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Revision No.	Date	Author	Revision(s) Made
1.0	9/23/2021	D. Petrosky	Created

Winter Heightened Awareness Checks

Document Type: Procedure
Document Owner: Director
Effective Date: 11/28/2021

Review Period: 1 year
Location: Tom Miller
Subject: Winter

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Space heaters introduce additional safety concerns when used and the following precautions should be observed:

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ENERGY • WATER • COMMUNITY SERVICES

Tom Miller (Austin) Dam

Title/Subject: **Winter Weather Preparations Checklist**
Revision: 1.0
Status: Active

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Revision No.	Date	Author	Revision(s) Made
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Winter Heightened Awareness Checks

Document Type: Procedure
Document Owner: Director
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Location: Wirtz
Subject: Winter

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ENERGY • WATER • COMMUNITY SERVICES

Wirtz Dam

Title/Subject: **Winter Weatherization Preparation Checklist**
Revision: 1.0
Status: Active

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Revision No.	Date	Author	Revision(s) Made
1.0	9/23/2021	D. Petrosky	Created

Hydro Winter Alert Levels

CONFIDENTIAL – PROTECTED INFORMATION

Level 1 – Normal Conditions (Routine)	Level 2 – Increased Awareness (Watch)	Level 3 - Alert Condition (Warning)	Level 4 - Limited Response (High)	Level 5 - Full Response (Severe)

§25.53 (e)(2)(B) A water shortage annex

LAKES BUCHANAN AND TRAVIS

WATER MANAGEMENT PLAN

AND

DROUGHT CONTINGENCY PLAN

SUBMITTED TO:

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

FEBRUARY 2019

APPROVED BY:

TEXAS COMMISSION ON ENVIRONMNTAL QUALITY

FEBRUARY 2020

Lower Colorado River Authority

Filed with TCEQ Feb. 2019
Conformed to TCEQ Order Feb. 2020

TABLE OF CONTENTS

Chapter 5 RIVER OPERATIONS

Tables

Figures

Appendix A – Technical Papers

Appendix B - Flood Control Regulations

Appendix C – WMP Orders

LAKES BUCHANAN AND TRAVIS
WATER MANAGEMENT PLAN

EXECUTIVE SUMMARY

A. BACKGROUND

LCRA's operation of lakes Buchanan and Travis is subject to the water rights for these lakes,[1] special conditions and criteria set forth by the court order (the "1988 Adjudication Order") that adjudicated these and other water rights in the lower Colorado River basin,[2] and the state statutes and regulations that generally govern use of state water. LCRA's exercise of its water rights pursuant to these requirements is subject to the continuing jurisdiction of the Texas Commission on Environmental Quality (TCEQ), the state agency with primary authority over surface water rights in Texas.

The 1988 Adjudication Order specifically required LCRA to submit a reservoir operations plan for lakes Buchanan and Travis,[3] and this requirement also is incorporated into the water rights for these lakes.[4] Certificates of Adjudication 14-5478 and 14-5482 state that "LCRA shall interrupt or curtail the supply of water . . . pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demand for water under such certificates pursuant to all firm, uninterruptible water commitments."[5] The Water Management Plan (WMP), which is subject to review and approval by TCEQ, is LCRA's required reservoir operations plan and provides the framework by which LCRA implements this requirement and sets forth the procedures by which LCRA makes water available from these lakes to help meet "firm" water customer needs, downstream "interruptible" agricultural demands, and environmental flow needs of the lower Colorado River and Matagorda Bay within LCRA's service area. The WMP also sets forth criteria for declaring a Drought Worse than Drought of Record (DWDR)[6] and includes a calculation of the Combined Firm Yield of Lakes Buchanan and Travis, which is the amount of water that can be supplied annually from lakes Buchanan and Travis through a repeat of the Drought of Record.[7]

The WMP is not a static document. LCRA's first WMP was developed by LCRA, approved by its Board of Directors, and approved by the Texas Water Commission, predecessor to the TCEQ, in 1989. The WMP is revised periodically to address changing conditions such as increased demands from Firm Water customers and updated science related to environmental flows. As the actual water demands from lakes Buchanan and Travis for Firm Water users continue to increase, the amount of Interruptible Stored Water available from the lakes is expected to continue to decrease. Revisions to the WMP have been approved by the TCEQ (or its predecessors) in 1991, 1992, 1999, 2010, and 2015.

As in previous WMP revisions, a group of interested participants consisting of individuals representing the diverse interests that depend on lakes Buchanan and Travis provided input to LCRA related to key areas in the plan. Participants included communities, industries and other firm water customers, interruptible agricultural customers, lake area interests, recreational interests, environmental interests, and elected officials. Throughout 2018, LCRA held numerous meetings to present information and solicit input on proposed revisions. The staff-proposed revisions were approved by the LCRA Board in December 2018.

More information about the history of the WMP and amendment process is provided in Chapter 1 of this WMP.

B. CHANGES FROM THE 2015 WATER MANAGEMENT PLAN

This WMP revision retains and builds upon changes to the methods used to determine the availability of Interruptible Stored Water from lakes Buchanan and Travis for agricultural use in the Gulf Coast, Lakeside, and Pierce Ranch operations, which were first included in the 2015 WMP. It also retains and builds upon the changes to the environmental criteria used to provide instream flow below Longhorn Dam and freshwater inflow into Matagorda Bay, which were first included in the 2015 WMP.

Some of the key changes in the 2015 WMP included separate determinations of the supply available for the First and Second Agricultural Seasons, and defined volumetric limits on the amount of Interruptible Stored Water available to the Gulf Coast, Lakeside, and Pierce Ranch operations for each season. The determination of available interruptible supply was based on water supply conditions and a look-ahead test under certain conditions. The 2015 WMP also incorporated the best available scientific studies into new criteria to help meet environmental flow needs of the lower Colorado River and Matagorda Bay.

This WMP revision includes the following key changes:

Interruptible Stored Water Availability

- Updated volumetric limits on the amounts of Interruptible Stored Water available for diversion at the Gulf Coast, Lakeside, and Pierce Ranch operations;
- Updated Combined Storage volume for the cutoff of Interruptible Stored Water during the middle of the First or Second Agricultural Season;
- Additional criteria for entering Extraordinary Drought based on severe drought conditions similar to 2011 conditions; and,
- New maximum limits for each Agricultural Season on releases of Interruptible Stored Water from lakes Buchanan and Travis as measured at Mansfield Dam.

Environmental Flows:

- Additional Nov. 1 Evaluation Date used for determining the environmental criteria in place during the period from November through February;

- Modified Combined Storage level for instream flow conditions switching between Base-Dry and Subsistence from 1.9 to 1.8 million acre-feet;
- Modified obligation related to the supply of water to help meet environmental flow needs at Wharton when Combined Storage is below 900,000 acre-feet; and,
- New provisions to allow water stored in Arbuckle Reservoir to be used to meet LCRA's obligation for bay inflows;
- Updated limits on releases of water to help meet environmental flow needs.

Other Key Changes:

- The Period of Record has been extended by three years to 1940 to 2016.
- Demand projections have been updated to reflect expected demands through year 2025.
- Updated assumptions about LCRA's use of its other water rights have been included in the modeling of WMP operations.
- Updated test for declaring Drought Worse than Drought of Record to reflect the intensity and duration of the recent new Drought of Record.
- The Combined Firm Yield of Lakes Buchanan and Travis has been recalculated, and reflects a reduction from 434,154 acre-feet per year to 418,848 acre-feet per year.

C. DEMANDS

Demands on the Highland Lakes and the lower Colorado River system are many, varied, and often competing. Cities, communities, industrial facilities, and farmers throughout the lower Colorado River basin depend on water from the Highland Lakes and Colorado River. In addition, hydroelectric facilities, recreational interests, businesses, fisheries, and the environment rely on the water in the lakes, flowing in the river, and flowing into Matagorda Bay. These demands are dynamic and will continue to evolve as the region's population grows and other factors change. This could include changes in agricultural programs, implementation of new water supply strategies, improvements in conservation, and new scientific studies that further enhance our understanding of the environment's water needs.

As discussed in detail in Chapter 2, for purposes of this WMP revision, LCRA used Firm Water demands based on year 2025 projections and interruptible agricultural demands based on year 2020 projections.

LCRA supplies two general categories of water from lakes Buchanan and Travis: Firm Water and Interruptible Stored Water.

- **Firm Water** is water that can be supplied on a consistent (or "firm") basis from lakes Buchanan and Travis through a repeat of the worst drought in recorded history for the lower Colorado River basin, which is the drought of the 2000s and 2010s, while honoring all downstream water rights. This drought is known as the Drought of Record. Firm Water is primarily made available through contracts with cities and industries within LCRA's service area, but also is used in more limited cases for irrigation, recreation, domestic use and environmental needs.

- **Interruptible Stored Water** is water from lakes Buchanan and Travis that must be cut back or cut off during drought or times of shortage to ensure LCRA can meet Firm Water customer demands through a repeat of the historic Drought of Record. Interruptible Stored Water is used for agricultural purposes in the downstream agricultural operations (LCRA's Garwood, Gulf Coast, and Lakeside agricultural divisions, and Pierce Ranch), and to help meet environmental flow needs below the Highland Lakes.

The Firm Water demands used in this WMP revision are generally based on projected demands from the Texas Water Development Board (TWDB) for the Lower Colorado Regional Water Planning Group (Region K) for the 2021 Regional Water Plan, the City of Austin's Water Forward plan development process and recent actual use. In this WMP revision, all types of Firm Water demands are weather varied during simulations of the historic Period of Record. The Firm Water demands are described in more detail in Section 2.2 and summarized in the table below.

WMP Firm Water Projected 2025 Demands
(acre-feet/year)

	Normal/Average	High/Max
Municipal/Manufacturing		
City of Austin	167,300	215,900
Other	109,000	130,100
Steam-Electric		
LCRA power plants	10,900	19,700
COA power plants	13,100	18,600
STP	39,400	39,400
Bastrop Energy Partners	2,300	2,300

Agricultural use has historically represented the largest demand of any user category on the lower Colorado River system. The demand for agricultural water varies from year to year based on the number of acres irrigated, the type of crop planted and weather conditions.

The supply used to meet agricultural demands at the four agricultural operations is made up of Interruptible Stored Water from lakes Buchanan and Travis and LCRA's downstream water rights. To the extent LCRA is able to make water available under its downstream rights, LCRA does not have to release water from lakes Buchanan and Travis.

For this WMP revision, the projected agricultural demands were generally based on data from Region K in preparation for the 2021 Regional Water Plan, and reflect projected year 2020 demands because demands are forecast to decrease over time. As in previous revisions to the WMP, LCRA used weather-varied demands for simulations of the historic Period of Record. The table below presents the projected demands for the maximum demand year, and the average demand over the Period of Record. Agricultural demands are discussed in more detail in Section 2.3.

Projected Demands by Agricultural Operation
(acre-feet/year)

	Average	Maximum
Garwood	87,897	100,000
Gulf Coast	139,391	156,690
Lakeside	114,086	135,311
Pierce Ranch	26,827	30,000
Total	368,200	422,001

The waters of the lower Colorado River basin help support a diverse and healthy aquatic habitat along the Colorado River downstream of Austin and in Matagorda Bay. Under the WMP, water is made available to help meet varying environmental flow levels based upon the Combined Storage in lakes Buchanan and Travis. The environmental flow needs are described in more detail in Section 2.4 and reflect the best available science.

D. WATER AVAILABILITY MODELING

LCRA developed specific Water Availability Models for this WMP revision. A Water Availability Model, or WAM, is a computer model that simulates how much water is available under different or alternative management scenarios through a repeat of a period of hydrology. The models use historic streamflow and evaporation data to calculate the supply of available surface water. Separate models were created to: 1) develop and evaluate the curtailment procedures in this WMP revision; and 2) determine the Combined Firm Yield of Lakes Buchanan and Travis.

During the 2015 WMP revision process, LCRA used models that simulated the operations of lakes Buchanan and Travis and major water rights downstream of the lakes using hydrologic data from 1940-2013. For this WMP revision process, the analysis included three additional years of recent hydrologic data. The hydrologic Period of Record in the WAM used for this WMP revision is 1940-2016. These models are discussed in detail in Technical Papers A-5 and A-6.

E. DETERMINATION OF INTERRUPTIBLE STORED WATER AVAILABILITY AND WATER FOR ENVIRONMENTAL FLOW NEEDS

One of the fundamental aspects of the WMP is to determine when and how to cut back the available supply of Interruptible Stored Water as needed to protect Firm Water demands through a repeat of the Drought of Record. This WMP revision contains a number of distinct trigger levels and conditions that are associated with determining the amount of Interruptible Stored Water available from lakes Buchanan and Travis to try to help meet:

- Agricultural water demands in the downstream agricultural operations;
- A range of freshwater inflows goals for Matagorda Bay; and,
- A range of instream flows goals for the Colorado River downstream of the Highland Lakes.

When determining available Interruptible Stored Water supplies, it is essential that Firm Water demands be protected during a repeat of the historic hydrology, including the Drought of Record.[8] This drought is the worst recorded drought to date, and the recent drought of the 2000s and 2010s is a new Drought of Record for the lower Colorado River as discussed in Chapter 3. The curtailment procedures in this WMP revision have been designed to ensure supply is available to meet Firm Water demands as described in Chapter 2, through a simulated repetition of historic hydrology from 1940 to 2016.

Since the evaluation of expected hydrologic and water demand conditions can only be simulated based on projected information, which is subject to some uncertainty, in all of its prior WMPs, LCRA has determined it prudent to designate a minimum Combined Storage level. This served as a safety factor to address model uncertainties and provide for hydrologic conditions other than those simulated. This WMP revision includes curtailment policies and procedures intended to maintain a minimum Combined Storage goal of 600,000 acre-feet (the storage trigger for a declaration of Drought Worse than Drought of Record) and the model simulations for this WMP revision maintained storage at or above this goal. This safety factor avoids triggering a Drought Worse than Drought of Record declaration as a result of releasing Interruptible Stored Water in the event of a repeat of historic hydrology, including the new Drought of Record.

This WMP revision continues and builds on a number of significant changes to procedures in the 2015 WMP regarding the availability of Interruptible Stored Water for agricultural use in the downstream agricultural operations, and the criteria used to determine the availability of water to help meet the environmental flow needs of the Colorado River and Matagorda Bay. (*See* Section B.) These procedures allow LCRA to be responsive to changes in water supply conditions over the course of the year. As with recent WMPs, evaluation of demands and the curtailment of Interruptible Stored Water for Garwood and Pierce Ranch under this WMP revision will be accomplished pursuant to the terms of specific agreements related to the supply of interruptible water to those operations.

Evaluation Dates and Water Supply Conditions

Under this WMP, there are three Evaluation Dates: March 1, July 1, and Nov. 1. On all three dates, the environmental flow criteria for the upcoming period will be determined. Additionally, on the March 1 and July 1 Evaluation Dates, the Combined Storage and recent inflows into the Highland Lakes will be evaluated to determine a Water Supply Condition: Normal, Less Severe Drought or Extraordinary Drought. The Water Supply Condition, along with the Combined Storage will be used to determine the amounts of Interruptible Stored Water from lakes Buchanan and Travis available to the Gulf Coast, Lakeside, and Pierce Ranch operations.

Separate limits and procedures for First and Second Agricultural Season

On March 1 and July 1, LCRA will determine for the upcoming Agricultural Season the curtailment procedures and specific volumes of Interruptible Stored Water available for diversion at the Gulf Coast, Lakeside, and Pierce Ranch operations as prescribed by the Water Supply Condition in place, unless the LCRA Board determines Combined Storage

would drop below 600,000 acre-feet in the next 12 months or below 900,000 acre-feet in the upcoming crop season. The supply of Interruptible Stored Water for each Agricultural Season also is subject to maximum limits on releases as measured at Mansfield Dam (Lake Travis). If Interruptible Stored Water for the First Agricultural Season is cut off for the entire season, then Interruptible Stored Water also is cut off for the Second Agricultural Season.

Helping meet environmental flow needs

Under this WMP, as in past WMPs, LCRA provides a combination of Firm Water and Interruptible Stored Water to help meet environmental flow needs. This WMP retains LCRA's commitment of 33,440 acre-feet per year of Firm Water supply from lakes Buchanan and Travis for environmental flow purposes.

This WMP reflects operational procedures that will be used to help meet environmental flow needs based on the best available scientific studies. The applicable environmental flow criteria under this WMP can change during the year, similar to the determination of agricultural water based on separate dates. The environmental flow criteria in place from March through June are based on the Combined Storage on March 1, the criteria in place from July through October are based on the Combined Storage on July 1, and the criteria in place from November through the following February are based on the Combined Storage on Nov. 1. (This represents a change from the 2015 WMP in which the environmental flow criteria for the period from July to the following February were based on July 1 Combined Storage.) Environmental flow criteria also take into account the availability of Interruptible Stored Water for agriculture.

F. RIVER OPERATIONS

Chapter 5 provides a general description of river operations as of February 2019. To manage its river operations, LCRA relies on a number of tools and practices, including data acquisition systems, decision support models, and standard operating guidelines and procedures. LCRA's operations are adjusted as needed to respond to actual conditions.

1. Certificates of Adjudication 14-5478, as amended, and 14-5482, as amended.
2. *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*, No. 115, 414-A-1 (264th Dist. Ct., Bell County, Tex. April 20, 1988) ("1988 Adjudication Order"), Lake Buchanan Conclusion of Law 4 and Lake Travis Conclusion of Law 6.
3. 1988 Adjudication Order, Lake Buchanan Conclusion of Law 4 and Lake Travis Conclusion of Law 6.
4. Certificate of Adjudication 14-5478 ¶ 2.B.(1); and Certificate of Adjudication 14-5482 ¶ 2.B.(1).
5. Certificate of Adjudication 14-5478 ¶ 2.B.(7); Certificate of Adjudication 14-5482 ¶ 2.B.(7).
6. TEX. COMM'N ON ENVTL. QUAL., *Order Approving Lower Colorado River Authority's Drought Management Plan*, Ordering Provision 1(f) (Dec. 18, 1991).
7. *See* 1988 Adjudication Order, Lake Buchanan: Conclusion 4(a), Lake Travis: Conclusion 6(a) (requiring that LCRA determine the Combined Firm Yield of Lake Travis and Buchanan).
8. Pursuant to the certificates of adjudication for Lakes Buchanan and Travis, LCRA shall curtail the supply of interruptible water under such water rights to the extent necessary to allow LCRA to satisfy all firm demands. (Certificates of Adjudication Nos. 14-5478, ¶ 2.B.(7) and 14-5482, ¶ 2.B.(7)).

LAKES BUCHANAN AND TRAVIS
WATER MANAGEMENT PLAN

GLOSSARY

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

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

1988 Adjudication Order – the court order adjudicating water rights in the Lower Colorado River segment of the Colorado River basin, cited as *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*, No. 115, 414-A-1 (264th Dist. Ct., Bell County, Tex. April 20, 1988).

agricultural – any of the following uses or activities involving agriculture, including irrigation:

- cultivating the soil to produce crops for human food, animal feed, or planting seed or for the production of fibers;
- the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or nonsoil media by a nursery grower;
- 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;
- raising or keeping equine animals;
- wildlife management;
- 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; and
- aquaculture.

Agricultural Season – the period of time in which water is supplied for agricultural use in the downstream agricultural operations. *See* "First Agricultural Season" and "Second Agricultural Season."

attenuation – the reduction in the peak of a hydrograph, as water moves downstream, resulting in a more broad, flat hydrograph**.**

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.

Combined Firm Yield of Lakes Buchanan and Travis – the calculated firm yield of lakes Buchanan and Travis when operated as a system, incorporating LCRA's agreements and operating assumptions regarding calls on the upper basin. The Combined Firm Yield is based on the 2000s to 2010s historic Drought of Record. *See* "firm yield" definition below and Chapter 3.

Combined Storage – the total volume of water stored in lakes Buchanan and Travis at a given point in time. For purposes of making various determinations under this WMP, the Combined Storage means the total of the daily average volume of water in Lake Buchanan and the daily average volume of water in Lake Travis, estimated to the nearest acre-foot. This determination excludes any water in Lake Buchanan above elevation 1,018 feet above mean sea level (feet msl) in the months of May through October or above 1,020 feet msl in the months of November through April and any water in Lake Travis above elevation 681 feet msl. A determination that relies on Combined Storage will not be based on a single reading during the day, but instead is the average for the day.

curtail or cutback (water) – to reduce the amount of water supply being provided.

cutoff (water) – to discontinue, or to terminate completely, the supply of water that would otherwise be provided.

