

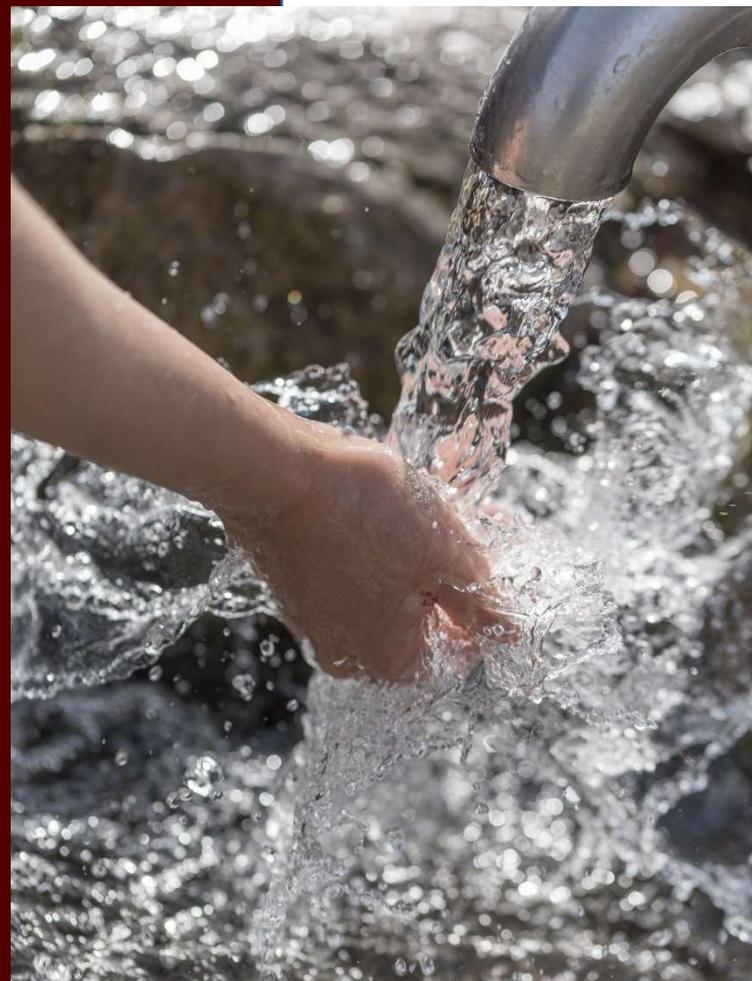
Legal & Regulatory Framework for Brackish Groundwater Desalination and Water Recycling in Texas



SCHOOL OF LAW
TEXAS A&M UNIVERSITY

Part 3: Case Study Appendices to the Technical Reports

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May 1, 2020



Texas A&M University School of Law Program in Energy, Environmental, & Natural Resources Systems

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Legal and Regulatory Framework for Brackish Groundwater Desalination and Water Recycling in Texas

Part 1: Brackish Groundwater
Desalination Technical Report

Part 2: Water Recycling Technical
Report for Direct Non-Potable Use

Part 3: Case Study Appendices to the Technical Reports

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DISCLAIMER: This Technical Report and its student authors do not in any way purport to opine, advise (legally or non-legally), or otherwise direct any person or entity to come to a certain conclusion. **This is not legal advice** and should not be construed that way. This Technical Report and the corresponding summary materials are merely **educational resources** that may **inform** municipal leaders and interested members of the public of legal and regulatory considerations in Texas.

INTRODUCTION

This Case Study Appendix to the Technical Reports expands on regulations in San Antonio and El Paso where these water alternatives are in place. The goal of this report is to provide insight into the legal and regulatory barriers, challenges, and opportunities for these technologies to go online. Each desalination and water recycling facility implementation site must comply with various laws and regulations. The information in these Case Studies comes from the study of brackish groundwater desalination and water recycling facilities currently operating in Texas. While there is no updated “one-stop-shop” resource where a municipal leader can find a list of all the necessary permits to build, operate, and maintain such facilities, this Technical Report aims to compile the existing, available information in an organized and accessible fashion.

The Desalination Technical report is the third in a series of three reports which make up the Project. These reports examine regulations surrounding desalination and water recycling. The companion reports generally highlight building, operating, and monitoring requirements for water recycling facilities in Texas.

CASE STUDY BACKGROUND AND CONTEXT

As part of the Texas A&M X-Grant Project, *Pathways to Sustainable Urban Water Security: Desalination and Water Reuse in the 21st Century*, the students in the 2020 Texas A&M University School of Law Energy, Environmental, and Natural Resources System Law Program Capstone class developed comprehensive case studies specific to individual regions.

Two case studies—El Paso and San Antonio, Texas—are particularly helpful to this Capstone project for the Texas Water Foundation. Both case studies include more detailed background information on the incentives of

each city to invest in diversifying their water portfolio through desalination and water recycling technology. As such, those interested in assessing whether or not to implement said technologies in a different municipality may find it beneficial to read these comprehensive reports. El Paso and San Antonio have pioneered the use of this technology in Texas and serve as examples and leaders of successful implementation.

The El Paso case study begins on page 3, and the San Antonio case study begins on page 21. It is worth noting that much of the information will be the same as both sites are in Texas. However, there are some differences. This format of this document is so that each case study can be read together or in isolation.

EL PASO, TEXAS

CASE STUDY

By: Seth Boettcher

I. Introduction

Local governance regimes determine pathways for the implementation of water reuse and desalination policy and projects. These regimes both facilitate and constrain the adoption of such technologies. Some challenges to sustainable outcomes include institutional fragmentation, lack of public trust, limited long-term strategic planning, poor leadership, lagging regulation, and failed stakeholder participation. This article will examine the legal frameworks that have affected desalination and water reuse in the El Paso, Texas, area.

The article aims to provide a critical institutional understanding that offers insight into the legal and regulatory barriers, challenges, and opportunities for these technologies to go online. Water reuse faces a considerable amount of legal and regulatory challenges related to wastewater treatment, water quality standards, and the effects of reuse on the total maximum daily loads (TMDLs) from discharges. Each implementation site of desalination and water reuse has had to find ways of complying with various laws and regulations.

II. Background

The City of El Paso, Texas is located in the northern extreme of the Chihuahuan Desert.¹ Due to its distinct location, culture, and diverse supply of resources, El Paso's consumption of water is unique among similarly situated municipalities in the southwest desert of the United States.² El Paso's water needs are serviced by the Rio Grande River and two aquifers, the Hueco and Mesilla Bolsons.³

¹ El Paso Water. *Water Conservation Plan 2019*, 10.

² El Paso Water. *Water Conservation Plan 2019*, 10.

³ El Paso Water. *Water Conservation Plan 2019*, 10.

Being in the desert, El Paso receives over 300 days of sun each year with an average daily temperature around 70° and an average rainfall of nine inches.⁴ El Paso is the sixth largest city in Texas and provides water services to approximately 759,000 residents.⁵ El Paso's water is provided through El Paso Water.⁶ El Paso uses both groundwater and surface water to provide potable water to its citizens.⁷ The city produced about 117,897 acre-feet of potable water in 2018.⁸ In 2018 the Rio Grande provided 40% of the total water demand, the Hueco Bolson aquifer provided 38%, the Mesilla Bolson aquifer provided 17%, and the Kay Bailey Hutchinson Desalination Plant provided 5% of the total water demand.⁹ El Paso also uses its reclaimed water plants to supply non-potable demands.¹⁰ Reclaimed water is also used in the operation of other water facilities, as well as to recharge the aquifers through injection wells.¹¹

A. Local information

El Paso's water history begins in 1882 when Sylvester Watts established the first area water works, building a reservoir that allowed mud and silt to settle before being piped to residents.¹² In 1910, the City purchased Watts' water works and began managing the supply to the residents of El Paso.¹³ At this time, the sole source of water came from wells.¹⁴ In 1923, El Paso's first wastewater treatment plant began operation.¹⁵ The City continued to upgrade its plants and their capacity to treat water, as well as to a higher quality and created the Public Service Board to manage the City's water system in 1952.¹⁶ In 1985, the Fred Harvey Wastewater Plant began operation, and was one of the first plants in the nation to pump water to help

⁴ El Paso Water. *Water Conservation Plan 2019*, 10.

⁵ El Paso Water. *Water Conservation Plan 2019*, 11.

⁶ El Paso Water. *Water Conservation Plan 2019*, 11.

⁷ El Paso Water. *Water Conservation Plan 2019*, 11.

⁸ El Paso Water. *Water Conservation Plan 2019*, 10.

⁹ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

¹⁰ El Paso Water. *Water Conservation Plan 2019*, 10.

¹¹ El Paso Water. *Aquifer Recharge*.

https://www.epwater.org/our_water/water_resources/aquifer_recharge.

¹² El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹³ El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹⁴ El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹⁵ El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹⁶ El Paso Water. *History*. https://www.epwater.org/about_us/history.

recharge of the aquifers.¹⁷ The Kay Bailey Hutchinson Desalination Plant became operational in 2007 to treat brackish groundwater to drinking standards, and is the largest inland desalination plant in the United States.¹⁸ Due to continued concerns over water resources, El Paso opened the Advanced Water Purification Pilot Plant in 2015 to be one of the first direct potable reuse plants in the country.¹⁹ In early 2016, El Paso Water completed a nine-month testing period of the plant and was granted permission by the Texas Commission on Environmental Quality to proceed with the design of a full-scale facility.²⁰

1. Desalination

El Paso Water Utilities operates the largest inland desalination facility in the United States.²¹ The Kay Bailey Hutchinson Desalination Plant began operation in 2007 and has an operating capacity of 27.5 million gallons per day.²² The facility is fed by sixteen production wells and sixteen blend wells from the Hueco Bolson aquifer that are strategically placed to slow and prevent brackish water intrusion to the freshwater wells.²³ The Kay Bailey Hutchinson facility uses a reverse osmosis process that results in approximately 83% of water treated to be collected while the concentrate is injected into the ground 22 miles from the facility via deep well injection.²⁴ El Paso Water has collaborated with Enviro Water Minerals that has a facility next door to filter the wastewater from the desalination process to further remove minerals into industrial-grade quality that have commercial value such as salt, gypsum, potash liquid fertilizer, and milk of magnesia.²⁵

¹⁷ El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹⁸ El Paso Water. *History*. https://www.epwater.org/about_us/history.

¹⁹ El Paso Water. *History*. https://www.epwater.org/about_us/history.

²⁰ El Paso Water. *Advanced Purification*.

https://www.epwater.org/our_water/water_planning/advanced_purification.

²¹ El Paso Water. *Desalination*.

https://www.epwater.org/our_water/water_resources/desalination.

²² El Paso Water. *Desalination*.

https://www.epwater.org/our_water/water_resources/desalination.

²³ El Paso Water. *Desalination*.

https://www.epwater.org/our_water/water_resources/desalination.

²⁴ El Paso Water. *Desalination*.

https://www.epwater.org/our_water/water_resources/desalination.

²⁵ El Paso Water. *Desalination*.

https://www.epwater.org/our_water/water_resources/desalination.

2. Reuse

El Paso Water utilizes four wastewater treatment plants to supply 5.83 million gallons per day of reclaimed water for agricultural, construction, and municipal uses.²⁶ While this water is not treated to drinking water standards, it does serve to supplement the use of potable water in commercial and agricultural uses as well as allow for the discharge into rivers and aquifers leading to valuable water credits in surface water.²⁷ Each of the four wastewater or reclamation plants serve a different purpose in the community.

The Fred Hervey Water Reclamation Plant began operation in 1985 and has the capacity to treat 12 million gallons of water per day.²⁸ The reclaimed water is used for industrial and agricultural purposes including golf courses and power plants.²⁹ A portion of the water is treated further to drinking water standards and is used to replenish the aquifer through injection wells and recharge zones.³⁰ Currently the facility injects 10 million gallons per day to the Hueco Bolson aquifer.³¹ The Fred Hervey Water Reclamation Plant serves primarily Northeast El Paso.³²

The John T. Hickerson Wastewater Treatment plant began operation in 1987 and currently has a treatment capacity of 17.5 million gallons per day.³³ The plant receives wastewater from residential and industrial sources in West El Paso and returns it to various parks in the west part of the city.³⁴

²⁶ El Paso Water. *Reclaimed Water*.

https://www.epwater.org/our_water/water_resources/reclaimed_water.

²⁷ El Paso Water. *Reclaimed Water*.

https://www.epwater.org/our_water/water_resources/reclaimed_water.

²⁸ El Paso Water. *Fred Hervey Water Reclamation Plant*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=10884159>.

²⁹ El Paso Water. *Fred Hervey Water Reclamation Plant*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=10884159>.

³⁰ El Paso Water. *Fred Hervey Water Reclamation Plant*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=10884159>.

³¹ El Paso Water. *Aquifer Recharge*.

https://www.epwater.org/our_water/water_resources/aquifer_recharge.

³² El Paso Water. *Fred Hervey Water Reclamation Plant*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=10884159>.

³³ El Paso Water. *John T. Hickerson WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422408>.

³⁴ El Paso Water. *John T. Hickerson WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422408>.

The plant uses an extended aeration activated sludge treatment method combined with UV radiation as a means to disinfect the reclaimed water.³⁵

The Haskell R. Street Wastewater Treatment Plant became operational in 1923 and has a treatment capacity of 27.7 million gallons per day.³⁶ The Haskell R. Street Plant discharges treated reclaimed water to both the Rio Grande and the American Canal, however discharge to the American Canal is preferred to allow use for irrigation by farmers.³⁷ In exchange to the discharge of water to the Rio Grande and the American Canal, El Paso receives water credits for surface water that can be treated to drinking water standards and reduces the reliance of pumping groundwater.³⁸ This plant also sends treated reclaimed water to various parks and golf courses in central El Paso.³⁹

The Roberto Bustamante Wastewater Treatment Plant began operation in 1991 and has a treatment capacity of 39 million gallons per day.⁴⁰ The Roberto Bustamante Plant has the main purpose to return clean water to the Riverside Canal and the Riverside Drain.⁴¹ Discharges to the Riverside Canal are used mainly for irrigation, while discharges to the Riverside Drain go mainly to the Rio Bosque Wetlands preserve.⁴² Like the John T. Hickerson Plant, the Roberto Bustamante Plant uses an extended aeration activated sludge process, biological nitrification, and caustic air scrubbers to both disinfect the water as well as address odor control.⁴³

³⁵ El Paso Water. *John T. Hickerson WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422408>.

³⁶ El Paso Water. *Haskell R. Street WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422911>.

³⁷ El Paso Water. *Haskell R. Street WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422911>.

El Paso Water. *Haskell R. Street WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422911>.

³⁹ El Paso Water. *Haskell R. Street WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422911>.

⁴⁰ El Paso Water. *Roberto Bustamante WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422908>.

⁴¹ El Paso Water. *Roberto Bustamante WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422908>.

⁴² El Paso Water. *Roberto Bustamante WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422908>.

⁴³ El Paso Water. *Roberto Bustamante WWTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7422908>.

Direct potable reuse is the process of using treated wastewater for drinking water without an environmental buffer.⁴⁴ In early 2015, El Paso Water began testing a closed system water treatment process to augment the water supply from surface and groundwater sources.⁴⁵ In early 2016, El Paso Water completed a nine month pilot test and submitted the results to the Texas Commission on Environmental Quality (TCEQ).⁴⁶ The TCEQ has approved the results of the pilot test, and gave permission to proceed designing a full-scale facility.⁴⁷ The TCEQ will continue to review and review and comment on the proposed plans before construction begins.⁴⁸ The current proposed facility will have a treatment capacity of 10 million gallons per day.⁴⁹

B. Local context

In 1910 the City of El Paso purchased the water works from Sylvester Watts and continued to improve them throughout the years adding various water treatment plants.⁵⁰ In 1952 the City Council created a board to better manage the City's water systems, the branch of the board that now manages the water is El Paso Water Utilities.⁵¹ El Paso Water Utilities is subject to the rules and regulations of the groundwater districts, the Texas Water Development Board, the Texas Commission on Environmental Quality, the Environmental Protection Agency, as well as a variety of federal regulations.

Due to its distinct location and weather conditions, El Paso is forced to look to many sources to meet its water demands. An assessment done by the Texas Water Development Board in 1979 predicted El Paso to run out of freshwater if pumping continued from the aquifers, leading the city to

⁴⁴ United States Environmental Protection Agency. *Water Reuse Research*. <https://www.epa.gov/water-research/water-reuse-research>.

⁴⁵ Arcadis. *El Paso Advanced Water Purification Facility*. <https://www.arcadis.com/en/united-states/what-we-do/our-projects/north-america/united-states/el-paso-advanced-water-purification-facility/>.

⁴⁶ El Paso Water. *Advanced Purification*. https://www.epwater.org/our_water/water_planning/advanced_purification.

⁴⁷ El Paso Water. *Advanced Purification*. https://www.epwater.org/our_water/water_planning/advanced_purification.

⁴⁸ El Paso Water. *Advanced Purification*. https://www.epwater.org/our_water/water_planning/advanced_purification.

⁴⁹ El Paso Water. *Advanced Purification*. https://www.epwater.org/our_water/water_planning/advanced_purification.

⁵⁰ El Paso Water. *History*. https://www.epwater.org/about_us/history.

⁵¹ El Paso Water. *History*. https://www.epwater.org/about_us/history.

conservation efforts and diversifying its water portfolio.⁵²⁵³ El Paso currently has water rights of about 70,000 acre-feet per year from the Rio Grande.⁵⁴ The Rio Grande is fed, in part, from spring run-off stored in the Elephant Butte Reservoir.⁵⁵ The Elephant Butte Lake is governed by a 1938 interstate compact between Colorado, New Mexico, and Texas to equitably apportion the waters of the Rio Grande Basin.⁵⁶ While El Paso depends on the Rio Grande for about half of their water needs, in years of drought only a fraction of that water may be available.⁵⁷ In 2013, the Rio Grande only provided water for less than two months.⁵⁸ El Paso has relied heavily on pumping from the Hueco Bolson, especially in years that water is not available from the Rio Grande.⁵⁹ With growing concerns on the level of the Hueco Bolson, El Paso has implemented conservation efforts including increase cost of water for high use, various incentive programs, and expanded reuse to augment the use of water from aquifers and the river.⁶⁰

C. Stakeholders

The stakeholders to alternatives to freshwater include the residents of El Paso and the local government, government agencies, and research institutes.

Those who benefited from recycling and desalination are primarily the residents of El Paso and the local government. It was estimated that El Paso would drain the aquifers of freshwater by 2020 if they did not make

⁵² ABC News. *El Paso Texas Residents To Drink Treated Sewage Water Due to Climate Change Drought*. <https://www.abcactionnews.com/news/national/el-paso-texas-residents-to-drink-treated-sewage-water-due-to-climate-change-drought>.

⁵³ Robert E. Mace et. al. *Review and Interpretation of the Hueco Bolson Groundwater Model*. 7.

⁵⁴ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

⁵⁵ El Paso Water. *Rio Grande and Elephant Butte*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7416449>.

⁵⁶ El Paso Water. *Rio Grande and Elephant Butte*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7416449>.

