DRAFT

2017 Water Management Plan

San Antonio Water System

Contents

ON THE COVER: San Antonio Water System's commitment to our community's water future is exemplified by new water supply projects like the Vista Ridge public-private partnership (top), conservation outreach efforts such as our annual Spring Bloom gardening festival (middle), and innovative technology like our new brackish groundwater desalination plant (bottom).

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1 Executive Summary

As San Antonio approaches a celebration of its 300th founding anniversary, and as San Antonio Water System celebrates its 25th anniversary, it's important to note how water was a critical factor in the founding of the city and continues to be the cornerstone of its vitality and development.

In its relatively short history, SAWS is now one of the largest municipal water utilities in the country providing water and wastewater services for more than 1.8 million people in San Antonio and surrounding areas. Nationally recognized for sustainable and responsible management, SAWS oversees existing water supplies while developing new water sources for the future – helping diversify its water supply and ensuring sustainable, affordable water services for generations.

SAWS' 2017 Water Management Plan continues a long-standing tradition of planning for and implementing a balanced mix of water supply projects and progressive water conservation programs. SAWS' first Water Management Plan was developed in 1998. New updates have since been developed in 2005, 2009, and 2012. SAWS is an international leader in water conservation, and has over a decade of operational experience with innovative water supply projects.

Diversified Water Supply

SAWS boasts the largest direct recycled water system in the country, the largest groundwater based Aquifer Storage & Recovery (ASR) facility in the nation, and several innovative infrastructure-sharing arrangements with regional partners. In addition, SAWS recently opened the Brackish Desalination Plant at H_2Oaks Center with the capacity to produce 12 million gallons of drinking water daily.

Since the 2012 Water Management Plan, several significant events have occurred to secure San Antonio's water future:

- Regional Carrizo Water Project was brought on line in 2013, providing more than 10,000 acre-feet of water in both 2015 and 2016 from the Carrizo Aquifer in Gonzales County to San Antonio
- The SAWS H_2Oaks Desalination Plant and water center began operations in January 2017
- SAWS ASR at H_2Oaks has reached a record storage volume of 125,000 acre-feet, which is over half a year's potable demand

With plans to be on line in early 2020, SAWS is actively working on the 142-mile Vista Ridge Regional Supply Project – the newest water resource to continue diversifying the city's water supply. As one of the largest water Public-Private Partnerships (P3), this project is being led on the private company side by Garney Construction. Design for the project is well advanced, well drilling has begun and pipe is being put in the ground. When it comes on line, this game-changing project will satisfy 20 percent of SAWS demand, and serve as added protection for the Edwards Aquifer during drought conditions.

***Figure 1-1**: SAWS will continue to reduce reliance on the Edwards Aquifer by bringing in new supplies.*

With Vista Ridge, SAWS' already robust water supply inventory will be increased to feature 16 different water supply projects from nine different water sources. By continuing to develop non-Edwards Aquifer supplies, SAWS will continue to reduce its reliance on the Edwards Aquifer throughout the planning period. This dedication to diversification and commitment to strategic water planning ensures San Antonio will have plentiful water for generations to come.

World Class Water Conservation

San Antonio's long-standing commitment and investment in water conservation and infrastructure improvements has yielded its largest water supply. SAWS' total per capita water consumption has decreased significantly from 225 gallons per capita per day (GPCD) in 1982 to 117 GPCD in 2016, which has resulted in approximately 3.2 million acre-feet of cumulative savings. Using today's larger population, a total per capita of 225 GPCD would require an additional 214,000 acre-feet of water per year. SAWS has successfully cultivated an ethic of conservation and invested in infrastructure over the past 35 years and effectively reduced GPCD by approximately 50 percent, all while SAWS' service area population has grown by approximately 150 percent.

Water conservation continues to be a strategy for long-term water supply. By 2070, conservation investments are projected to result in approximately 4.3 million acre-feet of cumulative water savings since 2017, and would replace the need for a water supply project of approximately 140,000 acre-feet per year.

***Figure 1-2**: SAWS conservation events such as Spring Bloom educate thousands of people each year on the many benefits of drought-tolerant landscaping.*

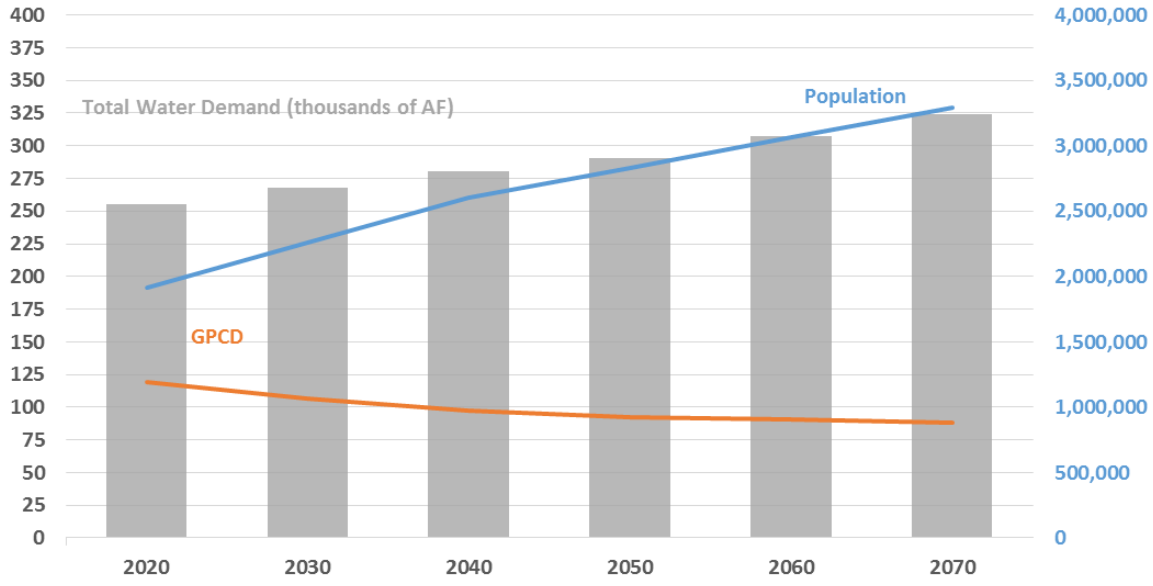
Over the last five years, several initiatives have contributed to our progress in extending San Antonio's water supplies through conservation:

- Over 1.6 million square feet of water-intensive grass has been replaced with low water-use plants or permeable patios through WaterSaver Landscape Coupon programs
- Irrigation Consultations providing home irrigation and landscape education visits have reduced household usage by 84 million gallons every year
- The GardenStyleSA.com website and e-newsletter providing timely San Antonio-focused low water use landscape information to reduce outdoor watering
- SAWS has partnered with University of Texas at Austin-based Pecan Street to develop an integrated conservation platform that will expand water conservation opportunities in the future

SAWS 2017 Water Management Plan assumes a total demand in 2070 that is approximately 75,000 acre-feet per year less than the 2012 Water Management Plan.

SAWS' 2017 Water Management Plan strives for a reduction of residential consumption to 55 GPCD by 2070, and a total consumption (to include commercial, industrial and non-revenue water) of 88 GPCD by 2070.

***Figure 1-3**: SAWS aims to achieve a total GPCD of 88 by 2070, which is comparable to water usage in population-dense cities such as San Francisco.*



Even with a significantly higher population projection than the 2012 Water Management Plan, the SAWS 2017 Water Management Plan assumes a total demand in 2070 that is approximately 75,000 acre-feet per year less than the 2012 Water Management Plan.

Visionary Planning

SAWS' 2017 Water Management Plan introduces a number of cutting edge topics that are new to the document, although not new to SAWS planning. For the first time, SAWS customers will be able to see how SAWS projects demand by customer class (versus total demand), using its disaggregated demand model. One component of SAWS demand is how much water is accounted for as nonrevenue, which this document expands upon in Section 7.

Acknowledging that climate may become more challenging in the future, the 2017 Water Management Plan includes comprehensive preparations for worst-case climate scenarios. In collaboration with the City of San Antonio, SAWS has begun to evaluate the potential challenges posed by more extreme weather conditions, and believes that it is uniquely positioned to manage those challenges, as outlined in Section 13. One way that SAWS is incorporating these issues is by planning for a more severe Drought of Record, which merges the duration of the drought of the 1950s with the intensity of the 2011-2014 drought.

Section 12 of this document addresses the increasingly important topic of integration, as we continue to diversify and grow our water supply portfolio. Finally, in order to convey all of these exciting new features, SAWS is leveraging technology and social media to educate customers and solicit input, as discussed in Section 16.

Waterful Solutions – One Regional Water Community

Coined by the US Water Alliance, the One Water approach re-frames the urban water cycle as a single integrated system, in which all flows are recognized as potential resources. Within this system, the interconnectedness of surface water, groundwater, stormwater and wastewater is optimized. The One Water approach strives for greater coordination among diverse stakeholders, recognizing that water quantity and quality depends on multi-faceted collaborations. San Antonio leads the country in *Waterful* solutions – providing sustainable innovations for water management and developing holistic water solutions for the San Antonio area.

Sustainability

As a nationally recognized leader in water conservation, SAWS demonstrates its commitment to sustainability through significant investments in conservation programs. While initially largely focused on reductions in indoor usage, these programs now work to reduce outdoor irrigation through a wide variety of education, rebate and coupon programs for both residences and businesses.

San Antonio is building resiliency via a number of different strategies, including but not limited to the following:

- SAWS helps businesses reclaim condensate water for use on-site as irrigation
- Accomplishment of the trifecta of wastewater treatment:
    - Highly treated effluent water is reused in the largest direct recycled system in the U.S.
    - Methane gas is captured and sold on the natural gas market
    - Solids are reused and sold as compost

__Figure 1-4__: Water Energy Nexus – CPS Energy utilizes SAWS property at Dos Rios Water Recycling Center to generate up to 20 megawatts of solar energy.

- Generating and saving energy:
    - Partnering with CPS Energy to develop a 20 MW solar panel field on SAWS property, among the largest solar fields in the state
    - Implementing peak energy avoidance programs at SAWS' Water Recycling Centers

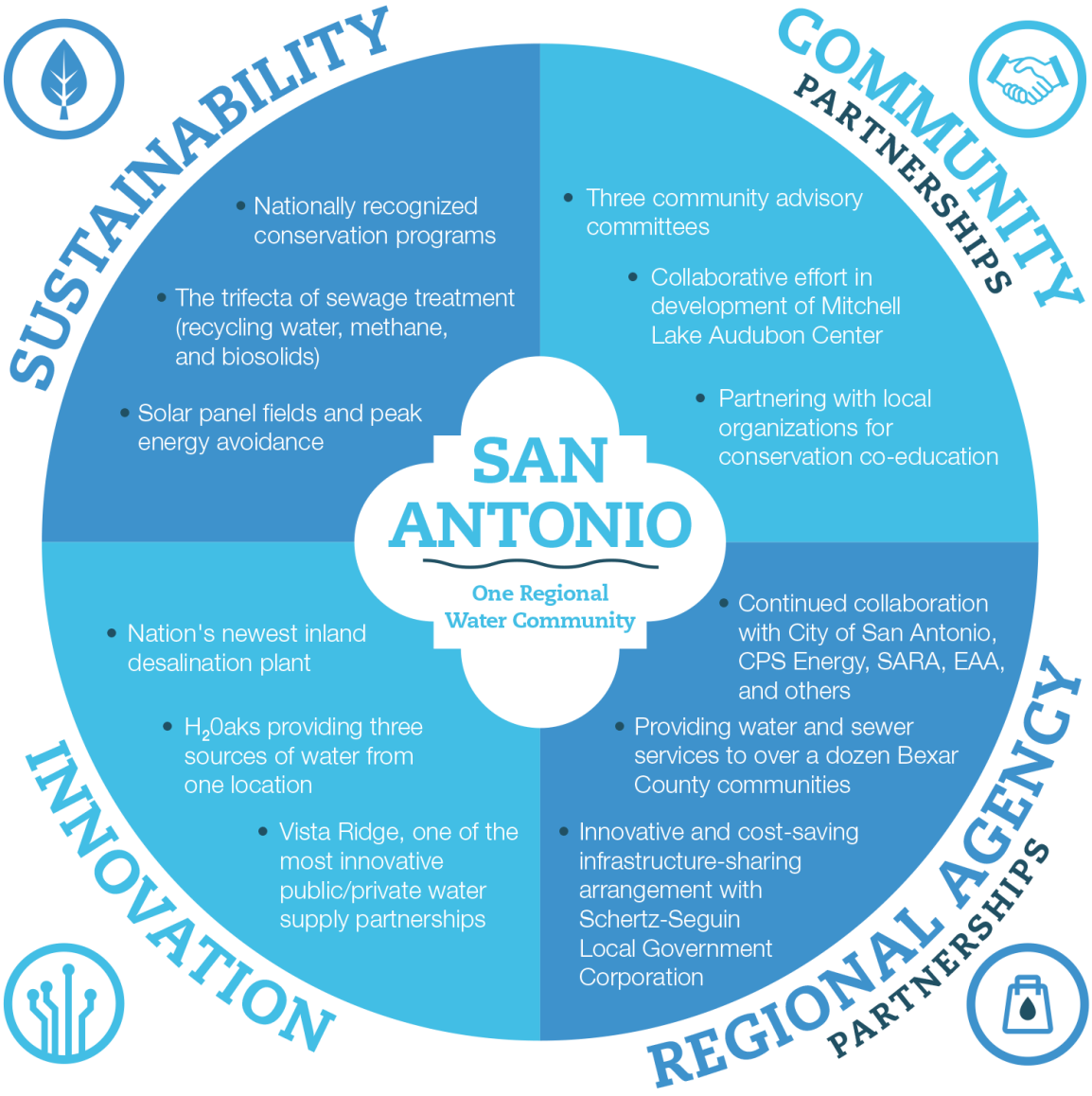
Innovation

- The nation's newest inland desalination plant – H_2Oaks Center – is the only known place in the U.S. that maximizes efficiency by providing three different sources of water from one site:
    - Desalinated brackish water from deep underground Bexar County

