.	0.	0.	45244.	45244.	0.71	554.	8760.	780.
7	0.	43738.	43738.	0.	0.	43005.	43005.	0.94	733.	8760.	780.
8	0.	55605.	55605.	0.	54872.	0.	54872.	0.94	733.	8760.	780.
9	0.	46049.	46049.	0.	45417.	0.	45417.	0.81	632.	8760.	780.
10	0.	29340.	29340.	0.	28942.	0.	28942.	0.51	398.	8760.	780.
11	0.	22946.	22946.	0.	22673.	0.	22673.	0.35	273.	8760.	780.
12	0.	22365.	22365.	0.	22263.	0.	22263.	0.13	101.	8760.	780.
TOTAL	0.	390714.	390714.	0.	174167.	212008.	386175.		4540.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1956 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	18058.	18058.	0.	21373.	0.	21373.	0.13	165.	58653.	1270.
2	0.	17336.	17336.	0.	20482.	0.	20482.	0.13	159.	55348.	1224.
3	0.	20222.	20222.	0.	26271.	0.	26271.	0.38	448.	48850.	1180.
4	0.	28276.	28276.	0.	35176.	0.	35176.	0.39	426.	41524.	1093.
5	0.	39868.	39868.	0.	47198.	0.	47198.	0.34	337.	33857.	991.
6	0.	45244.	45244.	0.	56549.	0.	56549.	0.68	601.	21951.	884.
7	0.	43005.	43005.	0.	56104.	0.	56104.	0.87	624.	8229.	717.
8	0.	54872.	54872.	0.	62783.	0.	62783.	0.86	318.	0.	370.
9	0.	45417.	45417.	0.	45417.	0.	45417.	0.72	0.	0.	0.
10	0.	28942.	28942.	0.	28942.	0.	28942.	0.47	0.	0.	0.
11	36.	22673.	22709.	0.	22709.	0.	22709.	0.33	0.	0.	0.
12	0.	22263.	22263.	0.	22263.	0.	22263.	0.12	0.	0.	0.
TOTAL	36.	386175.	386211.	0.	445266.	0.	445266.		3078.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1956 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	235639.	0.	235639.	0.	432150.	0.	432150.	52772.
2	0.	432150.	432150.	0.	193097.	234364.	427461.	4690.
3	675.	427461.	428136.	0.	176304.	214410.	390714.	37421.
4	0.	390714.	390714.	0.	174167.	212008.	386175.	4540.
5	36.	386175.	386211.	0.	445266.	0.	445266.	3078.

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1957 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	0.	0.	0.	22503.	0.	22503.	0.16	426.	22178.	2660.
2	363.	0.	363.	0.	20801.	0.	20801.	0.04	52.	1688.	1310.
3	19291.	0.	19291.	0.	13823.	0.	13823.	0.03	20.	7136.	671.
4	213243.	0.	213243.	0.	0.	0.	0.	-0.54	-3304.	223682.	6118.
5	784849.	0.	784849.	0.	42478.	51384.	93862.	-0.25	-4108.	918777.	16432.
6	117904.	0.	117904.	0.	19792.	92413.	112205.	0.25	5699.	918777.	22795.
7	0.	0.	0.	0.	7027.	0.	7027.	0.84	18981.	892769.	22596.
8	0.	0.	0.	0.	7226.	0.	7226.	0.91	20192.	865351.	22189.
9	8720.	0.	8720.	0.	241.	0.	241.	0.31	6817.	867013.	21992.
10	199235.	0.	199235.	0.	0.	148367.	148367.	-0.04	-896.	918777.	22400.
11	25997.	0.	25997.	0.	0.	27137.	27137.	-0.05	-1140.	918777.	22795.
12	84010.	0.	84010.	0.	0.	79679.	79679.	0.19	4331.	918777.	22795.
TOTAL	1453612.	0.	1453612.	0.	133891.	398980.	532871.		47071.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	22503.	22503.	0.	22382.	0.	22382.	0.15	120.	17540.	803.
2	0.	20801.	20801.	0.	20768.	0.	20768.	0.04	32.	17540.	803.
3	0.	13823.	13823.	0.	13799.	0.	13799.	0.03	24.	17540.	803.
4	0.	0.	0.	0.	0.	442.	442.	-0.55	-442.	17540.	803.
5	0.	93862.	93862.	0.	0.	94063.	94063.	-0.25	-201.	17540.	803.
6	0.	112205.	112205.	0.	0.	112013.	112013.	0.24	193.	17540.	803.
7	0.	7027.	7027.	0.	6345.	0.	6345.	0.85	683.	17540.	803.
8	0.	7226.	7226.	0.	6503.	0.	6503.	0.90	723.	17540.	803.
9	0.	241.	241.	0.	0.	0.	0.	0.30	241.	17540.	803.
10	0.	148367.	148367.	0.	0.	148399.	148399.	-0.04	-32.	17540.	803.
11	0.	27137.	27137.	0.	0.	27177.	27177.	-0.05	-40.	17540.	803.
12	0.	79679.	79679.	0.	0.	79526.	79526.	0.19	153.	17540.	803.
TOTAL	0.	532871.	532871.	0.	69798.	461620.	531417.		1453.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1957 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	22382.	22382.	0.	21490.	0.	21490.	0.14	893.	138500.	6375.
2	0.	20768.	20768.	0.	20513.	0.	20513.	0.04	255.	138500.	6375.
3	6643.	13799.	20442.	0.	20187.	0.	20187.	0.04	255.	138500.	6375.
4	235338.	442.	235780.	0.	0.	239350.	239350.	-0.56	-3570.	138500.	6375.
5	294498.	94063.	388561.	0.	0.	390410.	390410.	-0.29	-1849.	138500.	6375.
6	259274.	112013.	371287.	0.	0.	369884.	369884.	0.22	1403.	138500.	6375.
7	0.	6345.	6345.	0.	671.	0.	671.	0.89	5674.	138500.	6375.
8	0.	6503.	6503.	0.	702.	0.	702.	0.91	5801.	138500.	6375.
9	9044.	0.	9044.	0.	0.	7132.	7132.	0.30	1913.	138500.	6375.
10	445627.	148399.	594026.	0.	0.	594154.	594154.	-0.02	-128.	138500.	6375.
11	123208.	27177.	150385.	0.	0.	150767.	150767.	-0.06	-383.	138500.	6375.
12	0.	79526.	79526.	0.	0.	78251.	78251.	0.20	1275.	138500.	6375.
TOTAL	1373632.	531417.	1905049.	0.	63563.	1829947.	1893511.		11539.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	21490.	21490.	0.	21373.	0.	21373.	0.15	117.	8760.	780.
2	0.	20513.	20513.	0.	20482.	0.	20482.	0.04	31.	8760.	780.
3	0.	20187.	20187.	0.	20164.	0.	20164.	0.03	23.	8760.	780.
4	0.	239350.	239350.	0.	0.	239779.	239779.	-0.55	-429.	8760.	780.
5	0.	390410.	390410.	0.	0.	390613.	390613.	-0.26	-203.	8760.	780.
6	0.	369884.	369884.	0.	0.	369712.	369712.	0.22	172.	8760.	780.
7	0.	671.	671.	0.	0.	0.	0.	0.86	671.	8760.	780.
8	0.	702.	702.	0.	0.	0.	0.	0.90	702.	8760.	780.
9	0.	7132.	7132.	0.	0.	6905.	6905.	0.29	226.	8760.	780.
10	0.	594154.	594154.	0.	0.	594185.	594185.	-0.04	-31.	8760.	780.
11	0.	150767.	150767.	0.	0.	150814.	150814.	-0.06	-47.	8760.	780.
12	0.	78251.	78251.	0.	0.	78103.	78103.	0.19	148.	8760.	780.
TOTAL	0.	1893511.	1893511.	0.	62019.	1830111.	1892130.		1381.		

RESL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1957 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	21373.	21373.	0.	21373.	0.	21373.	0.20	0.	0.	0.
2	0.	20482.	20482.	0.	20482.	0.	20482.	0.02	0.	0.	0.
3	6107.	20164.	26271.	0.	26271.	0.	26271.	0.01	0.	0.	0.
4	168016.	239779.	407795.	0.	35176.	0.	35176.	-0.47	0.	372619.	0.
5	50532.	390613.	441145.	0.	47198.	0.	47198.	-0.14	-702.	767267.	5013.
6	104443.	369712.	474155.	0.	56549.	13234.	69782.	0.19	1571.	1170069.	8269.
7	0.	0.	0.	0.	56104.	0.	56104.	0.82	9141.	1104825.	11147.
8	0.	0.	0.	0.	62783.	0.	62783.	0.85	9113.	1032929.	10721.
9	20450.	6905.	27355.	0.	45417.	0.	45417.	0.08	815.	1014052.	10188.
10	52631.	594185.	646816.	0.	28942.	462259.	491201.	-0.04	-402.	1170069.	10047.
11	47384.	150814.	198198.	0.	22709.	176381.	199090.	-0.08	-892.	1170069.	11147.
12	0.	78103.	78103.	0.	22263.	54168.	76431.	0.15	1672.	1170069.	11147.
TOTAL	449563.	1892130.	2341693.	0.	445266.	706041.	1151307.		20317.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1957 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	1453612.	0.	1453612.	0.	133891.	398980.	532871.	47071.
2	0.	532871.	532871.	0.	69798.	461620.	531417.	1453.
3	1373632.	531417.	1905049.	0.	63563.	1829947.	1893511.	11539.
4	0.	1893511.	1893511.	0.	62019.	1830111.	1892130.	1381.
5	449563.	1892130.	2341693.	0.	445266.	706041.	1151307.	20317.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1958 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	25997.	0.	25997.	0.	0.	25541.	25541.	0.02	456.	918777.	22795.
2	100500.	0.	100500.	0.	0.	103007.	103007.	-0.11	-2507.	918777.	22795.
3	73362.	0.	73362.	0.	0.	71994.	71994.	0.06	1368.	918777.	22795.
4	25204.	0.	25204.	0.	0.	23380.	23380.	0.08	1824.	918777.	22795.
5	106521.	0.	106521.	0.	0.	105153.	105153.	0.06	1368.	918777.	22795.
6	47579.	0.	47579.	0.	0.	40968.	40968.	0.29	6611.	918777.	22795.
7	3534.	0.	3534.	0.	5945.	0.	5945.	0.74	16760.	899606.	22649.
8	0.	0.	0.	0.	5030.	0.	5030.	0.65	14529.	880047.	22353.
9	4949.	0.	4949.	0.	145.	0.	145.	0.18	3998.	880854.	22210.
10	7269.	0.	7269.	0.	112.	0.	112.	0.14	3115.	884896.	22247.
11	6436.	0.	6436.	0.	169.	0.	169.	0.22	4903.	886260.	22288.
12	9425.	0.	9425.	0.	128.	0.	128.	0.16	3575.	891982.	22342.
TOTAL	410776.	0.	410776.	0.	11529.	370045.	381574.		55998.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	25541.	25541.	0.	0.	25525.	25525.	0.02	16.	17540.	803.
2	0.	103007.	103007.	0.	0.	103104.	103104.	-0.12	-96.	17540.	803.
3	0.	71994.	71994.	0.	0.	71946.	71946.	0.06	48.	17540.	803.
4	0.	23380.	23380.	0.	0.	23308.	23308.	0.09	72.	17540.	803.
5	0.	105153.	105153.	0.	0.	105121.	105121.	0.04	32.	17540.	803.
6	0.	40968.	40968.	0.	0.	40752.	40752.	0.27	217.	17540.	803.
7	0.	5945.	5945.	0.	5351.	0.	5351.	0.74	594.	17540.	803.
8	0.	5030.	5030.	0.	4508.	0.	4508.	0.65	522.	17540.	803.
9	0.	145.	145.	0.	0.	0.	0.	0.18	145.	17540.	803.
10	0.	112.	112.	0.	0.	0.	0.	0.14	112.	17540.	803.
11	0.	169.	169.	0.	0.	0.	0.	0.21	169.	17540.	803.
12	0.	128.	128.	0.	0.	0.	0.	0.16	128.	17540.	803.
TOTAL	0.	381574.	381574.	0.	9858.	369756.	379614.		1959.		

RESER\ OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1958 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	53724.	25525.	79249.	0.	0.	79249.	79249.	0.00	0.	138500.	6375.
2	198439.	103104.	301543.	0.	0.	302499.	302499.	-0.15	-956.	138500.	6375.
3	106324.	71946.	178270.	0.	0.	177951.	177951.	0.05	319.	138500.	6375.
4	31968.	23308.	55276.	0.	0.	54639.	54639.	0.10	638.	138500.	6375.
5	71107.	105121.	176228.	0.	0.	176419.	176419.	-0.03	-191.	138500.	6375.
6	73342.	40752.	114094.	0.	0.	112882.	112882.	0.19	1211.	138500.	6375.
7	0.	5351.	5351.	0.	569.	0.	569.	0.75	4781.	138500.	6375.
8	0.	4508.	4508.	0.	491.	0.	491.	0.63	4016.	138500.	6375.
9	38557.	0.	38557.	0.	0.	37410.	37410.	0.18	1148.	138500.	6375.
10	24738.	0.	24738.	0.	0.	23973.	23973.	0.12	765.	138500.	6375.
11	28546.	0.	28546.	0.	0.	27207.	27207.	0.21	1339.	138500.	6375.
12	8651.	0.	8651.	0.	0.	7631.	7631.	0.16	1020.	138500.	6375.
TOTAL	635396.	379614.	1015010.	0.	1061.	999861.	1000921.		14089.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	79249.	79249.	0.	0.	79241.	79241.	0.01	8.	8760.	780.
2	0.	302499.	302499.	0.	0.	302608.	302608.	-0.14	-109.	8760.	780.
3	0.	177951.	177951.	0.	0.	177905.	177905.	0.06	47.	8760.	780.
4	0.	54639.	54639.	0.	0.	54568.	54568.	0.09	70.	8760.	780.
5	0.	176419.	176419.	0.	0.	176404.	176404.	0.02	16.	8760.	780.
6	0.	112882.	112882.	0.	0.	112695.	112695.	0.24	187.	8760.	780.
7	0.	569.	569.	0.	0.	0.	0.	0.73	569.	8760.	780.
8	0.	491.	491.	0.	0.	0.	0.	0.63	491.	8760.	780.
9	0.	37410.	37410.	0.	0.	37277.	37277.	0.17	133.	8760.	780.
10	0.	23973.	23973.	0.	0.	23872.	23872.	0.13	101.	8760.	780.
11	0.	27207.	27207.	0.	0.	27043.	27043.	0.21	164.	8760.	780.
12	0.	7631.	7631.	0.	0.	7506.	7506.	0.16	125.	8760.	780.
TOTAL	0.	1000921.	1000921.	0.	0.	999120.	999120.		1802.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1958 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	20661.	79241.	99902.	0.	21373.	78975.	100348.	-0.04	-446.	1170069.	11147.
2	57680.	302608.	360288.	0.	20482.	341813.	362295.	-0.18	-2006.	1170069.	11147.
3	41859.	177905.	219764.	0.	26271.	192713.	218983.	0.07	780.	1170069.	11147.
4	14439.	54568.	69007.	0.	35176.	32717.	67893.	0.10	1115.	1170069.	11147.
5	47069.	176404.	223473.	0.	47198.	175829.	223027.	0.04	446.	1170069.	11147.
6	81374.	112695.	194069.	0.	56549.	134845.	191394.	0.24	2675.	1170069.	11147.
7	0.	0.	0.	0.	56104.	0.	56104.	0.59	6577.	1107389.	11147.
8	0.	0.	0.	0.	62783.	0.	62783.	0.59	6336.	1038271.	10738.
9	23951.	37277.	61228.	0.	45417.	0.	45417.	0.01	102.	1053979.	10228.
10	24512.	23872.	48384.	0.	28942.	0.	28942.	0.02	207.	1073214.	10346.
11	15215.	27043.	42258.	0.	22709.	0.	22709.	0.17	1783.	1090980.	10490.
12	5720.	7506.	13226.	0.	22263.	0.	22263.	0.12	1275.	1080669.	10623.
TOTAL	332480.	999120.	1331600.	0.	445266.	956891.	1402157.		18843.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1958 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	410776.	0.	410776.	0.	11529.	370045.	381574.	55998.
2	0.	381574.	381574.	0.	9858.	369756.	379614.	1959.
3	635396.	379614.	1015010.	0.	1061.	999861.	1000921.	14089.
4	0.	1000921.	1000921.	0.	0.	999120.	999120.	1802.
5	332480.	999120.	1331600.	0.	445266.	956891.	1402157.	18843.

RESER\ OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1959 SIM("ATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	6436.	0.	6436.	0.	137.	0.	137.	0.17	3809.	894472.	22405.
2	9425.	0.	9425.	0.	0.	0.	0.	-0.02	-450.	904347.	22499.
3	5091.	0.	5091.	0.	281.	0.	281.	0.35	7893.	901264.	22551.
4	5352.	0.	5352.	0.	64.	0.	64.	0.08	1804.	904748.	22554.
5	5643.	0.	5643.	0.	1655.	0.	1655.	0.20	4515.	904220.	22577.
6	157299.	0.	157299.	0.	0.	140701.	140701.	0.09	2042.	918777.	22684.
7	64422.	0.	64422.	0.	0.	55304.	55304.	0.40	9118.	918777.	22795.
8	0.	0.	0.	0.	2603.	0.	2603.	0.32	7270.	908904.	22720.
9	617.	0.	617.	0.	3815.	0.	3815.	0.50	11267.	894439.	22534.
10	231344.	0.	231344.	0.	0.	208815.	208815.	-0.08	-1809.	918777.	22609.
11	46788.	0.	46788.	0.	0.	40405.	40405.	0.28	6383.	918777.	22795.
12	50049.	0.	50049.	0.	0.	49137.	49137.	0.04	912.	918777.	22795.
TOTAL	582466.	0.	582466.	0.	8555.	494362.	502917.		52754.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	137.	137.	0.	0.	0.	0.	0.17	137.	17540.	803.
2	0.	0.	0.	0.	0.	16.	16.	-0.02	-16.	17540.	803.
3	0.	281.	281.	0.	0.	0.	0.	0.35	281.	17540.	803.
4	0.	64.	64.	0.	0.	0.	0.	0.08	64.	17540.	803.
5	0.	1655.	1655.	0.	1495.	0.	1495.	0.20	161.	17540.	803.
6	0.	140701.	140701.	0.	0.	140628.	140628.	0.09	72.	17540.	803.
7	0.	55304.	55304.	0.	0.	54983.	54983.	0.40	321.	17540.	803.
8	0.	2603.	2603.	0.	2346.	0.	2346.	0.32	257.	17540.	803.
9	0.	3815.	3815.	0.	3406.	0.	3406.	0.51	410.	17540.	803.
10	0.	208815.	208815.	0.	0.	208887.	208887.	-0.09	-72.	17540.	803.
11	0.	40405.	40405.	0.	0.	40189.	40189.	0.27	217.	17540.	803.
12	0.	49137.	49137.	0.	0.	49105.	49105.	0.04	32.	17540.	803.
TOTAL	0.	502917.	502917.	0.	7246.	493808.	501054.		1863.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1959 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	6698.	0.	6698.	0.	0.	5614.	5614.	0.17	1084.	138500.	6375.
2	14006.	16.	14022.	0.	0.	14213.	14213.	-0.03	-191.	138500.	6375.
3	5851.	0.	5851.	0.	0.	3620.	3620.	0.35	2231.	138500.	6375.
4	15119.	0.	15119.	0.	0.	14673.	14673.	0.07	446.	138500.	6375.
5	0.	1495.	1495.	0.	156.	0.	156.	0.21	1339.	138500.	6375.
6	53646.	140628.	194274.	0.	0.	193828.	193828.	0.07	446.	138500.	6375.
7	0.	54983.	54983.	0.	0.	52305.	52305.	0.42	2678.	138500.	6375.
8	0.	2346.	2346.	0.	242.	0.	242.	0.33	2104.	138500.	6375.
9	371.	3406.	3777.	0.	398.	0.	398.	0.53	3379.	138500.	6375.
10	197654.	208887.	406541.	0.	0.	407306.	407306.	-0.12	-765.	138500.	6375.
11	0.	40189.	40189.	0.	0.	38467.	38467.	0.27	1721.	138500.	6375.
12	30722.	49105.	79827.	0.	0.	79572.	79572.	0.04	255.	138500.	6375.
TOTAL	324067.	501054.	825121.	0.	796.	809599.	810395.		14726.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	5614.	5614.	0.	0.	5482.	5482.	0.17	133.	8760.	780.
2	0.	14213.	14213.	0.	0.	14237.	14237.	-0.03	-23.	8760.	780.
3	0.	3620.	3620.	0.	0.	3347.	3347.	0.35	273.	8760.	780.
4	0.	14673.	14673.	0.	0.	14618.	14618.	0.07	55.	8760.	780.
5	0.	156.	156.	0.	0.	0.	0.	0.20	156.	8760.	780.
6	0.	193828.	193828.	0.	0.	193758.	193758.	0.09	70.	8760.	780.
7	0.	52305.	52305.	0.	0.	51985.	51985.	0.41	320.	8760.	780.
8	0.	242.	242.	0.	0.	0.	0.	0.31	242.	8760.	780.
9	0.	398.	398.	0.	0.	0.	0.	0.51	398.	8760.	780.
10	0.	407306.	407306.	0.	0.	407377.	407377.	-0.09	-70.	8760.	780.
11	0.	38467.	38467.	0.	0.	38257.	38257.	0.27	211.	8760.	780.
12	0.	79572.	79572.	0.	0.	79549.	79549.	0.03	23.	8760.	780.
TOTAL	0.	810395.	810395.	0.	0.	808609.	808609.		1786.		

RESER OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1959 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	3570.	5482.	9052.	0.	21373.	0.	21373.	0.15	1582.	1066766.	10545.
2	9262.	14237.	23499.	0.	20482.	0.	20482.	-0.07	-731.	1070513.	10441.
3	3682.	3347.	7029.	0.	26271.	0.	26271.	0.31	3245.	1048026.	10469.
4	27687.	14618.	42305.	0.	35176.	0.	35176.	0.01	103.	1055052.	10301.
5	0.	0.	0.	0.	47198.	0.	47198.	0.20	2071.	1005783.	10354.
6	22718.	193758.	216476.	0.	56549.	0.	56549.	0.22	2197.	1163513.	9985.
7	0.	51985.	51985.	0.	56104.	0.	56104.	0.45	4997.	1154398.	11104.
8	0.	0.	0.	0.	62783.	0.	62783.	0.29	3203.	1088413.	11045.
9	234.	0.	234.	0.	45417.	0.	45417.	0.44	4665.	1038564.	10603.
10	239262.	407377.	646639.	0.	28942.	486703.	515645.	-0.05	-512.	1170069.	10230.
11	0.	38257.	38257.	0.	22709.	13542.	36250.	0.18	2006.	1170069.	11147.
12	28640.	79549.	108189.	0.	22263.	85702.	107966.	0.02	223.	1170069.	11147.
TOTAL	335055.	808609.	1143664.	0.	445266.	585947.	1031213.		23050.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1959 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	582466.	0.	582466.	0.	8555.	494362.	502917.	52754.
2	0.	502917.	502917.	0.	7246.	493808.	501054.	1863.
3	324067.	501054.	825121.	0.	796.	809599.	810395.	14726.
4	0.	810395.	810395.	0.	0.	808609.	808609.	1786.
5	335055.	808609.	1143664.	0.	445266.	585947.	1031213.	23050.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1960 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	111009.	0.	111009.	0.	0.	110325.	110325.	0.03	684.	918777.	22795.
2	50049.	0.	50049.	0.	0.	48225.	48225.	0.08	1824.	918777.	22795.
3	18784.	0.	18784.	0.	0.	15821.	15821.	0.13	2963.	918777.	22795.
4	11951.	0.	11951.	0.	0.	6936.	6936.	0.22	5015.	918777.	22795.
5	10420.	0.	10420.	0.	2769.	0.	2769.	0.34	7750.	918678.	22794.
6	0.	0.	0.	0.	3327.	0.	3327.	0.42	9532.	905819.	22695.
7	3804.	0.	3804.	0.	337.	0.	337.	0.44	9921.	899365.	22548.
8	2492.	0.	2492.	0.	377.	0.	377.	0.47	10544.	890935.	22434.
9	2120.	0.	2120.	0.	4536.	0.	4536.	0.57	12685.	875834.	22255.
10	25569.	0.	25569.	0.	0.	0.	0.	-0.04	-894.	902297.	22341.
11	42202.	0.	42202.	0.	0.	24135.	24135.	0.07	1587.	918777.	22669.
12	83489.	0.	83489.	0.	0.	87136.	87136.	-0.16	-3647.	918777.	22795.
TOTAL	361889.	0.	361889.	0.	11347.	292578.	303925.		57964.		

LAKE INKS

MONTH	*INFLOW* (AF. UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION.	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	110325.	110325.	0.	0.	110301.	110301.	0.03	24.	17540.	803.
2	0.	48225.	48225.	0.	0.	48161.	48161.	0.08	64.	17540.	803.
3	0.	15821.	15821.	0.	0.	15724.	15724.	0.12	96.	17540.	803.
4	0.	6936.	6936.	0.	0.	6767.	6767.	0.21	169.	17540.	803.
5	0.	2769.	2769.	0.	2496.	0.	2496.	0.34	273.	17540.	803.
6	0.	3327.	3327.	0.	2997.	0.	2997.	0.41	329.	17540.	803.
7	0.	337.	337.	0.	0.	0.	0.	0.42	337.	17540.	803.
8	0.	377.	377.	0.	0.	0.	0.	0.47	377.	17540.	803.
9	0.	4536.	4536.	0.	4078.	0.	4078.	0.57	458.	17540.	803.
10	0.	0.	0.	0.	0.	40.	40.	-0.05	-40.	17540.	803.
11	0.	24135.	24135.	0.	0.	24063.	24063.	0.09	72.	17540.	803.
12	0.	87136.	87136.	0.	0.	87265.	87265.	-0.16	-128.	17540.	803.
TOTAL	0.	303925.	303925.	0.	9572.	292321.	301893.		2032.		

RESERVL OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1960 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	58185.	110301.	168486.	0.	0.	168295.	168295.	0.03	191.	138500.	6375.
2	53496.	48161.	101657.	0.	0.	101147.	101147.	0.08	510.	138500.	6375.
3	25056.	15724.	40780.	0.	0.	40143.	40143.	0.10	638.	138500.	6375.
4	22216.	6767.	28983.	0.	0.	27645.	27645.	0.21	1339.	138500.	6375.
5	0.	2496.	2496.	0.	265.	0.	265.	0.35	2231.	138500.	6375.
6	0.	2997.	2997.	0.	320.	0.	320.	0.42	2678.	138500.	6375.
7	7008.	0.	7008.	0.	0.	4649.	4649.	0.37	2359.	138500.	6375.
8	66714.	0.	66714.	0.	0.	63718.	63718.	0.47	2996.	138500.	6375.
9	0.	4078.	4078.	0.	445.	0.	445.	0.57	3634.	138500.	6375.
10	22066.	40.	22106.	0.	0.	22616.	22616.	-0.08	-510.	138500.	6375.
11	0.	24063.	24063.	0.	0.	23234.	23234.	0.13	829.	138500.	6375.
12	34468.	87265.	121733.	0.	0.	122625.	122625.	-0.14	-893.	138500.	6375.
TOTAL	289209.	301893.	591102.	0.	1030.	574072.	575101.		16001.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	168295.	168295.	0.	0.	168271.	168271.	0.03	23.	8760.	780.
2	0.	101147.	101147.	0.	0.	101085.	101085.	0.08	62.	8760.	780.
3	0.	40143.	40143.	0.	0.	40057.	40057.	0.11	86.	8760.	780.
4	0.	27645.	27645.	0.	0.	27481.	27481.	0.21	164.	8760.	780.
5	0.	265.	265.	0.	0.	0.	0.	0.34	265.	8760.	780.
6	0.	320.	320.	0.	0.	0.	0.	0.41	320.	8760.	780.
7	0.	4649.	4649.	0.	0.	4337.	4337.	0.40	312.	8760.	780.
8	0.	63718.	63718.	0.	0.	63351.	63351.	0.47	367.	8760.	780.
9	0.	445.	445.	0.	0.	0.	0.	0.57	445.	8760.	780.
10	0.	22616.	22616.	0.	0.	22671.	22671.	-0.07	-55.	8760.	780.
11	0.	23234.	23234.	0.	0.	23156.	23156.	0.10	78.	8760.	780.
12	0.	122625.	122625.	0.	0.	122742.	122742.	-0.15	-117.	8760.	780.
TOTAL	0.	575101.	575101.	0.	0.	573151.	573151.		1950.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1960 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	37604.	168271.	205875.	0.	21373.	184057.	205430.	0.04	446.	1170069.	11147.
2	49871.	101085.	150956.	0.	20482.	129916.	150398.	0.05	557.	1170069.	11147.
3	25935.	40057.	65992.	0.	26271.	38607.	64877.	0.10	1115.	1170069.	11147.
4	11645.	27481.	39126.	0.	35176.	2167.	37343.	0.16	1784.	1170069.	11147.
5	0.	0.	0.	0.	47198.	0.	47198.	0.35	3901.	1118969.	11147.
6	0.	0.	0.	0.	56549.	0.	56549.	0.32	3460.	1058960.	10814.
7	2194.	4337.	6531.	0.	56104.	0.	56104.	0.40	4153.	1005235.	10383.
8	3245.	63351.	66596.	0.	62783.	0.	62783.	0.36	3593.	1005455.	9981.
9	0.	0.	0.	0.	45417.	0.	45417.	0.52	5191.	954847.	9982.
10	32486.	22671.	55157.	0.	28942.	0.	28942.	-0.23	-2209.	983271.	9604.
11	0.	23156.	23156.	0.	22709.	0.	22709.	0.10	982.	982736.	9816.
12	29238.	122742.	151980.	0.	22263.	0.	22263.	-0.12	-1177.	1113631.	9812.
TOTAL	192218.	573151.	765369.	0.	445266.	354746.	800012.		21796.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1960 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	361889.	0.	361889.	0.	11347.	292578.	303925.	57964.
2	0.	303925.	303925.	0.	9572.	292321.	301893.	2032.
3	289209.	301893.	591102.	0.	1030.	574072.	575101.	16001.
4	0.	575101.	575101.	0.	0.	573151.	573151.	1950.
5	192218.	573151.	765369.	0.	445266.	354746.	800012.	21796.

RESERVO OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1961 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	61362.	0.	61362.	0.	0.	62046.	62046.	-0.03	-684.	918777.	22795.
2	83489.	0.	83489.	0.	0.	86452.	86452.	-0.13	-2963.	918777.	22795.
3	29764.	0.	29764.	0.	0.	25205.	25205.	0.20	4559.	918777.	22795.
4	8260.	0.	8260.	0.	289.	0.	289.	0.37	8433.	918315.	22791.
5	0.	0.	0.	0.	3183.	0.	3183.	0.39	8851.	906281.	22696.
6	155469.	0.	155469.	0.	0.	142292.	142292.	0.03	681.	918777.	22700.
7	38826.	0.	38826.	0.	0.	34267.	34267.	0.20	4559.	918777.	22795.
8	0.	0.	0.	0.	6454.	0.	6454.	0.76	17187.	895136.	22615.
9	4295.	0.	4295.	0.	2815.	0.	2815.	0.37	8281.	888335.	22382.
10	40116.	0.	40116.	0.	0.	3131.	3131.	0.29	6543.	918777.	22563.
11	6942.	0.	6942.	0.	0.	3523.	3523.	0.15	3419.	918777.	22795.
12	7024.	0.	7024.	0.	0.	4289.	4289.	0.12	2735.	918777.	22795.
TOTAL	435547.	0.	435547.	0.	12741.	361204.	373945.		61602.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	62046.	62046.	0.	0.	62062.	62062.	-0.02	-16.	17540.	803.
2	0.	86452.	86452.	0.	0.	86565.	86565.	-0.14	-112.	17540.	803.
3	0.	25205.	25205.	0.	0.	25044.	25044.	0.20	161.	17540.	803.
4	0.	289.	289.	0.	0.	0.	0.	0.36	289.	17540.	803.
5	0.	3183.	3183.	0.	2862.	0.	2862.	0.40	321.	17540.	803.
6	0.	142292.	142292.	0.	0.	142267.	142267.	0.03	24.	17540.	803.
7	0.	34267.	34267.	0.	0.	34114.	34114.	0.19	153.	17540.	803.
8	0.	6454.	6454.	0.	5836.	0.	5836.	0.77	618.	17540.	803.
9	0.	2815.	2815.	0.	2518.	0.	2518.	0.37	297.	17540.	803.
10	0.	3131.	3131.	0.	0.	2890.	2890.	0.30	241.	17540.	803.
11	0.	3523.	3523.	0.	0.	3394.	3394.	0.16	128.	17540.	803.
12	0.	4289.	4289.	0.	0.	4192.	4192.	0.12	96.	17540.	803.
TOTAL	0.	373945.	373945.	0.	11215.	360529.	371745.		2200.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1961 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	69388.	62062.	131450.	0.	0.	131386.	131386.	0.01	64.	138500.	6375.
2	106144.	86565.	192709.	0.	0.	193665.	193665.	-0.15	-956.	138500.	6375.
3	42796.	25044.	67840.	0.	0.	66565.	66565.	0.20	1275.	138500.	6375.
4	5493.	0.	5493.	0.	0.	3134.	3134.	0.37	2359.	138500.	6375.
5	0.	2862.	2862.	0.	312.	0.	312.	0.40	2550.	138500.	6375.
6	170129.	142267.	312396.	0.	0.	312078.	312078.	0.05	319.	138500.	6375.
7	25708.	34114.	59822.	0.	0.	58739.	58739.	0.17	1084.	138500.	6375.
8	0.	5836.	5836.	0.	608.	0.	608.	0.82	5228.	138500.	6375.
9	122.	2518.	2640.	0.	281.	0.	281.	0.37	2359.	138500.	6375.
10	3958.	2890.	6848.	0.	0.	4935.	4935.	0.30	1913.	138500.	6375.
11	6588.	3394.	9982.	0.	0.	8899.	8899.	0.17	1084.	138500.	6375.
12	12178.	4192.	16370.	0.	0.	15605.	15605.	0.12	765.	138500.	6375.
TOTAL	442504.	371745.	814249.	0.	1201.	795006.	796207.		18041.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	131386.	131386.	0.	0.	131394.	131394.	-0.01	-8.	8760.	780.
2	0.	193665.	193665.	0.	0.	193774.	193774.	-0.14	-109.	8760.	780.
3	0.	66565.	66565.	0.	0.	66409.	66409.	0.20	156.	8760.	780.
4	0.	3134.	3134.	0.	0.	2853.	2853.	0.36	281.	8760.	780.
5	0.	312.	312.	0.	0.	0.	0.	0.40	312.	8760.	780.
6	0.	312078.	312078.	0.	0.	312054.	312054.	0.03	23.	8760.	780.
7	0.	58739.	58739.	0.	0.	58598.	58598.	0.18	140.	8760.	780.
8	0.	608.	608.	0.	0.	0.	0.	0.78	608.	8760.	780.
9	0.	281.	281.	0.	0.	0.	0.	0.36	281.	8760.	780.
10	0.	4935.	4935.	0.	0.	4701.	4701.	0.30	234.	8760.	780.
11	0.	8899.	8899.	0.	0.	8774.	8774.	0.16	125.	8760.	780.
12	0.	15605.	15605.	0.	0.	15512.	15512.	0.12	94.	8760.	780.
TOTAL	0.	796207.	796207.	0.	0.	794070.	794070.		2137.		

RESER : OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1961 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	29070.	131394.	160464.	0.	21373.	82437.	103810.	0.02	216.	1170069.	10779.
2	90038.	193774.	283812.	0.	20482.	264445.	284927.	-0.10	-1115.	1170069.	11147.
3	24829.	66409.	91238.	0.	26271.	62738.	89009.	0.20	2229.	1170069.	11147.
4	3003.	2853.	5856.	0.	35176.	0.	35176.	0.31	3456.	1137294.	11147.
5	0.	0.	0.	0.	47198.	0.	47198.	0.39	4264.	1085832.	10933.
6	20565.	312054.	332619.	0.	56549.	192257.	248805.	-0.04	-423.	1170069.	10584.
7	3803.	58598.	62401.	0.	56104.	4403.	60506.	0.17	1895.	1170069.	11147.
8	0.	0.	0.	0.	62783.	0.	62783.	0.67	7469.	1099818.	11147.
9	43.	0.	43.	0.	45417.	0.	45417.	0.25	2672.	1051772.	10689.
10	867.	4701.	5568.	0.	28942.	0.	28942.	0.26	2686.	1025712.	10329.
11	1503.	8774.	10277.	0.	22709.	0.	22709.	0.07	709.	1012571.	10134.
12	2831.	15512.	18343.	0.	22263.	0.	22263.	0.09	903.	1007747.	10036.
TOTAL	176552.	794070.	970622.	0.	445266.	606280.	1051546.		24960.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1961 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	435547.	0.	435547.	0.	12741.	361204.	373945.	61602.
2	0.	373945.	373945.	0.	11215.	360529.	371745.	2200.
3	442504.	371745.	814249.	0.	1201.	795006.	796207.	18041.
4	0.	796207.	796207.	0.	0.	794070.	794070.	2137.
5	176552.	794070.	970622.	0.	445266.	606280.	1051546.	24960.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1962 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	6942.	0.	6942.	0.	0.	3295.	3295.	0.16	3647.	918777.	22795.
2	7024.	0.	7024.	0.	0.	2693.	2693.	0.19	4331.	918777.	22795.
3	0.	0.	0.	0.	2149.	0.	2149.	0.28	6364.	910264.	22730.
4	7114.	0.	7114.	0.	16.	0.	16.	0.02	454.	916908.	22716.
5	0.	0.	0.	0.	3271.	0.	3271.	0.42	9521.	904116.	22669.
6	3712.	0.	3712.	0.	137.	0.	137.	0.17	3837.	903855.	22569.
7	0.	0.	0.	0.	19636.	0.	19636.	0.77	17160.	867058.	22286.
8	0.	0.	0.	0.	21974.	0.	21974.	0.90	19520.	825565.	21688.
9	0.	0.	0.	0.	15896.	0.	15896.	0.37	7840.	801828.	21190.
10	45229.	0.	45229.	0.	26048.	0.	26048.	0.25	5278.	815732.	21111.
11	1172.	0.	1172.	0.	20438.	0.	20438.	0.21	4416.	792049.	21030.
12	1696.	0.	1696.	0.	20037.	0.	20037.	0.08	1654.	772055.	20670.
TOTAL	72889.	0.	72889.	0.	129601.	5988.	135588.		84023.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	3295.	3295.	0.	0.	3174.	3174.	0.15	120.	17540.	803.
2	0.	2693.	2693.	0.	0.	2540.	2540.	0.19	153.	17540.	803.
3	0.	2149.	2149.	0.	1932.	0.	1932.	0.27	217.	17540.	803.
4	0.	16.	16.	0.	8.	0.	8.	0.01	8.	17540.	803.
5	0.	3271.	3271.	0.	2934.	0.	2934.	0.42	337.	17540.	803.
6	0.	137.	137.	0.	0.	0.	0.	0.17	137.	17540.	803.
7	0.	19636.	19636.	0.	0.	19010.	19010.	0.78	626.	17540.	803.
8	0.	21974.	21974.	0.	0.	21251.	21251.	0.90	723.	17540.	803.
9	0.	15896.	15896.	0.	0.	15591.	15591.	0.38	305.	17540.	803.
10	0.	26048.	26048.	0.	0.	25847.	25847.	0.25	201.	17540.	803.
11	0.	20438.	20438.	0.	0.	20269.	20269.	0.21	169.	17540.	803.
12	0.	20037.	20037.	0.	0.	19973.	19973.	0.08	64.	17540.	803.
TOTAL	0.	135588.	135588.	0.	4873.	127656.	132529.		3059.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1962 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	2543.	3174.	5717.	0.	0.	4761.	4761.	0.15	956.	138500.	6375.
2	6042.	2540.	8582.	0.	0.	7307.	7307.	0.20	1275.	138500.	6375.
3	0.	1932.	1932.	0.	211.	0.	211.	0.27	1721.	138500.	6375.
4	0.	8.	8.	0.	8.	0.	8.	0.00	0.	138500.	6375.
5	0.	2934.	2934.	0.	320.	0.	320.	0.41	2614.	138500.	6375.
6	2433.	0.	2433.	0.	0.	1286.	1286.	0.18	1148.	138500.	6375.
7	0.	19010.	19010.	0.	0.	13846.	13846.	0.81	5164.	138500.	6375.
8	0.	21251.	21251.	0.	0.	15450.	15450.	0.91	5801.	138500.	6375.
9	0.	15591.	15591.	0.	0.	12977.	12977.	0.41	2614.	138500.	6375.
10	0.	25847.	25847.	0.	0.	24254.	24254.	0.25	1594.	138500.	6375.
11	0.	20269.	20269.	0.	0.	18867.	18867.	0.22	1403.	138500.	6375.
12	0.	19973.	19973.	0.	0.	19526.	19526.	0.07	446.	138500.	6375.
TOTAL	11018.	132529.	143547.	0.	538.	118274.	118812.		24735.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	4761.	4761.	0.	0.	4644.	4644.	0.15	117.	8760.	780.
2	0.	7307.	7307.	0.	0.	7159.	7159.	0.19	148.	8760.	780.
3	0.	211.	211.	0.	0.	0.	0.	0.27	211.	8760.	780.
4	0.	8.	8.	0.	0.	0.	0.	0.01	8.	8760.	780.
5	0.	320.	320.	0.	0.	0.	0.	0.41	320.	8760.	780.
6	0.	1286.	1286.	0.	0.	1153.	1153.	0.17	133.	8760.	780.
7	0.	13846.	13846.	0.	0.	13230.	13230.	0.79	616.	8760.	780.
8	0.	15450.	15450.	0.	0.	14756.	14756.	0.89	694.	8760.	780.
9	0.	12977.	12977.	0.	0.	12681.	12681.	0.38	296.	8760.	780.
10	0.	24254.	24254.	0.	0.	24066.	24066.	0.24	187.	8760.	780.
11	0.	18867.	18867.	0.	0.	18703.	18703.	0.21	164.	8760.	780.
12	0.	19526.	19526.	0.	0.	19472.	19472.	0.07	55.	8760.	780.
TOTAL	0.	118812.	118812.	0.	0.	115864.	115864.		2948.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1962 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	580.	4644.	5224.	0.	21373.	0.	21373.	0.10	1000.	990598.	10000.
2	1405.	7159.	8564.	0.	20482.	0.	20482.	0.18	1777.	976904.	9871.
3	0.	0.	0.	0.	26271.	0.	26271.	0.25	2442.	948191.	9769.
4	0.	0.	0.	0.	35176.	0.	35176.	-0.01	-96.	913110.	9554.
5	0.	0.	0.	0.	47198.	0.	47198.	0.40	3717.	862195.	9291.
6	3210.	1153.	4363.	0.	56549.	0.	56549.	0.15	1337.	808673.	8910.
7	0.	13230.	13230.	0.	56104.	0.	56104.	0.77	6587.	759213.	8554.
8	0.	14756.	14756.	0.	62783.	0.	62783.	0.79	6488.	704698.	8212.
9	0.	12681.	12681.	0.	45417.	0.	45417.	0.27	2113.	669848.	7827.
10	0.	24066.	24066.	0.	28942.	0.	28942.	0.24	1820.	663153.	7581.
11	0.	18703.	18703.	0.	22709.	0.	22709.	0.17	1281.	657866.	7534.
12	0.	19472.	19472.	0.	22263.	0.	22263.	0.03	225.	654850.	7497.
TOTAL	5195.	115864.	121059.	0.	445266.	0.	445266.		28690.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1962 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	72889.	0.	72889.	0.	129601.	5988.	135588.	84023.
2	0.	135588.	135588.	0.	4873.	127656.	132529.	3059.
3	11018.	132529.	143547.	0.	538.	118274.	118812.	24735.
4	0.	118812.	118812.	0.	0.	115864.	115864.	2948.
5	5195.	115864.	121059.	0.	445266.	0.	445266.	28690.