⁵⁷ El Paso Water. *Rio Grande and Elephant Butte*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7416449>.

⁵⁸ El Paso Water. *Rio Grande and Elephant Butte*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7416449>.

⁵⁹ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

⁶⁰ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

changes to their water supply.⁶¹ The city and its residents have a real and deep interest in protected their water supplies and making conservation efforts to continue to survive in the desert. El Paso Water Utilities began conservation and education efforts in the 1980s, and these efforts led to incorporation of desalination and water recycling for improved water security and a diversified water portfolio.⁶² The Public Service Board tries to give all stormwater and wastewater fees to El Paso Water to use for water, wastewater, and stormwater systems. The Public Service Board approved a \$436.1 million water budget for the 2019-2020 fiscal year.⁶³ While the City tries to put all water fees back for the benefit of the citizens, it also vigorously pursues grants from both the federal and state level to help offset the costs.⁶⁴

The government and government agencies have a real interest in desalination and recycling in El Paso because they are the entities that permit the facilities and make sure that they are in accordance with regulations, and at times they also help provide funding for the water projects. The Environmental Protection Agency is the federal agency that implements environmental regulations.⁶⁵ However, many of the responsibilities are delegated to the states and here in Texas the Texas Commission on Environmental Quality is the enforcing agency of environmental regulations.⁶⁶ The federal government contributed \$26 million in grants for the construction of the Kay Bailey Hutchison desalination facility, with the total cost of \$91 million.⁶⁷ The Texas Water Development Board also receives funding from the state legislature that it distributes as grants to cities

⁶¹ KLTU. *Climate Change Drying Up Rio Grande, Experts Say*.

<http://www.kltv.com/2018/11/30/climate-change-drying-up-rio-grande-river-experts-say/>.

⁶² Texas Observer. *El Paso is on the Cutting Edge of Water Conservation. It Really Has No Choice*. <https://www.texasobserver.org/el-paso-is-on-the-cutting-edge-of-water-conservation-it-really-has-no-choice/>.

⁶³ Texas Observer. *El Paso is on the Cutting Edge of Water Conservation. It Really Has No Choice*. <https://www.texasobserver.org/el-paso-is-on-the-cutting-edge-of-water-conservation-it-really-has-no-choice/>.

⁶⁴ Texas Observer. *El Paso is on the Cutting Edge of Water Conservation. It Really Has No Choice*. <https://www.texasobserver.org/el-paso-is-on-the-cutting-edge-of-water-conservation-it-really-has-no-choice/>.

⁶⁵ United States Environmental Protection Division. *Our Mission*. <https://www.epa.gov/aboutepa/our-mission-and-what-we-do>.

⁶⁶ Texas Commission on Environmental Quality. *Requirements for Reclaimed Water*. https://www.tceq.texas.gov/assistance/water/reclaimed_water.html.

⁶⁷ Texas Tribune. *Texas Water Woes Spark Interest Desalination*. <https://www.texastribune.org/2012/06/10/texas-water-woes-spark-interest-desalination/>.

for water works projects, as well as using it as funding for research projects.⁶⁸ The Environmental Protection Agency and the Bureau of Reclamation have prioritized funds for water reuse projects.⁶⁹

With the scarcity of freshwater, research institutes are becoming involved in projects surrounding water management and desalination and recycling technology. Some research partners of the Consortium for Hi-Technology Investigations in Water and Wastewater include El Paso Water, City of Alamogordo, NM, University of Texas at El Paso, Texas A&M University, and New Mexico State University.⁷⁰ The Texas Water Development Board was created by the state legislature and has the mission “to provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas.”⁷¹

D. Challenges

El Paso has had a surprising amount of support from its citizens with respect to water conservation efforts. No effort by El Paso has been a sudden or extreme change, which has helped the citizens to be more educated and understanding of the water conservation efforts. El Paso Water implemented conservation efforts including incentive programs, fines, and education programs to help citizens pursue more efficient water uses.⁷²

In 2015, a poll found that 77% of El Paso citizens were in favor of using Direct Potable Reuse.⁷³ The gradual conservation and education efforts

⁶⁸ Texas Water Development Board. *Financial Assistance*.

<http://www.twdb.texas.gov/financial/index.asp>.

⁶⁹ Water Reuse. *EPA Prioritizes Water Reuse in Wifia Funding Announcement*.

<https://watereuse.org/epa-prioritizes-water-reuse-in-wifia-funding-announcement/>.

⁷⁰ El Paso Water. *Desalination Research*.

https://www.epwater.org/our_water/water_resources/desalination/desalination_research.

⁷¹ Texas Water Development Board. *About the Texas Water Development Board*.

<https://www.twdb.texas.gov/about/>.

⁷² Governing. *Water Shortage Tests El Paso's Conservation Efforts*.

<http://www.governing.com/topics/transportation-infrastructure/gov-water-shortage-crisis-puts-el-pasos-conservation-efforts-to-the-test.html>.

⁷³ KRWG. *El Paso Plans For Possible "Toilet To Tap" Water Recycling*.

<http://www.krwg.org/post/el-paso-plans-possible-toilet-tap-water-recycling>.

made by El Paso Water helped El Pasoans become accepting of the changes.⁷⁴ Many other municipalities struggle with getting their residents on board with direct potable reuse due to the “Yuck Factor”.⁷⁵ Big Springs, Texas is one of the first towns in Texas to implement this toilet-to-tap out of necessity and scarcity of water.⁷⁶ Although the treated water is cleaner than what can be taken out of a river, many residents have a hard time overcoming the mental block that the treated water came from sewage.⁷⁷

In order for El Paso to further its conservation efforts, it has implemented alternatives to using freshwater which has required it to overcome the hurdle of numerous regulations and permits. It is estimated that the duration from the beginning of the permitting process to the time a desalination plant is commissioned is approximately 46 months.⁷⁸ Planning for the Kay Bailey Hutchison Desalination Plant began in 2001, an Environmental Impact Statement was submitted in 2004, construction began in 2005, and the plant was not operational until 2007.⁷⁹ El Paso Water Utility’s Advanced Water Purification plant was designed and constructed in the first quarter of 2015, and underwent a nine-month testing period to obtain Texas Commission on Environmental Quality approval.⁸⁰ El Paso Water received approval from Texas Commission on Environmental Quality to

⁷⁴ QUARTZ. *A major US city will start drinking its own sewage. Others need to follow.* <https://qz.com/1353825/a-major-us-city-will-start-drinking-its-own-sewage-others-need-to-follow/>.

⁷⁵ Marketplace. *Texas town closes the toilet-to-tap loop: Is this our future water supply?* <https://www.marketplace.org/2014/01/06/sustainability/texas-town-closes-toilet-tap-loop-our-future-water-supply>.

⁷⁶ Marketplace. *Texas town closes the toilet-to-tap loop: Is this our future water supply?* <https://www.marketplace.org/2014/01/06/sustainability/texas-town-closes-toilet-tap-loop-our-future-water-supply>.

⁷⁷ Marketplace. *Texas town closes the toilet-to-tap loop: Is this our future water supply?* <https://www.marketplace.org/2014/01/06/sustainability/texas-town-closes-toilet-tap-loop-our-future-water-supply>.

⁷⁸ R.W. Beck, Inc. *Guidance Manual for Permitting Requirements in Texas for Desalination Using Reverse Osmosis Facilities Processes.* 7-21.

⁷⁹ Texas Water Development Board. *Desalination Frequently Asked Questions.* <http://www.twdb.texas.gov/innovativewater/desal/faq.asp>.

⁸⁰ Arcadis. *El Paso Advanced Water Purification Facility.* <https://www.arcadis.com/en/united-states/what-we-do/our-projects/north-america/united-states/el-paso-advanced-water-purification-facility/>.

move forward with designing a full-scale direct potable reuse plant but there is not current date to begin construction.⁸¹

The Texas Water Development Board identified four challenges to implementing desalination plants.⁸² The first issue is research and funding.⁸³ The Texas Water Development Board acknowledges that such projects are costly and there is not an abundance of resources, additionally there is a significant lack of research in brackish desalination.⁸⁴ Second, the permitting and regulatory process for desalination is a slightly uncharted area and has not fully been updated since 2004.⁸⁵ Third, technology is continuing to improve and what research has been done on desalination was on technology that is now slightly outdated.⁸⁶ New research needs to be done in Texas, with emphasis put on site-specific parameters. Fourth, the sheer cost alone of desalination plants make them hard for municipalities to include them in their water infrastructure.⁸⁷ There are no set costs for a desalination plant, and much depends on site-specific factors.⁸⁸ It is difficult for municipalities to incorporate desalination plants into their water security due to lack of funding, research, and permitting guidance.

III. Alternative Sources of Freshwater Currently in Place

El Paso Water utilizes freshwater from the Rio Grande, both fresh and brackish water from wells in the Hueco and Mesilla Bolsons, and reclaimed wastewater to service the water needs of El Paso County.⁸⁹ El Paso Water obtains its water rights through the purchase of water rights lands, and leasing water rights from owners in El Paso County.⁹⁰ Currently El Paso Water has

⁸¹ El Paso Water. *Advanced Purification*.

https://www.epwater.org/our_water/water_planning/advanced_purification.

⁸² Texas Water Development Board. *The Future of Desalination in Texas*. 71.

⁸³ Texas Water Development Board. *The Future of Desalination in Texas*. 71.

⁸⁴ Texas Water Development Board. *The Future of Desalination in Texas*. 71.

⁸⁵ Texas Water Development Board. *The Future of Desalination in Texas*. 72.

⁸⁶ Texas Water Development Board. *The Future of Desalination in Texas*. 74.

⁸⁷ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*.

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⁸⁸ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*.

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⁸⁹ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

⁹⁰ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

water rights to about 70,000 acre-feet/year in the Rio Grande River.⁹¹ To combat its water issue, El Paso has supplemented alternatives to freshwater with education and conservation for many years and has reduced the water used per person per day by nearly 80 gallons in a twenty-year span.⁹²

Freshwater from Rio Grande, and the Hueco Mesilla Bolsons

The Jonathon Rogers Water Treatment Plant began operation in 1993 and has the current capacity to treat 60 million gallons of water per day.⁹³ The facility treats water from the Rio Grande to drinking water standards using a combination of physical and chemical processes to remove sediment and to sanitize the water.⁹⁴ The facility primarily serves far east El Paso and the Lower Valley Water District.⁹⁵

The Robertson Water Treatment Plant began operation in 1943 and the Umbenhauer section was added in 1967 to allow for a total 40 million gallons of water to be treated per day.⁹⁶ The plant operates primarily during the irrigation months (March-September) and treats water from the Rio Grande to drinking water standards to serve central and west El Paso.⁹⁷

The Upper Valley Water Treatment Plant was constructed and began operation in 2005 to comply with the Environmental Protection Agency's new standards on the allowable levels of arsenic in drinking water.⁹⁸ The facility treats and combines 30 million gallons of water per day, that is supplied by 21 groundwater wells, with up to an additional 30 million gallons

⁹¹ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

⁹² QUARTZ. *A Major US City Will Start Drinking Its Own Sewage. Others Need to Follow*. <https://qz.com/1353825/a-major-us-city-will-start-drinking-its-own-sewage-others-need-to-follow/>.

⁹³ El Paso Water. *Jonathan Rogers WTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7421563>.

⁹⁴ El Paso Water. *Jonathan Rogers WTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7421563>.

⁹⁵ El Paso Water. *Jonathan Rogers WTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7421563>.

⁹⁶ El Paso Water. *Robertson/Umbenhauer WTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7421580>.

⁹⁷ El Paso Water. *Robertson/Umbenhauer WTP*.

<https://www.epwater.org/cms/One.aspx?portalId=6843488&pageId=7421580>.

⁹⁸ El Paso Water. *Upper Valley WTP*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7422399>.

of untreated water for a final product of an arsenic percentage of 8 parts per billion or less.⁹⁹

IV. Existing Legal Landscape for Developing Alternative Sources of Freshwater

Alternative sources of freshwater are controlled by legal landscapes and permitting schemes on the federal, state, and local levels. Many of the same laws and regulations are applicable to the various types of reuse, but may have a different application and requirements.

A. Federal

There are several federal regulations governing the disposal of wastewater and byproducts from water treatment plants. The United States Environmental Protection Agency delegates the authority to operate some of the federal regulation to the states.¹⁰⁰ Under federal law, desalination projects must obtain source water permits, potable water permits, and waste permits.¹⁰¹

The Clean Water Act classifies water as either domestic or industrial use.¹⁰² Water discharged by desalination plants is classified as industrial waste.¹⁰³ Discharges classified as industrial are required to have a National Pollution Discharge Elimination System (NDPES) permit for surface discharges.¹⁰⁴ Discharges to sewers are not required to obtain a NDPES permit but compliance with the Environmental Protection Agency pretreatment requirements will be necessary.¹⁰⁵ Concentrate disposal by land application has to comply with federal and state regulations to protect

⁹⁹ El Paso Water. *Upper Valley WTP*.

<https://www.epwater.org/cms/one.aspx?portalId=6843488&pageId=7422399>.

¹⁰⁰ United States Environmental Protection Division. *Our Mission*.

<https://www.epa.gov/aboutepa/our-mission-and-what-we-do>.

¹⁰¹ American Legislative Exchange Council. *Government is Giving Desalination a Salty Reception*. <https://www.alec.org/article/government-is-giving-desalination-a-salty-reception-why-every-state-should-care/>

¹⁰² National Academy of Science. *Desalination: A National Perspective*. 152.

¹⁰³ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁰⁴ National Academy of Science. *Desalination: A National Perspective*. 152.

¹⁰⁵ National Academy of Science. *Desalination: A National Perspective*. 152.

groundwater, public health, and crops and vegetation.¹⁰⁶ Land application also requires a permit from state agencies.¹⁰⁷ There are no federal regulations directly governing water reuse.¹⁰⁸ However, the Clean Water Act applies generally to water reuse.¹⁰⁹ Surface discharges by reuse and wastewater treatment plants may also be required to obtain NPDES permits depending on the use.

The Safe Drinking Water Act provides water quality standards to ensure drinking water safety, as well as injection well programs to protect sources of freshwater.¹¹⁰ The Underground Injection Control (UIC) Program protects groundwater by setting guidelines for the construction of injection wells such as the injection depths and the casing and cement quality used in the wells.¹¹¹ The UIC Program applies only to the Kay Bailey Hutchison Facility in El Paso because of their reinjection of concentrate into the ground below the depth of the aquifers.¹¹²

The Resource Recovery and Conservation Act (RCRA) regulates solid waste residuals from water treatment plants.¹¹³ The by-products of desalination plants typically do not qualify as waste under RCRA but some by-products from wastewater treatment plants may.¹¹⁴ Sludge from brackish water sources can contain high levels of anthropogenic toxic compounds such as arsenic and cyanide, classifying them as hazardous waste.¹¹⁵ If a plant produces solids containing arsenic or other hazardous waste RCRA permit may be required.¹¹⁶ Because El Paso Water mixes freshwater with groundwater containing high levels of arsenic instead of simply removing the arsenic, a permit is not required. “RCRA applies to the disposal of the

¹⁰⁶ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁰⁷ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁰⁸ United States Environmental Protection Division. *2017 Potable Reuse Compendium*, 3-1.

¹⁰⁹ United States Environmental Protection Division. *2017 Potable Reuse Compendium*, 4-1.

¹¹⁰ National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹¹ National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹² National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹³ National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹⁴ National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹⁵ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 49 (2016).

¹¹⁶ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 49 (2016).

concentrate and brine discharge to receiving waters”, however El Paso reinjects to the ground through injection wells and not to receiving waters.¹¹⁷

The Solid Waste Disposal Act applies to non-hazardous solid waste and can typically encompass waste that is not covered by RCRA.¹¹⁸ The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is applicable to facilities that have treated, stored, or transferred hazardous waste as defined by RCRA.¹¹⁹

The Hazardous Materials Transportation Act applies to any hazardous residuals from treatment plants that are transported.¹²⁰ The Toxic Substances Control Act (TSCA). This law, controls the sale of toxic chemical substances. This can apply if by-products or concentrate from the treatment plants are defined by the TSCA and sold for reuse.¹²¹

Any proposed federal action that may constitute an effect on the environment must comply with the National Environmental Policy Act (NEPA), including any state projects that are provided federal funding such as the Kay Bailey Hutchison facility.¹²² As part of compliance with NEPA, an Environmental Impact Statement (EIS) must be prepared that includes the need for the proposal, alternatives, the environmental impact of the proposal and alternatives, and a listing of all person and agencies used in consultation.¹²³

“In addition, the USACE administers a permitting program under Section 10 of the Rivers and Harbors Act of 1899 to regulate obstructions to navigable waters (U.S. Army Corps of Engineers Regulatory Program). Depending on the scope of the project, several other entities (NMFS, USCG, NMFS and USFWS) may review the USACE permits. For example, the

¹¹⁷ Tamim Younos, *Permits and Regulatory Requirements*, UNIVERSITIES COUNCIL ON WATER RESOURCES JOURNAL OF CONTEMPORARY WATER RESEARCH & EDUCATION ISSUE 132, PAGES 19-26, DECEMBER 2005, pg 20.

¹¹⁸ National Academy of Science. *Desalination: A National Perspective*. 152.

¹¹⁹ National Academy of Science. *Desalination: A National Perspective*. 152.

¹²⁰ National Academy of Science. *Desalination: A National Perspective*. 153.

¹²¹ National Academy of Science. *Desalination: A National Perspective*. 153.

¹²² United States Environmental Protection Agency. *National Environmental Policy Act Review Process*. <https://www.epa.gov/nepa/national-environmental-policy-act-review-process>.

¹²³ United States Environmental Protection Agency. *National Environmental Policy Act Review Process*. <https://www.epa.gov/nepa/national-environmental-policy-act-review-process>.

USCG may consult and review the USACE permits for their potential impact on navigation, the NMFS may comment on permits that may affect National Marine Sanctuaries and their resources, and the USFWS may also comment on permits that may impact endangered species.”¹²⁴

B. Texas State

Many of the federal environmental programs are now operated by state agencies to comply with the regulations and laws.¹²⁵ Some states that have not been granted complete authority work closely with their regional EPA office to comply with federal regulations.¹²⁶ This process allows the states to have a voice as to where and when discharges can be allowed and even further regulations on waste.¹²⁷

1. Water Recycling

There are no federal regulations directly governing water reuse.¹²⁸ However, the Clean Water Act applies generally to water reuse.¹²⁹ The Safe Water Drinking Act applies to direct potable reuse to ensure the quality of drinking water.¹³⁰ The Texas Commission on Environmental Quality is the state agency responsible for regulating recycled water.¹³¹ Title 30 Chapter 210 of the Texas Administrative Code governs the use of reclaimed water.¹³²¹³³ Title 30 Chapter 321 of the Texas Administrative Code governs

¹²⁴ Tamim Younos, *Permits and Regulatory Requirements*, UNIVERSITIES COUNCIL ON WATER RESOURCES JOURNAL OF CONTEMPORARY WATER RESEARCH & EDUCATION ISSUE 132, PAGES 19-26, DECEMBER 2005, pg 20.