- Water stored in the ASR that was originally permitted from the Edwards Aquifer
- Locally pumped Carrizo Aquifer water

- Vista Ridge, the newest water project currently under construction, is one of the most innovative water projects in the country, and has become a global model of public-private partnerships. Through unprecedented public contract negotiations, this privately developed regionally-based water project protects San Antonio ratepayers from development and regulatory risk during the 30 year contract term.

***Figure 1-5**: Waterful Solutions – Local and regional partnerships allow for a unified One Water approach to water management and conservation.*



Community Partnerships

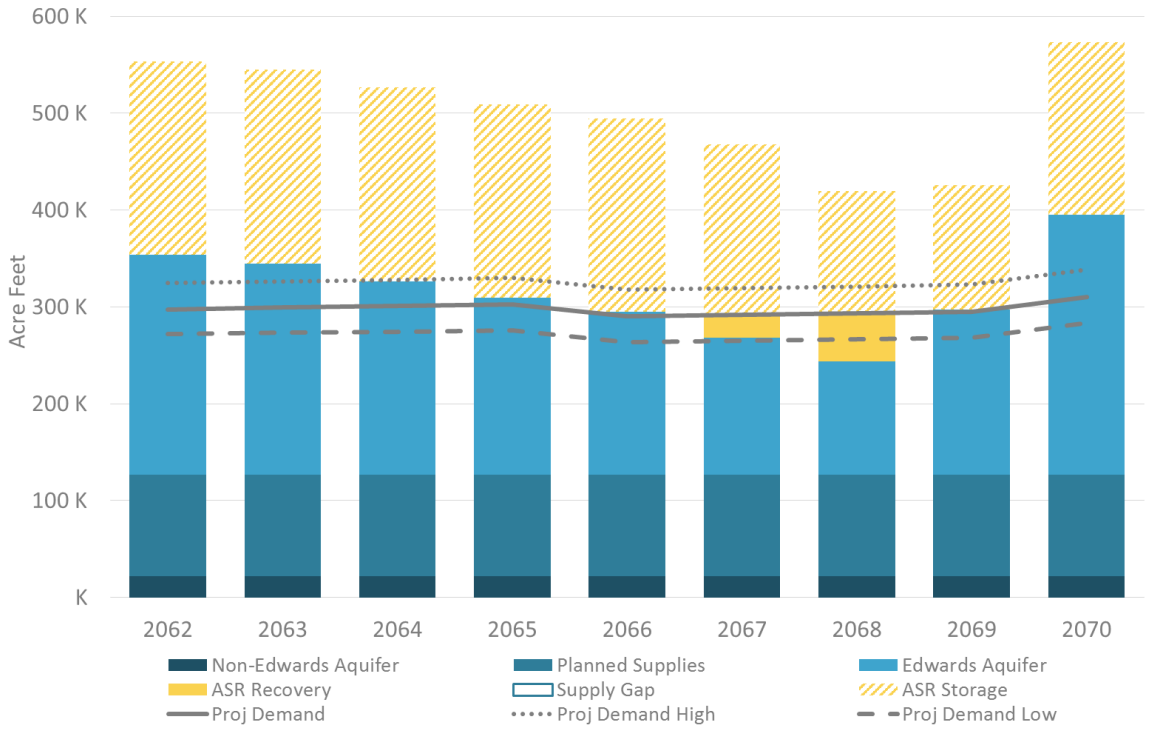
- Community advisory committees like the Citizens Advisory Panel and Community Conservation Committee advise the SAWS Board of Trustees and management on water and conservation projects.
- Community and environmental groups worked with SAWS to develop Mitchell Lake Audubon Center, a natural wonder that attracts people from around the world and helps educate current and future generations on the environment.

Regional Agency Partnerships

- Through coordination with the Edwards Aquifer Authority, San Antonio River Authority, and the City of San Antonio, SAWS efforts help ensure high water quality and healthy waterways.
- The Regional Carrizo Water Project was developed in coordination with the Schertz-Seguin Local Government Corporation, utilizing a shared pipeline to bring water pumped in Gonzales County to San Antonio, saving both entities millions of dollars.

Water for Generations

***Figure 1-6**: SAWS ensures water for generations by setting progressive demand goals with stage 1 and 2 landscape watering restrictions, and then evaluating the need to develop future planned supplies.*



Through the development of the various projects in this Plan, advanced water conservation efforts, and the efficient management and operations of its water supplies, SAWS will have water security in the driest of dry times through at least 2070.

The Task Force that worked on developing the new plan consisted of:

- Robert R. Puente, President/CEO
- Mary Bailey, Vice President Business Planning & Controller
- Andrea Beymer, President/CEO's Chief of Staff
- Donovan Burton, Vice President Water Resources and Governmental Relations
- Steve Clouse, Chief Operating Officer & Senior Vice President
- Doug Evanson, Chief Financial Officer and Senior Vice President
- Steve Kosub, Esq., Senior Water Resources Counsel
- Gavino Ramos, Vice President Communications & External Relations

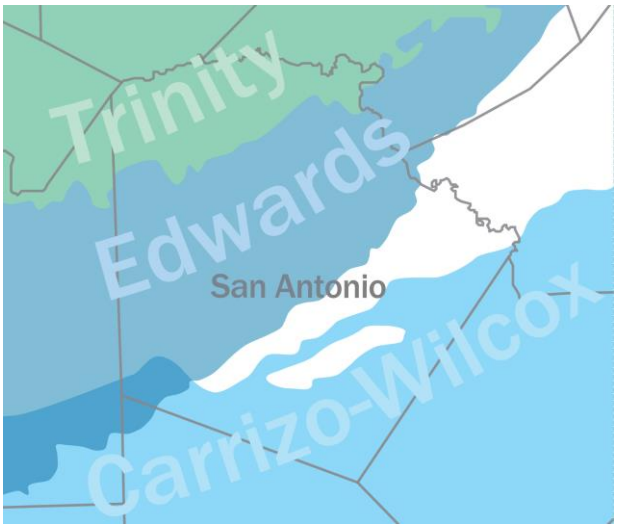
2 Geography, Geology, and Climate

San Antonio's location provides unique water opportunities and challenges. Three areas key to water analysis and planning are: geography; geology; and climate.

Geography

The SAWS service area encompasses 967 square miles in Bexar County and parts of four surrounding counties. SAWS' service area includes the city limits of San Antonio and several small incorporated cities, as well as surrounding unincorporated areas.

Figure 2-1: SAWS is fortunate to be in close proximity to four major aquifer systems.



Elevations vary from about 500 feet above sea level in the southeast to more than 1,400 feet above sea level in the northwest. The San Antonio Economic Development Foundation estimates that the 2016 population of the city of San Antonio was 1,440,900. The U.S. Census Bureau estimates the 2016 population of Bexar County to be 1,928,680. The estimated 2017 population projection for the SAWS service area is 1,817,387 people. The Bureau currently ranks San Antonio as the second largest city in Texas and the seventh largest city in the United States.

Geology

The San Antonio region overlies portions of four major aquifers. The most notable is the Edwards Aquifer, a prolific karst limestone aquifer which has always served as San Antonio's cornerstone source of water supply. SAWS also utilizes to a lesser degree resources from the Trinity Aquifer, the Carrizo Aquifer and the Wilcox Aquifer.

Climate

San Antonio generally experiences a modified humid subtropical climate. Its location between a semi-arid area to the west and a much wetter and more humid area to the east often results in large variations in monthly and annual precipitation amounts. The average high monthly temperatures range from 62 degrees in January to 95 degrees in July and August. The average low monthly temperatures range from 39 degrees in January to 74 degrees in July and August. The 30-year average (1981-2010) annual precipitation for San Antonio is 32 inches. Perhaps more significant than annual total rainfall is that rainfall is highly variable. Long dry periods can be punctuated by some of the highest rainfall intensities in the world.

Climate variability increases the difficulties in water management planning.

The combined impacts of geography, geology and climate impact both water supply and water demand in complex ways. Extreme weather can reduce availability of some water supplies, while concurrently increasing demand for water (or vice versa). SAWS deploys a variety of strategies to manage this challenge that include supply diversification, adding drought-firm supplies, and reducing weather-related water demand through focused water conservation initiatives.

3 Current Water Supply Portfolio

SAWS has one of the most diversified and innovative water supply portfolios in the country. Over the last 20 years, SAWS has led the country in developing water supply, for the purposes of reducing its reliance on the Edwards Aquifer and diversifying its portfolio, planning for one of the highest population growth corridors in the nation, and preparing for drought. San Antonio leadership has worked over these last 20 years to radically change the water supply situation, thereby sustaining a thriving economy.

In planning for future water supplies, SAWS applies Drought of Record (DOR) conditions to all water supplies in its current inventory to calculate firm yield. The drought of 1950-1958 in Texas is widely recognized as the Drought of Record for water resource planning purposes. Firm yield is defined by SAWS as the volume of water which can be produced from a specific source during a repeat of the Drought of Record under existing regulatory, legal, contractual, hydrological or infrastructure constraints. An innovative feature of SAWS' 2017 Water Management Plan is that the hydrological and regulatory constraints experienced in the 2011-2014 drought and the 1950-1958 drought were merged, to create a more severe Drought of Record which adds conservatism to water supply planning.

SAWS has numerous water supply contracts with various terms and expiration dates. Water supplies available by contract will not be accounted for after the term in which the current contract expires, unless an extension option for SAWS is unilateral. This assumption by SAWS is not an evaluation of the merits of these contracts or supplies

which are not assumed to be extended, but is simply an equitable methodology for planning purposes.

SAWS currently has access to the following supplies for providing water:

Edwards Aquifer Authority (EAA) Permit

The Edwards Aquifer has been, and will continue to remain, the cornerstone of San Antonio's water supply. SAWS currently holds permits issued by the EAA to produce approximately 292,000 acre-feet per year of Edwards Aquifer groundwater with approximately 88% of this amount owned and the remainder under lease to SAWS. Production under these permits is subject to regulatory cutbacks up to 44 percent during periods of drought. In addition to the regulatory cutbacks, SAWS has agreed to not produce approximately 8,000 acre-feet per year through 2027 for the benefit of the Edwards Aquifer Habitat Conservation Plan (EAHCP). In another agreement for the benefit of the EAHCP, SAWS has agreed to reduce (forebear) pumping by up to 46,300 acre-feet during any single year or 126,000 acre-feet aggregate during the term of the agreement under conditions replicating a Drought of Record. SAWS has conservatively planned for the continuation of this EAHCP commitment throughout the planning horizon. SAWS' objective is to maintain approximately 281,000 acre-feet per year of EAA-permitted groundwater withdrawal rights, through a variety of procurement methods, including buying, leasing, a potential dry year option, or other methods of managing in order to reduce SAWS Edwards Aquifer supplies.

The Edwards Aquifer has been, and will continue to remain, the cornerstone of San Antonio's water supply.