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, release, evaporation, or other losses.

drought – a period of below average rainfall and/or runoff that impacts streamflow and has the potential to impact water supplies.

drought contingency plan (DCP) – a plan required by state law and rules of the Texas Commission on Environmental Quality that outlines drought response measures to be taken in response to specific drought conditions. (*See* Tex. Water Code § 11.1272 and 30 Tex. Admin. Code ch. 288).

Drought of Record (DOR) – the worst hydrologic drought for which streamflow records are available and is considered to be the period of time during recorded history when natural hydrological conditions provided the least amount of water supply. For this WMP, the Drought of Record is the drought of the 2000s to 2010s.

Drought Worse than Drought of Record (DWDR) – a drought condition identified by the LCRA Board of Directors where an ongoing drought has a real likelihood of becoming a new Drought of Record. A DWDR declaration would trigger action to cut off any interruptible stored water not already cut off and implement mandatory pro rata curtailment of Firm Water demands. (*See* Sec. 4.6.)

Evaluation Date – the dates on which LCRA will determine the Interruptible Stored Water available for agriculture and effective environmental flow criteria, as described in Chapter 4.

Firm Water – water that can be supplied on a consistent (or "firm") basis from lakes Buchanan and Travis through a repeat of the worst drought in recorded history for the lower Colorado River basin, which is the drought of the 2000s to 2010s, while honoring all downstream water rights. This drought is known as the Drought of Record.

firm yield – that amount of water, that the reservoir could have produced annually if it had been in place during the worst drought of record. In performing this simulation, naturalized streamflows will be modified as appropriate to account for the full exercise of upstream senior water rights is assumed as well as the passage of sufficient water to satisfy all downstream senior water rights valued at their full authorized amounts and conditions as well as the passage of flows needed to meet all applicable permit conditions relating to instream and freshwater inflow requirements. (*See* 30 Tex. Admin Code § 297.1(20).)

First Agricultural Season – refers to the first part of the annual irrigation season when LCRA may be providing water to the downstream agricultural operations for agricultural purposes; this part of the irrigation season normally runs from March through about July and is coincident with growing of the first or main crop of rice. During the First Agricultural Season, water may be supplied for various types of agricultural uses.

freshwater inflow – the flows from a stream into a bay and estuary system that help support the health and productivity of that ecosystem.

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

hydrograph – a graphical representation of stage, flow, velocity, or other characteristics of water at a given point with respect to time.

Inflows into Lakes Buchanan and Travis – the total inflows into lakes Buchanan and Travis based upon flow readings at certain gauges upstream of lakes Buchanan and Travis (without any adjustment for the Pass-Through of water to meet downstream demands associated with senior water rights).

instream flow – an amount of streamflow in a stream or river to support aquatic life, minimize pollution, or for recreational use.

Interruptible Stored Water – water from lakes Buchanan and Travis that must be cut back or cut off during drought or times of shortage to ensure LCRA can meet Firm Water customer demands through a repeat of the historic Period of Record.

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.

LCRA General Manager (or General Manager) – the General Manager of the Lower Colorado River Authority or his or her designee.

Pass-Through – the amount of inflows into the Highland Lakes being passed through the lakes to meet demands of senior water right holders downstream.

Period of Record – the period 1940-2016. Model simulations for this WMP revision simulate a repeat of the historic hydrology for this period.

run-of-river flows – the flow in the river that is available under law at a given point on the river at a given point in time to honor a water right with a given priority date. 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 TCEQ.

Second Agricultural Season – refers to the second part of the irrigation season when LCRA may be providing water to the downstream agricultural operations for agricultural purposes; this part of the irrigation season normally runs from about August through about mid-October and is coincident with growing of the second or "ratoon" crop of rice. The ratoon crop is the crop of rice that re-grows from the rice plant's root system following harvest of the main or first crop of rice. The ratoon crop matures more quickly than the main crop since it is supported by an established root system. During the Second Crop Season, water may be supplied for various types of agricultural uses.

Storable Inflows – for purposes of making the determination of water available from lakes Buchanan and Travis to help meet certain environmental flows, Storable Inflows are the Inflows into Lakes Buchanan and Travis based upon flow readings at certain gauges upstream of lakes Buchanan and Travis minus any required Pass-Through of inflows. Storable Inflows exclude any Inflows to Lake Buchanan when Lake Buchanan is at or above elevation 1,018 feet above mean sea level (feet msl) in the months of May through October or at or above elevation 1,020 feet msl in the months of November through April, or LCRA is passing inflows in an effort to prevent the elevation from exceeding such levels. Storable Inflows exclude any inflows to Lake Travis when Lake Travis is at or above elevation 681 feet above mean sea level (feet msl), or LCRA is passing inflows in an effort to prevent the elevation from exceeding such levels.

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.

TCEQ 2015 Order – the order issued by the Texas Commission on Environmental Quality approving amendments to the LCRA Water Management Plan in November 2015, cited as TEX. COMM'N ON ENVTL. QUAL., *Order Approving Amendments to Lower Colorado River Authority's Water Management Plan* (Nov. 15, 2015).

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.

Water Supply Condition – a condition based upon Combined Storage and Inflows into Lakes Buchanan and Travis that is used to determine availability of Interruptible Stored Water and environmental flow criteria. The three Water Supply Conditions are: Normal, Less Severe Drought and Extraordinary Drought. (*See* Sec. 4.2.)

Acronyms:

CFS	cubic feet per second
DCP	Drought Contingency Plan
FEMA	Federal Emergency Management Agency
LCRA	Lower Colorado River Authority
MBHE	Matagorda Bay Health Evaluation
feet msl	Feet above mean sea level
STPNOC	STP Nuclear Operating Company
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WAM	Water Availability Model
WMP	Water Management Plan

CHAPTER 1
INTRODUCTION TO THE WATER MANAGEMENT PLAN

1.1 BACKGROUND

LCRA's operation of lakes Buchanan and Travis is subject to the water rights for these lakes,[1] special conditions, and criteria set forth by the court order (1988 Adjudication Order) that adjudicated these and other water rights in the lower Colorado River basin,[2] and the state statutes and regulations that generally govern use of state water. LCRA's exercise of its water rights pursuant to these requirements is subject to the continuing jurisdiction of the Texas Commission on Environmental Quality (TCEQ), the state agency with primary authority over state water rights.

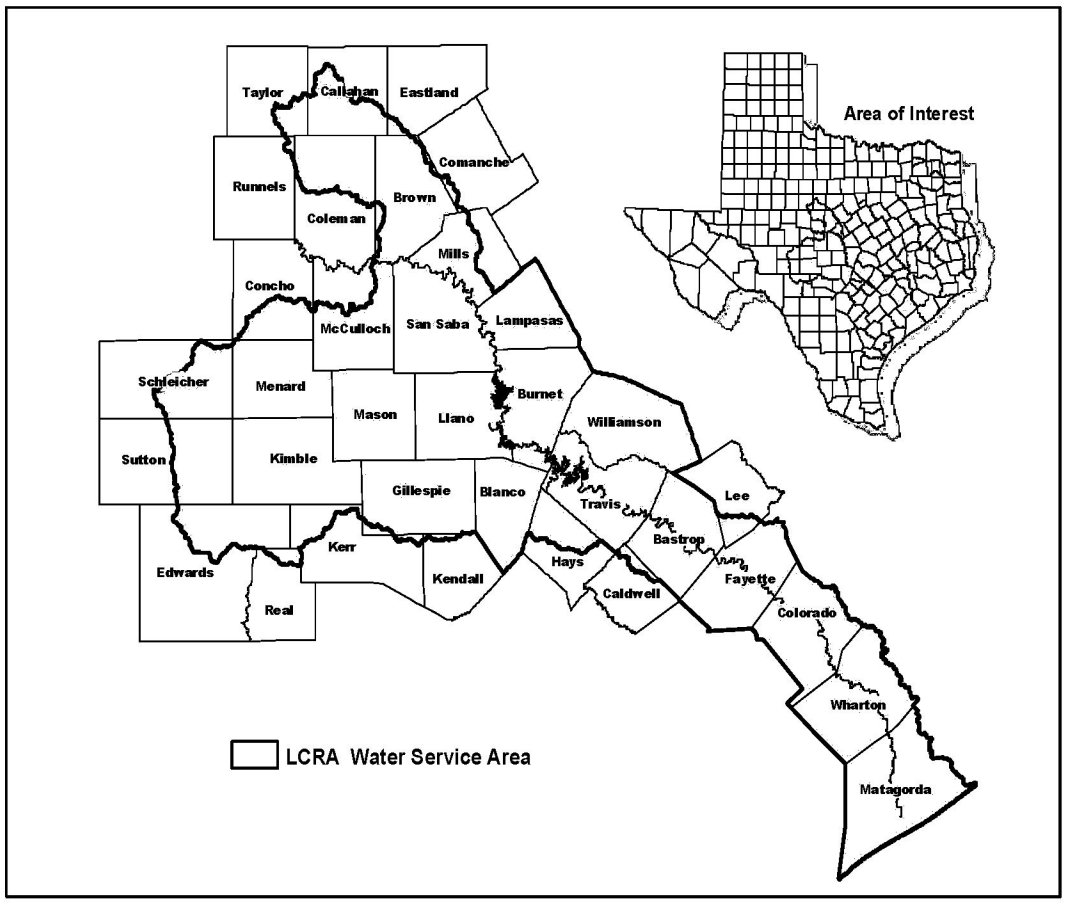
The 1988 Adjudication Order specifically required LCRA to submit a reservoir operations plan for lakes Buchanan and Travis,[3] and this requirement is incorporated into the water rights for these lakes.[4] Certificates of Adjudication 14-5478 and 14-5482 state that "LCRA shall interrupt or curtail the supply of water . . . pursuant to commitments that are specifically subject to interruption or curtailment, to the extent necessary to allow LCRA to satisfy all demand for water under such certificates pursuant to all firm, uninterruptible water commitments."[5] The Water Management Plan (WMP), which is subject to review and approval by TCEQ, is LCRA's required reservoir operations plan and provides the framework by which LCRA implements this requirement and sets forth the procedures by which LCRA makes water available from these lakes to help meet "firm" water customer needs, downstream interruptible agricultural demands, and environmental flow needs of the lower Colorado River and Matagorda Bay within LCRA's service area. (*See* Figure 1-1.) The WMP also sets forth criteria for declaring a Drought Worse than the Drought of Record (DWDR)[6] and includes a calculation of the Combined Firm Yield of Lakes Buchanan and Travis, which is the amount of water that can be supplied annually from lakes Buchanan and Travis through a repeat of the Drought of Record (DOR).[7] For purposes of the WMP, Firm and Interruptible Stored Water are defined as follows:

- **Firm Water** is water that can be supplied on a consistent (or "firm") basis from lakes Buchanan and Travis through a repeat of the worst drought in recorded history for the lower Colorado River basin, which is the drought of the 2000s and 2010s, while honoring all downstream water rights. This drought is known as the Drought of Record.

Firm Water is primarily made available through contracts with cities and industries within LCRA's service area, but also is used in more limited cases for irrigation, recreation, domestic use, and environmental needs.

- **Interruptible Stored Water** is water from lakes Buchanan and Travis that must be cut back or cut off during drought or times of shortage to ensure LCRA can meet Firm Water customer demands through a repeat of the Drought of Record. Interruptible Stored Water is used for agricultural purposes in the downstream agricultural operations (LCRA's Garwood, Gulf Coast, and Lakeside agricultural divisions, and Pierce Ranch), and to help meet environmental flow needs below the Highland Lakes.

Figure 1-1. LCRA Water Service Area as of February 2019.



LCRA's first WMP was developed by LCRA and approved by its Board of Directors and by the Texas Water Commission (predecessor to the TCEQ) in 1989. The WMP is revised periodically to address changing conditions, such as increased demands from Firm Water customers, updated science related to environmental flows, and updated hydrology. As the actual water demands from lakes Buchanan and Travis for Firm Water users continue to increase, the amount of Interruptible Stored Water available from the lakes is expected to continue to decrease. Revisions to the WMP have been approved by TCEQ (or its predecessors) in 1991, 1992, 1999, 2010 and 2015.

The 2015 WMP revision included significant changes that responded to the severe drought conditions of the early 2010s and incorporated recent scientific studies on the environmental flow needs of the lower Colorado River and Matagorda Bay. This WMP builds on that revision with additional hydrology through 2016 and demand projections through 2025.

1.2 BASIC GOALS AND GUIDELINES FOR MANAGING LAKES BUCHANAN AND TRAVIS

The initial WMP and various revisions have been developed using the following major goals, as provided in the 1988 Adjudication Order:

- Lakes Buchanan and Travis and the Colorado River will be managed together as a single system for water supply purposes;
- LCRA will manage the system to maximize the beneficial use of water derived from inflows below the Highland Lakes; and
- LCRA will manage the system to best use and conserve the water stored in lakes Buchanan and Travis.[8]

To achieve the goals stated above, LCRA manages the system according to the following general guidelines from the 1988 Adjudication Order:[9]

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. Water should be released from storage in lakes Buchanan and Travis to satisfy downstream demands only to the extent that such demands cannot be satisfied pursuant to run-of-river water rights;
4. Firm commitments from lakes Buchanan and Travis shall not exceed the Combined Firm Yield of Lakes Buchanan and Travis;
5. Water from lakes Buchanan and Travis may be available on an interruptible basis at any time that the actual demand for stored water under firm commitments is less than the Combined Firm Yield. To the extent that a demand for water may exist on an interruptible basis, such stored water should be made available;
6. The water from lakes Buchanan and Travis available on an interruptible basis should be interrupted or curtailed to the extent necessary to allow LCRA to satisfy all existing and projected demands pursuant to firm commitments; and
7. 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 not impair LCRA's ability to satisfy all existing and projected demands for stored water for firm and non-firm, interruptible commitments.[10]

The amount of Interruptible Stored Water that can be made available while honoring Firm

Water demands has been determined historically according to the following guidelines:

1. Water may be available on an interruptible basis at any time that the actual demand for firm water is less than the firm yield. Interruptible stored water should be made available to the extent that demands for such water exist;[11]
2. The extent to which interruptible stored water will be available in any year can be defined pursuant to an operational rule curve or other analysis that guarantees the supply of water for firm demands and identifies an amount of water for interruptible purposes;[12] and
3. The use of an operational rule curve is an acceptable approach to insure utilization of the lakes' storage while guaranteeing that firm demands will be met dependably.[13]

This WMP builds on the framework of the 2015 WMP by including following conditions:

1. Combined Storage is maintained above 600,000 acre-feet through a repeat of historic hydrology.
2. The WMP was developed with three additional years of hydrology, now extending through year 2016.
3. Demands for firm and interruptible customers are based on projected demands through 2025.
4. Demands associated with water rights that do not have an association with LCRA water supply contracts, including those of Corpus Christi, were included in the analysis at their full authorization.
5. The WMP includes a three-tier regime for interruptible agricultural curtailment that considers Combined Storage and inflow conditions, plus the use of a look-ahead test (as further explained in Chapter 4).

1.3 INTERESTS AFFECTED BY WATER MANAGEMENT PLAN

Lakes Buchanan and Travis are operated as a single water supply system and are designed to supply water and address varied interests within LCRA's service area, as described more fully below.

1.3.1 Municipal and Industrial Customers

The bulk of LCRA's Firm Water supply is provided to cities and industries within LCRA's service area. LCRA's municipal customers together supply water for over 1.4 million people in one of the fastest growing regions in the country. LCRA also supplies water on a firm basis to a number of industrial customers, including several power plants.

1.3.2 Agricultural Users

The Colorado River has served the agricultural and rice farming industry in Colorado, Wharton, and Matagorda counties near the Texas Gulf Coast since 1885, when the first rice

crops were planted near Eagle Lake, Texas. In the 1930s, not long after LCRA was created, it entered into contracts to provide a combination of stored water and run-of-river water to help meet the needs of irrigators within the Garwood, Gulf Coast, and Lakeside irrigation companies' service areas.

LCRA has a handful of Firm Water customers who purchase water for agricultural use, but most of the water provided by LCRA for agricultural use is purchased on an interruptible basis. The Water Management Plan is the mechanism that determines how much Interruptible Stored Water is available for this and other purposes. Historically, under the WMP, agricultural customers within LCRA's agricultural operations have had first claim to available interruptible supply over other interruptible users.[14]

1.3.3 Other Water Customers

LCRA also supplies water on a firm basis for other beneficial uses, such as golf course and landscape irrigation and household use.

1.3.4 Environmental Interests

The lower Colorado River helps support a diverse and healthy aquatic habitat downstream of Austin and in Matagorda Bay. LCRA makes water available from lakes Travis and Buchanan under the WMP from a combination of Firm and Interruptible Stored Water supply to help meet varying environmental flow needs for both the health of the lower Colorado River and Matagorda Bay. Water that LCRA provides for instream flows also helps protect water quality, particularly when combined with other LCRA programs to monitor and protect water quality in the river and the Highland Lakes. As discussed in Chapter 4, when water is available from storage in Arbuckle Reservoir and water is needed to meet an obligation under the WMP for Matagorda Bay, such water can be supplied from Arbuckle Reservoir in lieu of a release from lakes Buchanan and Travis.

1.3.4.1 Freshwater Inflows

The Colorado River, along with other area rivers and streams, provides freshwater inflows into the Matagorda Bay system. In the early 1990s, the Colorado River was re-routed to increase the freshwater inflows into West Matagorda Bay, and now contributes approximately 40 percent of the total inflow on an average annual basis. The Matagorda Bay system is the second largest estuary on the Texas Gulf Coast. The abundant production of finfish and shellfish make this environmentally sensitive area an important ecological resource and a source of economically significant commercial and sport fisheries.

1.3.4.2. Instream Flows and Water Quality

The aquatic environment of the lower Colorado River downstream of Austin can be affected by the quality, quantity and timing of water flowing through the ecosystem. Streamflow is a key variable that influences riverine habitat, biology, geomorphology, and water quality. As discussed more fully in Chapter 2, a range of flow conditions is necessary to maintain healthy ecosystems. While the WMP is designed to manage lakes Buchanan and Travis to provide Firm and Interruptible Stored Water supply and help meet environmental needs, the instream flow criteria also provides water quality protection.

1.3.5 Lake/River Recreation and Economic Interests

The entire lower Colorado River basin, from Lake Buchanan to Lady Bird Lake, and the river downstream to Matagorda Bay and the Gulf of Mexico, receives a great deal of recreational use from fishermen, boaters, park visitors, and swimmers from all over Texas. Significant economies have developed around these areas, particularly around the Highland Lakes. Because the reservoirs were built for flood management and water supply and not constructed to maximize recreational use on the lakes, the desire for higher lake levels can be difficult to accommodate. Similarly, providing water specifically to maintain river recreation below Austin would impact available water supply.

1.4 DEVELOPMENT OF CURRENT WATER MANAGEMENT PLAN

1.4.1 Texas Commission on Environmental Quality November 2015 Order

On Nov. 18, 2015, TCEQ approved the 2015 WMP (*see* Appendix C-8).[15] Consistent with the order approving the 2015 WMP, LCRA began the WMP revision process before Jan. 1, 2018.[16] This WMP includes naturalized streamflow data through 2016 as required by the order.[17]

1.4.2. Interested Participant Process

LCRA has used input from interested participants to develop every WMP. Participants in this revision process included communities, industries and other firm water customers, interruptible agricultural customers, lake area interests, recreational interests, environmental interests, and elected officials. Throughout 2018, LCRA held numerous meetings to present staff-proposed changes to the WMP, present modeling results, and solicit input from participants. Following each meeting, participants had the opportunity to submit written comments, and LCRA staff developed written responses to the comments. LCRA staff also was available for individual and small group meetings. Additionally, LCRA presented updates to the Board of Directors throughout 2018, leading up to action by the Board directing staff to prepare this WMP revision for TCEQ approval.

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1. Certificates of Adjudication 14-5478, as amended, and 14-5482, as amended.
2. *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*, No. 115, 414-A-1 (264th Dist. Ct., Bell County, Tex. April 20, 1988) ("1988 Adjudication Order"), Lake Buchanan Conclusion of Law 4, Lake Travis Conclusion of Law 6.
3. *Id.*
4. Certificate of Adjudication 14-5478 ¶ 2.B.(1); Certificate of Adjudication 14-5482 ¶ 2.B.(1).
5. Certificate of Adjudication 14-5478 ¶ 2.B.(7); Certificate of Adjudication 14-5482 ¶ 2.B.(7).
6. TEX. COMM'N ON ENVTL. QUAL., *Order Approving Lower Colorado River Authority's Drought Management Plan*, Ordering Provision 1(f) (Dec. 18, 1991).
7. *See* 1988 Adjudication Order, Lake Buchanan: Conclusion 4(a), Lake Travis:

Conclusion 6(a) (requiring that LCRA determine the Combined Firm Yield of Lakes Buchanan and Travis).