¹²⁵ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹²⁶ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹²⁷ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹²⁸ United States Environmental Protection Division. *2017 Potable Reuse Compendium*. 3-1.

¹²⁹ United States Environmental Protection Division. *2017 Potable Reuse Compendium*. 4-1.

¹³⁰ United States Environmental Protection Division. *2017 Potable Reuse Compendium*. 4-1.

¹³¹ Texas Commission on Environmental Quality. *Requirements for Reclaimed Water*. https://www.tceq.texas.gov/assistance/water/reclaimed_water.html.

¹³² 30 T.A.C. § 210.2.

¹³³ Texas Commission on Environmental Quality. *Reclaimed Water*. https://www.tceq.texas.gov/assistance/water/reclaimed_water.html

the qualifications of the reuse facilities.¹³⁴ In 2012, the Environmental Protection Agency released guidelines for the states to follow to help implement direct potable reuse, giving a brief description of federal regulations, planning considerations, and research needs.¹³⁵ The requirements of the Safe Water Drinking Act are included in Sections 341.031-351 of the Texas Health and Safety Code (THSC) and give the statutory basis for the TCEQ to review and approve any new source of water for potable consumption.¹³⁶ Title 30 Chapter 290 of the Texas Administrative Code provides the regulatory framework for the TCEQ to implement the SWDA and THSC.¹³⁷

The Texas Water Development Board has laid out a brief summary of steps that should be taken for direct potable reuse projects.¹³⁸ However, projects are carried out on a case-by-case basis and there is no exhaustive list of permits required.¹³⁹ It is suggested that each project contact the TCEQ early on, should plan for three months of a pilot test for the programs, and a minimum of two to three years should be anticipated for building approval.¹⁴⁰ El Paso Water Utilities underwent nine months of pilot testing for their facility and are currently still in the process of obtaining building approval from the TCEQ.

2. *Desalination*

The Kay Bailey Hutchison Desalination Plant is the largest inland desalination plant in the United States, and took three years to commission the facility in 2007 after an Environmental Impact Statement was submitted in 2004. The last comprehensive regulatory guideline for desalination in

¹³⁴ 30 T.A.C. § 321.301

¹³⁵ United States Environmental Protection Agency. *2012 EPA Guidelines for Direct Potable Reuse*, 3-30 – 3-32.

¹³⁶ Texas Water Development Board. *2015 TWDB Direct Potable Reuse Resource Document*, 8-2.

¹³⁷ Texas Water Development Board. *2015 TWDB Direct Potable Reuse Resource Document*, 8-2.

¹³⁸ Texas Water Development Board. *2015 TWDB Direct Potable Reuse Resource Document*, 8-7.

¹³⁹ Texas Water Development Board. *2015 TWDB Direct Potable Reuse Resource Document*, 8-6.

¹⁴⁰ Texas Water Development Board. *2015 TWDB Direct Potable Reuse Resource Document*, 8-7.

Texas was completed in 2004 by R.W. Beck in conjecture with the TWDB.¹⁴¹ This is the most recent guideline due to funding.¹⁴² The study provides regulations that need to be followed, a permitting decision model, and an estimated permit timeline for seawater desalination.¹⁴³ This paper relies on the similarities between brackish desalination and seawater desalination.

“A NPDES permit requires numeric limits for contaminants and whole effluent toxicity (WET), receiving water quality provisions, and policies that require the plant discharge be within ten percent of ambient levels of naturally occurring contaminants.”¹⁴⁴ Texas is “delegated to operate the NPDES program in their state.”¹⁴⁵ Discharge to a Water Resources Recovery Facility (WRRF) “wastewater collection system generally requires a permit issued by the local sewer agency use ordinance and will not cause issues with the NPDES discharge permits.”¹⁴⁶ If disposal is to waters of the state, a Texas Pollutant Discharge Elimination System (TPDES) permit is required.¹⁴⁷ If the effluent disposal is for a beneficial land use, a Texas Land Application Permit (TLAP) permit is needed.¹⁴⁸

The prevailing government agency in Texas that oversees environmental concerns is the Texas Commission on Environmental Quality (TCEQ). The Texas Administrative Code Title 30 Part 1 Chapter 331 controls Injection Well Permits required by TCEQ for the injection of brackish water

¹⁴¹ Telephone Interview with Erika Mancha, Manager for Innovative Water Technologies, Aquifer Storage and Recovery, Desalination, Water Reuse, Texas Water Development Board (April 8, 2019).

¹⁴² Telephone Interview with Erika Mancha, Manager for Innovative Water Technologies, Aquifer Storage and Recovery, Desalination, Water Reuse, Texas Water Development Board (April 8, 2019).

¹⁴³ R.W. Beck, Inc. *Guidance Manual for Permitting Requirements in Texas for Desalination Using Reverse Osmosis Facilities Processes*. 7-1.

¹⁴⁴ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁴⁵ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁴⁶ Michael Mickley & Nikolay Voutchkov, *Database of Permitting Practices for Seawater Desalination Concentrate*: Final Report, 48 (2016).

¹⁴⁷ Texas Commission on Environmental Quality. *Permits for Municipal Wastewater Treatment Plants: Learning More*.

<https://www.tceq.texas.gov/agency/decisions/participation/permitting-participation/municipal-wastewater>.

¹⁴⁸ Texas Commission on Environmental Quality. *Permits for Municipal Wastewater Treatment Plants: Learning More*.

<https://www.tceq.texas.gov/agency/decisions/participation/permitting-participation/municipal-wastewater>.

into geological formations.¹⁴⁹ Additionally, the TCEQ requires permits and requires permits and reports for water quality, water rights, air quality, and impacts to the land. All reclaimed water use and discharge require a permit through the TCEQ.¹⁵⁰

The Texas Water Development Board (TWDB) requires all water utility companies to submit a water conservation plan that includes population, water use data, proposed future plan, water supply system, wastewater systems, and conservation efforts.¹⁵¹ The Texas Department of Transportation (TxDOT) requires permits for any facility crossing a right of way or road that TxDOT owns, any change to existing permits also require a change of permit.¹⁵² The Texas Parks & Wildlife Division (TPWD) requires a permit to dig or remove parts of a of certain streambeds if the stream is perennial or is more than thirty feet wide even if it is dry the majority of the year.¹⁵³ Texas streambeds are considered state-owned and must be given access to use or modify through TPWD permits. The Texas Department of Licensing and Regulation requires that all facilities are compliant with the Americans with Disabilities Act (ADA). The Texas Historical Commission (THC) enforces the National Historic Preservation Act on projects that require compliance with the law such as federal development, municipal wastewater treatment facilities that require TCEQ or EPA compliance, and new highway construction that utilizes federal funds.¹⁵⁴

C. Local

El Paso has its own local permits that are required, but none specifically speak to desalination facilities or recycling facilities, they are general building permits. Applications for the permits can be found on the “Planning and Inspection” page of the city website.¹⁵⁵ Typical building

¹⁴⁹ 30 T.A.C. § 331.

¹⁵⁰ Texas Commission on Environmental Quality. *Requirements for Reclaimed Water*. https://www.tceq.texas.gov/assistance/water/reclaimed_water.html.

¹⁵¹ 31 T.A.C. § 363.15

¹⁵² Texas Department of Transportation. *Right-of-Way Forms*. <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/row.html>.

¹⁵³ Texas Parks and Wildlife. *Land & Water FAQ - Marl, Sand, Gravel, Shell or Mudshell Permits*. https://tpwd.texas.gov/faq/landwater/sand_gravel/.

¹⁵⁴ Texas Historical Commission. *National Historic Preservation Act*. <http://www.thc.texas.gov/project-review/national-historic-preservation-act>.

¹⁵⁵ The City of El Paso. *Planning and Inspections*. <https://www.elpasotexas.gov/planning-and-inspections/applications>.

permits include zoning and building permits, tree removal, erosion prevention, road crossings and easements, and well drilling permits from the Groundwater Conservation District.¹⁵⁶

Recycling

Texas State Regulations as well as regulations by El Paso's Public Service Board require compliance with PURPLE color coding for the use of reclaimed water that is not drinking water quality.¹⁵⁷ All irrigation pipeline must be in purple, and all above ground faucets must be in a purple locked box.¹⁵⁸ Additionally, all locations using reclaimed water must have a warning sign in both English and Spanish, on a purple background, in yellow or white lettering.¹⁵⁹ The number of signs required to comply with the regulation is dependent upon the size of the property, the amount of access points, and how frequently the location is trafficked.¹⁶⁰

V. Policy landscape for developing alternative sources of freshwater

As the second largest state in the country, and with much of the state being in an arid desert climate, Texas has suffered through drinking water shortages.¹⁶¹ Texas overlays a significant network of aquifers, but growing concerns of draining these aquifers in times of need has led to conservation efforts and the development of alternative sources to freshwater.¹⁶²

Texas has long experienced periodic draughts, and a 1996 draught caused the state billions of dollars and resulted in a move towards municipal

¹⁵⁶ R.W. Beck, Inc. *Guidance Manual for Permitting Requirements in Texas for Desalination Using Reverse Osmosis Facilities Processes*. 6-2 to 6-13.

¹⁵⁷ El Paso Water. *Reclaimed Water Regulatory Requirements*.

https://www.epwater.org/our_water/resources/reclaimed_water_regulatory_requirements.

¹⁵⁸ El Paso Water. *Reclaimed Water Regulatory Requirements*.

https://www.epwater.org/our_water/resources/reclaimed_water_regulatory_requirements.

¹⁵⁹ El Paso Water. *Reclaimed Water Regulatory Requirements*.

https://www.epwater.org/our_water/resources/reclaimed_water_regulatory_requirements.

¹⁶⁰ El Paso Water. *Reclaimed Water Regulatory Requirements*.

https://www.epwater.org/our_water/resources/reclaimed_water_regulatory_requirements.

¹⁶¹ John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 140 (2017).

¹⁶² John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 140-41 (2017).

water rationing and planning.¹⁶³ El Paso receives approximately 48% of water from the aquifers that it overlays, but growing concerns of draining the aquifers have led the city to look to reuse and desalination.¹⁶⁴ El Paso can also no longer rely on the Rio Grande to provide water with the severe droughts.¹⁶⁵ Historically water planning in Texas focused on groundwater, surface water, and conservation.¹⁶⁶ In 1985, Texas amended its water assistance statutes to encourage water quality and enhancement projects, including desalination.¹⁶⁷ Since the 1980s El Paso residents have cut water use per capita by 30%.¹⁶⁸ In 1989 the Texas Water Development Board made a prediction that El Paso would run out of water by 2020.¹⁶⁹ In 1997, Texas created 16 Regional Water Planning Areas to better plan water conservation efforts.¹⁷⁰ Each region is required to submit a 50-year water plan to the Texas Water Development Board for approval every five years.¹⁷¹ In 2007, El Paso opened a Water Resources Learning Center that offers interactive exhibits to increase water conservation awareness.¹⁷² El Paso offered incentives and rebates, as well as municipal conservation laws to help educate the public and allow them to be more receptive of using alternatives to freshwater sources.¹⁷³

VI. Analysis

The current legal and regulatory landscape in place is not the most conducive to developing alternative sources of freshwater. There are numerous permits on the federal and state level, and there is no one place to

¹⁶³ John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 141 (2017).

¹⁶⁴ El Paso Water. *Our Aquifers*.

https://www.epwater.org/our_water/water_resources/our_aquifers.

¹⁶⁵ El Paso Water. *Water Resources*. https://www.epwater.org/our_water/water_resources.

¹⁶⁶ John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 141 (2017).

¹⁶⁷ John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 141 (2017).

¹⁶⁸ El Paso Water. *Our History of Conservation*.

https://www.epwater.org/conservation/Billions_of_Gallons_Saved.

¹⁶⁹ KLTV. *Climate Change Drying Up Rio Grande River Experts Say*.

<http://www.kltv.com/2018/11/30/climate-change-drying-up-rio-grande-river-experts-say/>.

¹⁷⁰ John Duff, Victoria LaBate, & Anne M. Slugg, *Prospects and Pitfalls of Desalination Development: Insights from Three States*, 22 *Ocean & Coastal L. J.* 130, 141 (2017).

¹⁷¹ El Paso Water. *Water Planning*. https://www.epwater.org/our_water/water_planning.

¹⁷² El Paso Water. *Our History of Conservation*.

https://www.epwater.org/conservation/Billions_of_Gallons_Saved.

¹⁷³ El Paso Water. *Our History of Conservation*.

https://www.epwater.org/conservation/Billions_of_Gallons_Saved.

find every single one. While all of the laws and regulations are in place to protect the safety of the environment and of the citizens of the United States, they are difficult to traverse and hinder the process. The most comprehensive document that compiled a list of permits for desalination was done by R.W. Beck and focuses on seawater desalination and has not been updated since 2004. The current policy framework does support the development of these resources. We are in a time that the United States is recognizing the importance of conservation of resources and sustainability for future generations.

Texas requires each Regional Water Planning Area to submit a water plan every five years. This forces the areas to look into how their water resources are being used, a prediction of available resources, and future conservation efforts. By being required to compile this information, it helps these districts to truly look at their resources and recognize if there is an issue and address what changes need to be made.

What appears to be one of the more difficult situations in El Paso is navigating water rights. Texas is a rule of capture state for groundwater, and many aquifers span several groundwater conservation districts and Regional Water Planning Areas. Each area is allowed to use the aquifer as they like and while some will try to conserve the aquifers, others will deplete it instead of looking to alternatives to freshwater. El Paso has turned to alternative resources of freshwater out of necessity, it is in a desert and does not receive its full allotment from the Rio Grande. At one point the Texas Water Development Board determined that the city would run out of water by 2020 if no changes were made. It was not because the legal landscape is easy to navigate, or because this technology is cheap, the conservation efforts came out of a necessity and a will to survive.

The current regulatory landscape for developing water use facilities has its benefits and drawbacks. These regulations appear to provide for safer drinking water and use of the water, as well as give the government control as to the conservation of the resources. Water recycling does not have little public perception to overcome. Due to El Paso's efforts, many of the citizens are educated on the necessity of alternative resources and are welcome to the change. Also, because of the amount of land El Paso has, city does not have to fight "not in my backyard" arguments because it is easy to place these

plants out of sight. Water quality requirements are not only feasible, but El Paso exceeds the quality standards.¹⁷⁴

Desalination plant permitting process is heavily regulated by both federal and state agencies. The permitting process is lengthy, but is due to safety concerns. The Kay Bailey Hutchison plant took six years to complete, including three years to prepare the Environmental Impact Statement. The time commitment is worth the wait because of the volume of water that the facility can process, and because of the comparative volume of brackish water to freshwater that is in the aquifers. While the public may not completely understand the process or why, they do not appear to have a negative opinion of desalination and realize it is a necessity if they want more freedom with their water uses.

For both reuse and desalination, the permitting process is not easy to navigate. There are a series of regulations that are governed at the federal level, and some at the state, and some that the federal government has delegated to the state. However, all of these permits are available and do not hinder the development of the technology outside of the amount of time that the permitting process takes. El Paso is seeing the benefits of putting the effort in to create these facilities and find alternative sources to freshwater, however it would be a benefit if all permits were regulated by a singular body.

It appears that the actual permitting process for both desalination and recycling is not difficult, it is just that not all the permits are located in one place. There has not been a comprehensive permitting scheme published for direct potable reuse in Texas. One of the difficulties is that each facility is on a case-by-case basis and requires consulting with the TCEQ to find out what permits will be necessary. There has been a comprehensive permitting scheme published for desalination but it focuses mostly on seawater desalination, and it appears most scholarship focuses on seawater due to its abundance. An issue with seawater desalination is that it is expensive to transport the desalinated water after being filtered and inland desalination plants would be most practical for the majority of the United States in need of freshwater. Municipalities and organizations know what agencies to contact and consult for what permits are needed, however there is no simple step-by-step list of permits that are needed. Both desalination and direct potable reuse require a pilot period, but that information has been published

¹⁷⁴ El Paso Water. *Chemical Analysis – City Water*.
https://www.epwater.org/UserFiles/Servers/Server_6843404/File/Our%20Water/Water%20Quality/chemanalysis.pdf.

and so has an estimated timeline for how long the permitting process will take.

As more information is collected in the future, more in depth cost analysis can be done. There are estimates that the upfront costs of building freshwater alternative facilities such as desalination and reuse result in cost savings on the back end. With these large urban regions being able to process large volumes of water, there could be an option of providing processed water to regions and towns that do not have the infrastructure to build the facilities themselves. Additionally, as more research is done, the by products of these facilities could be used or sold into different industries if regulations allow.

VII. Conclusion

Located in the northern extreme of the Chihuahuan Desert, El Paso, Texas only receives nine inches of rainfall on average. In recent years, El Paso has not received its full allotment of water from the Rio Grande, and in some months the water is only available for two months out of the year. El Paso is continuing to see a rise in population, and requires the city to use its water resources efficiently. El Paso is one of the more progressive cities as to water conservation and the diversity of water resources. The use of desalinated and recycled water is a viable method to supple water resources. While the permitting process is a massive hurdle to overcome, alternative sources to freshwater are completely viable. Although the upfront costs to reuse and desalination plants are high, the implementation of such plants actually lead to savings in overall water supply costs and environmental effects. Part of what has made El Paso so successful is their education measures and gradual conservation efforts. By implementing alternatives to freshwater technologies, will remain self-sufficient in the region and by growing their facilities will be able to reduce the reliance on the Rio Grande and freshwater from the aquifers and possibly even supply water to surrounding towns.

SAN ANTONIO, TEXAS

CASE STUDY

By: Alexandra Lauren Lizano

I. Introduction

Local governance regimes determine pathways for the implementation of water reuse and desalination policy and projects. These regimes both facilitate and constrain the adoption of such technologies. Some challenges to sustainable outcomes include institutional fragmentation, lack of public trust, limited long-term strategic planning, poor leadership, lagging regulation, and failed stakeholder participation. This article will examine the legal frameworks that have affected desalination and water reuse in San Antonio, TX.

The article aims to provide a critical institutional understanding that offers insight into the legal and regulatory barriers, challenges, and opportunities for these technologies to go online. Water reuse faces a considerable amount of legal and regulatory challenges related to wastewater treatment, water quality standards, and the effects of reuse on the total maximum daily loads (TMDLs) from discharges. Each implementation site of desalination and water reuse has had to find ways of complying with various laws and regulations.

II. Background

A. Local Information

Located in Bexar County, Texas,¹⁷⁵ San Antonio is the second largest city in Texas and the seventh largest in the United States.¹⁷⁶ 2018 U.S. Census

¹⁷⁵ *City of San Antonio*, BEXAR.ORG, <https://www.bexar.org/1666/City-of-San-Antonio>.

¹⁷⁶ *Water City SA, 2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 14 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

data accounted for a population of over 1.5 million people.¹⁷⁷ However, San Antonio is continuing to add people to its population—it was the fastest growing city in the nation between 2016 and 2017.¹⁷⁸ The estimated population for the year 2070 is 3.3 million.¹⁷⁹ A growing population places greater demands on water supplies.

