

**TECHNICAL REPORT IN SUPPORT OF
THE WATER MANAGEMENT PLAN
FOR
WATER USE PERMIT No. 5851**



Brazos River Authority

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Acronyms

ALJ - Administrative Law Judge	SOAH - State Office of Administrative Hearings
BEPC - Brazos Electric Power Cooperative	SWAA - System Water Availability Agreement
BRA - Brazos River Authority	SWPA - Southwestern Power Administration
COA - Certificate of Adjudication	SWSA - Surface Water Supply Agreement
COC - Controlled Outlet Conduit	TCEQ - Texas Commission on Environmental Quality
CPNPP - Comanche Peak Nuclear Power Plant	TIFP - Texas Instream Flow Program
CRP - Clean Rivers Program	TMPA - Texas Municipal Power Agency
DCP - Drought Contingency Plan	TNRCC - Texas Natural Resource Conservation Commission
DMR - Discharge Monthly Report	TOC - Top of Conservation
DRTL - Diversion Rate Trigger Level	TP&L - Texas Power & Light Company
EAC - elevation-area-capacity	TPWD - Texas Parks and Wildlife Department
ED - Executive Director of the Texas Commission on Environmental Quality	TU - Texas Utilities
EWCRWS - East Williamson County Regional Water System	TWDB - Texas Water Development Board
FERC - Federal Energy Regulatory Commission	ULRMWD - Upper Leon River Municipal Water District
FNI - Freese and Nichols, Inc.	USACE - United States Army Corps of Engineers
GCWA - Gulf Coast Water Authority	USGS - United States Geological Survey
HFP - High Flow Pulse	WAM - Water Availability Modeling
HL&P - Houston Lighting & Power	WCBWDS - West Central Brazos Water Distribution System
IWAA - Interruptible Water Availability Agreement	WCP - Water Conservation Plan
LCRA - Lower Colorado River Authority	WCRRWL - Williamson County Regional Raw Water Line
MP - Measurement Point	WMP - Water Management Plan
NAVD - North American Vertical Datum	WRAP - Water Rights Analysis Package
NRC - Nuclear Regulatory Commission	WUGs - Water User Groups
PHDI - Palmer Hydrological Drought Index	
SB1 - Senate Bill 1	
SB2 - Senate Bill 2	
SB3 - Senate Bill 3	

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Executive Summary

ES.1 Development of the System Operation Permit

The Brazos River Authority (BRA) exists to develop, manage, and protect the water resources of the Brazos River basin to meet the needs of Texas. For more than 80 years, the BRA has sought and developed innovative low-cost water supplies to satisfy the water demands of the Brazos basin.

According to the Texas Water Development Board (TWDB), Texas' population will nearly double over the next 50 years, and the Texas Legislature has proactively passed legislation for effective water planning and efficient water management. The vast majority of this population growth resides in or adjacent to the Brazos River basin. Proper implementation and effective timing of recommended water supply strategies is critical to the continued economic strength of both the Brazos River basin and the State of Texas as a whole.

In 2004, the BRA submitted Water Use Permit Application No. 5851 to the Texas Commission on Environmental Quality (TCEQ), for the System Operation Permit to appropriate additional water that is made available through coordinated operation of the BRA's existing water rights and reservoirs, in conjunction with other unappropriated flows.

The System Operation Permit represents a unique approach by the BRA to address current and future water supply needs throughout the basin in a cost-effective and environmentally sensitive manner. On average, over five million acre-feet (acft) of water per year pass the furthest most downstream monitoring gage on the Brazos River into the Gulf of Mexico. The BRA's System Operation Permit application seeks to gain access to a portion of these uncontrolled flows and appropriate an immediate, low-cost, and reliable source of water that the BRA can use to supply municipalities, industry, agricultural and mining interests. The System Operation Permit will allow the BRA to use naturally occurring flows in the basin and return flows from wastewater treatment plants, in conjunction with the water supply in its 11 existing reservoirs. The

uncontrolled natural flow, originating downstream of the BRA's reservoirs during wet times, can be firmed up by releases from the upstream BRA reservoirs during dry times and collectively achieve a "System" yield that is substantially greater than the sum of the individual reservoir yields.

The proposed System Operation Permit also implements environmental flow requirements that were developed using data that mimic the natural hydrology and protect the seasonal distribution of flows under dry, average, and wet conditions. This regime was originally developed in close cooperation with the Texas Parks and Wildlife Department (TPWD) and the TCEQ, prior to and in anticipation of TCEQ's consideration of Senate Bill 3 (SB3) rules for the Brazos basin system. With SB3 rules now finalized, the environmental flow requirements and related provisions in the proposed System Operation Permit and BRA's Water Management Plan have been updated based on the environmental flows measurement points and other provisions outlined in those rules.