RESL.. OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1963 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	875.	0.	875.	0.	19235.	0.	19235.	0.19	3861.	749833.	20321.
2	3018.	0.	3018.	0.	18434.	0.	18434.	0.13	2599.	731819.	19989.
3	292.	0.	292.	0.	23644.	0.	23644.	0.28	5488.	702979.	19602.
4	335.	0.	335.	0.	31658.	0.	31658.	0.23	4360.	667296.	18956.
5	6553.	0.	6553.	0.	42478.	0.	42478.	0.24	4358.	627012.	18160.
6	11059.	0.	11059.	0.	50894.	0.	50894.	0.44	7554.	579623.	17168.
7	0.	0.	0.	0.	50493.	0.	50493.	0.83	13229.	515901.	15939.
8	0.	0.	0.	0.	56504.	0.	56504.	0.84	12223.	447174.	14551.
9	0.	0.	0.	0.	40875.	0.	40875.	0.60	8088.	398210.	13480.
10	4.	0.	4.	0.	26048.	0.	26048.	0.52	6624.	365542.	12738.
11	3936.	0.	3936.	0.	20438.	0.	20438.	0.13	1590.	347451.	12230.
12	48.	0.	48.	0.	20037.	0.	20037.	0.14	1654.	325807.	11817.
TOTAL	26120.	0.	26120.	0.	400739.	0.	400739.		71628.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19083.	19083.	0.19	153.	17540.	803.
2	0.	18434.	18434.	0.	0.	18338.	18338.	0.12	96.	17540.	803.
3	0.	23644.	23644.	0.	0.	23419.	23419.	0.28	225.	17540.	803.
4	0.	31658.	31658.	0.	0.	31474.	31474.	0.23	185.	17540.	803.
5	0.	42478.	42478.	0.	0.	42286.	42286.	0.24	193.	17540.	803.
6	0.	50894.	50894.	0.	0.	50533.	50533.	0.45	361.	17540.	803.
7	0.	50493.	50493.	0.	0.	49819.	49819.	0.84	675.	17540.	803.
8	0.	56504.	56504.	0.	0.	55822.	55822.	0.85	683.	17540.	803.
9	0.	40875.	40875.	0.	0.	40394.	40394.	0.60	482.	17540.	803.
10	0.	26048.	26048.	0.	0.	25631.	25631.	0.52	418.	17540.	803.
11	0.	20438.	20438.	0.	0.	20325.	20325.	0.14	112.	17540.	803.
12	0.	20037.	20037.	0.	0.	19925.	19925.	0.14	112.	17540.	803.
TOTAL	0.	400739.	400739.	0.	0.	397046.	397046.		3694.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1963 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19083.	19083.	0.	0.	17744.	17744.	0.21	1339.	138500.	6375.
2	0.	18338.	18338.	0.	0.	17636.	17636.	0.11	701.	138500.	6375.
3	0.	23419.	23419.	0.	0.	21698.	21698.	0.27	1721.	138500.	6375.
4	0.	31474.	31474.	0.	0.	30007.	30007.	0.23	1466.	138500.	6375.
5	0.	42286.	42286.	0.	0.	40756.	40756.	0.24	1530.	138500.	6375.
6	0.	50533.	50533.	0.	0.	47600.	47600.	0.46	2933.	138500.	6375.
7	0.	49819.	49819.	0.	0.	44272.	44272.	0.87	5546.	138500.	6375.
8	0.	55822.	55822.	0.	0.	50275.	50275.	0.87	5546.	138500.	6375.
9	0.	40394.	40394.	0.	0.	36569.	36569.	0.60	3825.	138500.	6375.
10	0.	25631.	25631.	0.	0.	22379.	22379.	0.51	3251.	138500.	6375.
11	10357.	20325.	30682.	0.	0.	29790.	29790.	0.14	893.	138500.	6375.
12	0.	19925.	19925.	0.	0.	19032.	19032.	0.14	893.	138500.	6375.
TOTAL	10357.	397046.	407403.	0.	0.	377759.	377759.		29644.		

LAKE MARBLE FALLS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	17744.	17744.	0.	0.	17596.	17596.	0.19	148.	8760.	780.
2	0.	17636.	17636.	0.	0.	17543.	17543.	0.12	94.	8760.	780.
3	0.	21698.	21698.	0.	0.	21479.	21479.	0.28	218.	8760.	780.
4	0.	30007.	30007.	0.	0.	29828.	29828.	0.23	179.	8760.	780.
5	0.	40756.	40756.	0.	0.	40561.	40561.	0.25	195.	8760.	780.
6	0.	47600.	47600.	0.	0.	47241.	47241.	0.46	359.	8760.	780.
7	0.	44272.	44272.	0.	0.	43617.	43617.	0.84	655.	8760.	780.
8	0.	50275.	50275.	0.	0.	49612.	49612.	0.85	663.	8760.	780.
9	0.	36569.	36569.	0.	0.	36101.	36101.	0.60	468.	8760.	780.
10	0.	22379.	22379.	0.	0.	21981.	21981.	0.51	398.	8760.	780.
11	0.	29790.	29790.	0.	0.	29681.	29681.	0.14	109.	8760.	780.
12	0.	19032.	19032.	0.	0.	18923.	18923.	0.14	109.	8760.	780.
TOTAL	0.	377759.	377759.	0.	0.	374163.	374163.		3596.		

RESL... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1963 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	17596.	17596.	0.	21373.	0.	21373.	0.17	1271.	649802.	7475.
2	0.	17543.	17543.	0.	20482.	0.	20482.	0.05	372.	646491.	7440.
3	0.	21479.	21479.	0.	26271.	0.	26271.	0.31	2299.	639400.	7416.
4	0.	29828.	29828.	0.	35176.	0.	35176.	0.21	1547.	632506.	7366.
5	0.	40561.	40561.	0.	47198.	0.	47198.	0.34	2488.	623380.	7318.
6	0.	47241.	47241.	0.	56549.	0.	56549.	0.46	3333.	610739.	7247.
7	0.	43617.	43617.	0.	56104.	0.	56104.	0.74	5287.	592966.	7144.
8	0.	49612.	49612.	0.	62783.	0.	62783.	0.79	5531.	574265.	7001.
9	0.	36101.	36101.	0.	45417.	0.	45417.	0.55	3767.	561181.	6850.
10	0.	21981.	21981.	0.	28942.	0.	28942.	0.47	3170.	551051.	6744.
11	5101.	29681.	34782.	0.	22709.	0.	22709.	0.14	933.	562191.	6662.
12	0.	18923.	18923.	0.	22263.	0.	22263.	0.11	743.	558108.	6752.
TOTAL	5101.	374163.	379264.	0.	445266.	0.	445266.		30740.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1963 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	26120.	0.	26120.	0.	400739.	0.	400739.	71628.
2	0.	400739.	400739.	0.	0.	397046.	397046.	3694.
3	10357.	397046.	407403.	0.	0.	377759.	377759.	29644.
4	0.	377759.	377759.	0.	0.	374163.	374163.	3596.
5	5101.	374163.	379264.	0.	445266.	0.	445266.	30740.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1964 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	3936.	0.	3936.	0.	19235.	0.	19235.	0.00	0.	310508.	11433.
2	13793.	0.	13793.	0.	18434.	0.	18434.	0.08	897.	304970.	11216.
3	17016.	0.	17016.	0.	23644.	0.	23644.	0.07	776.	297566.	11081.
4	14985.	0.	14985.	0.	31658.	0.	31658.	0.11	1190.	279703.	10819.
5	0.	0.	0.	0.	42478.	0.	42478.	0.25	2537.	234688.	10147.
6	28.	0.	28.	0.	50894.	0.	50894.	0.41	3615.	180207.	8816.
7	0.	0.	0.	0.	50493.	0.	50493.	0.78	5721.	123992.	7335.
8	0.	0.	0.	0.	21974.	0.	21974.	0.63	3759.	98259.	5967.
9	239623.	0.	239623.	0.	15896.	0.	15896.	0.20	1773.	320214.	8864.
10	33090.	0.	33090.	0.	26048.	0.	26048.	0.37	4257.	322999.	11504.
11	20265.	0.	20265.	0.	20438.	0.	20438.	0.09	1037.	321789.	11521.
12	10223.	0.	10223.	0.	20037.	0.	20037.	0.17	1936.	310040.	11386.
TOTAL	352959.	0.	352959.	0.	341230.	0.	341230.		27497.		

LAKE INKS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19235.	19235.	0.00	0.	17540.	803.
2	0.	18434.	18434.	0.	0.	18370.	18370.	0.08	64.	17540.	803.
3	0.	23644.	23644.	0.	0.	23595.	23595.	0.06	48.	17540.	803.
4	0.	31658.	31658.	0.	0.	31570.	31570.	0.11	88.	17540.	803.
5	0.	42478.	42478.	0.	0.	42278.	42278.	0.25	201.	17540.	803.
6	0.	50894.	50894.	0.	0.	50557.	50557.	0.42	337.	17540.	803.
7	0.	50493.	50493.	0.	0.	49859.	49859.	0.79	634.	17540.	803.
8	0.	21974.	21974.	0.	0.	21468.	21468.	0.63	506.	17540.	803.
9	0.	15896.	15896.	0.	0.	15727.	15727.	0.21	169.	17540.	803.
10	0.	26048.	26048.	0.	0.	25743.	25743.	0.38	305.	17540.	803.
11	0.	20438.	20438.	0.	0.	20365.	20365.	0.09	72.	17540.	803.
12	0.	20037.	20037.	0.	0.	19900.	19900.	0.17	137.	17540.	803.
TOTAL	0.	341230.	341230.	0.	0.	338668.	338668.		2562.		

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1964 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	687.	19235.	19922.	0.	0.	19986.	19986.	-0.01	-64.	138500.	6375.
2	7827.	18370.	26197.	0.	0.	25687.	25687.	0.08	510.	138500.	6375.
3	9007.	23595.	32602.	0.	0.	32284.	32284.	0.05	319.	138500.	6375.
4	0.	31570.	31570.	0.	0.	30996.	30996.	0.09	574.	138500.	6375.
5	0.	42278.	42278.	0.	0.	40748.	40748.	0.24	1530.	138500.	6375.
6	0.	50557.	50557.	0.	0.	47688.	47688.	0.45	2869.	138500.	6375.
7	0.	49859.	49859.	0.	0.	44695.	44695.	0.81	5164.	138500.	6375.
8	0.	21468.	21468.	0.	0.	17388.	17388.	0.64	4080.	138500.	6375.
9	160302.	15727.	176029.	0.	0.	174372.	174372.	0.26	1658.	138500.	6375.
10	10430.	25743.	36173.	0.	0.	33750.	33750.	0.38	2423.	138500.	6375.
11	54427.	20365.	74792.	0.	0.	74219.	74219.	0.09	574.	138500.	6375.
12	0.	19900.	19900.	0.	0.	18817.	18817.	0.17	1084.	138500.	6375.
TOTAL	242680.	338668.	581348.	0.	0.	560629.	560629.		20719.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19986.	19986.	0.	0.	19986.	19986.	0.00	0.	8760.	780.
2	0.	25687.	25687.	0.	0.	25624.	25624.	0.08	62.	8760.	780.
3	0.	32284.	32284.	0.	0.	32237.	32237.	0.06	47.	8760.	780.
4	0.	30996.	30996.	0.	0.	30918.	30918.	0.10	78.	8760.	780.
5	0.	40748.	40748.	0.	0.	40560.	40560.	0.24	187.	8760.	780.
6	0.	47688.	47688.	0.	0.	47360.	47360.	0.42	328.	8760.	780.
7	0.	44695.	44695.	0.	0.	44079.	44079.	0.79	616.	8760.	780.
8	0.	17388.	17388.	0.	0.	16897.	16897.	0.63	491.	8760.	780.
9	0.	174372.	174372.	0.	0.	174200.	174200.	0.22	172.	8760.	780.
10	0.	33750.	33750.	0.	0.	33454.	33454.	0.38	296.	8760.	780.
11	0.	74219.	74219.	0.	0.	74148.	74148.	0.09	70.	8760.	780.
12	0.	18817.	18817.	0.	0.	18684.	18684.	0.17	133.	8760.	780.
TOTAL	0.	560629.	560629.	0.	0.	558149.	558149.		2480.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1964 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

	INFLOW (AF)			*OUTFLOW* (AF)							
MONTH	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	339.	19986.	20325.	0.	21373.	0.	21373.	0.02	134.	556926.	6719.
2	3331.	25624.	28955.	0.	20482.	0.	20482.	0.07	470.	564929.	6710.
3	8816.	32237.	41053.	0.	26271.	0.	26271.	0.09	610.	579102.	6774.
4	0.	30918.	30918.	0.	35176.	0.	35176.	0.16	1102.	573742.	6889.
5	0.	40560.	40560.	0.	47198.	0.	47198.	0.25	1711.	565393.	6846.
6	0.	47360.	47360.	0.	56549.	0.	56549.	0.38	2576.	553629.	6778.
7	0.	44079.	44079.	0.	56104.	0.	56104.	0.76	5079.	536525.	6683.
8	0.	16897.	16897.	0.	62783.	0.	62783.	0.62	4058.	486581.	6545.
9	6748.	174200.	180948.	0.	45417.	0.	45417.	0.17	1041.	621071.	6122.
10	438.	33454.	33892.	0.	28942.	0.	28942.	0.38	2747.	623274.	7228.
11	4342.	74148.	78490.	0.	22709.	0.	22709.	0.14	1014.	678042.	7246.
12	0.	18684.	18684.	0.	22263.	0.	22263.	0.14	1069.	673393.	7639.
TOTAL	24014.	558149.	582163.	0.	445266.	0.	445266.		21611.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1964 SIMULATED 1980 RESERVOIR CONDITIONS

	INFLOW (AF)			*OUTFLOW* (AF)				
LAKE	UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	352959.	0.	352959.	0.	341230.	0.	341230.	27497.
2	0.	341230.	341230.	0.	0.	338668.	338668.	2562.
3	242680.	338668.	581348.	0.	0.	560629.	560629.	20719.
4	0.	560629.	560629.	0.	0.	558149.	558149.	2480.
5	24014.	558149.	582163.	0.	445266.	0.	445266.	21611.

RESER OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE BUCHANAN

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	20265.	0.	20265.	0.	19235.	0.	19235.	0.03	338.	310731.	11271.
2	73864.	0.	73864.	0.	18434.	0.	18434.	-0.14	-1662.	367823.	11872.
3	19672.	0.	19672.	0.	9195.	0.	9195.	0.14	1758.	376543.	12556.
4	11788.	0.	11788.	0.	12312.	0.	12312.	0.13	1641.	374378.	12621.
5	387112.	0.	387112.	0.	16519.	0.	16519.	-0.40	-6503.	751474.	16257.
6	25637.	0.	25637.	0.	289.	0.	289.	0.37	7515.	769306.	20312.
7	263.	0.	263.	0.	4799.	0.	4799.	0.62	12597.	752174.	20318.
8	0.	0.	0.	0.	5547.	0.	5547.	0.67	13413.	733214.	20019.
9	7399.	0.	7399.	0.	15896.	0.	15896.	0.48	9463.	715254.	19714.
10	13357.	0.	13357.	0.	112.	0.	112.	0.15	2948.	725551.	19651.
11	21009.	0.	21009.	0.	112.	0.	112.	0.13	2585.	743862.	19887.
12	11107.	0.	11107.	0.	0.	0.	0.	-0.05	-1007.	755976.	20139.
TOTAL	591473.	0.	591473.	0.	102451.	0.	102451.		43086.		

LAKE INKS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	19235.	19235.	0.	0.	19211.	19211.	0.03	24.	17540.	803.
2	0.	18434.	18434.	0.	0.	18554.	18554.	-0.15	-120.	17540.	803.
3	0.	9195.	9195.	0.	0.	9082.	9082.	0.14	112.	17540.	803.
4	0.	12312.	12312.	0.	0.	12207.	12207.	0.13	104.	17540.	803.
5	0.	16519.	16519.	0.	0.	16833.	16833.	-0.39	-313.	17540.	803.
6	0.	289.	289.	0.	0.	0.	0.	0.36	289.	17540.	803.
7	0.	4799.	4799.	0.	4301.	0.	4301.	0.62	498.	17540.	803.
8	0.	5547.	5547.	0.	5001.	0.	5001.	0.68	546.	17540.	803.
9	0.	15896.	15896.	0.	0.	15511.	15511.	0.48	385.	17540.	803.
10	0.	112.	112.	0.	0.	0.	0.	0.14	112.	17540.	803.
11	0.	112.	112.	0.	0.	0.	0.	0.14	112.	17540.	803.
12	0.	0.	0.	0.	0.	48.	48.	-0.06	-48.	17540.	803.
TOTAL	0.	102451.	102451.	0.	9302.	91447.	100748.		1702.		

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE LBJ

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	9670.	19211.	28881.	0.	0.	28563.	28563.	0.05	319.	138500.	6375.
2	106166.	18554.	124720.	0.	0.	125804.	125804.	-0.17	-1084.	138500.	6375.
3	20027.	9082.	29109.	0.	0.	28344.	28344.	0.12	765.	138500.	6375.
4	1310.	12207.	13517.	0.	0.	12880.	12880.	0.10	638.	138500.	6375.
5	132283.	16833.	149116.	0.	0.	151538.	151538.	-0.38	-2423.	138500.	6375.
6	12770.	0.	12770.	0.	0.	10539.	10539.	0.35	2231.	138500.	6375.
7	0.	4301.	4301.	0.	476.	0.	476.	0.60	3825.	138500.	6375.
8	0.	5001.	5001.	0.	538.	0.	538.	0.70	4463.	138500.	6375.
9	20037.	15511.	35548.	0.	0.	32424.	32424.	0.49	3124.	138500.	6375.
10	20099.	0.	20099.	0.	0.	19270.	19270.	0.13	829.	138500.	6375.
11	19577.	0.	19577.	0.	0.	18366.	18366.	0.19	1211.	138500.	6375.
12	26915.	48.	26963.	0.	0.	27409.	27409.	-0.07	-446.	138500.	6375.
TOTAL	368854.	100748.	469602.	0.	1014.	455137.	456151.		13451.		

LAKE MARBLE FALLS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	EVAPORATION (AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	0.	28563.	28563.	0.	0.	28531.	28531.	0.04	31.	8760.	780.
2	0.	125804.	125804.	0.	0.	125929.	125929.	-0.16	-125.	8760.	780.
3	0.	28344.	28344.	0.	0.	28243.	28243.	0.13	101.	8760.	780.
4	0.	12880.	12880.	0.	0.	12786.	12786.	0.12	94.	8760.	780.
5	0.	151538.	151538.	0.	0.	151834.	151834.	-0.38	-296.	8760.	780.
6	0.	10539.	10539.	0.	0.	10258.	10258.	0.36	281.	8760.	780.
7	0.	476.	476.	0.	0.	0.	0.	0.61	476.	8760.	780.
8	0.	538.	538.	0.	0.	0.	0.	0.69	538.	8760.	780.
9	0.	32424.	32424.	0.	0.	32049.	32049.	0.48	374.	8760.	780.
10	0.	19270.	19270.	0.	0.	19161.	19161.	0.14	109.	8760.	780.
11	0.	18366.	18366.	0.	0.	18241.	18241.	0.16	125.	8760.	780.
12	0.	27409.	27409.	0.	0.	27456.	27456.	-0.06	-47.	8760.	780.
TOTAL	0.	456151.	456151.	0.	0.	454490.	454490.		1661.		

RESE... OPERATION FOR THE HIGHLAND LAKES SYSTEM

CALENDAR YEAR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE TRAVIS

MONTH	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (FT)	(AF)	END OF MONTH CONTENT(AF)	AVERAGE AREA(AC)
1	771.	28531.	29302.	0.	21373.	0.	21373.	0.01	76.	681247.	7606.
2	45281.	125929.	171210.	0.	20482.	0.	20482.	-0.19	-1456.	833430.	7662.
3	3929.	28243.	32172.	0.	26271.	0.	26271.	0.14	1219.	838112.	8710.
4	831.	12786.	13617.	0.	35176.	0.	35176.	0.13	1136.	815417.	8739.
5	76894.	151834.	228728.	0.	47198.	0.	47198.	-0.27	-2321.	999269.	8597.
6	15440.	10258.	25698.	0.	56549.	0.	56549.	0.35	3478.	964940.	9936.
7	0.	0.	0.	0.	56104.	0.	56104.	0.61	5904.	902932.	9679.
8	0.	0.	0.	0.	62783.	0.	62783.	0.67	6174.	833976.	9215.
9	74972.	32049.	107021.	0.	45417.	0.	45417.	0.47	4095.	891485.	8713.
10	17766.	19161.	36927.	0.	28942.	0.	28942.	0.15	1369.	898100.	9130.
11	11021.	18241.	29262.	0.	22709.	0.	22709.	0.12	1101.	903552.	9179.
12	49417.	27456.	76873.	0.	22263.	0.	22263.	-0.12	-1106.	959268.	9220.
TOTAL	296322.	454490.	750812.	0.	445266.	0.	445266.		19671.		

ANNUAL OPERATION SUMMARY

CALENDAR YEAR 1965 SIMULATED 1980 RESERVOIR CONDITIONS

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	591473.	0.	591473.	0.	102451.	0.	102451.	43086.
2	0.	102451.	102451.	0.	9302.	91447.	100748.	1702.
3	368854.	100748.	469602.	0.	1014.	455137.	456151.	13451.
4	0.	456151.	456151.	0.	0.	454490.	454490.	1661.
5	296322.	454490.	750812.	0.	445266.	0.	445266.	19671.

RESERVOIR OPERATION FOR THE HIGHLAND LAKES SYSTEM

MINIMUM CAPACITY SUMMARY

RESERVOIR	MINIMUM CAPACITY	MONTH/YEAR
LAKE BUCHANAN	17.	8/1952
LAKE INKS	17540.	0/ 0
LAKE LBJ	138500.	0/ 0
LAKE MARBLE FALLS	8760.	0/ 0
LAKE TRAVIS	0.	7/1952

RESERV OPERATION FOR THE HIGHLAND LAKES SYSTEM

OPERATION SUMMARY

LAKE	*INFLOW* (AF) UNREGULATED	U/S RESERVOIR SPILL/RELEASE	TOTAL	*OUTFLOW* (AF) LOCAL DIVERSION	DOWNSTREAM DEMAND	SPILLS	TOTAL	EVAPORATION (AF)
1	9294576.	0.	9294576.	0.	3638907.	4512902.	8151809.	1305570.
2	0.	8151809.	8151809.	0.	531376.	7553230.	8084605.	67203.
3	6477424.	8084605.	14562030.	0.	348894.	13680633.	14029526.	532504.
4	0.	14029526.	14029526.	0.	325868.	13639075.	13964943.	64584.
5	3961387.	13964943.	17926332.	0.	11131651.	6467181.	17598832.	538300.

Volume II – Technical Report
Appendices

Appendix 2D
Stacy Reservoir Firm Yield Output

***** STACY DAM FIRM YIELD
***** ANALYSIS FROM 1941 TO 1965 *** FIRM YIELD = 91391. ***

MONTHLY DEMAND DISTRIBUTION

0.050	0.040	0.060	0.080	0.080	0.120	0.150	0.150	0.080	0.080	0.050	0.050

AREA VALUES USED

0.	10.	21.	33.	46.	55.	64.	73.
82.	92.	102.	112.	122.	132.	142.	153.
164.	176.	188.	201.	215.	230.	246.	263.
281.	300.	320.	341.	364.	388.	413.	439.
466.	494.	523.	553.	586.	622.	622.	704.
749.	797.	849.	905.	964.	1002.	1040.	1120.
1200.	1280.	1360.	1480.	1600.	1759.	1918.	2014.
2110.	2207.	2305.	2404.	2504.	2605.	2707.	2810.
2915.	3045.	3181.	3326.	3475.	3645.	3826.	4036.
4257.	4487.	4718.	4929.	5140.	5359.	5579.	5819.
6066.	6346.	6632.	6892.	7156.	7518.	7880.	8246.
8611.	8966.	9322.	9661.	10000.	10337.	10674.	11012.
11350.	11725.	12100.	12475.	12850.	13225.	13600.	13995.
14393.	14784.	15175.	15587.	16100.	16425.	16850.	17275.
17700.	18123.	18546.	18948.	19350.	19850.	20350.	20837.
21325.	21812.	22300.	22767.	23235.	23817.	24400.	24975.
25550.	26125.	26700.	27300.	27900.	28509.	29118.	29745.
30375.	31012.	31650.	32325.	33000.	33675.	34350.	35065.
35785.							

CAPACITY VALUES USED

0.	5.	21.	48.	87.	137.	197.	265.
343.	430.	527.	634.	751.	878.	1015.	1162.
1321.	1491.	1673.	1867.	2075.	2298.	2536.	2790.
3062.	3352.	3662.	3993.	4345.	4721.	5121.	5547.
6000.	6480.	6988.	7526.	8096.	8700.	9342.	10023.
10749.	11521.	12344.	13221.	14156.	15139.	16160.	17240.
18400.	19640.	20960.	22380.	23920.	25600.	27438.	29404.
31466.	33624.	35880.	38235.	40689.	43243.	45899.	48657.
51520.	54500.	57613.	60866.	64267.	67827.	71562.	75493.
79635.	84006.	88609.	93433.	93468.	103718.	109187.	114886.
120828.	127034.	133523.	140285.	147309.	154646.	162345.	170408.
178836.	187624.	196768.	206260.	216090.	226258.	236764.	247607.
258788.	270326.	282238.	294526.	307188.	320226.	333638.	347436.
361630.	376218.	391198.	406579.	422372.	438584.	455222.	472284.
489772.	507684.	526018.	544765.	563914.	583514.	603614.	624208.
645289.	666858.	688914.	711448.	734449.	757975.	782084.	806772.
832034.	857872.	884284.	911284.	938884.	967088.	995902.	1025334.
1055394.	1086088.	1117419.	1149406.	1182068.	1215406.	1249418.	1284126.
1319551.							

CALENDAR YEAR 1941

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1181.	0.	4570.	0.	0.16	3053.	547898.	19081.
2	4794.	0.	3656.	0.	0.03	571.	548466.	19020.
3	6688.	0.	5483.	0.	0.11	2092.	547579.	19016.
4	43010.	0.	7311.	27222.	0.09	1715.	554340.	19060.
5	140367.	0.	7311.	130952.	0.11	2104.	554340.	19127.
6	96312.	0.	10967.	80380.	0.26	4965.	554340.	19097.
7	8777.	0.	13709.	0.	0.64	12141.	537268.	18970.
8	12180.	0.	13709.	0.	0.59	11005.	524734.	18653.
9	6694.	0.	7311.	0.	0.37	6819.	517297.	18431.
10	49905.	0.	7311.	5739.	-0.01	-188.	554340.	18756.
11	7625.	0.	4570.	0.	0.33	6297.	551098.	19083.
12	4589.	0.	4570.	0.	0.21	3998.	547119.	19039.

CALENDAR YEAR 1942

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	3150.	0.	4570.	0.	0.24	4544.	541155.	18935.
2	2583.	0.	3656.	0.	0.27	5077.	535006.	18805.
3	1798.	0.	5483.	0.	0.44	8189.	523131.	18611.
4	28683.	0.	7311.	0.	-0.02	-374.	544877.	18717.
5	50481.	0.	7311.	27253.	0.34	6454.	554340.	18982.
6	1822.	0.	10967.	0.	0.55	10419.	534776.	18944.
7	1451.	0.	13709.	0.	0.78	14384.	508135.	18441.
8	13308.	0.	13709.	0.	0.41	7397.	500337.	18042.
9	13118.	0.	7311.	0.	0.32	5744.	500400.	17950.
10	25521.	0.	7311.	0.	0.05	908.	517702.	18155.
11	3172.	0.	4570.	0.	0.40	7302.	509003.	18254.
12	3652.	0.	4570.	0.	0.11	1993.	506092.	18120.

CALENDAR YEAR 1943

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2570.	0.	4570.	0.	0.23	4143.	499950.	18013.
2	2146.	0.	3656.	0.	0.38	6780.	491660.	17842.
3	1528.	0.	5483.	0.	0.25	4411.	483293.	17644.
4	938.	0.	7311.	0.	0.53	9197.	467723.	17353.
5	4603.	0.	7311.	0.	0.34	5799.	459216.	17055.
6	525.	0.	10967.	0.	0.65	10842.	437932.	16680.
7	2120.	0.	13709.	0.	0.73	11810.	414534.	16177.
8	1.	0.	13709.	0.	1.05	16170.	384656.	15400.
9	252.	0.	7311.	0.	0.40	5934.	371663.	14835.
10	328.	0.	7311.	0.	0.52	7523.	357157.	14468.
11	0.	0.	4570.	0.	0.29	4102.	348485.	14146.
12	115.	0.	4570.	0.	-0.06	-838.	344869.	13973.

CALENDAR YEAR 1944

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2077.	0.	4570.	0.	-0.06	-834.	343210.	13898.
2	2702.	0.	3656.	0.	0.01	139.	342118.	13858.
3	2172.	0.	5483.	0.	0.31	4258.	334549.	13734.
4	244.	0.	7311.	0.	0.54	7250.	320232.	13425.
5	24386.	0.	7311.	0.	0.17	2283.	335023.	13432.
6	1684.	0.	10967.	0.	0.76	10159.	315581.	13367.
7	1172.	0.	13709.	0.	0.84	10714.	292331.	12754.
8	7689.	0.	13709.	0.	0.80	9734.	276577.	12168.
9	15400.	0.	7311.	0.	0.48	5740.	278926.	11959.
10	24694.	0.	7311.	0.	0.39	4755.	291554.	12192.
11	749.	0.	4570.	0.	0.21	2580.	285153.	12287.
12	1519.	0.	4570.	0.	0.10	1212.	280890.	12124.

CALENDAR YEAR 1945

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2219.	0.	4570.	0.	0.15	1799.	276741.	11992.
2	2010.	0.	3656.	0.	0.09	1070.	274026.	11884.
3	1710.	0.	5483.	0.	0.23	2700.	267552.	11740.
4	10256.	0.	7311.	0.	0.22	2561.	267936.	11641.
5	1304.	0.	7311.	0.	0.63	7203.	254726.	11433.
6	5923.	0.	10967.	0.	0.59	6521.	243161.	11052.
7	51794.	0.	13709.	0.	0.34	3875.	277371.	11398.
8	1190.	0.	13709.	0.	0.82	9509.	255344.	11596.
9	396.	0.	7311.	0.	0.76	8371.	240057.	11015.
10	7526.	0.	7311.	0.	0.29	3112.	237160.	10732.
11	1341.	0.	4570.	0.	0.45	4751.	229180.	10559.
12	1731.	0.	4570.	0.	0.28	2895.	223447.	10339.

CALENDAR YEAR 1946

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1945.	0.	4570.	0.	-0.01	-102.	220924.	10202.
2	2407.	0.	3656.	0.	0.22	2223.	217453.	10103.
3	480.	0.	5483.	0.	0.34	3367.	209083.	9903.
4	0.	0.	7311.	0.	0.42	4015.	197756.	9560.
5	44164.	0.	7311.	0.	0.26	2589.	232020.	9959.
6	3625.	0.	10967.	0.	0.63	6488.	218190.	10299.
7	8.	0.	13709.	0.	1.06	10239.	194250.	9660.
8	1544.	0.	13709.	0.	1.07	9414.	172672.	8798.
9	24316.	0.	7311.	0.	0.37	3197.	186479.	8641.
10	3809.	0.	7311.	0.	0.42	3685.	179292.	8775.
11	5764.	0.	4570.	0.	0.23	1981.	178505.	8614.
12	12656.	0.	4570.	0.	0.05	438.	186154.	8752.

CALENDAR .EAR 1947

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2917.	0.	4570.	0.	0.11	974.	183527.	8854.
2	1743.	0.	3656.	0.	0.25	2179.	179435.	8718.
3	1077.	0.	5483.	0.	0.10	852.	174177.	8523.
4	2948.	0.	7311.	0.	0.35	2888.	166925.	8252.
5	53350.	0.	7311.	0.	0.18	1624.	211339.	9025.
6	13887.	0.	10967.	0.	0.66	6452.	207808.	9775.
7	183.	0.	13709.	0.	0.99	9216.	185066.	9309.
8	0.	0.	13709.	0.	0.85	7165.	164193.	8429.
9	66.	0.	7311.	0.	0.80	6122.	150826.	7653.
10	15587.	0.	7311.	0.	0.53	3941.	155160.	7436.
11	1274.	0.	4570.	0.	0.31	2296.	149569.	7405.
12	8278.	0.	4570.	0.	0.09	661.	152616.	7343.

CALENDAR YEAR 1948

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1911.	0.	4570.	0.	0.17	1245.	148713.	7322.
2	1353.	0.	3656.	0.	0.11	787.	145624.	7151.
3	2270.	0.	5483.	0.	0.40	2792.	139619.	6980.
4	1970.	0.	7311.	0.	0.49	3283.	130994.	6701.
5	6243.	0.	7311.	0.	0.50	3213.	126713.	6426.
6	5019.	0.	10967.	0.	0.70	4271.	116494.	6101.
7	45784.	0.	13709.	0.	0.65	4222.	144348.	6495.
8	3596.	0.	13709.	0.	0.99	6659.	127576.	6726.
9	3296.	0.	7311.	0.	0.66	4084.	119477.	6188.
10	2928.	0.	7311.	0.	0.43	2523.	112571.	5866.
11	1002.	0.	4570.	0.	0.46	2572.	106431.	5592.
12	769.	0.	4570.	0.	0.30	1608.	101023.	5359.

CALENDAR YEAR 1949

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1803.	0.	4570.	0.	-0.02	-105.	98362.	5273.
2	2301.	0.	3656.	0.	0.03	157.	96851.	5228.
3	20119.	0.	5483.	0.	0.24	1285.	110201.	5355.
4	83380.	0.	7311.	0.	-0.06	-433.	186703.	7212.
5	83458.	0.	7311.	0.	0.14	1437.	261412.	10264.
6	8632.	0.	10967.	0.	0.48	5430.	253648.	11312.
7	420.	0.	13709.	0.	0.80	8686.	231673.	10858.
8	3101.	0.	13709.	0.	0.70	7155.	213910.	10222.
9	1843.	0.	7311.	0.	0.53	5163.	203278.	9742.
10	13325.	0.	7311.	0.	0.21	2021.	207271.	9626.
11	569.	0.	4570.	0.	0.43	4107.	199163.	9552.
12	566.	0.	4570.	0.	0.15	1397.	193763.	9310.

CALENDAR YEAR 1950

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1369.	0.	4570.	0.	0.19	1731.	188831.	9109.
2	2389.	0.	3656.	0.	0.20	1791.	185774.	8953.
3	3.	0.	5483.	0.	0.41	3570.	176723.	8708.
4	1505.	0.	7311.	0.	0.27	2253.	168664.	8345.
5	6171.	0.	7311.	0.	0.17	1379.	166145.	8110.
6	1668.	0.	10967.	0.	0.61	4715.	152131.	7729.
7	777.	0.	13709.	0.	0.65	4556.	134644.	7009.
8	1000.	0.	13709.	0.	0.84	5278.	116657.	6284.
9	13659.	0.	7311.	0.	0.37	2212.	120793.	5979.
10	929.	0.	7311.	0.	0.62	3631.	110780.	5856.
11	137.	0.	4570.	0.	0.56	3076.	103272.	5492.
12	197.	0.	4570.	0.	0.26	1375.	97524.	5288.

CALENDAR YEAR 1951

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	228.	0.	4570.	0.	0.33	1703.	91479.	5162.
2	214.	0.	3656.	0.	0.18	855.	87183.	4750.
3	4.	0.	5483.	0.	0.29	1298.	80405.	4476.
4	3.	0.	7311.	0.	0.37	1503.	71594.	4063.
5	31804.	0.	7311.	0.	0.22	980.	95107.	4452.
6	27346.	0.	10967.	0.	0.31	1653.	109833.	5332.
7	11.	0.	13709.	0.	0.76	4028.	92107.	5300.
8	5513.	0.	13709.	0.	0.85	3902.	80010.	4590.
9	1299.	0.	7311.	0.	0.70	2829.	71169.	4041.
10	11.	0.	7311.	0.	0.53	1900.	61969.	3585.
11	1.	0.	4570.	0.	0.34	1105.	56295.	3249.
12	0.	0.	4570.	0.	0.33	991.	50735.	3002.