San Antonio’s climate is classified as “humid subtropical.”¹⁸⁰ This means that “[h]eat and humidity characterize the San Antonio summer months, with colder temperatures in the winter.”¹⁸¹ It is difficult to obtain annual rainfall data because rainfall is “highly variable.”¹⁸² San Antonio’s climate does not lend itself to predictable water supplies.¹⁸³ The 30-year annual average for rainfall in San Antonio is 32 inches.¹⁸⁴ However, this average is skewed because “long dry periods can be punctuated by some of the highest rainfall intensities in the world.”¹⁸⁵ This affects the water available to percolate for groundwater recharge. “Extreme weather can reduce availability of some water supplies, while concurrently increasing

¹⁷⁷ U.S. Census, *San Antonio*, U.S. CENSUS BUREAU, <https://www.census.gov/quickfacts/fact/table/sanantoniocitytexas/LND110210#LND110210>.

¹⁷⁸ Candace Evans, *San Antonio is Enjoying the Country's Largest Population Boom -- And Business is a Big Reason Why*, FORBES.COM (Jul. 13, 2018), <https://www.forbes.com/sites/candaceevans/2018/07/13/largest-population-boom-in-the-country-is-in-san-antonio-texas-because-business/#19d8cf2b4bdf>

¹⁷⁹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 26 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf

¹⁸⁰ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf; *Monthly Weather Forecast and Climate San Antonio, TX*, WEATHER ATLAS, https://www.weather-us.com/en/texas-usa/san-antonio-climate#climate_text_1.

¹⁸¹ San Antonio Missions Weather, NAT’L PARK SERV., <https://www.nps.gov/saan/learn/nature/weather.htm>.

¹⁸² Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf

¹⁸³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁸⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁸⁵ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

demand for water (or vice versa).¹⁸⁶ Therefore, in periods of extreme drought when there is less water available to recharge aquifers, and more competing interests needing water, it strains the aquifer in unsustainable ways. “The combined impacts of geography, geology and climate impact both water supply and water demand in complex ways.”¹⁸⁷ Therefore, San Antonio has put significant effort into diversifying its water supply.¹⁸⁸

The Edwards Aquifer is the primary source of freshwater for San Antonio.¹⁸⁹ The Edwards Aquifer is “is one of the most permeable and most productive aquifers in the world.”¹⁹⁰ The Edwards Aquifer covers about 8,000 square miles in the San Antonio region “and includes all or part of 13 counties in south central Texas.”¹⁹¹ San Antonio has 92 wells that pump about “136.50 million gallon per day or 418 acre-feet” per day, on average from the Edwards Aquifer.¹⁹²

To a lesser degree, San Antonio relies on three other aquifers that underlie the region; however, this seems to pale in comparison to the Edwards Aquifer.¹⁹³ The San Antonio Water System (“SAWS,” discussed *infra*

¹⁸⁶ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁸⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁸⁸ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁸⁹ San Antonio Water System, *Where Your Water Comes From*, SAWS.ORG, <https://www.saws.org/your-water/>.

¹⁹⁰ U.S. Geological Survey, *Edwards Aquifer Studies in Texas*, USGS, https://www.usgs.gov/centers/tx-water/science/edwards-aquifer-studies-texas?qt-science_center_objects=0#qt-science_center_objects.

¹⁹¹ San Antonio Water System, *About the Edwards Aquifer*, SAWS.ORG, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/edwards-aquifer/about-the-edwards-aquifer/>.

¹⁹² San Antonio Water System, *About the Edwards Aquifer*, SAWS.ORG, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/edwards-aquifer/about-the-edwards-aquifer/>.

¹⁹³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

section on stakeholders) characterizes the Edwards Aquifer as the “cornerstone source” of San Antonio’s water supply.¹⁹⁴

However, the demand placed on the Edwards Aquifer is intense. The Edwards Aquifer does not just serve San Antonio, but it is also the sole-source aquifer for Austin, Texas.¹⁹⁵ “The competition for ground water from the Edwards aquifer has created some controversial water issues in central Texas.”¹⁹⁶ Competing interests include: farming and ranching, recreation, and serving as critical habitat for endangered species.¹⁹⁷

B. Local Context

The Edwards Aquifer has always been the source of water for the San Antonio area.¹⁹⁸ It was the Edwards Aquifer that filled the San Pedro and San Antonio springs, which led Native Americans to settle in the area hundreds of years ago.¹⁹⁹ The availability of water is also what attracted Spanish settlers to San Antonio in 1718.²⁰⁰

Around 1720, irrigation canals became the mechanism of water distribution in the area. These canals are also called acequías and served both irrigation and domestic consumption purposes.²⁰¹ Rudimentarily, the canals also served as a sewer system since early populations would dispose of waste

¹⁹⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

¹⁹⁵ U.S. Geological Survey, *Edwards Aquifer Studies in Texas*, USGS, https://www.usgs.gov/centers/tx-water/science/edwards-aquifer-studies-texas?qt-science_center_objects=0#qt-science_center_objects.

¹⁹⁶ U.S. Geological Survey, *Edwards Aquifer Studies in Texas*, USGS, https://www.usgs.gov/centers/tx-water/science/edwards-aquifer-studies-texas?qt-science_center_objects=0#qt-science_center_objects.

¹⁹⁷ U.S. Geological Survey, *Edwards Aquifer Studies in Texas*, USGS, https://www.usgs.gov/centers/tx-water/science/edwards-aquifer-studies-texas?qt-science_center_objects=0#qt-science_center_objects.

¹⁹⁸ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

¹⁹⁹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁰ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰¹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

into the canals and then would flow downstream.²⁰² In 1836, officials designated one of the canals exclusively for drinking and cooking water to stop the sewage disposal and impose penalties on those who used the canal inappropriately.²⁰³ In 1866, an extreme cholera epidemic propelled San Antonio to work to establish a safe water supply system.²⁰⁴

In 1877, San Antonio agreed to contract with J.B. LaCoste and Associates for LaCoste to create a pump system near the headwaters of the San Antonio River.²⁰⁵ The water pressure from the river operated a pump which took the water from the river to a reservoir.²⁰⁶ Gravity then coaxed the water into the distribution system.²⁰⁷ However, six short years later in 1883, George W. Brackenridge's company acquired the water system.²⁰⁸ The Brackenridge company determined that the springs in the area were likely originating from an underground reservoir and drilled wells to obtain water.²⁰⁹ This correctly assumed the presence of an aquifer, which the Brackenridge company linked directly to the water distribution system.²¹⁰

There were several changes of ownership and name in the early 1900s, including a brief period of time when a Belgian syndicate owned the supply system.²¹¹ However, the City of San Antonio ("City") felt the tensions between foreign ownership and local interests come to a head in 1924.²¹² After that, the City issued \$7 million in bonds to purchase the water system

²⁰² *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰³ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁴ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁵ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁶ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁷ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁸ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²⁰⁹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁰ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹¹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹² *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

and retain local control over the water supply.²¹³ By June of 1925, the City created a utility board—the City Water Board—to manage pumping 25 million gallons per day to about 38,000 customers in the City.²¹⁴ Separately, the City Water Board was also attempting to construct a sewage treatment plant.²¹⁵

Throughout the Great Depression-era and war years, the City Water Board saw a lot of success in maintaining water supply and meeting demand.²¹⁶ However, the post-war economic boom coupled with a significant drought period put the City Water Board in a tight position, struggling to meet demand.²¹⁷ In 1954, the Board of Trustees for the City Water Board hired a private consulting engineering firm to make recommendations for improvement.²¹⁸ Financial difficulty posed a problem for the city, but a voter approved bond of \$21 million helped modernize the entire water utility system.²¹⁹

In the time period from the 1960s to the 1980s, San Antonio only saw continued growth and increased demand for water and wastewater systems.²²⁰ This primed San Antonio to create the San Antonio Water System (“SAWS,” discussed *infra* Stakeholders).²²¹ SAWS is currently the entity that manages San Antonio’s water, wastewater, and water recycling in San Antonio today.²²²

²¹³ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁴ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁵ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁶ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁷ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁸ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²¹⁹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²⁰ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²¹ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²² *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

C. Stakeholders

1. San Antonio Water System (“SAWS”)

SAWS is the combination of three related, but previously independently functioning city departments and agencies—the City Water Board, the City Wastewater Department, and the Alamo Water Conservation and Reuse District.²²³ It is now SAWS’ responsibility to manage the city-owned water supply utility, the sewage collection and treatment facilities, and the city’s recycled wastewater treatment.²²⁴ Additionally, “[a]n important component of SAWS’ planning role is the responsibility to protect the purity of the city’s water supply coming from the Edwards Aquifer[.]”²²⁵ SAWS is therefore one of the most involved and invested stakeholders in San Antonio’s water supply and distribution.

2. Texas Water Development Board (“TWDB”)

The Texas Water Development Board was created by legislation and supported by a Constitutional Amendment in 1957.²²⁶ “TWDB is to provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water in Texas.”²²⁷ Importantly, the TWDB provides loans to develop water supply projects, studies the availability of ground and surface water, and manages the state’s water plan.²²⁸ As such, SAWS and the City of San Antonio rely on TWDB for both financial assistance and resource information for developing water supply diversity like desalination and water recycling.

²²³ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²⁴ *See History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²⁵ *History & Chronology*, SAWS.ORG, <https://www.saws.org/about-saws/history-chronology/>.

²²⁶ *About the Texas Water Development Board*, TEX. WATER DEVELOPMENT BD., <https://www.twdb.texas.gov/about/>.

²²⁷ *About the Texas Water Development Board*, TEX. WATER DEVELOPMENT BD., <https://www.twdb.texas.gov/about/>.

²²⁸ *About the Texas Water Development Board*, TEX. WATER DEVELOPMENT BD., <https://www.twdb.texas.gov/about/>.

3. Texas Commission on Environmental Quality (“TCEQ”)

TCEQ is the head environmental agency in the state of Texas.²²⁹ TCEQ is tasked with monitoring the quality of surface water, defining standards for water quality, permitting discharges to Texas water, and restoring water quality when necessary.²³⁰ TCEQ is often the permitting authority with respect to projects that will affect water quality or supply.²³¹ Entities like SAWS need to work with TCEQ to secure the necessary permits for building and operating desalination and water recycling plants.

4. San Antonio Residents

The residents of San Antonio, the recipients of water, have a vested interest in the development of diversified water supplies. SAWS took an extraordinarily proactive role in water conservation awareness with its consumers.

In the 1990s, the Sierra Club sued the City of San Antonio because allegedly the amount of water the City was using amounted to a “taking” of the endangered species in the area.²³² While ultimately reversed by the Fifth Circuit, the Western District of Texas granted an injunction which ordered San Antonio to make reductions.²³³ The lower court commented, “[w]ithout a fundamental change in the value the region places on fresh water, a major effort to conserve and reuse Aquifer water, and implemented plans to import supplemental supplies of water, the region's quality of life and economic future is imperiled.”²³⁴ The injunction was overturned by the Fifth Circuit for

²²⁹ *About Us*, TEX. COMM’N ON ENVIRONMENTAL QUALITY, <https://www.tceq.texas.gov/agency/about-the-tceq>.

²³⁰ *Water Quality Program Successes*, TEX. COMM’N ON ENVIRONMENTAL QUALITY, <https://www.tceq.texas.gov/waterquality/watersuccess/waterqualitysuccess>.

²³¹ *Water Quality Program Successes*, TEX. COMM’N ON ENVIRONMENTAL QUALITY, <https://www.tceq.texas.gov/waterquality/watersuccess/waterqualitysuccess>.

²³² See generally *Sierra Club v. City of San Antonio*, 112 F.3d 789, 792 (5th Cir. 1997); Louisa C. Brinsmade, *Nature’s Water Clinic*, AUSTIN CHRONICLE (July 26, 1996), <https://www.austinchronicle.com/news/1996-07-26/532325/>.

²³³ *Sierra Club v. City of San Antonio*, 112 F.3d 789, 792 (5th Cir. 1997).

²³⁴ *Sierra Club v. City of San Antonio*, 112 F.3d 789, 792 (5th Cir. 1997) (quoting the Western District of Texas opinion) (brackets included in original quotation).

procedural deficiencies,²³⁵ but the lawsuit triggered massive legislative and policy considerations about water conservation.²³⁶

The City “installed more than 130 miles of pipelines” that used recycled water to maintain golf courses, parks, industrial customers, and the River Walk.²³⁷ It created an aquifer storage recovery program.²³⁸ “[I]t replaced 250,000 older toilets and urinals with more water-efficient models.”²³⁹ San Antonio residents get cash rebates on water bills, which encouraged citizens to cut down on water use and increase drought-resistant landscapes.²⁴⁰ While the lawsuit may have triggered the policies, the global community is taking note.²⁴¹ San Antonio may have been “forced to see this [referring to new water policy] as hugely important faster than most cities . . . more people are living in urban communities than rural ones, and providing safe and clean and cheap water for these people in cities in a global challenge.”²⁴² Importantly, “San Antonio’s water policies and program[s] can be a model for cities all over the world.”²⁴³

²³⁵ See *Sierra Club v. City of San Antonio*, 112 F.3d 789 (5th Cir. 1997).

²³⁶ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²³⁷ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²³⁸ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²³⁹ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²⁴⁰ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²⁴¹ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

²⁴² *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander> (quoting San Antonio Mayor, Ron Nirenberg).

²⁴³ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander> (quoting San Antonio Mayor, Ron Nirenberg).

Uniquely, San Antonio residents are intimately familiar with the Edwards Aquifer and the level at which they can expect extreme drought restrictions.

While most Americans can't even name the source of their drinking water, many San Antonians know not just their water source—an underground limestone formation called the Edwards Aquifer—but its height above sea level. That's because that level, which is posted every day on the city water authority's website, determines whether they can sprinkle their lawns — and whether the water police are likely to be out in full force.²⁴⁴

This benchmark height above sea level measurement is called J-17.²⁴⁵ San Antonio residents know that 660 feet above sea level is the magic number.²⁴⁶ Any lower than 660 feet triggers drought restrictions on the entire city.²⁴⁷ Wade Goodwyn, an interviewer for NPR News reported, “[u]nlike the lush lawns in Dallas and Houston, there are yellow lawns everywhere you look in San Antonio. The entire city has a different mindset. Neighbors narc out the cheaters next door to the water cops. After a warning, fines are steep. In San Antonio, everyone's in it together whether they want to be or not.”²⁴⁸

Because these drought restrictions will affect residents, namely if they will be cited for water use restriction violations, the average San Antonio citizen has a heightened awareness of water levels in the Edwards Aquifer and water use restrictions.

²⁴⁴ Sandra Postel, *Conservation in San Antonio is Saving More than Water*, NAT'L GEOGRAPHIC (July 14, 2011), <https://blog.nationalgeographic.org/2011/07/14/conservation-in-san-antonio-is-saving-more-than-water/>.

²⁴⁵ Louisa C. Brinsmade, *Nature's Water Clinic*, AUSTIN CHRONICLE (July 26, 1996), <https://www.austinchronicle.com/news/1996-07-26/532325/>.

²⁴⁶ Louisa C. Brinsmade, *Nature's Water Clinic*, AUSTIN CHRONICLE (July 26, 1996), <https://www.austinchronicle.com/news/1996-07-26/532325/>.

²⁴⁷ Louisa C. Brinsmade, *Nature's Water Clinic*, AUSTIN CHRONICLE (July 26, 1996), <https://www.austinchronicle.com/news/1996-07-26/532325/>.

²⁴⁸ Scott Simon, *Recycled Water Quenches San Antonio's Thirst*, NPR NEWS (Oct. 1, 2011), <https://www.npr.org/transcripts/140937267>.

5. Edwards Aquifer Authority

The Edwards Aquifer Authority (“EAA”) is the groundwater conservation district that authorizes the withdrawals and use of the groundwater in the aquifer.²⁴⁹ In 1993, a lawsuit authorized the federal government through the U.S. Fish and Wildlife Service (“USFWS”) to set “minimum spring flow standards” on two of the largest streams in Texas and the entire U.S. southwest—the San Marcos and Comal Springs.²⁵⁰ In order to avoid the USFWS taking control of the Edwards Aquifer, the Texas Legislature created the EAA.²⁵¹ “By mandating a capped permitting system that limits withdrawals from the aquifer, the [Edwards Aquifer] Act was intended to preserve the resource while also protecting threatened and endangered species in the aquifer-fed Comal and San Marcos springs to the extent required by federal law.”²⁵² Because the EAA is the body responsible for managing the Edwards Aquifer, including allocating groundwater permits and use restrictions, it has a significant role in San Antonio’s water supply.

6. Edwards Aquifer Habitat Conservation Plan

Those with conservation concerns regarding the endangered species in the area are a predominant stakeholder group.²⁵³ In 2006, regional stakeholders met with the USFWS and initiated a habitat conservation plan for the species.²⁵⁴ Commonly referred to by its acronym, the Edwards Aquifer Habitat Conservation Plan (“EAHCP”), has incentivized a more protective balance between species habitat and groundwater use.²⁵⁵ The EAHCP is in place until 2027²⁵⁶ contractually requires SAWS to reduce its reliance on the

²⁴⁹ Edwards Aquifer Authority, *About*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaaf/>.

²⁵⁰ Joe Nick Patoski, *The Edwards Aquifer & the EAA*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaaf/history/>.

²⁵¹ See Joe Nick Patoski, *The Edwards Aquifer & the EAA*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaaf/history/>.

²⁵² Edwards Aquifer Authority, *About*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaaf/>.

²⁵³ City of New Braunfels, *Edwards Aquifer Habitat Conservation Plan*, NBTexas.ORG, <https://www.nbtexas.org/1867/Habitat-Conservation-Plan>.

²⁵⁴ City of New Braunfels, *Edwards Aquifer Habitat Conservation Plan*, NBTexas.ORG, <https://www.nbtexas.org/1867/Habitat-Conservation-Plan>.

²⁵⁵ Joe Nick Patoski, *The Edwards Aquifer & the EAA*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaaf/history/>.

²⁵⁶ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 18 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

Edwards Aquifer when one of two “triggers” occurs.²⁵⁷ The first trigger is if J-17 falls below 630 feet.²⁵⁸ The second trigger is if the “rolling 10 year average of the Edwards Aquifer recharge falling below 500,000 [acre feet per year].”²⁵⁹ As such, the EAHCP has significant influence on whether SAWS can use its water rights to the fullest extent.

III. Alternative Sources of Freshwater

A. Freshwater Sources

1. Edwards Aquifer

San Antonio heavily relies on the Edwards Aquifer for groundwater to sustain the population in the region.²⁶⁰ “The Edwards Aquifer has been, and will continue to remain, the cornerstone of San Antonio’s water supply.”²⁶¹ Currently, SAWS is the groundwater permit holder for San Antonio’s groundwater supply.²⁶² This permit is issued by the Edwards Aquifer Authority and allows SAWS to pump “292,000 acre-feet per year of Edwards Aquifer groundwater, with approximately 88[%] of this amount owned and the remainder under lease to SAWS.”²⁶³

²⁵⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 82 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁵⁸ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 82 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁵⁹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 82 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶⁰ *About the Edwards Aquifer*, CITY OF SAN ANTONIO, <https://www.sanantonio.gov/EdwardsAquifer/About>.