The BRA acknowledges that the System Operation Permit is a complex approach to water management. Thus, the BRA included in its original permit application a proposal that a water management plan be developed to accompany and complement the System Operation Permit, in order to ensure the water is managed in accordance with the conditions of the water right.

The BRA has developed the BRA Water Management Plan (WMP) to be included as part of the Permit application. The WMP is intended to be the regulatory document that, upon approval, will be effectively incorporated as part of the System Operation Permit. The BRA has prepared this Technical Report and related Appendices to provide comprehensive support for the regulatory provisions proposed in the WMP. Throughout this Technical Report and Appendices, any references to "inflows" or "spills" as "BRA water" means inflows or spills available to BRA for appropriation after senior water rights are satisfied. Unless otherwise indicated by the context, references to the proposed System Operation Permit are to the draft version of Permit No. 5851 noticed by TCEQ in 2013, as subsequently updated following TCEQ's adoption of SB3 rules for the Brazos basin.

ES.2 Water Management Plan Technical Report – Summary of Sections

ES.2.1 Introduction (Section I)

Originating in New Mexico, the Brazos River basin includes all or part of 70 counties in Texas, and discharges into the Gulf of Mexico near the City of Freeport, Texas. As the Brazos River flows in the southeasterly direction, the climate changes from an arid environment to a sub-tropical environment. There are four cities within the basin (Lubbock, Abilene, Waco, and Killeen) with populations greater than 100,000, with several others approaching that figure. The economy of the region includes extensive agriculture activity, as well as mineral production, manufacturing, and trades and service.

In 1929, the Texas Legislature created the organization now known as the BRA to conserve, develop, and manage the surface water resources in the Brazos River basin. Between the 1930s and 1980s, the BRA, along with the U.S. Army Corps of Engineers (USACE), developed water resources in eleven reservoirs: Possum Kingdom, Granbury, Whitney, Aquilla, Proctor, Belton, Stillhouse Hollow, Georgetown, Granger, Limestone, and Somerville.

With the Texas Legislature's passage of Senate Bill 1 (SB1) in 1997, Senate Bill 2 (SB2) in 2001, and SB3 in 2007, the State of Texas and its local and regional partners, such as the BRA, embarked on a systematic approach to address the state's water supply needs over the next 50 years. Through this process, every five years Texas develops regional water plans that are then incorporated into a state water plan.

The 2011 Regional Water Plans and the 2012 State Water Plan identify projected demands for water in the Brazos River basin that are in excess of existing supplies. For BRA customers, the plans project shortages of 140,056 acft in 2020 and 382,841 acft in 2060. In order to help alleviate these projected water shortages, additional supplies must be developed. The 2012 State Water Plan identifies the BRA System Operation Permit as a recommended water supply strategy for two of the regional planning areas, Brazos G and Region H.

The BRA System Operation Permit application was filed with the TCEQ in June 2004, with notice of the application published in May 2005. The BRA, the TCEQ, and the TPWD worked together from 2005 to 2009 to develop environmental flow special conditions for the System Operation Permit, and in 2010, the TCEQ released a draft permit. The application and the draft System Operation Permit were referred to the State Office of Administrative Hearings (SOAH) for a contested case hearing, which convened in May 2011. The Administrative Law Judges (ALJs) prepared a proposal for decision, and in January 2012, the TCEQ Commissioners considered the System Operation Permit application and the proposal for decision. The Commissioners ruled that the WMP should be prepared before the issuance of the System Operation Permit, and provided the BRA 10 months to prepare the accompanying WMP. Following BRA's submission and TCEQ's technical review of the WMP, the Commissioners issued an interim order in December 2013 requiring that the WMP use the SB3 rules once adopted, and thus the contested case proceedings were further abated pending that update.

Prior to and during the 10-month period of development of the WMP, the BRA coordinated with the TCEQ, TPWD, and TWDB, meeting 8 times with the agencies' representatives, to solicit input regarding the plan and to provide reports on the progress of the WMP. The BRA also held 9 stakeholder meetings throughout the Brazos River basin. At these meetings, the BRA provided the public with updates on the progress of the plan and received comments. To further engage the public, the BRA developed and is maintaining a dedicated webpage for the WMP. Through this webpage, the public is able to obtain pertinent information and provided comments and questions to the BRA during the stakeholder process.