CALENDAR YEAR 1952

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	0.	0.	4570.	0.	0.28	781.	45385.	2788.
2	0.	0.	3656.	0.	0.33	858.	40871.	2600.
3	0.	0.	5483.	0.	0.36	857.	34531.	2382.
4	8704.	0.	7311.	0.	0.36	813.	35110.	2259.
5	29556.	0.	7311.	0.	0.31	838.	56517.	2704.
6	9514.	0.	10967.	0.	0.79	2409.	52655.	3049.
7	0.	0.	13709.	0.	0.79	2104.	36843.	2663.
8	0.	0.	13709.	0.	1.15	2285.	20850.	1987.
9	34381.	0.	7311.	0.	0.43	954.	46965.	2219.
10	156.	0.	7311.	0.	0.72	1853.	37956.	2574.
11	1413.	0.	4570.	0.	0.19	440.	34360.	2317.
12	498.	0.	4570.	0.	0.17	364.	29924.	2140.

CALENDAR YEAR 1953

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	78.	0.	4570.	0.	0.32	612.	24821.	1912.
2	1.	0.	3656.	0.	0.23	348.	20818.	1514.
3	12782.	0.	5483.	0.	0.15	246.	27871.	1640.
4	8.	0.	7311.	0.	0.36	576.	19991.	1601.
5	12101.	0.	7311.	0.	0.41	597.	24184.	1455.
6	5.	0.	10967.	0.	0.84	997.	12225.	1187.
7	1819.	0.	13709.	0.	0.71	336.	0.	473.
8	37709.	0.	13709.	0.	0.62	503.	23498.	811.
9	1532.	0.	7311.	0.	0.76	994.	16724.	1309.
10	19508.	0.	7311.	0.	0.31	464.	28457.	1496.
11	1107.	0.	4570.	0.	0.28	514.	24481.	1834.
12	83.	0.	4570.	0.	0.31	449.	19545.	1449.

CALENDAR YEAR 1954

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	58.	0.	4570.	0.	0.19	212.	14821.	1116.
2	15.	0.	3656.	0.	0.36	317.	10864.	881.
3	126.	0.	5483.	0.	0.39	228.	5278.	585.
4	65197.	0.	7311.	0.	0.11	245.	62919.	2228.
5	85444.	0.	7311.	0.	0.25	1327.	139725.	5308.
6	9599.	0.	10967.	0.	0.72	4861.	133496.	6751.
7	2139.	0.	13709.	0.	1.08	6723.	115204.	6225.
8	269.	0.	13709.	0.	1.03	5601.	96163.	5438.
9	0.	0.	7311.	0.	0.95	4550.	84302.	4789.
10	4.	0.	7311.	0.	0.66	2796.	74199.	4236.
11	132.	0.	4570.	0.	0.45	1712.	68049.	3805.
12	1.	0.	4570.	0.	0.42	1475.	62006.	3511.

CALENDAR YEAR 1955

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	0.	0.	4570.	0.	0.15	490.	56947.	3264.
2	727.	0.	3656.	0.	0.20	615.	53403.	3074.
3	18.	0.	5483.	0.	0.44	1259.	46679.	2861.
4	0.	0.	7311.	0.	0.50	1285.	38082.	2571.
5	125966.	0.	7311.	0.	0.18	939.	155798.	5214.
6	59039.	0.	10967.	0.	0.54	4619.	199251.	8554.
7	37403.	0.	13709.	0.	0.74	7181.	215765.	9704.
8	2646.	0.	13709.	0.	0.75	7255.	197447.	9673.
9	26013.	0.	7311.	0.	0.55	5272.	210877.	9586.
10	6572.	0.	7311.	0.	0.66	6400.	203737.	9697.
11	2.	0.	4570.	0.	0.41	3862.	195307.	9420.
12	0.	0.	4570.	0.	0.39	3552.	187186.	9107.

CALENDAR YEAR 1956

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1.	0.	4570.	0.	0.19	1676.	180941.	8822.
2	266.	0.	3656.	0.	0.16	1376.	176176.	8599.
3	2.	0.	5483.	0.	0.50	4144.	166551.	8287.
4	2653.	0.	7311.	0.	0.39	3079.	158813.	7895.
5	99057.	0.	7311.	0.	0.39	3720.	246839.	9538.
6	0.	0.	10967.	0.	0.88	9390.	226482.	10671.
7	1197.	0.	13709.	0.	1.07	10656.	203314.	9959.
8	866.	0.	13709.	0.	1.11	10134.	180338.	9130.
9	49.	0.	7311.	0.	0.99	8257.	164819.	8340.
10	30070.	0.	7311.	0.	0.60	5033.	182545.	8388.
11	4804.	0.	4570.	0.	0.65	5624.	177156.	8652.
12	3052.	0.	4570.	0.	0.18	1525.	174113.	8472.

CALENDAR YEAR 1957

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	132.	0.	4570.	0.	0.27	2231.	167445.	8262.
2	0.	0.	3656.	0.	0.07	561.	163228.	8016.
3	7740.	0.	5483.	0.	0.33	2611.	162874.	7912.
4	48078.	0.	7311.	0.	-0.09	-793.	204433.	8806.
5	418099.	0.	7311.	63705.	-0.19	-2825.	554340.	14867.
6	166230.	0.	10967.	147825.	0.39	7438.	554340.	19071.
7	2295.	0.	13709.	0.	0.92	17337.	525589.	18845.
8	1587.	0.	13709.	0.	1.00	18186.	495281.	18186.
9	17690.	0.	7311.	0.	0.57	10165.	495495.	17833.
10	291947.	0.	7311.	221911.	0.21	3880.	554340.	18476.
11	11250.	0.	4570.	5724.	0.05	957.	554340.	19139.
12	3868.	0.	4570.	0.	0.29	5534.	548104.	19084.

CALENDAR YEAR 1958

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	4485.	0.	4570.	0.	0.04	760.	547259.	19009.
2	6908.	0.	3656.	0.	0.00	0.	550512.	19035.
3	6056.	0.	5483.	0.	0.05	953.	550131.	19065.
4	2183.	0.	7311.	0.	0.20	3793.	541209.	18967.
5	14449.	0.	7311.	0.	0.24	4536.	543811.	18900.
6	6590.	0.	10967.	0.	0.65	12187.	527247.	18750.
7	501.	0.	13709.	0.	0.93	16951.	497089.	18226.
8	422.	0.	13709.	0.	0.78	13689.	470113.	17550.
9	3611.	0.	7311.	0.	0.25	4280.	462132.	17122.
10	1403.	0.	7311.	0.	0.23	3887.	452337.	16900.
11	855.	0.	4570.	0.	0.28	4667.	443955.	16669.
12	493.	0.	4570.	0.	0.25	4114.	435764.	16458.

CALENDA .EAR 1959.

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	460.	0.	4570.	0.	0.24	3909.	427746.	16288.
2	231.	0.	3656.	0.	0.12	1938.	422382.	16154.
3	5.	0.	5483.	0.	0.52	8256.	408648.	15877.
4	0.	0.	7311.	0.	0.40	6185.	395152.	15462.
5	1859.	0.	7311.	0.	0.34	5148.	384552.	15140.
6	35671.	0.	10967.	0.	0.21	3210.	406046.	15285.
7	23773.	0.	13709.	0.	0.29	4541.	411570.	15659.
8	225.	0.	13709.	0.	0.81	12452.	385634.	15373.
9	0.	0.	7311.	0.	0.62	9185.	369137.	14814.
10	146293.	0.	7311.	0.	0.02	328.	507791.	16423.
11	7431.	0.	4570.	0.	0.24	4346.	506306.	18108.
12	3704.	0.	4570.	0.	0.09	1625.	503815.	18061.

CALENDAR YEAR 1960

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	16896.	0.	4570.	0.	-0.01	-182.	516323.	18178.
2	5522.	0.	3656.	0.	0.18	3295.	514895.	18306.
3	2439.	0.	5483.	0.	0.32	5820.	506030.	18187.
4	14652.	0.	7311.	0.	0.38	6874.	506497.	18089.
5	4655.	0.	7311.	0.	0.49	8800.	495041.	17960.
6	2496.	0.	10967.	0.	0.85	14912.	471657.	17544.
7	50.	0.	13709.	0.	0.69	11691.	446308.	16944.
8	571.	0.	13709.	0.	0.65	10622.	422548.	16342.
9	108.	0.	7311.	0.	0.70	11066.	404278.	15809.
10	11784.	0.	7311.	0.	0.28	4348.	404404.	15527.
11	2408.	0.	4570.	0.	0.41	6320.	395922.	15415.
12	2040.	0.	4570.	0.	-0.05	-764.	394156.	15278.

CALENDAR YEAR 1961

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	7275.	0.	4570.	0.	-0.10	-1531.	398393.	15311.
2	6310.	0.	3656.	0.	0.11	1692.	399355.	15381.
3	997.	0.	5483.	0.	0.39	5949.	388920.	15254.
4	18.	0.	7311.	0.	0.57	8498.	373128.	14909.
5	12194.	0.	7311.	0.	0.43	6313.	371698.	14682.
6	25339.	0.	10967.	0.	0.06	891.	385179.	14842.
7	10627.	0.	13709.	0.	0.47	6997.	375101.	14886.
8	941.	0.	13709.	0.	0.80	11543.	350791.	14428.
9	24045.	0.	7311.	0.	0.43	6122.	361402.	14238.
10	11011.	0.	7311.	0.	0.34	4886.	360216.	14370.
11	2817.	0.	4570.	0.	0.14	2002.	356462.	14301.
12	2669.	0.	4570.	0.	0.19	2695.	351866.	14184.

CALENDAR YEAR 1962

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	2459.	0.	4570.	0.	0.23	3230.	346526.	14044.
2	1385.	0.	3656.	0.	0.33	4577.	339678.	13871.
3	301.	0.	5483.	0.	0.38	5177.	329318.	13625.
4	196.	0.	7311.	0.	0.39	5190.	317013.	13307.
5	5.	0.	7311.	0.	0.73	9411.	300295.	12892.
6	1036.	0.	10967.	0.	0.39	4846.	285518.	12426.
7	5074.	0.	13709.	0.	0.68	8119.	268765.	11940.
8	268.	0.	13709.	0.	0.94	10611.	244713.	11288.
9	877.	0.	7311.	0.	0.33	3553.	234726.	10766.
10	14532.	0.	7311.	0.	0.38	4051.	237896.	10659.
11	1857.	0.	4570.	0.	0.28	2973.	232211.	10619.
12	1134.	0.	4570.	0.	0.18	1880.	226895.	10443.

CALENDAR YEAR 1963

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	1221.	0.	4570.	0.	0.20	2054.	221493.	10269.
2	363.	0.	3656.	0.	0.22	2219.	215981.	10088.
3	93.	0.	5483.	0.	0.47	4617.	205974.	9824.
4	106.	0.	7311.	0.	0.40	3782.	194987.	9455.
5	28716.	0.	7311.	0.	0.17	1634.	214757.	9611.
6	12721.	0.	10967.	0.	0.43	4262.	212250.	9911.
7	500.	0.	13709.	0.	0.99	9377.	189664.	9472.
8	1521.	0.	13709.	0.	0.76	6589.	170888.	8669.
9	257.	0.	7311.	0.	0.60	4799.	159035.	7999.
10	159.	0.	7311.	0.	0.57	4248.	147634.	7453.
11	1138.	0.	4570.	0.	0.20	1415.	142787.	7077.
12	446.	0.	4570.	0.	0.16	1102.	137561.	6888.

CALENDAR YEAR 1964

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	374.	0.	4570.	0.	0.18	1203.	132163.	6683.
2	1471.	0.	3656.	0.	0.28	1815.	128163.	6484.
3	449.	0.	5483.	0.	0.34	2120.	121008.	6236.
4	13237.	0.	7311.	0.	0.39	2400.	124534.	6154.
5	2870.	0.	7311.	0.	0.49	2972.	117120.	6066.
6	4706.	0.	10967.	0.	0.69	3932.	106928.	5698.
7	619.	0.	13709.	0.	0.84	4402.	89436.	5241.
8	13185.	0.	13709.	0.	0.78	3631.	85281.	4655.
9	24861.	0.	7311.	0.	0.23	1179.	101652.	5127.
10	1173.	0.	7311.	0.	0.43	2247.	93266.	5225.
11	5943.	0.	4570.	0.	0.19	974.	93666.	5127.
12	462.	0.	4570.	0.	0.27	1302.	88257.	4821.

CALENDAR .EAR 1965

MONTH	INFLOW(AF)	RELEASE(AF)	DEMAND(AF)	SPILLS(AF)	EVAP(FT)	EVAP(AF)	CONTENT(AF)	SRF AREA(AC)
1	660.	0.	4570.	0.	0. 19	870.	83477.	4580.
2	2181.	0.	3656.	0.	0. 81	3506.	78496.	4328.
3	745.	0.	5483.	0.	0. 30	1211.	72547.	4038.
4	663.	0.	7311.	0.	0. 38	1398.	64501.	3679.
5	95877.	0.	7311.	0.	-0. 14	-781.	153847.	5578.
6	21872.	0.	10967.	0.	0. 42	3218.	161535.	7661.
7	16777.	0.	13709.	0.	0. 94	7278.	157325.	7743.
8	1252.	0.	13709.	0.	0. 74	5336.	139532.	7211.
9	5447.	0.	7311.	0.	0. 63	4250.	133418.	6746.
10	4046.	0.	7311.	0.	0. 31	2018.	128134.	6511.
11	1843.	0.	4570.	0.	0. 25	1575.	123833.	6299.
12	1089.	0.	4570.	0.	0. 11	672.	119681.	6108.

Volume II – Technical Report
Appendices

Appendix 3
LCRA Raw Water Contract Administrative Rules and Standard Form
Municipal Water Sale Contract

ENERGY • WATER • COMMUNITY SERVICES

WATER CONTRACT RULES
(August 26, 2009)
TABLE OF CONTENTS

Page

Article 1. PURPOSE 3
Article 2. AUTHORITY 3
Article 3. DEFINITIONS 3
Article 4. Application PROCEDURES 6
4.1 Application submittal. 6
4.2 Administrative Review. 6
4.3 Technical Review. 7
4.4 Notice of Application. 8
4.5 Board Approval Required. 8
4.6 Action on an Application by the General Manager or Designee. 8
4.7 Action on an Application by the Board 9
4.8 Application Following Default. 9
4.9 Retention in Central Records and Transmittal to Purchaser. 9
4.10 TCEQ filing requirements. 9
Article 5. Application Content Requirements 10
5.1 Elements of an administratively complete application. 10
5.2 Maps and descriptions required. 11
5.3 Water Conservation, Drought Contingency Plans. 12
5.4 Purchasers with multiple contracts. 12
5.5 Secondary water sales. 12
5.6 Non-Standard Application. 13
5.7 Application Forms. 13
5.8 Application fees. 13
Article 6. Standard Contract Provisions 14
6.1 Required Standard Contract Terms Regarding Water Use. 14
6.2 Surplus Water and Return Flows. 15
6.3 Source of Supply. 15
6.4 Terms of contracts. 15
6.5 Notices required. 16
6.6 Provision of Regulatory Approvals. 17
Article 7. AMENDMENTS 17
7.1 Amendments to Standard Contract terms. 17
7.2 Amendments to existing contracts. 17
7.3 Contract assignments. 18
Article 8. SUPPLEMENTAL REQUIREMENTS 18
8.1 Water measurement. 18
8.2 Testing of Measuring Device. 19
8.3 Water audit and unaccounted-for water loss. 20
8.4 Water intakes, diversion works, and impoundments. 20
8.5 Use of LCRA property. 20
8.6 Exceedance of MAQ. 20
8.7 Upstream or Downstream Tributary Contracts. 21
8.8 Returned Instrument Fee. 21
8.9 Pro rata reduction during water shortage. 21

Article 9. AGRICULTURAL INTERRUPTIBLE WATER SERVICE CONTRACTS 21
9.1 Applicability. 21
9.2 Deadline for Applications and Contracts. 21
9.3 Unpaid Account Balances. 22
Article 10. VARIANCES 22
TABLE 1 23

WATER CONTRACT RULES

ARTICLE 1. PURPOSE

The purpose of these rules is to provide guidance and establish procedures for the administration of the Lower Colorado River Authority's (LCRA's) water contracts and related activities, consistent with LCRA Board Policy and State law. The LCRA Board of Directors may amend these rules from time to time. These rules apply to LCRA's various water contracts, as well as resolutions passed by the LCRA Board of Directors for the supply of water under water rights and from water supplies owned or otherwise controlled by LCRA. Except as set forth in Article 9 of these Rules, these rules do not apply to LCRA's Agricultural Interruptible Water Service Contracts. Sales of water by LCRA are subject to, among other things, water availability, the policies and directives of LCRA including the Water Management Plan, and the requirements of the Texas Water Code and rules of TCEQ.

ARTICLE 2. AUTHORITY

(a) These rules are promulgated in accordance with state law, including the LCRA enabling legislation and the Texas Water Code, LCRA's existing water rights, LCRA's Water Management Plan, and LCRA policies and rules.

(b) As a Texas conservation and reclamation district and owner of major water rights in the lower Colorado River watershed, LCRA makes water available from its water rights to purchasers in accordance with State laws, rules and permits and applicable LCRA policies and rules on terms that are just, reasonable and without discrimination to the extent that water is available based on LCRA's water rights.

ARTICLE 3. DEFINITIONS

The following definitions shall apply to terms used in these administrative rules and in LCRA's water contracts, unless such terms are otherwise defined in the water contracts.

3.1 **Acre-foot of water**: A quantity of water equal to 325,851 U.S. gallons. Such quantity of water would cover one acre of land to a depth of one foot.

3.2 **Agriculture or agricultural**: These terms mean any of the following activities:

a) Cultivating the soil to produce crops for human food, animal feed, or planting seed or for the production of fibers;
b) The practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or non-soil media by a nursery grower;
c) Raising, feeding, or keeping animals for breeding purposes or for the production of food or fiber, leather, pelts, or other tangible products having a commercial value;
d) Raising or keeping equine animals;
e) Wildlife management; and
f) Planting cover crops, including cover crops cultivated for transplantation, or leaving land idle for the purpose of participating in any governmental program or normal crop or livestock rotation procedure.

3.3 **Agricultural Interruptible Water Service Contract**: Contracts issued typically on a seasonal term for water diverted and delivered to Purchasers by LCRA's Irrigation Operations. Except for Article 9 of these rules, these rules do not apply to Agricultural Irrigation Service Contracts.

3.4 **Agricultural use**: Any use or activity involving Agriculture, including Irrigation.

3.5 **Applicant**: A person, association of persons, or other entity who has submitted an application for a contract to purchase water from LCRA, and who has provided all information required under these rules.

3.6 **Beneficial Use**: Use of that amount of water that is economically necessary for the purpose authorized in the contract, when reasonable intelligence and reasonable diligence are used in applying the water to the purpose.

3.7 **Certificate of Adjudication**: An instrument evidencing a water right issued to each person adjudicated a water right in conformity with the provisions of the Texas Water Code.

3.8 **Conveyance, Delivery or System Loss:** That amount of additional water needed to transport water downstream using the bed and banks of a stream or watercourse, through a canal system or other similar conveyance system to meet the requested or ordered amount of water at the point or location of delivery under the contract; or that amount of water that is reasonably expected to be lost due to evaporation, transpiration, recharge, seepage, leakage or other similar losses in the transportation of the water from the source of supply to the Point of Delivery or Point(s) of Availability under the contract

3.9 **Customer**: A person, association of persons, or other entity to whom a water contract has been issued (*see* Purchaser).

3.10 **Domestic Use**: Use of water by an individual or a household to support domestic activity. Such use may include water for drinking, washing, or culinary purposes; for irrigation of lawns, or of a family garden and/or orchard; for watering of domestic animals; and for water recreation including aquatic and wildlife enjoyment. If the water is diverted, it may be diverted solely through the efforts of the user or may be diverted using facilities that are shared by other domestic users, so long as the water that is diverted does not receive any treatment prior to receipt by individual users or households. Domestic use does not include water used to support activities for which consideration is given or received or for which the product of the activity is sold.

3.11 **Drought Contingency Plan**: A plan prepared by an Applicant or Purchaser, in accordance with LCRA's Drought Contingency Plan Rules (included in these Water Contract Rules as Appendix B), which includes a strategy or combination of strategies for temporary supply and demand management responses to temporary and potentially recurring water supply shortages and other water supply emergencies.

3.12 **Firm water supply**: A supply of water available for Beneficial Uses including domestic, municipal, agricultural, industrial, mining, aquifer storage and recovery, wildlife management, livestock use, instream flows, and bays/estuaries inflows that could be provided during a repetition of: i) the historical drought for the lower Colorado River specified in the Water Management Plan or other written determination of Highland Lakes firm water supply approved by TCEQ; or, ii) the most severe historical drought – according to TCEQ, the Texas Water Development Board or applicable groundwater conservation district permit, water management plan and/or rules and regulations for any other source of supply from which LCRA makes water available.

3.13 **Highland Lakes:** Lakes Austin, Travis, Marble Falls, LBJ, Inks, and Buchanan.

3.14 **Industrial use**: The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, including commercial fish and shellfish production and the development of power by means other than hydroelectric, but does not include agricultural use.

3.15 **Interruptible water supply**: A supply of water available for irrigation, instream flows, bays/estuaries inflows, and other non-firm water supply uses that is subject to interruption or curtailment pursuant to published policies and procedures as established in LCRA's Water Management Plan.

3.16 **Irrigation**: The use of nonpotable water, not including reclaimed water or sewage effluent distributed through a municipal distribution system, for the irrigation of crops, trees, and pasture land including, but not limited to, golf courses and parks.

3.17 **Livestock use**: The use of water for the open-range watering of livestock, exotic livestock, game animals, or fur-bearing animals. For purposes of this definition, the terms "livestock" and "exotic

livestock" are to be used as defined in §142.001 of the Agriculture Code, and the terms "game animals" and "fur-bearing animals" are to be used as defined in §63.001 and §71.001, respectively, of the Parks and Wildlife Code.

3.18 **Maximum Annual Quantity (MAQ)**: The maximum amount of water to be made available from LCRA supplies to a Purchaser in any year under a water contract.

3.19 **Mining use**: The use of water for mining processes including hydraulic use, drilling, washing sand and gravel, and oil field repressuring.

3.20 **Municipal use**: The use of potable water within a community or municipality and its environs for domestic, recreational, commercial or industrial purposes or for the watering of golf courses, parks and parkways, or the use of reclaimed water in lieu of potable water for the preceding purposes or the application of municipal sewage effluent on land, under a Texas Water Code, Chapter 26, permit where:

a) the application site is land owned or leased by the Chapter 26 permit holder; or

b) the application site is within an area for which the TCEQ has adopted a no-discharge rule.

3.21 **Non-potable Water.** Water that is not suitable for direct human consumption.

3.22 **Point(s) of Delivery**: The point or points where the Secondary Purchaser's water conveyance system is connected to a Primary Purchaser's water conveyance system.

3.23 **Point(s) of Availability**: The point or points from which water is diverted, pumped, impounded or otherwise withdrawn, from a reservoir, watercourse, stream or other water source.

3.24 **Potable Water.** Water that is suitable for direct human consumption.

3.25 **Primary Purchaser**: A Purchaser who receives water directly from LCRA's firm water supply and delivers all or a part of that water to a Secondary Purchaser.

3.26 **Purchaser**: A person, association of persons, or other entity to whom a water contract has been issued (*see* Customer).

3.27 **Recreational Use**: The use of water impounded in or diverted or released from a reservoir or watercourse for fishing, swimming, water skiing, boating, hunting, and other forms of water recreation, including aquatic and wildlife enjoyment, and aesthetic land enhancement of a subdivision, golf course or similar development by addition of water features such as amenity ponds or water traps from which no water is withdrawn for other purposes.

3.28 **Return Water or Return Flow:** That portion of water diverted from a source of water supply and put to Beneficial Use, which portion is not consumed as a consequence of that use and is returned to the source of supply. Return flow includes sewage effluent.

3.29 **Reuse or Direct Reuse**: The authorized use of water obtained pursuant to a water contract, for the Beneficial Use identified in and within the service area of the water contract, which water remains unconsumed after the water is used for the original purpose of use but before that water is either disposed of or discharged or otherwise allowed to flow into a stream, watercourse, lake or other body of state-owned water.

3.30 **Secondary Purchaser**: A Purchaser who receives firm water under contract with LCRA through delivery from a Primary Purchaser.

3.31 **Standard Contract**: A contract that may be issued by the General Manager or his/her designee without specific approval of the Board of Directors in accordance with these rules. The General Manager may, at his or her discretion, recommend that any request for a Standard Contract be considered by the Board if the General Manager determines there are extenuating circumstances.

3.32 **Surplus Water:** Water taken from any source in excess of the initial or continued Beneficial Use of the appropriator for the purpose or purposes authorized by law. Water that is recirculated within a reservoir for cooling purposes shall not be considered to be surplus water.

3.33 **Temporary water contract**: A contract issued for any of the various Beneficial Uses of water authorized in LCRA's Certificates of Adjudication or any other water right associated with water under LCRA's control when a small volume of water is needed for a short period of time.

3.34 **TCEQ**: The Texas Commission on Environmental Quality or any of its predecessor or successor agencies.

3.35 **Water Conservation.** Water conservation includes, but is not limited to, those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve efficiency in the use of water, and increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

3.36 **Water Conservation Plan**: A plan prepared by an Applicant or Purchaser, in accordance with LCRA's Water Conservation Plan Rules (attached hereto as Appendix A), which is intended to, among other things, promote efficiency in a Purchaser's use of water.

3.37 **Water Contract Rules**: The rules promulgated by LCRA's Board of Directors which provide guidance and establish procedures for the administration LCRA's water contracts and related activities, including LCRA's Water Conservation Plan Rules and LCRA's Drought Contingency Plan Rules.

3.38 **Water Management Plan**: A plan required in specific water rights held by LCRA and approved by the TCEQ that defines LCRA's reservoir operations, water management program and policies under those water rights.

3.39 **Water right**: A right acquired under the laws of the State of Texas to impound, divert, or use state water.

3.40 **Water contract**: A contractual agreement between LCRA and a Purchaser for the sale of water from the source of supply as specified in Section 6.3 of these rules.

ARTICLE 4. APPLICATION PROCEDURES

4.1 Application submittal.

(a) The Applicant shall submit to LCRA for review and approval a water contract application and associated materials as described in Article 5 of these rules. Prior to submittal of the application, the Applicant (or the Applicant's representative) may request a meeting with LCRA staff to discuss the application procedure and various requirements.

(b) An application for a single contract for multiple purposes of use may be submitted unless the General Manager or his/her designee finds that a separate application and contract for each category of use is required for accounting, reporting, or consistency with any underlying LCRA water right.

(c) The timelines in these rules for LCRA staff to conduct its administrative and technical review of an application are intended as guidance to be followed in good faith and are not enforceable by the Applicant or any other party against LCRA. Failure by LCRA to complete review within the timelines provided in these rules shall not constitute a waiver by LCRA of any of its rights. The timelines in these rules are not applicable to review of an application that require a non-standard contract.

4.2 Administrative Review.

(a) LCRA staff shall use reasonable efforts to conduct a review of the application for administrative completeness within fifteen (15) business days of receipt of the application. To be determined administratively complete, Applicant must submit all information required under Article 5 of these rules.

(b) If the application is determined to be administratively incomplete on its face, LCRA staff shall notify the Applicant in writing of the deficiencies. After receipt of such notice from LCRA, the Applicant shall have fifteen (15) business days to file additional information as requested to correct such deficiencies.

(c) If the information subsequently provided by Applicant does not allow LCRA staff to

determine that the application is administratively complete, or if Applicant does not provide additional information, then LCRA staff shall return the application to Applicant as administratively incomplete.

(d) In the event that LCRA determines that it has insufficient supplies of firm water to meet the requested needs of competing contract applications for firm water, LCRA shall use the order of preferred uses contained in Texas Water Code (currently, section 11.024) in determining the preference in contracting to assign to requests that are deemed administratively complete on the same date.

4.3 Technical Review.

(a) Once the application has been declared administratively complete, LCRA staff shall use reasonable efforts to conduct a technical review of the application material within forty-five (45) business days of the declaration of administrative completeness.

(b) The review of the Applicant's proposed water conservation plan and any applicable drought contingency plan shall be conducted as part of the technical review in accordance with the procedures published in LCRA's Water Conservation Plan Rules, attached hereto as Appendix A; LCRA's Drought Contingency Plan Rules, attached hereto as Appendix B; and TCEQ rules governing water conservation plans and drought contingency plans. Contracts will not be presented to the LCRA Board of Directors and/or approved by LCRA staff without LCRA staff approving Applicant's water conservation and drought contingency (if applicable) plans.

(c) If necessary, an extended technical review period shall be provided to determine: (i) the source of supply, infrastructure, water right permits or other authorizations needed to supply water under the contract; (ii) the time frames in which water may be developed under the contract; and, (iii) the appropriate share of the costs to be contributed by the Purchaser, or charged to the Purchaser through surcharges, in addition to the rates, fees and charges under a Standard Contract. Such extended technical review shall be necessary for: (i) any contract request for an amount of 1,500 acre-feet of water or greater; (ii) any contract request for which the water supply would be inconsistent with the 2006 Lower Colorado Regional Water Plan; or, (iii) any contract request for which staff determines that the request seeks a supply for which water may not be immediately available from existing supplies without additional water right permits, infrastructure, or firm water supplies. Technical review of all other aspects of the application material will be conducted in accordance with the procedures herein.

(d) After the appropriate technical review has been completed, the Applicant shall be notified of the approval or rejection of the application. In addition, staff shall provide to Applicant proposed non-standard terms for inclusion in the contract. If additional information is needed to complete the technical review of the application, LCRA shall notify the Applicant in writing and the Applicant shall have thirty (30) business days from receipt of such notification to submit the additional information to LCRA.

(e) If the Applicant fails to submit the requested information within the requested timeframe, the application will be returned.

(f) If Applicant provides the requested information and LCRA staff reviews it and approves, LCRA shall provide Applicant a final draft of the proposed contract. If Applicant accepts the terms of the final draft, then Applicant shall provide public notice in accordance with Section 4.4.

(g) No reservation of water or other consideration shall be made for the requested water until execution of the contract.

4.4 Notice of Application.

(a) Upon notice by staff of the completion of the technical review of an application for which Board approval is required and acceptance by Applicant of LCRA's proposed contract terms, including preparation of all necessary exhibits, the Applicant shall cause to have published at its own expense in a newspaper of general circulation in the county or counties where the water will be impounded, diverted, or otherwise used notice of the application and proposed Board action.

(b) Notice of the application and proposed Board action shall contain:

1) the name and address of the applicant;
2) the date on which the application was received by LCRA;
3) the proposed amount, purpose of use and location of the requested water;
4) a description of the diversion works and impoundment(s) and their locations;
5) the time and location where the Board will consider the application; and
6) information on where a person may obtain a copy of the application from the Applicant.

(c) The date of publication of notice of the application and Board action shall not be less than 30 days prior to the date set for Board consideration of the application.

(d) An affidavit of publication from the publisher shall be submitted by the Applicant to the General Manager or his or her designee within five (5) business days of publication.

(e) The Applicant also shall provide mailed notice by certified mail of the application and proposed Board action to the Commissioner's Court of the county or counties in which the requested water is proposed for impoundment, diversion, or use. Such notice shall contain the information as provided for publication in this section and shall be received by the Commissioner's Court not less than 30 days prior to the date set for Board consideration of the application. Receipt of delivery of certified mail shall be provided by the Applicant to the General Manager or his/her designee within five (5) business days of Applicant's receipt of the delivery receipt.

(f) LCRA shall not take action on an application for which notice is required until notice is given as required by this section and proof of publication and delivery is provided to LCRA in accordance with this section.

(g) If action on the application is delayed to a Board meeting held within 6 months of the date for which notice was provided, the Applicant shall not be required to renotice.

4.5 Board Approval Required.

(a) The following contracts and contract amendments are subject to approval by the LCRA Board of Directors:

1) all proposed water contracts, whether a Standard Contract or not, with a Maximum Annual Quantity of at least 501 acre-feet per annum;
2) Substantive amendments (see Section 7.2) to existing Standard Contracts with a MAQ of at least 501 acre-feet per annum;
3) amendments to existing contracts that increase the MAQ to at least 501 acre-feet; and,
4) any non-standard water contracts or substantive amendments to non-standard water contracts.

(b) All other contracts and contract amendments may be approved by LCRA's General Manager or his/her designee in accordance with these rules.

4.6 Action on an Application by the General Manager or Designee.

(a) Upon completion of staff technical review, if staff determines that a contract can be approved

by the General Manager or his/her designee as provided by these rules, staff will prepare the contract for execution and send such contract to the Applicant for signature.

(b) Within thirty (30) days of receipt, the proposed contract(s) shall be signed by the Applicant or the Applicant's duly authorized representative, and returned to LCRA. If the Applicant is a corporation, partnership, public district, county, municipality, or other corporate entity, the contract shall be signed by a duly authorized official. Written evidence in the form of bylaws, charters, resolutions or other written documentation that specifies the authority of the official to take such action shall be submitted with the signed contract. A corporation may file a corporate affidavit as evidence of the official's authority to sign.

(c) Upon LCRA's receipt of the proposed contract signed by the Applicant or the Applicant's duly authorized representative and all other documentation requested as part of the application process, the proposed contracts will be delivered to LCRA's General Manager or his/her designee for signature.

4.7 Action on an Application by the Board

(a) Following public notice of the application provided in accordance with Section 4.4., LCRA staff shall schedule the proposed contract request for consideration by the Board. If approved by the LCRA Board, staff will prepare the contract for execution and send such contract to the Applicant for signature.

(b) Within thirty (30) days of receipt, the proposed contract(s) shall be signed by the Applicant or the Applicant's duly authorized representative, and returned to LCRA. If the Applicant is a corporation, partnership, public district, county, municipality, or other corporate entity, the contract shall be signed by a duly authorized official. Written evidence in the form of bylaws, charters, resolutions or other written documentation that specifies the authority of the official to take such action shall be submitted with the signed contract. A corporation may file a corporate affidavit as evidence of the official's authority to sign.

(c) Upon LCRA's receipt of the proposed contract signed by the Applicant or the Applicant's duly authorized representative and all other documentation requested as part of the application process, the proposed contracts will be delivered to LCRA's General Manager or his/her designee for signature.

4.8 Application Following Default.

LCRA reserves the right to reject an application for a water contract or renewal of a water contract by a person or entity that has defaulted on another water contract with LCRA. LCRA reserves the right to reject an application for a water contract by an entity for which the majority interest is controlled by a person or entity that has defaulted on another water contract.

4.9 Retention in Central Records and Transmittal to Purchaser.

Following execution of the water contract by the LCRA General Manager or his/her designee the contract will be incorporated into LCRA's Central Records where an original executed contract will be retained as a public record. Another original executed contract will be transmitted to the Purchaser for its records as soon as reasonably possible following the approval of the contract.

4.10 TCEQ filing requirements.

LCRA staff shall file with the TCEQ a copy of any newly executed water contracts as may be required by TCEQ's substantive and procedural rules for water rights.

ARTICLE 5. APPLICATION CONTENT REQUIREMENTS

5.1 Elements of an administratively complete application.
An application for a water contract shall be considered administratively complete upon the receipt by LCRA of the following information:

(a) The full name, physical address, mailing address (if different than physical address), telephone number, and social security or taxpayer identification number for each Applicant, as follows:

1) A corporation shall be designated by the firm name followed by the words "corporation" or "Inc." Corporate applications shall include a listing of all corporate executives, titles, and social security numbers. A partnership shall be designated by the firm name and the words "a partnership." Partnership applications shall include a listing of all partners, titles, and social security or taxpayer identification numbers. A joint venture shall be designated by the joint venture's name followed by the words "Joint Venture." Joint venture applications shall include a listing of all ventures, titles, and social security or taxpayer identification numbers. A trust shall be designated by the trust's name, the trustee's name, followed by the word "trustee." Trust applications shall include the taxpayer identification number and/or social security number of the trustee;
2) If someone other than the named Applicant executes the application, the name, position, mailing address and telephone number of the person executing the application shall be given as well as documentation evidencing the authority of the person to sign the contract on behalf of the named Applicant.

(b) Documentation describing the Applicant's organizational structure (e.g., if the Applicant is a corporation, provide a certificate from the Secretary of State);

(c) All information requested by LCRA to establish:

1) the Applicant's intended water use, including a demand or use schedule that estimates the Applicant's annual water usage, and any increases to it over time, of the water to be supplied under the proposed contract (the "Demand Schedule");
2) whether the application is for a firm or interruptible supply of water:
3) the amount, or Maximum Annual Quantity, of water that Applicant requests LCRA to supply, including a detailed description of how Applicant determined the amount necessary for the proposed Beneficial Use;
4) the appropriate water source and any necessary infrastructure or water rights amendments that may be required to supply the water requested (based on Applicant's proximity to water source, topographic, hydraulic, hydrologic and jurisdictional constraints);
5) the Applicant's intended method of wastewater disposal, and the estimated amount and location of Return Flow;
6) whether the Applicant intends to request a renewal or amendment of the contract upon its termination and any related future long-term water supply requests by the Applicant to LCRA; and
7) the Applicant's compliance with any applicable rules of any regulatory agencies.

(d) The application fee as provided in the amount described in Section 5.8 of these rules;

(e) Maps showing the Point(s) of Availability, point of delivery (as appropriate), point of Return Flow (if any), and the legal description of the service area in the manner required in these rules;

(f) A copy of any water rights or permits, or applications for water rights or permits, associated with the Point(s) of Availability or service area upon which Applicant may rely;

(g) If the Applicant is a corporation, partnership or joint venture, documentation showing the Applicant's legal rights with regard to the property included in the service area (e.g., deed, lease);

(h) A draft Water Conservation Plan and Drought Contingency Plan, unless these rules or LCRA's Water Conservation Plan Rules or LCRA's Drought Contingency Plan Rules do not require such a plan for the type of contract sought by Applicant;

(i) An analysis of how the requested amount of water was determined by the Applicant to be necessary for the proposed use when considering the Beneficial Use of the water without waste and the full implementation of the Applicant's water conservation plan;

(j) If Applicant has an alternate source of water supply that it will also be diverting from the same facilities used to divert water under the requested contract, Applicant shall provide a proposed accounting plan setting forth how it intends to account for and report water used from the various sources of supply;

(k) An estimate, prepared and sealed by a Texas-registered professional engineer, of conveyance, delivery or system losses that are expected to be incurred to make the amount of water requested available at the Point(s) of Availability under the contract. Upon approval by LCRA staff of appropriate estimates, conveyance, delivery or system losses amounts shall be incorporated into the requested MAQ, as appropriate;

(l) For a contract for water upstream of any of the Highland Lakes, or water from a tributary of the Colorado River downstream of the Highland Lakes, a technical analysis performed and sealed by a Texas-registered professional engineer, of the potential maximum impact of the proposed sale on LCRA's Combined Firm Yield of Lakes Buchanan and Travis or any other senior downstream water rights that the LCRA staff may designate. Upon acceptance and approval of appropriate estimates by LCRA, such analysis shall be used to establish the MAQ of the contract. Applicant also shall include such estimates in its application for the Permit to Use State Water necessary to use the water sought in the contract request;

(m) Any other information required by the General Manager, these rules, the application form, or otherwise by law; and,

(n) The notarized signature of a representative authorized to sign the application on behalf of the Applicant.

5.2 Maps and descriptions required.

The Applicant shall submit four (4) copies of the items listed below. All maps should be of reasonable size and scale to permit attachment to the contract as exhibits and must be legible and readable when reduced to 8.5" x 11" size. The items below will be attached to the water contract and incorporated by reference.

(a) Point(s) of Availability map. The Applicant shall provide a map identifying the location of all Points of Availability (points of diversion and/or impoundment) and points for discharge of Return Flow, if any. The map shall be a 7-½ minute United States Geological Survey topographic map indicating the bearing and distance from an original county survey, or from abstracts or surveys in the State of Texas Stream Adjudication Map, to the Points of Availability or its latitude and longitude. The Applicant shall also provide GPS coordinates of any intakes or impoundments.

(b) Legal description. The Applicant shall provide the legal description of the service area. A complete metes and bounds survey of the service area, or other legal documentation filed with county, state, or federal agencies (e.g., a plat filed in county public records; a Certificate of Convenience and Necessity map filed with the TCEQ) will be accepted. The Applicant may submit as a service area only that area for which it has a legal right and requisite authority to serve. The service area for a city shall not extend outside of the city's extraterritorial

jurisdiction absent documentation showing the city's authority to serve the area. Service area as defined in a Certificate of Convenience and Necessity (CCN) or service areas of officially recognized political subdivisions should appear exactly as they appear in the documentation of any applicable regulating authority. If an Applicant has applied for but not yet been granted a CCN or similar right to serve a particular area, the service area proposed in the contract shall be that area that is included in the filing for a certified service area. If no CCN or other right to serve is required, the service area shall be that area where the Applicant intends to provide water.