²⁶¹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶² Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

2. Aquifer Storage and Recovery

SAWS operates an Aquifer Storage and Recovery (ASR) facility.²⁶⁴ The ASR facility allows for storage of Edwards Aquifer water during “wet times” when there is a lot of water and little demand.²⁶⁵ That storage can then be used when the aquifer has less water or demand is high.²⁶⁶ While San Antonio does have an ASR facility, the technicalities and regulations related to ASR are largely outside of the scope of this research study.

3. Carrizo Aquifer Groundwater

The Carrizo-Wilcox Aquifer extends lengthwise across Texas from the Louisiana border to Mexico. The groundwater that comes from this aquifer is “hard” groundwater.²⁶⁷ Hard groundwater is the term used to describe groundwater that has high levels of magnesium and calcium.²⁶⁸ Hard water is often undesirable for domestic purposes because the minerals can leave deposits inside pipes.²⁶⁹ Despite being “hard” groundwater, the water is usually fresh and therefore valuable.²⁷⁰ SAWS retains the right to pump groundwater from the Carrizo-Wilcox Aquifer because it owns property in other counties that overlie the aquifer.²⁷¹ The following chart describes the amounts of water that SAWS retains from the Carrizo-Wilcox Aquifer.

²⁶⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 20 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶⁵ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 20 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶⁶ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 20 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁶⁷ *Carrizo-Wilcox Aquifer*, TEX. WATER DEVELOPMENT BD., <http://www.twdb.texas.gov/groundwater/aquifer/majors/carrizo-wilcox.asp>.

²⁶⁸ *Quality of Groundwater*, U.S. GEOLOGIC SERVICE, <https://pubs.usgs.gov/gip/gw/quality.html>.

²⁶⁹ *Quality of Groundwater*, U.S. GEOLOGIC SERVICE, <https://pubs.usgs.gov/gip/gw/quality.html>.

²⁷⁰ *Carrizo-Wilcox Aquifer*, TEX. WATER DEVELOPMENT BD., <http://www.twdb.texas.gov/groundwater/aquifer/majors/carrizo-wilcox.asp>.

²⁷¹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 21 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

County	Amount of Groundwater
Bexar County	9,900 acre-feet per year ²⁷²
Gonzales County	11,688 acre-feet per year ²⁷³
Gonzales & Guadalupe Counties (through a contract with Canyon Regional Water Authority)	2,800 acre-feet per year ²⁷⁴

4. Trinity Aquifer

The Trinity Aquifer is located in central and northeastern Texas.²⁷⁵ It is primarily used to serve municipalities.²⁷⁶ SAWS has three separate contracts with different entities to buy groundwater from the Trinity Aquifer.²⁷⁷ Whereas pumping from the Edwards Aquifer requires pumping water uphill, resulting in increased energy costs, the groundwater from the Trinity Aquifer flows down, saving transportation and energy costs.²⁷⁸ SAWS relies on this source to extract 16,100 acre-feet per year in a year that is considered “average,” but at a minimum SAWS can rely on the Trinity Aquifer for 4,000 acre-feet per year.²⁷⁹ However, these contracts are expiring soon. The contract with the Water Exploration Company will end in 2027 and

²⁷² Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 21 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁷³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 23 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁷⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁷⁵ *Trinity Aquifer*, TEX. WATER DEVELOPMENT BD., <http://www.twdb.texas.gov/groundwater/aquifer/majors/trinity.asp>.

²⁷⁶ *Trinity Aquifer*, TEX. WATER DEVELOPMENT BD., <http://www.twdb.texas.gov/groundwater/aquifer/majors/trinity.asp>.

²⁷⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁷⁸ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁷⁹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

the contract with Bulverde Sneckner Ranch will end in 2020.²⁸⁰ SAWS anticipates an extension of the contract with Oliver Ranch to last into 2035.²⁸¹

5. Canyon Lake

Canyon Lake is a reservoir formed by a dam on the Guadalupe River.²⁸² SAWS contracts with the Guadalupe-Blanco River Authority to purchase water within the range of 4,000 to 9,000 acre-feet of water per year.²⁸³ This contract expires in 2037.²⁸⁴ While there is an option to renew the contract until 2077, this is dependent on certain financial circumstances, which SAWS considers “uncertain.”²⁸⁵

6. Lake Dunlap

Lake Dunlap is another reservoir filled with water from the Guadalupe River.²⁸⁶ SAWS contracts with the Canyon Regional Water Authority to purchase as much as 4,000 acre-feet per year.²⁸⁷ Of the water

²⁸⁰ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸¹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸² *Canyon Lake*, U.S. ARMY CORPS OF ENGR'S, <http://www.swf-wc.usace.army.mil/canyon/Information/History.asp>.

²⁸³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸⁵ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸⁶ *Lake Dunlap*, TEX. PARKS & WILDLIFE DEP'T, <https://tpwd.texas.gov/fishboat/fish/recreational/lakes/dunlap/>.

²⁸⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

that SAWS purchases, it leases 500 acre-feet per year to the Springs Hill Water Supply Corporation.²⁸⁸ This contract expires in 2038.²⁸⁹

7. Medina Lake

Medina Lake is a reservoir on the Medina River.²⁹⁰ SAWS contracts with the Bexar-Medina-Atascosa Water Control and Improvement District #1 to buy 19,974 acre-feet of water per year.²⁹¹ This contract is not stable because in drought years, the lake is “virtually empty.”²⁹² This contract expires in 2049.²⁹³

B. Challenges to Freshwater Sources

1. Conservation Concerns

The groundwater permit from the Edwards Aquifer Authority is subject to being cut significantly—by up to 44% in periods of drought.²⁹⁴ Additionally, because of various environmental and conservation concerns, like those of the EAHCP, SAWS agreed to voluntarily reduce pumping by 8,000 acre-feet per year through the year 2027.²⁹⁵ In a separate agreement

²⁸⁸ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁸⁹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 22 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹⁰ *Lake Medina*, LAKESONLINE.COM, <http://medina.uslakes.info/>.

²⁹¹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 23 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹² Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 23 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 23 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹⁵ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

that also is intended to benefit the EAHCP, SAWS agreed to reduce pumping by a maximum of 46,300 acre-feet during a year when conditions are the same as those of the 1950 Drought of Record.²⁹⁶ As a result of these agreements and a general understanding to reduce reliance on the Edwards Aquifer, SAWS intends to reduce pumping by 11,000 acre-feet per year.²⁹⁷

2. Effect of Development on Recharge

In addition to conservation concerns, there are also issues with recharge rate as San Antonio grows. The Edwards Aquifer relies on rainfall through “fractures, caves, sinkholes and other features” for replenishing the groundwater.²⁹⁸ A threat to recharge is San Antonio’s increased development.²⁹⁹ As San Antonio develops and builds over the fractures, caves, sinkholes, or other means of replenishment, it seals those features off from receiving rain.³⁰⁰ As such, expansive development can impact the amount of recharge that the Edwards Aquifer receives.³⁰¹ This is exacerbated by uncertain rainfall patterns leading to an overall unpredictable recharge rate in the aquifer.³⁰² Moreover, the increased strain on the Edwards Aquifer, SAWS is committed to “develop non-Edwards Aquifer supplies” and “continue to reduce its reliance on the Edwards Aquifer.”³⁰³ In order to

²⁹⁶ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 17 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

²⁹⁸ *About the Edwards Aquifer*, CITY OF SAN ANTONIO, <https://www.sanantonio.gov/EdwardsAquifer/About>.

²⁹⁹ *About the Edwards Aquifer*, CITY OF SAN ANTONIO, <https://www.sanantonio.gov/EdwardsAquifer/About>.

³⁰⁰ *About the Edwards Aquifer*, CITY OF SAN ANTONIO, <https://www.sanantonio.gov/EdwardsAquifer/About>.

³⁰¹ *About the Edwards Aquifer*, CITY OF SAN ANTONIO, <https://www.sanantonio.gov/EdwardsAquifer/About>.

³⁰² Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

³⁰³ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 5, 15 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

reduce the San Antonio area's reliance, SAWS is diversifying its water supply through recycled water and desalination.³⁰⁴

C. Desalination

The H2Oaks facility in San Antonio is the central hub for three methods of water production and diversification.³⁰⁵ First, the facility is home to the Carrizo Well, where SAWS pumps freshwater out of an underlying freshwater aquifer.³⁰⁶ Second, the facility is home to SAWS' aquifer storage and recovery program.³⁰⁷ Third, H2Oaks is the site of SAWS' brackish groundwater desalination plant, which is the focus of this case study for desalination.³⁰⁸

To the extent that it will be necessary to understand the permitting process involved, a brief description of H2Oaks' desalination process is provided. SAWS pumps brackish groundwater "from the Wilcox Aquifer about 1,500 feet below the surface."³⁰⁹ Twelve production wells pump water from the aquifer and ten miles of pipes transport the water from the ground to the H2Oaks facility where it is treated.³¹⁰ The H2Oaks facility uses reverse osmosis to remove "99.9 percent of the salts and minerals from the water. Reverse osmosis yields treated water, which is separated from a salt and

³⁰⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 4 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

³⁰⁵ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³⁰⁶ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³⁰⁷ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³⁰⁸ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³⁰⁹ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹⁰ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

mineral concentrate (“concentrate”) that has been removed from the water.³¹¹ Once treated, the water tastes the same as Edwards Aquifer water and blends with the rest of the water in [the] system.”³¹² The remaining concentrate is injected into one of two injection wells and disposed of one mile underground.³¹³

The recovery rate of treated water is about 90%.³¹⁴ “Every 10 gallons of brackish water is converted to nine gallons of drinking water.”³¹⁵ Further, the H2Oaks brackish groundwater desalination plant is capable of producing 12 million gallons per day (13,441 acre-feet per year), which can “supply up to 53,000 households.”³¹⁶

According to Tetra Tech, which is one of the design, permitting, and construction administration teams that SAWS selected to help construct the desalination plant, the project cost around \$150 million for its Phase I construction.³¹⁷ Phase I encompasses the plant as it operates right now in 2019, capable of producing 12 million gallons per day, or 13,441 acre-feet per year.³¹⁸ However, SAWS plans for two more phases to expand the

³¹¹ See generally *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹² *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹³ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹⁴ See *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹⁵ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹⁶ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

³¹⁷ *San Antonio Desalination Plant*, TETRA TECH, <https://www.tetrattech.com/en/projects/san-antonio-desalination-plant> (last visited Nov. 24, 2019).

³¹⁸ *Brackish Groundwater Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/brackish-groundwater-desalination/> (last visited Nov. 24, 2019).

capacity of the plant and produce up to 30,000 acre-feet per year.³¹⁹ That puts an almost \$400 million price tag on the final project.³²⁰

D. Challenges to Desalination

1. TWDB Identified Challenges to Desalination

TWDB identified four key challenges to successfully implementing desalination projects. While these challenges are broadly applicable to desalination in the State of Texas generally, each has a local component that would need resolution at a San Antonio-specific level.³²¹

Research Gaps and Research Funding

The first challenge to widespread desalination projects in Texas is the lack of funding to conduct the necessary research.³²² In order to make brackish groundwater desalination a viable source of freshwater, there are research gaps that need closing such as: species' ability to tolerate changing salinity levels, how to properly integrate desalinated water into drinking water distribution networks, and the subsurface intake process.³²³ TWDB also recognized that the State needs to do a re-assessment of what research

³¹⁹ Iris Dimmick, *H2Oaks Desalinated Water Passes the Taste Test*, RIVARD REPORT (Jan. 27, 2017), <https://therivardreport.com/h2oaks-desalination-plant-latest-in-move-to-diversify-water-sources/>.

³²⁰ Iris Dimmick, *H2Oaks Desalinated Water Passes the Taste Test*, RIVARD REPORT (Jan. 27, 2017), <https://therivardreport.com/h2oaks-desalination-plant-latest-in-move-to-diversify-water-sources/>; Joey Palacios, *SAWS Opens New Water Desalination Plant*, TEXAS PUBLIC RADIO (Jan. 27, 2017), <https://www.tpr.org/post/saws-opens-new-water-desalination-plant>.

³²¹ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 71 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²² Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 71 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²³ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 71 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

needs to be done.³²⁴ This is the idea that “we don’t know what we don’t know yet.” As research and knowledge gaps are increasing, funding for such research is falling short. “The Texas Legislature last appropriated funds to the TWDB to advance seawater and brackish groundwater desalination in Texas in 2009.”³²⁵

Regulatory Setbacks

The problem with regulatory setbacks is twofold: (1) permitting processes for desalination are not well-established, and (2) any work completed on mapping the permit system needs to be updated.

As a whole, the permitting processes in Texas are not well established.³²⁶ In 2004, a TWDB-funded study created a decision tree to determine what permits were required to build desalination plants.³²⁷ While instructive at the time, permitting processes and regulatory bodies have evolved and there is no new research of this kind to determine whether or not these requirements are up to date.

³²⁴ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 72 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²⁵ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 71 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²⁶ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 72 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²⁷ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 72 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773; See R.W. Beck, *Guidance Manual for Permitting Requirements in Texas for Desalination Facilities Using Reverse Osmosis Processes*, R.W. BECK, INC. (Nov. 23, 2004), http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/2003483509.pdf.

Technological Advancement

Most pilot-plant studies conducted around 2010 relied on data from technology that is now rather dated.³²⁸ There are a number of studies in the United States that are focused on how to improve the desalination process. For example, a research team at Penn State is studying the structure of membranes used in reverse osmosis.³²⁹ This research is aimed at better understanding “which characteristics must remain for the membrane to function and which could be manipulated to improve membrane longevity, antifouling, and enhance water recovery.”³³⁰ Another study led by a Columbia Engineering team is researching a solvent extraction approach to desalination that could potentially replace reverse osmosis or evaporation as the primary desalination techniques.³³¹ Their focus is whether temperature swing solvent extraction (more commonly referred to as “TSEE”) can serve as a less costly desalination option that can also desalinate seawater that has a higher percentage of brine.³³²

While those are examples of advancements in desalination technology on a macro-level, Texas also needs to conduct studies on the local level to understand what technology is most efficient at Texas plants. “Although there are 35 brackish groundwater desalination facilities in state, desalination is dependent on site-specific parameters such as water quality and water yield that require installing monitoring wells and conducting other pilot- and demonstration-scale testing for a successful project.”³³³

³²⁸ *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 72 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³²⁹ Penn State, *3D Electron Microscopy Uncovers the Complex Guts of Desalination Membranes*, SCIENCEDAILY (Sept. 17, 2018), www.sciencedaily.com/releases/2018/09/180917191846.htm.

³³⁰ Penn State, *3D Electron Microscopy Uncovers the Complex Guts of Desalination Membranes*, SCIENCEDAILY (Sept. 17, 2018), www.sciencedaily.com/releases/2018/09/180917191846.htm.

³³¹ Columbia University School of Engineering and Applied Science, *Radical Desalination Approach May Disrupt the Water Industry*, PHYS.ORG (May 6, 2019), <https://phys.org/news/2019-05-radical-desalination-approach-disrupt-industry.html>.

³³² Columbia University School of Engineering and Applied Science, *Radical Desalination Approach May Disrupt the Water Industry*, PHYS.ORG (May 6, 2019), <https://phys.org/news/2019-05-radical-desalination-approach-disrupt-industry.html>.

³³³ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 73 (Dec. 1, 2018),

Advancements can contribute to more efficient desalination technologies at site-specific plants in Texas. The problem is that Texas entities are not being funded to allow for pilot-testing with new technology.

The Cost of Desalination Itself

Desalination is expensive technology.³³⁴ While the details of the cost will be “site specific,” the cost includes capital costs, indirect capital costs, and operation and maintenance costs.³³⁵ Direct capital costs are things like owning the land on which the desalination plant will operate, construction of the facility, and equipment.³³⁶ Indirect capital costs include legal and administrative services.³³⁷ Operation and maintenance costs include everything from labor of employees on-site to the power it takes to operate the facility.³³⁸ Because the sites can vary dramatically, it is difficult to get a cost estimate based on existing facilities.³³⁹

2. Other Challenges

Energy Use

Desalination technology is also expensive because of its energy use. “Desalination plants around the world consume more than 200 million

https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

³³⁴ See Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

³³⁵ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 3 (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

³³⁶ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 3 (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

³³⁷ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 3 (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

³³⁸ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 3 (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

³³⁹ Jorge Arroyo and Saquib Shirazi, *Cost of Brackish Groundwater Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 1 (Sep. 2012),

http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas.pdf.

kilowatt-hours each day, with energy costs an estimated 55 percent of plants' total operation and maintenance costs. It takes most reverse osmosis plants about three to 10 kilowatt-hours of energy to produce one cubic meter of freshwater from seawater."³⁴⁰ Energy represents a large portion of the cost of desalination.³⁴¹ In order to appropriately account for costs, the cost of power has to be considered.³⁴² The cost of desalination has been steadily declining since the 1970s, so experts are optimistic that desalination can be a cost-competitive.³⁴³ However, a "best management practice" for energy management in desalination plants has yet to be identified.³⁴⁴ As technology advances over time, the energy consumption of desalination plants will also become more efficient.³⁴⁵ The most promising area of improvement right now is to improve the membrane technology itself.³⁴⁶

San Antonio-Specific Infrastructure

A specific challenge for San Antonio relates to infrastructure limitations.³⁴⁷ The original pipe system was originally built to distribute Edwards Aquifer water and primary pump stations functioned independently.³⁴⁸ To expand utilization of new facilities and water diversification techniques, SAWS has to undertake infrastructure

³⁴⁰ Brian Bienkowski, *Desalination is an Expensive Energy Hog, but Improvements are on the Way*, PUBLIC RADIO INT'L (May 15, 2015), <https://www.pri.org/stories/2015-05-15/desalination-expensive-energy-hog-improvements-are-way>.

³⁴¹ Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴² Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴³ Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴⁴ Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴⁵ Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴⁶ Jorge A. Arroyo, *Water Desalination Supplies: Energy Management BMPs for Desalination*, Freese & Nichols Workshop at Corpus Christi (Oct. 4, 2019).

³⁴⁷ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 55 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

³⁴⁸ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 55 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

expansions.³⁴⁹ There are substantial costs associated with developing these pipelines that includes construction, eminent domain, and permitting costs.

3. H2Oaks-Specific Challenges

Andrea Beymer, the Vice President of Engineering and Construction at SAWS identified four challenges that were specific to the H2Oaks facility. First, “[l]ack of water quality or well productivity data prior to the design of the plant was one of the greatest challenges.”³⁵⁰ When there is little to no data about the aquifer which the water supply company intends to extract water, additional research has to be carefully conducted.³⁵¹ Specifically, in San Antonio there was no data on the Wilcox formation.³⁵² “SAWS had to obtain oil field data (geophysical logs) to develop general geology thickness and structure maps. An initial estimate of water quality was developed by drilling three test wells.”³⁵³ Second, reverse osmosis does not always work with all types of brackish groundwater.³⁵⁴ SAWS had to verify that the reverse osmosis process would be compatible with the water by doing “membrane pilot testing for RO membranes from three different manufactures prior to the design of the plant.”³⁵⁵ Third, SAWS faced challenges with the best way to dispose of the brine from the plant.³⁵⁶ Brine disposal is a significant problem for all desalination plants. Where other facilities will “either poured into surface waters, pumped back out to sea, or occasionally stored in wells and holding tanks[.]”³⁵⁷ San Antonio does neither. San Antonio assessed options such as “disposal in SAWS waste water treatment plant, evaporation ponds, disposal in the San Antonio River, and deep well injection” and eventually decided on deep well injection.³⁵⁸ Fourth and finally, there was some citizen resistance to the project.³⁵⁹ While the general attitude of those in San Antonio is very supportive of brackish groundwater desalination generally, those with water rights to the Wilcox aquifer in the Carrizo formation

³⁴⁹ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 55 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf.