8. 1988 Adjudication Order, Lake Buchanan: Finding 19, Lake Travis: Finding 26.
9. *Id.*
10. *Id.*
11. *Id.* Lake Buchanan: Finding 19(e), Lake Travis: Finding 26(e).
12. *Id.* Lake Buchanan: Finding 24; Lake Travis: Finding 31; TEX. COMM'N ON ENVTL. QUAL., *Order Approving Lower Colorado River Authority's Water Management Plan and Amending Certificates of Adjudication Nos. 14-5478 and 14-5482*, Finding of Fact 51 (Sept. 7, 1989) ("1989 WMP Order").
13. 1989 WMP Order, Finding of Fact 90.
14. TEX. COMM'N ON ENVTL. QUAL., Docket No. 1995-1317-WR, *Order Overruling Objections to LCRA's System of Priorities Set Forth in its Water Management Plan* (June 3, 2003).
15. TEX. COMM'N ON ENVTL. QUAL., Order Approving Amendments to Lower Colorado River Authority's Water Management Plan (Nov. 18, 2015).
16. *Id.* Ordering Provision 1.f.
17. *Id.* Ordering Provision 1.h.

CHAPTER 2
DEMANDS

2.1 BACKGROUND

Demands on the Highland Lakes and the lower Colorado River system are many, varied, and often competing. Cities, communities, industrial facilities, and farmers throughout the lower Colorado River basin depend on water from the Highland Lakes and Colorado River. In addition, hydroelectric facilities, recreational interests, businesses, fisheries, and the environment rely on the water in the lakes, flowing in the river, and flowing into Matagorda Bay. These demands are dynamic and will continue to evolve as the region's population grows and other factors change. This could include changes in agricultural programs, implementation of new water supply strategies, improvements in conservation, and new scientific studies that further enhance our understanding of the environment's water needs.

As discussed further in this chapter, for purposes of this WMP, LCRA used Firm Water demands based on year 2025 projections, and interruptible agricultural demands based on year 2020 projections.

2.2 FIRM WATER

2.2.1 Demands

Firm Water demands primarily consist of municipal and industrial demands that are to be met without shortage through a repeat of the Period of Record, including the Drought of Record. A small portion of Firm Water is also used for irrigation, mining, domestic, and recreational purposes, and LCRA has set aside a portion of its Firm Water supply to help meet environmental flow needs.

Municipal use includes water used by cities, municipalities, water districts, commercial establishments, industries, and institutions to the extent such uses are included in the definition of municipal use in the rules of the Texas Commission on Environmental Quality (TCEQ).

For the purposes of the WMP, the demands of individual households that pump water directly from the lakes (domestic use) were included with municipal demands. LCRA included existing and projected domestic water use in the demands for this WMP revision as it did in the 2010

and 2015 WMP revisions. LCRA has issued a significant number of Firm Water contracts for domestic use. Absent a contract, most if not all of diverters around the lakes who take water for domestic use have no legal claim to the water they are diverting. In recent years, LCRA has been working to bring these diverters into compliance with state law.

Industrial demands include water for manufacturing, construction, and cooling for electric generation by means other than hydrogeneration. Most of the lower Colorado River basin's industrial users are located downstream of the Highland Lakes.

The Firm Water demands for LCRA's customers used in this WMP revision generally are based on projected demands from the Texas Water Development Board (TWDB) for the Lower Colorado Regional Water Planning Group (Region K) for the 2021 Regional Water Plan, the City of Austin's Water Forward plan development process, and recent actual use.[1] Specific assumptions related to Firm Water demand projections were:

1. Demands are for year 2025 and include the demands of both existing customers and entities whose demand is assumed by Region K to be met by LCRA.
2. Projected demands for domestic use on the Highland Lakes were included.
3. Demands are weather-varied for the period of record as follows:
    a. Demands for municipal and other non-power plant uses are developed for two conditions: high-use demand for hot and dry years and an average-use demand for all other years. (*See* Technical Paper A-1 for additional details.)
    b. Demands for power plants included weather variability for evaporation from the South Texas Project Nuclear Operating Company (STPNOC) cooling reservoir, and weather variability for the diversion demands from the Colorado River for other power plants with cooling reservoirs. (*See* Technical Paper A-2 for additional details.)
4. Estimated conveyance inefficiencies and losses from the Highland Lakes to downstream demand locations are included. (*See* Technical Paper A-6, section 7.7.)

The projected 2025 Firm Water demands are summarized in Table 2-1.

Table 2-1. WMP Firm Water Projected 2025 Demands (acre-feet/year)

	Normal/Average	High/Max
Municipal/Manufacturing		
City of Austin[1]	167,300	215,900
Other	109,000	130,100
Steam-electric		
LCRA power plants	10,900	19,700
COA power plants[2]	13,100	18,600
STPNOC	39,400	39,400
Bastrop Energy Partners	2,300	2,300

Notes:
1. Does not include 2,747 acre-feet per year of current demand met with direct reuse. (*See* Technical Papers A-1 and A-6.)

2. Does not include 1,209 acre-feet per year of demand at Sand Hill Energy Center met with direct reuse. (*See* Technical Paper A-6.)

2.2.2 Board Reservation

Out of concern for the future needs of the many areas in LCRA's 35-county water service area, including areas now using groundwater supplies that are becoming depleted or are of poor water quality, the LCRA Board has reserved a portion of the Combined Firm Yield.

2.3 AGRICULTURAL DEMANDS IN THE DOWNSTREAM IRRIGATION OPERATIONS

LCRA supplies interruptible water for agricultural purposes downstream of the Highland Lakes in four irrigation operations: Garwood, Gulf Coast, Lakeside, and Pierce Ranch. LCRA has supplied interruptible water primarily for rice farming, although turf grass, row crops, hay, pasture, aquaculture, and wildlife management also have used interruptible water within these operations.

Agricultural use has represented the largest demand of any user category on the lower Colorado River system. The demand for agricultural water varies from year to year based on the number of acres irrigated, the type of crop planted, and weather conditions.

The interruptible water supply used to meet agricultural demands at the four irrigation operations is made up of Interruptible Stored Water from lakes Buchanan and Travis and LCRA's downstream water rights. To the extent LCRA is able to make water available under its downstream rights, LCRA does not have to release water from storage in lakes Buchanan and Travis. However, the timing and availability of water under the downstream water rights (whether originating above or below the Highland Lakes) is often insufficient to meet all agricultural needs. When available, Interruptible Stored Water released from lakes Buchanan and Travis helps make up for the shortfall of water available under the downstream water rights. Interruptible Stored Water from lakes Buchanan and Travis for agricultural use is subject to being curtailed or cut off, as detailed in Chapter 4 of this WMP.

The agricultural demands for LCRA's customers used in this WMP revision generally are based on projected demands from TWDB for Region K for the 2021 Regional Water Plan. (*See* Technical Paper A-3 for additional details.) This WMP revision uses year 2020 demands (as opposed to year 2025) because TWDB forecasts agricultural water demands by the downstream irrigation operations will decrease over time.

Table 2-2 represents the maximum year demands and overall average demands expected for a simulation of the 1940-2016 Period of Record. This period included significant weather variability, which resulted in variability in agricultural demands. As has been done in previous revisions to the WMP, LCRA used weather-varied water demands for model simulations. (*See* Technical Paper A-3 for additional details.)

Table 2-2. Projected Demands by Irrigation Operation (acre-feet/year)

	Average	Maximum
Garwood	87,897	100,000
Gulf Coast	139,391	156,690
Lakeside	114,086	135,311
Pierce Ranch	26,827	30,000
Total	**368,200**	**422,001**

2.4 ENVIRONMENTAL NEEDS FOR INSTREAM FLOWS AND BAY AND ESTUARY INFLOWS

The waters of the lower Colorado River basin help support a diverse and healthy aquatic habitat along the Colorado River and in Matagorda Bay. Under the WMP, water is made available to help meet varying environmental flow levels downstream of Austin based upon the Combined Storage in lakes Buchanan and Travis.

2.4.1 Instream Flows

The aquatic environment of the lower Colorado River downstream of Austin can be affected by the quality, quantity, and timing of water flowing through the ecosystem. Streamflow is a key variable that influences riverine habitat, biology, geomorphology, and water quality. A range of flow conditions is necessary to maintain healthy ecosystems.

A comprehensive instream flow study was completed in 2008 that investigated the flow relationships to aquatic habitat and the state-threatened blue sucker fish.[2] The study approach was consistent with the Texas Instream Flow Program methodology designed to support "a sound ecological environment," which is described as "…a functioning ecosystem characterized by intact, natural processes, resilience, and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of the region." The study collected extensive biological and physical data to develop hydraulic, habitat, water quality, and sediment transport models. LCRA used these models to support the development of the subsistence and base flow recommendations.[3]

- The subsistence flow recommendations represent minimum conditions at which water quality is maintained at acceptable levels and aquatic habitats are expected to be consistent with those found in natural settings during drought conditions. The study recommendations provide a goal of maintaining flows at or above subsistence levels all the time. Dissolved oxygen is expected to be maintained at 5.0 mg/L, or above, at all sites. This level of dissolved oxygen supports a healthy aquatic community. Special consideration for the state-threatened blue sucker is reflected in the February and March recommendations for instream flows at the Bastrop and Columbus gauges. Subsistence recommendations for these months and these sites were adjusted to help ensure that 90 percent of the spawning habitat is maintained during these key spawning times.
- The base flow recommendations provide habitat conditions and year-to-year variability sufficient to maintain a sound ecological environment. Although the study

recommendations acknowledge that the frequency of achievement may need to be adjusted to reflect various considerations, those study recommendations call for achieving compliance on a long-term basis with Base-Dry recommendations about 80 percent of the time and with Base-Average recommendations about 60 percent of the time. A comprehensive evaluation of the habitat model results, duration curves, exceedance tables, and water quality and sediment transport modeling led to the development of two base flow recommendations called Base-Dry and Base-Average. These recommendations are designed to provide the variability in habitat type, amount, and distribution needed to support a sound ecological environment.

Subsistence and base flow levels for each month are presented in Table 2-3.

Table 2-3. Subsistence and Base Flow Levels by Gauge (cubic feet per second)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austin Gauge												
Subsistence	50	50	50	50	50	50	50	50	50	50	50	50
Bastrop Gauge												
Subsistence	208	274	274	184	275	202	137	123	123	127	180	186
Base-Dry	313	317	274	287	579	418	347	194	236	245	283	311
Base-Average	433	497	497	635	824	733	610	381	423	433	424	450
Columbus Gauge												
Subsistence	340	375	375	299	425	534	342	190	279	190	202	301
Base-Dry	487	590	525	554	966	967	570	310	405	356	480	464
Base-Average	828	895	1,020	977	1,316	1,440	895	516	610	741	755	737
Wharton Gauge												
Subsistence	315	303	204	270	304	371	212	107	188	147	173	202
Base-Dry	492	597	531	561	985	984	577	314	410	360	486	470
Base-Average	838	906	1,036	1,011	1,397	1,512	906	522	617	749	764	746

2.4.2 Bay and Estuary Inflows

Many factors, including freshwater inflows, contribute to the high natural productivity of Matagorda Bay and estuary. The seasonality of these freshwater flows also is important to the health and productivity of the bay.

The Matagorda Bay Health Evaluation (MBHE), completed in 2008, used the best available data and science to assess the relationship between various factors and bay conditions.[4] Several measures of bay health were investigated, including salinity, habitat condition, species abundance, nutrient supply, and benthic condition. Salinity, habitat, and benthic modeling were the primary factors used to develop criteria.

The recommended Colorado River inflows from the MBHE study were designed to cover the

full range of inflow conditions into Matagorda Bay, with a regime that incorporates five levels of inflow, each with an associated desired achievement guideline. The lowest level, Threshold, is a fixed monthly value to provide refuge conditions that would ideally be achieved 100 percent of the time. The remaining levels, MBHE-1 through MBHE-4, represent different inflow targets recommended to be achieved with the following frequencies: MBHE-1, 90 percent; MBHE-2, 75 percent; MBHE-3, 60 percent; and MBHE-4, 35 percent. The levels all include seasonal variability and incorporate influxes of fresh water into the bay in the spring and fall that reflect the natural pattern of inflows into the bay. The MBHE freshwater inflow categories and descriptions are summarized in Table 2-4. The inflow values associated with these inflow levels are presented in Table 2-5.

Table 2-4. Summary of Matagorda Bay Health Evaluation Inflow Levels

Inflow Level	Descriptions
Threshold	Refuge conditions for all species and habitat
MBHE-1	Maintain tolerable oyster reef health, benthic character and habitat conditions
MBHE-2	Provide inflow variability and sustain oyster reef health, benthic condition, low estuarine marsh, and shellfish and forage fish habitat
MBHE-3	Provide inflow variability and support quality oyster reef health, benthic condition, low estuarine marsh, and shellfish and forage fish habitat
MBHE-4	Provide inflow variability and support high levels of primary productivity, and high quality oyster reef health, benthic condition, low estuarine marsh, and shellfish and forage fish habitat

Table 2-5. Matagorda Bay Health Inflow Values (acre-feet)

Inflow Category	Spring (Three-month total)	Fall (Three-month total)	Intervening (Six-month total)	Monthly
Threshold	-	-	-	15,000
MBHE-1	114,000	81,000	105,000	-
MBHE-2	168,700	119,900	155,400	-
MBHE-3	246,200	175,000	226,800	-
MBHE-4	433,200	307,800	399,000	-

For purposes of this WMP, "Operational Criteria" have been developed to help meet the range of freshwater inflow needs associated with MBHE levels 1 through 4. To help meet MBHE inflow levels, the MBHE three-month "spring" and "fall" and six-month "intervening" flow totals for a given inflow category are converted into equivalent two-month Operational Criteria as shown in Table 2-6. These running two-month values are applied in seasonal periods representing spring, fall, and intervening. The spring Operational Criteria apply for the two-month periods ending in March, April, May, and June. The fall Operational Criteria apply for the two-month periods ending in July, August, September, and October. Finally, the intervening Operational Crtieria apply for the two-month periods ending in November,

December, January, and Februrary. For example, the MBHE-1 spring three-month total of 114,000 acre-feet is converted into a two-month Operational Criteria of 76,000 acre-feet. To determine whether the criteria was met at the end of March, LCRA will look at total inflows from Feb. 1 through March 31. The monthly Threshold bay inflow need applies in every month, regardless of the season or inflow level sought to be achieved. While Table 2-5 represents the general criteria for attempting to meet MBHE inflows, Chapter 4 includes the full suite of criteria applied to determine how much stored water will be made available from lakes Buchanan and Travis for environmental flows, including some limitations on the amounts of water that would be made available to meet the Operational Criteria.

Table 2-6. Operational Criteria for Matagorda Bay Inflows

Inflow Category	Two-Month Operational Criteria (acre-feet)		
	Spring March-June	Fall July-October	Intervening November-February
OP-1	76,000	54,000	35,000
OP-2	112,000	80,000	52,000
OP-3	164,000	117,000	76,000
OP-4	289,000	205,000	133,000

2.5. HYDROELECTRIC POWER GENERATION

Hydroelectric power plants are located at each of the dams owned and operated by LCRA and total approximately 295 megawatts of capacity as shown in Table 2-7. Until the 1960s, the hydroelectric plants represented LCRA's total capability for generating electric energy. LCRA's Enabling Act and its water rights (as well as those of the City of Austin for Tom Miller Dam) include provisions that largely subordinate the right to generate hydropower. In essence, this subordination[5] recognizes the competing needs for the stored water in the reservoirs, and hydrogeneration is allowed only when LCRA needs to release water to meet other water demands, when hydrogeneration will not impair LCRA's ability to satisfy all water demands, or when there is an "emergency shortage of electricity." To the maximum extent possible, releases of water are made in a manner to take maximum advantage of the energy produced by those releases. Because water released for hydrogeneration but retained in or above Lake Austin is still available to meet a water supply demand, these limitations generally apply only to water released for hydrogeneration that leaves Tom Miller Dam that cannot be used to meet a downstream water demand. In recent years, those demands have ranged from zero to 490 acre-feet. While releases can be made under this WMP revision, a specific demand was not simulated in the modeling analysis.

Table 2-7. Hydroelectric Capacities

Lake	Dam	Generation Capacity (megawatts)*	Discharge Capacity (cubic feet per second)*
Buchanan	Buchanan	55	5,940
Inks	Inks	14	3,380
LBJ	Wirtz	60	10,500
Marble Falls	Starcke	42	10,700
Travis	Mansfield	108	7,580
Austin	Miller	17	3,720

* Actual capacities will vary. Reported values are based on reservoirs at top of normal operating range.

To conform to current ERCOT protocols and LCRA operations, LCRA employs a definition of "emergency shortage of electricity" that allows LCRA to release water for hydroelectric generation absent a downstream water demand when such releases are:

1. Made while ERCOT is in an Energy Emergency Alert (EEA) for a short supply condition;
2. In response to an ERCOT-issued Reliability Directive or other emergency order;
3. Required to comply with ERCOT's Responsive Reserve Service release and dispatch orders;
4. Required to comply with a Security-Constrained Economic Dispatch (SCED) dispatch instruction to generation at approximately the ERCOT's current System Wide Offer Cap (SWOC), which indicates a market-based shortage of supply; or
5. In response to, or required by, other similar circumstances or protocols as those listed in 1 through 4.

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1. TEX. WATER DEV. BD., 2021 REGIONAL WATER PLAN DEMAND PROJECTIONS (2018) (*available at*: http://www.twdb.texas.gov/waterplanning/data/projections/2022/demandproj.asp); AUSTIN WATER, WATER FORWARD DRAFT PLAN REPORT (2018) (*available at*: https://www.austintexas.gov/waterforward).
2. BIO-WEST, INC., FINAL REPORT: COLORADO RIVER FLOW RELATIONSHIPS TO AQUATIC HABITAT AND STATE THREATENED SPECIES: BLUE SUCKER, Prepared for LCRA and SAWS (2008).
3. TEX. COMM'N ON ENVTL. QUAL., TEX. PARKS & WILDLIFE DEPT., & TEX. WATER DEV. BD., TEXAS INSTREAM FLOW PROGRAM STUDIES: TECHNICAL OVERVIEW REPORT 369 (May 2008).
4. FINAL REPORT: MATAGORDA BAY INFLOW CRITERIA (COLORADO RIVER), MATAGORDA BAY HEALTH EVALUATION, Prepared for LCRA and SAWS (Dec. 2008).
5. The special conditions affecting LCRA's exercise of its hydrogenation rights are identical in all of its rights for the Highland Lakes. *See, e.g.,* Certificate of Adjudication No. 14-5478 (Lake Buchanan), ¶ 2.D (Use) at 6.

CHAPTER 3
FIRM YIELD OF LAKES BUCHANAN AND TRAVIS

3.1 INTRODUCTION

The 1988 Adjudication Order adjudicating LCRA's Highland Lakes water rights requires that LCRA calculate the Combined Firm Yield of Lakes Buchanan and Travis (Combined Firm Yield).[1] TCEQ rules define firm yield as follows:

> That amount of water, that the reservoir could have produced annually if it had been in place during the worst drought of record. In performing this simulation, naturalized streamflows will be modified as appropriate to account for the full exercise of upstream senior water rights is assumed as well as the passage of sufficient water to satisfy all downstream senior water rights valued at their full authorized amounts and conditions as well as the passage of flows needed to meet all applicable permit conditions relating to instream and freshwater inflow requirements.[2]

As part of this WMP revision, LCRA has recalculated the Combined Firm Yield.[3] For purposes of the WMP, the Combined Firm Yield is the firm yield of lakes Buchanan and Travis when operated as a system, incorporating LCRA's agreements and operating assumptions as discussed below. The Combined Firm Yield represents the maximum amount of water LCRA can commit from lakes Buchanan and Travis for Firm Water supply.[4]

The concept of firm yield of a reservoir or system of reservoirs is fundamental to water supply planning. For lakes Buchanan and Travis, it defines a reliable level of supply that can be reasonably expected to be available in the future should a drought occur that is as severe as the Drought of Record. It also is possible for a drought more severe than the historic Drought of Record to occur in the future, in which case the full firm yield amount would not be available.

3.2 COMBINED FIRM YIELD COMPUTATION

A water availability model (WAM) was used to calculate the Combined Firm Yield. The computer model accounts for all surface water rights in the Colorado River basin and uses historical streamflow data, hydrology, and climatic conditions to simulate the supply of surface water available on a monthly basis. This model's parameters and assumptions relate to the legal representation of all water rights in the basin and assume all other rights in the Colorado River basin exercise the full legal amounts authorized by their associated water rights, regardless of what these water rights' demands actually are or are anticipated to be. This model incorporates LCRA's agreements regarding O.H. Ivie Reservoir and certain other upstream water rights whereby LCRA would not make a call on such water rights. This model also incorporates the settlement agreement between LCRA and the City of Austin[5] regarding treatment of return flows discharged by Austin as it impacts the Combined Firm Yield. Key model assumptions are summarized in Table 3.1. The model assumptions are addressed in detail in Appendix A, Technical Paper A-5.