ES.2.2 Sources of Supply and Water Rights (Section II)

The Brazos River basin is the largest of the 16 major river basins in Texas, with a contributing drainage area of approximately 36,028 square miles (out of the approximately 42,000 square miles of the basin proper). The BRA is the largest provider of wholesale surface water within the basin. The BRA stores water in three wholly owned and operated reservoirs: Possum Kingdom Lake, Lake Granbury, and

Lake Limestone. The BRA also contracts for conservation storage space in eight USACE reservoirs in the basin: Lakes Whitney, Aquilla, Proctor, Belton, Stillhouse Hollow, Georgetown, Granger, and Somerville.

The BRA holds 17 water rights in the Brazos River basin, 11 of which are associated with the reservoirs mentioned above. In addition to these reservoirs, the BRA is a joint owner and permittee with the City of Houston and the TWDB in the water right for the proposed Allens Creek Reservoir. The BRA has a 30 percent ownership interest in the project, and the City of Houston is the 70 percent owner. The five remaining rights are associated with the system operation of the reservoirs, use of excess flows in the lower Brazos basin, and interbasin transfers to the San Jacinto-Brazos coastal basin.

ES.2.3 Water Supply Contracting (Section III)

The BRA supplies water to customers throughout the basin from its Water Supply System. The BRA Water Supply System includes (1) BRA's water rights in the 11 BRA System reservoirs, (2) other water rights and supply sources, such as contract water, and (3) the facilities, infrastructure and properties, such as BRA's raw water pipelines, insofar as they are related to making water available. BRA's customers include municipalities, water districts, water supply corporations, agricultural irrigators, steam electric generating facilities, manufacturing entities, and mining operations. Water is supplied to these customers through water supply contracts that are generally classified by BRA as either long-term (term greater than five years) or short-term (term of five years or less). Use of water under contracts issued by the BRA must comply with BRA's underlying water rights, as well as BRA's Water Conservation Plan (WCP) and Drought Contingency Plan (DCP). Since 1991, BRA has used a standard form contract for long-term water supplies. As of November 1, 2012, the BRA had 146 long-term water supply contracts providing for the diversion and use of approximately 696,719 acre-feet of water per year (acft/yr).

ES.2.4 Water Supply Operations (Section IV)

The BRA's water supply operations involve a number of components including physical operation of the reservoirs, as well as compliance with permits and contractual

requirements. Facilities and infrastructure currently associated with raw water supply operations include Lakes Possum Kingdom, Granbury, Whitney, Aquilla, Proctor, Belton, Stillhouse Hollow, Georgetown, Granger, Limestone, and Somerville, the Williamson County Regional Raw Water Line (WCRRWL) connecting Lake Stillhouse Hollow to Lake Georgetown, and the West Central Brazos Water Distribution System (WCBWDS) that delivers water from Possum Kingdom Lake to Stephens and Eastland Counties.

The BRA operates its Water Supply System in accordance with its water rights and water supply contracts to meet the needs of its customers. This includes making releases from reservoir storage for downstream customer water supply needs, accounting for lakeside customer diversions, performing daily reservoir water accounting, passing water for environmental purposes, accounting for senior water right holders during low flow conditions, passing excess runoff and flood flows through the three reservoirs owned and operated by BRA (Lakes Possum Kingdom, Granbury and Limestone), and conveying water through the raw water pipelines (WCRRWL and WCBWDS).

Section IV describes BRA's water supply operations in greater detail, including operations under the proposed System Operation Permit. Water availability modeling results comparing current conditions and existing operations to several future conditions under the proposed System Operation Permit are presented. Additionally, analyses and discussion related to the special conditions for environmental flows and other requirements of the proposed System Operation Permit are presented.

ES.2.5 Water Rights Accounting and Reporting (Section V)

The BRA has developed an Accounting Plan to report compliance with the terms and conditions of the proposed System Operation Permit and its use of water under other BRA water rights. The Accounting Plan consists of a series of tables in Excel workbooks that cover a calendar year, with a new Accounting Plan starting on January 1 of each year. Entries in the Accounting Plan will be made regularly by BRA staff. The Accounting Plan includes:

- Customer water use, including delivery of water to downstream customers as adjusted for travel time and transportation losses;
- System reservoir operations, including inflows, diversions, water supply releases, passage of instream flows, and storage and use of water under the applicable BRA authorizations;
- Diversions made under the new appropriation contained in the proposed System Operation Permit, including use of return flows;
- Compliance with environmental flow standards set out in BRA's Water Management Plan; and
- Summaries of use under the various BRA water rights.

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