³⁵⁰ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵¹ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵² Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵³ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵⁴ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵⁵ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵⁶ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵⁷ Meryl McBroom, *What's the Deal with Desalination?*, ENV'T'L. & ENERGY STUDY INSTITUTE (Nov. 16, 2018), <https://www.eesi.org/articles/view/whats-the-deal-with-desalination>.

³⁵⁸ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁵⁹ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

were concerned. “Many residents of Atascosa and Wilson Counties were concerned that the production of brackish water from the Wilcox aquifer would effectively dry up production from their household and irrigation wells located in the overlying Carrizo Formation.”³⁶⁰ However, these concerns have been eased for the moment since “[t]o date, SAWS has seen no water level declines in the Carrizo Formation while pumping the brackish Wilcox.”³⁶¹

E. Water Recycling

There are three water recycling centers in San Antonio, Texas: (1) the Medio Creek Water Recycling Center, (2) the Leon Creek Water Recycling Center, and (3) the Steven M. Clouse Water Recycling Center.

Water recycling generally takes wastewater, treats it by separating the biosolids from the water itself, and putting the recycled water to use. “Recycled water can be used for irrigation and in industrial processes, biosolids can be used in soil conditioning or compost production, and gases can be captured and used to produce heat and power.”³⁶² “The Steven M. Clouse and Leon Creek Water Recycling Centers are conventional activated sludge facilities, while the Medio Creek Water Recycling Center uses an extended aeration process.”³⁶³ Much of the information in this case study is based on interviews with SAWS’ employees and site visit at the Steven M. Clouse Water Recycling Center. As such, it is specifically referenced several times throughout the following sections. San Antonio’s water recycling facilities are “designed to provide up to 35,000 acre feet a year of recycled water to commercial and industrial businesses in San Antonio.”³⁶⁴

The water recycling process yields biosolids, which become part of the SAWS Composting Program. This program “can divert up to 208,000 cubic yards of biosolids from landfills each year”³⁶⁵ and produce 140,000

³⁶⁰ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁶¹ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

³⁶² *Recycling Centers*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/recycling-centers/> (last visited Nov. 24, 2019).

³⁶³ *Recycling Centers*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/recycling-centers/> (last visited Nov. 24, 2019).

³⁶⁴ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 1 (of Appendices) (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

³⁶⁵ *Biosolids Composting Process*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/compost/biosolids-composting-process/> (last visited Feb. 18, 2020).

tons of biosolids.³⁶⁶ SAWS' involvement with processing the biosolids is authorized by its TPDES permit,³⁶⁷ discussed earlier in this report. However, SAWS retains contractors who are licensed to compost, market, and distribute the composted biosolids.³⁶⁸ The composted biosolids ends up in use at places like the San Antonio Botanical Garden, "lawns, gardens, trees, [and] public parks."³⁶⁹

Moreover, SAWS "harness[es] methane gas generated during the wastewater treatment process as a renewable green energy source. This biogas, which is 60 percent methane, is a byproduct of the anaerobic digestion process from biosolids."³⁷⁰ SAWS works with "Ameresco, Inc., a national energy company focusing on renewable energy, and by 2010 Ameresco began to process more than 1.5 million standard cubic feet of biogas a day and deliver a minimum of 900,000 cubic feet of natural gas each day to a nearby commercial pipeline to sell on the open market."³⁷¹

F. Challenges to Water Recycling

1. Finding the Right Clientele

In San Antonio, there are over 60 recycled water customers, whose contracts account for almost 18,214 acre-feet per year.³⁷² "More than 130 miles of pipeline delivers highly treated recycled water to golf courses, parks, commercial and industrial customers throughout the city."³⁷³ Initially, there were a certain number of large users who committed to use recycled water so when the recycled water facilities were built, the pipelines were constructed to get recycled water to those specific users.³⁷⁴ As demand for recycled water

³⁶⁶ *Biogas*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/biogas/> (last visited Feb. 18, 2020).

³⁶⁷ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁶⁸ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁶⁹ *Compost*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/compost/> (last visited Feb. 18, 2020).

³⁷⁰ *Biogas*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/biogas/> (last visited Feb. 18, 2020).

³⁷¹ *Biogas*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/biogas/> (last visited Feb. 18, 2020).

³⁷² *Recycled Water*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/recycled-water/> (last visited Nov. 24, 2019).

³⁷³ *Recycled Water*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/recycled-water/> (last visited Nov. 24, 2019).

³⁷⁴ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

grows, a primary challenge is finding users who can be feasibly reached by the existing pipeline systems.³⁷⁵ If a new user were to enter the market, it would be expensive to construct pipes that could carry recycled water to that user.

2. Flat-Line Demand

Ideally, users of recycled water have a “flat-line year-round demand.”³⁷⁶ Water recycling centers have to be wary of users who have irrigation demands that will peak in the summer and taper off in the winter.³⁷⁷ This is because if the demand is concentrated in the summer, there is unused capacity for the rest of the year.³⁷⁸ In order to resolve this issue, water recycling contracts have to be worded very carefully, taking into consideration any peaks or limits there may be in the summer.³⁷⁹

3. Regulatory Hurdles

There are also a number of regulatory hurdles that recycled water users face. Not just any individual can contract to use recycled water. There are a number of state and local rules and regulations that pertain to recycled water use. These will largely be discussed below in the state and local water recycling legal landscape sections.

IV. Existing Legal Landscape

A. Federal

1. Groundwater Desalination

Under federal law, desalination projects must obtain source water permits, potable water permits, and waste permits.³⁸⁰

³⁷⁵ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁷⁶ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁷⁷ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁷⁸ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁷⁹ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

³⁸⁰ Daniel Cochran, *Government is Giving Desalination a Salty Reception*, AMERICAN LEGISLATIVE EXCHANGE COUNCIL (July 6, 2016), <https://www.alec.org/article/government-is-giving-desalination-a-salty-reception-why-every-state-should-care/>.

SAWS had the foresight to keep a “permit log” of what federal, state, and local permits and regulations they considered throughout the construction of their brackish groundwater desalination facility.³⁸¹ For ease of reference and understanding, the permits and regulations have been summarized in chart form in each of the corresponding sections.

The federal permits that SAWS had to consider include:

Permit / Regulation Name	Federal Agency	Purpose	Ultimately Applicable for H2Oaks?
Clean Water Act (“CWA”) § 404 Permit	United States Army Corps of Engineers (“USACE”)	Activities that might discharge dredged or fill material into waters of the United States are required to get a 404 permit. ³⁸² USACE performs Jurisdictional Determinations to determine if water on a property is a water of the United States and therefore subject to the 404 permit process. ³⁸³	No
Safe Drinking Water Act Total Dissolved Solid (“TDS”) Requirement	Environmental Protection Agency (“EPA”)	The EPA sets National Primary Drinking Water Regulations, and states can be more stringent and enact secondary regulations regarding the TDS present in drinking water. ³⁸⁴	Yes

³⁸¹ Email Interview between Heather Dyer, J.D. Candidate and Saqib Shirazi, San Antonio Water System Project Manager (Feb. 4, 2019).

³⁸² *Permit Program Under CWA Section 404*, U.S. ENVT’L. PROT. AGENCY, <https://www.epa.gov/cwa-404/permit-program-under-cwa-section-404> (last visited Dec. 4, 2019).

³⁸³ *How Wetlands are Defined and Identified Under CWA Section 404*, U.S. ENVT’L. PROT. AGENCY, <https://www.epa.gov/cwa-404/how-wetlands-are-defined-and-identified-under-cwa-section-404> (last visited Dec. 4, 2019).

³⁸⁴ *Drinking Water Regulations and Contaminants*, U.S. ENVT’L. PROT. AGENCY, <https://www.epa.gov/dwregdev/drinking-water-regulations-and-contaminants#Primary> (last visited Dec. 18, 2019).

Permit / Regulation Name	Federal Agency	Purpose	Ultimately Applicable for H2Oaks?
Endangered Species Act Take Permit	U.S. Fish and Wildlife Service (“USFWS”)	If the Environmental Assessment reveals that there are endangered species or endangered species habitat on the project site, then a permit is required to proceed with construction on the site. ³⁸⁵	No
Conditional Letter of Map Revision/Letter of Map Revision	Federal Emergency Management Agency (“FEMA”)	If a proposed construction project is in the floodplain or requires changing the floodplain it requires permission from FEMA first. ³⁸⁶	No
Antenna Permit	Federal Aviation Administration (“FAA”), a branch of the U.S. Department of Transportation	If the antenna is higher than the average height of the terrain, then the antenna needs height authorization from the FAA.	No

It is notable that the federal permits that SAWS considered did not ultimately end up being necessary for the H2Oaks brackish groundwater desalination plant. However, they are worth mentioning because of their broader applicability to future potential construction of brackish groundwater desalination plants.

It is worth noting that many federal statutes delegate implementation at the state level to state agencies. As a result, some of the permits that are required at the state level are actually state derivatives of federal requirements. These are discussed below in Section IV.b.i.

³⁸⁵ *Endangered Species Permits*, U.S. FISH AND WILDLIFE SERV., <https://www.fws.gov/endangered/permits/index.html>. (last updated April 16, 2019).

³⁸⁶ *Conditional Letter of Map Revision*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/conditional-letter-map-revision> (last updated July 24, 2019).

2. Water Recycling

There are no federal regulations directly governing water recycling.³⁸⁷ This authority is mostly delegated to individual states by virtue of the states' obligations under the Clean Water Act.³⁸⁸

B. State

1. Groundwater Desalination

As discussed above, SAWS kept a detailed permit log of the potential permits they considered while constructing the H2Oaks brackish groundwater desalination facility. The state-level permits are summarized in chart form below. Moreover, if the state level permit is the state derivative of federal delegation, that is also provided in the chart.

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
Clean Water Act § 401 Water Quality Certification	Yes, CWA	TCEQ	If the pipeline crossed waterways or wetlands, a Section 401 permit is needed.	No
Secondary Standard for Total Dissolved Solids ("TDS")	Yes, Safe Drinking Water Act	TCEQ	States can enact secondary regulations regarding the TDS present in drinking water. ³⁸⁹ TCEQ's standard is 1,000 mg/L. ³⁹⁰	Yes

³⁸⁷ *Water Reuse and Recycling: Community and Environmental Benefits*, U.S. ENVT'L. PROT. AGENCY, <https://www3.epa.gov/region9/water/recycling/#regs> (last visited Nov. 17, 2019).

³⁸⁸ *Water Reuse and Recycling: Community and Environmental Benefits*, U.S. ENVT'L. PROT. AGENCY, <https://www3.epa.gov/region9/water/recycling/#regs> (last visited Nov. 17, 2019).

³⁸⁹ See *Drinking Water Regulations and Contaminants*, U.S. ENVT'L. PROT. AGENCY, <https://www.epa.gov/dwregdev/drinking-water-regulations-and-contaminants#Primary> (last visited Dec. 18, 2019).

³⁹⁰ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
TPDES General Stormwater Construction Permit (TXR150000)	Yes, CWA NPDES permit derivative	TCEQ / SAWS	If a construction site will discharge stormwater associated with the construction activity and that disturbs more than one acre of land, the project will need a stormwater discharge permit. ³⁹¹	Yes
Phase II, Small MS4 ³⁹² permit (TXR040000)	Yes, CWA NPDES permit derivative	TCEQ / SAWS	Stormwater permits regulate the “requirements related to water quality permitting for stormwater runoff from construction sites, industrial facilities, and publicly owned and operated storm sewers.” ³⁹³ Specifically, the Phase II permit covers “small MS4[s]” in urbanized areas. ³⁹⁴	No

³⁹¹ *General Permit to Discharge Under the Texas Pollutant Discharge Elimination System*, TEX. COMM’N ON ENV’T’L. QUALITY at 1, 5 (Mar. 5, 2018),

<https://www.tceq.texas.gov/assets/public/permitting/stormwater/txr150000-cgp.pdf>.

³⁹² “An MS4 is a conveyance or system of conveyances that is: *owned by a state, city, town, village, or other public entity that discharges to waters of the U.S., *designed or used to collect or convey stormwater (e.g. storm drains, pipes, ditches), *not a combined sewer, and *not part of a sewage treatment plant, or publicly owned treatment works (POTW).”

Stormwater Discharges from Municipal Sources, U.S. ENV’T’L PROT. AGENCY, <https://www.epa.gov/npdes/stormwater-discharges-municipal-sources> (last visited Dec. 5, 2019).

2019).

³⁹³ *Stormwater Permit*, TEX. COMM’N ON ENV’T’L. QUALITY,

<https://www.tceq.texas.gov/permitting/stormwater>

(last visited Dec. 4, 2019).

³⁹⁴ *Municipal Separate Storm Sewer System (MS4) Discharges: Am I Regulated?*, TEX. COMM’N ON ENV’T’L. QUALITY,

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
Public Water System Plan Review, Membrane Pilot Study	N/A	TCEQ	The membranes in the reverse osmosis plant have to undergo a pilot study for approval.	Yes
Public Water System Plan Review, Interim Public Well Completion Approval (for each production well)	N/A	TCEQ	Prior to drilling the wells, TCEQ has to approve them.	Yes
Public Water System Plan Review, Final Public Well Completion Approval (for each production well)	N/A	TCEQ	After the wells are completed, TCEQ has to approve them.	Yes
Public Water System Plan Reviews for each of the following:				
• Site Access Road		TWDB		Yes
• Ground storage tank		TWDB		Yes
• Well build out		TCEQ / TWDB		Yes
• Conveyance pipeline		TWDB		Yes
• Reverse osmosis plant		TCEQ		Yes
• Injection wells		TWDB		Yes
• Electrical and instrumentation and controls		TWDB		Yes
• Production wells		TCEQ		Yes

https://www.tceq.texas.gov/permitting/stormwater/ms4/WQ_ms4_AIR.html (last visited Dec. 5, 2019).

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
• Engineering report (serving as the basis of design memos)		TCEQ / TWDB		Yes
Class I Underground Injection Control (UIC) Permit (for each injection well)	Yes, SDWA sets federal standards for UIC requirements	TCEQ	In order to inject the concentrate brine from reverse osmosis back into the ground below the underground source of drinking water, TCEQ has to issue a permit. Additionally, SAWS had to file a Notice of Completion (NOC) when the well began operating.	Yes
Air Permit by Rule ³⁹⁵ 30 Tex. Admin. Code § 106.532	N/A	TCEQ	Water treatment units are subject to permitting by TCEQ.	Yes
Air Permit by Rule 30 Tex. Admin. Code § 106.511	N/A	TCEQ	Electric generators are subject to permitting by TCEQ.	Pending at time of Interview.
Certification of Operators for Public Water Supply System	N/A	TCEQ / SAWS	The persons hired to operate the reverse osmosis plant have to be certified and trained at the Class D level, which after one year needs to be upgraded to Class C. ³⁹⁶	Yes

³⁹⁵ “A permit by rule is the state air authorization for activities that produce more than a de minimis level of emissions but too little for other permitting options.” *Indexes to Air Permits by Rule*, TEX. COMM’N ON ENV’T L. QUALITY, <https://www.tceq.texas.gov/permitting/air/permitbyrule> (last updated May 5, 2019).

³⁹⁶ See generally *Occupational Licenses: Water System Operators*, TEX. COMM’N ON ENV’T L. QUALITY, <https://www.tceq.texas.gov/licensing/licenses/waterlic#acceptD> (last updated Aug. 29, 2019).

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
Register Above Ground Storage Tanks	N/A	TCEQ	Above ground storage tanks with petroleum products over a certain capacity have to be registered.	No
Utility Installation Permit to cross roads within the Texas Department of Transportation (“TxDOT”) right-of-way (“ROW”) ³⁹⁷	N/A	TxDOT	If the utilities have to cross roads in TxDOT’s ROW TxDOT has to approve that.	No
Permit to construct access driveway facilities on Highway Right-of-Way (Form 1058)	N/A	TxDOT	See above.	No
Texas Antiquities Permit for Investigation	N/A	Texas Historical Commission (THC)	State agencies and political subdivisions of the state including cities, counties, river authorities, municipal utility districts, and school districts must notify THC of ground-disturbing activity on public land.	Yes

³⁹⁷ See generally *Right-of-Way Forms*, TEX. DEP’T OF TRANSPORTATION, <https://www.txdot.gov/government/processes-procedures/row-forms.html> (last visited Dec. 5, 2019).

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
Texas Antiquities Permit	N/A	THC	If an environmental assessment cultural resource report reveals that the project will disturb the ground on public land, THC has to issue a permit.	Pending at time of Interview.
National Historic Preservation Act	Yes, a federal statute with delegated authority to THC	THC	Federal agencies must take into account the effects of their undertakings on historic properties.	Pending at time of Interview.
Marl, Sand, Gravel, Shell or Mudshell Permit	N/A	Texas Parks and Wildlife Department (TPWD)	A permit is required to dig in a stream bed. ³⁹⁸	No
Elimination of Architectural Barriers Law (“EABL”)	N/A	Texas Department of Licensing and Regulation (TDLR)	The EABL is a law that “ensure[s] that each building and facility subject to this chapter is accessible to and functional for persons with disabilities without causing the loss of function, space, or facilities.” ³⁹⁹	Yes

³⁹⁸ *Land & Water Frequently Asked Questions*, TEX. PARKS AND WILDLIFE DEP’T, https://tpwd.texas.gov/faq/landwater/sand_gravel/#dig (last visited Dec. 5, 2019).

³⁹⁹ 4 Tex. Gov. Code § 469.001.

Permit / Regulation Name	Derivative of Federal Statute?	Agency	Purpose	Ultimately Applicable for H2Oaks?
Environmental Assessment pursuant to 31 Tex. Admin. Code § 363.14	Yes, a state regulation mandating coordinated regulatory effort across several federal and state environmental laws if the project receives TWDB funding	TWDB	This is a state regulation that mandates coordinated regulatory effort across several federal and state environmental laws if the project receives TWDB funding.	Yes
Well registration for production wells	N/A	TDLR	Drillers have to submit well registration after it is constructed.	Yes
General Plan Review	N/A	TWDB	The project has to undergo plan review with TWDB.	Yes
Texas Land Application Permit (“TLAP”)	Yes- Subset of the TPDES permit, which is CWA	TCEQ	If water is discharged to waters of the state, need a TLAP.	No

2. Water Recycling

TPDES Permit

One of the only permits that is needed to operate the Steven M. Clouse water recycling center in Texas⁴⁰⁰ is the Texas Pollution Discharge Elimination System (“TPDES”) permit. As stated above, many environmental regulatory schemes are delegated to the states. The federal version of this is the National Pollution Discharge Elimination System (“NPDES”) permitting program.⁴⁰¹ The Clean Water Act authorized the

⁴⁰⁰ Conclusion based on email interview with Gregg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

⁴⁰¹ *About NPDES*, U.S. ENV’T’L. PROT. AGENCY, <https://www3.epa.gov/region9/water/recycling/#regs> (last visited Nov. 17, 2019).