Table 3-1. Firm Yield Model – Key Assumptions

Model Parameter	Firm Yield Model
Period of record	1940-2016
Reservoir sedimentation conditions	Year 2025
Priority "cutoff" assumption[1]	O.H. Ivie and Brownwood
Non-LCRA water rights	Authorized amount
LCRA downstream water rights	Authorized amount
City of Austin return flows included	Yes
Environmental flows represented	No

Note:

1. All water rights upstream of the reservoirs noted are represented as being able to divert and store water with priority over all water rights downstream of these upstream reservoirs regardless of the actual priority date stated in their water rights. This assumption is appropriate at and above O.H. Ivie and Brownwood reservoirs because several of the large water rights at the Highland Lakes and downstream have "no call" agreements in place with numerous entities upstream of these reservoirs.

The model results indicate that the recent drought, specifically the period from October 2007 through April 2015, is the new Drought of Record for lakes Buchanan and Travis. The Combined Firm Yield as calculated in this WMP revision is 418,848 acre-feet per year. This replaces the value of 434,154 acre-feet per year calculated in the 2015 WMP.[6] A more detailed explanation of the Combined Firm Yield calculation can be found in Appendix A, Technical Paper A-5.

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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*, No. 115, 414-A-1 (264th Dist. Ct., Bell County, Tex. April 20, 1988) ("1988 Adjudication Order"),
2. 30 TEX. ADMIN. CODE § 297.1(20).
3. TEX. COMM'N ON ENVTL. QUAL., *Order Approving Lower Colorado River Authority's Water Management Plan and Amending Certificates of Adjudication Nos. 14-5478 and 14-5482*, Finding of Fact 51 (Sept. 7, 1989) Finding of Fact 47 & Ordering Paragraph 1(m) (specifically noting that the firm yield "is subject to adjustment and refinement from time to time as additional studies and simulations are developed that more accurately reflect assumption s and operations required by law.") Certificates of Adjudication 14-5478A, ¶ 1(b) and 14-5482A ¶ 1(b), which were issued at the same time as the 1989 Order, also expressly state that this calculation may be modified from time to time.
4. *Id.* Finding of Fact 23.c.
5. *Settlement Agreement by and between the City of Austin and the Lower Colorado River Authority Regarding Joint Water Resource Management and the Resolution of Certain Regulatory Matters Pending at the Texas Commission on Environmental Quality*, § VIII.C. (June 18, 2007).
6. The initial WMP and revisions prior to the 2015 WMP reported a Combined Firm Yield value of 445,266 acre-feet per year and also reported as part of the Combined Firm Yield an additional 90,546 acre-feet per year associated with O.H. Ivie Reservoir for a total of 535,812 acre-feet per year. The revised calculation reflects sedimentation survey data that shows a reduction in the total storage capacity in lakes Buchanan and Travis,

which is important to reflect for operational purposes. However, LCRA is not requesting any amendments to the authorizations contained in the underlying water rights for lakes Buchanan and Travis.

CHAPTER 4

DETERMINATION OF INTERRUPTIBLE STORED WATER AVAILABILITY AND WATER FOR ENVIRONMENTAL FLOW NEEDS

4.1. INTRODUCTION

This Water Management Plan (WMP) revision contains a number of distinct trigger levels and conditions that are associated with determining the amount of Interruptible Stored Water available from lakes Buchanan and Travis to help meet the following demands:[1]

- Agricultural water demands in the downstream agricultural operations;
- A range of freshwater inflow goals for Matagorda Bay; and,
- A range of instream flow goals downstream of the Highland Lakes.

When determining available Interruptible Stored Water supplies, it is essential that Firm Water demands be protected during a repeat of the historic hydrology, including the Drought of Record.[2] This drought is the worst hydrologic drought for which streamflow records are available and is considered to be the period of time during recorded history when natural hydrological conditions provided the least amount of water supply. Until this WMP revision, that drought was the drought that spanned the 1940s and 50s. However, the recent drought period of the 2000s and 2010s has been determined to be a new Drought of Record, with an updated Combined Firm Yield for Lakes Buchanan and Travis, as discussed in Chapter 3. In that analysis, the drought began with lakes Buchanan and Travis full in October 2007, and the Combined Storage fell to a minimum level in April 2015, before beginning to refill. The curtailment procedures in this WMP revision have been designed to ensure supply is available to meet Firm Water demands as described in Chapter 2, through a simulated repeat of historic hydrology from 1940 to 2016 (the "Period of Record"), which includes the new Drought of Record.

Since the evaluation of expected hydrologic and water demand conditions can only be simulated based on projected information, which is subject to some uncertainty, LCRA has designated a minimum Combined Storage level in all of its prior WMPs. This served as a safety factor to address model uncertainties and provide for hydrologic conditions other than those simulated. This WMP revision includes curtailment policies and procedures intended to ensure that LCRA can satisfy current and projected firm demands during drought conditions, and, in simulations of this WMP revision, LCRA's release of Interruptible Stored Water does not result in Combined Storage dropping to the Drought Worse than Drought of Record (DWDR) storage trigger of 600,000 acre-feet.

As discussed in Chapter 2, demands of LCRA's Firm Water customers are projected to increase. To meet those demands without shortage through a repeat of historic hydrology, this WMP revision includes decreases in the amount of Interruptible Stored Water available as compared to the 2015 WMP.

This WMP revision retains and builds upon changes to the methods used to determine the availability of Interruptible Stored Water from lakes Buchanan and Travis for agricultural use in the Gulf Coast, Lakeside, and Pierce Ranch operations, which were first included in the 2015 WMP. It also retains and builds upon the changes to the environmental criteria used to provide instream flow below Longhorn Dam and freshwater inflow into Matagorda Bay, which were first included in the 2015 WMP.

Some of the key changes made in this WMP revision compared to the 2015 WMP include:

Interruptible Stored Water Availability

- Updated volumetric limits on the amounts of Interruptible Stored Water available for diversion at the Gulf Coast, Lakeside, and Pierce Ranch operations;
- Updated Combined Storage volume for the cutoff of Interruptible Stored Water during the middle of the First or Second Agricultural Season;
- Additional criteria for entering Extraordinary Drought based on severe drought conditions similar to 2011 conditions; and,
- New maximum limits for each Agricultural Season on releases of Interruptible Stored Water from lakes Buchanan and Travis as measured at Mansfield Dam.

Environmental Flows

- Additional Nov. 1 Evaluation Date used for determining the environmental criteria in place during the period from November through February;
- Modified Combined Storage level for instream flow conditions switching between Base-Dry and Subsistence from 1.9 to 1.8 million acre-feet;
- Modified obligation related to the supply of water to help meet environmental flow needs at Wharton when Combined Storage is below 900,000 acre-feet;
- New provisions to allow water stored in Arbuckle Reservoir to be used to help meet LCRA's obligation for bay inflows; and,
- Updated limits on releases of water to help meet environmental flow needs.

Drought Worse Than Drought of Record

- Updated test for declaring Drought Worse than Drought of Record to reflect intensity and duration of the recent new Drought of Record.

LCRA's drought contingency plans for both firm and interruptible customers take into account and build from elements of the WMP. Pursuant to Texas Water Code § 11.1272 and TCEQ's rules (30 Tex. Admin. Code Ch. 288), the LCRA Board has approved a Drought Contingency Plan for Firm Water Customers (Firm DCP), which is included as Appendix F. The Firm DCP is incorporated into Chapter 4 of the WMP by reference for all purposes as if set forth in Chapter 4. LCRA will update its Drought Contingency Plan for Interruptible Agricultural Customers upon final TCEQ approval of this amended WMP.

Several terms specific to the WMP are capitalized in this document and defined in the Glossary. For ease of reference, the definitions of key terms used in this chapter are repeated below:

- **Combined Storage** – The total volume of water stored in lakes Buchanan and Travis at a given point in time. For purposes of making various determinations under this WMP, the Combined Storage means the total of the daily average volume of water in Lake Buchanan and the daily average volume of water in Lake Travis, estimated to the nearest acre-foot. This determination excludes any water in Lake Buchanan above elevation 1,018 feet above mean sea level (feet msl) in the months of May through October or above elevation 1,020 feet msl in the months of November through April

and any water in Lake Travis above elevation 681 feet msl. A determination that relies on Combined Storage will not be based on a single reading during the day, but instead is the average for the day.

- **Inflows into Lakes Buchanan and Travis** – For purposes of making the determination of the Water Supply Condition or evaluating drought intensity, "Inflows into Lakes Buchanan and Travis" means the total inflows into lakes Buchanan and Travis based upon flow readings at certain gauges upstream of lakes Buchanan and Travis (without any adjustment for the Pass-Through of water to meet downstream demands associated with senior water rights).

- **Storable Inflows** – For purposes of making the determination of water available from lakes Buchanan and Travis to help meet certain environmental flows, the term "Storable Inflows" means the Inflows into Lakes Buchanan and Travis based upon flow readings at certain gauges upstream of lakes Buchanan and Travis minus any required Pass-Through of inflows. Storable Inflows exclude any inflows to Lake Buchanan when Lake Buchanan is at or above elevation 1,018 feet above mean sea level (feet msl) in the months of May through October or at or above elevation 1,020 feet msl in the months of November through April, or LCRA is passing inflows in an effort to prevent the elevation from exceeding such levels. Storable Inflows exclude any inflows to Lake Travis when Lake Travis is at or above elevation 681 feet above mean sea level (feet msl), or LCRA is passing inflows in an effort to prevent the elevation from exceeding such levels.

4.2. EVALUATION DATES AND DETERMINATION OF WATER SUPPLY CONDITION

4.2.1. Introduction

This WMP revision considers basin conditions ("Water Supply Conditions") at various times throughout the year ("Evaluation Dates") to determine LCRA's obligations to provide water for downstream agricultural operations in Gulf Coast, Lakeside, and Pierce Ranch and environmental flows. This section presents details regarding this process. This WMP revision includes three Evaluation Dates: March 1, July 1, and Nov. 1. The Evaluation Dates are used to determine available supply and environmental criteria for the periods shown in Table 4-1.

Table 4-1. Evaluation Dates and Operative Periods

Evaluation Date	Operative Period for Interruptible Stored Water availability for Gulf Coast, Lakeside, and Pierce Ranch	Operative Period for Environmental Criteria
March 1	First Agricultural Season	March 1 to June 30
July 1	Second Agricultural Season	July 1 to Oct. 30
Nov. 1	Not applicable	Nov. 1 to last day in February

On the March 1 and July 1 Evaluation Dates, a Water Supply Condition (Normal, Less Severe Drought, or Extraordinary Drought) is determined based on Combined Storage and Inflows into Lakes Buchanan and Travis. On the Nov. 1 Evaluation Date, the Combined Storage is used for determining the environmental flow criteria, while the Water Supply Condition from the preceding July 1 remains in effect.

The Water Supply Condition is used for the determination of Interruptible Stored Water availability and environmental flow criteria on the Evaluation Date. The Water Supply Condition remains in effect until criteria for entering a new Water Supply Condition or for exiting the Water Supply Condition are met on a subsequent March 1 or July 1 Evaluation Date as described below.

4.2.2. Normal Condition

The Normal condition is in effect under either of the following two conditions:

1. Condition 1:
   (a) For the period prior to the Evaluation Date, neither the Less Severe Drought nor the Extraordinary Drought condition was in effect; and,
   (b) On the Evaluation Date, neither the criteria for entering Less Severe Drought nor the criteria for entering Extraordinary Drought are met.
2. Condition 2:
   (a) For the period prior to the Evaluation Date, the Less Severe Drought or Extraordinary Drought condition was in effect; and,
   (b) On the Evaluation Date, the criteria for lifting Less Severe Drought are met.

4.2.3. Less Severe Drought Condition

The Less Severe Drought condition can be entered from, or exited to, either a Normal condition or an Extraordinary Drought condition, as discussed below. The Less Severe Drought condition remains in effect until either the criteria for entering the Extraordinary Drought condition (*see* Section 4.2.4.1) are met or the criteria for exiting the Less Severe Drought condition and returning to the Normal condition are met, as determined on the Evaluation Date (*see* Section 4.2.3.2).

4.2.3.1. Entering Less Severe Drought Condition

To enter the Less Severe Drought condition from a Normal condition, one of the following two sets of criteria must be met on the Evaluation Date:

1. Combined Storage is below 1.5 million acre-feet and cumulative Inflows into Lakes Buchanan and Travis for the preceding three months (e.g., for the March 1 Evaluation Date, the inflows for December, January and February) are less than 50,000 acre-feet; or,
2. Combined Storage is below 1.4 million acre-feet and cumulative Inflows into Lakes Buchanan and Travis for the preceding three months are less than the 33rd percentile of Inflows into Lakes Buchanan and Travis for that three-month period.

The 33rd percentile will be based upon stream flow data that the U.S. Geological Survey (USGS) has approved for publication as of the Evaluation Date.

The Less Severe Drought condition also is entered upon exiting the Extraordinary Drought condition unless, on the Evaluation Date, the criteria for exiting Less Severe Drought (described below) also are met.

4.2.3.2. Exiting Less Severe Drought Condition

To exit the Less Severe Drought condition and return to the Normal condition, one of the following two sets of criteria must be met on the Evaluation Date:

1. a) Combined Storage has been above 1.5 million acre-feet for one or more days during the period since the preceding Evaluation Date on which a Water Supply Condition was determined (i.e. for a July 1 evaluation, the period preceding the Evaluation Date is March 1 to June 30 and for a March 1 evaluation, the period preceding is July 1 to the last day of February); and
   b) Neither of the criteria for entering the Less Severe Drought condition are met on the Evaluation Date; or,
2. a) Combined Storage has been above 1.4 million acre-feet for one or more days during the period since the preceding Evaluation Date on which a Water Supply Condition was determined; and
   b) Inflows into Lakes Buchanan and Travis for the preceding three months are equal to or above the 50th percentile of Inflows into Lakes Buchanan and Travis for that three-month period and neither of the criteria for entering the Less Severe Drought condition are met on the Evaluation Date. The 50th percentile of inflows will be based stream flow data USGS has approved for publication as of the Evaluation Date.

4.2.4. Extraordinary Drought

4.2.4.1. Entering Extraordinary Drought Condition

To enter the Extraordinary Drought condition, one of the following two sets of criteria must be met on the Evaluation Date:

1. a) Combined Storage is below 1.3 million acre-feet; and,
   b) The drought duration (as described below) is at least 18 months; and,
   c) The cumulative Inflows in Lakes Buchanan and Travis since the initiation of the drought are equal to or less than the cumulative inflows over the same number of months from an inflow curve representing the 1950s drought[3] as described below and depicted in Figure 4-1;
2. a) Combined Storage on the July 1 Evaluation Date is below 1.4 million acre-feet; and,
   b) Combined Storage for the period from March 1 to July 1 has decreased by more than 300,000 acre-feet.

For purposes of this WMP, drought duration is measured in whole months. "Drought" begins the first whole month following the last month during which Combined Storage was full at any time. "Full" is defined as when either of the following criteria are met:

1. Combined Storage is at or above 98 percent of the combined managed conservation storage capacity (consisting of storage in Lake Travis up to elevation 681 ft. msl. and storage in Lake Buchanan up to seasonal operational limits or other constraints on storage); or
2. Lakes Buchanan and Travis have each been at their respective managed conservation storage capacity within 30 days of each other.

For purposes of measuring drought intensity relative to the 1950s drought, the cumulative Inflows into Lakes Buchanan and Travis since the beginning of the drought will be compared to a drought inflow envelope curve that reflects the cumulative inflows in the 1950s drought. The envelope curve is represented by the following equation and is demonstrated in Figure 4-1.

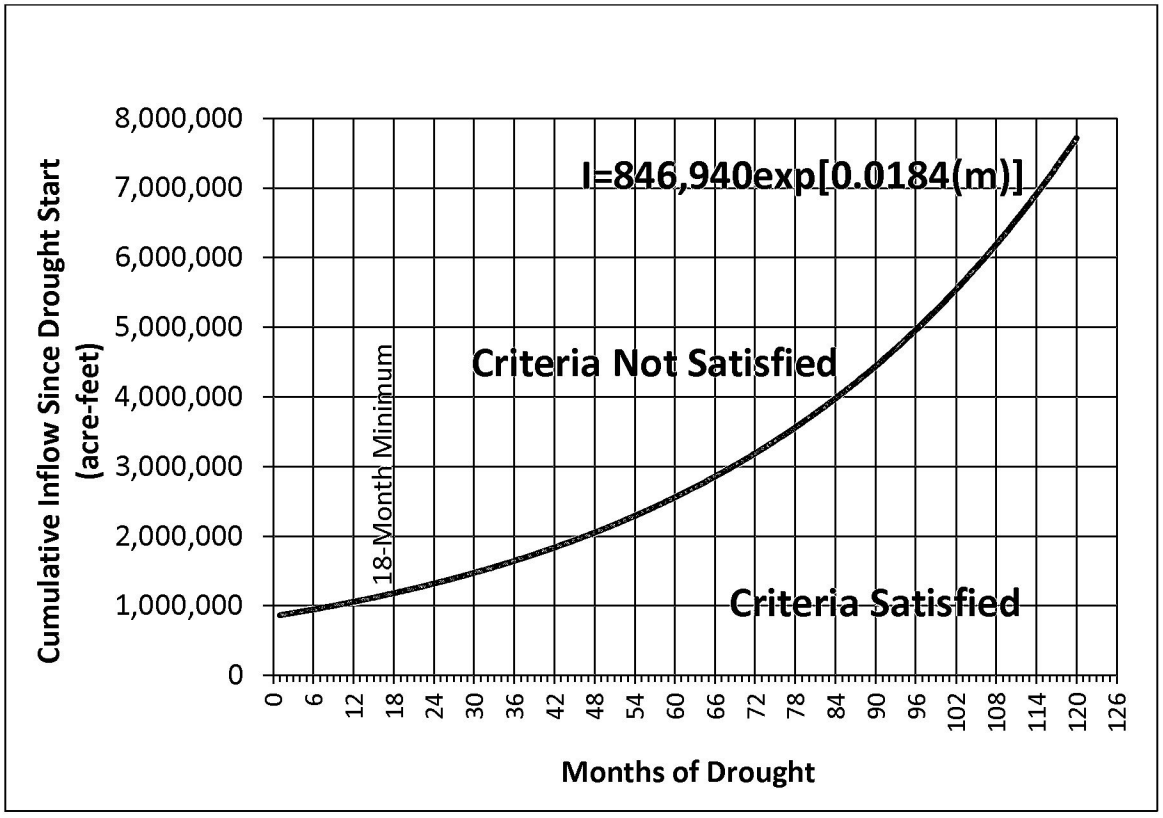
$$I = 846{,}940e^{(0.0184m)}$$

Where:

I = Cumulative inflow in acre-feet since lakes Buchanan and Travis were each full, using the determination of full described above.

m = Months of drought duration using the criteria described above.

Figure 4-1. Drought Intensity Curve for Extraordinary Drought Test



4.2.4.2. Exiting Extraordinary Drought Condition

The Extraordinary Drought condition remains in effect until the following criteria for exiting Extraordinary Drought have been met:

1. Combined Storage has been above 1.3 million acre-feet for one or more days during the period since the preceding Evaluation Date on which a Water Supply Condition was determined; and,
2. The criteria for entering the Extraordinary Drought condition are not met on the Evaluation Date.

If the criteria for exiting the Extraordinary Drought condition are met, the Less Severe Drought condition takes effect, unless the criteria for exiting Less Severe Drought also is met, in which case the Normal condition takes effect.

4.3. CURTAILMENT PROCEDURES FOR AGRICULTURAL OPERATIONS AT GULF COAST, LAKESIDE AND PIERCE RANCH

4.3.1. Introduction

Section 4.3 presents the curtailment procedures that apply to releases and diversions of Interruptible Stored Water for agricultural uses in LCRA's Gulf Coast and Lakeside divisions and Pierce Ranch. Interruptible Stored Water may be available for these operations for a variety of agricultural purposes, including rice, turf grass, row crops, hay, pasture, aquaculture, and wildlife management.