- **Edwards Aquifer Habitat Conservation Plan (EAHCP)** – Development and implementation of the nationally recognized EAHCP has been undertaken by a remarkably diverse set of stakeholders and interest groups from throughout the Edwards Aquifer region. The EAHCP will be in place until 2027; however, the necessity to balance

***Figure 3-1**: The Texas blind salamander is one of eight species in the Edwards Aquifer ecosystem that have been designated as either threatened or endangered.*

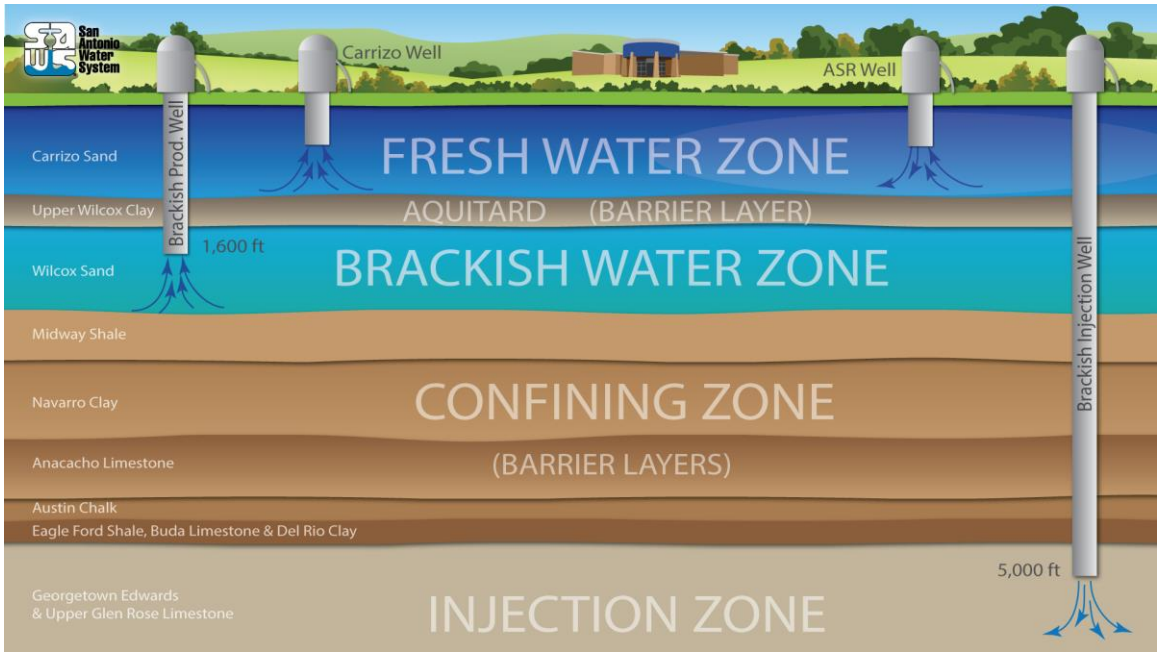
the needs of the human users of the Edwards Aquifer and the Federally-listed threatened and endangered species associated with it will remain. Some form of aquifer management for periods of record-breaking drought stress will be required to continue. While those future forms of aquifer management cannot be predicted, SAWS has chosen to continue to represent the EAHCP commitment on the water supply and demand charts beyond the expiration of the present EAHCP.

H_2Oaks Center

Located 20 miles south of downtown San Antonio in southern Bexar County, the SAWS H_2Oaks Center is the only known location in the U.S. where a utility produces three different water supplies at one location. With the H_2Oaks Center over the Carrizo-Wilcox formations, SAWS is able to serve the public through the production of freshwater from the Carrizo Aquifer, the production of brackish groundwater from the Lower Wilcox Aquifer at the Brackish Groundwater Desalination facility, and the recovery of stored Edwards Aquifer water from the Aquifer Storage and Recovery project. In keeping with South Texas tradition, SAWS leases the land back to its original owners for agricultural use and cattle grazing.

SAWS desalination represents a wholly new, sustainable, drought-proof water supply.

__Figure 3-2__: Geologic cross section below the SAWS H_2Oaks Center (not to scale).



- **Aquifer Storage and Recovery (ASR) Facility** – The SAWS ASR has been an unquestioned success, and has become the largest groundwater-based ASR in the nation. This valuable asset allows SAWS to store Edwards Aquifer water during wet times or low demand seasons, and to recover that water during droughts, periods of peak usage, or other times when demand on the Edwards Aquifer is high. SAWS recovered large volumes of Edwards Aquifer water during the record-breaking drought between 2011 and 2014. Thanks to above average rainfall, SAWS was able to store nearly 20,000 acre-feet of Edwards Aquifer water in 2015, and more than 35,000 acre-feet in 2016. SAWS' trailblazing project has been so successful that it plays a prominent role in the EAHCP developed to withstand a recurrence of drought similar to the Drought of Record in the Edwards Aquifer region. SAWS has stored over 125,000 acre-feet of water in the facility, which is available for use. Over 57,000 acre-feet of the total storage volume has been contributed by the EAA to offset Edwards Aquifer extraordinary pumping limitations imposed on SAWS by the EAHCP agreement discussed above. SAWS plans for a total storage volume of approximately 200,000 acre-feet. This level of storage has been supported by recent studies which have estimated total storage capacity of 200,000 acre-feet or more.

- **Carrizo Aquifer Groundwater in Bexar County** – SAWS has access to a total of 9,900 acre-feet per year of Carrizo Aquifer groundwater from property owned by SAWS in southern Bexar County. A portion of that access is derived from wells located on SAWS' H_2Oaks property, and a portion is derived from wells located proximal to that property.

- **Brackish Groundwater Desalination (BGD) Phase I** – Development of this water resource in close proximity to San Antonio will diversify SAWS water resources portfolio with a wholly new, abundant, drought-proof supply. The BGD program involves the production of brackish

Figure 3-3: Racks of reverse osmosis membranes remove dissolved solids from brackish groundwater at the SAWS H_2Oaks Center desalination plant in southern Bexar County.

(salty) groundwater from the Lower Wilcox Aquifer in southern Bexar County, and reverse osmosis treatment to drinking water quality standards at the SAWS H_2Oaks Center. Phase I of the BGD program is fully constructed, consisting of new production wells, a conveyance pipeline, concentrate disposal wells and disposal pipeline, and a reverse osmosis treatment plant. Phase I of this innovative water supply project provides up to 13,441 acre-feet per year of firm water supply. The facility is designed for expansion in two phases to produce up to an additional 20,000 acre-feet per year.

Trinity Aquifer

SAWS has three contracts to purchase groundwater from privately owned Trinity Aquifer projects and one SAWS-owned project in North Central San Antonio. By utilizing this water source, as opposed to pushing Edwards Aquifer water uphill, SAWS customers save on avoided operating and energy costs. In the 2012 Water Management Plan, SAWS considered its Trinity Aquifer supply to be firm at 2,000 acre-feet per year. As a result of both valuable experience gained during the recent drought, as well as thoughtful and sustainable management, SAWS now considers its supply from the Trinity Aquifer to be 16,100 acre-feet per year in average years, and firm at 4,000 acre-feet per year. For long-term planning purposes, SAWS assumes termination of its contract with Water Exploration Company (WECo) in 2027, termination of its contract with Bulverde Sneckner Ranch (BSR) in 2020, and extension of its contract with Oliver Ranch to 2034.

Canyon Lake

SAWS has a contract with the Guadalupe-Blanco River Authority to purchase between 4,000 and 9,000 acre-feet per year of stored water from Canyon Lake, delivered to North Central and Northwestern Bexar County. The contract expires in 2037. It includes an option to extend to 2077 under terms that SAWS currently considers not viable. Thus, SAWS assumes termination of this contract in 2037.

Canyon Regional Water Authority (CRWA)

SAWS has a contract with CRWA to purchase up to 4,000 acre-feet per year of treated surface water from Lake Dunlap on the Guadalupe River near New Braunfels. SAWS has agreed to lease 500 acre-feet per year of this water to Springs Hill Water Supply Corporation through 2023. SAWS has an additional contract with CRWA to purchase 2,800 acre-feet per year of Carrizo Aquifer groundwater from sources in Gonzales and Guadalupe Counties. The Lake Dunlap contract expires in 2038 and the Wells Ranch contract expires in 2047, and SAWS assumes termination in those years.

Carrizo Aquifer Groundwater from Gonzales County

When this Carrizo Aquifer supply became operational in 2013, it provided SAWS customers with the largest non-Edwards Aquifer groundwater supply to-date through an innovative and cost-saving infrastructure-sharing arrangement with Schertz-Seguin Local Government Corporation (SSLGC). This plan includes the 11,688 acre-feet per year permit (minus losses) that SAWS is permitted to produce and export, but does not include surplus deliveries from SSLGC. SAWS has the option of whether or not to purchase surplus water made available by SSLGC. SAWS is proud of the mutual benefits that this major public-public partnership has made possible, eliminating the need to construct over 50 miles of pipeline, a new water treatment plant, and two pump stations, thereby saving SAWS customers $88 million, and providing a back-up supply and debt payments to SSLGC. The term of this supply goes beyond the planning horizon of 2070.

SAWS customers saved $88 million thanks to an infrastructure-sharing arrangement with Schertz-Seguin Local Government Corporation.

Medina System

SAWS has a contract with the Bexar-Medina-Atascosa Water Control & Improvement District #1 (BMA) to purchase up to 19,974 acre-feet per year of stored water from Medina Lake delivered to a SAWS treatment plant via the Medina River. Medina Lake was virtually empty during the 2011-2014 drought. SAWS therefore considers the firm yield of this supply to be zero acre-feet per year during the worst six years of a Drought of Record. The contract expires in 2049, and SAWS assumes termination in that year.

Recycled Water

SAWS has the nation's largest direct recycled water system, with infrastructure capacity to deliver up to 35,000 acre-feet per year of treated recycled water through more than 130 miles of pipeline to commercial and industrial customers, golf courses, and parks throughout the city. The system was also designed to supplement flows in the San Antonio River and Salado Creek. In addition, recycled water supplies up to 50,000 acre-feet per year conveyed via bed and banks to CPS Energy for use in electrical generation.

SAWS has the nation's largest direct recycled water system.

Regional Regulations (Non-Edwards Aquifer Groundwater)

Groundwater Conservation Districts (GCDs) manage the aquifers within their jurisdiction. As part of this management, they are required to set a desired condition over a 50-year planning period — referred to as the Desired Future Condition (DFC). These future aquifer conditions are identified through a policy-driven process within a larger group of conservation districts called Groundwater Management Areas (GMAs). Once these geographic areas have agreed on the 50-year future condition policy, a groundwater availability calculation is then determined using a computer model. This calculation, referred to as the Modeled Available Groundwater (MAG) is then used by conservation districts to assist in managing production from their district along with the available groundwater calculation being used in statewide water planning processes.

__Figure 3-4__: SAWS began planning for the large-scale reuse of recycled wastewater in the 1990s as a sustainable way to reduce pumping from the Edwards Aquifer.

The MAG is a calculation that is determined through a policy driven process and is not a representation of the amount of water that is physically available within an aquifer. The MAG is one of several factors that a GCD uses to manage groundwater production from an aquifer. The DFCs are revisited every five years and in the past have been known to change based on new policy and interpretation of newly acquired data.

The 2017 Water Management Plan is the first SAWS water management plan which addresses this regulatory planning process. All of SAWS non-Edwards Aquifer groundwater projects are affected by MAGs. As described above, GCDs must take the MAG into consideration in their regulatory structure; however, they are afforded flexibility in determining how DFCs will be met. The Vista Ridge Regional Supply Project (described in Section 7) is a non-Edwards Aquifer project influenced by the MAG. The project will deliver up to 50,000 acre-feet of groundwater per year from Burleson County throughout the 30-60 year term. Current DFCs adopted for the groundwater in Burleson County do not fully support the full yield of the project. In an effort to make decisions with the best data possible, GMA 12, which oversees the area of the Carrizo-

Wilcox and Simsboro Aquifers that will be the source of the Vista Ridge project, is proactively developing a new groundwater model to better answer questions related to the aquifer's properties. This new groundwater model will be available for the next revision of the future state of the aquifer.