NPDES permitting program in 1972.⁴⁰² “An NPDES permit is typically a license for a facility to discharge a specified amount of a pollutant into a receiving water under certain conditions. Permits may also authorize facilities to process, incinerate, landfill, or beneficially use sewage sludge.”⁴⁰³ In 1998, Texas was approved to assume this responsibility from the federal government by virtue of having its own, approved TPDES program.⁴⁰⁴ As such, the TCEQ “now has federal regulatory authority over discharges of pollutants to Texas surface water.”⁴⁰⁵

TCEQ is the primary regulatory body that issues permits and monitors the process for wastewater plants from construction to operation. “Prior to constructing or altering domestic wastewater collection systems, collection system units, wastewater treatment facilities, and treatment units, a wastewater treatment facility must acquire a wastewater permit.”⁴⁰⁶ Obtaining a wastewater permit requires several steps. The application includes: 1. The wastewater permit application itself, 2. A domestic administrative report, 3. A domestic technical report, 4. A sewage sludge technical report, and a core data form.⁴⁰⁷ The permit application then undergoes several review processes.⁴⁰⁸

There is an administrative review to ensure the application is complete.⁴⁰⁹ If it is not complete, TCEQ will send a “Notice of Deficiency letter” and give the applicant a period of time by which to correct the

⁴⁰² *About NPDES*, U.S. ENVT’L. PROT. AGENCY, <https://www3.epa.gov/region9/water/recycling/#regs> (last visited Nov. 17, 2019).

⁴⁰³ *About NPDES*, U.S. ENVTL. PROT. AGENCY, <https://www3.epa.gov/region9/water/recycling/#regs> (last visited Nov. 17, 2019).

⁴⁰⁴ *What Is the “Texas Pollutant Discharge Elimination System (TPDES)”?*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/pretreatment/tpdes_definition.html (last updated Aug. 29, 2019).

⁴⁰⁵ *What Is the “Texas Pollutant Discharge Elimination System (TPDES)”?*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/pretreatment/tpdes_definition.html (last updated Aug. 29, 2019).

⁴⁰⁶ *Wastewater System Design: Requirements*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/plans/WW_design_requirements.html (last updated Aug. 29, 2019).

⁴⁰⁷ *Domestic Wastewater Permits: The Permitting Process*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/municipal/WQ_Domestic_Wastewater_Permits_Steps.html (last updated Sept. 4, 2019).

⁴⁰⁸ *Id.*

⁴⁰⁹ *Id.*

application.⁴¹⁰ If it is approved, TCEQ will send a “Notice of Receipt of Application and Intent to Obtain Permit” also known as a “NORI.”⁴¹¹ The applicant must publish the NORI.⁴¹²

Next, the permit application undergoes technical review.⁴¹³ TCEQ will evaluate the technical information in the applicable and decide if it is complete.⁴¹⁴ “If the application is declared technically complete, staff will proceed with preparing a draft permit, technical summary or fact sheet for the application and public notice.”⁴¹⁵ Again the applicant will be required to publish the “Notice of Application and Preliminary Decision,” also known as a “NAPD.”⁴¹⁶

After the NORI and NAPD stages, the applicant themselves is “given the opportunity to review and provide comments on the draft permit. In addition, certain permits are sent to EPA for their review and approval after comments from the applicant are resolved.”⁴¹⁷ If a draft permit is issued, the applicant has to go through a second round of public notice.⁴¹⁸ That notice must be published “in a local and widely distributed newspaper and make a copy of the application and draft permit available in a public place.”⁴¹⁹ These notices provide the public with the procedures for interacting with the application in a public forum or hearing.⁴²⁰ After the public hearing, TCEQ staff prepares a “Response to Comments.”⁴²¹

If all of this proceeds as planned, eventually TCEQ takes a final action with respect to the permit.⁴²² “If a permit is issued, you will need to comply with the provisions of the permit which include effluent limits and monitoring requirements, standard provisions, sludge provisions, and other requirements. In addition, you will be required to pay an annual water quality fee.”⁴²³

⁴¹⁰ *Id.*

⁴¹¹ *Id.*

⁴¹² *Id.*

⁴¹³ *Id.*

⁴¹⁴ *Id.*

⁴¹⁵ *Id.*

⁴¹⁶ *Id.*

⁴¹⁷ *Id.*

⁴¹⁸ *Id.*

⁴¹⁹ *Id.*

⁴²⁰ *Id.*

⁴²¹ *Id.*

⁴²² *Id.*

⁴²³ *Id.*

Once the TPDES permit is obtained, the licensed facility can begin construction.⁴²⁴ This permit also impliedly authorizes the facility to obtain the raw sewage itself that enters the system.⁴²⁵ Once the waste enters the wastewater facility, there are no other permits involved until the end of the process where, if done correctly, should yield completely separate products: biosolids and recycled water.

Biosolids are monitored by the TCEQ as well. At the Steven M. Clouse water recycling facility, SAWS contracts with independent parties to process, market, and distribute the biosolids so that they can be put to other beneficial uses like composting.⁴²⁶ However, there are additional permits and permissions from TCEQ in order to further process, apply the biosolids to land, or incinerate them.⁴²⁷ These permits or notice requirements can differ based on if the biosolid is a Class A, AB, or B biosolid.⁴²⁸

At the Steven M. Clouse water recycling facility, the recycled wastewater is in part discharged via an outfall to a stream. That outfall system is regulated by the TPDES permit as well.⁴²⁹ But the recycled water that goes to customers is regulated under Chapter 210 of the Texas Administrative Code.⁴³⁰ Chapter 210 authorization is required before one can reuse water.⁴³¹

Chapter 210 Requirements

Chapter 210 of the Texas Administrative Code (“Chapter 210”) sets forth the requirements related to “transfer, storage, and irrigation using reclaimed water and design criteria of reclaimed water systems.”⁴³²

⁴²⁴ *Wastewater System Design: Requirements*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/plans/WW_design_requirements.html (last updated Aug. 29, 2019).

⁴²⁵ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

⁴²⁶ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

⁴²⁷ *Sewage Sludge: Permits for Land Application, Processing, or Disposal*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/sludge/WQ_sludge_ClassB_forms.html (last updated June 5, 2019).

⁴²⁸ *Sewage Sludge: Permits for Land Application, Processing, or Disposal*, TEX. COMM’N ON ENVT’L. QUALITY, https://www.tceq.texas.gov/permitting/wastewater/sludge/WQ_sludge_ClassB_forms.html (last updated June 5, 2019).

⁴²⁹ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

⁴³⁰ Tex. Water Code ch. 210.

⁴³¹ Email Interview with Gegg Eckhardt, San Antonio Water Systems (Nov. 3, 2019).

⁴³² Tex. Admin. Code § 210.21.

Reclaimed water is defined as “[d]omestic or municipal wastewater which has been treated to a quality suitable for a beneficial use, pursuant to the provisions of this chapter and other applicable rules and permits.”⁴³³ While the Code references “reclaimed water,” this is the same as what the TWDB and other agencies in Texas call “recycled water.”⁴³⁴

(1) Storage

Notably, water recycling facilities cannot be located in floodways.⁴³⁵ This is important because certain municipalities in Texas may not be able to utilize water recycling as a water diversification strategy based on their location as it relates to floodways.

One of the first steps in the water recycling process is when the water enters a holding pond, frequently called a stabilization pond, where the wastewater initially enters the water recycling plant.⁴³⁶ While the wastewater is in the pond, some of the organic matter will settle to the bottom, which contributes to purifying the water.⁴³⁷ This pond stabilization process is a key step in treating wastewater in facilities across the country, but the first recorded wastewater treatment pond was actually constructed in San Antonio in 1901.⁴³⁸ Chapter 210 regulates the construction, lining, design, and certification of the ponds.⁴³⁹

⁴³³ Tex. Admin. Code § 210.3(24).

⁴³⁴ *Frequently Asked Questions*, TEX. WATER DEVELOPMENT BD., <http://www.twdb.texas.gov/innovativewater/reuse/faq.asp> (last visited Dec. 4, 2019).

⁴³⁵ Tex. Admin. Code § 210.23.

⁴³⁶ Marcos von Sperling & Carlos Augusto de Lemos Chernicharo, *Biological Wastewater Treatment in Warm Climate Regions*, IWA Publishing (2005) at 184, <https://www.iwapublishing.com/sites/default/files/ebooks/9781780402734.pdf>.

⁴³⁷ Marcos von Sperling and Carlos Augusto de Lemos Chernicharo, *Biological Wastewater Treatment in Warm Climate Regions*, IWA Publishing (2005) at 184, <https://www.iwapublishing.com/sites/default/files/ebooks/9781780402734.pdf>.

⁴³⁸ Eugenia McNaughton, James E. Smith, Jr., & Sally Stoll, *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers*, U.S. ENV'T'L. PROT. AGENCY at xxv (Jan. 21, 2011), <https://www.epa.gov/sites/production/files/2014-09/documents/lagoon-pond-treatment-2011.pdf>.

⁴³⁹ Tex. Admin. Code § 210.23.

(2) Irrigation with Recycled Water

There are a number of regulations that relate to how recycled water can be used for irrigation.⁴⁴⁰ These regulations are key when it comes to contracting with potential recycled water clientele. For example, “[i]rrigation of edible crops that will be peeled, skinned, cooked, or thermally processed before consumption is allowed[,]”⁴⁴¹ but if the crop will not go through a thermal process, then contact with recycled water is “prohibited.”⁴⁴² This means the water recycling facility needs to monitor who it contracts with to make sure that the recycled water is being put to uses that are allowed under the Texas Administrative Code.

Landscaped areas on public access facilities are governed by individual contracts with the reclaimed water providers, but Chapter 210 does not allow recycled wastewater to be using in structures “designed for contact recreation” like filling pools or hot tubs.⁴⁴³

There are also a number of general irrigation requirements that related to preventing “water overflow, crop stress, and undesirable soil contamination.”⁴⁴⁴

(3) Special Design Criteria for Water Recycling Systems

Finally, Chapter 210 also creates the purple pipe system for recycled water.⁴⁴⁵ The SAWS Recycled Water Users’ Handbook summarizes the regulations in bullet point form which is excerpted here:

- “hose bibs will be required on all potable water faucets on users onsite facilities.
- all exposed piping should have proper color coding or stenciled
- where recycled water is stored signs will be posted reading, in both English and Spanish, ‘RECYCLED WATER, DO NOT DRINK’ or similar warning.
- quick couplers will be required for all recycled water faucets and signs will be posted reading, in both English and

⁴⁴⁰ See Tex. Admin. Code § 210.24.

⁴⁴¹ Tex. Admin. Code § 210.24(b)(1)(A).

⁴⁴² Tex. Admin. Code § 210.24(b)(1)(D).

⁴⁴³ Tex. Admin. Code § 210.24(b)(3)(A)–(B).

⁴⁴⁴ Tex. Admin. Code § 210.24(d).

⁴⁴⁵ Tex. Admin. Code § 210.25.

Spanish, ‘RECYCLED WATER, DO NOT DRINK’ or similar warning. quick couplers shall be keyed entry to restrict access, painted purple and designed to prevent connection to a standard hose[.]”⁴⁴⁶

Therefore, at the state level, water recycling facilities must obtain a TPDES permit and follow Chapter 210 of the Texas Administrative Code to comply with the requisite federal and state permits and regulations.

C. Local

1. Groundwater Desalination

As discussed above, SAWS kept a detailed permit log of the potential permits they considered while constructing the H2Oaks brackish groundwater desalination facility. The local-level permits are summarized in chart form below.

Permit / Regulation Name	Agency	Purpose	Ultimately Applicable to H2Oaks?
SAWS’ internal standard for TDS	SAWS	“SAWS quality goal for the brackish desalination project was to produce a product water similar to the water chemistry of the Edwards Aquifer (approximately 400 mg/L of TDS)” ⁴⁴⁷	Yes

⁴⁴⁶ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at p.1 of Appendices (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁴⁷ Email Interview with Andrea Beymer, San Antonio Water System (Nov. 14, 2019).

Permit / Regulation Name	Agency	Purpose	Ultimately Applicable to H2Oaks?
Coordination with CPS Energy ⁴⁴⁸	CPS Energy	Coordination with CPS if electric or gas lines are present.	Yes
Bexar County Driveway/ROW Permits	Bexar County	Construction activities in Bexar County-maintained ROWs need a ROW permit prior to construction.	Yes
Bexar County Floodplain Development Permit (for the entire site, the pipeline, and pipeline production wells)	Bexar County	If a construction site falls within the 100 Year Flood Plain.	Yes
Bexar County Septic Permit	Bexar County	Permit related to the on-site sewage facility system.	Yes
Bexar County Storm Water Quality Site Development Permit	Bexar County	County-specific permit for project disturbing more than 1 acre.	Yes
Bexar County Building Permit	Bexar County	For building construction, flammable liquid systems, fire protection system permits, for the reverse osmosis plant and supervisory control and data acquisition (SCADA).	Yes

⁴⁴⁸ “CPS Energy is the largest municipally owned, vertically integrated electric and natural gas company in the United States, providing competitively-priced power through a diverse generation portfolio to the Greater San Antonio area.” *Corporate Fact Sheet*, CPSENERGY.COM, <https://www.cpsenergy.com/content/dam/corporate/en/Documents/Trustees/CorporateFactSheet.pdf> (last updated May 30, 2019).

Permit / Regulation Name	Agency	Purpose	Ultimately Applicable to H2Oaks?
Bexar County Building Permit	Bexar County Fire Marshal	For building construction, flammable liquid systems, fire protection system permits, for production wells and injection wells.	Yes
Bexar County Building Permit	Bexar County Fire Marshal	Required for renovations to the Aquifer Storage and Recovery program if moving walls or changing exits.	No
Wilson County Permits and Inspections	Wilson County	Potentially applicable if it is necessary to coordinate with Wilson County.	No
Wilson County Flood Development Permits	Wilson County	Coordination with Wilson County regarding floodplain in the county.	Yes
City of San Antonio Tree Permit	City of San Antonio	SAWS had to comply with city ordinance to preserve as many trees as possible.	Yes
City of San Antonio Fee-in-lieu-of (“FILO”)	City of San Antonio	Developers must mitigate increases in storm water runoff resulting from their development. ⁴⁴⁹	Yes
Evergreen Water District Coordination/Permit for Raw Water/ Production Wells	Evergreen Water District	Must coordinate with Evergreen Water District if the production wells draw on water in that district.	Yes

⁴⁴⁹ *Regional Storm Water Management Program*, City of San Antonio, <https://www.sanantonio.gov/TCI/Services/Storm-Water-Plan-Review/Regional-Storm-Water-Management-Program> (last visited Dec. 5, 2019).

Permit / Regulation Name	Agency	Purpose	Ultimately Applicable to H2Oaks?
Certificate of Determination for Platting Production Wells	City of San Antonio	“By platting a property within the city limits of the City of San Antonio, you can vest a property’s regulatory rights at the time of platting. Upon preparation of a plat the City tracks the property in connection with the Unified Development Code. This may prevent the property from being subject to more burdensome changes to the code in the future.” ⁴⁵⁰	Yes
Edwards Aquifer Authority Pump Rights or Regulations	EAA	SAWS consulted EAA to see if additional permits were needed for water rights or regulation.	No
Electric Service Property-Environmental Impact	CPS Energy or any other Gas/Electric Companies	If additional electric lines are impacted, CPS or other companies should be consulted.	No
Flammable & Combustible Liquid Tank (Fuel) Permits	Bexar County Fire Marshal	If the project uses generators or trucks with tanks greater than 100 gallons then need a permit from the Fire Marshal.	Yes

⁴⁵⁰ *What is the Platting Process in San Antonio?*, WGIINC.COM (April 14, 2014), <https://wginc.com/what-is-the-platting-process-in-san-antonio/>.

Permit / Regulation Name	Agency	Purpose	Ultimately Applicable to H2Oaks?
Construction Trailers Mobile Permit	Bexar County Fire Marshal	Temporary trailers on site during development needed permits.	Yes
Bexar County Fire Marshal Site Development Permit	Bexar County Fire Marshal	General site development permit.	Yes

2. Water Recycling

The City of San Antonio explicitly limits the authorized uses of recycled water to “commercial, industrial, irrigation, landscape maintenance, streamflow enhancement and other specific uses described in the recycled water contract between SAWS and a customer.”⁴⁵¹ As such, SAWS’ water recycling centers engage in direct, non-potable reuse. Direct non-potable reuse “refers to the use of reclaimed water that is piped directly from a wastewater treatment facility to a site for non-potable beneficial uses such as golf course and landscape irrigation, power plant cooling, or manufacturing.”⁴⁵²

“The SAWS Water Recycling Program is designed to provide up to 35,000 acre feet a year of recycled water to commercial and industrial businesses in San Antonio. By substituting 20 percent of SAWS’ demand on the Edwards Aquifer (35,000 acre feet/year) with recycled water for nondrinking uses, aquifer water can be preserved for drinking water[.]”⁴⁵³

At the local level, recycled water is not subject to the drought water reduction measures in the City Code, so in addition to being cheaper than potable water, it is available even in times of drought.⁴⁵⁴

⁴⁵¹ San Antonio City Code § 34-1.03.

⁴⁵² Texas Water Development Board, *Water Reuse*, WATER FOR TEXAS, <http://www.bcragd.org/wp-content/uploads/2016/12/TX-Water-Development-Board-WaterReuse.pdf> (last visited Dec. 4, 2019).

⁴⁵³ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 1 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁵⁴ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 1 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

Permitting

In San Antonio, specifically at the Stephen M. Clouse Water Recycling Facility, there were no local permits needed to construct the facility or operate it.⁴⁵⁵ The project's operations depend on the TPDES permit.⁴⁵⁶ This permit is detailed above, in Section IV.b.

Rules and Regulations

The SAWS Recycled Water Users' Handbook summarizes the state and local regulations that users of recycled water ("users") have to follow to receive and properly use recycled water from SAWS. Many of these are San Antonio city ordinances, which are enumerated in the San Antonio City Code.⁴⁵⁷

The San Antonio City Code governs the entire process from construction of main lines to receive recycled water⁴⁵⁸ to priority of users to service⁴⁵⁹ and disconnection.⁴⁶⁰ The City Code gives a lot of deference to SAWS.⁴⁶¹

SAWS "requires a written contract that stipulates the terms and conditions of service which may be different for each customer."⁴⁶² These contracts include that the user "designate a site supervisor" to be the contact person for SAWS and oversee "all records, signage, and training of employees on the proper usage of recycled water."⁴⁶³ SAWS further disclaims liability related to the "misuse of the recycled water by the user."⁴⁶⁴ While SAWS is responsible in some part for the safe transfer of water to the

⁴⁵⁵ Email Interview with Gegg Eckhardt, San Antonio Water System (Nov. 3, 2019).