In this chapter, references are made to the First or Second Agricultural Season. These references are to the splitting of the full agricultural season into two parts that are coincident with the two watering seasons for rice production, i.e. the First Agricultural Season and the Second Agricultural Season. For rice, the second or ratoon crop re-grows from the rice plant's root system following harvest of the first or main crop of rice. The second crop matures more quickly than the first crop since it is supported by an established root system. For rice, the first crop is typically irrigated in the mid-March through July timeframe and the second crop is typically irrigated in the August through mid-October timeframe. Weather conditions, type of crops grown and location affect the timing of these seasons within the agricultural operations. Although the First and Second Agricultural Seasons are, in general, references to the rice growing seasons, during these timeframes and subject to availability under contracts for such purposes of use, water also may be available in the agricultural operations for other non-rice agricultural purposes.

4.3.2. Determination of Interruptible Stored Water Available for Agricultural Operations at Gulf Coast, Lakeside, and Pierce Ranch

The procedures for determining the total amount of Interruptible Stored Water available for the agricultural operations at Gulf Coast, Lakeside, and Pierce Ranch include various elements and limitations as described in the following subsections. As with recent WMPs, evaluation of demands and the curtailment of Interruptible Stored Water for Garwood and Pierce Ranch under this section will be accomplished pursuant to the terms of specific

agreements related to the supply of interruptible water to those operations. Because LCRA's agreement to provide interruptible water to Pierce Ranch is subject to the WMP, as it may be amended from time to time, the curtailment procedures set forth in this WMP apply to Pierce Ranch.

The Interruptible Stored Water available for the Gulf Coast, Lakeside, and Pierce Ranch agricultural operations will be determined separately for the First Agricultural Season and the Second Agricultural Season. On the March 1 and July 1 Evaluation Dates, LCRA will determine which Water Supply Condition is in effect for purposes of this WMP (Normal, Less Severe Drought, or Extraordinary Drought) in accordance with Section 4.2. The curtailment procedures for that Water Supply Condition will be followed for the upcoming Agricultural Season unless the LCRA Board determines that Combined Storage would drop below 600,000 acre-feet in the next 12 months or below 900,000 acre-feet in the upcoming season as described in Section 4.2.3.4. If releases of Interruptible Stored Water for the First Agricultural Season are cut off for the entire First Agricultural Season, then releases of Interruptible Stored Water also are cut off for the Second Agricultural Season.

4.3.2.1. Curtailment Procedures for First Agricultural Season under Normal or Less Severe Drought Conditions

LCRA will make available for diversion in First Agricultural Season the total amounts shown in Table 4-2 and Figure 4-2 at the Gulf Coast, Lakeside, and Pierce Ranch agricultural operations based on the effective Water Supply Condition (Normal or Less Severe Drought). These amounts are limits on the total supply of Interruptible Stored Water available for diversion during the season. If the total diversions of Interruptible Stored Water in the First Agricultural Season for the Gulf Coast, Lakeside, and Pierce Ranch agricultural operations reach the total available amount, no additional Interruptible Stored Water will be made available for diversion for those operations. If all available Interruptible Stored Water has been diverted in the First Agricultural Season, but there will be Interruptible Stored Water available for the Second Agricultural Season, then all or part of the Interruptible Stored Water available for the Second Agricultural Season can be used to finish the First Agricultural Season.

The maximum supply of Interruptible Stored Water to be released to the Gulf Coast, Lakeside, and Pierce Ranch operations in the First Agricultural Season is 210,000 acre-feet as measured at Mansfield Dam and is inclusive of all Interruptible Stored Water releases for those operations, regardless of whether the water is diverted at those operations. However, if 210,000 acre-feet of Interruptible Stored Water has been released for those operations in the First Agricultural Season and there will be Interruptible Stored Water available for the Second Agricultural Season, then all or part of the maximum supply of Interruptible Stored Water available for release in the Second Agricultural Season can be used to finish the First Agricultural Season.

If Combined Storage falls below 1 million acre-feet at any time during the First Agricultural Season, all releases of Interruptible Stored Water to the Gulf Coast, Lakeside, and Pierce Ranch operations will be cut off for the remainder of the season. If releases of Interruptible Stored Water are cut off in the middle of the season (due to the diversions reaching the total Interruptible Stored Water available, releases of Interruptible Stored Water from Mansfield Dam reaching the maximum, or Combined Storage falling to the cutoff level), LCRA will not provide to the Gulf Coast, Lakeside, or Pierce Ranch operations any Pass-Through run-of-

river water under LCRA's downstream water rights that originates upstream of Lake Travis unless and until Combined Storage is above 1.3 million acre-feet. During the remainder of the season, if Combined Storage exceeds 1.3 million acre-feet, LCRA will make these Pass-Through run-of-river supplies available, limited to the amounts needed to finish the season. If releases of Interruptible Stored Water for the First Agricultural Season are cut off for the entire season, then releases of Interruptible Stored Water are also cut off for the Second Agricultural Season. Garwood operations will be provided Interruptible Stored Water consistent with the Garwood Purchase Agreement.

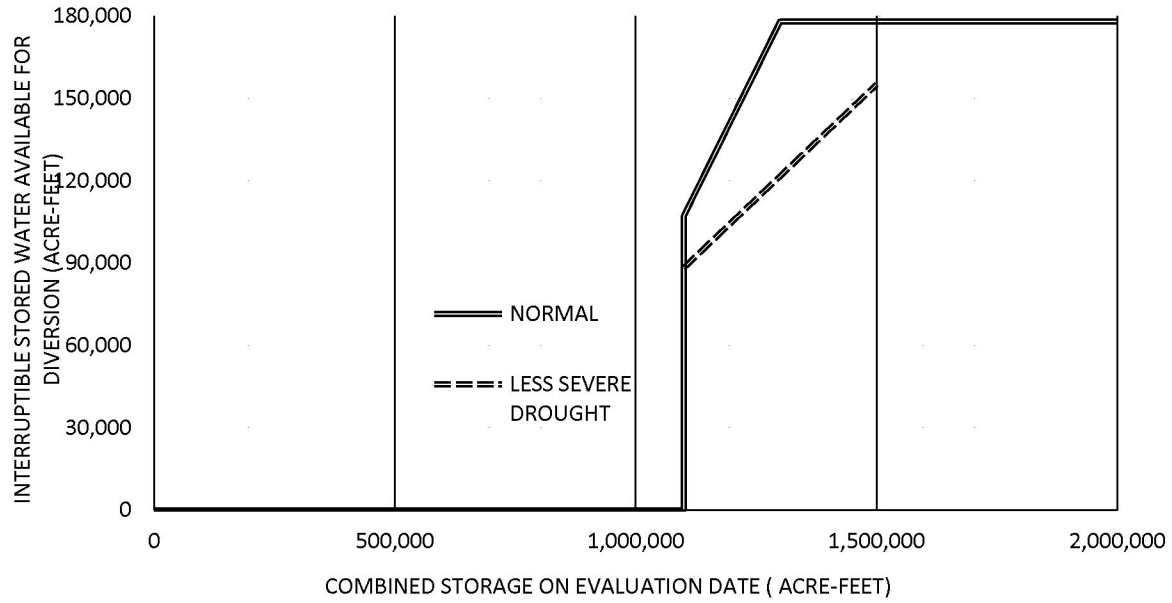
Table 4-2. Total Interruptible Stored Water from Lakes Buchanan and Travis Available for Diversion at the Gulf Coast, Lakeside, and Pierce Ranch Operations in the First Agricultural Season

Normal Condition		Less Severe Drought Condition	
Combined Storage on March 1 (acre-feet)	Interruptible Stored Water (acre-feet)*	Combined Storage on March 1 (acre-feet)	Interruptible Stored Water (acre-feet)*
Below 1,100,000	0	Below 1,100,000	0
1,100,000 to 1,300,000	107,100 to 178,000**	1,100,000 to 1,499,999	88,200 to 155,000**
Above 1,300,000	178,000	1,500,000 or above	Not Applicable
Anytime cutoff* if storage drops to or below 1 million acre-feet		Anytime cutoff* if storage drops to or below 1 million acre-feet	

* Non-Garwood operations.

** For Combined Storage within the specified ranges, the Interruptible Stored Water available follows a linear scale between the values shown.

Figure 4-2. Total Interruptible Stored Water from Lakes Buchanan and Travis Available for Diversion at the Gulf Coast, Lakeside, and Pierce Ranch Operations in the First Agricultural Season



4.3.2.2. Curtailment Procedures for Second Agricultural Season under Normal or Less Severe Drought Conditions

LCRA will make available for diversion in Second Agricultural Season the total amounts shown in Table 4-3 and Figure 4-3 at the Gulf Coast, Lakeside, and Pierce Ranch agricultural operations based on the effective Normal or Less Severe Drought conditions. These amounts are limits on the Interruptible Stored Water available for diversion during the season. If the total diversions of Interruptible Stored Water in the Second Agricultural Season for Gulf Coast, Lakeside, and Pierce Ranch agricultural operations and any amounts of Second Agricultural Season water that may have been used to finish the previous First Agricultural Season reach the total available amount, no additional Interruptible Stored Water will be made available for diversion in those operations.

The maximum supply of Interruptible Stored Water to be released to the Gulf Coast, Lakeside, and Pierce Ranch operations in the Second Agricultural Season is 82,000 acre-feet as measured at Mansfield Dam and is inclusive of all Interruptible Stored Water releases for those operations, regardless of whether the water is diverted at those operations. The amount available for Second Agricultural Season will be reduced by the amount of the Second Agricultural Season maximum supply that is used to finish the First Agricultural Season.

If Combined Storage falls below 1.0 million acre-feet at any time during the Second Agricultural Season, then all releases of Interruptible Stored Water to Gulf Coast, Lakeside, and Pierce Ranch will be cut off for the remainder of the season. If releases of Interruptible Stored Water are cut off in the middle of the season (due to the diversions reaching the volumetric limit, releases of Interruptible Stored Water from Mansfield Dam reaching the maximum, or Combined Storage falling to the cutoff level), then LCRA will not provide to the Gulf Coast, Lakeside, or Pierce Ranch operations any Pass-Through run-of-river water under LCRA's downstream water rights that originates upstream of Lake Travis unless and until Combined Storage is above 1.3 million acre-feet. During the remainder of the season, if Combined Storage exceeds 1.3 million acre-feet, LCRA will make these Pass-Through run-of-river supplies available, limited to the amounts needed to finish the season. If releases of Interruptible Stored Water for the First Agricultural Season were cut off for the entire season, then releases of Interruptible Stored Water also are cut off for the Second Agricultural Season. Garwood operations will be provided Interruptible Stored Water consistent with the Garwood Purchase Agreement.

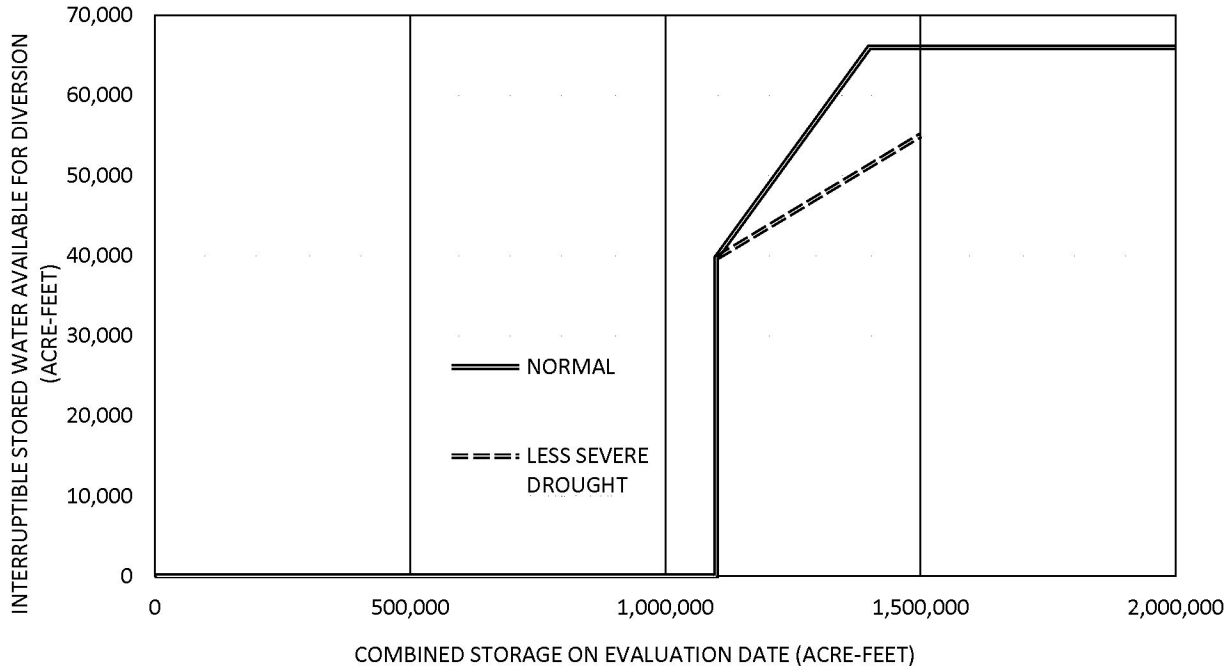
Table 4-3. Total Interruptible Stored Water from Lakes Buchanan and Travis Available for Diversion at the Gulf Coast, Lakeside, and Pierce Ranch Operations in Second Agricultural Season

Normal Condition		Less Severe Drought Condition	
Combined Storage on July 1 (acre-feet)	Interruptible Stored Water (acre-feet)*	Combined Storage on July 1 (acre-feet)	Interruptible Stored Water (acre-feet)*
Below 1,100,000	0	Below 1,100,000	0
1,100,000 to 1,400,000	39,700 to 66,000**	1,100,000 to 1,499,999	39,700 to 55,000**
Above 1,400,000	66,000	1,500,000 or above	Not Applicable
Anytime cutoff* if storage drops to or below 1 million acre-feet		Anytime cutoff* if storage drops to or below 1 million acre-feet	

* Non-Garwood operations.

** For Combined Storage within the specified ranges, the Interruptible Stored Water available follows a linear scale between the values shown.

Figure 4-3. Total Interruptible Stored Water from Lakes Buchanan and Travis Available for Diversion at the Gulf Coast, Lakeside and Pierce Ranch Operations in Second Agricultural Season



4.3.2.3. Curtailment Procedures for Extraordinary Drought Condition

If the Extraordinary Drought condition is in effect, no Interruptible Stored Water or Pass-Through run-of-river water under LCRA's downstream water rights that originates above Lake Travis will be made available for diversion in the Gulf Coast, Lakeside, and Pierce Ranch

operations during the season. LCRA will provide Interruptible Stored Water for the Garwood operation consistent with the Garwood Purchase Agreement.

4.3.2.4. Curtailment Procedures under the Look-Ahead Test

Considering antecedent conditions, current storage, and forecasted conditions (under a "Look-Ahead Test") the LCRA Board of Directors could determine that the WMP does not allow a release of Interruptible Stored Water for the Gulf Coast, Lakeside, and Pierce Ranch operations. Specifically, that would occur if under either Normal or Less Severe Drought conditions the Board determines that the release of Interruptible Stored Water to those operations would result in Combined Storage dropping below 600,000 acre-feet in the next 12 months or below 900,000 acre-feet in the upcoming Agricultural Season. In the event of such a determination, LCRA also will not provide to the Gulf Coast, Lakeside, or Pierce Ranch operations any Pass-Through run-of-river water under LCRA's downstream water rights that originates upstream of Lake Travis. LCRA will provide Interruptible Stored Water for the Garwood operation consistent with the Garwood Purchase Agreement.

In making its determination under the Look-Ahead Test, LCRA will use the 99 percent exceedance probability, unless a different trend for inflows and combined storage is being observed. In no case will LCRA's determination rely on less than a 95 percent exceedance probability. Exceedance probability refers to the likelihood that a future outcome will be better than the specified value.

4.4. CURTAILMENT PROCEDURES FOR ENVIRONMENTAL FLOWS IN THE LOWER COLORADO RIVER BASIN

4.4.1. Providing Stored Water for Environmental Flow Needs

Under this WMP revision, as in past WMPs, LCRA provides a combination of Firm and Interruptible Stored Water from lakes Buchanan and Travis to help meet environmental flow needs. Under this WMP revision, LCRA also can use water stored in Arbuckle Reservoir to help meet LCRA's obligation for freshwater inflows to Matagorda Bay that arise under the WMP. This WMP revision retains LCRA's commitment of 33,440 acre-feet per year of Firm Water supply from lakes Buchanan and Travis for environmental flow purposes. In the event of a pro rata curtailment of Firm Water supplies, the applicable instream flow and bay and estuary freshwater inflow criteria will be subject to the same percentage reduction as is imposed on LCRA's Firm Water customers.

The applicable environmental flow criteria under this WMP revision can change during the year. There are three different Evaluate Dates for determining LCRA's obligation under the WMP: March 1, July 1, and Nov. 1. The environmental flow criteria in place from March through June are based on Combined Storage on March 1, the environmental flow criteria in place from July through October are based on the Combined Storage on July 1, and the environmental flow criteria in place from November through the following February are based on the Combined Storage on Nov. 1. The manner in which water for environmental purposes is provided and tracked is set forth below.

4.4.2. Curtailment of Water for Instream Flows

This WMP includes instream flow criteria for three levels of flow, located at four streamflow gauging station locations (Austin, Bastrop, Columbus, and Wharton), as presented in Chapter 2 and in Table 4-4. The three levels of instream flows, "Subsistence," "Base-Dry" and "Base-Average" are based on the most recent instream flow studies,[4] which are generally consistent with the environmental flow standards adopted by TCEQ for the lower Colorado River basin.

This WMP limits LCRA's obligation to help meet instream flows at the Base-Average and Base-Dry levels to releasing no more than the Storable Inflows to lakes Buchanan and Travis. LCRA's obligation to help meet Subsistence instream flows includes providing Storable Inflows and, when necessary, releasing previously stored water from lakes Buchanan and Travis. In the event Combined Storage is below 900,000 acre-feet, LCRA's obligation to provide previously stored water from lakes Buchanan and Travis for instream flows at the Wharton gauge is limited to helping maintain the greater of 50 percent of the Subsistence value for the current month or 107 cubic feet per second (cfs). When Combined Storage is below 900,000 acre-feet, LCRA is obligated to provide Storable Inflows for Wharton up to the full Subsistence value.

Table 4-5 presents the applicable instream flow criteria for this WMP based on the Combined Storage on the Evaluation Date. In the event of a pro rata curtailment of Firm Water supplies, the applicable instream flow criteria will be subject to the same percentage reduction as imposed on LCRA's Firm Water customers.

Table 4-4. Subsistence and Base Flow Criteria by Gauge (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austin Gauge												
Subsistence	50	50	50	50	50	50	50	50	50	50	50	50
Bastrop Gauge												
Subsistence	208	274	274	184	275	202	137	123	123	127	180	186
Base-Dry	313	317	274	287	579	418	347	194	236	245	283	311
Base-Average	433	497	497	635	824	733	610	381	423	433	424	450
Columbus Gauge												
Subsistence	340	375	375	299	425	534	342	190	279	190	202	301
Base-Dry	487	590	525	554	966	967	570	310	405	356	480	464
Base-Average	828	895	1,020	977	1,316	1,440	895	516	610	741	755	737
Wharton Gauge												
Subsistence	315	303	204	270	304	371	212	107	188	147	173	202
Base-Dry	492	597	531	561	985	984	577	314	410	360	486	470
Base-Average	838	906	1,036	1,011	1,397	1,512	906	522	617	749	764	746

Table 4-5. Instream Flow Triggers and Flow Levels

Combined Storage on Evaluation Date (acre-feet)	Instream Flow Criteria
Above 1,960,000	Base-Average
1,960,000 to 1,800,000	Base-Dry
Below 1,800,000	Subsistence

For purposes of this WMP, the Subsistence criteria at Austin represent daily minimum (instantaneous) flow requirements. The Subsistence, Base-Dry and Base-Average criteria for gauges other than the Austin gauge are daily average flow values. For the Bastrop gauge only, the following additional requirements for daily minimum flow apply:

1. During those times when Base-Average criteria are in effect, the daily minimum flow requirements, subject to availability of Storable Inflows, are 70 percent of the Base-Average criteria for the given month.
2. During those times when Base-Dry criteria are in effect, the daily minimum flow requirements, subject to availability of Storable Inflows, are 70 percent of the Base-Dry criteria for the given month.
3. During those times that Subsistence criteria are in effect, releases will be scheduled so the daily minimum flow does not drop below:
    a. 90 percent of Subsistence criteria when Combined Storage is equal to or greater than 1.4 million acre-feet; or
    b. 80 percent of Subsistence criteria when Combined Storage is less than 1.4 million acre-feet.