(c) Service area map. The Applicant shall provide a map delineating the service area in relation to the surrounding landmarks, established cities, and major thoroughfares. This map should reflect the legal description provided above.

5.3 Water Conservation, Drought Contingency Plans.

(a) The Applicant shall submit for review and approval four (4) copies each of a water conservation plan and a drought contingency plan (where applicable) in accordance with the LCRA Water Conservation Plan Rules (attached hereto as Appendix A), LCRA Drought Contingency Plan Rules (attached hereto as Appendix B) and any applicable TCEQ regulations for drought contingency plans. The plans must address the requirements of the rules in regard to conservation and drought contingency.

(b) LCRA staff will review each plan to determine whether it is consistent with the LCRA Water Conservation Rules, LCRA Drought Contingency Plan Rules and applicable state law or rules. Any required plans approved by LCRA staff will be attached to the proposed contract and will be incorporated into the contract by reference.

(c) LCRA, through written notice to Purchaser, may require a Purchaser from time to time to amend its Water Conservation Plan or its Drought Contingency Plan to reflect changes in LCRA's Water Conservation Plan Rules, LCRA's Drought Contingency Plan Rules, or state law or rules. If Purchaser subsequently fails to amend its plans in accordance with such amended rules or changes in applicable state law, or fails to implement its conservation plan, LCRA may terminate the water contract following written notice to Purchaser and opportunity to cure of not more than thirty (30) days.

5.4 Purchasers with multiple contracts.

In the event that the Applicant has a pre-existing water supply contract with LCRA for a different use or service area than the proposed contract, and the Applicant desires to designate some or all of the same Point(s) of Availability for its proposed contract, the Applicant must provide four (4) copies of the following additional information:

(a) A map of reasonable size and scale, showing the Point(s) of Availability to be shared and the Points of Delivery on the Purchaser's water conveyance system for Purchaser's existing and proposed contracts. Such map will be incorporated into the proposed contract(s) by reference.

(b) At the Points of Delivery, Purchaser shall install appropriate water measuring devices in order to determine the amount of water being supplied under each contract. The map submitted pursuant to subsection (a) shall show the location of such measuring devices.

5.5 Secondary water sales.

In the event the Applicant, as a Secondary Purchaser, desires to procure a contract for water from LCRA but have another of LCRA's water sale customers, the Primary Purchaser, divert, and deliver that water from LCRA's firm supply, or the Applicant is a Primary Purchaser that will divert and

deliver water to a Secondary Purchaser, the Applicant must provide four (4) copies of the following additional information:

(a) A map of reasonable size and scale, showing the point where the Secondary Purchaser's water conveyance system is connected to the Primary Purchaser's water conveyance system. Such map will be incorporated into the proposed contract by reference. At the Point of Delivery, the Secondary Purchaser shall install an appropriate water measuring device in order to determine the amount of water being supplied to the Secondary Purchaser such that the Primary Purchaser is not charged for that water.

(b) A written agreement between the Secondary Purchaser and the Primary Purchase for the supply of water.

5.6 Non-Standard Application.

Any application for a contract that, in staff's determination, would require terms in addition to, or a variance from, the Standard Contract terms shall provide the information and fees requested in this Article and shall provide any additional technical information or data that the General Manager or his/her designee determines is necessary for the evaluation of the contract application, including but not limited to any information related to the infrastructure, water right or other authorizations, estimated costs and schedules that may be needed for LCRA to supply the water sought by the application. The General Manager or his/her designee will work with the Applicant to develop a proposed schedule for having the Applicant or a third party (on which third party Applicant and the General Manager or his/her designee must agree) develop any additional technical or other information needed for LCRA to evaluate the contract application. In the event that the Applicant does not provide the requested additional technical or other information within a reasonable timeframe as outlined in the proposed schedule, then said application shall be returned to Applicant as administratively incomplete with the deficiencies duly noted.

5.7 Application Forms.

LCRA staff shall furnish, upon written request, an application form(s) and instructions for preparing such application. The use of the application form is not mandatory; however, the Applicant must submit all the information required by these rules and requested in the application form. Should an Applicant choose not to use the form provided by LCRA, the Applicant shall provide all data requested in the application form and by these rules in such a manner that the information is separated into paragraphs numbered to correspond with those on the printed form. All applications shall be typewritten or printed legibly in ink. Illegible applications will be returned to the Applicant.

5.8 Application fees.

A non-refundable application fee shall be charged for all applications for firm and interruptible water contracts (except those governed by Article 9), including contract renewals, as described below. The fee must be submitted with the application. Applicants requesting more than one water contract must submit the appropriate application fee for each application. The LCRA Board of Directors reserves the right to from time to time modify the fees associated with water contract applications.

(1) Application for a New Standard Contract	$1,000
(2) Temporary Contract Application	$100
(3) Temporary Contract Application for Domestic Use	no charge
(4) Application for a Replacement Standard Contract or Substantive Amendment	$600
(5) Application to Amend a Standard Contract (when a Replacement Contract is not required)	$150
(6) Minimum for a Non-Standard Application	$2,000*

* In the event that the General Manager or his/her designee determines that the application fee filed with an application for a non-standard contract is not sufficient to cover the costs of LCRA staff evaluating the technical information provided by the Applicant, the General Manager or his/her designee may require additional funds be deposited with LCRA to cover such costs or may negotiate an agreement with the Applicant to allow for such evaluation to take place by a third party chosen by the General Manager or his/her designee at the expense of the Applicant.

ARTICLE 6. STANDARD CONTRACT PROVISIONS

6.1 Required Standard Contract Terms Regarding Water Use.
The proposed contract must address the following elements regarding the Applicant's proposed use of the water:

(a) Purpose. Classification of the purpose for which the water will be used shall be determined in accordance with the definitions in Article 3. The General Manager or his/her designee may issue contracts for multiple purposes provided the Maximum Annual Quantity is less than 501 acre-feet per annum. A proposed contract for multiple purposes with a Maximum Annual Quantity of at least 501 acre-feet per annum must be approved by the LCRA Board of Directors.

(b) Amount. The contract shall specify the Maximum Annual Quantity of water to be supplied by LCRA. LCRA shall determine the reasonableness of the MAQ requested by the Applicant by evaluating the availability of water, LCRA's current water commitments, the amount necessary for the Beneficial Use of the water without waste for the proposed use, Purchaser's Water Conservation Plan, the amount of conveyance, delivery or system losses for the proposed contract, and any impact to LCRA's water rights. Agency and industry standards shall be used in LCRA's assessment under this section including, but not limited to, the Water Conservation Implementation Task Force Report to the 79th Legislative (TWDB November 2004); Texas Water Development Board Water Conservation Task Force Best Management Practices; and, other best management practices, standards and guidance commonly used by the same industries. To the extent that Purchaser proposes a MAQ that is based on standards other than those provided in this section, Purchaser shall submit a written justification describing the reasons the standards were not employed in the calculation of the MAQ. In addition, LCRA shall use the following criteria in determining the reasonableness of the MAQ:

1) Temporary Uses:
Shall not exceed ten (10) acre-feet per year or any lower limitations provided by these rules for specific types of temporary uses.

2) Municipal Uses:
   (i) Shall not be less than the average annual quantity required by the TCEQ under its safe yield requirements for public drinking water systems.
   (ii) Shall not result in an average per capita consumption greater than the lesser of: (a) the average per capita consumption of adjacent and similar water users; or, (b) the average per capita consumption recommended in the current approved and applicable Regional Water Plan.

3) Irrigation Uses:
   (i) Shall be determined by consideration of crop type, soil characteristics, topography, method of irrigation, average annual precipitation, and average annual evaporation.
   (ii) Shall not result in an average per acre water demand greater than the average per acre water demand of adjacent and similar water users.

4) Industrial Uses:
   (i) Shall be justified, in a written report, by a registered professional engineer's estimate of the water demands of the specific industrial process being used.
   (ii) Shall not result in an average daily consumption greater than the average daily demand of similar water users in the same region.
5) Firm or Interruptible. The Contract shall specify whether the contract is for a firm or interruptible supply of water.

Notwithstanding the above, for contract purposes, the MAQ shall be no less than 0.75 acre-feet per annum.

6.2 Surplus Water and Return Flows.
In accordance with state law and Board Policy 501, water that Purchaser diverts but does not use for Beneficial Use in accordance with the contract shall be returned to the Colorado River or a tributary of the Colorado River unless otherwise provided in a Board-approved non-standard contract.

6.3 Source of Supply.
(a) Unless specifically provided otherwise in the contract, LCRA may make available water under a contract from any existing or future source of firm water supply available to LCRA.
(b) It is the Purchaser's sole responsibility to obtain access to the source of supply. A contract does not convey any express or implied easements.

6.4 Terms of contracts.
(a) The standard terms for water contracts are as follows:

	Maximum	**Minimum**
(i) Temporary Contracts	3 years	30 days
(ii) Firm Contracts (Municipal or Industrial)	40 years	5 years
(iii) Firm Contracts (other than Municipal or Industrial)	10 years	1 year
(iv) Interruptible Water Supply Contracts	10 years	1 year

(b) Purchaser may reduce the MAQ or terminate the contract, to be effective after the completion of the minimum term defined in Section 6.4(a), subject to minimum notice requirements. For contracts with a MAQ of 1,500 acre-feet per year or greater, the minimum notice for termination or reduction in MAQ shall be one (1) year. For all other contracts, the minimum notice shall be six (6) months.
(c) A Purchaser pursuant to a municipal or industrial use contract based on LCRA's standard form executed on or after January 1, 2001, may: i) reduce the MAQ provided under the contract after the first anniversary of the date the contract takes effect by an amount up to, but not to exceed a total of, twenty-five percent (25%) of the contract's original MAQ; or, ii) terminate the contract after the third anniversary of the date the contract takes effect provided that LCRA has received administratively complete applications for a total amount that exceeds the MAQ of the contract to be terminated. Any such reduction or termination shall be made by a written amendment to the contract or termination instrument on a form approved by LCRA staff and shall be subject to the minimum notice requirements defined in Section 6.4(b).
(d) LCRA's General Manager, or his/her designee, in his/her discretion, may approve a term in excess of the maximum term provided in this rule if a Purchaser requests a longer term that coincides with the terms of loans, bonds, or other financial instruments, as required by governmental entity or financial institution or for other good cause. The Purchaser, to justify the longer term, must provide, in writing, a letter from that governmental entity or financial institution requesting such extension or other special circumstances or compelling reasons in

support of the request for an extended term for good cause. In determining whether to grant a longer term, the General Manager or his/her designee shall consider the priority for firm water for municipal and domestic use provided in these rules.

(e) No continuation of the service obligation under any contract after the expiration of the contract term shall be expressed or implied. The terms of a contract may expressly provide that the Purchaser is required to develop alternative or replacement supplies prior to the expiration of the contract and may further provide for the enforcement of such terms by penalties, fees, or other such provision. LCRA, however, in its sole discretion, may extend the term of an existing contract for a specified period of time pending issuance of a new contract to the same customer provided that the customer has submitted an application for renewal contract prior to the expiration of the existing contract.

6.5 Notices required.

A Purchaser shall notify LCRA in writing of certain activities throughout the term of a Purchaser's contract, which notice requirements shall include those listed below, unless otherwise required by law, in addition to those listed in the contract:

(a) Related water rights permit. In the event the Purchaser is required by state law to obtain a water right permit or water right permit amendment – including but not limited to contractual, term, or temporary water right permits – from TCEQ related to water that is reserved or purchased pursuant to an LCRA water contract, Purchaser shall provide LCRA both (i) a copy of the application for the water right permit or water right permit amendment within five (5) business days of its filing with TCEQ; and, (ii) a copy of the water right permit or water right permit amendment promptly following the issuance of the water right permit or water right permit amendment. Purchaser also shall provide LCRA two copies of any notice or action by TCEQ of a violation or termination of the water right permit or water right permit amendment within ten (10) days of Applicant receiving notice from TCEQ. By March 15th of each year, Purchaser shall also provide LCRA a copy of its annual water use reports filed with TCEQ.

(b) Notice of intent to divert. A Purchaser shall notify LCRA in writing of its intentions to initiate diversions of water under the Purchaser's contract not more than eight (8) weeks, nor less than four (4) weeks, prior to Purchaser's initiation of diversions. If diversions of water are being continued from a previous contract or other right to divert no notice is necessary;

(c) Reuse. A Purchaser shall notify LCRA in writing not more than eight (8) weeks, nor less than four (4) weeks, prior to implementing a program for Reuse for water that is reserved or purchased pursuant to an LCRA water contract;

(d) Transfer to Secondary Purchaser. A Primary Purchaser shall notify LCRA in writing of any agreement it has made to divert or deliver water for a Secondary Purchaser. Such notice shall be provided at least thirty (30) days prior to any diversions or deliveries from the Primary Purchaser to the Secondary Purchaser and shall include the information required by Section 5.5 of these rules.

(e) Termination of contract. A Purchaser shall notify LCRA pursuant to the Purchaser's contract of its desire to cancel said contract. A Purchaser shall remain liable for all fees and charges accruing under the contract through the effective date of termination of the contract. Termination of the contract does not release a Purchaser of its obligation to pay in full all fees and charges that have accrued prior to the contract being terminated;

(f) Change of ownership. A Purchaser shall provide LCRA prior written notice of any change of ownership of Purchaser or the sale, conveyance, merger, or dissolution of the corporate entity or Service Area identified in the Purchaser's contract. Such notice does not constitute the assignment of Purchaser's rights or duties under Purchaser's contract;,

(g) Change of address or executive staff. A Purchaser shall notify LCRA of any change of address or change of executive staff that was provided in Purchaser's application within ten (10) days of the change.

(h) Annual reports of due diligence. Purchaser is required to report to LCRA, on a yearly basis, progress made toward obtaining any and all necessary authorizations (e.g. TCEQ permits, Army Corps of Engineers permits, etc.) as well as progress towards commencing and completing construction of facilities which will be used to divert, impound, and/or convey water under Purchaser's contract; and

(i) As-built plans and location of facilities. Purchaser shall provide to LCRA "as-built" drawings and plans (including GPS coordinates of any intakes or impoundments) for facilities which will be used to divert, impound, and/or convey water under Purchaser's contract were actually built within thirty (30) days of completion of construction.

6.6 Provision of Regulatory Approvals.
Except for water rights permits governed by Section 6.5 (a) of these rules, a Purchaser shall provide LCRA copies of any approvals received from federal, state or local agencies that relate to water reserved or purchased pursuant to Purchaser's contract or to facilities intended to divert, transport or use water provided under Purchaser's contract within a reasonable amount of time following a written request by LCRA staff.

ARTICLE 7. AMENDMENTS

7.1 Amendments to Standard Contract terms.
When it is necessary to amend the Standard Contract terms to more accurately define specific circumstances related to the Applicant's particular location, intended use, etc., LCRA's General Manager or his/her designee may amend the standard form water contract, unless the amendment is a substantive amendment requiring other actions or approval as provided herein.

7.2 Amendments to existing contracts.

(a) If a Purchaser desires to amend an existing contract, the following conditions apply:

1) No amendments will be made to contracts with unpaid account balances.
2) Substantive amendments (as determined by the General Manager or his/her designee except as otherwise provided herein) may be made to existing contracts based on the most current LCRA standard form water contract. Substantive amendments shall include, at a minimum:
   (i) assignment of the contract;
   (ii) increasing the contract's term;
   (iii) increasing the MAQ; and,
   (iv) service area amendments that increase the service area size by: a) fifty (50) acres or more; or, b) ten percent (10%) of the current service area size or more.

Substantive amendments shall require approval by either LCRA's General Manager or the LCRA Board in accordance with these rules.

(b) Only contracts based on the most current LCRA Standard Contract terms may be amended for substantive amendments. If the contract sought to be substantively amended does not contain the most current LCRA Standard Contract terms, the Purchaser will be required to submit an application for a new water contract to replace the existing non-conforming water contract in accordance with these rules.

(c) Nonsubstantive corrections and amendments may be made by LCRA's General Manager, or his/her designee, without LCRA Board of Directors approval. Sufficient documentation shall

be supplied by the Purchaser to justify such amendments.

7.3 Contract assignments.

(a) Water contracts do not convey with the title of the property in the contract service area. If a Purchaser desires to assign the rights and duties under its contract the following conditions apply:

1) Water contracts may only be assigned as specified in the text of the contract. In the event that a Purchaser sells, trades, or otherwise transfers the title to property being supplied water or was to be supplied with water under the terms of a water contract, that water contract will be rendered null and void unless:

(i) Such action is specifically allowed in the contract; and,

(ii) The necessary authorization is obtained from LCRA in advance of the sale, trade, or transfer.

2) If a Purchaser desires to assign a contract and such assignment is permitted under the terms of that contract, the following conditions apply:

(i) LCRA will not authorize the assignment of any contract that has an unpaid account balance;

(ii) LCRA will not authorize the assignment of any contract that is not based on the most current Standard Contract form. LCRA may, however, authorize the assignment of an existing contract if that assignment incorporates all the language and policies reflected in the most current Standard Contract form.;

(iii) the Purchaser must submit legal documentation validating the sale, trade, or transfer of the property covered by the contract's service area; and,

(iv) both assignor and assignee must execute a written instrument of assignment that clearly discloses the assignee, or new Purchaser, and states that the assignee agrees to abide by all terms and conditions contained in the referenced contract.

(b) If the property covered by the contract's service area is foreclosed upon, and the entity exercising its lien desires to continue to supply water to the property, LCRA may at its discretion allow a temporary assignment of rights and duties under the contract to the lien holder for a period not to exceed one year. Such assignment will allow the lien holder as the property owner to continue operation of the system until either: (1) it can negotiate a new water contract with LCRA on its behalf; or, (2) the property can be sold to a subsequent owner. In the event that the property is sold, the subsequent owner must negotiate a new water contract within sixty (60) calendar days of the close of the sale of the property if it desires to continue to purchase water from LCRA.

ARTICLE 8. SUPPLEMENTAL REQUIREMENTS

8.1 Water measurement.

(a) If the water purchased under a contract is to be diverted from a source of supply, Purchaser must measure water diverted with a measuring device approved by LCRA unless otherwise provided in the contract. Measurement of water purchased under contract that does not solely involve the diversion of water from the source of supply (e.g., impoundment of water for recreation or livestock watering) may be accomplished through an alternative method approved by LCRA and included in the contract.

(b) Meters and measuring devices acceptable to LCRA include the following types: displacement, venturi, multi-jet, turbine (various), propeller, proportional, compound, or other

appropriate water meters as recognized by the American Water Works Association. Other measuring devices that may be proposed by a Purchaser must be approved in writing by LCRA. All acceptable meters or measuring devices must, unless otherwise approved in writing by LCRA:

1) Be installed on Purchaser's system as near to the water source as practical and upstream of any connections, taps, faucets or other appurtenances where water may be withdrawn.
2) Be installed in a location that provides LCRA with reasonably safe access to the meter for the purpose of making meter readings, testing, and/or periodic inspections and that does not disrupt the periodic reading of LCRA's other customer's meters. A Purchaser must provide LCRA's representatives access across Purchaser's property for inspection, testing and reading of the meter. A Purchaser must provide an all-weather road to facilitate access to meter. LCRA shall have the right to approve both the design of the meter as well as the location of its installation.
3) Be accurate within ± 5% of the indicated flow over the range of possible flows. In the case of a contract issued for an on-channel impoundment, an alternative measuring device or methodology with a 5% accuracy may be used with prior approval from LCRA.
4) Be able to measure and register quantities of water in increments of 1,000 gallons or less.
5) Be capable of measuring volumetric flow rates and registering total volumetric quantity.
6) Be installed in accordance with the manufacturer's specifications and consistent with standard engineering practices.
7) Be properly screened to prevent debris from causing meter malfunctions.
8) Be of suitable material and of proper construction to withstand a surface water environment.
9) Have serial number easily visible in its installed location.
10) When installed outdoors be in a covered vault or other solid enclosure.
11) Have hermetically sealed registers or other means to prevent the occurrence of condensation on register glass.
12) Be installed in a manner to prevent flooding of the meter enclosure.

(c) A Purchaser must repair, replace or make necessary improvements to a meter or other approved measuring device that is not in compliance with these rules promptly after Purchaser becomes aware of the deficiency that causes the measuring device to not comply with these rules. Prior to or immediately following the time that a meter or other approved measuring device goes out of service, Purchaser and LCRA shall agree on an alternative method for determining the amount of water diverted and/or used.

(d) LCRA, in its sole discretion, may rely on measurements reported to LCRA by a Purchaser but doing so shall not relieve Purchaser from any requirements in these rules relating to meters or measuring devices.

(e) LCRA, in calculating fees due under a firm water contract, may base fees on a measurement of the amount of water made available from the December meter reading date to the next December meter reading date.

8.2 Testing of Measuring Device.

Periodic testing as required under the terms of a water contract must be performed in accordance with testing specifications as published by the American Water Works Association.

(a) Where and when possible such testing is to be performed *in situ* (in place). Measuring device testing should be accomplished on or about January 1 of each year by those contracts that require periodic testing. All testing should be performed by qualified personnel familiar with American Water Works Association testing procedures and with a background in such procedures.

(b) All contracts or contract amendments approved following the effective date of these rules must include the following, or a substantially similar, paragraph:

"In the event PURCHASER fails to test the meter for a period of fifteen (15) consecutive months, PURCHASER agrees: (1) to provide LCRA reasonable access to the meter so that LCRA may test the meter; and, (2) to pay LCRA for the actual cost of testing the meter plus a fifty dollar ($50) administrative fee. LCRA will provide PURCHASER a written statement of the cost of testing the meter, and said statement will subject to the payment terms of this contract."

8.3 Water audit and unaccounted-for water loss.
The Purchaser shall conduct water loss audits in accordance with the Texas Water Development Board rules (Texas Administrative Code, Title 31, Chapter 358).

8.4 Water intakes, diversion works, and impoundments.

(a) All intakes should be designed by a registered professional engineer using standard engineering practices and should be able to facilitate the diversion of water at various water surface elevations. Intake structures or their appurtenances must not pose a threat to public safety or navigability of the Colorado River or LCRA's Highland Lakes. Municipal use intakes should be designed in accordance with the TCEQ rules for public water systems. Any and all markers, buoys, floating intake structures or appurtenances must be approved by LCRA. Information relating to the elevations and depth of the intake shall be submitted with the application if the Highland Lakes are the source of supply.

(b) LCRA representatives shall be provided with reasonable access to any impoundment, storage facility, intake or diversion works for the purpose of inspection and monitoring for compliance with the contract. The diversion works, impoundments, or intake structures shall be equipped or designed in a manner that allows LCRA to access and lock or otherwise prevent Purchasers' continued diversion or other use of water as a result of a default under the contract and after notice to the Purchaser as provided in the contract.

(c) It shall be the Purchaser's responsibility to have the capability to take the water at the Point(s) of Availability. No implied easement to access the source of supply is provided by the contract.

(d) Table 1 provides reference elevations for designing intakes on the Highland Lakes. However, these elevations should not be construed as a guarantee of any minimum lake elevation.

8.5 Use of LCRA property.
Purchasers are required to secure from LCRA, separate from a Purchaser's water contract, any leases, easements, or permits necessary to construct and/or operate any facility on, over, or under any LCRA owned property, including but not limited to the water surface of all of LCRA owned reservoirs.

8.6 Exceedance of MAQ.
If the amount of water made available for a Purchaser for any reason exceeds the Maximum Annual Quantity stated in Purchaser's contract during two (2) consecutive years, or in two (2) out of any four (4) consecutive years, the Purchaser will be required to submit a new application for a replacement contract, including applicable fees, and negotiate a new standard contract for an adjusted MAQ, the

reasonableness of which shall be determined consistent with these rules, to the extent LCRA has additional water supplies available.

8.7 Upstream or Downstream Tributary Contracts.
A Purchaser for the use of water upstream of any of the Highland Lakes or for use of water from a tributary downstream of the Highland Lakes must also obtain a term or temporary permit from the TCEQ as required by TCEQ's substantive and procedural rules for water rights.

8.8 Returned Instrument Fee.
In the event a Purchaser attempts to pay LCRA by check, draft, credit card or any other similar instrument and the instrument is returned or refused by the bank or other similar institution as insufficient or non-negotiable for any reason, Purchaser shall be assessed and must pay to LCRA, per each returned instrument, LCRA's current returned instrument fee. The LCRA returned instrument fee is currently $50.00 per returned instrument.

8.9 Pro rata reduction during water shortage.
(a) During a water shortage, the water supply provided by LCRA under a water contract is subject to curtailment in accordance with section 11.039 of the Texas Water Code, LCRA's water rights, LCRA's Drought Contingency Plan, and any curtailment plan developed with customers as required by LCRA's Water Management Plan.
(b) Consistent with state law and these plans, and to effectively address the water shortage, the curtailment shall be based on the customers' reasonable water needs during the curtailment period, and not the contracted amount, after consideration of the customers' implementation of their water conservation and drought contingency plans.
(c) In the event the supply of water provided to a Purchaser is limited because of a curtailment imposed by LCRA or state law in accordance with these rules to an amount less than the Purchaser's MAQ, then the Purchaser shall pay a surcharge, in excess of the firm water rate, to be set by the LCRA Board of Directors multiplied by any amount of water diverted by Purchaser in excess of the amount Purchaser is authorized to divert during the curtailment. Unless otherwise specifically provided under the contract, a curtailment of water under this provision shall not result in a reduction or suspension of the Reservation Fee for the unused portion of the full Maximum Annual Quantity under the contract.

8.10 Implementation of Water Conservation Plan, Drought Contingency Plan and Demand Schedule.
Purchaser shall adopt and implement the approved Water Conservation Plan and Drought Contingency Plan for the duration of the water contract. In addition, Purchaser must periodically report on progress made in implementation of its water conservation plan according to LCRA's Water Conservation Plan Rules. At least once every five (5) years, a Purchaser must submit an updated Drought Contingency Plan to LCRA, provided than any amended Drought Contingency Plan shall not be effective until reviewed and approved in writing by LCRA. At least once every five (5) years, a Purchaser must submit an updated Demand Schedule to LCRA.

ARTICLE 9. AGRICULTURAL INTERRUPTIBLE WATER SERVICE CONTRACTS

9.1 Applicability.
Notwithstanding any other provision of these Rules, this Article 9 controls requests for contracts for Agricultural Interruptible Water Service.

9.2 Deadline for Applications and Contracts.
LCRA shall not enter in a contract if the request for a contract is received after March 1 in any year except where:

(a) a curtailment of interruptible supply has not been declared by the LCRA Board;
(b) provision of water under the requested contract would not appreciably increase LCRA's operation costs nor unreasonably interfere with LCRA operations;
(c) provision of water under the requested contract would not impair LCRA's ability to deliver water to other customers who made request for contracts on or before March 1; and,
(d) the request for a contract is caused by a failure of the customer's other water supply (i.e. groundwater pump failure) or other emergency need for water.

9.3 Unpaid Account Balances.
LCRA shall not execute a Agricultural Interruptible Water Service Contract with a prospective customer if that customer has an unpaid account balance under a prior Agricultural Interruptible Water Service Contract.

ARTICLE 10. VARIANCES

Where special conditions or compelling circumstances exist, the LCRA Board of Directors may consider and approve requests for variances from the requirements of these rules on a case-by-base basis upon recommendation by LCRA staff.

TABLE 1

HIGHLAND LAKES
REFERENCE ELEVATIONS
(in feet above mean sea level, based on the 1988 North American Vertical Datum)

Lake Buchanan		
	Spillway	1,020.76
	Flood Gate Sill at 15.5 foot	1,005.76
	Flood Gate Sill at 25.5 foot	995.76
	Penstock Intake at bottom	937.76
Inks Lake		
	Spillway	888.63
	Penstock Intake at bottom	845.2
Lake LBJ		
	Top of Normal Operating Pool	825.68
	Flood Gate Sill	795.68
	Penstock Intake at bottom	793.38
Lake Marble Falls		
	Top of Normal Operating Pool	737.69
	Flood Gate Sill	725.69
	Penstock Intake at bottom	710.69
Lake Travis		
	Spillway	714.52
	Top of Conservation Pool	681.6
	Penstock Intake at bottom	552.7
	Flood Gate Conduits at bottom	536.5
Lake Austin		
	Spillway	493.11
	Flood Gate Sill at 12 foot	480.31
	Flood Gate Sill at 18 foot	475.31
	Penstock Intake at bottom	462.31

APPENDIX A
LCRA WATER CONSERVATION PLAN RULES

APPENDIX B
LCRA DROUGHT CONTINGENCY PLAN RULES

FIRM WATER CONTRACT

by and between

LOWER COLORADO RIVER AUTHORITY

And

_____

PURCHASER

TABLE OF CONTENTS

I. WATER SUPPLY 1

A. MAXIMUM ANNUAL QUANTITY 1
B. EXCEEDANCE OF MAXIUMUM ANNUAL QUANTITY 2
C. SOURCE OF WATER SUPPLY 2
D. _____ USE ONLY 3
E. SERVICE AREA 3
F. WATER CONSERVATION AND DROUGHT CONTINGENCY MEASURES 4
G. AVAILABILITY OF WATER 4
H. DELIVERY OF WATER 4
I. STATE REGULATION OF LCRA WATER SUPPLIES 5
J. OPERATIONS OF DAMS AND RESERVOIRS 5
K. QUALITY OF WATER 5
L. INTERBASIN TRANSFER 6
M. REQUIRED NOTICES 6

II. CONTRACT ADMINISTRATION 7

A. TERM OF CONTRACT 7
B. PAYMENT 7
C. MEASURING WATER 9
D. TERMINATION OF CONTRACT 10
E. NON-PAYMENT 12
F. EQUITABLE REMEDIES 12
G. NOTICE 13
H. ASSIGNMENT OF CONTRACT 13
I. COMPLIANCE WITH FILING REQUIREMENTS 14

III. ENVIRONMENTAL, PERMITTING AND OTHER ISSUES RELATED TO WATER SUPPLY 14

A. NONPOINT SOURCE WATER POLLUTION ABATEMENT 14
B. SEWAGE REGULATIONS 14
C. DOCUMENTATION OF COMPLIANCE; RIGHT OF ENTRY 14
D. ANNUAL REPORTS OF DUE DILIGENCE; AS-BUILT PLANS 14

IV. GENERAL PROVISIONS 15

A. EFFECTIVE DATE 15
B. PREVIOUS CONTRACT 15
C. INDEMNIFICATION 15
D. FORCE MAJEURE 16
E. NO THIRD-PARTY BENEFICIARY 16
F. NO RIGHTS OR TITLE ACQUIRED 16
G. REPRESENTATIONS AND WARRANTIES 16

H. DISPUTE RESOLUTION 16
I. ACTUAL DAMAGES 18
J. AMENDMENT 18
K. BINDING EFFECT 18
L. COMPLETE CONTRACT 18
M. COUNTERPARTS 18
N. FURTHER ASSURANCES 19
O. GOVERNING LAW 19
P. HEADINGS: TABLE OF CONTENTS 19
Q. INCORPORATION OF WATER CONTRACT RULES 19
R. INCORPORATION OF EXHIBITS 19
S. INTERPRETATION AND RELIANCE 19
T. RELATIONSHIP OF PARTIES 19
U. SEVERABILITY 20
V. NO ADDITIONAL WAIVER IMPLIED 20
W. SHORT TERM SALES OF FIRM WATER TO THIRD PARTIES 20

EXHIBITS

A. Description of Point(s) of Availability
B. Description of Service Area
C. Depiction of Service Area
D. Water Conservation Plan
E. Drought Contingency Plan
F. Arbitration Procedures

FIRM WATER CONTRACT

This Contract is entered by and between the LOWER COLORADO RIVER AUTHORITY (hereinafter, together with its successors and assigns, "LCRA") and _____ _____ (hereinafter, together with its successors and assigns as provided herein, "PURCHASER", who, in mutual consideration of the provisions herein contained, agree as follows:

I. WATER SUPPLY

PERMIT REQUIRED [Add this section as Section I.A. only for impoundments or diversion points upstream of the Highland Lakes or on a tributary to the Colorado River]

PURCHASER may not impound, divert, or use water under this contract unless PURCHASER, in accordance with the substantive rules of the Texas Commission on Environmental Quality ("TCEQ") for upstream sales of water, obtains and maintains in effect a permit from the Texas Commission on Environmental Quality that authorizes impoundment, diversion and/or consumptive use of water at the Point(s) of Availability consistent with the limitations set forth in Section I.B. of this agreement for the term of this contract.

A. MAXIMUM ANNUAL QUANTITY.

From and after the Effective Date hereof, PURCHASER shall have the right to a maximum of _____ acre-feet (_____ gallons) of raw or untreated water per annum (the "Maximum Annual Quantity" or "MAQ") made available by LCRA. PURCHASER shall designate a point or points of diversion for such water on the _____ _____ described and depicted in Exhibit "A" attached hereto (the "Point of Diversion"), said Exhibit depicting the location by reference to a corner of an original land survey and/or other survey point, giving course and distance and providing the latitude and longitude.

[Downstream of Mansfield Dam version – adjust as necessary]

From and after the Effective Date hereof, PURCHASER shall have the right to a maximum of _____ acre-feet (_____ gallons) of raw or untreated water per annum (the "Maximum Annual Quantity" or "MAQ") made available by LCRA. Of this amount, no more than ____ acre-feet per annum of raw or untreated water may be diverted by or on behalf of PURCHASER from the Point(s) of Availability (defined below). For purposes of this contract, the term "made available" refers to the greatest of: (i) the amount of water released from LCRA firm supplies to allow for diversions by or on behalf of PURCHASER; (ii) the amount of water diverted by or on behalf of PURCHASER from LCRA firm supplies plus the Loss Factor (defined below) times the amount of water diverted; or (iii) the amount of water impounded by or on behalf of PURCHASER from LCRA firm supplies

Notwithstanding the foregoing, PURCHASER and LCRA agree that calculations of Maximum Annual Quantity and the amount of water made available under this contract will be based on the amount of water which LCRA makes available for diversion by or on behalf of PURCHASER at the Point(s) of Availability plus ____ percent (the "Loss Factor") of the amount made available for diversion at the Point(s) of Availability.

The Loss Factor is LCRA's best available estimate of the conveyance, delivery, or system loss incurred to provide water under this Agreement. PURCHASER acknowledges that this Loss Factor reflects an estimate of conveyance, delivery and system loss within LCRA's _____ Canal of ___ percent from LCRA's Pumping Plant _____ to the Point of Availability on the canal, and an estimated conveyance, delivery and system loss of ____ percent for stored water released from Lake Travis and diverted at LCRA's Pumping Plant ____, within the LCRA _____ Irrigation Division. LCRA hereby reserves the right to modify the Loss Factor and make any associated changes to the MAQ, at any time, based on any revised estimates of conveyance, delivery, or system loss associated with the delivery of water to PURCHASER, including but not limited to changes in the source of supply LCRA uses to make water available to PURCHASER or updated and substantiated information related to river or canal losses.

PURCHASER may, at its option, conduct its own investigation of conveyance, delivery, or system losses, associated with the delivery of water by LCRA under this Agreement. If PURCHASER conducts such study in accordance with LCRA's then-current Water Contract Rules, it shall provide to LCRA in a written report the results of any such investigation within sixty (60) calendar days of completion and LCRA agrees to consider whether any adjustment to the Loss Factor is appropriate under this Agreement. If LCRA determines that an adjustment to the Loss Factor is appropriate, it shall provide PURCHASER written notice, by certified mail, of any change to the Loss Factor and resulting change to the contract MAQ, within fifteen (15) business days of adopting such change. A change to the Loss Factor that results in an increase in the MAQ of 500 acre-feet per year or more shall not take effect until approved by the LCRA Board as an amendment to this Agreement. Notwithstanding the foregoing or any provision in LCRA's raw water contract rules, LCRA will not require PURCHASER to obtain a new contract on the most current standard form water contract where the change to the MAQ is based solely on a change to the Loss Factor.

PURCHASER shall designate a point or points of diversion for such water on the _____ described and depicted in Exhibit "A" attached hereto (the "Point(s) of Availability"), said Exhibit depicting the location by reference to a corner of an original land survey and/or other survey point, giving course and distance and providing the latitude and longitude.

[Firm Yield Impact Version – adjust as necessary]

Upon issuance by TCEQ to PURCHASER of a permit to impound, divert, and use water at the Point(s) of Diversion and/or Impoundment ("Point(s) of Availability") as required in Section I.A. of this contract, PURCHASER shall have the right to impound up to a maximum of _____ acre-feet of raw water and to divert therefrom a maximum of ____

_____ acre-feet of raw water per year, such impoundment to be located on _____, a tributary of the Colorado River in Travis County, Texas, at a point or points of availability within a segment bordering on _____, a tributary of the Colorado River, described and depicted in Exhibit "A" attached hereto (the "Point(s) of Availability"), said Exhibit depicting the segment by reference to a corner of an original land survey and/or other survey point, giving both course and distance and latitude and longitude. PURCHASER acknowledges that the impoundment, diversion and consumptive use, including evaporative losses, of water at the Point(s) of Availability will have an estimated impact to LCRA's senior water rights approximately _____ acre-feet per year (the "Maximum Annual Quantity" or "MAQ"). PURCHASER further acknowledges that this estimate is based on certain assumptions regarding diversion and/or impoundment limitations and other criteria that may be modified by the TCEQ as part of its review and issuance of PURCHASER's Permit to Appropriate State Water. In the event that such permit differs in the amount authorized for impoundment, diversion, or use by PURCHASER or is based on different assumptions than those used to determine the MAQ stated herein, LCRA will amend this contract to reflect those limitations.

B. EXCEEDANCE OF MAXIMUM ANNUAL QUANTITY.

If the amount of water made available to PURCHASER for any reason exceeds the Maximum Annual Quantity stated in PURCHASER's contract during two (2) consecutive years, or two (2) out of any four (4) consecutive years, PURCHASER shall submit an application (including the application fee) for a new standard form water contract for an adjusted MAQ, the reasonableness of which shall be determined consistent with LCRA's then effective Water Contract Rules, to the extent LCRA has water supplies available.

C. SOURCE OF WATER SUPPLY.

(1) The water made available for impoundment, diversion and/or use under this contract will be water provided from any source available to LCRA at the time PURCHASER uses water under this contract.

(2) LCRA may make water available under this contract in accordance with LCRA's Water Management Plan, as may be amended in accordance with state law from time to time, from storage in Lakes Buchanan and/or Travis in accordance with water rights held by LCRA as set forth in Certificates of Adjudication No. 14-5478, as amended, and 14-5482, as amended.

(3) LCRA may make water available under this contract from water rights owned by LCRA based on that certain water right previously owned by the Garwood Irrigation Company and identified as Certificate of Adjudication No. 14-5434 issued by the Texas Water Commission on June 28, 1989, as amended (herein, "Garwood's Right"). That portion of Garwood's Right that is owned by LCRA (and for which reference is made to Certificate of Adjudication No. 14-5434C

issued by the Texas Natural Resource Conservation Commission) is referred to herein as "Garwood's Remaining Right."

(a) PURCHASER acknowledges and agrees that LCRA may make water available for impoundment, diversion and/or use under this contract from Garwood's Remaining Right only following approval by the Texas Commission on Environmental Quality or its successors (hereafter, "TCEQ"), of amendments to allow use of Garwood's Remaining Right for the type of use authorized by this contract at the Point of Diversion.

(b) In this event, this contract is subject to the commitments and conditions set forth in Section 7.08 of that certain Purchase Agreement, dated July 20, 1998, between Garwood Irrigation Company, as seller, and the Lower Colorado River Authority, as buyer (the "LCRA-Garwood Purchase Agreement"), and is further subject to all terms, provisions and special conditions contained within Garwood's Remaining Right, as amended. Copies of the LCRA-Garwood Purchase Agreement and Garwood's Remaining Right, as amended, are available at the following internet web-site address:
http://www.lcra.org/water/contracts.html

PURCHASER also may obtain copies of the LCRA Purchase Agreement and Garwood's Remaining Right, as amended, by request to LCRA's address for notices herein. By executing this contract, PURCHASER hereby acknowledges receipt of copies of the LCRA Purchase Agreement and Garwood's Remaining Right, as amended.