⁴⁵⁶ Email Interview with Gegg Eckhardt, San Antonio Water System (Nov. 3, 2019).

⁴⁵⁷ See San Antonio City Code chapter 34.

⁴⁵⁸ San Antonio City Code §§ 34-4.01 to 34-5.03.

⁴⁵⁹ San Antonio City Code § 34-7.01.

⁴⁶⁰ San Antonio City Code § 34-7.09.

⁴⁶¹ See San Antonio City Code chapter 34.

⁴⁶² *Recycled Water Users' Handbook*, SAN ANTONIO WATER SYSTEM at 6 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf; San Antonio City Code § 34-1.02.

⁴⁶³ *Recycled Water Users' Handbook*, SAN ANTONIO WATER SYSTEM at 6 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁶⁴ *Recycled Water Users' Handbook*, SAN ANTONIO WATER SYSTEM at 6 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

point of delivery, it will not take responsibility for what the user does after.⁴⁶⁵ In fact, if SAWS learns of any violations of local, state, or federal rules it will notify TCEQ.⁴⁶⁶

SAWS places a number of record keeping and reporting requirements on the user itself as well because SAWS has to report things like quality⁴⁶⁷ and quantity of water delivered to each customer to TCEQ.⁴⁶⁸ Users have to notify SAWS “of any Recycled Water use not authorized, including, but not limited to, spills, leaks, discharges, or releases of a material volume of Recycled Water into or adjacent to the waters of the State. The only exception is when the discharge or spill is caused by rainfall events or in accordance with a permit issued by the TCEQ.”⁴⁶⁹

If a user wants to modify their recycled water system such as extending it or reducing it, the user has to get a permit from SAWS and the City of San Antonio Plumbing Inspection Department.⁴⁷⁰ Additionally, the user also has to “obtain the written consent of SAWS before changing the intended purpose of location of use of SAWS recycled water.”⁴⁷¹

SAWS also has a separate program called the Trucking Program in which approved users can get water hauled to them from the main line.⁴⁷² These users may have to get additional permits and face additional restrictions. For example, the vehicle used to transport the recycled water needs a permit.⁴⁷³ SAWS also requires that the user use the recycled water on the same day it is picked up to avoid the additional TCEQ-approved

⁴⁶⁵ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 6 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁶⁶ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 6 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁶⁷ Quality must conform to the specifications of San Antonio City Code § 34-2.01.

⁴⁶⁸ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 8 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁶⁹ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 8 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷⁰ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 9 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷¹ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 9 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷² *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 2 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷³ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 2 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

disinfection procedures for recycled water held for more than 24 hours.⁴⁷⁴ These users also have to be especially diligent in keeping a log of all deliveries, use dates, quantities and sites.⁴⁷⁵

Most of the local ordinances in the City Code give SAWS the authority to approve permits for construction, alterations, and disclaim liability for users who misuse recycled water. Therefore, users of recycled water must follow the specifications of their contract with SAWS to maintain compliance with the local regulations.

IV. Policy Landscape

A. Desalination

1. Texas Legislature

The Texas Legislature meets in odd-numbered years. In the interim period between legislative sessions, each of the chambers of the legislature charges legislative committees to research issues and priorities that the next legislative session may address. The 2019 directives recognize and reflect a shift in priority to develop sustainable water supply strategies, including groundwater supplies. While the directives do not necessarily address brackish groundwater desalination processes or technology directly, they do and will influence the accessibility of brackish groundwater, which is an essential element of the type of desalination this article has addressed.

As is relevant to this discussion, the Texas House of Representatives tasked the Committee on Natural Resources to oversee and monitor implementation of House Bill 722 (“HB 722”).⁴⁷⁶ HB 722 is “an act relating to the development of brackish groundwater.”⁴⁷⁷ This bill was signed into law by Governor Abbott on June 14, 2019 and took effect on September 1, 2019. According to the Texas Water Journal,

⁴⁷⁴ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 3 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷⁵ *Recycled Water Users’ Handbook*, SAN ANTONIO WATER SYSTEM at 3 (Sept. 2013), https://www.saws.org/wp-content/uploads/2019/02/recycled_water_hb_rev_20130926.pdf.

⁴⁷⁶ Dennis Bonen, Speaker of the House, *Interim Committee Charges* at 35 (Nov. 2019), <https://house.texas.gov/media/pdf/interim-charges-86th.pdf>.

⁴⁷⁷ Tex. House Bill 722 (2019 Legislative Session).

HB 722 is intended to provide greater access to brackish groundwater by simplifying procedures, expediting processing, reducing expenses, and providing flexibility to certain applicants within a GCD. The bill authorizes (and in the case of a petition from a groundwater owner, requires) a GCD to adopt and implement special permitting rules relating to the completion and operation of electric generation or municipal wells for the withdrawal of brackish groundwater within brackish groundwater production zones designated by the TWDB.⁴⁷⁸

This bill could have a great effect on the processes that govern obtaining brackish groundwater in Texas. As such, groundwater conservation districts (“GCDs”) will play a significant role in shaping the policy in the state. Municipalities that wish to implement brackish groundwater desalination facilities should pay attention to any new regulations that GCDs adopt relating to obtaining brackish groundwater.

In the Texas Senate, two of the charges of the Natural Resources and Economic Development Committee and Water and Rural Affairs related to the development of water supplies and groundwater in the state.⁴⁷⁹ One of the directives is for the Committees to “[e]xamine current laws, processes, and water storage options and availability. Make recommendations promoting the state's water supply, storage, availability, valuation, movement, and development of new sources.”⁴⁸⁰ The other directive is to study the regulatory framework for groundwater in the state and “make recommendations to improve groundwater regulation, management, and permitting.”⁴⁸¹

Both chambers of the Texas Legislature are focused on developing rules and regulations related to brackish groundwater in Texas. These legislative policy initiatives may have great impact on the development of alternative water sources, including brackish groundwater desalination.

⁴⁷⁸ 10 Tex. Water J. 81–82 (2019), https://twj.media/wp-content/uploads/2019/08/86thLegeWrapUps.opt_.pdf.

⁴⁷⁹ Dan Patrick President of the Senate, *2019 Interim Legislative Charges* at 13 (Oct. 30, 2019), <https://senate.texas.gov/assets/pdf/Senate-Interim-Charges-86.pdf>.

⁴⁸⁰ Dan Patrick President of the Senate, *2019 Interim Legislative Charges* at 13 (Oct. 30, 2019), <https://senate.texas.gov/assets/pdf/Senate-Interim-Charges-86.pdf>.

⁴⁸¹ Dan Patrick President of the Senate, *2019 Interim Legislative Charges* at 13 (Oct. 30, 2019), <https://senate.texas.gov/assets/pdf/Senate-Interim-Charges-86.pdf>.

2. Texas Water Development Board Policy Evaluation

TWDB created a report to send to the Texas Legislature prior to the 2019 session that evaluated the future of desalination in Texas.⁴⁸² In this report, TWDB made four policy suggestions for the legislature to consider.⁴⁸³

First, TWDB suggested that the State make it a priority to appropriate funds to research seawater and brackish groundwater studies.⁴⁸⁴ Second, TWDB identified that the permitting process is an obstacle for those that want to pursue desalination for the first time.⁴⁸⁵ TWDB identified, “[t]he State can assist in the permitting process by participating in and facilitating meetings between water providers or municipalities and regulatory agencies.”⁴⁸⁶ Third, cities and other subdivisions of the state that are eligible for TWDB loans and grants to fund water supply projects, like desalination, need to be informed of their eligibility.⁴⁸⁷ Fourth and finally, TWDB encouraged the legislature to consider and promote public-private partnerships as a mechanism by which to implement large-scale desalination projects.

⁴⁸² See Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

⁴⁸³ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 75 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

⁴⁸⁴ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 75 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

⁴⁸⁵ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 75 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

⁴⁸⁶ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 75 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

⁴⁸⁷ Texas Water Development Board, *The Future of Desalination in Texas*, TEX. WATER DEVELOPMENT BD. at 75 (Dec. 1, 2018), https://www.twdb.texas.gov/innovativewater/desal/doc/2018_TheFutureofDesalinationinTexas.pdf?d=1546638725773.

3. SAWS Potential for Ocean Desalination

SAWS continues to include ocean desalination in its water management plans. The most recent water management plan “includes an ocean water desalination supply project as a conceptual long-term strategy (2040 – 2070) for San Antonio.”⁴⁸⁸ Most notably, San Antonio is not a coastal city in Texas. One of the biggest challenges for implementing ocean desalination in the water portfolio is “the cost and logistics of transporting the water via pipeline at least 140 miles inland and uphill from the coast.”⁴⁸⁹ Naturally, there are other concerns as well such as the “need for feasibility and design studies to fill in knowledge gaps regarding potential environmental impacts and projected performance of desalination facilities. There is also a need to test the regulatory path with a demonstration facility to ensure we fully understand the permitting process[.]”⁴⁹⁰ Despite the research gaps and the fact that ocean desalination has not been implemented anywhere in Texas yet, it is important that SAWS still recognizes ocean desalination as a viable goal for the future.

B. Water Recycling

There is less information about the water recycling policy in Texas. It does not seem that water recycling has been made a legislative priority and as such, it is really up to individual municipalities to determine the benefits and drawbacks of water recycling on the local level.

San Antonio has engaged in informal water recycling for a long time. “Few places in the United States have practiced reuse of wastewaters longer than San Antonio. As early as 1894, raw sewage was widely used in agriculture in fields south of town.”⁴⁹¹ After years of experimenting with

⁴⁸⁸ *Ocean Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/ocean-desalination/> (last visited Dec. 16, 2019).

⁴⁸⁹ *Ocean Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/ocean-desalination/> (last visited Dec. 16, 2019).

⁴⁹⁰ *Ocean Desalination*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/new-water-sources/current-water-supply-projects/ocean-desalination/> (last visited Dec. 16, 2019).

⁴⁹¹ Gregg Eckhardt, *Using Recycled Edwards Water*, EDWARDSAQUIFER.NET, <https://www.edwardsaquifer.net/waterrecycling.html> (last visited Dec. 14, 2019).

recycled water throughout the 1950s and 60s, SAWS created a reliable water recycling facility in 2000.⁴⁹²

However, this was not an easy process. “Although reuse is encouraged by the Texas State Water Plan, the state’s rules and regulations have not caught up with the 21st century, and for almost a decade SAWS was unable to obtain permits from the Texas Commission on Environmental Quality to allow full utilization of the reuse system. In 2009, the utility was successful in obtaining legislation to allow full utilization, thereby bypassing the regulatory process.”⁴⁹³

Moreover, while drought conditions in some cities in Texas have forced municipalities to find ways to use recycled wastewater as a drinking water and domestic use source,⁴⁹⁴ SAWS only operates in the direct, non-potable sphere.

Therefore, San Antonio has really created its own policy when it comes to water recycling. It is the nation’s largest direct recycled water system and implemented this system on its own, at the local level.⁴⁹⁵

V. Analysis

San Antonio is not unique in its motivations for diversifying its water supply. In fact, most places that successfully implement desalination plants or water recycling centers are somewhat forced to do so for emergency reasons.⁴⁹⁶ That is, they are usually places that are faced with a quickly depleting freshwater supply. In San Antonio’s case, the threat of judicial

⁴⁹² Gregg Eckhardt, *Using Recycled Edwards Water*, EDWARDSAQUIFER.NET, <https://www.edwardsaquifer.net/waterrecycling.html> (last visited Dec. 14, 2019).

⁴⁹³ Gregg Eckhardt, *Using Recycled Edwards Water*, EDWARDSAQUIFER.NET, <https://www.edwardsaquifer.net/waterrecycling.html> (last visited Dec. 14, 2019).

⁴⁹⁴ See generally Desmond Lawler, *What Every Texan Needs to Know About “Toilet to Tap” Water*, UNIVERSITY OF TEXAS NEWS (Aug. 1, 2014), <https://news.utexas.edu/2014/08/01/what-every-texan-needs-to-know-about-toilet-to-tap-water/>.

⁴⁹⁵ *Water Recycling*, SAN ANTONIO WATER SYSTEM <https://www.saws.org/your-water/water-recycling/> (last visited Dec. 16, 2019).

⁴⁹⁶ See generally Meryl McBroom, *What’s the Deal with Desalination?*, ENVT’L. & ENERGY STUDY INSTITUTE (Nov. 16, 2018), <https://www.eesi.org/articles/view/whats-the-deal-with-desalination>.

intervention⁴⁹⁷ in combination with new regulations on the Edwards Aquifer⁴⁹⁸ is what prompted city-specific action. “If the Edwards Aquifer was never regulated, then those out-of-the box activities might not have happened or not happen as early,” he [Darren Thompson] said. “When you go from an unlimited source of water to one that is regulated and you don’t have enough of it to meet future demands, you tend to get very creative and maximize what you do have.”⁴⁹⁹ Since San Antonio resolved to dedicate time, personnel, and resources to water supply diversification, the city and specifically SAWS “leads the nation in innovation—from water conservation programs to developing new, sustainable water resources.”⁵⁰⁰

The transparency and communication that SAWS has with the residents of San Antonio is incredibly unique. “Transparency with the people of San Antonio is a major priority at SAWS, along with providing a plentiful supply of clean water for generations to come.”⁵⁰¹ Despite the major technological innovations SAWS made with the H2Oaks facility and water recycling centers, SAWS also spearheads the city’s water conservation and awareness campaigns.⁵⁰² “Our [SAWS] water conservation efforts are among the best in the nation, boasting a record-low GPCD (gallons per capita per day) of 117; that’s down by 50% over the past 35 years, even as our population increased by nearly 150%.”⁵⁰³ In 1982, water consumption in San

⁴⁹⁷ *How an Endangered Salamander Forced a Texan City to Save Water*, THE GUARDIAN (last visited Oct. 18, 2019), <https://www.theguardian.com/cities/2018/mar/02/san-antonio-texas-water-usage-salamander>.

⁴⁹⁸ See Joe Nick Patoski, *The Edwards Aquifer & the EAA*, EDWARDSAQUIFER.ORG (last visited Oct. 28, 2019), <https://www.edwardsaquifer.org/eaahistory/>.

⁴⁹⁹ Kathy Wythe, *Diversifying Water Portfolios*, TEX. WATER RESOURCES INSTITUTE, <https://twri.tamu.edu/publications/txh2o/2019/summer-2019/diversifying-water-portfolios/> (last visited Dec. 18, 2019) (quoting Darren Thompson, SAWS Director of Water Resources).

⁵⁰⁰ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵⁰¹ San Antonio Water System, *Water Quality*, WATERFUL.SAWS.ORG, <https://waterful.saws.org/water-quality/> (last visited Dec. 18, 2019).

⁵⁰² San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵⁰³ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

Antonio was 225 GPCD; in 2016, even with population growth, the demand was 117 GPCD.⁵⁰⁴

SAWS does this by offering coupons and rebates to residents who are reducing irrigation lawn usage.⁵⁰⁵ SAWS also offers residents free, one-on-one consultations about the best way that individual can reduce their water use.⁵⁰⁶ The SAWS homepage on their website also maintains up-to-date daily readings of J-17.⁵⁰⁷

As explained above, the H2Oaks facility is only operating in Phase I of three planned expansion phases. But “once complete[sic], San Antonio will have the largest inland desalination plant in the country, delivering 25 million gallons of drinking water per day.”⁵⁰⁸

Moreover, “San Antonio boasts the largest direct recycled water delivery system in the nation.”⁵⁰⁹ SAWS is committed to providing recycled water to “business, golf courses, and even one of San Antonio’s most well-known attractions, the River Walk.”⁵¹⁰ But it isn’t just the commitment to provide recycled wastewater that makes SAWS efforts unique. “We also recycle our biosolids to produce compost that is sold commercially, and we sell the biogas on the open market that is generated during the treatment process. San Antonio is the only U.S. city to reuse all three wastewater treatment process byproducts.”⁵¹¹ Specifically, the Steven M. Clouse water

⁵⁰⁴ Water City SA, *2017 Water Management Plan*, SAN ANTONIO WATER SYSTEM at 5 (last updated Nov. 7, 2017), http://www.saws.org/wp-content/uploads/2019/02/20171107_SAWS-2017-Water-Management-Plan.pdf

⁵⁰⁵ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵⁰⁶ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵⁰⁷ See SAWS.org.

⁵⁰⁸ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵⁰⁹ *Water Recycling*, SAN ANTONIO WATER SYSTEM <https://www.saws.org/your-water/water-recycling/> (last visited Dec. 16, 2019).

⁵¹⁰ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

⁵¹¹ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

recycling facility has been recognized with “the industry’s top honor, the U.S. EPA’s Operations and Maintenance Excellence Award.”⁵¹²

The combination of public transparency and interaction with the technological advancements of state-of-the-art brackish groundwater desalination facility and water recycling centers makes SAWS a “water pioneer.”⁵¹³

Although SAWS made tremendous strides as a leader in the water portfolio diversification field, it was not a simple task to build new facilities from the ground up. The success that SAWS has seen cannot be accredited to similar transparency and streamlining in the permitting processes and legal realms. For H2Oaks, everything from construction and operation of the plant through the quality of the desalinated water is carefully monitored and contingent upon federally delegated, state, and local permits and permissions. The relatively fewer permits and permissions required of the water recycling facilities in San Antonio are largely due to the legislative permission to bypass state regulations. Additionally, there are still many local rules created by SAWS or the San Antonio City Code to track how recycled water is used. Moreover, there is no “easy” way to find information about these permits. Without contacts at SAWS who were knowledgeable or willing to speak about the permitting processes, the information contained in this article was seemingly not accessible online or in articles.

VI. Conclusion

San Antonio, Texas was essentially forced to consider how to diversify its water supply when various stakeholder tensions came to a head in the 1990s. Increasing concerns regarding Edwards Aquifer depletion, endangered species conservation, and increased regulation of the Edwards Aquifer triggered a need for a diversified water supply portfolio. Environmental and stakeholder interests coupled with a rapidly increasing population in the present day continues to motivate SAWS in its innovation of new water supply methods. Thus far, SAWS has been a tremendous

⁵¹² *SAWS Water Recycling Facts*, SAN ANTONIO WATER SYSTEM, <https://www.saws.org/your-water/water-recycling/recycling-centers/saws-water-recycling-facts/> (last visited Dec. 18, 2019).

⁵¹³ San Antonio Water System, *Innovative Programs and Practices Make SAWS a Water Pioneer*, RIVARD REPORT, <https://therivardreport.com/innovative-programs-and-practices-make-saws-a-water-pioneer/> (last updated Oct. 22, 2017).

leader not just in Texas, but nation-wide. Specifically, SAWS strides in in communication with and education of the public, brackish groundwater desalination, and water recycling has earned national recognition. While the permitting processes are not always easy to navigate, SAWS took a methodical and organized approach to tracking the permits at its H2Oaks facility and found ways to legislatively bypass permitting processes for the water recycling facilities.



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