To help meet the instream flow criteria in the lower Colorado River, LCRA will schedule releases in amounts sufficient to meet the applicable criteria to the extent of Storable Inflows or for Subsistence, using previously stored water in addition to Storable Inflows. In scheduling releases, LCRA will rely on best available data sources, including but not limited to: measurements of rainfall and water levels in streams and reservoirs; flow ratings for streams, canals, hydroelectric turbines, spillways, floodgates, and pumps; elevation/area/capacity ratings for reservoirs; model results for predicted storm runoff and ungauged gains or losses of flow along the Colorado River; simulated routing and attenuation of flows along channels and through reservoirs; effluent discharge as reported by wastewater treatment plant operators; and scheduled and actual pumping as reported by major diverters. By scheduling releases in this manner, LCRA will meet its obligation under this WMP. Notwithstanding the scheduling of releases using the best available data sources, the actual instream flows may be less than the applicable criteria as a result of unavoidable constraints such as unforeseen diversions, unforeseen changes in flow conditions downstream, unforeseen or unscheduled operations at Longhorn Dam, adjustments to gauges or flow ratings, and attenuation of releases. LCRA will maintain records of such occurrences.

Although LCRA does not manage water in the lower basin to specifically provide for pulse flows as part of this WMP, LCRA will monitor pulse flows in the lower river basin during the time this WMP revision is in effect to help assess whether pulse flows are occurring with the

frequency recommended in the 2008 comprehensive instream flow study.[5] If flow is below the Subsistence level at the Wharton gage, LCRA will monitor water quality conditions in the Wharton reach.

4.4.3. Curtailment of Water for Freshwater Inflows to Matagorda Bay

This WMP includes five levels of freshwater inflow criteria based upon the Matagorda Bay Health Evaluation (MBHE) study.[6] Storable Inflows available to help meet freshwater inflow criteria are determined on a monthly basis and exclude any Storable Inflows that have already been released to help meet freshwater inflow or instream flow criteria.

This WMP incorporates criteria to guide implementation to help meet the range of freshwater inflow needs from the Colorado River identified in the MBHE study. In all months, LCRA will release water to help meet at least the "Threshold" level of 15,000 acre-feet per month, to the extent LCRA has received Storable Inflows. For higher flow levels, the criteria is designed to help achieve seasonal freshwater inflow freshets. The MBHE three-month "spring" and "fall" freshets (shown in Table 4-6) and six-month "intervening" flow totals for a given inflow category have been converted into equivalent two-month Operational Criteria (OP 1-4) as first presented in Chapter 2 and repeated here in Table 4-7. (*See* Section 2.4.2 for further explanation of these criteria.) At the end of each month, to the extent LCRA has received Storable Inflows during that month, LCRA will release water as necessary to help meet the two-month Operational Criteria. In May and June, LCRA also will determine if the three-month MBHE "spring" freshet for the given inflow category has been met within the March-June period, and if so, the two-month Operational Criteria will be reduced to the corresponding amount for the intervening period. In September and October, LCRA will similarly determine if the "fall" freshet has been met within the July-October period, and if so, the two-month Operational Criteria will be reduced to the corresponding amount for the intervening period. In the event of a pro rata curtailment of Firm Water supplies, the applicable freshwater inflow criteria (including the Threshold criteria) will be subject to the same percentage reduction as imposed on LCRA's Firm Water customers.

Table 4-6. MBHE Three-Month Freshets into Matagorda Bay

Inflow Category	Seasonal Three-Month Freshet (acre-feet)	
	Spring	Fall
MBHE-4	433,200	307,800
MBHE-3	246,200	175,000
MBHE-2	168,700	119,900
MBHE-1	114,000	81,000

Table 4-7. Operational and Threshold Criteria for Colorado River Freshwater Inflows to Matagorda Bay

Inflow Category	Two-Month Operational Criteria Applicable in the Individual Months (acre-feet)			Monthly (acre-feet)
	Spring March-June	Fall July-October	Intervening November-February	-
OP-4	289,000	205,000	133,000	-
OP-3	164,000	117,000	76,000	-
OP-2	112,000	80,000	52,000	-
OP-1	76,000	54,000	35,000	-
Threshold	-	-	-	15,000

When providing water under this WMP revision to help meet freshwater inflow needs, LCRA's obligation is limited to the amount of Storable Inflows to lakes Buchanan and Travis during the applicable month. LCRA's obligation to provide water to help meet freshwater inflow needs may be met by providing water from lakes Buchanan and Travis or, alternatively, from water stored in Arbuckle Reservoir, authorized under Certificate of Adjudication 14-5476, as amended.

In the event the Storable Inflows in a given month are greater than LCRA's obligation to release water for that month's environmental flow needs, and Combined Storage is greater than 1.0 million acre-feet at the end of the month, the remainder of the Storable Inflows less the actual release for environmental flow needs ("Remaining Storable Inflows") will be carried forward for one month. If, in the subsequent month, the Threshold criteria cannot be met using Storable Inflows from that month, up to 5,000 acre-feet of the prior month's Remaining Storable Inflows will be released to help meet the Threshold criteria. Table 4-8 presents the applicable freshwater inflow criteria.

Table 4-8. Freshwater Inflow Triggers and Inflow Criteria

Combined Storage on Evaluation Date (million acre-feet)	**Freshwater Inflow Criteria**
1.95 and above for March 1 and July 1; 1.85 and above on Nov. 1	OP-4
1.5 to 1.949 for March 1 and July 1; 1.5 to 1.849 for Nov. 1	OP-3
1.3 to 1.499	OP-2
1.0 to 1.299	OP-1
Less than 1.0	Threshold only

The freshwater inflow criteria are further subject to the following specific limitations, which may reduce the amount of water LCRA must provide to help meet freshwater inflow needs:

1. Maximum Monthly Release for Bay Inflow Criteria – To the extent that LCRA has received Storable Inflows, the maximum release to meet freshwater inflow criteria

is limited based on Combined Storage at the end of the month for which the criteria applies as presented in Table 4-9.

Table 4-9. Maximum Monthly Bay Release

Combined Storage (million acre-feet)	**Maximum Release for Bay Criteria** (acre-feet)
1.5 and above	82,000
1.3 to 1.499	56,000
Less than 1.3	25,000

2. Bay Release Percentage Rule – Releases for freshwater inflow criteria that exceed 15,000 acre-feet for a month are limited to the percentages of Storable Inflows remaining after the release of water for instream flows and the release of 15,000 acre-feet for freshwater inflow criteria, based on Combined Storage at the end of the month for which the criteria applies as presented in Table 4-10.

Table 4-10. Bay Release Percentage Limits

Combined Storage (million acre-feet)	**Bay Release Percentage**
Less than 1.5	50 percent
1.5 or greater	60 percent

3. Bay Criteria Limited to Threshold.
   a. If Combined Storage falls below 1.0 million acre-feet at any time during a month, Threshold is the only freshwater inflow criteria in effect for that month.
   b. If Combined Storage on the Evaluation Date is less than 1.3 million acre-feet and Interruptible Stored Water for the Gulf Coast, Lakeside, and Pierce Ranch agricultural operations is cut off for the season, Threshold is the only freshwater inflow criteria in effect until the next Evaluation Date. (For the November to February period, determination of whether Interruptible Stored Water is cut off is based on the preceding Second Agricultural Season.)

4. Bay Criteria Deferral Provision.
   Notwithstanding a bay inflow deficit for a two-month operational criteria and available Storable Inflows under the WMP to help meet the two-month operational criteria, LCRA's obligation to make a release for the bay may be deferred based on certain quantities of additional flow to the bay on the first two days of the following month, or direct rainfall on the bay as set forth below:
   a. If flow to the bay from the Colorado River in the first two days of the month following a month with a bay inflow deficit for operational criteria is in an amount that is greater than the bay inflow deficit and occurs with an average daily flowrate for the two days (as measured at Bay City) of at least 4,000 cubic feet per second then LCRA's obligation to release water based on the prior month's bay inflow deficit for operational criteria is deferred and tracked as "Deferred Storable Inflows" as set forth in subsection c.

b. If direct rainfall on the bay (as measured at the Matagorda rainfall gage) in a month with a bay inflow deficit for operational criteria exceeded 10 inches and the average of the salinity readings at the Shell Marker B and West Bay Tripod locations as computed on a seven-day rolling average (the "7-Day SMB/Tripod Salinity") is at or below 15 parts per thousand (ppt) within the first two days of the following month, LCRA's obligation to release water to meet a bay operational criteria is deferred. If the 7-Day SMB/Tripod Salinity increases above 15 ppt before the end of that month, then LCRA shall begin making those deferred releases in a timely manner and shall continue them until either 1) the deferred amount has been released; or 2) the applicable three-month MBHE inflow criterion for the season that includes the preceding month has been met. If the 7-Day SMB/Tripod Salinity does not exceed 15 ppt during that month the releases may be further deferred and tracked as "Deferred Storable Inflows" in accordance with provision (c) below.

c. Deferrals and tracking of Deferred Storable Inflows are subject to the following limitations and procedures:
    i. A deferral under provision (a) or (b) can only be applied once in any 4-month period.
    ii. A deferral under provision (b) can only be applied during OP-3 or OP-4 conditions.
    iii. A deferral under provision (b) only applies if, during the 3-month period which includes the preceding month, either cumulative inflow to Matagorda Bay from the Colorado River was equal to or greater than 160,000 acre-feet, or inflow to Matagorda Bay from the Colorado River during at least one month was equal to or greater than 80,000 acre-feet.
    iv. If releases are deferred pursuant to provision (a) or (b), the Storable Inflows maintained in storage in lakes Buchanan and Travis as a result of the deferral shall be tracked as "Deferred Storable Inflows" and, subject to the limitations set out below, released in the event of a bay inflow deficit occurring in either of the two months following the receipt of the Storable Inflows.
    v. The volume of the "Deferred Storable Inflows" that is actually released in any one month is limited to no more than 60 percent of the Deferred Storable Inflows. In determining the volume of available Deferred Storable Inflows to be released in any given month, the volume is reduced by the volume of Deferred Storable Inflows previously released to help meet bay inflows. Releases of Deferred Storable Inflows are not subject to the volume limits applicable to releases of other Storable Inflows and releases of Deferred Storable Inflows are not considered in applying such volume limits.

Nothing in this Bay Inflow Deferral Provision shall be interpreted as reducing LCRA's obligation to release water based on Storable Inflows to help meet inflow targets for the month in which the deferred releases occur or to meet the Threshold bay inflow criteria.

In the event more than one of the above limitations applies, the most restrictive limitation on releases for freshwater inflow needs will apply.

4.4.4. Annual and Multi-Year Caps on Water for Environmental Flows

The amounts of water made available for environmental flows from lakes Buchanan and Travis are subject to limits to ensure the actual amounts made available do not exceed the amounts simulated in the development of this WMP revision for periods when Combined Storage was below 1.3 million acre-feet on the first day of the month in which the obligation is incurred.(To the extent LCRA can meet the obligation for environmental flows from releases from Arbuckle Reservoir, such releases do not count towards the annual or multi-year caps.) In the event the cumulative amounts made available in such periods equals or exceed the annual or multi-year caps below, dedicated releases to help meet environmental flow needs that are subject to these annual or multi-year caps are suspended for the remainder of the year. For purposes of the multi-year caps, the cumulating of water made available starts when Combined Storage drops below 98 percent of combined managed conservation storage capacity and multi-year caps are reset when storage increases to 98 percent or higher. The annual and multi-year caps on water made available for environmental flow needs when Combined Storage is below 1.3 million acre-feet at the beginning of the month are as follows:

1. 66,000 acre-feet in any one year.
2. 131,000 acre-feet in any two consecutive years.
3. 177,000 acre-feet in any three consecutive years.
4. 233,000 acre-feet in any four consecutive years.
5. 240,000 acre-feet in any five consecutive years.
6. 240,000 acre-feet in any six consecutive years.
7. 240,000 acre-feet in any seven consecutive years.

4.5. CURTAILMENT OF FIRM WATER DEMANDS

Pursuant to its water rights for lakes Buchanan and Travis, LCRA must follow reservoir operations procedures to ensure it can meet Firm Water demands during a repeat of the Drought of Record.

Consistent with state law, LCRA will not invoke mandatory curtailments of Firm Water demands unless a particular drought is declared to be a Drought Worse than the Drought of Record, or some other water emergency exists that drastically reduces the available Firm Water supply. However, consistent with state law and TCEQ rules regarding drought contingency planning, LCRA will engage its Firm Water customers and seek voluntary reductions of Firm Water use in the early stages of a drought through the Firm Customer DCP (*see* Appendix F). As part of its contracts, LCRA also will continue to require each of its Firm Water customers to prepare and adopt a legally enforceable local drought contingency plan consistent with the Firm Customer DCP and state law.

It is not possible to determine with absolute certainty whether a particular drought event is more or less severe than the Drought of Record in a timeframe that allows for an effective response to the drought conditions. However, LCRA has developed a "drought monitoring procedure" for identifying when a drought may become worse than the Drought of Record for the Highland Lakes watershed (*see* Section 4.6). When these conditions are reached, the

LCRA Board will declare a DWDR (as described in Section 4.6), and LCRA will curtail and distribute the available supply of stored water among its Firm Water customers on a pro rata basis according to the amount of water to which they are legally entitled, consistent with the Pro Rata Plan for Firm Water Demands approved by TCEQ (*see* Appendix C-7). All releases of Interruptible Stored Water will be cut off prior to and during any mandatory pro rata curtailment of Firm Water supplies. Following a DWDR declaration, if conditions improve, pro rata curtailment of Firm Water customers will be lifted consistent with criteria determined by the LCRA Board.

4.6. DECLARATION AND CANCELLATION OF DROUGHT WORSE THAN DROUGHT OF RECORD

As discussed above, the WMP is designed so LCRA can meet all Firm Water demands through a repeat of the historic Drought of Record. If drought conditions reach a stage where an ongoing drought has a real likelihood of becoming a new Drought of Record, LCRA must suspend all releases of Interruptible Stored Water and curtail Firm Water demands to extend the supply for critical human needs. To measurably extend the supply, LCRA may need to take these actions before it is determined with absolute certainty that the drought is indeed a new drought of record. This section presents the conditions under which LCRA will respond to a severe drought by making a DWDR declaration. A DWDR declaration would trigger action to cut off any Interruptible Stored Water not already cut off and implement mandatory pro rata curtailment of Firm Water demands. The criteria for making a DWDR declaration represent circumstances that have not been recorded during the historic period used in developing this WMP. Even if the criteria are satisfied, there is a possibility the drought would not be a new drought of record. A DWDR declaration is a declaration a particular drought is *potentially* worse than the Drought of Record and warrants more significant response measures.

The LCRA Board will make a DWDR declaration when the following three conditions are simultaneously met:

1. Drought duration is at least 24 consecutive months; and
2. Drought intensity is greater than that of the Drought of Record as measured by Inflows into Lakes Buchanan and Travis; and,
3. Combined Storage in lakes Buchanan and Travis is less than 600,000 acre-feet.

Additionally, the LCRA Board will declare a DWDR when a drought's duration is at least seven years and Combined Storage in lakes Buchanan and Travis is less than 600,000 acre-feet.

For purposes of measuring drought duration, the beginning of the drought is based on the last time lakes Buchanan and Travis were both full. For purposes of measuring drought duration under this WMP, full is defined when either of the following criteria are met:

1. Combined Storage is at or above 98 percent of the combined managed conservation storage capacity (consisting of storage in Lake Travis up to elevation 681 ft. msl. and storage in Lake Buchanan up to seasonal operational limits or other constraints on storage); or

2. Lakes Buchanan and Travis have each been at their respective managed conservation storage capacity within 30 days of each other.

For purposes of measuring drought intensity relative to the Drought of Record, the cumulative Inflows into Lakes Buchanan and Travis since the beginning of the drought will be compared to a Drought of Record inflow envelope curve that reflects the cumulative inflows in the Drought of Record. The envelope is represented by the following equation and is demonstrated in Figure 4-4.

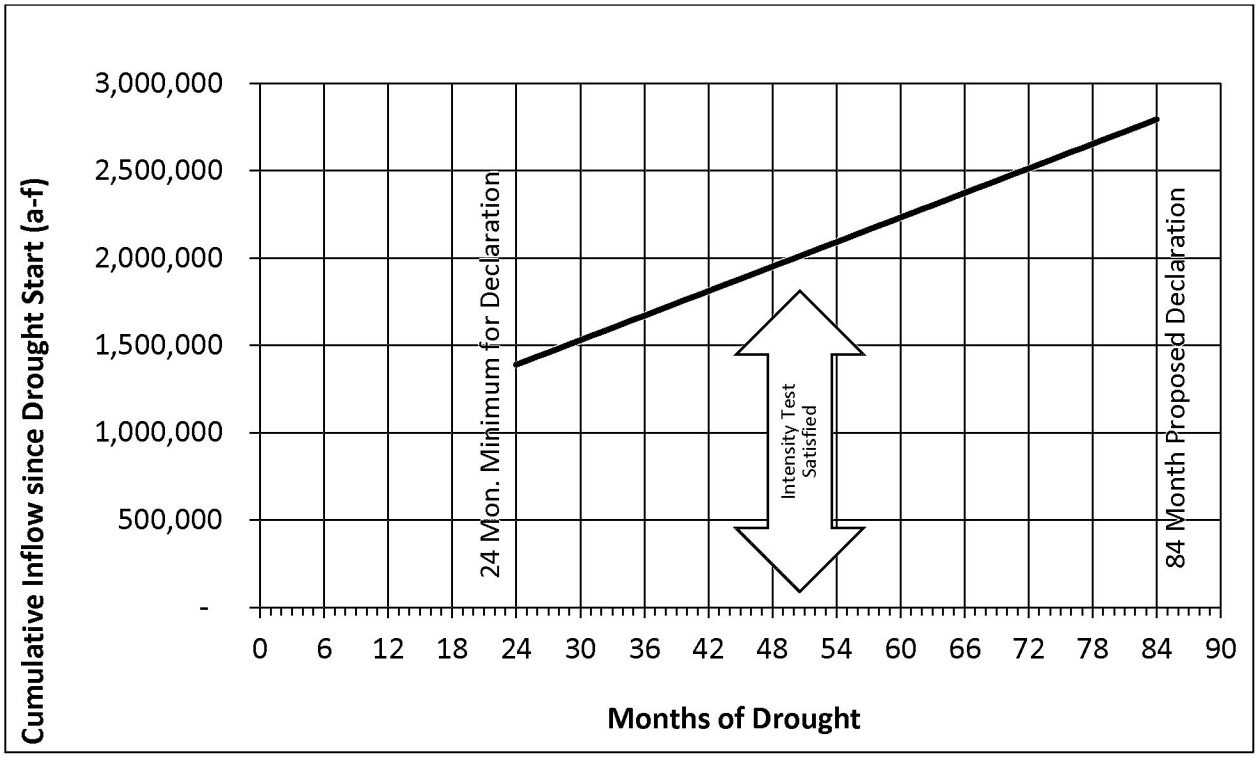
$$I = (22{,}292m + 787{,}402) * 1.05$$

Where:

I = Cumulative inflow in acre-feet since lakes Buchanan and Travis were each full, using the determination of full described above.

m = Months of drought duration using the criteria described above.

Figure 4-4. Drought Intensity Curve for Drought Worse Than Drought of Record Declaration



LCRA will cancel a DWDR declaration if Combined Storage increases to 1.4 million acre-feet. LCRA will notify TCEQ within 30 days of the declaration or cancellation of a DWDR.

(*See* Appendix A, Technical Paper A-7 for additional information regarding the criteria for a DWDR declaration.)

4.7. POTENTIAL IMPACTS OF THE RECOMMENDED CURTAILMENT POLICIES UNDER THIS WMP

This section summarizes potential impacts of this WMP revision on various interests based on modeling simulations. The specific values presented in this section are based on model simulations that include many assumptions, including a repeat of historic hydrologic conditions through 2016. Actual observed conditions while this plan is in effect may vary.

4.7.1. Firm Water Customers

All simulated demands for Firm Water customers can be fully satisfied under a simulated repeat of hydrologic conditions during the historic period of 1940-2016, including the 1950s drought and the more recent Drought of Record. The minimum storage in the model was maintained above 600,000 acre-feet at all times, providing a safety factor for more severe drought conditions than were simulated.

4.7.2. Agricultural Customers in Downstream Agricultural Operations

With the projected increase in Firm Water demands, there is less Interruptible Stored Water supply from lakes Buchanan and Travis as compared to the 2015 WMP. For a simulated repeat of the Period of Record, the average annual amount of Interruptible Stored Water supplied for diversion at the Gulf Coast, Lakeside, and Pierce Ranch operations was about 69,000 acre-feet under this WMP revision compared to 118,000 acre-feet under the 2015 WMP. Considering supply of Interruptible Stored Water and available downstream supplies, the average annual supply to the four downstream agricultural operations is about 322,000 acre-feet per year.