D. _____ USE ONLY.

PURCHASER represents to LCRA and LCRA relies on such representation that all water made available under this contract will be impounded, diverted, and/or used by PURCHASER for _____ use only, as such term is defined by the substantive rules for water rights of the TCEQ. In accordance with state law, any part of the water that PURCHASER impounds or diverts but does not use or consume for such use in accordance with this contract shall be returned to the Colorado River or a tributary of the Colorado River.

E. SERVICE AREA.

Water made available under this contract shall only be used within that certain area consisting of a total of _____ acres, as described in Exhibit "B" attached hereto and depicted in Exhibit "C," attached hereto, together hereinafter called the "Service Area."

F. WATER CONSERVATION AND DROUGHT CONTINGENCY MEASURES.

(1) PURCHASER agrees to implement the water conservation program contained in the water conservation plan (the "Water Conservation Plan") described in Exhibit

"D" attached hereto. PURCHASER further agrees that the water impounded and/or diverted by PURCHASER pursuant to this contract will be used in accordance with such Water Conservation Plan. LCRA, in accordance with applicable law, may from time to time adopt reasonable rules and regulations relating to water conservation measures. PURCHASER agrees to amend its Water Conservation Plan, as necessary, to reflect amendments in state law, regulations or LCRA's water conservation rules and regulations. PURCHASER further agrees to do so within 180 days of the effective date of such amendments, provided that, if the amendments are adopted by LCRA (rather than, for example, TCEQ), the deadline for PURCHASER to make corresponding amendments to its Water Conservation Plan shall run from the date LCRA provides written notice of the amendments to PURCHASER. PURCHASER further agrees to submit its amended Water Conservation Plan to LCRA within 30 days after its adoption. In the event that PURCHASER agrees to furnish water or water services to a third party, who in turn will furnish the water or water services to an ultimate consumer, PURCHASER agrees to include in its agreement with the third party provisions that obligate the third party to: a) develop and implement a water conservation program consistent with PURCHASER's Water Conservation Plan; and, b) amend its water conservation program to reflect amendments in state law, regulations or LCRA's water conservation rules and regulations within the same timelines that apply to PURCHASER.

(2) PURCHASER agrees to implement the drought contingency program contained in the drought contingency plan (the "Drought Contingency Plan") described in Exhibit "E" attached hereto. PURCHASER further agrees that the water impounded and/or diverted by PURCHASER pursuant to this contract will be used in accordance with such Drought Contingency Plan. PURCHASER shall review and update the Drought Contingency Plan not less than once every five (5) years or following written request by LCRA consistent with any other schedule required by LCRA's Water Contract Rules. PURCHASER further agrees to submit any amended Drought Contingency Plan to LCRA within 30 days after its adoption. LCRA, in accordance with applicable law, may from time to time adopt reasonable rules and regulations relating to drought contingency measures, including LCRA's Water Management Plan. PURCHASER agrees to amend its Drought Contingency Plan, as necessary, to reflect amendments in state law or regulations or LCRA's rules, regulations or Water Management Plan. PURCHASER further agrees to do so within 180 days of the effective date of such amendments, provided that, if the amendments are adopted by LCRA (rather than, for example, TCEQ), the deadline for PURCHASER to make corresponding amendments to its Drought Contingency Plan shall run from the date LCRA provides written notice of the amendments to PURCHASER. In the event that PURCHASER agrees to furnish water or water services to a third party, who in turn will furnish the water or water services to an ultimate consumer, PURCHASER agrees to include in its agreement with the third party provisions that obligate the third party to: a) develop and implement a drought contingency program consistent with PURCHASER's Drought Contingency Plan; and b) amend its drought contingency program to reflect

amendments in state law, regulations, or LCRA's rules, regulations, or Water Management Plan within the same timelines that apply to PURCHASER.

G. AVAILABILITY OF WATER.

LCRA is committing to make available to PURCHASER under this contract a portion of LCRA's firm water supply, as defined in LCRA's Water Contract Rules; provided, however, LCRA may interrupt or curtail the water supplied under this contract as required by state law or in accordance with LCRA's Water Management Plan or Drought Contingency Plan, as such Plans and any amendments thereto have been approved and may be approved in the future by the TCEQ.

[Use version below for impoundments or diversion points upstream of Highland Lakes or on a tributary of the Colorado River.]

Water supplied under this contract is water that otherwise would have flowed into the Colorado River and is a commitment against LCRA's firm water supply, as defined in LCRA's Water Contract Rules, subject to diversion and use rights of all senior right holders downstream of the Point(s) of Availability. Additionally LCRA may interrupt or curtail the water supplied under this contract as required by state law or in accordance with LCRA's Water Management Plan or Drought Contingency Plan, as such Plans and any amendments thereto have been approved and may be approved in the future by the TCEQ.

H. DELIVERY OF WATER.

LCRA is responsible for making water available under this contract only up to the MAQ. LCRA makes no guarantee that the water made available under this contract will be available at any particular time or place or that any LCRA owned/operated reservoir or the Colorado River will be maintained at any specific elevation or flow at any particular time. Furthermore, PURCHASER acknowledges and agrees that LCRA's obligations under this contract shall not require LCRA to make additional releases of water from LCRA firm water supplies beyond the MAQ or to make releases to raise the water elevations or flows at the Point(s) of Availability at a particular time sufficient for PURCHASER's intake and/or diversion facilities to operate.

I. STATE REGULATION OF LCRA WATER SUPPLIES.

PURCHASER acknowledges and agrees that the water LCRA makes available under this contract may be regulated in whole or in part by the State of Texas or local regulatory authorities. PURCHASER further acknowledges and agrees that LCRA's water rights are subject to regulation by the State of Texas, including but not limited to periodic review and amendment of LCRA's Water Management Plan by the TCEQ. LCRA and PURCHASER acknowledge and agree that LCRA shall be obligated to exercise due diligence to manage its water supplies within such regulatory regimes to make water available to PURCHASER in accordance with the terms of this contract. PURCHASER acknowledges and agrees, however, that LCRA's obligations under this contract may be

affected by orders of the State of Texas, its agencies or local regulatory authorities. Orders of the State of Texas, its agencies or local regulatory authorities may constitute a "force majeure" event in accordance with this contract.

J. OPERATIONS OF DAMS AND RESERVOIRS.

The right of LCRA to maintain and operate its several dams and their appurtenances on the Colorado River and its associated tributaries and at any and all times in the future to impound and release waters thereby in any lawful manner and to any lawful extent LCRA may see fit is recognized by PURCHASER; and, except as otherwise provided herein, there shall be no obligation upon LCRA to release or not to release any impounded waters at any time or to maintain any waters at any specified elevation or flow. PURCHASER acknowledges that the elevations of said reservoirs and the Colorado River will vary as a result of hydrologic events, or lack thereof, (e.g. floods or droughts) in the watershed and LCRA's operations of its dams on the Colorado River.

[insert following paragraph, if applicable]

PURCHASER acknowledges that Longhorn Dam, which is owned and operated by the City of Austin, lies upstream of the Point of Diversion and downstream of Lake Travis. PURCHASER agrees to hold LCRA harmless for any claims that PURCHASER has against LCRA for any action or inaction by the City of Austin relating to its ownership and operation of Longhorn Dam.

K. QUALITY OF WATER.

LCRA makes no representation as to the quality of the water made available under this contract, and PURCHASER hereby releases LCRA and agrees to hold it harmless from any and all claims that PURCHASER or PURCHASER's customers or users have or may have against LCRA for any diminution in or impairment of the quality of water made available under this contract.

L. INTERBASIN TRANSFER.

Any surface water made available under this contract may not be transferred or used outside of the Colorado River basin unless such transfer or use is within LCRA's water service area or is otherwise in strict compliance with LCRA Board Policies, LCRA water rights and a final permit for interbasin transfer ("IBT") issued by the TCEQ. In the event that PURCHASER intends to transfer or use surface water made available under this contract outside of the Colorado River basin in accordance with this section, PURCHASER, by executing this contract, authorizes LCRA to apply to the TCEQ for the necessary authorization pursuant to Texas Water Code § 11.085 and 11.122 within forty-five (45) days of the Effective Date of this Agreement. LCRA shall diligently pursue such authorization after it is filed. PURCHASER shall pay for any filing and notice fees related to such application after LCRA bills PURCHASER for such fees in accordance with this contract.

M. REQUIRED NOTICES.

(1) PURCHASER shall notify LCRA in writing of its intention to initiate diversions of water under this contract not more than eight (8) weeks, nor less than four (4) weeks, prior to PURCHASER's initiation of diversions. If impoundments or diversions of water are being continued from a previous contract or other right to divert, no notice is necessary.

(2) If PURCHASER's Point(s) of Availability are located downstream of Lake Travis or on a tributary which flows into the Colorado River downstream of Lake Travis, PURCHASER shall notify LCRA's River Operations Center (ROC) of its intent to impound and/or divert water under this contract and shall either (1) develop with the ROC a written process or mechanism for notifying the ROC of its intent to divert water under this contract; or (2) notify the ROC _____ days prior to making any impoundment and/or diversion under this contract.

(3) In the event the PURCHASER is required by state law to obtain a water right permit or water right permit amendment – including but not limited to contractual, term, or temporary water right permits – from TCEQ related to water that is reserved or purchased pursuant to an LCRA water contract, PURCHASER shall provide LCRA: (i) a copy of the application for the water right permit or water right permit amendment within five (5) business days of its filing with TCEQ; (ii) a copy of any proposed notice related to the application; and (iii) a copy of the water right permit or water right permit amendment promptly following the issuance of the water right permit or water right permit amendment. PURCHASER shall incorporate LCRA's comments into the application notice provided that: (i) LCRA provides its comments to PURCHASER within ten (10) business days of LCRA's receipt of the draft notice, unless a shorter response period is required by the TCEQ; and (ii) TCEQ accepts LCRA's comments in the final version of the notice. Applicant also shall provide LCRA two copies of any notice or action by TCEQ of a violation or termination of the water right permit or water right permit amendment within ten (10) days of Applicant receiving notice from TCEQ

(4) PURCHASER shall notify LCRA in writing not more than eight (8) weeks, nor less than four (4) weeks, prior to implementing a program for reuse of water that is reserved or purchased pursuant to this contract and that falls within the type of use and Service Area provided in this contract. PURCHASER will make available to LCRA non-privileged documents regarding PURCHASER's reuse program within a reasonable amount of time, not to exceed fifteen (15) business days, following a written request by LCRA staff. For all purposes of this contract, the term "reuse" means the authorized use of water, which water was diverted and used pursuant to this contract, but which water remains unconsumed and has yet to be either disposed of or discharged or otherwise allowed to flow into a watercourse, lake or other body of state-owned water.

(5) PURCHASER shall notify LCRA in writing of its intentions to divert or deliver water for a Secondary Purchaser at least thirty (30) days prior to any diversions or deliveries from PURCHASER to the Secondary Purchaser.

(6) Prior to the effective date of this contract, PURCHASER shall provide to LCRA a demand or use schedule that estimates PURCHASER's annual usage, and any increases to it over time, of the water to be made available by LCRA under this contract (the "Demand Schedule"). PURCHASER shall review, update if needed, and provide to LCRA the Demand Schedule not less than once every five (5) years or following written request by LCRA consistent with any other schedule required by LCRA's Water Contract Rules.

II. CONTRACT ADMINISTRATION

A. TERM OF CONTRACT.

This contract shall be for a term of _____ years commencing on the Effective Date, and ending on the year _____ anniversary of the Effective Date, unless terminated earlier by either party as provided below.

B. PAYMENT.

[Default – unhighlighted text is for billing consistent with the April 2007 Standard Form Contract and will be the default method for billing under the August 2009 Form.]

[Blue Highlighting – Firm Yield Impact Version – Purchaser to pay the full Water Rate as 1/12 per month; however, prior to initiating diversions or impoundment, Purchaser to pay the Reservation Rate as 1/12 per month.]

[Purple Highlighting – For monthly billing of Reservation Fees on contracts diverting from the Highland Lakes substitute item (3) below]

[Yellow Highlighting – Downstream of Mansfield Dam Version]

(1) The "Water Rate" is the rate determined by the Board of Directors of LCRA to then be in effect for all sales of firm water for the same use as provided in this contract. The "Reservation Rate" is the rate determined by the Board of Directors of LCRA to then be in effect for the reservation of firm water for the same use as provided in this contract. The "Inverted Block Rate" is the rate determined by the Board of Directors of LCRA to then be in effect for diversion or use of water in amounts in excess of the Maximum Annual Quantity.

(2) The Water Rate presently in effect is $138 per acre-foot ($0.42 per 1,000 gallons) of water. The Reservation Rate presently in effect is $69 per acre-foot. The Inverted Block Rate presently in effect is $262.20 per acre-foot of water. LCRA

reserves all rights that it may have under law to modify the Water Rate, the Reservation Rate, or the Inverted Block Rate. PURCHASER understands and acknowledges that the Water Rate, Reservation Rate, and the Inverted Block Rate set forth in this contract have been approved by LCRA's Board of Directors, and that the Board may change all rates, fees and charges under the contract from time to time.

(3) PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – an amount of money (the "Use Charge") equal to the Water Rate multiplied by the amount of water made available to the PURCHASER during the previous billing period ("Monthly Use"). For purposes of this section, the term "made available" refers to the greatest of: (i) the amount of water released from LCRA firm water supplies to allow for diversions by PURCHASER; (ii) the amount of water diverted by PURCHASER; or, (iii) the amount of water impounded by PURCHASER.

[Firm Yield Impact Version – substitute item (3) below]

(3) PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – an amount of money (the "Use Charge") equal to the Water Rate multiplied by one-twelfth (1/12) of the MAQ.

[Monthly billing option on Reservation Fees for contracts diverting from the Highland Lakes: substitute item (3) below]

(3) PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – an amount of money (the "Use Charge") equal to the Water Rate less the Reservation Rate multiplied by the amount of water made available to the PURCHASER during the previous billing period ("Monthly Use"). For purposes of this section, the term "made available" refers to the greatest of: (i) the amount of water released from LCRA firm water supplies to allow for diversions by PURCHASER; (ii) the amount of water diverted by PURCHASER; or, (iii) the amount of water impounded by PURCHASER.

[Downstream of Mansfield Dam Version – substitute item (3) below; apply conforming changes for the monthly billing option on Reservation Fees.]

(3) PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – an amount of money (the "Use Charge") equal to the Water Rate multiplied by the Monthly Use. The Monthly Use shall be the sum of i) the Monthly Diversion, plus, ii) the Loss Factor times the Monthly Diversion, as such Loss Factor is established under Section I.A. In the event the amount diverted at the Point(s) of Availability is less than the amount LCRA made available (through releases from

storage and/or pumping into LCRA canals) at the Point(s) of Availability at PURCHASER's request, for purposes of this Section II.B, the Monthly Diversion shall be the amount of water made available at the Point(s) of Availability. Otherwise the Monthly Diversion shall be calculated from the actual amount diverted at the Point(s) of Availability.

(4) PURCHASER also agrees and covenants to pay LCRA – on a calendar year basis – an amount of money (the "Reserved Water Charge") equal to the Reservation Rate multiplied by the "Reserved Water," which shall be the excess of the Maximum Annual Quantity over the amount of water made available to PURCHASER during the previous calendar year ("Annual Use").

[Firm Yield Impact Version – substitute item (4) below]

(4) In the event that PURCHASER has not initiated any diversions or impoundment of water under this contract, PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – an amount of money (the "Reservation Charge") equal to the Reservation Rate multiplied by one-twelfth (1/12) of the MAQ.

[Monthly billing option on Reservation Fees for contracts diverting from the Highland Lakes, substitute item (4) below; apply conforming changes to contracts diverting downstream of Mansfield Dam. [that last clause confuses me]]

(4) PURCHASER agrees and covenants to pay LCRA – on a monthly basis beginning with the first billing period after the Effective Date of this contract – the "Reservation Charge," which shall be an amount of money equal to the Reservation Rate multiplied by one-twelfth (1/12) of the MAQ.

[Downstream of Mansfield Dam Version – substitute item (4) below; apply conforming changes for the monthly billing option on Reservation Fees.]

(4) PURCHASER also agrees and covenants to pay LCRA – on a calendar year basis – an amount of money (the "Reserved Water Charge") equal to the Reservation Rate multiplied by the "Reserved Water," which shall be the excess of the Maximum Annual Quantity over the amount of water made available during the previous calendar year. For purposes of this calculation, water "made available during the previous calendar year" will be calculated as the sum of the Monthly Use as defined above.

(5) PURCHASER further agrees and covenants to pay LCRA – on a calendar year basis – an amount of money (the "Excess Use Charge") equal to the Inverted Block Rate multiplied by any amount of water made available to PURCHASER in excess of the Maximum Annual Quantity during the previous calendar year, less any amount PURCHASER has previously paid for the same water through the Use Charge and/or Reserved Water Charge. In the event the amount of water made available to PURCHASER is limited because of a curtailment imposed by

LCRA or state law in accordance with this contract to an amount less than the MAQ, then PURCHASER shall pay a surcharge, in excess of any Use or Reserved Water Charges, to be set by LCRA's Board of Directors, multiplied by any amount of water made available to PURCHASER in excess of the amount PURCHASER is authorized to have available during the curtailment (the "Curtailment Surcharge").

(6) The term "billing period," as used for purposes of metering and billing in this Agreement, shall refer to each period between readings of the Meter(s), which readings typically are performed on a monthly basis. All charges under this contract shall be pro-rated as necessary to reflect the Effective Date or date of termination of this Contract; in other words, LCRA may include in an invoice up to thirty (30) additional days in a billing period to account for water reserved, released, diverted or impounded during days following execution or prior to termination of this Agreement. For purposes of metering and billing, the "calendar year" may be based upon the 12-month period from the December meter reading date to the next December reading date.

(7) Each month, LCRA will mail an invoice to PURCHASER showing the Monthly Use. Such invoice shall also show the amount of money owed by PURCHASER to LCRA in accordance with the Reservation Charge and/or Use Charge and any late payment charges, as specified herein.

(8) The invoice mailed by LCRA to PURCHASER in the month of January each year, in addition to showing the amount of money owed by PURCHASER to LCRA in accordance with the Reservation Charge and/or Use Charge, shall also show any amount of water that PURCHASER had made available to it in excess of the Maximum Annual Quantity during the previous calendar year, as well as the corresponding Excess Use Charge.

[Firm Yield Impact Version – substitute item (8) below]

(8) The invoice mailed by LCRA to PURCHASER in the month of January each year, in addition to showing the amount of water owed by PURCHASER to LCRA in accordance with the Reservation Charge and/or Use Charge, shall also show any amount of water LCRA has determined that PURCHASER has impounded, diverted, or otherwise consumptively used that would result in an impact to LCRA's senior water rights in excess of the Maximum Annual Quantity during the previous calendar year, as well as the corresponding Excess Use Charge.

(9) PURCHASER shall pay LCRA for water provided under this contract in the amount of each invoice submitted to PURCHASER by LCRA on or before thirty (30) days from the date of the invoice. PURCHASER shall mail checks for payments to the address indicated on the invoice. PURCHASER may pay by hand-delivery of checks or cash to LCRA's headquarters in Austin, Travis County, Texas, or by bank-wire if PURCHASER obtains LCRA's approval and

makes arrangements for doing so prior to the due date. Payment must be received at the address provided on the invoice, or, if approved, at LCRA's headquarters or bank, not later than thirty (30) days from the invoice date in order not to be considered past due or late. In the event PURCHASER fails to make payment of that invoice within thirty (30) days of the invoice date, PURCHASER shall then pay a late payment charge of five percent (5%) of the amount of the invoice. For each calendar month or fraction thereof that the invoice remains unpaid, PURCHASER shall pay interest at the rate of one and one-half percent (1.5%) per month. In the event PURCHASER attempts to pay LCRA by check, draft, credit card or any other similar instrument and the instrument is returned or refused by the bank or other similar institution as insufficient or non-negotiable for any reason, PURCHASER shall be assessed and must pay to LCRA, per each returned instrument, the LCRA's current returned instrument fee. If the invoice has not been paid within thirty (30) days of the invoice date, PURCHASER further agrees to pay all costs of collection and reasonable attorney's fees, regardless of whether suit is filed, as authorized by Section 271.159, Texas Local Government Code.

C. MEASURING WATER.

(1) To measure the amount of water diverted by PURCHASER hereunder, PURCHASER agrees at PURCHASER's expense to install such measuring and recording devices or methods as are approved by LCRA (the "Meter"), such Meter to permit, within five percent (5%) accuracy, determination of quantities of raw water diverted from the reservoir or stream hereunder in units of 1,000 gallons. LCRA shall have the right to approve both the design of the meter as well as the location of its installation. PURCHASER must repair, replace or make necessary improvements to a meter that is not in compliance with this contract or LCRA's Water Contract Rules promptly after PURCHASER becomes aware of the deficiency that causes the meter to not comply with this contract or LCRA's Water Contract Rules.

[conforrming changes as necessary for water contracts for diversion points located upstream or downstream of the Highland Lakes or for water contracts for impoundment of water, or diversion from or through LCRA facilities.]

(a) PURCHASER agrees to provide LCRA's representatives access across PURCHASER's property for inspection, testing and reading of the Meter. PURCHASER shall locate the meter in a manner that provides LCRA with reasonably safe access to the Meter for the purpose of making meter readings, testing, and/or periodic inspections.

(b) PURCHASER agrees that the Meter shall be tested for accuracy by qualified personnel as approved by LCRA and at the expense of PURCHASER once each calendar year at intervals of approximately twelve (12) months.

(c) PURCHASER shall furnish to LCRA a report of such test results. Readings within five percent (5%) of accuracy shall be considered correct.

(d) In the event PURCHASER fails to test the Meter for a period of fifteen (15) consecutive months, PURCHASER agrees to pay LCRA for the actual cost of testing the Meter plus a fifty dollar ($50) administrative fee. LCRA will provide PURCHASER a written invoice of the cost of testing the Meter, and said invoice will be subject to the payment terms provided in section II.B of this contract.

(e) If, at any time, LCRA provides PURCHASER a written notice that questions the accuracy of the Meter, PURCHASER promptly shall test the Meter and, in this event, the expense of such test will be paid by LCRA if the Meter is found to be correct and by PURCHASER if it is found to be incorrect.

(f) Any party that tests the Meter shall provide written notice of the test to the other party at least five (5) business days in advance of the test and shall allow the other party to observe the test.

(g) PURCHASER shall be required to take necessary steps to correct any inaccuracy in the Meter discovered during any test. LCRA may install, at its expense, check meters in or to any of PURCHASER's Meters at any time and may leave such check meters installed for such periods as is reasonably necessary to determine the accuracy of PURCHASER's Meters.

(h) If, as a result of any test, the Meter is found to be registering inaccurately (i.e., in excess of five percent (5%) of accuracy), the readings of the Meter shall be corrected at the rate of its inaccuracy for any period which is definitely known and agreed upon or, if no such period is known and agreed upon, the shorter of the following periods shall be used as the basis for correction:

(i) a period extended back either sixty (60) days from the date of demand for the test or, if no demand for the test was made, sixty (60) days from the date of the test; or

(ii) a period extending back half of the time elapsed since the last previous test; and the records of reading shall be adjusted accordingly.

(2) In the event PURCHASER is charged based on water released from LCRA firm water supplies under this contract rather than the actual amount withdrawn from the reservoir or stream by PURCHASER, LCRA shall include the amount of such releases in the monthly invoice provided to PURCHASER. LCRA shall make available information regarding its calculation of the amount of water released attributable to PURCHASER's actual diversions under this contract within a reasonable period following PURCHASER's written request.

D. TERMINATION OF CONTRACT.

This contract may be terminated as follows:

[Adjust (1) as necessary for contracts other than municipal and industrial (Purchaser may terminate after 1 year), and for contracts with a MAQ of 1500 afy or greater (which require 12 months notice).]

(1) If PURCHASER is current on all payments due to LCRA under this contract, PURCHASER may terminate this contract at any time following the expiration of five (5) years, measured from the Effective Date, by providing at least six (6) months prior written notice to LCRA.

(2) LCRA at its sole option, in accordance with the terms and conditions set forth in Section II.E., "NON-PAYMENT," may terminate this contract without recourse should PURCHASER fail to comply with the terms and conditions of this contract for the payment of moneys owed to LCRA pursuant to Section II.B. "PAYMENT."

(3) If PURCHASER fails to comply with its Water Conservation Plan, its Drought Contingency Plan, or any applicable LCRA nonpoint source water pollution abatement ordinance, or if PURCHASER fails to amend its Water Conservation Plan or its Drought Contingency Plan to reflect changes in LCRA's Water Conservation Plan Rules, LCRA's Drought Contingency Plan Rules, or state law or rules, LCRA may terminate, at its sole option, this contract without recourse unless such default is cured within thirty (30) days (or, if the nature of such default is not susceptible of being cured within such thirty (30) day period, such longer period of time during which PURCHASER diligently prosecutes the cure of such default, not to exceed one hundred eighty (180) days of PURCHASER's receipt of written notice of such default.

(4) If PURCHASER fails to comply with the requirements of Sections III.A., "NONPOINT SOURCE POLLUTION ABATEMENT," III.B., "SEWAGE REGULATIONS," or III.C., "DOCUMENTATION OF COMPLIANCE; RIGHT OF ENTRY," LCRA may, at its sole option, terminate this contract without recourse unless such default is cured within thirty (30) days (or if the nature of such default is not susceptible of being cured within such thirty (30) day period, such longer period of time during which PURCHASER diligently prosecutes the cure of such default, not to exceed one hundred eighty (180) days of PURCHASER's receipt of written notice of such default. For purposes of this section, LCRA shall not deem PURCHASER to be in default for so long as PURCHASER is in compliance with any remedial or enforcement agreement authorized by an agency of appropriate jurisdiction.

(5) If PURCHASER fails to comply with other requirements of this contract not specifically stated above, LCRA may, at its sole option, terminate this contract without recourse unless such default is cured within thirty (30) days (or, if the nature of such default is not susceptible of being cured within such thirty (30) day period, such longer period of time during which PURCHASER diligently prosecutes the cure of such default, not to exceed one hundred eighty (180) days of PURCHASER's receipt of written notice of such default.

(6) Subject to the requirements of applicable bankruptcy laws, including the rights of a trustee to assume contracts under applicable bankruptcy laws, this contract may be terminated immediately by LCRA upon the declaration of bankruptcy by PURCHASER.

(7) In the event TCEQ denies to PURCHASER, or terminates for any reason, a permit required by this contract, this contract shall terminate automatically upon such date as the TCEQ action is final and nonappealable, without further action by either party, and shall be of no further force or effect.

PURCHASER shall remain liable for all fees and charges accruing under the contract through the date the contract is terminated, including but not limited to a pro-rated Reserved Water Charge, which shall be calculated based upon the excess of the Maximum Annual Quantity, pro-rated to the date of termination, over the amount of water made available to PURCHASER through the date of termination. In the event LCRA terminates this Contract as provided herein, PURCHASER shall suspend immediately upon such termination all withdrawal of water from the Colorado River, or any tributaries thereof, under this Contract. LCRA may exercise any rights that it may have at law or in equity to prevent unauthorized withdrawals by PURCHASER or enforce the requirements of PURCHASER's Water Permit, if any.

[Firm Yield Impact Version]

PURCHASER shall remain liable for all fees and charges accruing under the contract through the date the contract is terminated. In the event LCRA terminates this Contract as provided herein, PURCHASER shall suspend immediately upon such termination all withdrawal of water from the Colorado River, or any tributaries thereof, under this Contract. LCRA may exercise any rights that it may have at law or in equity to prevent unauthorized withdrawals by PURCHASER or enforce the requirements of PURCHASER's Water Permit, if any.

E. NON-PAYMENT.

(1) If LCRA determines that PURCHASER has not paid the full amount owed for any payment due under Section II.B., "PAYMENT", hereof within the time provided therefore, LCRA shall give written notice to PURCHASER stating the amount LCRA has determined is due and unpaid. If LCRA gives notice as provided herein and PURCHASER fails to pay within thirty (30) days the amounts claimed in such notice to be due and unpaid, LCRA may, at its sole option: (1) upon giving ten (10) days written notice to PURCHASER terminate this contract without recourse; and/or, (2) request injunctive relief from a court of competent jurisdiction to prevent PURCHASER from impounding and/or diverting additional water pursuant to this contract.

(2) If PURCHASER should dispute PURCHASER's obligation to pay all or any part of the amount stated in any invoice or notice, PURCHASER may, in addition to all

other rights that PURCHASER may have under law, pay such amount under protest in which case such amount shall be deposited by LCRA in an interest bearing account mutually acceptable to both LCRA and PURCHASER pending final resolution of such dispute in accordance with Section IV.H., "DISPUTE RESOLUTION." LCRA may not terminate this contract, or request injunctive relief to prevent additional impoundments and/or diversions, for failure to pay the amount stated in any invoice or notice if PURCHASER pays such amount under protest and until there is a final resolution of such dispute in accordance with Section IV.H., "DISPUTE RESOLUTION," favorable to LCRA.

F. EQUITABLE REMEDIES.

PURCHASER agrees that diversions or impoundments of water by PURCHASER without the authorization provided by this contract will result in damages to LCRA that cannot be adequately compensated by money alone. As a result, PURCHASER agrees that LCRA shall have available to it equitable remedies, including injunctive relief against additional diversions or impoundments by PURCHASER unless PURCHASER demonstrates that it is otherwise authorized to divert or impound water. In addition, PURCHASER agrees that the provisions of Section IV.H., "DISPUTE RESOLUTION," will not apply to any legal action brought by LCRA seeking equitable remedies under this contract except as expressly provided by Section II.E.(2) regarding "NON-PAYMENT."

G. NOTICE.

Any notice under this contract may be delivered by facsimile transmission or by certified mail, return receipt requested. If delivered by facsimile transmission, notice shall be effective upon receipt. If delivered by certified mail, return receipt requested, notice shall be deemed effective five (5) days after the date on which the notice is post-marked.

All notices and invoices to PURCHASER shall be addressed to:

_____

_____

_____

and all notices and payments to LCRA shall be addressed to:

Lower Colorado River Authority
Attn: River Services
P.O. Box 220
Austin, Texas 78767
(512) 473-3551 for facsimile transmission

And

Lower Colorado River Authority

Attn: River Operations Center
P.O. Box 220
Austin, Texas 78767
(512) 473-3551 for facsimile transmission

Either party may change its address by giving written notice of such change to the other party. PURCHASER is required to provide notice of change in address or contact person within ten (10) days of such change. PURCHASER shall maintain a physical address on file with LCRA.

H. ASSIGNMENT OF CONTRACT.

PURCHASER shall have the right to assign this contract provided that: i) there is no change to the MAQ, source, type of use or Service Area provided in this Contract; ii) prior to such assignment, this contract is amended to be consistent with all terms of LCRA's then-current standard form contract for purchase of firm water from Lake Travis and LCRA's then-current Water Contract Rules as determined by LCRA; iii) the Water Conservation Plan and Drought Contingency Plan are updated as may be necessary in accordance with this contract as determined by LCRA; iv) PURCHASER provides LCRA at least sixty (60) days prior written notice of such assignment; and, v) PURCHASER is not in default under this contract at the time of such assignment.

I. COMPLIANCE WITH FILING REQUIREMENTS.

LCRA agrees to file a copy of this contract with the Executive Director of the TCEQ, P.O. Box 13087, Capitol Station, Austin, Texas 78711, it being fully recognized by PURCHASER hereunder that the effectiveness of this contract is dependent upon compliance with the substantive rules and procedural rules for water rights of the TCEQ.

III. ENVIRONMENTAL, PERMITTING AND OTHER ISSUES RELATED TO WATER SUPPLY

A. NONPOINT SOURCE WATER POLLUTION ABATEMENT.

If PURCHASER will use water under this contract to serve areas located within the jurisdictional area of LCRA Lake Travis Nonpoint Source Pollution Control Ordinance, the Upper Highland Lakes Nonpoint Source Pollution Control Ordinance, or any other LCRA water quality ordinance that has been adopted by the LCRA Board, PURCHASER agrees to comply with and shall comply with the provisions of that respective ordinance, which ordinance may require a permit and compliance with other applicable local, state, and federal rules and regulations pertaining to water quality protection. If PURCHASER will use water under this contract to serve areas wholly outside the jurisdiction of an LCRA water quality ordinance, PURCHASER agrees to comply with and shall comply with any applicable local, state, and federal rules and regulations pertaining to water quality protection. PURCHASER further agrees to distribute to its customers in its service area water quality protection educational materials that LCRA provides to PURCHASER.

B. SEWAGE REGULATIONS.

PURCHASER agrees to obtain, or cause to be obtained, all approvals required by all applicable local, state or federal agencies for any sanitary sewage system or systems that collect sewage derived from water diverted herein or any sanitary sewage system whose effluent is discharged within the boundaries of LCRA's statutory district. Failure of PURCHASER to meet any standards imposed by such agencies for sanitary sewage systems, including on-site systems, shall subject PURCHASER under this contract to all remedies allowed by law including, without limitation, termination or suspension of this contract by LCRA. PURCHASER further agrees that if a sewage treatment plant is located within the Service Area, LCRA shall have reasonable access to such plant for the purpose of taking samples of sewage effluent from such plant for testing by LCRA to determine whether PURCHASER is in compliance with regulatory standards imposed by such agencies.

C. DOCUMENTATION OF COMPLIANCE; RIGHT OF ENTRY; .

(1) In addition to notices required by Section I of this Contract, PURCHASER shall provide LCRA copies of any approvals that PURCHASER has received from federal, state, or local agencies that relate to water reserved or purchased pursuant to PURCHASER's contract or to facilities intended to impound, divert, transport, or use water provided under PURCHASER's contract within a reasonable amount of time, not to exceed fifteen (15) business days, following a written request by LCRA staff.

(2) PURCHASER agrees that LCRA employees and agents shall be entitled to enter any property where facilities impound or deliver water to the service area of PURCHASER at any reasonable time following a reasonable attempt at prior notification for the purpose of inspecting and investigating conditions relating to the quality of water; the compliance by PURCHASER with any rule, regulation, permit or other order of the state, its agencies, local regulatory authorities or LCRA; compliance by PURCHASER with the requirements of this contract; or, inspection of any of PURCHASER's facilities related to the use, diversion or impoundment of water under this contract. LCRA employees or agents acting under this contract who enter PURCHASER's property shall observe rules and regulations concerning safety, internal security, and fire protection, and shall notify any occupant or management of their presence and shall exhibit proper credentials.

D. ANNUAL REPORTS OF DUE DILIGENCE; AS-BUILT PLANS

(1) PURCHASER shall report to LCRA, on a yearly basis, progress made toward obtaining any and all necessary authorizations (e.g. TCEQ permits, Army Corps of Engineers permits, etc.) as well as progress towards commencing and completing construction of facilities which will be used to divert, impound, and/or convey water under PURCHASER's contract.

(2) PURCHASER shall provide to LCRA "as-built" drawings and plans (including GPS coordinates of any intakes or impoundments) for facilities which will be used to divert, impound, and/or convey water under PURCHASER's contract were actually built within thirty (30) days of completion of construction.

IV. GENERAL PROVISIONS

A. EFFECTIVE DATE.

"Effective Date" means the last date of execution of this Agreement by the Parties; provided all of the parties must execute this Agreement for it to be effective.

B. PREVIOUS CONTRACT.

There is no contractual relationship between the parties prior to the Effective Date.

[OR – modify as necessary]

Upon the Effective Date of this contract that certain Water Contract between LCRA and _ _____ (LCRA Contract No. _____) dated _____, _____ shall be null, void, and of no further legal force and effect.

C. INDEMNIFICATION.

PURCHASER will indemnify and hold LCRA harmless from any and all claims and demands whatsoever to which LCRA may be subjected by reason of any injury to any person or damage to any property resulting from any and all actions and activities (or failure to act) of PURCHASER under this contract except to the extent caused by LCRA's gross negligence or willful misconduct. PURCHASER's pumping and related facilities shall be installed, operated and maintained by PURCHASER at PURCHASER's sole risk. Nothing in this contract shall be construed as authorizing PURCHASER, or recognizing that PURCHASER has any right, to install any equipment or improvements on property owned by LCRA or third parties.

LCRA will hold PURCHASER harmless from any and all claims or demands whatsoever to which LCRA may be subjected by reason of any injury to any person or damage to any property resulting from or in any way connected with any and all actions and activities (or failure to act) of LCRA under this contract.

D. FORCE MAJEURE.

The term "Force Majeure" as used herein, shall mean those situations or conditions that are beyond the control of LCRA or PURCHASER and that, after the exercise of due diligence to remedy such situation or condition, render LCRA or PURCHASER unable, wholly or in part, to carry out the covenants contained herein. Such force majeure includes, but is not limited to acts of God, strikes, lockouts, acts of the public enemy, orders of any kind of the government or agencies of the United States or of the State of

Texas, excluding LCRA, or any civil or military authority, insurrections, riots epidemics, landslides, lightning, earthquakes, fires, hurricanes, storms, floods, washouts, droughts, civil disturbances, explosions, breakage or accidents to machinery, pipelines, canals, or dams, partial or entire failure of water supply insofar as each of the foregoing are beyond the reasonable control of the party in question. LCRA shall not be held liable or responsible for any damage that may be caused by its inability, after the exercise of due diligence, to make the supply of water available to PURCHASER due to any force majeure. LCRA shall use reasonable and timely diligence to repair or recondition LCRA's machinery, canals, or dams in the event such machinery, canals or dams are damaged or made unserviceable from any force majeure.

E. NO THIRD-PARTY BENEFICIARY.

The parties hereto are entering into this contract solely for the benefit of themselves and agree that nothing herein shall be construed to confer any right, privilege or benefit on any person or entity other than the parties hereto.

F. NO RIGHTS OR TITLE ACQUIRED.

PURCHASER agrees and acknowledges that it acquires by this contract no rights or title to the water that is the subject of this contract other than those rights explicitly set forth herein.

G. REPRESENTATIONS AND WARRANTIES.

Each of LCRA and PURCHASER represents and warrants to the other that this contract has been duly executed by an authorized officer and constitutes a valid and binding contract, enforceable against it in accordance with its terms (except as such enforceability may be limited by bankruptcy laws or other similar laws relating to the enforcement of creditors' rights generally and by general equitable principles).

H. DISPUTE RESOLUTION.

(1) Settlement by Mutual Agreement. In the event any dispute, controversy or claim between or among the parties arises under this contract or is connected with or related in any way to this contract or any right, duty or obligation arising hereunder or the relationship of the parties hereunder (a "Dispute or Controversy"), including, but not limited to, a Dispute or Controversy relating to the effectiveness, validity, interpretation, implementation, termination, cancellation, or enforcement of this contract, the parties shall first attempt in good faith to settle and resolve such Dispute or Controversy by mutual agreement in accordance with the terms of this subsection (1). In the event a Dispute or Controversy arises, any party shall have the right to notify the other party to such Dispute or Controversy that it has elected to implement the procedures set forth in this subsection (1). Within thirty (30) days after delivery of any such notice by one party to the other regarding a Dispute or Controversy, the designated representatives of the parties shall meet at a mutually agreed time and place to attempt, with diligence and good faith, to resolve and

settle such Dispute or Controversy. Should a mutual resolution and settlement not be obtained at the meeting of the parties' designated representatives for such purpose or should no such meeting take place within such thirty (30) day period, then any party may by notice to the other party, as the case may be, refer the Dispute or Controversy to senior management of the parties for resolution. Within thirty (30) days after delivery of any such notice by one party to the other referring such Dispute or Controversy to senior management of the parties for resolution, representatives of senior management of each of the parties shall meet at a mutually agreed upon time and place to attempt, with diligence and good faith, to resolve and settle such Dispute or Controversy. Should mutual resolution and settlement not be obtained at the meeting of representatives of senior management of each of the parties for such purposes or should no such meeting take place within such thirty (30) day period (unless extended by mutual agreement), then any party may by notice to the other party, as the case may be, submit the Dispute or Controversy to binding arbitration in accordance with the provisions of subsection (2) and "Exhibit F." Upon the receipt of notice of referral to arbitration hereunder, and except as otherwise expressly provided by this contract, the parties shall be compelled to arbitrate the Dispute or Controversy in accordance with the terms of this Section H and Exhibit F without regard to the justiciable character or executory nature of such Dispute or Controversy.