As a recent example of management of this risk, several other SAWS water supply projects sourced from the Carrizo and Wilcox Aquifers were reflected at a lower volume, or at zero, during the first round of DFCs, and subsequently the MAG. With additional data acquired during the actual operation of the water supply projects, GCDs were able to take that information into consideration towards the development of the latest approved DFCs. After further discussion and analysis by the GCDs, SAWS groundwater supply projects sourced from the Carrizo and Wilcox Aquifers (with the exception of Vista Ridge) are now fully supported by MAG determinations in the most recently adopted DFCs.

Given recent experiences, impending changes to the groundwater models, and the fact that the issue is not yet ripe, for purposes of the 2017 Plan, SAWS has determined that any MAG limitations reflected at this point are a manageable risk. This will continue to be evaluated as the projects mature and the regulatory scheme of groundwater evolves, and this may be revised in future Water Management Plans.

4 Population Projections

The estimated 2017 population for the SAWS service area is approximately 1.8 million. By 2070, the population is projected to increase to approximately 3.3 million(see Figure 4-1). These projections are higher than the 2012 Water Management Plan population projections primarily because of the change in methodology from half-migration to full-migration, consistent with the City of San Antonio (CoSA). Texas State Data Center (TSDC) defines full-migration as the assumption that "trends in age, sex and race/ethnicity net migration rates of the post-2000 decade will characterize those occurring in the future of Texas." In short, growth rates experienced since 2000 are predicted to continue in the future. SAWS has decided to align its 2017 population estimate with the CoSA projections by adopting the specific full-migration growth rates consistent with the City's SA Tomorrow initiative. The full-migration growth rates adopted by CoSA only extend to 2040. Based upon long term planning recommendations from the State Demographer, SAWS used the half-migration methodology beyond 2040.

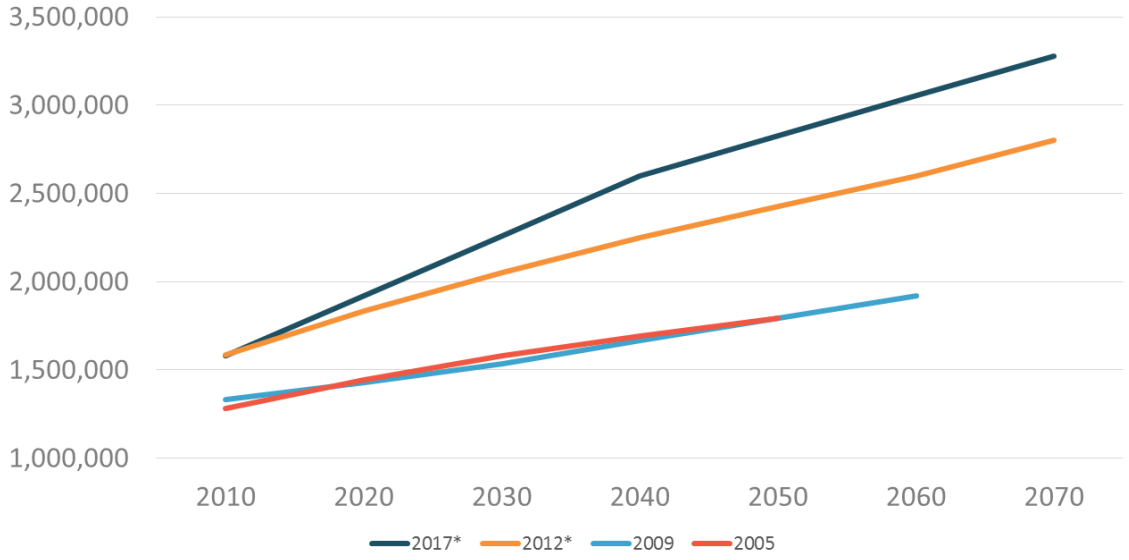
Population is projected to increase by more than 1.46 million people within the planning horizon.

The final combined growth rates for the 54-year period averaged out to 1.15 percent, with a 2017 growth rate of 1.83 percent, and ending the planning period in 2070 with a growth rate of 0.70 percent. This translates to approximately 35,000 more people per

year in the 2020s, and approximately 23,000 more people per year in the 2060s. This plan does not assume any expansion of existing SAWS service area.

In the graph below, SAWS 2005 and 2009 Water Management Plans did not plan for the population in areas that at that time were served by Bexar Metropolitan Water District, whereas the 2012 and 2017 Water Management Plans do. Additionally, SAWS 2012 Water Management Plan assumed a half-migration growth rate and SAWS 2017 Water Management Plan assumes a full-migration growth rate to 2040 (consistent with the City's SA Tomorrow initiative), which explains the new higher population projections.

***Figure 4-1**: SAWS Water Management Plan population projections*



* Includes population in areas formerly served by Bexar Metropolitan Water District.

5 Demand Projections

San Antonio's long-standing commitment and investment in water conservation and infrastructure improvements has yielded its largest water supply. SAWS total per capita water consumption has decreased significantly from 225 gallons per capita per day (GPCD) in 1982 to 117 GPCD in 2016, which has resulted in approximately 3.2 million acre-feet of cumulative savings. Using today's larger population, a total per capita of 225 GPCD would require an additional 214,000 acre-feet of water per year. Over the past 35 years, SAWS has reduced GPCD by approximately 50 percent by improving infrastructure and cultivating an ethic in conservation, all while population has grown by approximately 150 percent. If SAWS experienced a severe drought today and had not achieved the significant reductions in water usage and development of water supply projects that it has since 1982, SAWS would need approximately several substantially sized water supply projects, resulting in higher current and future rates.

Over the past 35 years, SAWS has reduced GPCD by approximately 50 percent, while population has grown by approximately 150 percent.

In the decades to come, proactive conservation programs will assist all water users in finding ways to be even more efficient. Success of conservation initiatives will continue to be measured by each class of customers to illustrate how each contributes to cost-

effective ways to manage the long-term usage of water. Water conservation continues to be a SAWS strategy for long-term water supply. By 2070, conservation investments will result in approximately 4.3 million acre-feet of cumulative water savings since 2017, and would replace the need for an additional water supply project of approximately 140,000 acre-feet per year.

SAWS residential customers have enthusiastically embraced conservation both inside their homes and in how they manage their landscapes. During 2015 and 2016, homeowners replaced over 1.6 million square feet of traditional grass with drought-tolerant landscape plants and grass. Multi-family residential locations are also upgrading landscapes and improving irrigation efficiency. With these trends established, residential GPCD is projected to decline significantly over time, due to a community that embraces a strong conservation ethic (see Figure 5-2). Higher water rates reflecting the cost of more expensive new water supplies are also expected to suppress demand and encourage conservation.

Over a two year period, San Antonio homeowners replaced the equivalent of 35 football fields with drought tolerant plants.

Residential consumption is the most variable of all customer groups served by SAWS. During wet winter months, the average usage declines significantly. In contrast, usage may increase quickly during hot summer months when there is little or no rainfall. The projections provided in Figure 5-2 illustrate the uncertainty associated with variable weather. Residential GPCD is expected to decline in the coming decades, but can fluctuate within the ranges identified in SAWS high, average, and low demand projections.

High demand is characterized by well above average temperatures, and/or well below average rainfall. Average demand

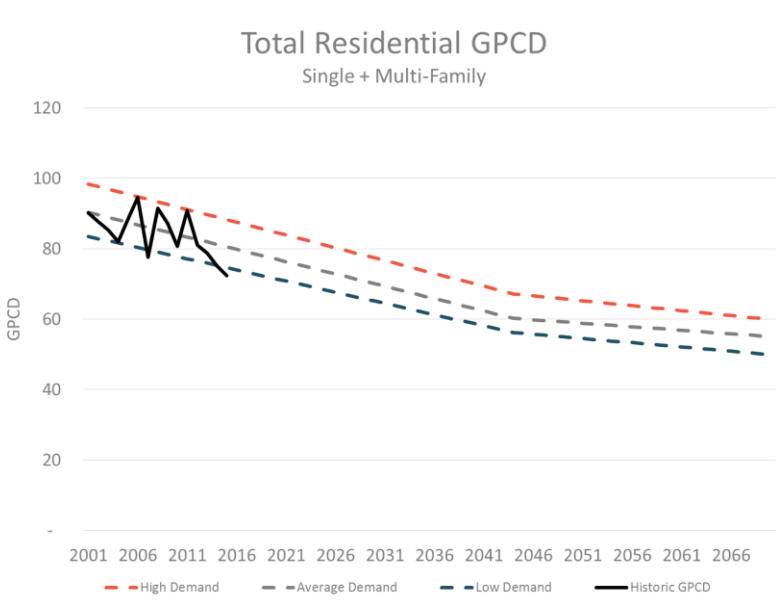
***Figure 5-1**: SAWS uses its GardenStyleSA.com website, along with a weekly email newsletter, to help residents keep their landscapes beautiful while using less water.*

is characterized by average temperatures, and/or average rainfall. Low demand is characterized by below average temperatures, and/or above average rainfall. Outdoor watering restrictions will also reduce discretionary usage, to some degree.

It is important to note the changes that are expected to occur in residential per capita usage do not require radical modifications to lifestyle by San Antonio citizens. Detailed studies of indoor consumption patterns in San Antonio and in pilot high-efficiency homes reveal that indoor per capita of our community has not yet reached its full potential for efficiency. As homeowners replace the few remaining high water use fixtures and become more aware of the need for proactive leak repair, this usage will decline.

Outdoor consumption varies greatly, but in some years, it may account for up to 50 percent of that year's residential consumption. This will decline over time as landscape design trends continue to favor Texas natives and other drought-tolerant plants. As landscapes are less dominated by grass supported by irrigation systems, it will be possible to maintain attractive outdoor areas with less water. The trend toward this more resilient style of landscape is being accelerated by conservation education and incentives, as well as changes in land use and a shift to higher density development.

***Figure 5-2**: Long-Term Conservation Projections for Residential Customers*

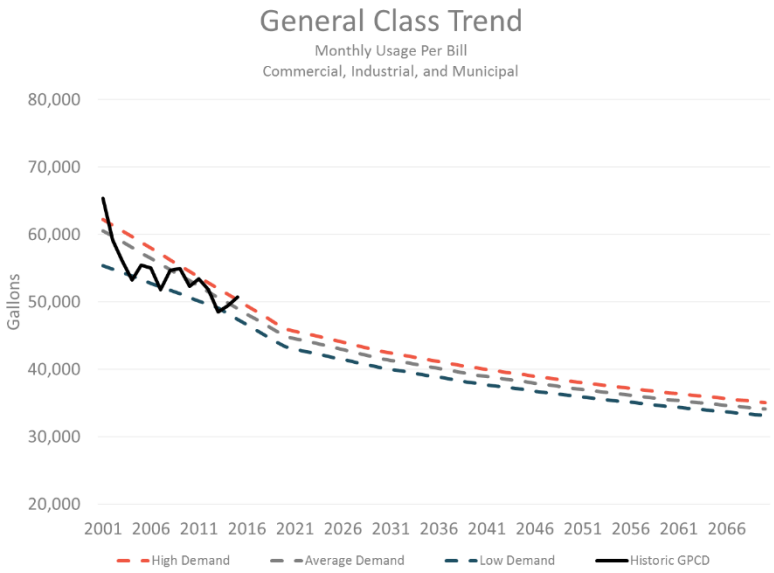


Residential per capita use varies with weather fluctuations more than any other class of customers. Some of this volatility will continue as San Antonio temperatures and rainfall vary from year to year. Adoption of resilient plant material and improved irrigation habits will mitigate some of this fluctuation and help contribute to long-term per capita decline.

Commercial and industrial customers continue to find innovative ways to be productive while using less water. Each year, commercial and industrial efforts account for approximately 30 percent of the annual water savings achieved through conservation

programs. Business water efficiency is expected to continue for many years (see figures 5-3 and 5-4). Business locations are not only being efficient in their industrial operations, but are also finding ways to beautify their landscapes with less water. Water-saving plant material is being maintained with more efficient irrigation technology. In addition to conservation programs, a heavily tiered irrigation rate structure should reduce demand. The reductions achieved from these efforts are expected to contribute to lower total per capita demand for decades.