Agricultural users in the four downstream agricultural operations would be most affected during a repeat of the Drought of Record. The modeling simulation indicates no Interruptible Stored Water would be available for Gulf Coast, Lakeside, and Pierce Ranch in Second Agricultural Season of 2011, followed by four consecutive years (2012 to 2015) in which no Interruptible Stored Water would be available for both the First and Second Agricultural Seasons. Additionally, in a repeat of the 1950s drought, no Interruptible Stored Water would not be available for Gulf Coast, Lakeside and Pierce Ranch in five years out of the period from 1947 to 1957.

The actual frequency and magnitude of Interruptible Stored Water curtailments may differ from the values reflected in this simulation, depending on factors such as future hydrologic conditions and actual demands associated with Firm and Interruptible Stored Water users.

4.7.3. Environmental Flows

The average annual amount of total stored water made available as dedicated releases under this WMP revision for environmental purposes during a simulated repeat of the Period of Record was about 114,000 acre-feet and during the drought years from 2011 to 2015 was about 58,000 acre-feet. Dedicated releases for environmental flows are expected to be needed on a more frequent basis under simulations of this WMP revision because of the reduced releases of Interruptible Stored Water for agricultural users and corresponding reduction in river flows.

As mentioned in Section 4.4.1, LCRA is not recommending any changes to the level of Firm Water commitment for environmental flows as part of this WMP revision. The current total Firm Water reservation of 33,440 acre-feet for environmental flow purposes represents about 8 percent of the total Firm Water supply available from lakes Buchanan and Travis.

4.7.4. Individual Lake Storage and Elevations

As noted in Section 4.7.1, the minimum Combined Storage in lakes Buchanan and Travis in the WMP revision is maintained above 600,000 acre-feet at all times. The percent of months in which simulated Combined Storage is below 900,000 acre-feet is about 3 percent. As noted in Section 5.4.1.3, the model simulations were not performed to represent with a high level of precision how the total Combined Storage in lakes Buchanan and Travis would be split between those two reservoirs. Thus, separate lake storage and elevation results are not presented here.

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1. Prior WMP revisions also provided a limited amount of Interruptible Stored Water to customers outside of the downstream agricultural operations when storage levels in lakes Buchanan and Travis were at high levels, e.g. above 1.9 million. Under the 2015 WMP, this supply was phased out as of December 2018.
2. Pursuant to the certificates of adjudication for Lakes Buchanan and Travis, LCRA shall curtail the supply of interruptible water under such water rights to the extent necessary to allow LCRA to satisfy all firm demands. Certificate of Adjudication 14-5478 ¶ 2.B.(7); Certificate of Adjudication 14-5482 ¶ 2.B.(7).
3. The 1950s drought intensity is less severe than the Drought of Record from the 2000s and 2010s. Using the 1950s drought as part of this evaluation results in triggering Extraordinary Drought in conditions that, based on inflows, are not as severe as the Drought of Record, but are as severe as the 1950s drought that previously was the Drought of Record.
4. BIO-WEST, Inc., COLORADO RIVER FLOW RELATIONSHIPS TO AQUATIC HABITAT AND STATE THREATENED SPECIES: BLUE SUCKER, FINAL REPORT PREPARED FOR LCRA AND SAWS (2008).
5. *Id.* § 4.3 at 91-95 (2008).
6. FINAL REPORT: MATAGORDA BAY INFLOW CRITERIA (COLORADO RIVER), MATAGORDA BAY HEALTH EVALUATION, Prepared for LCRA and SAWS (Dec. 2008).

CHAPTER 5
RIVER OPERATIONS

5.1 INTRODUCTION

LCRA operates the Colorado River and the Highland Lakes as a system to efficiently manage water supply and mitigate flood damage. To accomplish these goals, LCRA uses a number of tools and practices. This chapter provides a general description of river operations as of February 2019.

These tools and practices are regularly updated, and any references to specific tools and practices in this chapter does not bind LCRA to continue to use the specific tools and practices described herein, nor does it limit LCRA from using modified or additional tools and practices at any point.

LCRA may deviate from this general description of river operations to respond to emergency incidents, to lower lakes below their normal operating range, to test or maintain its facilities, or for other reasons.

5.2 DATA SOURCES

LCRA maintains and operates a hydrological-meteorological data acquisition system (Hydromet) of more than 275 gauges located throughout the lower Colorado River basin. The Hydromet gauges send water levels, rainfall, and other weather data to LCRA computers every 15 minutes. Once stored on LCRA computers, the data can be validated, automatically shared with other partner agencies, and used to analyze the quantity and movement of water through the Colorado River basin and the Highland Lakes.

LCRA has executed an agreement with the U.S. Geological Survey (USGS) to share the maintenance and operation of 16 Hydromet gauges, and receives data from an additional 15 gauges USGS operates cooperatively with other agencies. The USGS and LCRA share data from stream discharge measurements and discharge ratings (stage vs. flow ratings). This collaboration improves the timeliness of updates to ratings for ongoing operations and provides an independent review of basic data on quantities of flow. USGS publishes final stream discharge estimates upon completion of its quality assurance/quality control processes. Because of the real-time nature of river operations, LCRA must rely on "provisional" data, which is subject to change.

LCRA shares Hydromet data with the National Weather Service West Gulf River Forecast Center in Fort Worth, Texas (WGRFC). WGRFC uses rainfall data from the Hydromet system to calibrate radar estimates of rainfall and to produce Quantitative Precipitation Estimates (QPE). WGRFC then shares the QPE data with LCRA. This improves the hydro-meteorological information available to LCRA and WGRFC, and allows each agency to more accurately project lake levels and flow conditions along creeks and rivers in the Colorado River basin.

LCRA develops and maintains computer systems and protocols to collect data from its reservoirs and pump stations, and to communicate with major water users that operate reservoirs, pump stations, and wastewater treatment plants that contribute significant amounts of return flows to the Colorado River below Mansfield Dam. Data on expected and actual storage, diversions, and return flows is used to plan water supply operations, to coordinate pumping operations, and to report on water use.

5.3 DECISION SUPPORT MODELS

LCRA uses a number of specialized computer models to analyze the movement of water, help make decisions for river operations, and allocate and report on water use.

For water supply operations, LCRA has developed a suite of models (including spreadsheet and RiverWare models) of the Colorado River.[1] Combined, these models make use of a variety of data sources described above, and are used to perform the following functions:

- Estimate the amount of flows entering the Colorado River;
- Evaluate the routing or timing and attenuation of flows released from the Highland Lakes to the lower Colorado River;
- Determine the necessary releases of stored water and Pass-Through of run-of-river flows to meet downstream demands;
- Schedule daily releases from dams; and
- Allocate releases and diversions for users to the appropriate source of supply (run-of-river or stored water) based on water rights priority.

LCRA, in conjunction with partner agencies, also engages in modeling for flood operations.

5.4 STANDARD GUIDELINES AND PROCEDURES FOR RIVER OPERATIONS

LCRA develops and maintains standard guidelines and procedures for water supply operations and for flood operations. LCRA conducts water supply operations to provide water to meet or help meet the water supply needs of customers, other water right holders or environmental flow obligations, to adjust system storage or lake levels, or to produce hydroelectric power. The Highland Lakes portion of the Colorado River is subject to floods, and LCRA is sometimes able to conduct flood operations at one or more of the six dams that form the Highland Lakes. Each of these modes of operation is described below.

5.4.1 Water Supply Operations

Water supply operations involve the management of the system to: (1) provide water to

customers, (2) help meet environmental flow requirements, (3) honor senior water rights, (4) adjust system storage or lake levels, or (5) produce hydroelectric power.

During water supply operations, water is captured and stored in lakes Buchanan and Travis up to the top of their conservation pool elevations, subject to available inflows. The top of the conservation pool for Lake Travis is 681 feet above mean sea level (feet msl) and 1,020 feet msl for Lake Buchanan. LCRA limits Lake Buchanan to 1,018 feet msl in the months of May through October based on a flood control agreement as discussed in Section 5.4.2. (In recent years, LCRA also has limited Lake Buchanan to 1,018 feet msl year round while a floodgate refurbishment project is underway.) The intervening lakes (Inks, LBJ, Marble Falls, and Austin) are normally maintained within a specified range of elevations at the dams shown in Table 5-1. Lake Austin is operated consistent with an agreement between LCRA and the City of Austin.[2] When moving water downstream through the Highland Lakes under water supply operations, LCRA generally passes water through hydroelectric generating units at the dams.

Table 5-1. Target Elevation Ranges for Intervening Lakes

Lake Level at the Dam (Headwater Gauge)	Lower Elevation (Legacy Datum[1])	Upper Elevation (Legacy Datum)	Adjustment to NAVD88
Inks	886.9 feet msl	887.7 feet msl	+0.31 feet
LBJ	824.4 feet msl	825.0 feet msl	+0.68 feet
Marble Falls	736.2 feet msl	737.0 feet msl	+0.69 feet
Austin[2]	491.8 feet msl	492.8 feet msl	+0.31 feet

Notes:
1. Elevations are based on the "legacy" datum for each dam. Legacy data are elevation benchmarks set for construction of the dams forming the Highland Lakes that have not been adjusted to a standard datum such as the National Geodetic Vertical Datum of 1929 (NGVD29) or the North American Vertical Datum of 1988 (NAVD88).
2. Although LCRA typically operates Lake Austin within a 1-foot range, the long-term agreement between the LCRA and Austin allows for operations within a 3-foot range.

Within LCRA, water supply operations involve a variety of key activities including:

- Maintaining Hydromet field equipment and ratings to measure and report on rainfall, evaporation, streamflow, water levels, and irrigation diversions;
- Monitoring LCRA's water supply in the Colorado River and Highland Lakes on a daily basis;
- Evaluating demands for water based upon specific orders and pumping status of certain customers (including the City of Austin, power plant customers, and the irrigation operations, among others);
- Determining the required releases of water from the Highland Lakes to most efficiently meet demands including those associated with downstream senior water rights, consistent with water rights and agreements;
- Coordinating pumping operations of downstream customers;
- Monitoring evaporation at lakes Travis and Buchanan;

- Monitoring lake levels and river inflows;
- Determining availability of hydroelectric generating units and setting the hydro schedule; and
- Coordinating hydroelectric generation with the Electric Reliability Council of Texas (ERCOT).

The following subsections describe the manner in which LCRA supplies demands that are met or backed up with water from lakes Buchanan and Travis.

5.4.1.1 Releases from Lake Travis

Tom Miller Dam, which forms Lake Austin, is downstream of Mansfield Dam, which forms Lake Travis, and is the most downstream of the six Highland Lakes dams operated by LCRA. Tom Miller Dam is owned by the City of Austin, but operated by the LCRA pursuant to a long-term agreement. Longhorn Dam, which forms Lady Bird Lake, is immediately downstream of Lake Austin and is operated by the City of Austin. The majority of LCRA's major irrigation and industrial customers divert water along 300 miles of the lower river from Tom Miller Dam to Matagorda Bay. Requirements for instream flows and freshwater inflows to Matagorda Bay apply along the lower river below Longhorn Dam. LCRA determines the daily release from Tom Miller Dam to deliver water and regulate the flow in the lower river. Releases from Mansfield Dam are determined, as needed, to satisfy diversions from Lake Austin by the City of Austin and other municipal customers and to maintain Lake Austin within its normal operating range, consistent with the long-term agreement between LCRA and the City of Austin.

Releases from Tom Miller Dam typically require up to a week (or even longer during low-flow conditions) to flow along the river channel to reach the most downstream points of delivery. The timing of a release is as important as the quantity to ensure the right amount of water is made available at the right place and the right time.

When making decisions regarding the daily operations of the Colorado River and Highland Lakes, LCRA first considers the location, amount, and timing of the demands of major customers that take water from the Colorado River below Mansfield Dam, and the environmental requirements for instream flows and freshwater inflows to Matagorda Bay. LCRA next considers the requirements of all water rights and agreements that apply to each demand and uses the best information available at the time to estimate the amount and timing of run-of-river inflows to the Colorado River below Mansfield Dam and to the Highland Lakes above Mansfield Dam, and the amount of water stored in the Arbuckle Reservoir. Finally, LCRA determines the minimum amount of stored water from lakes Buchanan and Travis that must be released from Mansfield Dam to meet any demands that do not have access to run-of-river or Arbuckle Reservoir sources of supply. Releases are then scheduled from Tom Miller Dam and Mansfield Dam to meet all demands as efficiently as possible (i.e., with the least amount of stored water released from lakes Buchanan and Travis) and according to all applicable requirements.

Demands and releases from Tom Miller Dam are determined on a daily basis, but travel time to the points of diversion or stream gauges varies and is not necessarily an exact number of days. For example, the travel time may be three and a half days, rather than exactly three or

four days. Furthermore, water released from Tom Miller Dam tends to attenuate as it moves downstream, so that one day's release at Tom Miller Dam may arrive at a downstream location over several days. In practice, releases from Tom Miller Dam may be averaged over one or more days as needed to efficiently supply downstream demands.

Various factors affect the movement and delivery of water to locations below Tom Miller Dam. The amounts of water actually released through hydroelectric generation on a daily basis generally match the amounts scheduled for release within the constraints of the capacity of each hydroelectric unit. Releases from Tom Miller Dam to the lower river pass through Lady Bird Lake and Longhorn Dam, which are operated by the City of Austin. The operation of Longhorn Dam can affect the timing and flow rate of water LCRA releases from Tom Miller Dam as the water flows through Lady Bird Lake to the lower river. LCRA cannot control the many diversions from the Colorado River and return flows to the river. The natural characteristics of the channel along the lower river are constantly changing. Flow measurements at gauging stations on tributary creeks and along the main stem of the Colorado River have a generally accepted level of precision. All of these factors affect LCRA's ability to forecast the exact rate, timing, attenuation, and gain or loss of flows along the lower river.

5.4.1.2 Releases from Lake Buchanan

LCRA's water supply needs are met from both lakes Buchanan and Travis. Releases from Lake Buchanan are routed through the intervening lakes and Lake Travis to help meet the demands of LCRA's customers and environmental flow needs downstream of Mansfield Dam. Releases from Lake Buchanan also are used to meet LCRA customer needs, replenish evaporative losses, and maintain lake levels within established operating ranges on lakes Inks, LBJ, and Marble Falls.

5.4.1.3 Operating Guidelines

LCRA determines the amount of water to be released from lakes Buchanan and Travis on a daily basis according to internal operating guidelines that provide general guidance on the allocation of releases from each lake. These allocation guidelines, and river operations in general, are intended to optimize the capture of inflows to the lakes, reduce evaporative losses, and minimize risks to life and property. In practice, the allocation of releases from lakes Buchanan and Travis is adaptive, based on actual conditions at the time, and may vary from the guidelines. Conditions considered by LCRA include lake levels and capacities, inflows to each lake, the location of needs for water, intake elevations, and planned operation and maintenance activities. LCRA regularly projects changes to lake elevations to assist customers in their planning efforts, consistent with these operating guidelines.

The WMP models include as output the Combined Storage of lakes Buchanan and Travis as well as individual storage levels for each reservoir. Because the WMP's primary focus is to preserve sufficient Combined Storage in *both* lakes Buchanan and Travis to meet Firm Water customers' demands relative to the amount of Interruptible Stored Water that can be provided, the models only allocate water between lakes Buchanan and Travis at a very coarse level. While the WMP models are limited to only two zones for determining which reservoir provides the entire release, in actual operations, lakes Buchanan and Travis are divided into five zones for which a percentage of the total release is specified for each reservoir. In other words,

there is a greater level of control over the balance of releases between the reservoirs than can be simulated by the model, resulting in significant differences in the simulated Combined Storage split compared to what would actually occur under LCRA's operating guidelines.

The WMP model results related to lake elevations, therefore, do not represent specific anticipated lake elevations for any given Combined Storage amount. Rather, the actual allocation of releases from the two reservoirs – and the resulting lake elevations – will be based on LCRA's operational decisions governed by LCRA's internal operating guidelines and specific facts, as discussed above.

5.4.2 Flood Operations

When necessary, flood operations take precedence over scheduled water supply and environmental release operations. Flood operations at Buchanan, Inks, Wirtz, and Starcke dams are conducted pursuant to an agreement between LCRA and the Federal Emergency Management Agency (*see* Appendix B-1). Flood operations at Mansfield Dam are conducted pursuant to U.S. Army Corps of Engineers rules (*see* Appendix B-2).

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1. RiverWare is a modeling environment developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado.
2. Lease and Agreement between City of Austin and Lower Colorado River Authority, February 5, 1938.

Drought Contingency Plan for the Fayette Power Project

May 2013

DROUGHT CONTINGENCY PLAN

Fayette Power Plant

6549 Power Plant Road

La Grange, TX 78945

Section 1: Declaration of Policy, Purpose and Intent

In cases of extreme drought, periods of abnormally high usage, system contamination, or extended reduction in ability to supply water due to equipment failure, temporary restrictions may be instituted to limit non-essential water usage. The purpose of this Drought Contingency Plan is to encourage a reduction of water use in order to maintain adequate supply to ensure the safe and reliable operation of the Fayette Power Plant (FPP), and to protect the fresh water resources available to the LCRA and FPP.

This plan applies to the use of raw water at FPP. This Drought Contingency Plan complies with LCRA's Drought Contingency Plan for firm water customers as currently incorporated in the LCRA Water Management Plan.

This drought contingency plan, as signed by the LCRA Executive Manager below, indicates acknowledgment and acceptance of the drought contingency plan and shall be the means of implementation.

In a shortage of water not covered by the LCRA Water Management Plan or other conservation plan approved by TCEQ applicable to LCRA's firm water supply, a water contract customer who fails to implement its applicable drought contingency plan is subject to curtailment of firm water supply by LCRA based on the customer's pro rata share less the amount of water the customer would have saved if the customer had operated its water system in compliance with the drought contingency plan.

Jimmy Havins, P.E. — 7/1/13

Jimmy Havins
Executive Manager, Generation

Date

Section 2: Facility Staff Education

Management at FPP will periodically provide the employees of the facility with information about the Drought Contingency Plan, including the importance of the Plan, information about the conditions under which each stage of the Plan is to be initiated, responses under each of the stages, processes used to reduce water use and pending or current drought conditions. Facility staff will be updated on the stages of the drought as those stages change throughout the year.

Drought plan information will be posted on the plant SharePoint site available to employees. Pertinent aspects of the plan will be discussed at regular and special staff meetings to ensure all personnel are duly informed.

Section 3: Initiation and Termination of Response Stages

The Plant Manager for FPP will order the initiation and termination of drought response stages based on the triggering criteria set forth in this plan.

Section 4: Stages and Response Measures

STAGE I: YEAR-ROUND WATER CONSERVATION

Action: Implement the FPP Water Conservation Plan.

Reduction Target: Because the plant is continuously operating at this stage, there is not a reduction target. Specific actions implemented to ensure year-round water conservation are defined in the Water Conservation Plan.

Initiation: Ongoing.

Termination: None.

Water Use Reduction Response Measures:

1. Irrigation of landscaped areas with hose-end sprinklers or in-ground irrigation systems is limited to no more than twice weekly. Watering hours will be limited to between midnight and 10 a.m. and 7 p.m. and midnight.
2. Reduce water use directing allowed process water to the reservoir where possible. Examples include, directing coal pile runoff pond and other process water to discharge directly to the reservoir, when possible and seek opportunities to reduce water use on a consistent basis.

3. At the time of landscape irrigation, operations or maintenance staff will monitor the spray nozzles on system to ensure that no leaks, overspray, and/or excessive pressure are evident.

STAGE II: MODERATE WATER SHORTAGE

Action: Curtail outdoor use of water for irrigation of landscape except for the purpose of long-term care of dams and waste management units.

Reduction Target: 10% of non-cooling water use.

Initiation: When the combined storage of lakes Travis and Buchanan is less than 900,000 acre-feet of water.

Termination: When LCRA no longer requests that its customers implement mandatory restrictions in their drought contingency plans.

Water Use Reduction Response Measures:

1. Prohibit irrigation of landscape, except by use of hand-held hose, hand-held bucket or drip irrigation.
2. Discontinue irrigation of lawns.
3. Discontinue washing and rinsing of vehicles and other equipment unless required for operation of the plant or to reduce hazards.
4. Plant piping and pumps shall be maintained in good working order so as to minimize water loss due to leaks or breaks. Repair leaks and correct flows, as needed.

STAGE III: SEVERE WATER SHORTAGE; MANDATORY CURTAILMENT

Action: Curtail consumptive water uses.