(2) Arbitration. Except as otherwise expressly provided by this contract, each party hereby agrees that any Dispute or Controversy that is not resolved pursuant to the provisions of subsection (1) may be submitted to binding arbitration hereunder and, if submitted timely according to this contract, shall be resolved exclusively and finally through such binding arbitration. Except as otherwise expressly provided by this contract, this Section H and Exhibit F constitute a written agreement by the parties to submit to arbitration any Dispute or Controversy arising under or in connection with this contract within the meaning of Section 171.001 of the Texas Civil Practice and Remedies Code.

(3) Emergency Relief. Notwithstanding the parties' agreement to arbitrate Dispute and Controversies, either party may seek injunctive relief or other form of emergency relief at any time from any state court of competent jurisdiction in Austin, Texas, the federal court for such district, or any state or federal regulatory agency of competent jurisdiction.

(4) Survival. The provisions of this Section H shall survive expiration or earlier termination of this contract.

I. ACTUAL DAMAGES.

NEITHER PARTY SHALL BE LIABLE OR HAVE ANY RESPONSIBILITY TO THE OTHER FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, PUNITIVE OR DELAY-RELATED OR PERFORMANCE-RELATED DAMAGES INCLUDING, WITHOUT LIMITATION, LOST EARNINGS OR PROFITS. SUCH LIMITATION ON LIABILITY SHALL APPLY TO ANY CLAIM OR ACTION, WHETHER IT IS

BASED IN WHOLE OR IN PART ON CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, STATUTE OR ANY OTHER THEORY OF LIABILITY. The provisions of this Section IV.I. shall have no effect on the party's indemnity obligations under Section IV.C.

J. AMENDMENT.

This contract may not be modified or amended except by an instrument in writing signed by authorized representatives of the parties.

K. BINDING EFFECT.

The terms of this contract shall be binding upon, and inure to the benefit of, the parties and their permitted successors and assigns.

L. COMPLETE CONTRACT.

This contract, together with all Exhibits attached hereto, constitutes the entire agreement of the parties relating to the subject matter of this contract and supersedes all prior contracts, agreements or understandings with respect to the subject matter hereof, both oral or written.

Each party agrees that the other party (and its agents and representatives) has not made, and has not relied upon, any representation, warranty, covenant or agreement relating to the transactions contemplated hereunder other than those expressly set forth herein.

M. COUNTERPARTS.

This contract may be executed by the parties in any number of separate counterparts, each of which when so executed and delivered shall be deemed an original, but all such counterparts shall together constitute one and the same agreement. All signatures need not be on the same counterpart.

N. FURTHER ASSURANCES.

Each party agrees to do all acts and things and to execute and deliver such further written instruments, as may be from time to time reasonably required to carry out the terms and provisions of this contract.

O. GOVERNING LAW.

This contract and the rights and duties of the parties arising out of this contract shall be governed by, and construed in accordance with, the laws of the State of Texas, without reference to the conflict of laws rules thereof.

P. HEADINGS; TABLE OF CONTENTS.

The headings of the Articles and Sections of this contract and the Table of Contents are included for convenience only and shall not be deemed to constitute a part of this contract.

Q. INCORPORATION OF WATER CONTRACT RULES.

PURCHASER acknowledges receipt of LCRA's Water Contract Rules ("Rules"), and further acknowledges that, unless expressly stated otherwise in this Agreement, such Rules, as may be amended by LCRA's Board of Directors from time to time, are incorporated herein by reference in their entirety and made a part hereof for all purposes.

R. INCORPORATION OF EXHIBITS.

All Exhibits attached to this contract are incorporated herein by this reference in their entirety and made a part hereof for all purposes.

S. INTERPRETATION AND RELIANCE.

No presumption will apply in favor of any party in the interpretation of this contract or in the resolution of any ambiguity of any provisions thereof.

T. RELATIONSHIP OF PARTIES.

This contract and the transactions contemplated hereunder are based upon the active participation of all parties.

Neither the execution nor delivery of this contract, nor the consummation of the transactions contemplated hereunder, shall create or constitute a partnership, joint venture, or any other form of business organization or arrangement between the parties, except for the contractual arrangements specifically set forth in this contract. Except as is expressly agreed to in writing in this contract, no party (or any of its agents, officers or employees) shall be an agent or employee of the other party, nor shall a party (or any of its agents, officers or employees) have any power to assume or create any obligation on behalf of the other party. Nothing contained in this contract shall create or constitute a partnership, joint venture, or any other form of business organization or arrangement among LCRA on the one hand and the PURCHASER on the other hand, except for the contractual arrangements specifically set forth herein.

U. SEVERABILITY.

In the event that any provision of this contract is held to be unenforceable or invalid by any court of competent jurisdiction, the parties shall negotiate an equitable adjustment to the provisions of this contract with the view to effecting, to the extent possible, the original purpose and intent of this contract, and the validity and enforceability of the remaining provisions shall not be affected thereby.

V. NO ADDITIONAL WAIVER IMPLIED.

No waiver or waivers of any breach or default (or any breaches or defaults) of any term, covenant, condition or liability under this contract, or of performance by the other parties of any duty or obligation under this contract, shall be deemed or construed to be a waiver of subsequent breaches or defaults of any kind, under any circumstances.

W. SHORT TERM SALES OF FIRM WATER TO THIRD PARTIES.

In accordance with LCRA Board Policy 501, Water Resources Management, LCRA and PURCHASER agree that LCRA may market and re-sell any portion of PURCHASER's Reserved Water to third parties on a limited term basis for a management fee and under terms mutually acceptable to LCRA and PURCHASER and in accordance with LCRA Board Policies.

LOWER COLORADO RIVER AUTHORITY

By: _____
Karen Bondy, P.E.
Manager, River Management Services

Date: _____

PURCHASER

By: _____
Name: _____
Title: _____
Date: _____

EXHIBIT A

DESCRIPTION OF POINT(S) OF AVAILABILITY

EXHIBIT B

DESCRIPTION OF SERVICE AREA

EXHIBIT C

DEPICTION OF SERVICE AREA

EXHIBIT D

WATER CONSERVATION PLAN

EXHIBIT E

DROUGHT CONTINGENCY PLAN

EXHIBIT F

ARBITRATION PROCEDURES

Section 1. Arbitration.

1.1. Binding Arbitration. Binding arbitration shall be conducted in accordance with the following procedures:

(a) The party seeking arbitration hereunder shall request such arbitration in writing, which writing shall be delivered to the opposing party or parties and include a clear statement of the matter(s) in dispute. If a legal proceeding relating to the matter(s) in dispute has previously been filed in a court of competent jurisdiction (other than a proceeding for injunctive or ancillary relief) then such notice of election under this section shall be delivered within ninety (90) days of the date the electing party receives service of process in such legal proceeding. Otherwise, the legal proceeding shall be allowed to continue and binding arbitration shall not apply to the matter(s) in dispute in that legal proceeding.

(b) Except to the extent provided in this Exhibit F, the arbitration shall be conducted in accordance with the commercial rules of the American Arbitration Association by a single arbitrator to be appointed as follows: (i) upon the issuance and receipt of a request for arbitration, the requesting and receiving party each shall designate a representative for the sole purpose of selecting, by mutual agreement with the other party's designee, the individual who shall arbitrate the Dispute or Controversy referred to arbitration hereunder; (ii) within twenty (20) days of their appointment, the two representatives shall designate a third individual who shall be the arbitrator to conduct the arbitration of the Dispute or Controversy; (iii) said individual shall be qualified to arbitrate the Dispute or Controversy referred to arbitration hereunder and have a schedule that permits him or her to serve as arbitrator within the time periods set forth herein. In order to facilitate any such appointment, the party seeking arbitration shall submit a brief description (no longer than two (2) pages) of the Dispute or Controversy to the opposing party. In the event the parties' two representatives are unable to agree on a single arbitrator of the Dispute or Controversy within the twenty (20) day period, then the arbitrator shall be appointed by the then-serving chief administrative district judge of Travis County, Texas, or any successor thereto within the next ten (10) day period. The party seeking arbitration shall make the parties' request for appointment of an arbitrator and furnish a copy of the aforesaid description of the Dispute or Controversy to said judge. Each party may, but shall not be required to, submit to said judge a list of up to three (3) qualified individuals as candidates for appointment as the arbitrator whose schedules permit their service as arbitrator within the time periods set forth herein. The arbitrator appointed by the judge need not be from such lists.

(c) Within thirty (30) days of the date the arbitrator is appointed, the arbitrator shall notify the parties in writing of the date of the arbitration hearing, which hearing date shall be not less than one-hundred twenty (120) days from the date of the arbitrator's appointment. The arbitration hearing shall be held in Austin, Texas. Except as otherwise provided

herein, the proceedings shall be conducted in accordance with the procedures of the Texas General Arbitration Act, Tex. Civ. Prac. & Remedies Code § 171.001 et seq. (the "Texas General Arbitration Act"). Depositions may be taken and other discovery may be made in accordance with the Texas Rules of Civil Procedure, provided that (i) depositions and other discovery shall be completed within ninety (90) days of the appointment of the arbitrator, (ii) there shall be no evidence by affidavit allowed, and (iii) each party shall disclose a list of all documentary evidence to be used and a list of all witnesses and experts to be called by the party in the arbitration hearing at least twenty (20) days prior to the arbitration hearing. The arbitrator shall issue a final ruling within thirty (30) days after the arbitration hearing. Any decision of the arbitrator shall state the basis of the award and shall include both findings of fact and conclusions of law. Any award rendered pursuant to the foregoing, which may include an award or decree of specific performance hereunder, shall be final and binding on, and not appealable by, the parties, and judgment thereon may be entered or enforcement thereof sought by either party in a court of competent jurisdiction. The foregoing deadlines shall be tolled during the period that no arbitrator is serving until a replacement is appointed in accordance with this Exhibit F.

(d) Notwithstanding the foregoing, nothing contained herein shall be deemed to give the arbitrator appointed hereunder any authority, power or right to alter, change, amend, modify, waive, add to or delete from any of the provisions of the contract.

Section 2. Further Qualifications of Arbitrators; Conduct. All arbitrators shall be and remain at all times wholly impartial and, upon written request by any party, shall provide the parties with a statement that they can and shall decide any Dispute or Controversy referred to them impartially. No arbitrator shall be employed by any party, the State of Texas, or have any material financial dependence upon a party, the State of Texas, nor shall any arbitrator have any material financial interest in the Dispute or Controversy.

Section 3. Applicable Law and Arbitration Act. The agreement to arbitrate set forth in this Exhibit shall be enforceable in either federal or state court. The enforcement of such agreement and all procedural aspects thereof, including the construction and interpretation of this agreement to arbitrate, the scope of the arbitrable issues, allegations of waiver, delay or defenses as to arbitrability and the rules (except as otherwise expressly provided herein) governing the conduct of the arbitration, shall be governed by and construed pursuant to the Texas General Arbitration Act. In deciding the substance of any such Dispute or Controversy, the arbitrator shall apply the substantive laws of the State of Texas. The arbitrator shall have authority, power and right to award damages and provide for other remedies as are available at law or in equity in accordance with the laws of the State of Texas, except that the arbitrator shall have no authority to award incidental or punitive damages under any circumstances (whether they be exemplary damages, treble damages or any other penalty or punitive type of damages) regardless of whether such damages may be available under the laws of the State of Texas. The parties hereby waive their right, if any, to recover punitive damages in connection with any arbitrated Dispute or Controversy.

Section 4. Consolidation. If the parties initiate multiple arbitration proceedings, the subject matters of which are related by common questions of law or fact and which could result in conflicting awards or obligations, then the parties hereby agree that all such proceedings may be consolidated into a single arbitration proceeding.

Section 5. Pendency of Dispute; Interim Measures. The existence of any Dispute or Controversy eligible for referral or referred to arbitration hereunder, or the pendency of the dispute settlement or resolution procedures set forth herein, shall not in and of themselves relieve or excuse either party from its ongoing duties and obligations under the contract or any right, duty or obligation arising therefrom; provided, however, that during the pendency of arbitration proceedings and prior to a final award, upon written request by a party, the arbitrator may issue interim measures for preservation or protection of the status quo.

Section 6. Complete Defense. The parties agree that compliance by a party with the provisions of this Exhibit shall be a complete defense to any Action or Proceeding instituted in any federal or state court, or before any administrative tribunal by any other party with respect to any Dispute or Controversy that is subject to arbitration as set forth herein, other than a suit or action alleging non-compliance with a final and binding arbitration award rendered hereunder.

Section 7. Costs. Each party shall bear the costs of its appointed representative to select the arbitrator of the Dispute or Controversy and its own attorneys' fees, while the costs of the arbitrator of the Dispute or Controversy incurred in accordance with the foregoing shall be shared equally by the parties. Additional incidental costs of arbitration shall be paid for by the nonprevailing party in the arbitration; provided, however, that where the final decision of the arbitrator is not clearly in favor of either party, such incidental costs shall be shared equally by the parties.

3A - SYSTEM ABILITY TO MEET DEMAND

Bryan W. Shaw, Ph.D., *Chairman*
Buddy Garcia, *Commissioner*
Carlos Rubinstein, *Commissioner*
Mark R. Vickery, P.G., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

January 11, 2010

LaDonna Castañuela, Chief Clerk
Texas Commission on Environmental Quality
Office of the Chief Clerk, MC-105
P.O. Box 13087
Austin, Texas 78711-3087

Re: Supplemental Agenda Backup Materials
Application by Lower Colorado River Authority to Amend its Water Management Plan;
Docket No. 2010-0025-WR

Dear Ms. Castañuela:

Enclosed for filing, please find one original and 7 copies of a document entitled "Chapter 4: Drought Management Plan and Drought Contingency Plan." This document is provided as supplemental backup for the above-referenced matter, which the Executive Director believes will be heard by the Commission at its January 27, 2010 agenda meeting.

LCRA submitted this document by e-mail to TCEQ staff on January 5, 2010. It is a redline/strikeout version of Chapter 4 of LCRA's Water Management Plan showing amendments requested to that Chapter. A redline/strikeout version of the Water Management Plan showing all other amendments requested is available on the LCRA's public website at http://www.lcra.org/library/media/public/docs/water_RevisedWMP.pdf. With the exception of the attached Chapter 4 amendments, LCRA's proposed amendments were sent to the Executive Director's staff on November 24, 2009 and have been posted on the LCRA's public website since November 30, 2009.

If you have any questions, please do not hesitate to contact me at (512) 239-1088.

Sincerely,

Shana L. Horton

Shana L. Horton
Staff Attorney
Environmental Law Division

CHAPTER 4
DROUGHT MANAGEMENT PLAN AND DROUGHT CONTINGENCY PLAN

A. Introduction 4-2
1. Background 4-2
2. The Lower Colorado River System 4-3
3. Major Water Rights Holders 4-3
4. Historic Operation of the Highland Lakes 4-4
5. Purpose and Legal Considerations 4-5
B. Water Users and Interest Groups 4-6
1. LCRA Firm Water Customers 4-6
2. Agricultural Interests 4-7
a. Historic Claims to the Waters of the Colorado River 4-7
b. Concerns of the Agricultural Interests 4-7
3. Recreation and Tourism Interests ..... 4-8~~7~~
4. Concerns for Instream Flows and Freshwater Inflows for the Bays and Estuaries 4-8
C. Projected 2010 Surface Water Demands During Droughts 4-9
1. Introduction 4-9
2. Projected Firm Water Demands 4-10
a. Municipal, Manufacturing, Steam-Electric, and Domestic Water Demand Projections 4-10
b. Instream Flow Demands 4-12
c. Freshwater Inflow Demands ..... 4-13~~12~~
3. Projected Interruptible Stored Water Demands ..... 4-15~~14~~
a. Interruptible Stored Water Customers ..... 4-15~~14~~
b. Projected Rice Irrigation Water Demands ..... 4-15~~14~~
c. Instream Flow and Estuarine Freshwater Inflow Water Demands ..... 4-19~~17~~
4. Summary ..... 4-19~~18~~
D. Projected Water Supplies ..... 4-19~~18~~
1. Water Supply Management Procedure ..... 4-19~~18~~
a. Systems Operation Concept ..... 4-19~~18~~
b. Critical Drought Period Concept ..... 4-20~~18~~
c. Procedures For Evaluating Water Availability ..... 4-20~~18~~
2. Supplies for Firm Demands ..... 4-21~~19~~
3. Supplies for Interruptible Stored Water Demands ..... 4-21~~20~~
E. Water Curtailment Policies ..... 4-22~~21~~
1. Triggering Conditions ..... 4-22~~21~~
2. Curtailment of Interruptible Stored Water Demands within Irrigation Districts and for Instream and Bay and Estuary Freshwater Inflows ..... 4-22~~21~~
a. Recommendation for Interruptible Stored Water Demand Curtailment for Irrigation and Environmental Needs ..... 4-23~~21~~
b. Irrigation Allocation Among the Irrigation Districts ..... 4-27~~28~~
c. Irrigation Allocation Within the Irrigation Districts ..... 4-28~~29~~

d. Drought More Severe Than Drought of Record 4-30
e. Termination of Water Allocation Policy ..... 4-30~~31~~
f. Procedures for Water Use Accounting ..... 4-30~~31~~
g. Transfer of Water Among Individual Users ..... 4-30~~31~~
h. Variances 4-31
i. Enforcement ..... 4-31~~32~~
3. Curtailment of Interruptible Stored Water Demands for Other than Irrigation Districts ..... 4-31~~32~~
4. Curtailment of Firm Water Demands ..... 4-31~~32~~
a. Policy Recommendation for Firm Water Demand Curtailment ..... 4-32~~33~~
b. Monitoring and Enforcement ..... 4-33~~34~~
c. Variances ..... 4-33~~34~~
d. Notification of TCEQ Executive Director ..... 4-34~~35~~
5. Declaration and Cancellation of a Drought More Severe Than the Drought of Record ..... 4-34~~35~~
6. Public Notice ..... 4-35~~36~~
7. Impacts of the Recommended Management Policy ..... 4-35~~36~~
a. Firm Water Demands and Supplies ..... 4-35~~36~~
b. Interruptible Stored Water Demands and Supplies ..... 4-35~~36~~
c. Lake Storage Levels ..... 4-37~~38~~
d. Flows in the Colorado River ..... 4-37~~38~~
F. Annual Implementation of Drought Management and Drought Contingency Plans ... 4-38~~39~~
1. Annual Review and Revisions ..... 4-38~~39~~
2. Administration ..... 4-38~~39~~

Introduction

1. Background

On September 20, 1989, the Texas Water Commission, the predecessor agency to the TCEQ, issued its Order approving LCRA's Water Management Plan (see Appendix C, Volume I) for the Highland Lakes and the lower Colorado River. The Commission's Order included a requirement for LCRA to submit, within one year, a Drought Management Plan (DMP) with the Commission for its review and approval. On December 23, 1991, the Texas Water Commission issued its Order approving the DMP. (See Appendix D, Volume I). TCEQ subsequently adopted specific rules requiring water suppliers, such as LCRA, to develop a Drought Contingency Plan (DCP). LCRA's initial DCP was modeled after the most recent DMP approved by the Commission in 1999. As part of this WMP revision, LCRA proposes to fully incorporate into the WMP the LCRA's DCP, with modifications.

Chapter 4 describes the Lower Colorado River Authority's DMP, as required by the water rights granted to LCRA, as well as LCRA's DCP, as required by Commission rules (collectively DMP/DCP). Although the water resources available in the lower Colorado River are considered

as a system, only waters used under LCRA's water rights are addressed by this DMP/DCP.

LCRA recognizes that its responsibility and authority under this DMP/DCP is subject to and shall not conflict with the authority of any Watermaster operation the TCEQ may establish on the Colorado River. Moreover, LCRA recognizes that the Commission has jurisdiction to resolve any and all disputes regarding the allocation of stored water from Lakes Buchanan and Travis, not withstanding the procedures and guidelines set forth in this DMP/DCP.

2. The Lower Colorado River System

The lower Colorado River is considered to be the lower portion of the drainage basin of Colorado River beginning in San Saba County and continuing to Matagorda County on the Texas Gulf Coast (see Figure 1-1). The river flows through nine of the ten counties that make up LCRA's statutory water district.

The upper portion of LCRA's district is part of the Texas Hill Country. In the Hill Country, the river is largely controlled by a series of five dams and their reservoirs--Buchanan, Inks, Wirtz, Starcke, and Mansfield. Marked by steep slopes and shallow rocky soils with outcroppings of granite and limestone, the Hill Country ends abruptly in the Balcones Fault region near the edges of Austin. At Austin is the Tom Miller Dam that creates Lake Austin. From the eastern edges of Austin the river broadens out, snaking through the dark rich Blackland Prairie soils and then rolls gently downstream through the sand and shale of the coastal plains.

Water from the Colorado River and its tributaries is used for a variety of purposes to support the citizens and economy in the LCRA district. These uses include public water supply, manufacturing, cooling water for electric generating plants, irrigation, agriculture and mining. The water to supply these uses comes largely from the natural runoff into the Colorado River. However, the Colorado River Basin is subject to recurrent, severe droughts and devastating floods resulting in wide ranges of river flows. To provide an assured water supply and to relieve flooding, the LCRA, with the help of the Federal government, constructed the Highland Lakes reservoir system.

The development of LCRA's dams and reservoirs on the Colorado River, accomplished in the years from 1939 through 1951, changed Central Texas in many ways. Beginning by controlling the devastating floods on the river, using the river's power to generate electricity, and creating a secure and reliable water supply, LCRA has helped to stimulate the growth and development of the region. The lower Colorado River's water resources satisfy a wide variety of uses, many of which have changed and will continue to change in concert with the changes in the environment and the growth and development of the region.

3. Major Water Rights Holders

The largest water right holders in LCRA's water district also use the majority of the water (Table 4-1). LCRA holds the largest rights, with rights to use up to 1.5 million acre-feet per year from

Lakes Buchanan and Travis. Some of the other large water right holders downstream of Lakes Buchanan and Travis have priority dates earlier than that of LCRA's Highland Lakes permits. These rights belong to the City of Austin, Corpus Christi (portion of Garwood), LCRA for Pierce Ranch, and the LCRA's Garwood, Lakeside and Gulf Coast Irrigation Operations. These rights are considered as senior in time and superior to LCRA's right to store water in the Highland Lakes. Hence, any inflows to the Highland Lakes that need to be diverted for use under these rights must be passed through the Lakes for use downstream. There are also some large water rights downstream of Lakes Buchanan and Travis that have junior priority dates.

TABLE 4-1 MAJOR WATER RIGHTS AND AUTHORIZED RIGHTS IN THE LOWER COLORADO RIVER BASIN, LISTED IN ORDER OF PRIORITY (Acre-Feet/Year)

LCRA (GARWOOD)	133,000
CORPUS CHRISTI (GARWOOD)	35,000
CITY OF AUSTIN (LAKE AUSTIN)	250,150
LCRA (GULF COAST)	228,570
LCRA (LAKESIDE)	107,500
LCRA (PIERCE RANCH)	55,000
CITY OF AUSTIN (Remainder of Certificate of Adjudication No. 5471)	46,403
LCRA (Lakes Buchanan and Travis)	1,500,000
CITY OF AUSTIN (Certificate of Adjudication No. 5489)	35,456
STP NUCLEAR OPERATING COMPANY and LCRA	102,000
LCRA (Gulf Coast junior portion)	33,930
LCRA (Lakeside junior portion)	78,750
TOTAL	2,606,759

4. Historic Operation of the Highland Lakes

Lakes Buchanan and Travis serve as the water supply and flood control reservoirs in the Highland Lakes system. Since their construction in the late 1930s and early 1940s, the water storage in these lakes has fluctuated dramatically in response to extreme floods and droughts. The lakes were at their lowest levels in 1952 when Lake Buchanan was at 983 feet mean sea level (msl) and Lake Travis was at 614 feet msl. The highest water surface elevations were in 1991 for Lake Travis (710.4 feet msl) and in 1991 for Buchanan (1021.37 feet msl).

Operational management of the lakes has also changed over time. A major use of the dams in the 1940s and 1950s was for hydroelectric power generation. That use became secondary to water supply purposes when LCRA developed its fossil fuel electric generation stations. As a result of the Final Judgment and Decree for LCRA's water rights, the use of water for hydroelectric generation was formally subordinated to higher uses except during emergency shortages of electricity, and during other times to the extent that such releases will not impair

LCRA's ability to satisfy all existing and projected demands for water from Lakes Buchanan and Travis pursuant to all firm commitments and all non-firm, interruptible stored water commitments.

5. Purpose and Legal Considerations

The purpose of the DMP/DCP is to specify how LCRA will contract and supply firm and interruptible stored water supplies during a repetition of the critical Drought of Record. In managing the stored water from Lakes Buchanan and Travis, LCRA must

- Define the conditions under which water shortages exist, and
- Specify the actions to be taken by LCRA to mitigate the adverse effects of such shortages.

The overall goals of the DMP/DCP are to:

- Extend available water supplies.
- Preserve essential uses of water and protect public health and safety during extreme shortages of supplies.
- Equitably distribute among LCRA's water customers any adverse economic, social and environmental impacts associated with drought-induced water shortages.

The scope of the DMP/DCP must adhere to the findings of the State District Court's Final Judgment and Decree, adjudicating LCRA's water rights, as well as the 1989 Water Commission's Order approving the WMP and TCEQ rules concerning drought contingency plans. The scope of the DMP is limited to the curtailment of LCRA's interruptible stored water supplies to insure that there is sufficient firm water available to meet projected demands for such water through a repetition of the Drought of Record and also addresses how LCRA will provide water for environmental flow needs. Firm water is subject to curtailment only if it is determined that the drought in effect is worse than the Drought of Record. The DCP also addresses water use reduction goals required by TCEQ's Chapter 288 rules and establishes more detailed procedures for pro rata allocation of interruptible stored water during periods of curtailment.

In times of shortage of supply caused by drought or emergency, LCRA, in accordance with Section 11.039 of the Texas Water Code, will first curtail and distribute the available supply of interruptible stored water among all of its interruptible stored water supply customers on a pro rata basis, so that preference is given to no one and all interruptible stored water supply customers suffer alike. Although projected firm demands for stored water for the next ten years are significantly greater than demands included in the last revision to WMP, these projected needs are still significantly less than the total firm water supplies available.

If the shortage of supply caused by the drought is worse than the Drought of Record, then LCRA must curtail and distribute the available supply of firm water among all of its firm water supply customers on a pro rata basis, so that preference is given to no one and all firm water supply

customers suffer alike.

In the annual allocation of interruptible stored water supplies, LCRA follows the priority order of water use as specified in Section 11.024 of the Texas Water Code and the WMP.

Similarly, in making additional commitments of firm water supplies, LCRA must also follow the priority order of uses given in Section 11.024 of the Texas Water Code.

As noted above, a goal of the DMP/DCP is to determine how to allocate available water supplies when there is not sufficient supplies to meet projected water demands even after reasonable, cost-effective water conservation efforts have reduced the water demands. Therefore, the DMP/DCP does not emphasize water conservation practices that should occur all the time, not just in drought conditions. LCRA has major programs to encourage conservation in water use. These programs are summarized in Chapter 3 of this WMP.

As discussed previously, the WMP, and the DMP/DCP, require periodic revision to reflect changes in water demands. The last revision was completed by LCRA in February 1997 and approved by TCEQ in March 1999. Significant changes in demand, as discussed below, have necessitated the present revision.

The most noticeable changed condition over the last five years has been a significant increased projection of municipal and industrial (firm) water demands. The WMP approved in 1999 projected the ten-year future firm demands within LCRA's service area at about 280,000 acre-feet annually for 2005. Based on the analyses for Regional Plans pursuant to the Senate Bill 1, the ten-year projected demands are now projected to be about 360,100 acre-feet per year for 2010 (see Table 4-2). The primary reason for this increase is additional water needs to meet population and economic growth in the Austin area, including domestic water use around the Highland Lakes.

With this large projected increase in firm water demand, the WMP must be adjusted to give a compensating reduction in the interruptible stored water supplies available since firm needs take priority. This reduction can be achieved by revising the annual interruptible stored water supply curtailment policy adopted in the WMP.

Water Users and Interest Groups

1. LCRA Firm Water Customers

LCRA manages the Highland Lakes for the benefit of all users. LCRA supplies water under its water rights for the Highland Lakes to numerous municipal water supply systems, manufacturers, and power generating plants. As of May 2003, LCRA had over 110 contracts for firm water supplies. The total contractual commitments and reservations of firm water from Lakes Travis and Buchanan at the time was about 318,364 acre-feet per year. This number does not include any commitment to instream flows or freshwater inflows to the bays and estuaries or the amount

allocated to O. H. Ivie Reservoir. Annual use of firm stored water was about 35-36 percent of the 318,364 acre-foot amount.

The major concern of firm water customers is that sufficient supplies be allocated to insure that their demands for water are fully satisfied even during severe drought conditions. An additional concern for those customers pumping water directly from Lakes Buchanan and Travis is that the lake levels remain sufficiently high for them to continue to use their existing water intake structures. Extending intake facilities further into the lake to follow retreating shorelines can be very expensive. Most of the intakes can accommodate water levels at the historical low lake levels of 614 feet msl on Lake Travis and 983 feet msl on Lake Buchanan.

2. Agricultural Interests

a. Historic Claims to the Waters of the Colorado River

The waters of the Colorado River have served the rice farming industry of the Texas Gulf Coast counties of Colorado, Wharton and Matagorda counties since 1885 when the first rice crops were planted near Eagle Lake, Texas. When legislation creating LCRA was first proposed in the Texas Legislature in 1933, promises were given to the rice producers and other farmers that the waters stored behind the dams proposed for the LCRA system would be available to serve their needs when the natural flow of the river diminishes in dry years.

Rice is the major crop irrigated in the most downstream three counties in the LCRA water district. While some rice producers in the region irrigate their crops with pumped groundwater, the major source of water for irrigation is from the waters of the Colorado River, either under run-of-river water rights, or from releases of interruptible stored water from Lakes Buchanan and Travis. Approximately 40% of the water used to irrigate in the three counties comes from groundwater. The majority, 60%, is supplied from surface water. Approximately 379,300 acre-feet, which is about 56% of the annual water use of the Colorado River and the Highland Lakes, is used for rice farming. During an average year, about 30% of the total surface water used for irrigation comes from the interruptible stored water in Lakes Buchanan and Travis.

When LCRA has purchased irrigation operations (Gulf Coast in 1959, Lakeside in 1983, and Garwood in 1998) and their associated senior water rights from private firms, LCRA made certain commitments to the farmers to provide water from Lakes Buchanan and Travis as back-up to the run-of-river rights.

b. Concerns of the Agricultural Interests

The primary concern of the agricultural interests is how LCRA will curtail the interruptible stored water during times of shortage. The producers understand the interruptible concept because, in essence, the waters were always interruptible. The WMP formalizes the understanding of how the water supply--both run-of-river and stored water--is managed.

3. Recreation and Tourism Interests

The waters of the Colorado River and the Highland Lakes serve a variety of recreational and tourism interests in Central Texas. In the WMP, LCRA recognizes the economic interests of the tourism and recreation industry around the Highland Lakes through a commitment to limit its sales or commitments of interruptible stored water, other than to satisfy the four irrigation operations' Conservation Base acreage or Priority Allocation acreage, based on the volume of water in Lakes Buchanan and Travis, as described later in this Chapter.

While the WMP sets minimum projected reservoir storage levels for Lake Travis and for Lake Buchanan, the lakes will most likely have fallen below these levels during even a brief drought period. Economic hardship on the owners of the many marinas, small recreation businesses (bait stores, fishing camps, restaurants, campgrounds), and larger businesses, such as motels, could last much longer than the drought conditions. Many of the marinas on Lake Travis have the ability to move boat docks further out into deeper water and are willing to bear the added operational costs of such moves to stay in business. On Lake Buchanan, the shallow nature of the shoreline allows little flexibility in moving docks and other facilities. Some residents and other lake users have expressed concerns about the lack of access to the lakes during low elevations. Most of LCRA's boat ramp facilities and private boat ramps and launches become unusable when Lake Travis falls below 640 feet msl and Lake Buchanan falls below 1000 feet msl. Additionally, water hazards such as tree stumps and rock areas increase as reservoir levels recede, restricting more of the lake surface available for sail and power boating.

Lake area Chambers of Commerce, residents, and representatives of the tourism industry are also concerned about the elevation of the lakes area during low water periods even when a true drought is not in effect. There is a concern that first time visitors will not return to the area having once experienced low water levels in the reservoirs, thus dampening potential future economic growth.

River recreation interests downstream of the Highland Lakes are also concerned that drought conditions will leave stretches of almost dry riverbed and that water quality will deteriorate severely during drought periods.

4. Concerns for Instream Flows and Freshwater Inflows for the Bays and Estuaries

The Colorado River is the largest single source of freshwater flowing into the Lavaca-Tres Palacios estuary through channels in the Colorado River Delta. The Lavaca-Tres Palacios estuary is one of the largest of the seven major and three minor estuaries along the 370 miles of Texas Gulf shoreline. The bays and estuaries of this system provide a rich environment for wildlife, commercial seafood harvest, recreation, and aesthetic opportunities.

Average inflow to the bay has been 2.9 million acre-feet per year. Of that inflow, about 34 percent came from the Coastal Basins, 22 percent from the Lavaca River Basin, and 44 percent from the Colorado River. Freshwater inflows influence estuarine biological productivity by

lowering salinity, increasing nutrients, and providing sediments. In 1991, the U.S. Corps of Engineers re-routed the Colorado River into West Matagorda Bay to increase biological productivity by increasing the amount of freshwater entering the estuary. However, a storm blocked the new route until its channel could be dredged in 1992, when it became fully functional.

The Colorado River contributes freshwater to the estuary directly from the river and indirectly through return flows from rice fields irrigated from the river. Prior to the 1991 change, an average of 1.3 million acre-feet annually from the Colorado River entered the estuary at the mouth of the river, with about 150,000 acre-feet contributed through irrigation return flows. With the change in the Colorado River delta in 1991, the full average of 1.8 million acre-feet of annual flow of the Colorado River now enters Matagorda Bay.

Estuaries and their associated wetlands are a transition zone between the fresh water and marine environments and serve as the nurseries for over 97% of the fishery species in the Gulf of Mexico. Thus, the levels of salinity, nutrients, and sediments determined by freshwater inflows is critical for high estuarine production. Fluctuation of estuarine conditions from severe droughts, floods, and hurricanes results in a shift of the biological elements of the system and can directly affect the production and survival of many plant and animal species.

During the rice irrigation season, even under drought conditions, the instream flow needs should be satisfied as a result of natural inflows and return flows downstream of the Highland Lakes, pass-throughs of inflows to the Highland Lakes required to honor downstream senior water rights, and releases of interruptible stored water flowing downstream to the irrigation operations. Under current water demand conditions, it is in the winter months, when the portions of inflows required to be passed through the reservoirs to honor downstream senior rights are low and when downstream demands for stored water are also low, that it is most likely that instream flows will need to be supplemented with firm stored water releases. However, should interruptible stored water for irrigation be curtailed or cut off, the periods of low flow in the river would be extended and additional water would be demanded to serve these needs for periods of time.

While it is difficult to estimate the full effect of inadequate instream flows or inadequate inflow to the bays and estuaries, it is clear that many plant and animal species in the food chains would be severely stressed and that productivity would be lessened if the condition persisted for an extended period of time.

Projected 2010 Surface Water Demands During Droughts

1. Introduction

To properly allocate available water supplies in the DMP/DCP, LCRA must project the future water demand on those supplies. The DMP/DCP is based on conditions that may occur in the next decade. This ten year planning period was chosen because the critical drought period used to determine the Combined Firm Yield of Lakes Buchanan and Travis lasted approximately a

decade. Further, the estimates of future water demands are most accurate in the near future. If the critical drought were to repeat itself beginning now, the maximum demands during the drought period would be those in year 2010. Thus, a ten year planning period was used for the development of the DMP/DCP.

Total estimated surface water use in LCRA's 35 county water service area (Figure 1-1) in 2000 was approximately 675,800 acre-feet annually, including water released to maintain instream flows in the lower Colorado River. About 56% of water diverted was used for rice irrigation in the four major irrigation operations located in Colorado, Wharton and Matagorda Counties. The next largest demand for surface water is the City of Austin, with approximately 134,000 acre-feet yearly averaged over the last ten years for municipal use and steam-electric power generation. In general, City of Austin's use has been increasing steadily, with a use of 163,800 acre-feet for the year 2000.

LCRA supplies water to two general categories of water demands: firm and interruptible. Firm demands presently include the water for municipal, domestic, industrial, steam-electric power generation, some irrigation, and instream flow maintenance purposes. Currently, interruptible stored water is used almost entirely for agricultural irrigation, specifically rice irrigation, and for environmental needs. As noted earlier, the most noticeable changed condition over the last five years has been a significant increased projection of municipal and industrial water (firm) demands. With the large projected increase in firm water demand, the DMP/DCP must be adjusted to give a compensating reduction in the interruptible stored water supplies available since firm needs take priority.

Surface water demands in LCRA's water district over the next decade have been projected by LCRA staff based on drought-condition weather, population growth, water use patterns, and economic development, as outlined in the Senate Bill 1 regional water plan for Region K. The assumptions used in projecting 2010 demands are described in the following sections.

2. Projected Firm Water Demands

a. Municipal, Manufacturing, Steam-Electric, and Domestic Water Demand Projections

LCRA staff allocated Senate Bill 1 2010 projected demands using a 1996 water use distribution. Actual water use in 2000 and projected water demands for 2010 are shown in Table 4-2.

The water demand for STP and the Austin power plants may be met by using unregulated run-of-river flows under separate water rights associated with those facilities, supplemented as necessary with stored water. The arrangements for satisfying these demands at STP and at LCRA power plants are described in more detail in Finding 58 of the September 7, 1989 Order of the Texas Water Commission approving LCRA's WMP. The 2010 demands included in this WMP for these facilities reflect those provided to the Senate Bill 1 Regional Planning Group (Region K) by the City of Austin and the South Texas Project Nuclear Operating Company.

Today, LCRA has only a handful of firm water contracts for domestic water use. Unfortunately, most of this water is taken from the Highland Lakes by landowners that do not have contracts with LCRA. Absent a contract, most if not all of these diverters have no legal claim to the water they are diverting. At some point, LCRA may choose to pursue enforcement of its water rights to curtail these unauthorized diversions. Total domestic water use is projected to increase to 6,273 acre-feet by 2010. As water supplies become more and more scarce, many landowners are likely to realize the benefit of a firm water contract that better protects their water supply during drought conditions. Thus, for purposes of this WMP, LCRA has estimated that approximately 5,000 acre-feet of domestic water use will come under contract with LCRA over the next ten years.

TABLE 4-2. REPORTED 2000 AND PROJECTED 2010 ANNUAL FIRM SURFACE WATER DEMANDS UNDER DROUGHT CONDITIONS

Water Demand Category	2000 Reported Water Use (Acre-Feet)	Projected 2010 Water Demand (Acre-Feet)
Highland Lakes Municipal	23,100	37,200
Manufacturing (Excluding Austin)	8,500	11,500
City of Austin Municipal and Manufacturing	153,300	187,931
City of Austin Power Plants*	10,400	13,500
LCRA Power Plants	22,000	29,500
South Texas Project (STP)*	64,800	47,000
Instream Flow Maintenance & Estuarine Inflows	14,500	**33,440
Total	296,600	**360,071

*Firm water demands for STP and the City of Austin may be met from run-of-river flows, if they are available, under their existing water rights.

**Based on the 2003 revision resulting from the effect of the new trigger for curtailment of interruptible stored water supplies from Lakes Buchanan and Travis and freshwater inflow needs of the Matagorda Bay, as described in this Chapter.

b.Instream Flow Demands

LCRA completed the initial instream flow needs study in 1992. The study identified two sets of instream flow needs: critical flows and target flows. The recommended instream flows for the Colorado River downstream of Austin are in Table 2-1.