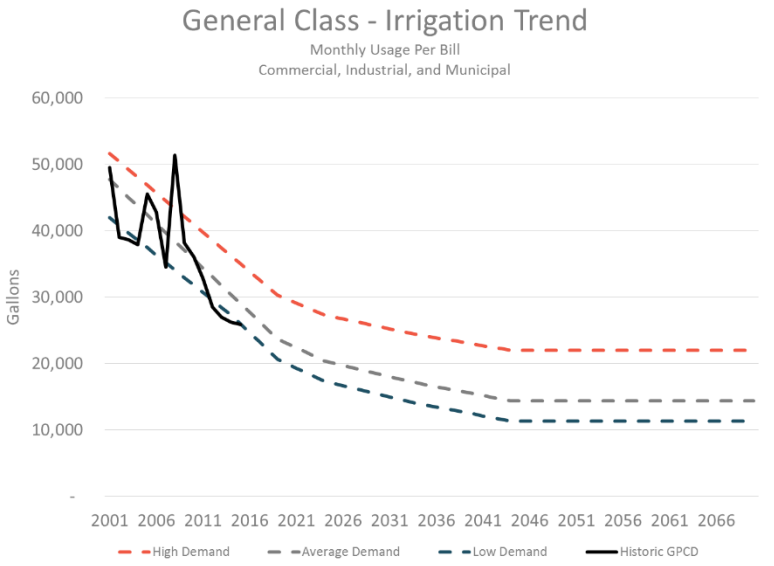
***Figure 5-3**: Long-Term Conservation Projections for Commercial Usage*



Commercial customers contribute half of the water savings achieved each year through innovation and vigilance:

- *Adoption of new water efficient practices*
- *Installation of new equipment that requires less water*

***Figure 5-4**: Long-Term Conservation Projections for Commercial Landscape Water Use*



Commercial landscape irrigation efficiency has been on a fast-track since 2009. Success can be attributed to many efforts that include:

- *Changes to less water-needy plant material*
- *Adoption of improved irrigation technology*
- *Increased vigilance in water management*
- *Tiered rate structure adjustments*

Improvements in nonrevenue water (see Section 6) and reductions in usage from all types of customers will result in a long-term total per capita decline. SAWS projects total per capita to reach a low of 88 GPCD by the year 2070. Fluctuations of plus or minus 8 GPCD are expected with weather. Conservation strategies being used to meet these targets are outlined in SAWS' 2014 Five Year Water Conservation Plan. Drought demand strategies such as Stage 1 and 2 drought restrictions will reduce the GPCD and total demand projections (found in figures 5-5 and 5-6) even further. Those Stage 1 and 2 reductions are built into the Drought of Record planning in this 2017 Water Management Plan. For instance, while Figure 5-6 shows a total demand in 2067 of approximately 330,000 acre-feet, Figure 11-2 (see Section 11) shows a total demand in 2067 of approximately 295,000 acre-feet, due to the demand reductions that can be achieved using Stage 2 restrictions.

SAWS 2017 Water Management Plan assumes a total demand in 2070 that is approximately 75,000 acre-feet per year less than the 2012 Water Management Plan.

***Figure 5-5**: Long-Term Average Year Total Per Capita Demand Projections for All Customer Classes*

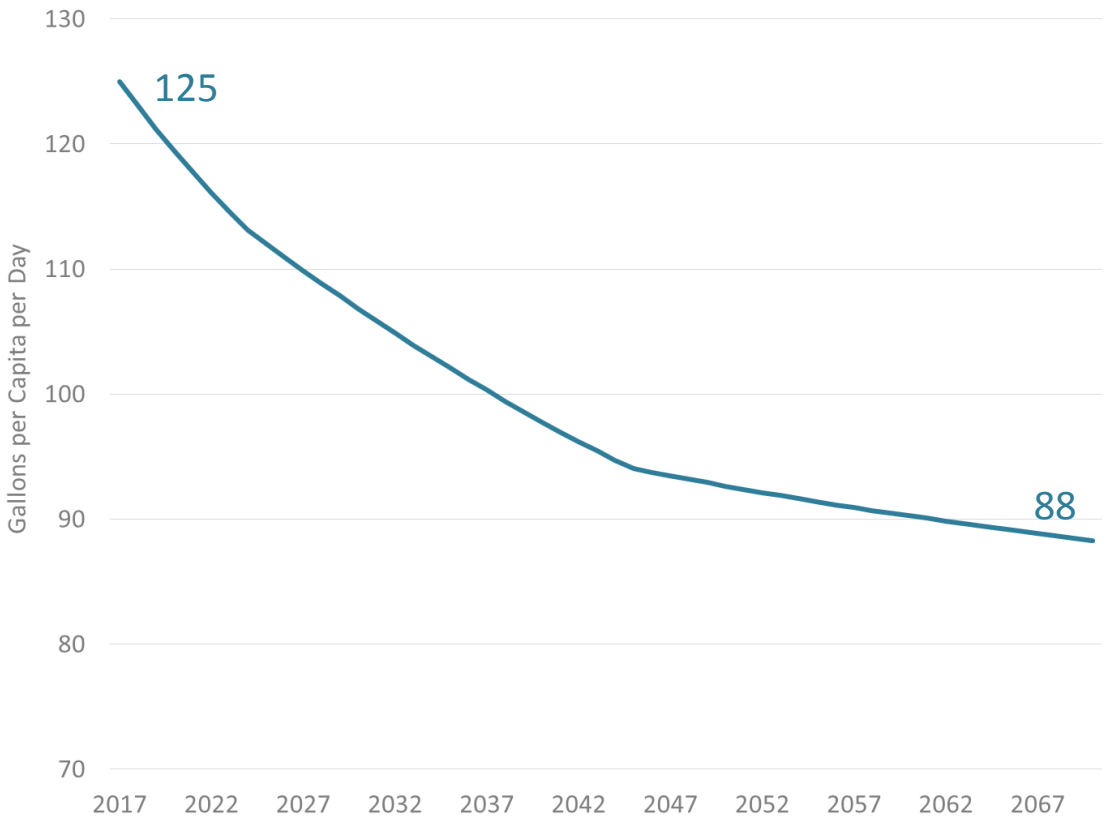
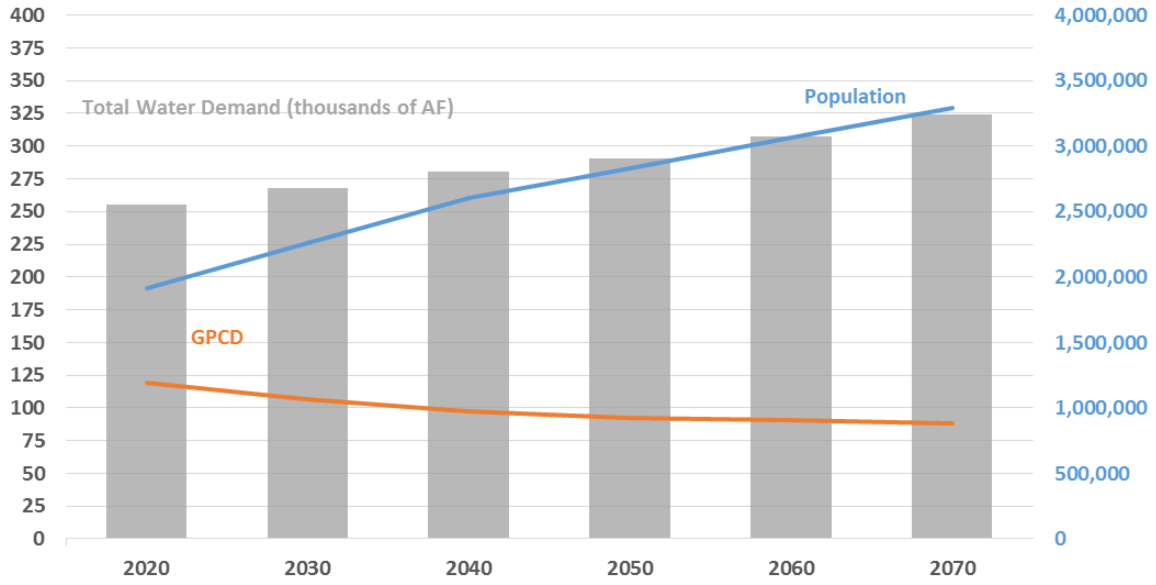


Figure 5-6: SAWS population projections, total GPCD projections, and total demand projections. Total Water Demand = GPCD x Population



6 Nonrevenue Water Program

Nonrevenue water is the water for which SAWS does not receive payment. Nonrevenue water is not composed solely of water leaks and main breaks (real losses). It also includes business uses such as firefighting and flushing water mains to meet water quality regulations (authorized use), and paper losses such as meter under-registration and undetected theft (apparent loss). Determining and addressing the factors contributing to nonrevenue water requires specialized knowledge, funding, accurate measurements/quality data, dedication, and use of standardized audit tools to ensure detailed accounting.

The average nonrevenue water percent by total production nationally and in Texas is approximately 17 percent. SAWS' nonrevenue percentage in 2016 was 16.9 percent, slightly below the average. SAWS is implementing cost-effective activities to reduce nonrevenue water and focusing on near-term opportunities that can result in a reduction in real and apparent losses of 5,000-7,000 acre-feet by 2025. This assumption translates to approximately 14 percent nonrevenue water by total production volume by 2025, real losses under 10 percent, and contributes to SAWS' total GPCD reduction goals. Reducing SAWS

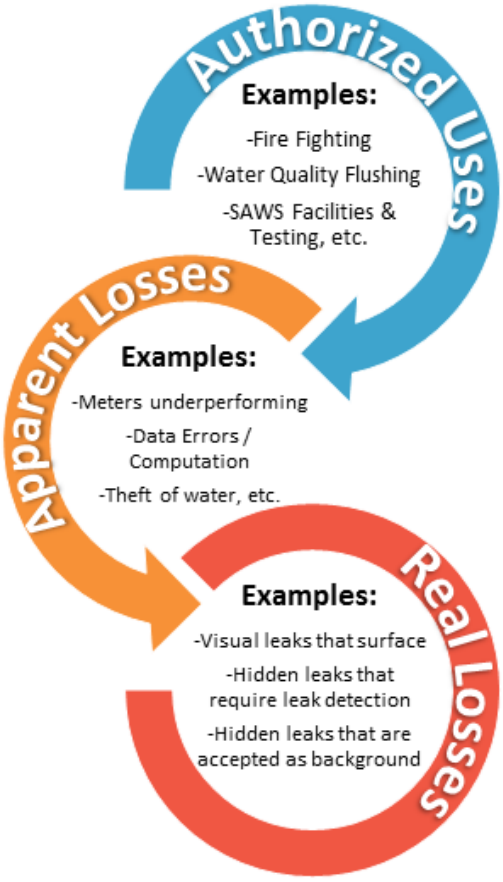
SAWS is leveraging $18.6 million of EAHCP funding to address leaks.

nonrevenue percentage to 14 percent and maintaining that level will require significant, strategically targeted investment in its potable water infrastructure. SAWS is dedicated to continuously improving infrastructure and reducing nonrevenue throughout the planning horizon.

SAWS is working with nationally recognized loss control professionals in order to evaluate additional opportunities and sustain improvements. SAWS is proactively taking steps to reduce nonrevenue water, which include:

- Implementing detailed leak surveys to further identify hidden leaks
- Leveraging $18.6 million of EAHCP funding committed between 2016 and 2020 for leak repair
- Evaluating efficiencies of field operations
- Reviewing production and customer metering annually to ensure effective measurement and management
- Performing annual water balance audits using industry standard approach
- Conducting internal and external education, with the aid of professional consultants to help guide SAWS loss control programming

Figure 6-1: Quantifying nonrevenue water starts with adding up all known authorized uses, then evaluating apparent losses. The remainder of losses are considered real *losses.*



SAWS has committed efforts on nonrevenue water recovery, and has increased expenditures related to nonrevenue water management. SAWS will be increasing the amount of service area that it inspects for leaks from one quarter of the system every year to half of the system every year. Nonrevenue water recovery will remain a priority to SAWS, as the cost of supply diversification continues to increase. Some challenges to reducing nonrevenue water include the increasing number of contractors hitting water lines and

causing water loss, as well as continued governmental regulations requiring line flushing.