Reduction Target: 20% reduction in the amount of water consumed for the base year as established in the curtailment plans for firm water customers. This amount is referred to as the Annual Allotment. LCRA and Austin Energy will utilize their curtailed water supply proportionately to maintain the water level in Lake Fayette sufficient to ensure operability of the generation units. The overall 20% reduction for either LCRA or Austin Energy will be based on LCRA's or Austin Energy's total curtailed water supply from all of their facilities and not just the Annual Allotment for FPP.

Initiation: Stage III will be initiated upon notification from LCRA's Water Conservation Office that all interruptible stored water supplies have been halted and a drought worse than the drought of record has been declared by the LCRA Board.

Termination: LCRA announces that mandatory curtailment of water supply for firm water customers is no longer required.

Water Use Reduction Response Measures:

1. All water use for washing equipment will be stopped unless the water source is from an alternate supply, such as reclaimed water, rainwater, or gray water.
2. Pumping of water from the Colorado River to Lake Fayette will be adjusted as required to comply with the LCRA and Austin Energy raw water curtailment plans issued in response to the declaration of a drought worse than the drought of record unless ERCOT requires the power plant to operate for longer periods of time to preserve the integrity of the power grid.

If Austin Energy or LCRA are able to obtain alternative water supplies, the use of these supplies will be considered the same as having achieved a comparable reduction in the use of Fayette's normal supply from the Colorado River.

The Plant Manager may request a variance to the Annual Allotment if failure to grant a variance would result in a threat to public health, welfare or safety and there is no practical alternative water supply.

The river pump station that supplies water to Lake Fayette is only able to pump when the river has sufficient water to provide an adequate pumping pool. During periods of low river flow, pump operation may not be possible.

STAGE IV: EMERGENCY WATER CONDITIONS

Action: Further curtail water consumption per LCRA Board direction.

Reduction Target: The water supply reduction target will be determined by the LCRA Board.

Initiation: Stage IV will be initiated upon notification from LCRA's Water Conservation Office that the LCRA Board has declared a water emergency due to natural or man-made contamination of the water supply source; or due to other emergency water supply or demand conditions that the LCRA Board determines constitutes a water supply emergency or is associated with the LCRA Board declaration of a drought worse than the drought of record.

Termination: LCRA announces that mandatory water restrictions for firm water customers are no longer required.

Water Use Reduction Response Measures:

1. Operation of the power plant will be adjusted as required to comply with the LCRA Board's emergency declaration unless ERCOT requires the power plant to operate for longer periods of time to preserve the integrity of the power grid.
2. Investigate other sources of water supply.
3. If curtailed, attempt to optimize and manage lake level and run of river water to optimize lake level to meet needs.

If Austin Energy or LCRA are able to obtain alternative water supplies, the use of these supplies will be considered the same as having achieved a comparable reduction in the use of Fayette's normal supply from the Colorado River.

Section 5: Notification

Notification of the implementation of any mandatory provision of this Drought Contingency Plan shall be made to the LCRA General Manager in writing within five (5) business days of implementation.

§25.53 (e)(2)(C) A restoration of service annex

Table of Contents

1 Introduction

This manual defines LCRA's Generator Operator (GOP) and Qualified Scheduling Entity (QSE), GenDesk's, functional obligation associated with the process of coordinating, scheduling and reporting planned generator outages and reporting forced outages and deratings as well as procedures for coordinating and scheduling outages of telemetry, control and communication equipment. Information relating to the coordination of transmission equipment outages owned by the Generation Owner (GO) is also included.

1.1. Purpose

Scheduled generator and transmission outages that may affect the reliability of interconnected operations must be planned and coordinated among Balancing Authorities, Transmission Operators, and Reliability Coordinators.

1.2. Related Documents

NERC Standard TOP-001-4 – Transmission Operations

NERC Standard EOP-005-3 – System Restoration from Blackstart Resources

ERCOT Protocols Section 3.1.2 – Planned Outage or Maintenance Outage Data Reporting

ERCOT Protocols Section 3.1.3.2 (1) Resources

ERCOT Protocols Section 3.1.4.2 - Method of Communication

ERCOT Protocols Section 3.1.4.3 - Reporting for Planned Outages, Maintenance Outages, and Rescheduled Outages of Resource and Transmission Facilities

ERCOT Protocols Section 3.1.4.4 - Management of Resource or Transmission Forced Outages or Maintenance Outages

ERCOT Protocols Section 3.1.4.5 - Notice of Forced Outage or Unavoidable Extension of Planned or Maintenance Outage Due to Unforeseen Events

ERCOT Protocols Section 3.1.4.6 – Outage Coordination of Forecasted Emergency Conditions

ERCOT Protocols Section 3.1.4.7 – Reporting of Forced Outages

ERCOT Protocols Section 3.1.6 - Outages of Resources Other than Reliability Resources

ERCOT Protocols Section 3.1.6.6 - Timelines for Response by ERCOT for Resource Outages

ERCOT Protocols Section 3.1.6.9 Withdrawal of Approval or Acceptance and Rescheduling of Approved or Accepted Planned Outages of Resource Facilities

ERCOT Protocols Section 3.1.6.10 – Opportunity Outage

ERCOT Protocols Section 3.1.7 – Reliability Resource Outages

ERCOT Protocols Section 3.1.7.1 - Timelines for Response by ERCOT on Reliability Resource Outages

ERCOT Protocols Section 3.1.7.2 - Changes to an Approved Reliability Resource Outage Plan

ERCOT Protocols Section 3.3.2.1 (1) – Information to be Provided to ERCOT

2 Procedures

2.1. Generators Schedule / Modify Outages

2.1.1. Time to Review Long-Term Outage Schedule (Generator)

Procedural Steps

1. A long term outage schedule that includes both hydro and thermal resources is maintained in spreadsheet format for outages in the 12 month thru 10 year timeframe.
2. On a monthly basis, each facility shall review its 12-month rolling outage schedule for changes.
3. Annually, each facility reviews its 1-10 year outage schedule
4. If an outage schedule change is identified, the change shall be communicated to the GenDesk so that the spreadsheet can be updated.

2.1.2. Update Long-Term Outage Schedule (GenDesk Manager)

Procedural Steps

1. The GenDesk maintains the 12 month-10 year outage schedule (excel spreadsheet) located on I:drive\Shared\GenDesk\Outage Schedule\12-Month Rolling Outage Files
2. At the beginning of each month the GenDesk Manager or appointee will email the 12-month rolling outage schedule to all generation facilities, requesting an approval of the existing outage schedule or submit alternate changes to the outage schedule for the next 12 months
3. When changes are identified, update the 12 month-10 year outage schedule (excel spreadsheet)
4. Update Outages in PCI Outage Scheduling and submit to ERCOT's Market Information System (MIS) / Applications / Outage Scheduler as necessary

2.1.3. New or Revised Planned or Maintenance Outage Identified (Generator)

Failure of (or necessary repairs to) critical power plant equipment occur that may trigger a request for a new outage or modification of a previously planned outage

Procedural Steps

1. Fill out Outage / Derate Request Form (follow instructions on form)
2. The new or modified form is sent to the "GenDesk Outage" email group
3. If outage start date is more than 45 days out, the GenDesk will submit the outage and ERCOT will accept the outage
4. Outages submitted within 45 days shall be approved by ERCOT, but can be rejected if the outage will impair ERCOT's ability to meet reliability standards.
5. All planned outages should be confirmed with GenDesk using the Outage / Derate Request Form at least 9 days ahead of time to reduce risk of ERCOT rejecting the outage request

2.1.4. Planned Outage on Reliability Resource - Blackstart (Generator)

Procedural Steps

1. Fill out Outage / Derate Request Form and send to the "GenDesk Outage" email group
2. All Planned Reliability Resource outages **MUST** be submitted to ERCOT **no less than 30 days in advance** in order to be approved by ERCOT
3. ERCOT will approve or reject the Planned Outage no later than 15 days before the start of the proposed outage

2.1.5. Maintenance Level II & III on Reliability Resource - Blackstart (Generator)

Procedural Steps

1. Fill out Outage / Derate Request Form and send to the "GenDesk Outage" email group

2. All Maintenance Level II & III Reliability Resource outages submitted to ERCOT between three and eight days prior to the proposed start date, ERCOT will approve or reject two days before the start of the proposed outage
3. All Maintenance Level II & III Reliability Resource outages submitted to ERCOT between nine and thirty days prior to the proposed start date, ERCOT will approve or reject four days before the start of the proposed outage

****NOTE**** All Reliability Resources, Forced and/or Maintenance Level 1, Outages SHALL be communicated to the GenDesk as soon as practicable for submission to ERCOT which are automatically approved

2.1.6. Outage Requested by Generator (GenDesk)

LCRA GenDesk serves as the Master QSE and schedules outages for all LCRA owned generating resources and behalf of a wind generation resource owned by a separate entity. Each facility submits required outage form to the GenDesk for scheduling with ERCOT.

Procedural Steps

1. Receive verbal communication of Planned or Maintenance Outage from Resource Facility.
2. Resource facility sends the Outage / Derate Request Form and the GenDesk Trader completes the bottom portion and saves Outage / Derate Request Form on SharePoint
3. The request is entered into PCI Outage Scheduler as follows:

    1. Select "Add"
    2. Pull down menu "Action" – select "Submit-Create Outage"
    3. Select the appropriate resource
    4. Begin & End actual time
    5. Pull down menu "Event Type" – select "EEO-PCI OS – Outage"
    6. Pull down menu "Outage Type" – select the appropriate outage type
    7. Pull down menu "Nature of Work" – select the appropriate reason for outage
    8. Enter "Requestor & Supporting Notes" fields
    9. Click on "Save & Approve"
    10. Click on "Submit" which sends the outage to ERCOT MIS
    11. Within the "My Tasks To Monitor" window, you will see a green emblem which means a successful submission to ERCOT
    12. Click "Update" and a new ISO MRID will be displayed
    13. Verify new outage is in MIS

4. When an outage is to occur on a GT of a Combined Cycle Resource or an entire Plant Outage of a Combined Cycle, the request is entered into PCI Outage Scheduler as depicted in Appendix C.
5. Update GenDesk Operator Log

2.2. Starting and Ending Planned or Maintenance Outages

2.2.1. Generator Outage Commencement (Generator)

Procedural Steps

1. On or about the preceding day of the planned outage start time, the generating facility shall confirm with the GenDesk to insure the outage plans remain unchanged. For FPP 1 & 2, the FPP/AEN hotline shall be used to communicate this information.

2. Update Outage / Derate Request Form as needed to reflect changes greater than 2 hours. Send to "GenDesk Outage" email group.
3. The resource facility will send an updated form to the GenDesk with the Actual Start Time included.

2.2.2. Generator Outage Commencement (GenDesk)

Procedural Steps

1. Outage plans are reflected in the Current Operating Plan that are completed by Day Ahead market staff.
2. The Current Operating Plan for the generation resource shall be submitted with a status of "OUT" for the duration of the outage.
3. The GenDesk will enter the Actual Start time for the outage through the ERCOT Market Information System.
4. Receive an updated Outage/Derate Request Form with Actual Start Time from resource facility and store on SharePoint.

2.2.3. Generator Outage Completion or Extension (Generator)

Procedural Steps

1. On or about the preceding day of the planned outage end time, the generating facility shall confirm with the GenDesk to insure the outage plans remain unchanged. For FPP 1 & 2, the FPP/AEN hotline shall be used to communicate this information.
2. If the end time will require an extension, the generation resource shall communicate the reason to the GenDesk.
3. Update and send a revised Outage / Derate Request Form as needed to reflect changes greater than 2 hours. Send to "GenDesk Outage" email group.
4. Upon completion of outage, finalize and archive Outage / Derate Request Form by adding the actual end date and time. Send to "GenDesk Outage" email group.

2.2.4. Generator Outage Completion or Extension (GenDesk)

Procedural Steps

1. At the completion of the outage, the resource facility will email the final revision to the GenDesk
2. Enter the Actual End time for the outage on the ERCOT Market Information System.
3. Complete the Outage / Derate Request Form and save to SharePoint.
4. If generator planned outage is completed early, the GenDesk **SHALL** notify ERCOT as soon as practicable – but not later than at least two hours prior to beginning startup – to seek permission to return to service.
5. Generator repair time extension is necessary;
   a. GenDesk enters extension in PCI Outage Scheduler
   b. Include Austin Energy in discussion for FPP 1 & 2
6. The GenDesk will submit the new expected end time and the supporting information to ERCOT by entering the data into the PCI Outage Scheduler and submitting to the ERCOT Market Information System.
7. The new end time caused by the extension shall be updated in the applicable Outage / Derate Form for the generation resource.
8. Inform Day-Ahead group and GenDesk Manager of extension

2.3. New or Revised Derating

2.3.1. Resource Derating (Generator)

Reductions of a resource's seasonal HSL output that may trigger a request for a short or long term derate.

Procedural Steps
1. Inform the QSE operators of a derate request.
2. If the Derate is expected to last longer than 48 hours, fill out Outage / Derate Request Form (follow instructions on form) and email the "GenDesk Outage" group.
3. If the Derate is expected to be less than 48 hours, notify the QSE operators and alter the HSL telemetered regulating and/or operating limit.

2.3.2. Resource Derating (GenDesk)

Derates are temporary and do not trigger a change in the Seasonal HSL value. However, the resource is required to alter their high regulating and/or high operating limit to the new available capacity (HSL) which is telemetered to the GenDesk and then sent to ERCOT via ICCP telemetry.

ERCOT Protocol Derate guidelines:
- The portion of the resource removed from service when the derating exceeds 10 MW or 5% of its seasonal unit net real power capability verification (seasonal HSL).
- For wind-powered generation resources (WGRs), the loss of a portion of the capacity shall be due to the unavailability of a portion of the equipment and shall not include capacity changes due to changes in wind speed at the WGR facility.
- The Resource Entity or its designee must enter Forced Derates that are expected to last more than 48 hours into the ERCOT Outage Scheduler.

2.3.2.1. Derate longer than 48 hours

Procedural Steps
1. GenDesk must notify ERCOT for any generation resource deratings that occur in the current operating period.
2. Derates expected to last longer than 48 hours shall be built in the PCI Outage Scheduler and submitted to the ERCOT Outage Scheduler system. These requests are approved automatically. This will provide us a historical record within PCI and can easily be modified in case the derate continues longer than expected.
3. Verify that the GMS display reflects the resource HSL telemetered regulating and/or operating limit.

***Note* Only derates that are expected to last longer than 48 hrs and is greater than 5% of the seasonal HSL value shall require facility resource operations group to submit a derate form to the QSE. The QSE operator will retain the form in the SNB drive folder.**

2.3.2.2. Derate less than 48 hours

Temporary derates are defined as a loss of generation capacity from a resource due to limiting factors that will not allow the resource to attain its seasonal HSL value.

An example of a temporary derate is any reduction of a resource's seasonal HSL, for any reason that will not exceed 48 hours in total time.

For short term temporary derates, the QSE operator will build an outage (FR Forced Reduction) through the outage scheduler in PCI. This outage will NOT be submitted to ERCOT but is used for creating the correct COP limits in PCI that will be submitted to ERCOT reflecting the new derated levels of the unit.

Procedural Steps
1. GenDesk must notify ERCOT for any generation resource deratings that occur in the current operating period.

2. Build an outage in the PCI outage scheduler utilizing the FR (forced reduction) outage type. ***NOTE: It is NOT necessary to submit the outage to ERCOT for temporary derates.***
3. In the thermal unit constraints page, verify that the hours entered for the forced reduction for the resource is reflected on the unit excel spreadsheet for the correct hours of the outage.
4. Select "COP Submit" macro from the PCI Real Time Dashboard
5. Select "TPO Submit" Macro from the PCI Real Time Dashboard
6. Review the AS responsibility page to determine the amount of AS, if any, that you can no longer serve. If there is a shortfall of capacity available to cover the AS obligations, the Trader will need to reallocate the AS to available resources.
7. If unexpected delays cause an extension of the derate amount and/or time and will not exceed 48 hours from the start of the original derate, modify the original forced reduction outage in the PCI outage scheduler to reflect this new information and rerun AS Allocater.
8. Enter all derate information (date, time, reason) into the "Ongoing Issues" section of the GenDesk Operator Log.
9. In the event that the resource is unable to release the derate within the allowed 48 hours time period and that the derate amount is greater than 5% of the resource's seasonal HSL, then the QSE operator will update the outage if needed in the outage scheduler and submit the outage to ERCOT.
10. Verify that the GMS display reflects the resource HSL telemetered regulating and/or operating limit throughout the duration of the derate.

If a resource has a previous derate built through "Outage Scheduling" (EOO & FR, PL or M1), then the Trader will build a second derate to the new lower limit but DO NOT cancel the first original derate. (In PCI, when multiple EOO derates are built on a single resource, the most limiting MW derate will trump any other derate during the same hour.) See Appendix F.

Procedural Steps

1. GenDesk must notify ERCOT for any generation resource deratings that occur in the current operating period.
2. Build a derate from the PCI Outage Scheduling using Event Type FR or PL. It is not necessary to submit the derate to ERCOT. But if you would rather submit to ERCOT you must build it as an M1 derate since the timeline is out into the future.
3. Select "COP Submit" macro from the PCI Real Time Dashboard
4. Select "TPO Submit" Macro from the PCI Real Time Dashboard Review the AS responsibility page to determine the amount of AS, if any, that you can no longer serve
5. If there is a shortfall of capacity available to cover the AS obligations, the Trader will need to reallocate the AS to available resources. If unexpected delays cause the derate to continue then modify the derate ending hour in PCI Outage Scheduling and rerun –AS Allocater
6. Enter all derate information (date, time, reason) into the GenDesk Operator Log (grayed area titled ongoing issues) in order to track how long the derate has been ongoing. It's highly unlikely but the derate could last through multiple shift changes.
7. Verify the GMS reflects the resources HSL telemetered regulating and/or operating limit for the duration of the derated period.

***NOTE* Unless the derate is of significant size (E.g. Gideon 3 and Ferguson) most derates will not likely have much impact on the ability to serve the AS)**

3 Forced Outage

3.1. Generator Trip or Equipment Failure Requiring a Forced Outage (Generator)

Failure of (or necessary repairs to) critical power plant equipment occur that may trigger a forced outage.

Procedural Steps

1. Inform GenDesk and Austin Energy (for FPP 1 & 2) of Forced Outage
2. Ensure safe and orderly shutdown
3. Submit Outage / Derate Request Form to GenDesk as soon as details of event are available. Send to "GenDesk Outage" email group.
4. Follow the facility's trip investigation procedure

3.1.1. Forced Outage (GenDesk)

****NOTE**** All Reliability Resources Derate, Forced and/or Maintenance Level 1 Outages SHALL be communicated to ERCOT and LCRA SOCC **within 24 hours** of resource changed status.

Procedural Steps

1. Change the telemetered Resource Status to "OUT" in the GMS.
2. GenDesk must notify ERCOT by verbal communication for any generation resource forced outage that occur in the current operating period.
3. Call facility (as soon as practicable), requesting information for cause of trip and expected return to service time
4. Update the COP in the GMS (for the existing Operating Hour) to "OUT."
5. Any Forced Outage of a Resource that occurs in Real-Time must be entered into the PCI Outage Scheduler and submitted to ERCOT through the MIS Outage Scheduler if it is to remain in outage for longer than two hours and with the expected return-to-service time.
6. Build a outage in the PCI Outage Scheduler and submit to ERCOT MIS Outage Scheduler during the Adjustment Period with the expected return-to-service time
   a. Select "Add"
   b. Pull down menu "Action" – select "Submit-Create Outage"
   c. Select the appropriate resource
   d. Begin & End actual time
   e. Pull down menu "Event Type" – select "EEO-PCI OS – Outage"
   f. Pull down menu "Outage Type" – select "FR" (Forced and/or Forced Reduction)
   g. Pull down menu "Nature of Work" – select the appropriate reason for outage
   h. Enter "Requestor & Supporting Notes" fields
   i. Click on "Save & Approve"
   j. Click on "Submit" which sends the outage to ERCOT MIS
   k. Within the "My Tasks To Monitor" window, you will see a green emblem which means a successful submission to ERCOT
   l. Click "Update" and a new ISO MRID (ERCOT outage ID#) will be displayed
   m. Verify new outage is in ERCOT MIS
7. In the event of simultaneous loss of 1000 MW's or more of LCRA portfolio generation, (counting both shares on loss of FPP 1 & 2), the GenDesk Trader will notify the GenDesk Manager and we must complete and submit the "NERC Event Report Attachment 2" form to NERC within **24-hours** via email (esisac@nerc.com), or by facsimile (609-452-9550). See "Event Reporting Process" for the proper form. Also send copies of the report to Texas RE and ERCOT Shift Supervisor.