LCRA will continue with the reservoir operation procedure to release stored water from Lakes Buchanan and Travis to maintain daily river flows ~~at~~as follows:

1. LCRA will release stored water and pass storable inflows to maintain no less than the critical instream flow needs in all years~~, and~~ as set forth in Table 2~~. the target~~-1, including maintaining, on an instantaneous basis, instream flows of 46 cfs and 500 cfs critical flows as set forth in Table 2-1 during the times those respective flow ~~needs~~values are in effect, and

2. In those years when the four major irrigation operations are not curtailed, ~~to~~ LCRA will schedule the ~~extent~~passage of ~~storable~~ inflows ~~each day~~ to ~~the Highland Lakes~~lakes Buchanan and Travis that are legally available for storage, as measured at the upstream stream gages~~.~~, to maintain the target flows as set forth in Table 2-1 as a daily average. Furthermore, during those times when target instream flow requirements are in effect and when such inflows are sufficient to allow LCRA to satisfy the daily target flow requirement at the Bastrop gage, LCRA will also schedule the passage of these inflows to maintain the following minimum flows, as measured at any time at the Bastrop gage:

Month	**Minimum Flow (cfs) 100% of the time**	**Minimum Flow (cfs) 95% of the time**
January	266	
February	269	
March	233	
April	244	287
May	492	579
June	355	418
July	295	347
August	165	
September	201	

October	208	
November	241	
December	264	

In rare instances, LCRA's ability to meet the instream flow requirements set forth in this WMP may be impaired by certain unavoidable constraints such as the capacity of its hydro-generation units and hydro-generation scheduling mandates as well as unforeseen diversions, unforeseen changes in flow conditions downstream, and adjustments to the ratings of the applicable gages.

This recommendation fully meets the most important instream flow needs at all times and meets the target flows during periods of normal or above normal streamflow conditions.

To fully honor this commitment, LCRA will use both firm water and interruptible stored water. Firm water is only supplied in years when the interruptible stored water supply is curtailed for the four major irrigation operations. The actual annual releases of stored water will vary from year to year depending on hydrologic conditions.

For the 2003 update, it is estimated that an annual average of about 27,380 acre-feet of firm water is needed to meet these instream flow commitments, with the remainder coming from interruptible stored water supplies. Therefore, the present annual commitment for instream flows of 12,860 acre-feet of firm water is recommended to be increased to 27,380 acre-feet per year. In addition to firm water, interruptible stored water will be provided to meet instream flow needs. The estimated interruptible stored water to be supplied during the critical drought will be an additional 8,590 acre-feet/year. Demands for both firm and interruptible stored water for instream flow needs were estimated from the simulated results of the water supply alternative that was recommended for the 2003 update of the WMP. The recommended water supply alternative represents a careful balance of environmental and irrigation impacts based on results from various scenarios that were considered.

The releases for instream flows generally, but not always, contribute to meeting the Critical or Target freshwater inflow needs of Matagorda Bay. However, the timing for these instream flow releases is independent of the monthly freshwater inflow needs for the bay.

c.Freshwater Inflow Demands

The water demands for maintaining the ecological balance of coastal bays and estuaries have been determined in 1997 by LCRA, in cooperation with TPWD, TWDB and TNRCC (predecessor to TCEQ). As indicated in Table 2-4, estimates of freshwater inflow needs (FIN) from the Colorado River at Bay City are 1.03 million acre-feet annually for the target needs and 171,000 acre-feet yearly to meet critical needs. Historically, an average of approximately 1,800,000 acre-feet flows annually in the Colorado River at Bay City.

For the 2003 WMP update, LCRA has recommended a change in the reservoir operation procedure for releasing stored water from Lakes Buchanan and Travis for estuarine needs after a

careful balance of environmental and irrigation impacts from the results of various scenarios that were considered. LCRA will release stored water from Lakes Buchanan and Travis to maintain monthly estuarine inflows at:

1. the target inflow needs in those years when the combined storage in Lakes Buchanan and Travis on January 1 is greater than or equal to 1.7 million acre-feet, to the extent of storable inflows each month to Lakes Buchanan and Travis, as measured at the upstream stream gages;

2. one hundred and fifty percent of the critical inflow needs in all years when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1.7 million acre-feet and greater than 1.1 million acre-feet, to the extent of storable inflows each month to Lakes Buchanan and Travis, as measured at the upstream stream gages; and

3. the critical inflow needs in all years when the combined storage in Lakes Buchanan and Travis on January 1 is less than 1.1 million acre-feet, to the extent of storable inflows each month to the Highland Lakes, as measured at the upstream stream gages.

With the recommended intermediate estuarine inflow reservoir operation procedure of increasing the release of stored water from Lakes Buchanan and Travis in years when the combined storage is between 1.1 and 1.7 million acre-feet, the estuarine ecosystem will receive more freshwater inflows during moderate droughts than it would have under the WMP as approved in 1999. For any given month, LCRA will compensate for any deficit in releasing stored water to meet freshwater inflow needs during the following month by releasing additional stored water from the Lakes Buchanan and Travis. LCRA will not account for the inflow in the following month in making such release to make up for the previous month's deficits.

The reservoir operation procedure of releasing stored water for the freshwater inflow needs are based on the following:

- both Target and Critical FIN are provided with stored water;
- Target FIN are used as the estuarine inflow demands during years of plentiful water;
- water supply needs for the four major irrigation operations from the interruptible stored water supply were balanced carefully with the environmental needs while assessing the impacts from the results of various scenarios that were considered;
- the frequency and duration of high salinity conditions in Matagorda Bay are kept relatively low; and
- the Critical FIN are met about 80 percent of the months during the critical drought.

This recommendation will require an estimated 205,060 acre-feet of stored water during the ten-

year critical drought for estuarine inflows. However, not all of this is from the Combined Firm Yield of Lakes Buchanan and Travis. Similar to the instream flow demands, both firm water and interruptible stored water are used to meet the freshwater inflow needs. Firm water is only supplied in years when the interruptible stored water supply is curtailed for the four major irrigation operations. An annual average of about 6,060 acre-feet of firm water should be allocated, with the remainder coming from interruptible stored water supplies to meet freshwater inflow needs. The estimated annual interruptible stored water supplied during the critical drought will be an additional 14,450 acre-feet/year. The recommended changes are based on the alternative that was selected for the 2003 update based on a careful balance of environmental and irrigation impacts from the results of various scenarios that were considered.

For purposes of estimating required releases of water from Lakes Buchanan and Travis to meet the instream flow or freshwater inflow requirements of this WMP, LCRA will rely on stage data obtained from the gaging system jointly maintained and operated by the U.S. Geological Survey and LCRA for determining these requirements. If the ratings used to convert stage to flow published by LCRA and the USGS are not identical at the time required releases are estimated, LCRA will exercise its discretion to rely on the latest updated rating of the gage.

3. Projected Interruptible Stored Water Demands

a. Interruptible Stored Water Customers

LCRA presently supplies interruptible stored water to four major irrigation operations. These operations are: Pierce Ranch Irrigation Company, and LCRA's Garwood, Lakeside and Gulf Coast Irrigation Operations. These operations have associated with them very early run-of-river rights to divert surface water from the Colorado River, to the extent it is available, to satisfy customer needs up to their permitted amounts. These run-of-river rights are all senior to LCRA's water rights in the Highland Lakes. Thus, LCRA may impound only that portion of the inflows to the Highland Lakes remaining after passing through inflows to the extent needed to honor these and any other downstream senior water rights.

These four operations are primarily concerned with the growing of rice although there are some turf and row-crops grown within these operations. Virtually all irrigation water is pumped from the Colorado River. Only the Lakeside Irrigation Division has the use of a small amount of groundwater for irrigation purposes.

b. Projected Rice Irrigation Water Demands

The projected average annual irrigation water demand for 2010 is about 438,200 acre-feet annually (Table 4-3). Water to supply that need will come from both interruptible stored water and run-of-river sources. Statistical analysis by LCRA staff indicates that agricultural water diversions at these operations are influenced by the number of acres planted, rainfall, and evaporation. Planted acreage is the strongest statistical predictor of agricultural water use, but is also the most difficult to forecast since annual acreage varies greatly. Rice acreage is largely

governed by the federal farm support program, which is currently undergoing changes. It is premature to forecast the ultimate impact of these changes on the rice industry in LCRA's water district.

Because of the many variables that impact total water diversions at the irrigation operations, a conservative projection was made of future rice irrigation water acreage. First crop acreage for each operation was projected to be equal to the largest acreage cultivated over the last ten years. The projected first crop acreage, as well as 2000 actual first crop acreage, is given in Table 4-3. The Lakeside Irrigation Division has cultivated more acreage in the last ten years, but has used groundwater to meet the excess water needs.

The projections of second crop acreage are based on a fraction of the first crop acreage. The fraction used is the ratio of the second crop to first crop acreage in the year of greatest first crop acreage over the past ten years. These fractions are 0.44, 0.83, and 0.96, respectively, for Gulf Coast, Lakeside and Garwood. Second crop acreage for Pierce Ranch is taken as 6% of the total second crop acreage for Gulf Coast, Lakeside and Garwood.

The actual use of water for irrigation is highly variable, with relatively large differences from year to year. Water diversions projected for each irrigation operation, except Pierce Ranch, are calculated from predictive equations that consider rainfall and evaporation conditions, as well as acreage, during each irrigation season (Martin, 1990). These projected demands are based on rainfall and evaporation conditions expected during the duration of a repetition of the critical drought period experience from 1947 through 1956. The projected demands from Pierce Ranch are taken as 9% of the total projected demands of the other three major irrigation systems. This percentage reflects Pierce Ranch's historical proportion of total diversions over the past ten years adjusted for the major water reductions through water conservation.

TABLE 4-3. REPORTED YEAR 2000 AND PROJECTED ACREAGE AND SURFACE WATER DEMANDS FOR IRRIGATION				
Irrigation System	**Reported 2000 First Crop Acreage (Acres)**	**Reported 2000 Water Use (Acre-Feet)**	**Projected Year 2010 First Crop Acreage (Acres)**	**Projected Year 2010 Water Use (Acre-Feet)**
Gulf Coast	18,800	152,200	30,300	155,600
Lakeside	23,500*	117,800	27,500	135,600
Garwood	15,000**	83,200	21,200	109,000
Pierce Ranch	4,500**	26,100	4,740	36,000
Other Senior Rights	0	0	1,000	2,000
Total	61,800	379,300	84,740	438,200
* Includes acreage supplied from groundwater.				
** Estimated				

Adjustments are also made to the water demand estimates developed from the equations to reflect ongoing water use efficiency improvement programs. Aggressive water conservation efforts are projected to reduce the water diversions at the Gulf Coast Division by over 25% by 2010, from historical 1968-1986 period usage levels. The water demands for the other three major irrigation operations are expected to decline as well due to water conservation efforts, with 5% total cumulative reductions by 2010, from patterns of historical usage.

To estimate the demand for interruptible stored water supply for irrigation needs, a table of acreage was developed for the irrigation operations that included the likely allocation of various amounts of interruptible stored water between first and second rice crop. Such table was developed based on several assumptions.

Allocation of interruptible stored water supply to the individual irrigation operations was according to the following formula:

> Interruptible Stored Water Supply = 0.5*Average annual interruptible stored water usage over past 10 years + 0.5*Highest year of interruptible stored water usage within past 10 years.

Using the last ten years of interruptible stored water usage, it was found that each irrigation operation is entitled to the following percentages of interruptible stored water supplies available:

Gulf Coast	.425
Lakeside	.425
Garwood	.063
Pierce Ranch	.088

Pierce Ranch was not included in the acreage table since there is not a reasonably accurate predictive equation for water use at Pierce Ranch. To represent Pierce Ranch's needs, water use and acreage were assumed at 9 % and 6 %, respectively, of the combined water use and acreage, respectively, of the other three operations.

In developing the table of acreage, it was assumed that the hydrologic and meteorological conditions reflected a 1 in 5 dry year, or stated differently, the dry conditions that would be expected only 20% of the time.

The maximum annual demand for the interruptible stored water acreage projected for 2010, under a 1 in 5 dry year condition, was 273,000 acre-feet. Using that as the greatest interruptible stored water demand, a set of smaller interruptible stored water supplies were assumed to generate a set of first and second crop acreages expected to be cultivated by the three major operations. These acreages were assumed to be the maximum planting acreage that could be supported by the limited water supplies, both run-of-river and interruptible stored water. The allocation of the available interruptible stored water supplies for irrigation was based on the assumption that the demand for projected first crop acreage for rice (83,700 acres) will be fully met, with any acreage curtailments occurring in second crop.

The acreage level was set for each level of interruptible stored water supply using the following process:

1. The total interruptible stored water supply available was allocated to each of the three major operations according to the percentages given above.

2. The available interruptible stored water for each irrigation operation was used first to meet the needs of first crop rice.

3. The remaining interruptible stored water supply, after first crop, was used for second crop needs. If there was insufficient interruptible stored water supplies, then the maximum allowed second crop acreage was reduced in the same proportion as the ratio of the available to the maximum needed interruptible stored water supplies. For example, if there is only 50% of the interruptible stored water needed to meet the needs of the maximum second crop acreage allowed, the second crop acreage is set to 50% of the maximum second crop.

The table of acreage thus developed for the irrigation operations was used in simulations conducted with the RESPONSE model for this WMP update to define the planning decisions of allocating available interruptible stored water when curtailments were instituted. As noted

before, Pierce Ranch acreage and water demand were treated in the RESPONSE model as percentages of the combined acreage and water demand of the three other irrigation operations.

In addition to the senior water right holders and major irrigation operations, there are additional demands for surface water along the Colorado River. These demands, and their water rights, are junior in time to December 1, 1900 but senior to November 1, 1987. Consistent with LCRA's water rights for Lakes Buchanan and Travis, the WMP provides that LCRA will treat any of these rights junior to the water rights for Lakes Buchanan and Travis in the same manner as the users of interruptible stored water. The maximum amount of interruptible stored water to meet the demand of such junior water rights is about 4,700 acre-feet annually, however these demands are not likely to take place each and every year.

c. Instream Flow and Estuarine Freshwater Inflow Water Demands

As noted in the section on firm water demands, interruptible stored water is used to meet part of the environmental water demands for instream flow and estuarine freshwater inflows. During the critical drought, the average annual demand on interruptible stored water is estimated to be 23,030 acre-feet per year, with 8,600 acre-feet per year of that amount provided for instream flow maintenance.

4. Summary

Projected surface water demands in LCRA's ten-county water district during severe droughts total about 798,300 acre-feet annually in 2010. Firm water demands are projected to be approximately 360,100 acre-feet annually in 2010 (See Table 4-2). Surface water demands for irrigated agriculture under drought conditions are estimated to be 438,200 acre-feet annually. The projected irrigation demands, as well as reported use in 2000, are indicated in Table 4-3.

REFERENCES

Tex. Water Dev. Bd., WATER FOR TEXAS – 2002 VOLUME III (2002) (Region K Plan) (available online at http://www.twdb.state.tx.us/rwp/k/PDFs/).

Martin, Q. W. (1990). "Economic Evaluation of Alternative Rice Cropping Decisions," Open File Report, Water and Wastewater Utilities Program, Lower Colorado River Authority, Austin, TX.

Projected Water Supplies

1. Water Supply Management Procedure

a. Systems Operation Concept

A fundamental concept of the WMP is that Lakes Buchanan and Travis and the lower Colorado River are operated as a combined water supply system. Unregulated inflows entering the

Colorado River from drainage areas downstream of the Highland Lakes must be used to the maximum extent possible before inflows to the Lakes Buchanan and Travis are passed through or stored and subsequently released to satisfy downstream water needs.

Such a system concept requires a careful and extensive analysis of the interconnection of hydrologic conditions, water demands, and priority of water rights and uses. The WMP uses the following general guidelines for the storage and use of water in the Highland Lakes and the lower Colorado River.

b.Critical Drought Period Concept

A basic assumption in assessing water availability for the DMP/DCP is that all operational procedures must be evaluated as if the worst drought ever recorded for the lower Colorado River were to reoccur. This Drought of Record for the Highland Lakes was the 1947-1957 period, a period that was identified as the most severe occurring during the 105 years since data collection started in February 1898.

c.Procedures For Evaluating Water Availability

LCRA staff developed a computer program for evaluating water availability under a variety of management policies. This program is called "RESPONSE - Lower Colorado River Authority Reservoir System Simulation Computer Program." The evaluation of water availability proceeds on an annual basis. For each year, a three-stage process is executed:

1. water demands are estimated for each user or usage category for the coming year;
2. the daily flows are allocated among users based on legal priority or seniority; and
3. the operation of Lakes Buchanan and Travis is simulated on a monthly basis to reflect the storage of unused inflows, evaporation, and potential spills.

The demands for water in the next year are specified as either fixed annual amounts or demands that vary depending on water in storage. The firm demands are all held constant in each year of simulated hydrologic conditions. The irrigation demands change from year to year depending on: (1) the acres cultivated in each irrigation operation for first and second crop rice; (2) weather conditions (rainfall and evaporation) in that year; and (3) water held in storage in Lakes Buchanan and Travis at the beginning of the year. The water demand for first crop rice occurs only in the months of March through July, while second crop demands are in August through October. All annual water demands are distributed on a daily basis using historical water usage information.

The simulated allocation of inflows into Lakes Buchanan and Travis in the DMP/DCP among downstream senior water rights holders follows the same procedure used in developing the Combined Firm Yield of Lakes Buchanan and Travis for the WMP. It is important to note, however, that these simulated monthly operations do not necessarily reflect the actual day-to-day

operations of the reservoir system, which often requires the exercise of best professional judgment.

2. Supplies for Firm Demands

The annual dependable water supply that can be supplied from Lakes Buchanan and Travis during a repetition of the Drought of Record is referred to as the Combined Firm Yield. Based on the studies available to LCRA, the Combined Firm Yield has been calculated by LCRA to be 445,266 acre-feet per year, exclusive of the amount allocated to O.H. Ivie Reservoir. In addition to this Combined Firm Yield, water supplies are also available from the natural flow of the river downstream of the Highland Lakes to meet a major part of the City of Austin's and the South Texas Project's firm water demands.

Adding the other firm water demands to those of the City of Austin gives a projected drought-condition demand in the year 2010 of approximately 360,100 acre-feet annually, as described in Table 4-2. Portions of the demands of the City of Austin and of STP can be supplied from run-of-river flows under separate water rights, reducing the projected drought-condition demand for stored water in year 2010 to about 184,000 acre-feet annually. The estimate of drought-condition firm demand for stored water in 2005 is about 134,000 acre-feet annually. The firm demands for stored water over the next ten years are low relative to the firm supplies from the Combined Firm Yield. Thus, curtailment of firm demands is not likely in the next decade, even under a recurrence of extreme drought conditions. A large surplus in firm stored water supplies is therefore available to meet interruptible stored water needs without placing at risk the stored water needed for firm water users in the next decade.

3. Supplies for Interruptible Stored Water Demands

As specified by the WMP, the amount of interruptible stored water available for the next irrigation season is projected by LCRA staff in November of each year. The projected supply depends upon the amount expected to be in the combined storage in Lakes Buchanan and Travis on January 1, anticipated inflows for the subsequent months through the irrigation season, and the current demands for firm water.

Several procedures were evaluated to predict the likely supplies available, during a repetition of the Drought of Record, in the next year for interruptible stored water demand. Historical records of streamflow were examined, but were found to be highly variable and hence not accurate in estimating water availability for the next year. The most accurate indicator of water availability is the combined storage in Lakes Buchanan and Travis at the beginning of the year. Thus, for the DMP/DCP, the allocation of stored water supplies to meet interruptible stored water demands is based solely on the combined reservoir storage in Lakes Buchanan and Travis at the beginning of each year, and decisions to curtail interruptible stored water supplies in annual contracts are keyed to particular total January 1 storage levels.

At relatively full storage levels on January 1, the supply of interruptible stored water is sufficient

to meet all projected firm and interruptible stored water demands. However, at or below some storage levels, there are not sufficient supplies and the annual contracts for interruptible stored water must be reduced. At lower and lower January 1 storage levels, less and less interruptible stored water is available for allocation through the annual contracts. At some relatively low storage, there will be a total cutoff of water for interruptible stored water use in the coming year. Provisions will be made to revise the water supply estimates during the year to respond to significant changes in projected streamflow and storage due to rainfall in the basin.

The evaluation of expected hydrologic and water demand conditions during a repetition of the Drought of Record can only be simulated based on projected information. This projected information is subject to some uncertainty. LCRA has determined it prudent to designate some minimum storage level serving as a safety factor to insure that all firm demands are fully met during the critical drought. Under this conceptual operating plan, there would be a storage level which, when reached at any time during the year, would require the total cutoff of all water for interruptible stored water use. That storage level defines a Reserve Storage Pool for the system.

With the increase in projected firm water needs of about 50,000 acre-feet annually from Lakes Buchanan and Travis for 2010, there is less water for interruptible stored water supply from Lakes Buchanan and Travis since firm water needs take priority over interruptible stored water uses. To avoid shortages to firm water users, it is recommended that interruptible stored water supplies from Lakes Buchanan and Travis be reduced during the critical drought years from what is available under the WMP approved in 1999 by revising the annual interruptible stored water supply curtailment policy, as discussed below. This reduction in supplies impacts irrigation primarily since irrigation has the highest priority for use of interruptible stored water.

Water Curtailment Policies

1. Triggering Conditions

The DMP/DCP contains distinct triggering levels, as well as several associated cancellation measures, that are associated with the amount of water available in Lakes Buchanan and Travis. These responses range from voluntary conservation by firm water customers to total cutoff of interruptible stored water customers. This DMP/DCP fully meets the critical instream flow needs at all times and meets the target flows during periods of normal or above normal stream flow conditions.

2. Curtailment of Interruptible Stored Water Demands within Irrigation Operations and for Instream and Bay and Estuary Freshwater Inflows

Given the large demand for interruptible stored water for rice production, there will likely be a shortage of interruptible stored water at some time during the next decade. The curtailment policies considered in the DMP/DCP focus primarily on the reduction in interruptible stored water supplies through the annual contracting process. The impact of reducing supplies in the annual contracts is far less than forcing a curtailment or total cutoff during the year after the rice

farmers have made economic commitments based on the assumed availability of the water.

a. Recommendation for Interruptible Stored Water Demand Curtailment for Irrigation and Environmental Needs

To examine possible alternative policies for the 2003 update, LCRA staff reviewed with the Water Management Plan Revision Advisory Committee over thirty options for allocating water supply between irrigation and environmental needs.

In determining available interruptible stored water supplies, it is essential that firm water demands be fully protected during a repetition of the Drought of Record (DOR). This drought is the worst ever recorded on the lower Colorado River and occurred from 1947 through 1956. As noted earlier, projected firm water demands from Lakes Buchanan and Travis over the next ten years (to 2010) are estimated to increase by 50,000 acre-feet annually (24 percent) from the ten-year projections used in the 1999 version of the WMP (to 2005). Meeting those increased demands may only be achieved by decreasing the interruptible stored water supplies presently provided from Lakes Buchanan and Travis. This reduction in supplies impacts irrigation primarily since irrigation has the highest priority for use of interruptible stored water. The second factor affecting interruptible stored water supplies available for irrigation is the allocation of interruptible stored water supplies between irrigation and environmental protection. This allocation is always a delicate balancing between benefits and adverse impacts.

After examining the alternatives, LCRA recommends that interruptible stored water supplies be reduced from present levels and that additional water be provided for estuarine freshwater inflows. As more specifically described below, LCRA recommends that interruptible stored water supplies be reduced from the current levels with the initial storage curtailment threshold raised from the current value of 1.1 to 1.4 million acre-feet. The annual interruptible stored water supplies are determined based on beginning-of-year storage. As storage declines, there is a decline in annual interruptible stored water supplies available. For storage levels less than 1.4 million acre-feet, there would be progressive reductions in annual interruptible stored water supplies.

Further, LCRA recommends that an intermediate release schedule be provided for estuarine freshwater inflows that allows a slightly more gradual reduction of inflows to Matagorda Bay during low flow years. The recommended changes are deemed by LCRA as a balance between a modest incremental decrease in irrigation water supplies during drought conditions and modest increased inflow to Matagorda Bay during non-drought years to help maintain the ecological health of the Bay. Based on a balance of environmental and irrigation impacts, the recommended WMP changes include an increase of stored water released for estuarine freshwater inflow. This increase would be provided in years when the January 1 storage level in Lakes Buchanan and Travis is between 1.1 to 1.7 million acre-feet (55 and 86 percent full).

The recommendations for the current update are as follows:

1) Open Supply - If the total January 1 storage in Lakes Travis and Buchanan combined is equal to or greater than 1,400,000 acre-feet, then LCRA will supply all interruptible stored water demands. This assumes 273,000 acre-feet of interruptible storage water is sufficient to irrigate a total of 83,700 acres within the four irrigation operations, with seventy percent (70%) of that acreage being irrigated for a ratoon, or second, crop of rice.

2) Curtailment will begin if the total January 1 storage is less than 1,400,000 acre-feet and greater than 325,000 acre-feet. The available interruptible stored water supply when combined storage on January 1 is less than 1,400,000 acre-feet is shown in Figure 4-1. If combined storage on January 1 is between 1.4 million acre-feet and 1.15 million acre-feet, the interruptible stored water supply available will vary beginning at 273,000 acre-feet available at 1.4 million acre-feet of storage and decreasing at a rate of approximately 31,200 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 195,000 acre-feet available at a combined storage of 1.15 million acre-feet. When the combined storage in Lakes Buchanan and Travis on January 1 is less than 1,150,000 acre-feet, the interruptible stored water supply available will vary beginning at 195,000 acre-feet available at 1.15 million acre-feet of storage and decreasing at a rate of approximately 4,250 acre-feet for each 100,000 acre-foot decrease in combined storage until a value of 160,000 acre-feet available at a combined storage of 325,000 acre-feet.

3) Cutoff of the interruptible stored water supply for the coming year will occur when the combined storage in Lakes Buchanan and Travis on January 1 is less than or equal to 325,000 acre-feet.

4) Reserve Storage Pool - If at any time during the year the total storage in Lakes Buchanan and Travis, combined, is less than or equal to 200,000 acre-feet then all use of interruptible stored water will be stopped.

5) During periods of curtailment or cutoff instituted on January 1, LCRA will cancel the curtailment of interruptible stored water for the irrigation operations at any time during the year prior to July 31, if the combined storage in Lakes Buchanan and Travis is projected to be equal to or greater than 1.4 million acre-feet anytime in July. Further, the remaining available interruptible stored water supplies for the year may be reallocated, at this time, between irrigation operations if such allocations do not adversely affect any irrigation operation.

6) During periods of curtailments, LCRA will allow each irrigation operation the option of either: (1) using up to a maximum authorized volume of interruptible stored water allocated to that operation, or (2) using sufficient water to cultivate a level of acreage agreed upon among the customers within each particular irrigation operation and LCRA.

Since the curtailment begins at a storage level more than one half full, curtailment of irrigation water supplies may occur during some relatively mild droughts, however such curtailment would be limited in scope and duration. Further, it is likely that the rice producers will only be

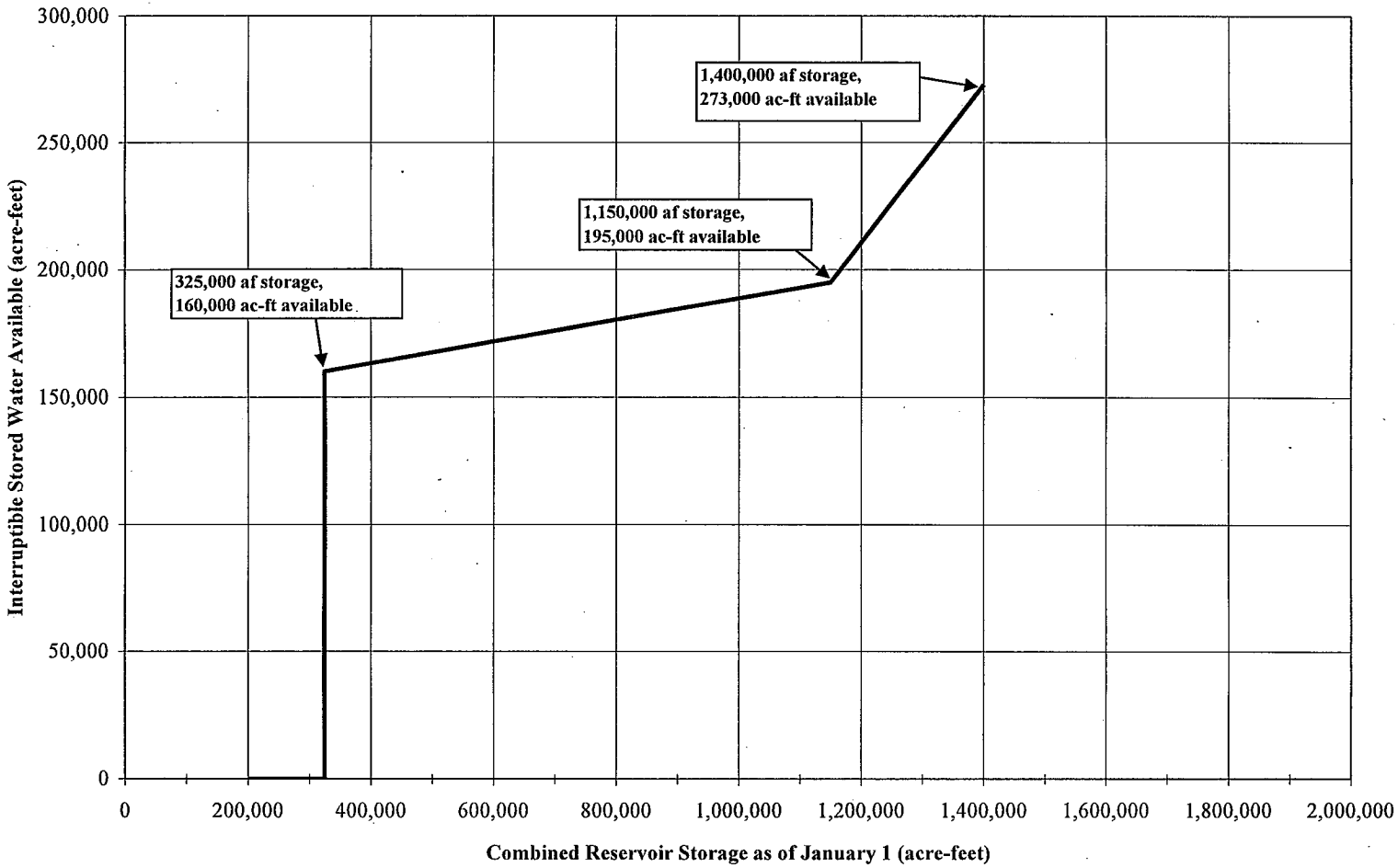
tentatively required to curtail second crop rice, which is cultivated after first crop rice is harvested in July and August. Thus, the curtailment plan has the added advantage that spring rains and runoff may increase water supplies and reduce demand and thereby allow an increase in the estimate of interruptible stored water available for second crop rice. Rice producers could relatively easily increase their second crop acres if they were aware of any increased water supply by June 15.

To achieve the estimated benefits of the management policy, it is necessary for the irrigation operations to reduce their water demands to correspond to reductions in the estimated interruptible stored water supplies, in accordance with the procedures in this WMP or the terms and conditions of contracts between LCRA and stored water users. Close coordination between LCRA and the operations will be needed. Should an operation choose not to reduce the acreage cultivated in response to the projected shortage of interruptible stored water supply, LCRA will only supply that operation with its estimated portion of the reduced interruptible stored water supply. No additional interruptible stored water will be released in that year for that irrigation operation once the diversion limit has been reached.

In addition to the above features, and consistent with state law, LCRA's customers must prepare and adopt a legally enforceable local drought contingency plan, which should include specifics concerning the actions to be taken to comply with LCRA's DMP/DCP regarding the curtailment of interruptible stored water supplies. LCRA staff is available to provide technical assistance with the preparation of required local plans.

FIGURE 4-1

Interruptible Stored Water Available During Curtailment
Based On January 1 Combined Storage in Lakes Buchanan and Travis



b.Irrigation Allocation Among the Irrigation Operations

As provided in Finding 25 of the September 7, 1989 Order of the Texas Water Commission approving LCRA's WMP, "the priority allocation and terms governing the interruption of supply of stored water for Garwood are based upon a contract between Garwood and LCRA."

LCRA has negotiated a contract with Pierce Ranch governing the interruption of the supply of stored water to Pierce Ranch. Interruption of the supply of stored water for other commitments similarly would be governed by contract or LCRA Board resolution.

There are many ways in which interruptible stored water demands may be curtailed through the annual contracts. The two most likely are a gradual curtailment with reductions indexed against beginning of year storage in Lakes Buchanan and Travis; or an abrupt total cutoff policy where the full demands are supplied if the beginning of year storage level in Lakes Buchanan and Travis was above a specific level, otherwise totally stop interruptible stored water sales for the next year.

The largest use for interruptible stored water is rice production. Rice producers must plan their crops for the next season based upon the projected interruptible stored water supply, even though more supply may actually be available in future months. The advantages of the gradual approach of curtailment are that the rice industry could use the water allocated to achieve the greatest benefit. Water could be used in first crop on the hope that conditions in the spring would refill the river and lakes. The disadvantage is that some curtailment would occur when it was not really necessary in years when the critical drought was not repeated. Lakes Buchanan and Travis would refill and spill because the drought ends before conditions become as severe as the critical Drought of Record.

The advantages of the "all or nothing" approach are that there would be more years when the full demands would be met and minor droughts would not affect available supplies. Disadvantages would be that in some years there would be no interruptible stored water and most rice producers would risk substantial or total loss of their crops if sufficient run-of-river water was not available throughout the growing season.

In years when there is not sufficient projected interruptible stored water available to meet all irrigation needs, the interruptible stored water will be allocated to the irrigation operations so that all operations have the same percentage shortage in their total interruptible stored water demand. The calculation of the annual demand of interruptible stored water will be based on a projection of relatively dry weather and low streamflow conditions in the next year.

The allocation of interruptible stored water supply to the individual irrigation operations is discussed above in Section C.3.b. Briefly, allocation of interruptible stored water supply to the individual irrigation operations for the 2003 update of the WMP is according to the following formula:

Interruptible Stored Water Supply = 0.5*Average annual interruptible stored water usage over past 10 years + 0.5*Highest year of interruptible stored water usage within past 10 years.

Using the last ten years of interruptible stored water usage, each irrigation operation was determined to be entitled to the following percentages of interruptible stored water supplies available:

Gulf Coast	.425
Lakeside	.425
Garwood	.063
Pierce Ranch	.088

Based on this allocation, a table of acreage was developed for the three major irrigation operations showing the likely allocation of various amounts of interruptible stored water between first and second rice crop. Pierce Ranch was not included in the table since there is not a reasonably accurate predictive equation for water use at Pierce Ranch. To represent Pierce Ranch's needs, water use and acreage were assumed at 9 and 6 %, respectively, of the combined water use and acreage, respectively, of the other three operations.

c. Irrigation Allocation Within the Irrigation Operations

Because Pierce Ranch has entered into a long-term interruptible stored water contract with LCRA, Pierce Ranch will determine how water will be allocated within its own operation. Within each LCRA irrigation operation, LCRA and its customers, through the advisory committees, will mutually determine which of the following allocation methods to follow:

Volumetric method – The total volume of water available to each operation will be divided by the operation's total ~~ten-year~~recent base history to establish an amount available per acre, not to exceed 5.25 acre-feet. Each customer's actual first crop per acre usage for each landmass will then be subtracted from the per acre farm level availability and the balance, if any, will be made available to the customer for second crop production. Additional water made available due to any customers choosing not to irrigate either first or second crop will be equitably distributed to customers who irrigate other crops within the operation.

Acreage Method – The irrigation operation choosing this method would irrigate first crop acreage, but prior to the initial contracting process, would determine the maximum first crop acreage that could be irrigated with allocated water supplies. The first crop acreage for the particular irrigation operation would be determined by dividing the total water available to the particular irrigation operation by a first crop acre-foot per acre water use duty as agreed upon

between LCRA and the respective advisory committee. Contracted first crop acreage would be limited to this amount and would be made available to individual customers pro rata, based on their recent irrigation history as described below. For irrigation operations using volumetric measurement, any use of water in excess of the first crop acre-feet per acre duty would be subject to a surcharge. Prior to contracting for second crop water, the acreage available for second crop would be determined and contracted for on a pro rata basis, in a manner similar to that used for first crop, including a duty and surcharge. During ~~first crop~~a curtailment, water would be available for rice only, except at the Gulf Coast irrigation operation, where water would also be available for turf grass.~~ During second crop, other irrigation~~ Other supplemental agricultural interruptible demands within ~~the~~ an operation would also be considered ~~if additional run-of-river supplies are~~on a limited basis and only to the extent that water is available within the canal system which is not needed for rice irrigation.

Each customer's average base acreage history ~~shall~~is to be determined based upon an averaging period agreed to by the farmer advisory committees. The averaging periods are as follows: Garwood – five (5) years; Gulf Coast – two (2) years; and Lakeside – six (6) years.

At the Lakeside and Garwood irrigation operations, the base acreage history shall be based upon the lands irrigated such that a customer shall not be entitled to irrigate lands in a curtailment year that were not previously irrigated by that customer, unless the current landowner of the land that contributed to the base acreage history grants express written consent, and such consent is provided to LCRA with customer's application. In the event that a customer no longer farms land which has a history of being farmed, that history shall be credited to the current landowner or a successor tenant farmer unless the landowner has granted consent for such base acreage to follow the customer to additional lands as described above.

At the Gulf Coast irrigation operation, the base acreage history shall follow the LCRA customer, and not be restricted to a particular landmass.

Allocation of curtailed interruptible stored water to the various users within the irrigation operation will be based on the amount of irrigated acreage on each landmass. This water use will be determined by accounting for established crop rotations during the defined averaging period and will include only those years during that same period that water was used on the landmass. Irrigation operations personnel will maintain this information for each irrigated landmass. Separate base acreage histories will be maintained for rice and turf grass. During periods of curtailment, irrigation customer contracts will be limited to the base acreage as determined by the method ~~just~~ described above and any reductions necessary will be made from this base acreage.

d.Drought More Severe Than Drought of Record

In the event that the LCRA Board of Directors declares a drought to be more severe than the Drought of Record, limits would be placed on first crop production. If that occurred, the following key elements of limiting first crop would stand:

- On Jan. 1 of each consecutive critical drought year, the projected run-of-river flow and interruptible stored water would be calculated and the water volume available to each operation would be projected.

- Each irrigation operation would decide with LCRA which allocation method to use, either the maximum acreage plan or the maximum volume plan.

- The application and contracting process would have a final deadline of February 15th of each year of the drought period that is more critical than the Drought of Record.

e.Termination of Water Allocation Policy

The water allocation model and water allocation plan for agricultural irrigation will terminate when the combined stored volume of Lakes Buchanan and Travis exceeds 1.4 million acre-feet.

The first crop water allocation process described here would terminate when LCRA reallocates interruptible stored water to the irrigation operations after the Board declares the drought worse than the Drought of Record to be over.

f. Procedures for Water Use Accounting

LCRA will employ its ordinary and standard water measurement procedures to account for water used during curtailment periods. During the implementation of the water allocation policies, LCRA will notify each customer of the amount of acreage for which LCRA will provide water. LCRA staff will perform actual field surveys to verify that each customer was not planting more than the allocated acreage. Customers planting excess acreage will be required to prevent irrigation waters from entering excess acreage through construction of appropriate outside levees enclosing only permitted acreage.

g.Transfer of Water Among Individual Users

Water allocation among individual users within individual operations is not a property right and there are no procedures or policies for individual users to obtain that right. All waters available during the critical drought would be allocated on a pro-rata basis to the landmasses contracted to irrigate during that critical drought year and either the maximum volume or maximum acreage for that irrigation operation would be consistent with that plan.

h. Variances

Within each LCRA irrigation operation, the LCRA General Manager or his designee is authorized, after consultation with the operation's advisory committee, to move and adjust the averaging period for base acreages within farm service agency farms units to account for established field rotations and contemporary changes in management practices so long as such adjustments do not result in a net increase in acreage history.

i. Enforcement

All LCRA interruptible stored water contracts include a provision requiring that, in cases of a shortage of water resulting from drought, the water be distributed in accordance with LCRA's WMP and Texas Water Code section 11.039.

Interruptible stored water customers within the irrigation operations failing to comply with the pro-rata allocation requirements (curtailment plan) shall be subject to a civil action to enjoin the non-compliant customers for breach of contract. Additionally, the use of water in excess of the customer's per acre duty as described in section C.3.c above is subject to a surcharge.

3. Curtailment of Interruptible Stored Water Demands for Other than Irrigation Operations

LCRA will limit additional sales or commitments of interruptible stored water, other than for the four irrigation operations' Conservation Base acreage or other priority allocation, based on the combined volume of water in Lakes Buchanan and Travis at certain times of the year.