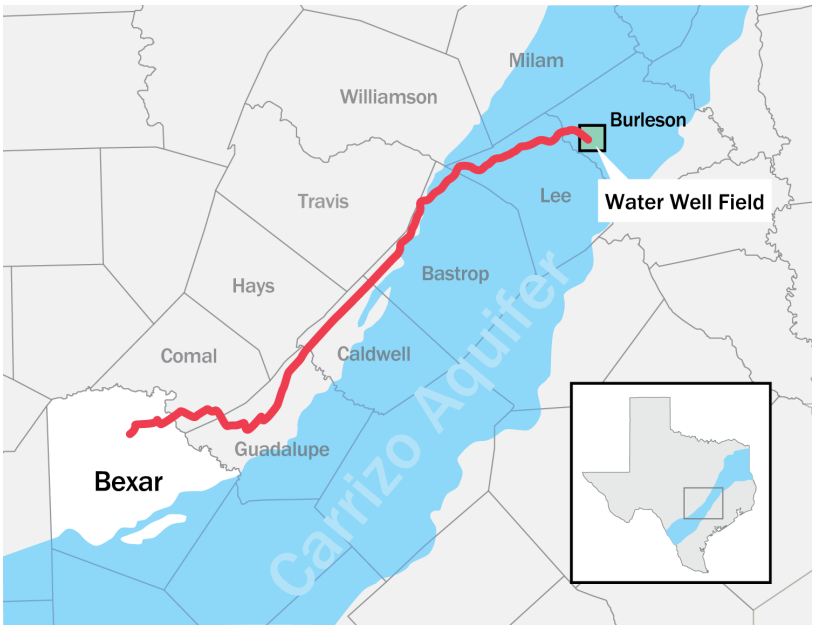
Percentage-based measurements, however, may not be the best indicator to measure the utility's nonrevenue water status and should not be used to compare one utility to another. Moreover, while some water utilities have a single or very few points of water supply delivery, SAWS has over a hundred Edwards Aquifer wells and over a dozen different water supply projects. This gives SAWS tremendous integration and water supply redundancy, however it creates more nonrevenue water complications as compared to other entities.

The Infrastructure Leakage Index (ILI) has been found to be a better tool for utilities in similar regions, as it compares a ratio of current annual real losses to a system's theoretical real losses. This measurement takes into account a utility's specific operational challenges, such as system pressure, connection density, and distance of customer meter to street, to name a few. For the State of Texas, a unit-less measure between 1 and 3 is deemed acceptable. SAWS ILI has improved from 2.9 in 2010 to 2.2 in 2016, thanks in part to improved standardized auditing over that period. The drop in ILI to 2.2 pushes SAWS well ahead of the national average of 3.8. The ultimate goal of an ILI is to be as close to 1 as possible, as long as implementation activites are cost effective.

7 Near Term Projects (2017-2025)

SAWS has a contract with Vista Ridge LLC (VR) to purchase up to 50,000 acre-feet per year of Carrizo/Simsboro Aquifer groundwater. VR will build and operate wells and a pipeline system to pump the groundwater in Burleson County and deliver it to San Antonio for 30 years. SAWS will pay a fixed unit price for water delivered plus all operating and maintenance and utility costs. Ownership of the wells and pipeline system will transfer to SAWS at the end of the term, after which a separate agreement with the owner of the groundwater leases, Blue Water Vista Ridge, will give SAWS the ability to continue production for an

Figure 7-1: Texans Helping Texans – The Vista Ridge pipeline will transport high quality drinking water through one of the highest growth areas in the nation.



additional 30 year term and deliver the water at a much lower price. Combined, the two agreements provide for a 60-year contracted supply of water.

In Texas, SAWS' arrangement with VR is a first-of-its-kind water supply public-private partnership (P3) which merges the strengths of public utility and private industry. The agreement transfers risk of project development, financing, and water source availability to VR. The project represents a major step forward in water diversification and will meet San Antonio's water needs for several decades. On November 2, 2016, VR reached Financial Close by entering into an agreement with a group of banks to finance design and construction of the system. Construction began in the spring of 2017, to be completed and delivering water in the spring of 2020. The 30-year operating period will begin after successful completion of construction and performance testing.

Figure 7-2: Construction underway on the Vista Ridge pipeline in Caldwell County, April 2017.

The Vista Ridge pipeline route parallels the I-35 corridor, one of the highest growth regions in the country. Communities throughout the region have increasing water needs to sustain both growing populations and flourishing economies. SAWS may wholesale up to 15,000 acre-feet per year from the Vista Ridge pipeline or its existing water supply projects, providing regional communities a diversified water supply and potentially reducing costs to SAWS ratepayers.

In addition to VR's construction of the pipeline system to convey water to the delivery point in northern San Antonio, SAWS must build the infrastructure needed to integrate the water within its system. This integration infrastructure will be elaborated upon in Section 12.

World Class Water Conservation

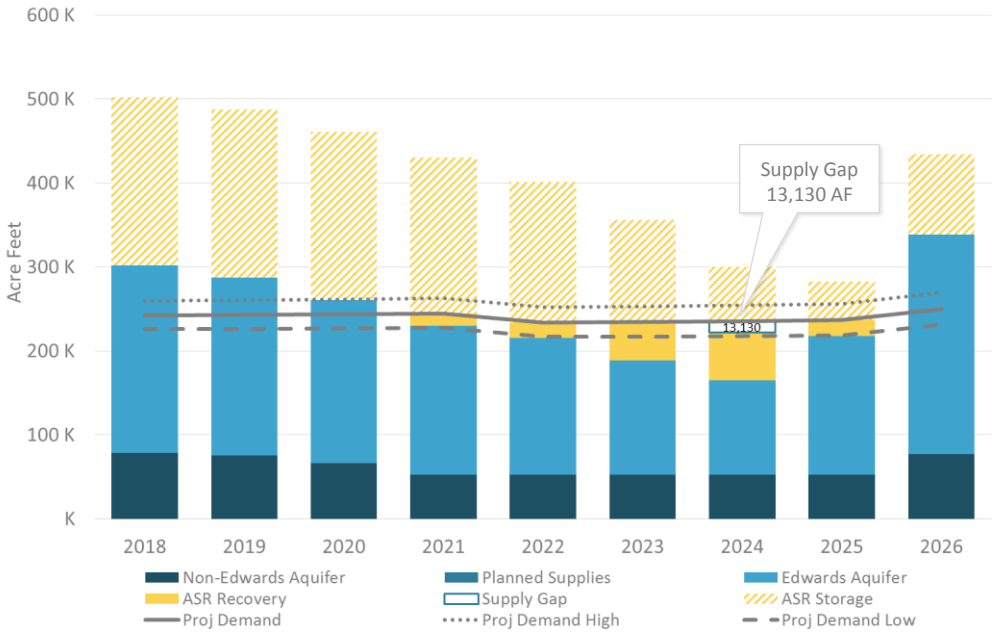
SAWS will also continue to focus on conservation, by implementing education, incentives and reasonable regulations to continue reducing demand. During this period, SAWS aims to reduce total planned per capita consumption in an average year from 124 GPCD in 2017 to 112 GPCD in 2025 (+/- 8 GPCD). SAWS total per capita consumption in 2016 was 117 GPCD, due in large part to above average rainfall. Despite rapid population growth in this time period, SAWS progressive GPCD goals will help moderate the growth in total annual demand, for an increase of approximately 7,000 acre-feet per year during that period. SAWS also plans to implement drought demand management to further reduce demand, when appropriate.

***Figure 7-3**: In 2017, SAWS distributed 6,000 rain barrels in a single day – the largest distribution event of its kind in U.S. history.*

8 Evaluation of Near Term Supply and Demand

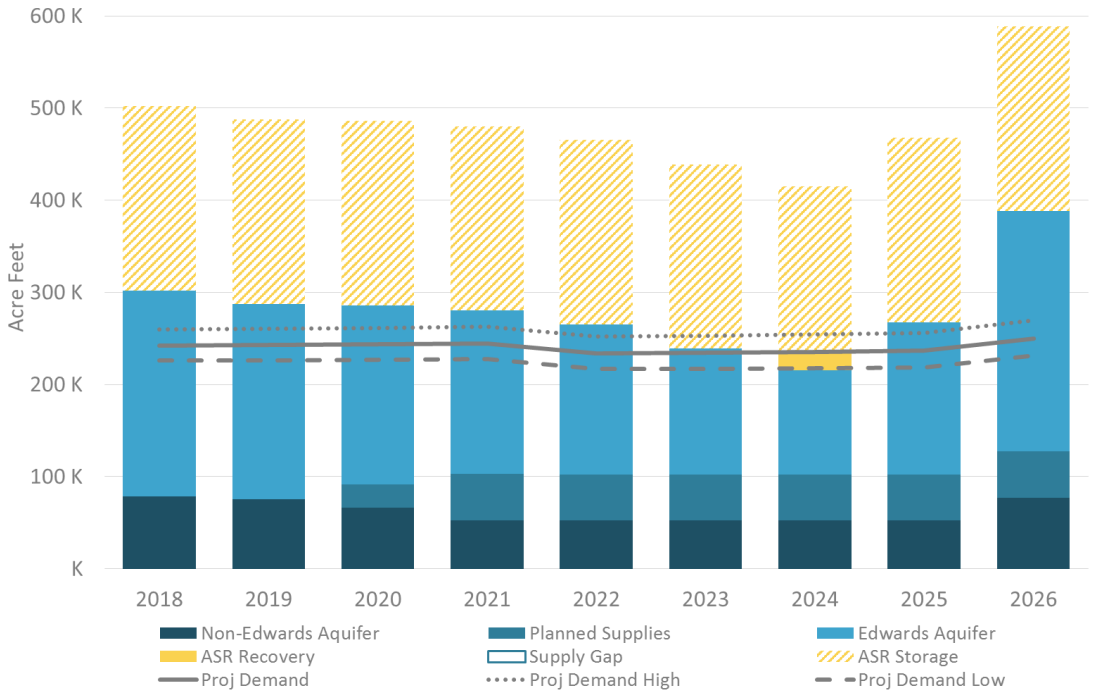
Even with the progressive per capita goals described in Section 5 and the robust, diversified water supply portfolio that SAWS has managed to acquire over the last two decades, without further development of supplies, SAWS ***could*** experience Permitted Supply Gaps in the 2020s, assuming a recurrence of the Drought of Record.

__Figure 8-1__: SAWS Near Term supply and demand outlook shows a supply gap of 13,130 acre-feet could occur in 2024 without further supply development, such as Vista Ridge.



The combination of progressive per capita consumption goals and the acquisition of the Vista Ridge water supply project will give San Antonio water security in the Near Term, and for the decades that follow in the Mid Term (see Section 11).

***Figure 8-2**: SAWS Near Term supply and demand outlook shows no supply gap with further supply development, such as Vista Ridge.*



Understanding the Supply and Demand Graphs

For ease of understanding, the 2017 Water Management Plan has been broken down into bracketed time periods described as Near Term, Mid Term and Long Term.

There are various elements to the supply and demand graph presented in the Executive Summary, and in later sections. The three lines in the graphs illustrate three different demand scenarios: high demand, average demand, and low demand. High demand is characterized by well above average temperatures, and/or well below average rainfall. Average demand is characterized by average temperatures, and/or average rainfall. Low demand is characterized by below average temperatures, and/or above average rainfall. Outdoor watering restrictions will also reduce discretionary usage, to some degree. While the 2012 Water Management Plan incorporated reductions in demand due to

conservation as a supply bar, this 2017 Water Management Plan reduces the demand lines. This was done in response to recommendations that showing conservation as a reduction in the demand lines would aid in understanding the graphs.

SAWS' Edwards Aquifer supply is shown as a teal bar, and non-Edwards supply (dark blue) and planned supplies (light blue) are combined for simplicity of display into single bars. Unlike other water supplies in this Plan, Aquifer Storage and Recovery (ASR) is not an annual supply that renews with the passing of the calendar. Rather, it is a supply reserve whose yield is based on artifical recharge as opposed to natural cycles or regulatory management. Cumulative water stored in ASR is shown as hatched yellow bars, whereas annual water recovered from ASR is shown as solid yellow bars. A more detailed description of each supply is provided in Section 5.

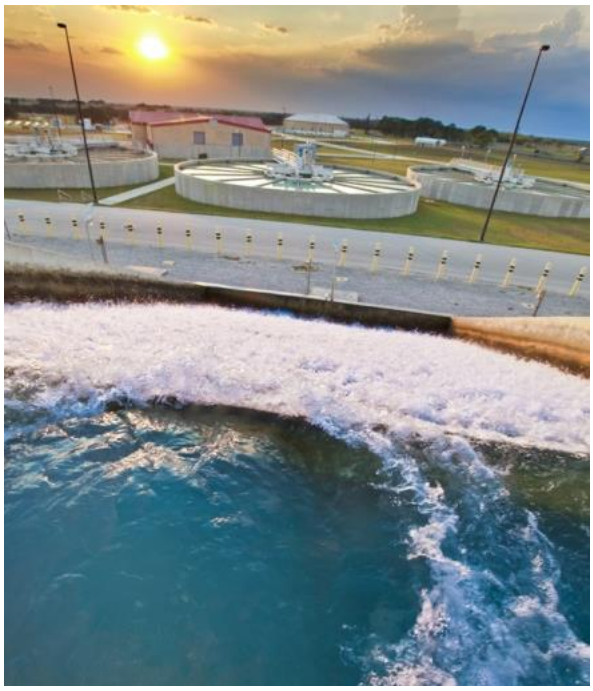
In the graphs, when the line (demand) exceeds the totality of the bars (supply), a Permitted Supply Gap is shown. Since most water resources are regulated and administered through an annual permit, it is typically the case that a shortfall of firm yield is regulatory in nature rather than a physical absence of water during extreme drought or any inadequacy in the infrastructure necessary to access that supply. Therefore, the term Permitted Supply Gap should not be construed as an allowable or hydrological deficit of supplies – rather, it is a term chosen to specifically reflect the primarily regulatory nature of firm yield in South Central Texas at this time.