The supply of interruptible stored water made available outside the irrigation operations for the January through June period will be based on the January 1 storage levels in Lakes Buchanan and Travis taken separately. The supply for the July through December period for such sales will be based on the minimum of the maximum storage levels in April, May, and June in Lakes Buchanan and Travis, taken separately. No such sales will be allowed if either lake is less than 94% of its maximum conservation capacity. If both lakes are at their maximum conservation capacity as calculated above for either six-month period, then such interruptible stored water sales will be limited to a total of 30,000 acre-feet for that year. For projected lake volumes between 94% and 100% of conservation capacity, such interruptible stored water sales would be limited proportionately, based on the storage reservoir with the lowest percentage of capacity as calculated above.

4. Curtailment of Firm Water Demands

LCRA is required by TCEQ and the Texas Water Code to follow water supply allocation procedures to insure that there is no shortage or deficiency of stored water to meet firm demands during a repeat of the Drought of Record. Given the relatively small demand on firm water supplies at present, the possibility of a firm water shortage occurring is remote for the foreseeable future.

LCRA cannot determine with absolute certainty whether a particular drought event will be more or less severe than the Drought of Record. Therefore, LCRA will engage its customers in a public education campaign and seek voluntary reduction of firm demands from its firm customers in the early stages of a drought, as more specifically described below.

LCRA cannot invoke mandatory curtailments of firm water demand unless a particular drought event is determined to be more severe than the Drought of Record or some other water emergency that drastically reduces the available firm water supply. LCRA Water Supply Planning staff has developed a simplified "drought monitoring procedure" for identifying a drought worse than the Drought of Record for the Highland Lakes watershed. Historical inflow data for the contributing watershed of the Highland Lakes were used in the development of this procedure.

a. Policy Recommendation for Firm Water Demand Curtailment

1) Recommendation 1: LCRA will ask its firm water customers to promote water conservation of five percent (5%) among their end users through implementation of voluntary water use reduction measures in their Drought Contingency Plans whenever the total storage in Lakes Buchanan and Travis drops below 1.6 million acre-feet. At such times, LCRA will also implement an aggressive public information campaign to provide up-to-date information on water supply conditions.

2) Recommendation 2: LCRA will further encourage promote water conservation and will ask its firm water customers to begin continue to implementing the voluntary water restriction componentsuse reduction measures of in their Drought Contingency Plans whenever the total storage in Lakes Buchanan and Travis is at or below 1.4 million acre-feet.

3) Recommendation 3: Whenever the total storage in Lakes Buchanan and Travis is at or below 900,000 acre-feet, LCRA will ask all its firm water customers to conserve ten to twenty-five percent (10-25%) of their demands through implementation of the mandatory water use reduction measures in their Drought Contingency Plans. LCRA will also begin discussions with firm water customers to develop a specific stored water curtailment plan, to be approved by the LCRA Board and TCEQ.

4) Recommendation 4: A mandatory pro rata curtailment of up to thirty-five percent (35%) of the LCRA's firm water customers' demands pursuant to Texas Water Code §11.039 will be implemented when the LCRA Board determines that the river system is experiencing a drought more severe than the Drought of Record. LCRA will curtail and distribute the available supply of firm water among all of its firm water supply customers on a pro rata basis according to the amount of firm water to which they are legally entitled under the terms of their contract and consistent with the curtailment plan approved by the LCRA Board and TCEQ. All uses of interruptible stored water will be totally cutoff prior to and during any mandatory pro rata curtailment of firm stored water supplies.

In addition to the above features, this curtailment policy for firm water demands, LCRA will require each of its firm water customers to prepare and adopt a legally enforceable local drought contingency plan that specifies the actions to be taken to comply with this DMP/DCP regarding the curtailment of firm supplies. Such plans should be developed pursuant to LCRA guidelines and submitted for LCRA review and acceptance within a reasonable time.

b.Monitoring and Enforcement

LCRA will monitor customers' compliance with the required demand reduction goals and will take enforcement action as necessary against noncompliant customers. Monitoring and enforcement of water-use restrictions at the end-user level generally will be the customers' responsibility.

c.Variances

LCRA's General Manager or his designee may, in writing, grant a temporary variance to the pro rata water allocation requirement of this DMP/DCP if it is determined that failure to grant such a variance would cause an emergency condition adversely affecting the public health, welfare or safety and if one or more of the following conditions are met:

- Compliance with the plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the plan is in effect.

- Alternative methods can be implemented that will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of the DMP/DCP shall file a petition for variance with the LCRA General Manager or his designee within five (5) days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the LCRA Board of Directors and shall include the following:

- Name and address of the petitioner(s).

- Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the LCRA DMP/DCP adversely affects the petitioner or what damage or harm will occur to the petitioner or others if the petitioner complies with the pro rata reduction requirements of the plan.

- Description of the relief requested.

- Period of time for which the variance is sought.

- Alternative measures the petitioner is taking or proposes to take to meet the intent of the plan and the compliance date.

- Other pertinent information.

Variances granted by the LCRA Board of Directors shall be subject to the following conditions, unless waived or modified by the LCRA Board of Directors:

- Variances shall include a timetable for compliance.

- Variances granted shall expire when pro-rata reduction requirements are no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of the LCRA DMP/DCP occurring prior to the issuance of the variance(s).

d.Notification of TCEQ Executive Director

The LCRA General Manager or his designee will notify the TCEQ Executive Director within five (5) business days of implementation of any mandatory provisions in the DMP/DCP.

5. Declaration and Cancellation of a Drought More Severe Than the Drought of Record

The LCRA Board of Directors will declare a drought worse than the drought of record when the following three conditions are simultaneously met: (a) drought at least 24 consecutive months (24 months since both Lakes Buchanan and Travis were at their maximum allowable water conservation storage levels); and (b) the cumulative inflow deficit since the beginning of the drought exceeds the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; and (c) the combined storage in Lakes Buchanan and Travis is less than 600,000 acre-feet.

Curtailments of interruptible stored water due solely to the declaration of a drought worse than the drought of record of duration less than 36 months is only effective on the following January 1 or July 31, whichever occurs first following the declaration by the LCRA Board of Directors. Droughts more than 36 months in length have no restrictions as to when supply reductions can be implemented.

The LCRA Board of Directors will cancel such a declaration if any of the following conditions are met: (a) the cumulative inflow deficit since the beginning of the drought is less than the envelope curve for cumulative inflow deficits by at least 5% for six consecutive months; or (b) the combined storage in Lakes Buchanan and Travis is greater than 1.4 million acre-feet of water, which is simply the recommended threshold for curtailment of interruptible stored water during a repetition of the drought of record. Prior to declaring a drought worse than the drought

of record, LCRA will re-evaluate this threshold level to determine if a more accurate conservation storage level in lieu of 1.4 million acre-feet can be determined.

6. Public Notice

LCRA will carry out a public information campaign that is appropriate to the particular curtailment contemplated. This could include some or all of the following efforts: (1) news releases, (2) news updates to area media, (3) interviews with local radio and television stations, (4) responses to requests for information, (5) distribution of water conservation education materials, (6) advertisements in local newspapers to inform the public about current water supply and usage and our water management planning strategies, (7) improvements to LCRA's automated telephone message system to provide information on lake levels, and (8) public service announcements on local radio stations.

7. Impacts of the Recommended Management Policy

a. Firm Water Demands and Supplies

All projected year 2010 demands for firm water are fully satisfied under these simulated critical drought conditions. The largest firm water demand is for the City of Austin. The majority of Austin's projected annual demand of 201,400 acre-feet is met from run-of-river flows diverted under its senior water rights.

Approximately 65% of the demand during the 1947-1956 critical drought years is estimated to be supplied by these flows with the remainder supplied by firm stored water.

b. Interruptible Stored Water Demands and Supplies

With the increase in projected firm water needs for 2010, there is less water for interruptible stored water supply from Lakes Buchanan and Travis since firm water needs take priority over interruptible stored water uses. To avoid shortages to firm water users, it is recommended that interruptible stored water supplies from Lakes Buchanan and Travis be reduced during the critical drought years from what is available under the WMP approved in 1999. This reduction in supplies primarily impacts irrigation.

Under the recommended management policy, all interruptible stored water available during a repetition of the Drought of Record is used by the four downstream irrigation operations, except for that portion committed to maintaining instream flows and estuarine freshwater inflows.

With the curtailment threshold raised from the current value of 1.1 to 1.4 million acre-feet, the projected first crop demand of 83,700 acres will be fully met under the proposed changes, as it is under the WMP approved in 1999. However, there will be a substantial reduction in the irrigation acreage supplied for second crop under the proposed curtailment policy. The WMP approved in 1999 provides sufficient water to irrigate an average of 56,500 acres of second crop each year during a repetition of the Drought of Record. The proposed plan would provide water

only for an average of 32,700 acres of second crop under the same drought conditions. Approximately 92 percent (21,800 acres) of this decrease in acreage is due to the increased projected municipal demands, with the remainder (2,000 acres) due to the proposed change in environmental releases for estuarine inflows. In spite of this reduction, irrigators would use, during a repeat of the Drought of Record, an average of 168,400 acre-feet annually, or 75 percent of all interruptible stored water used for irrigation and environmental protection.

The simulated acreage cultivated in first and second crops are given for all four operations combined and individually in Figures 4-2 thru 4-6, at the end of this Chapter. As noted previously, however, the actual interruptible stored water curtailments may differ from the values reflected by the cultivated acreage as shown in this simulation, depending on the facts as they then exist and the terms and conditions of the contracts between LCRA and users.

The recommendation concerning instream flows reflects the philosophy adopted in the initial WMP and continuation in the amendments to the WMP that instream flows be curtailed whenever there is a curtailment of interruptible stored water to the four major irrigation operations. Since the curtailment threshold for irrigation supplies is recommended to rise from 1.1 to 1.4 million acre-feet, LCRA has proposed that the curtailment storage threshold for instream flows also be revised upwards the same amount. By synchronizing these curtailment trigger points, the WMP reflects reduced supplies available to maintain instream flows, including both supplies released for irrigation that simultaneously benefit instream flows as well supplies dedicated to maintain streamflows for ecological benefit.

The recommended intermediate estuarine inflow policy would provide for releases of stored water from Lakes Buchanan and Travis of up to 256,700 acre-feet (150 percent of Critical FIN) annually to Matagorda Bay in years whenever the combined storage in Lakes Buchanan and Travis on January 1 is between 1.1 and 1.7 million acre-feet. By increasing the releases of stored water from Lakes Buchanan and Travis in years when the January 1 storage is within this given range, the estuarine ecosystem receives more freshwater inflows during moderate droughts than it would be under the present WMP.

The WMP, with the proposed revisions herein, will have essentially the same total stored water commitments for environmental purposes as currently provided in the present WMP. During a repetition of the DOR, the present WMP would provide an annual average of 56,000 acre-feet for both instream flows and estuarine inflows. With the proposed changes, the WMP would provide about 56,500 acre-feet annually during the same period and for the same purposes.

The proposed increase in the firm water allocated for environmental purposes from about 16,000 to 33,400 acre-feet is required to properly account for the stored water dedicated for environmental purposes. Whenever irrigation interruptible stored water supplies are curtailed, stored water used for environmental protection has be accounted as firm water since irrigation has priority use of available interruptible stored water supplies. Since the proposed storage threshold for curtailment of irrigation supplies is significantly greater than the present threshold, there will be more years in the DOR when irrigation supplies are curtailed, hence increasing the

environmental flows that have to be assigned to firm water supplies.

The proposed additional 17,400 acre-feet firm water commitment for environmental purposes would be provided from the presently uncommitted firm yield of 60,952 acre-feet. The remaining firm yield available after this allocation would be 43,462 acre-feet. This amount is in addition to 50,000 acre-feet reserved by the Board for future uses. The total proposed firm water allocation of 33,400 acre-feet for environmental purposes represents 8 percent of the total firm supply from Lakes Buchanan and Travis.

c.Lake Storage Levels

For the simulated repetition of the Drought of Record, the total combined storage of Lakes Buchanan and Travis was reduced to very low levels in the worst drought years (Figure 4-8), even with the partial curtailment of interruptible stored water supplies. Approximately 200,000 acre-feet of stored water remains in Lakes Travis and Buchanan combined at the lowest storage content. The simulated lake water surface elevations and storage levels are given in Figures 4-9 and 4-10, for Lakes Buchanan and Travis, respectively. The minimum lake water surface levels during the simulation period are about 960 feet msl on Lake Buchanan and 578 feet msl on Lake Travis. The average lake water surface elevations (for the repetition of the 1941-1965 period hydrology) are projected to be 1005 feet msl on Lake Buchanan, and 657 feet msl on Lake Travis.

The simulated minimum water levels in Lakes Travis and Buchanan are lower than the historical low levels of 614 feet and 983 feet, respectively. The greater drawdown on the lakes in the simulated operation is largely because of greater water demands and lower storable inflows than occurred historically. The projected year 2010 water demands are significantly greater than those that occurred historically in the 1941-1965 period. Firm water demands during the actual drought of record were only a small fraction of those projected by year 2010. Additionally, the rice producers only cultivated one crop of rice prior to about 1963. The current practice of producing two crops each year has increased the water demands of irrigation over those of the 1947-1956 critical drought period.

The second factor causing the simulated storage levels to be lower than historical levels is a difference in the storable inflows. The simulated operation uses historical inflows adjusted for any flow reductions caused by water diverted for upstream water rights, particularly major reservoirs <u>including</u> O. H. Ivie Reservoir. Most of the large reservoirs upstream of the Highland Lakes were not in operation during the critical drought period. During any repetition of the Drought of Record, these upstream reservoirs would likely significantly reduce storable inflows.

d.Flows in the Colorado River

For a repetition of the hydrologic conditions in the 1947-1956 critical drought years, the estimated average flow of the Colorado River at Bay City is about 471,000 acre-feet annually with the projected 2010 demands. For a repetition of the 1941-1965 period, the simulated annual

flow at Bay City averages 1.22 million acre-feet. Of this total, a portion of the flow consists of dedicated releases of stored water from Lakes Buchanan and Travis to meet the Target and Critical freshwater inflow needs and a portion consists of stored water released to meet critical instream flow needs at several upstream locations.

The dedicated firm and interruptible stored water releases for the 1947-1956 critical period amount to an average of 56,500 acre-feet per year of which 36,000 acre-feet is for maintaining instream flows.

Annual Implementation of Drought Management and Drought Contingency Plans

1. Annual Review and Revisions

As part of the WMP, the DMP/DCP is subject to review each year. The DMP/DCP may be revised at any time subject to approval by the LCRA Board and the TCEQ. Changing water supply and demand conditions on the lower Colorado River will be reflected as necessary in future amendments to the WMP.

2. Administration

The curtailment of interruptible stored water supply will occur through the annual contracting process in November through January of each year. The curtailment of firm water will depend on storage levels and will be monitored continuously. Curtailment of interruptible stored water supply for Garwood and other entities supplied pursuant to long-term contracts will be accomplished pursuant to the terms of those contracts.

LCRA will monitor customer compliance with the required demand reduction goals and take enforcement action as necessary against noncompliant customers. Monitoring and enforcement of water use restrictions at the end-user level generally will be the customer's responsibility. At present, LCRA's ability to enforce curtailments of firm water demands is uncertain and may be limited to taking civil action to enjoin a non-compliant customer for breach of contract.

Figure 4-2: Simulated Irrigated Acreage - 4 Irrigation Operations Combined

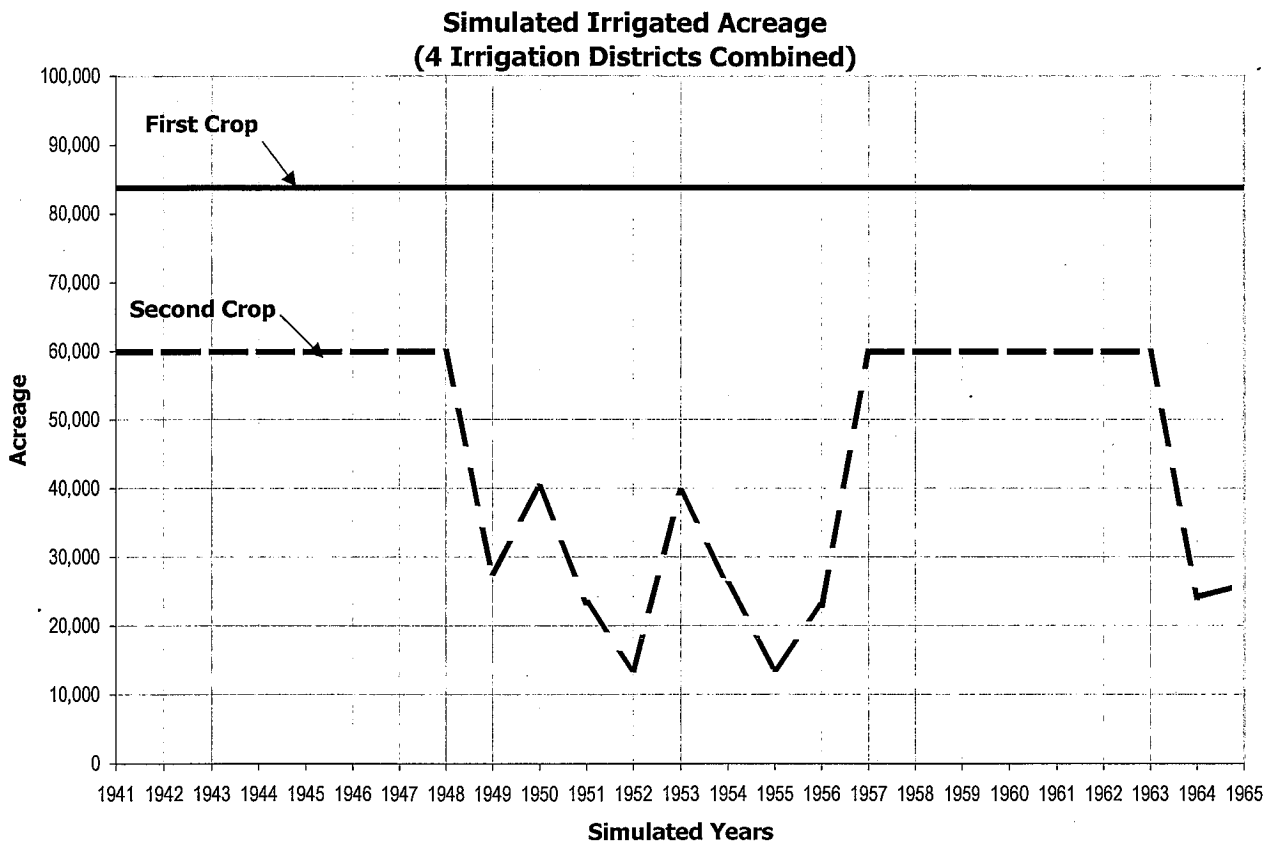


Figure 4-3: Simulated Irrigated Acreage - Gulf Coast

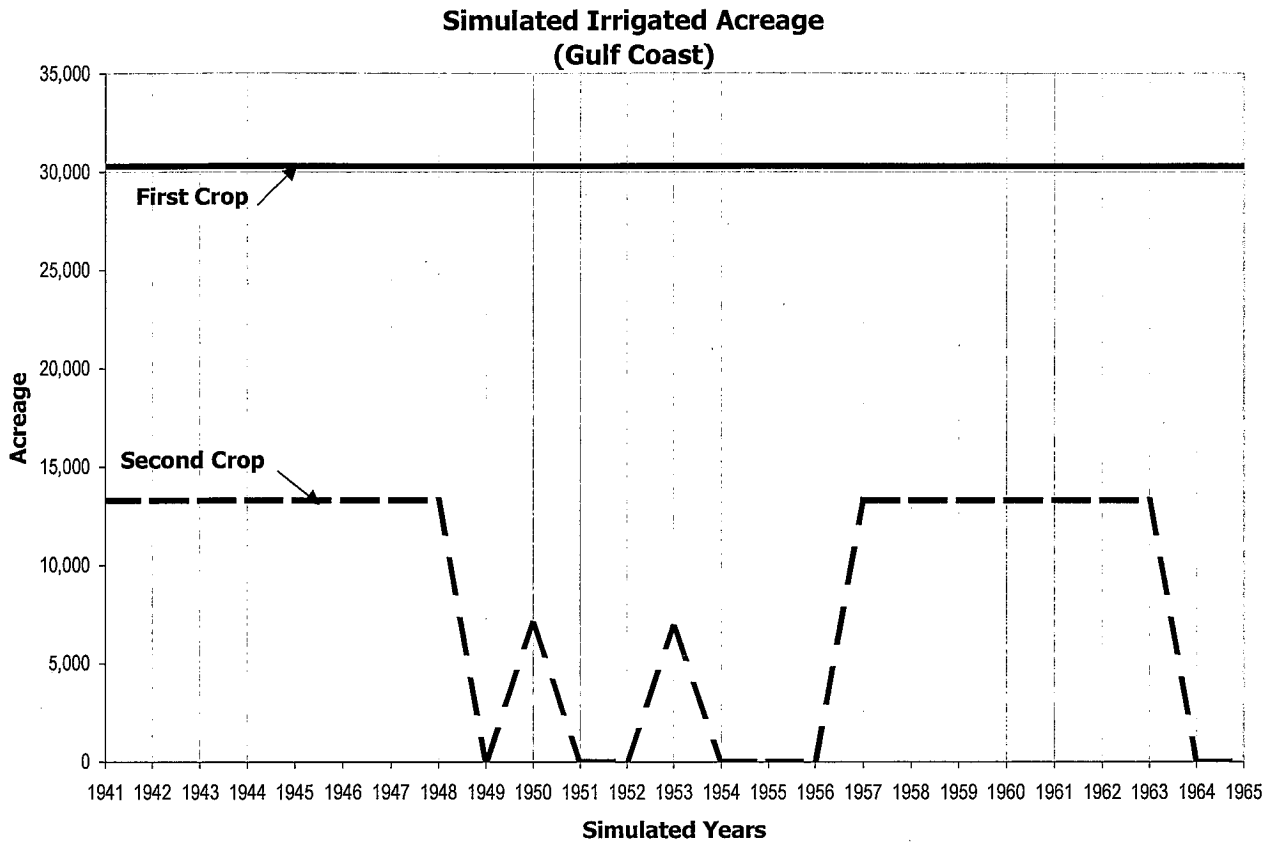


Figure 4-4: Simulated Irrigated Acreage - Lakeside

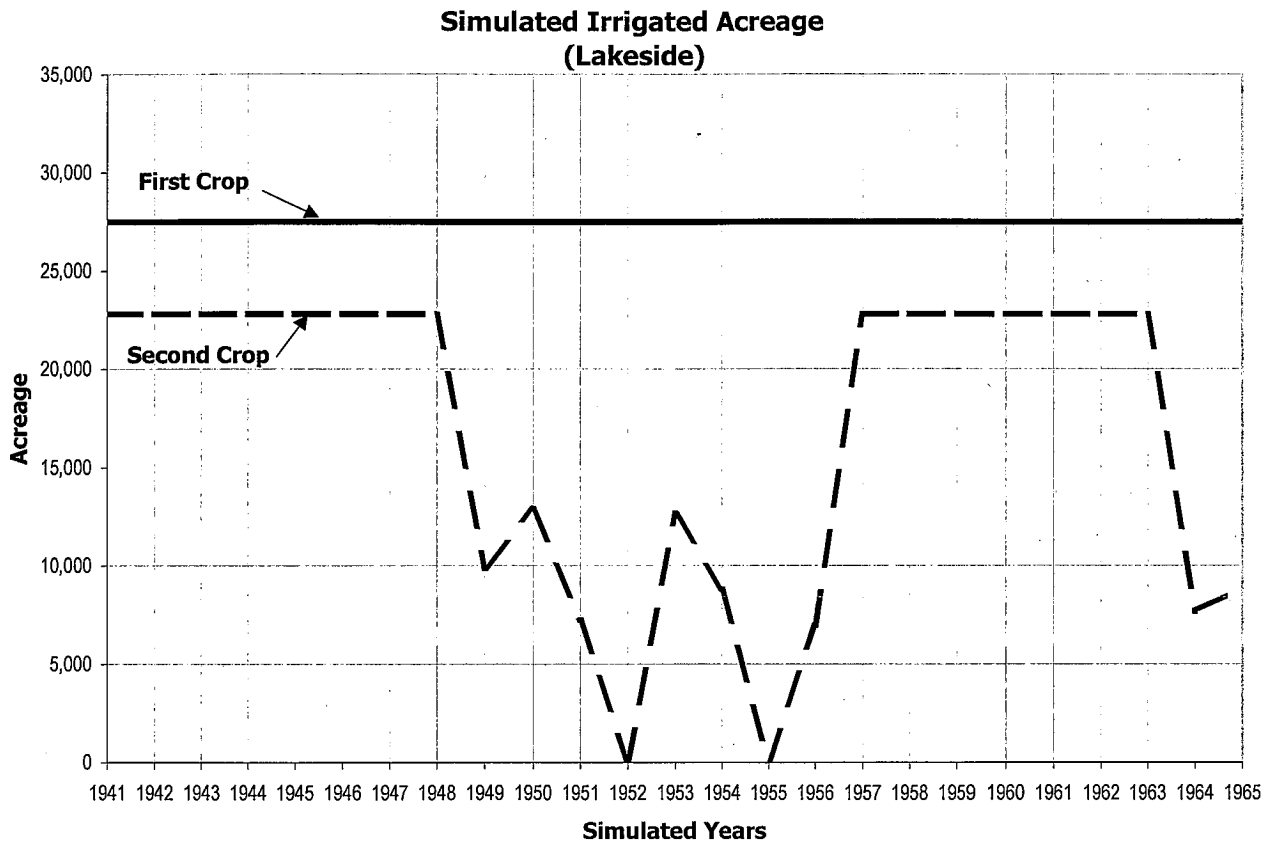


Figure 4-5: Simulated Irrigated Acreage - Garwood

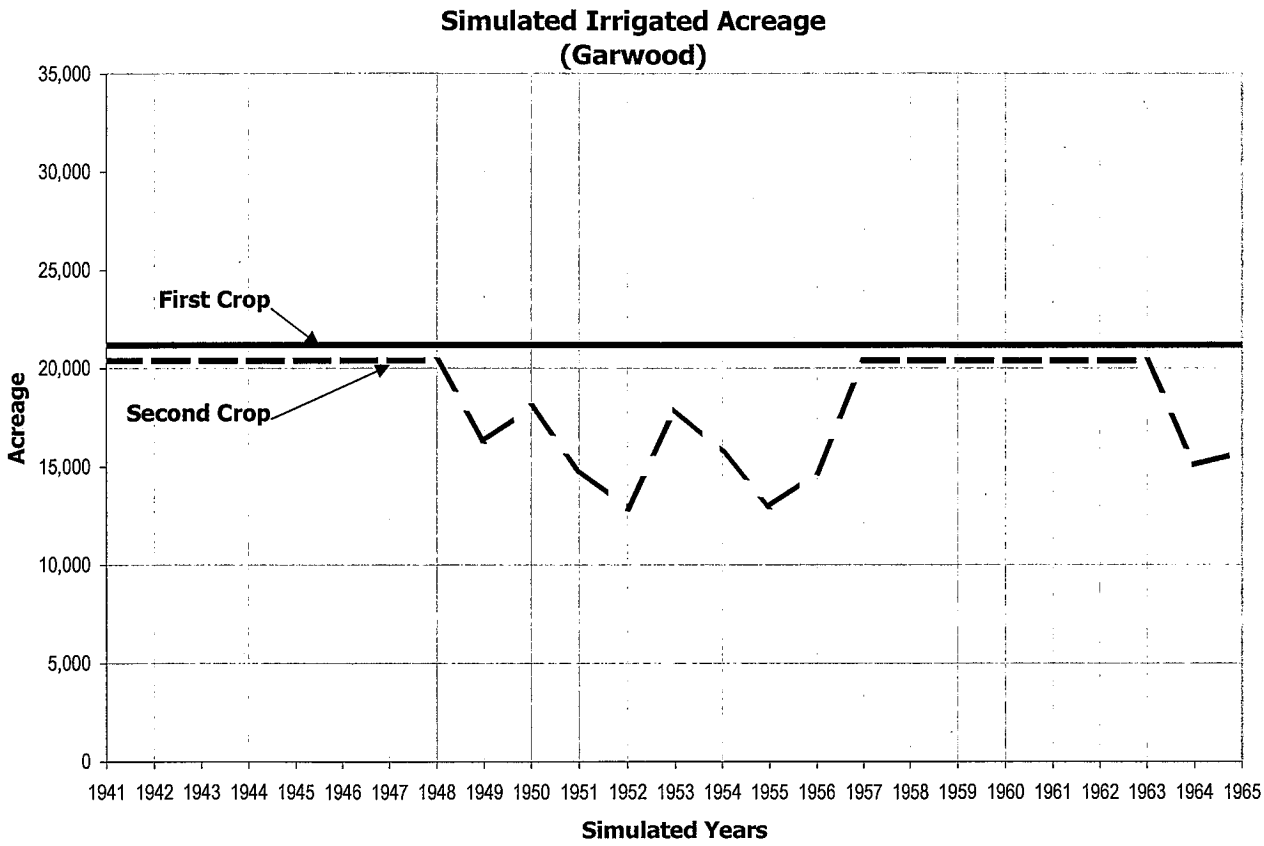


Figure 4-6: Simulated Irrigated Acreage - Pierce Ranch

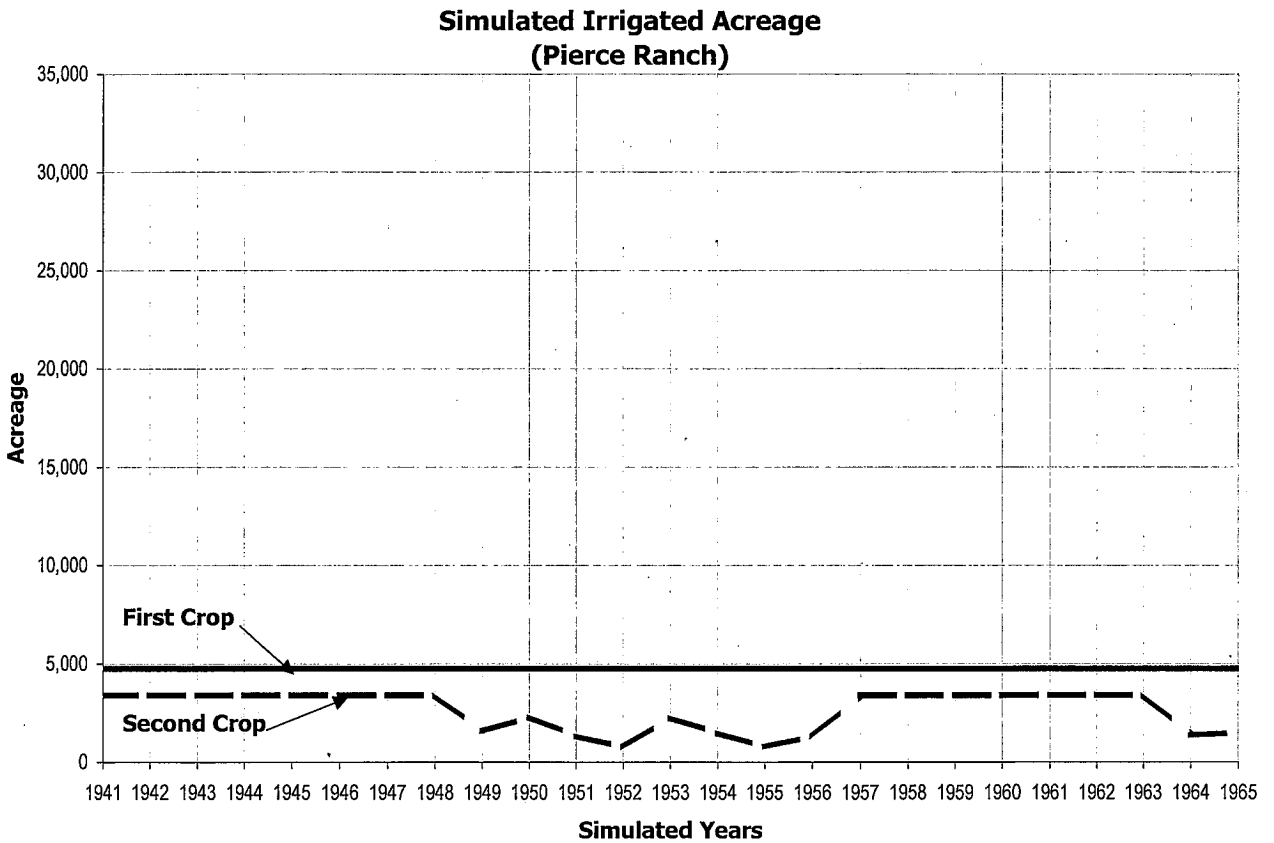


Figure 4-7: Simulated Travis and Buchanan Storage Condition

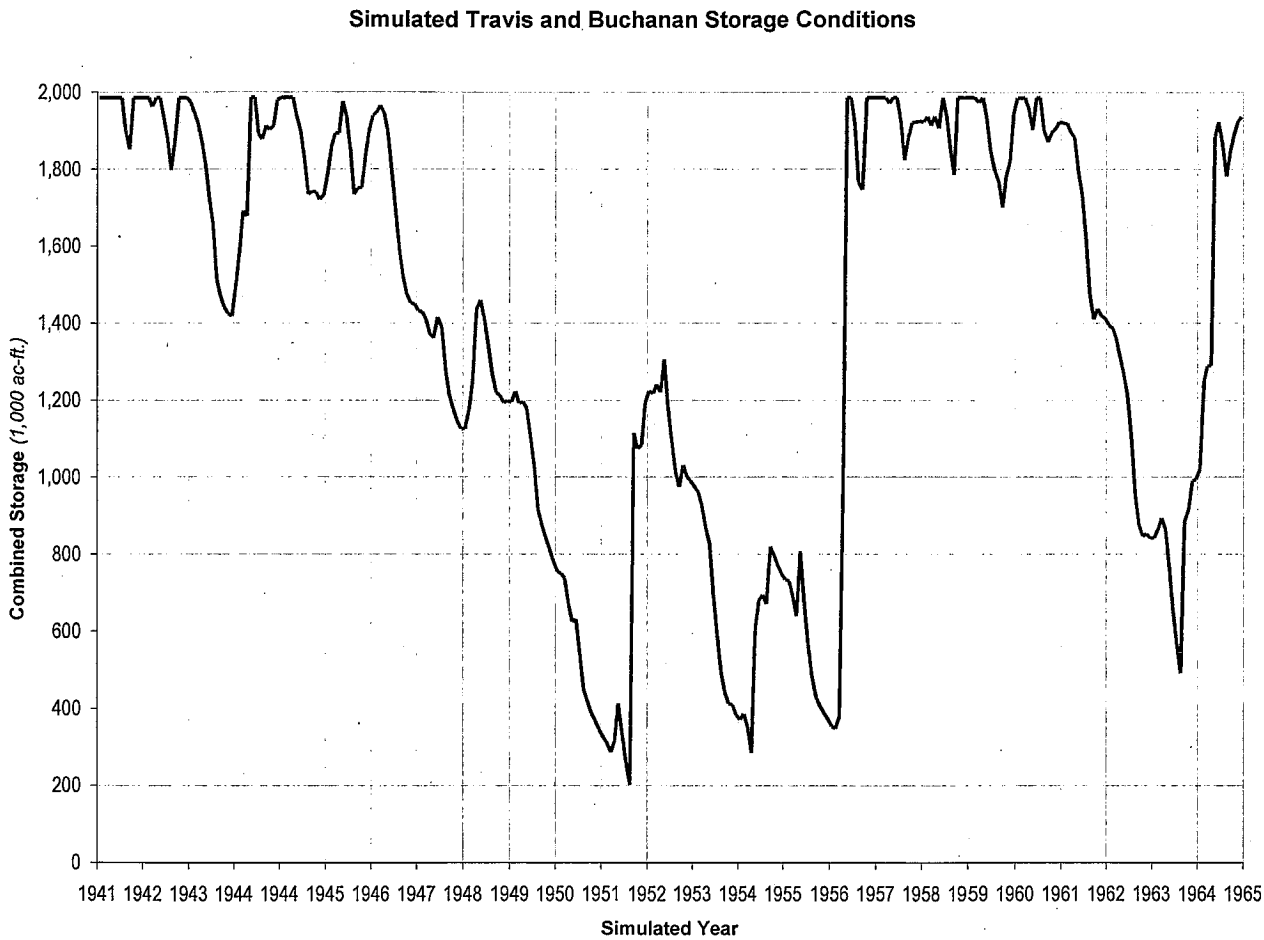


Figure 4-8: Lake Buchanan Simulated Elevation and Storage

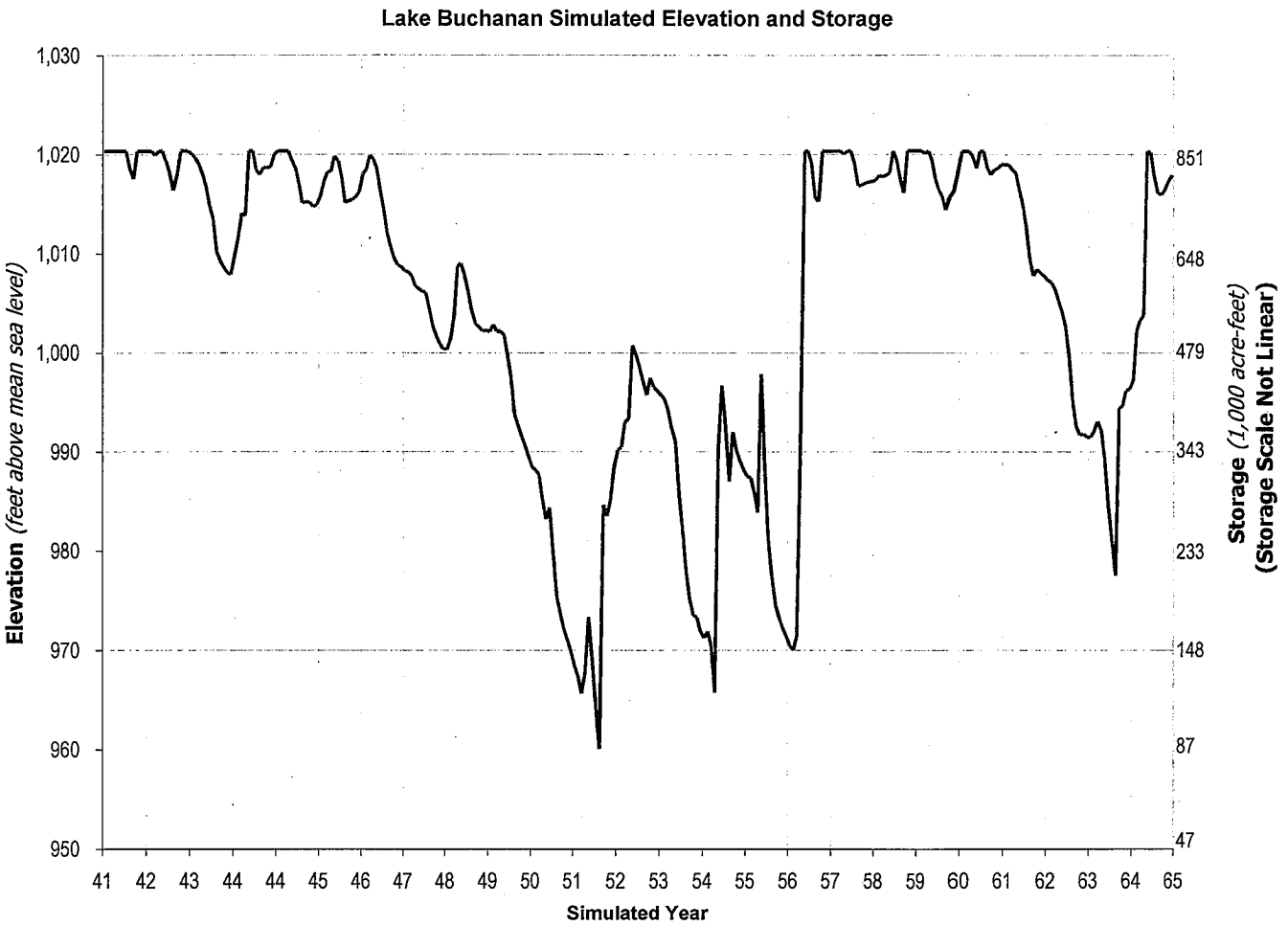


Figure 4-9: Lake Travis Simulated Elevation and Storage