9 Planned Projects for the Mid Term (2026-2040)

Diversified Water Supply

SAWS does not anticipate a new water supply project in the Mid Term. During this period, SAWS will seek to maintain its inventory of Edwards Aquifer groundwater withdrawal rights at 281,000 acre-feet per year. SAWS also plans to address water treatment and integration issues. Water integration challenges between 2026 and 2040 will be identified in Section 12. As to water treatment, the ability to treat Carrizo Aquifer groundwater at the H_2Oaks facility is currently limited to 30 million gallons per day (MGD). During the latter portion of the Mid Term planning horizon, SAWS anticipates relying more heavily on the ability to recover ASR water in order to delay the construction of costly water supply projects. As larger quantities of water are recovered, more treatment capacity may be required. In

__Figure 9-1__: Raw water undergoes aeration, clarification and sand filtration at the SAWS H_2Oaks Center treatment plant.



order to accommodate the additional treatment, SAWS will likely need to add an additional 30 MGD of treatment capacity. Fortunately, SAWS anticipated this eventual need in the original design of the H_2Oaks facility, and has gained valuable hands-on knowledge of the treatment requirements of the Carrizo Aquifer in southern Bexar County, which will make for optimal design, construction, and operation.

World Class Water Conservation

SAWS has implemented a prudent combination of sustainable water supply projects and reasonable water usage for decades, and the strategy in the Mid Term is no different.

__Figure 9-2__: In 2015 and 2016, SAWS customers replaced more than 1.6 million square feet of turf grass with drought-tolerant landscaping via the highly popular WaterSaver Coupon programs.

During this period, SAWS will strive to continue leading the nation in water conservation, aiming to reduce its total planned per capita consumption in an average year from 112 GPCD in 2025 to 98 GPCD in 2040 (+/- 8 GPCD). These per capita reductions will help to largely offset increases in demand stemming from population growth with its total annual demand during that time frame increasing by only 20,000 acre-feet. This approach will delay the need to build additional water supply projects for decades (see Section 11). On top of reductions in demand due to conservation, SAWS will implement drought demand management strategies to further reduce demand, when appropriate.

10 Planned Projects for the Long Term (2041-2070)

During the end of its planning horizon, SAWS will continue the two-pronged approach that it has implemented over the last few decades.

Diversified Water Supply

Design of new infrastructure will begin in the 2040s, with construction and operation shortly thereafter. Recent modeling has shown that the maximum yield of brackish groundwater from Bexar County is estimated at 22 MGD. Building the project with an ultimate yield of 30 MGD will therefore likely require SAWS to drill production wells outside of Bexar County. Without changes in current groundwater regulations, and public buy-in from surrounding counties, development of brackish groundwater outside of Bexar County could pose permitting challenges that may impact the project at that time. At this point, however, the 30 MGD ultimate yield of this project is included in the current DFCs for GMA 13.

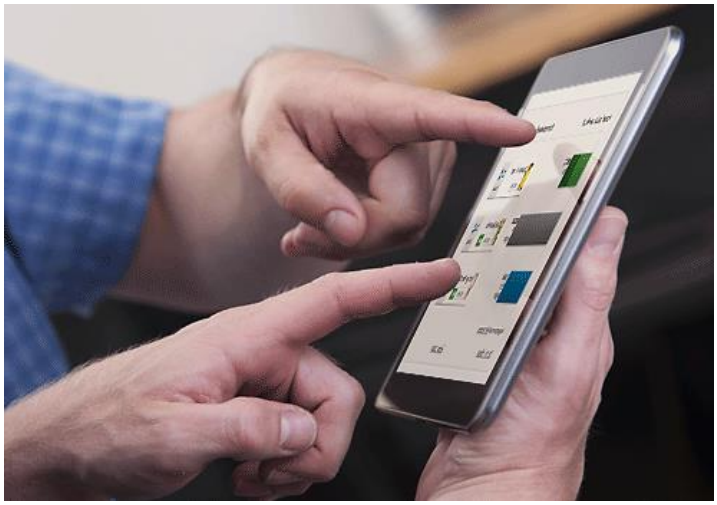
Also located in southern Bexar County, the Expanded Carrizo project will improve with the operational knowledge gained from the Local Carrizo project, and take advantage of the additional 30 MGD of treatment capacity. The project will develop an additional 21,000 acre-feet per year of Carrizo Aquifer from properties in Bexar County proximal to the H_2Oaks facility. Some advantages of this project are: it can be designed and constructed quickly relative to other supplies, the project easily ties into existing infrastructure, and the project's yield is included in the current DFC for GMA 13.

The implementation of future phases of the brackish groundwater desalination and the Expanded Carrizo projects are highly flexible due to SAWS ownership and control. If any unforseen circumstances arise during the Near or Mid Terms in regards to SAWS water supply projects or to demand, SAWS has the ability to adjust the timing of these projects to fill those voids quickly.

World Class Water Conservation

SAWS will implement programs that are intended to reduce total planned per capita consumption in an average year from 98 GPCD in 2040 to 88 GPCD in 2070. Combined with the change in population growth rate to half-migration starting in 2040 outlined in Section 4, this means that total annual demand will only increase by approximately 40,000 acre-feet between 2041 and 2070. In addition to these conservation efforts, SAWS will implement drought demand management, when appropriate.

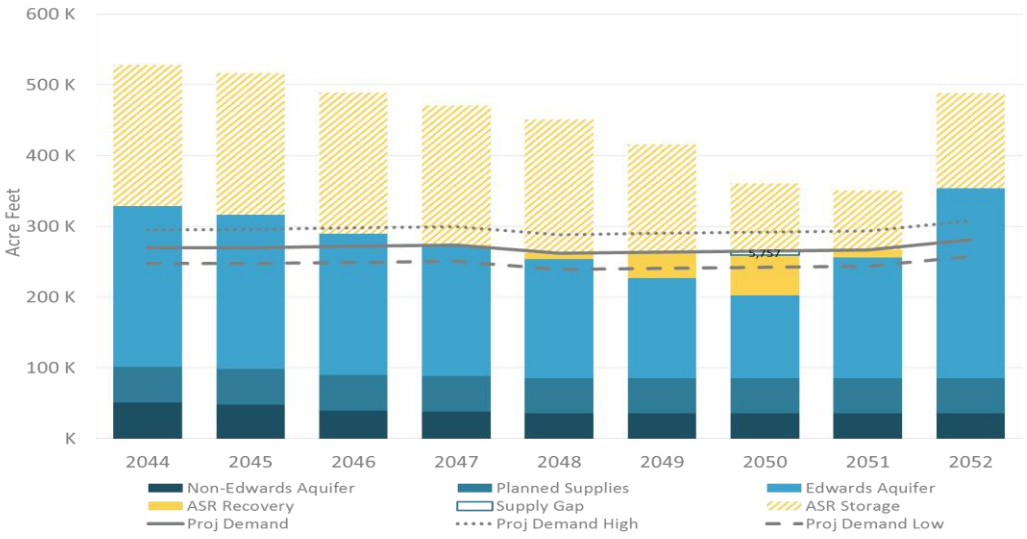
__Figure 10-1__: Technology, such as mobile apps that allow customers to track their own water use, will be instrumental in reducing total consumption to 88 GPCD by 2070.



11 Evaluation of Mid Term (2026-2040) and Long Term (2041-2070) Supply and Demand

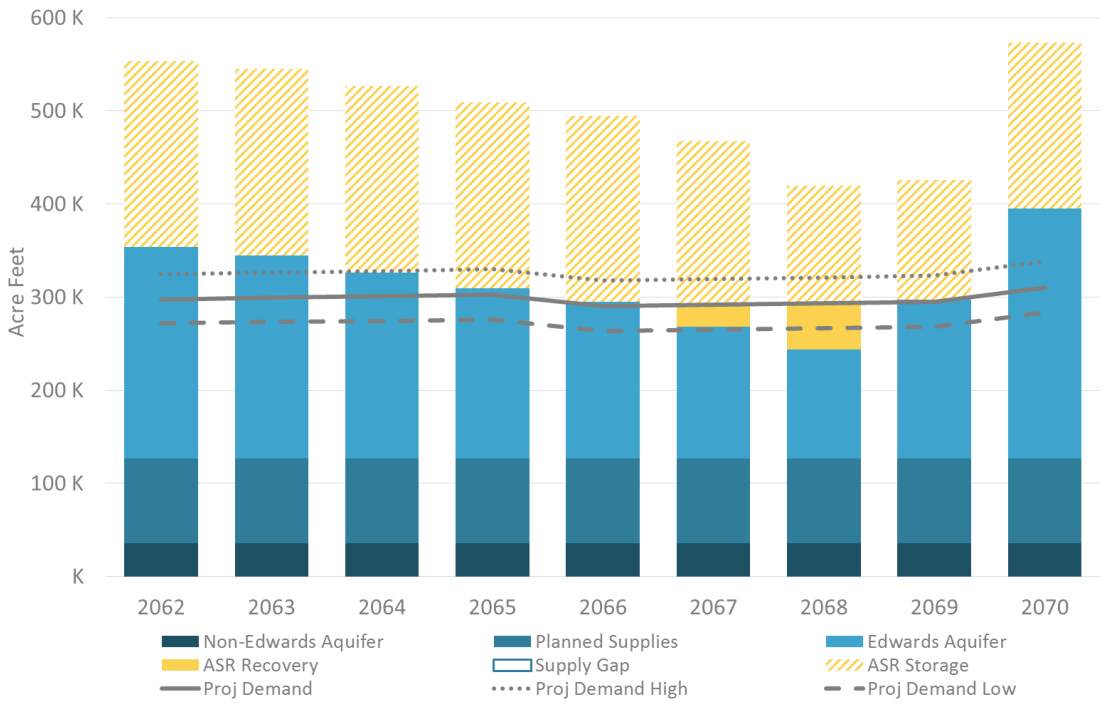
The combination of progressive per capita consumption goals and timely additions to SAWS' water supply portfolio is expected to give San Antonio water security for decades. Without expansion of either brackish groundwater desalination or Local Carrizo Aquifer production, the first Permitted Supply Gap after the acquisition of the Vista Ridge water supply project is not anticipated until the early 2050s.

***Figure 11-1**: After 30 years of water security from Vista Ridge supply, SAWS Long Term supply and demand outlook shows a supply gap of 5,757 acre-feet could occur in 2050 without further supply development, such as additional phases of desalination.*



Starting in the 2040s, SAWS will likely begin design and construction of the additional two phases of its Brackish Groundwater Desalination program for startup to coincide with projected Permitted Supply Gaps. However, this could alternatively be switched by two phases of the Expanded Carrizo project or any combination of sources. This provides SAWS with flexibility. With full build-out of both brackish groundwater desalination and Expanded Carrizo Aquifer production, SAWS will have water security for the entire planning period.

***Figure 11-2**: SAWS Long Term supply and demand outlook shows no supply gap with further supply development, with desalination and Expanded Carrizo fully built.*



12 Integration of Multiple Water Supplies

The SAWS water distribution system was originally built to distribute Edwards Aquifer groundwater. Most of the primary pump stations function largely as independent systems that are not strongly interconnected by significant pipelines. In order to expand utilization of these facilities to accommodate new supplies, SAWS must construct additional large diameter pipelines to effectively interconnect the stations and to connect them to new sources of water.

Eastern Pipeline

The ASR pipeline was built with the dual purpose of storing and recovering water to and from the ASR facility (now called H_2Oaks Center). The pipeline has sufficient capacity to also accommodate delivery of treated water from the initial phases of brackish groundwater desalination and Local Carrizo Aquifer production. This large-diameter pipeline is approximately 36 miles long and links the H_2Oaks Center to the Artesia, Seale, and Randolph Pump Stations along the eastern edge of the SAWS service area.

Western Pipeline

The Water Resources Integration Program (WRIP) was designed to increase the ability and flexibility to integrate water from the H_2Oaks Center by delivering that water to western Bexar County. The first phase of the WRIP includes 28 miles of large capacity water transmission pipeline and new pump stations at the H_2Oaks facility and the Old

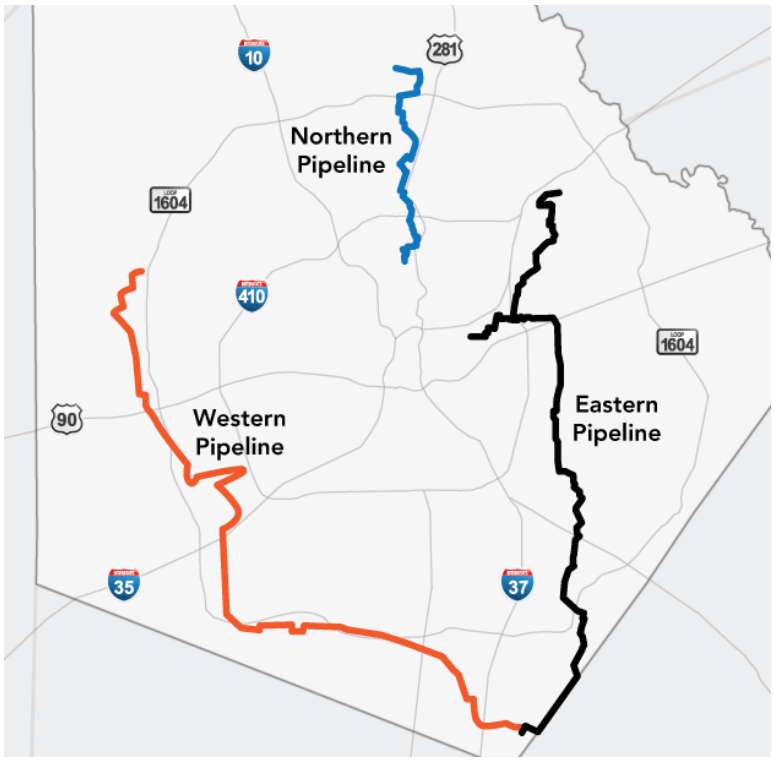
Pearsall Pump Station. Phase one became operational in 2016 and will enable SAWS to integrate H_2Oaks water to south Bexar County.

The second phase of the WRIP includes 17 miles of large diameter pipeline and additional pumping capacity at the H_2Oaks and Old Pearsall Pump Stations. This project is planned to be operational by 2020. With the addition of the Anderson Pump Station facility as a water integration point, the rated capacity of both phases of WRIP will be 75 MGD.

Northern Pipeline

The Vista Ridge Regional Supply Project will introduce approximately 45 MGD of water to the SAWS system through a single entry point. The biggest integration challenge SAWS faces in the early years of this project will be using this constant rate water supply during times of low customer demand. This is typically the cooler winter months when demand is at a minimum.

Figure 12-1: By 2020, SAWS will complete construction of a sophisticated transmission system that will give operators a great deal of flexibility in water distribution.



During cold and/or wet periods during the early years of the project, the Vista Ridge water will make up approximately one-third of the total water demand of the system. This water must be conveyed to locations in the distribution system where it can be effectively consumed. This will require construction of new integration infrastructure. Vista Ridge integration improvements include a combination of re-purposing existing infrastructure, and construction of new pipeline, control valves, tanks and pumps. Design and construction encompasses a segment from the terminus point of the Vista Ridge delivery line north of Loop 1604, delivering to both the existing Knights Cross facility and south to the existing Basin Pump Station.

13 Climatic Conditions

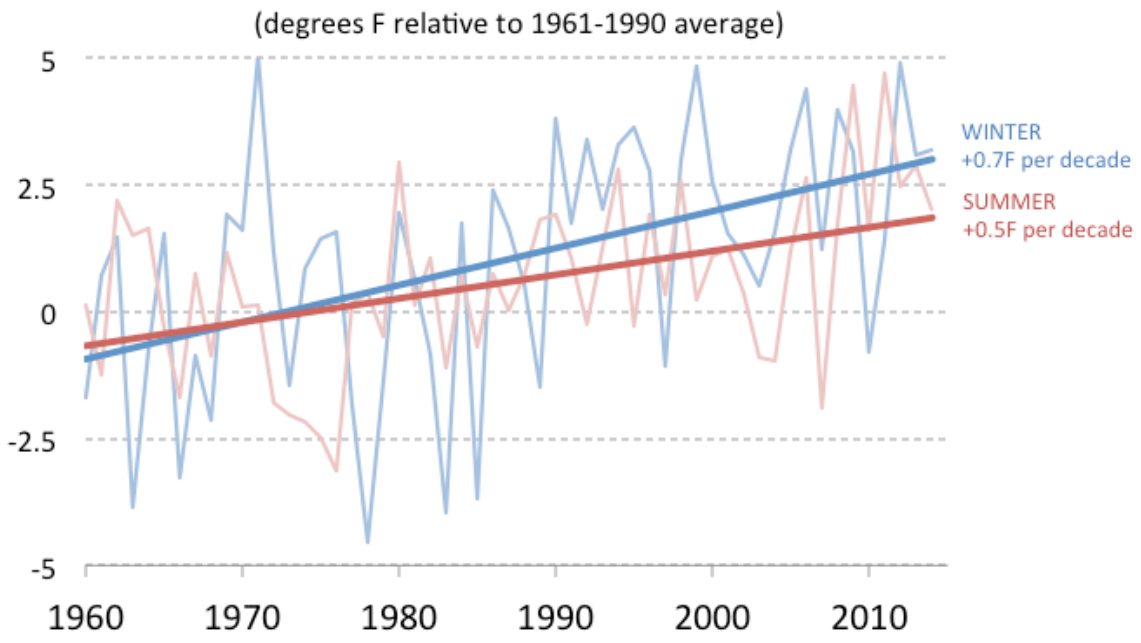
SAWS supplies are relatively resilient to changing climatic conditions, due in part to an already diverse water portfolio. Many water utilities across the country are analyzing how reductions in snowpack and rising sea levels might impact them. SAWS is not directly affected by those phenomena.

The majority of municipal water supplies delivered in the U.S. are from surface water, and those utilities are having to mitigate against increasing evaporation. Less than 10 percent of SAWS' supply portfolio comes from surface water. In fact, SAWS built the largest groundwater-based Aquifer Storage & Recovery system in the country over 10 years ago, which has a storage capacity almost the size of Medina Lake (approximately 250,000 acre-feet), but without the risk of evaporative loss.

Analysis suggests that San Antonio will experience higher temperatures and more extreme precipitation in the future.

Finally, the Edwards Aquifer is an ideal natural system to capture projected additional flooding events. The Edwards Aquifer is one of the most prolificly recharging karst aquifers in the world. Recharge is provided by precipitation over eight major drainage basins. The median recharge since 1934 is estimated at 557,000 acre-feet per year, with a low of 44,000 acre-feet in 1956 and a high of 2,486,000 acre-feet in 1992. The Edwards Aquifer remains a reliable resource for agriculture, water supply, and the environment for south central Texas, now and into the future.

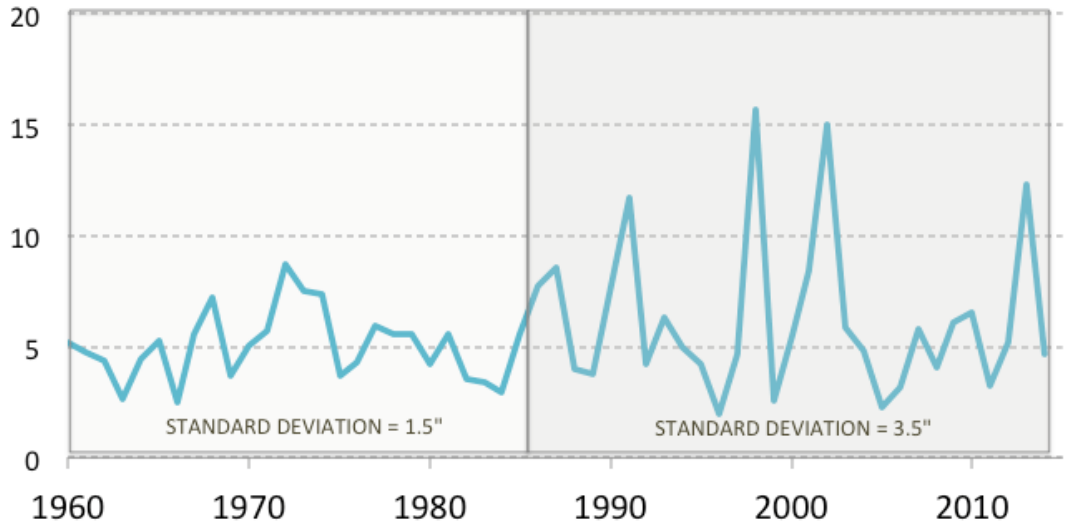
Figure 13-1: Seasonal Average Temperatures (Source: City of San Antonio Sustainability Plan)



SAWS planning accounts for predicted changes in climate in several ways. Rather than use the standard Drought of Record scenario for planning, SAWS uses a hybrid Drought of Record scenario that incorporates the more extreme reductions experienced during the 2011-2014 drought. SAWS has developed models that allow this scenario to be applied and tested during many different time periods and under different supply planning assumptions to assess needs under many worst-case scenarios. SAWS has direct experience with climate change research due to its involvement in the LCRA-SAWS Water Project and the EAHCP. In addition, SAWS has analyzed water planning implications of research that was done for the City of San Antonio and the City of Austin by Dr. Katherine Hayhoe, Ph.D., a leading climate science expert.

While not climatologically the same, Austin and San Antonio have very similar climate patterns. Dr. Hayhoe found that projected changes for Austin include increases in annual and seasonal average temperatures, more frequent high temperature extremes, and more frequent extreme precipitation. Higher temperatures and flashier rain patterns may make customer demand patterns more challenging to predict. An important strategy to mitigate these challenges has been implementation of conservation programs that transition San Antonio landscapes to attractive, resilient plant material.

Figure 13-2: Wettest 5-Day Rainfall in Inches (Source: City of San Antonio Sustainability Plan)



SAWS' water supply portfolio might be relatively mitigated in instances of extreme weather patterns, but every water utility will face operational challenges associated with changes in climatic conditions. Pipe corrosion, tree root ingress, sanitary sewer overflows, pipe bursts, degraded disinfection byproducts due to higher water temperature, pump and motor inefficiencies due to higher air temperature, and higher irrigation demand are all potential ramifications against which all water utilities will need to be vigilant.

Several initiatives have been undertaken to lessen SAWS' impact on the environment. These initiatives are exemplified by SAWS' Dos Rios Water Recycling Center which recycles water, biosolids and methane, and has a solar partnership with SunEdison. Upon visiting Dos Rios, former EPA Administrator Gina McCarthy stated, "I don't think there's a better example than San Antonio. It's remarkable what you've done here…It's going to be the kind of project we tout across the U.S." SAWS also has implemented load reduction programs that lower emissions, by shifting energy load to non-peak hours.

"I don't think there's a better example than San Antonio. It's remarkable what you've done here…It's going to be the kind of project we tout across the U.S."

SAWS is uniquely positioned to manage the challenges predicted by changing conditions and by extreme weather variations. SAWS continues to join water utilities across the nation that are analyzing how variable and extreme weather patterns might impact supplies, demand and infrastructure, and this Plan outlines a water management program that mitigates these conditions, and are also good business practices for SAWS.

14 Projects That Merit Further Consideration

While this Plan identifies the timing and magnitude of water supply projects and water conservation programs up until 2070, SAWS evaluates many different strategies and technologies. In the event of a change in demand projections or supply reliability, other options are also available to SAWS for further consideration. These options are compared against other projects and could be implemented during the planning horizon.

Expansion of Brackish Groundwater Desalination

Additional brackish groundwater desalination could be undertaken in the future. SAWS would acquire brackish groundwater production rights from interested landowners whose properties overlie aquifers containing brackish groundwater. Wells would be drilled and brackish water would be piped to a desalination plant constructed proximate to San Antonio. The amount of water that would be developed would be based on future needs, and could be constructed in phases as demand develops. SAWS did a preliminary analysis of an expanded desalination project into Wilson County in 2011, however, regulatory and permitting challenges were noted, and the project was to be a similar cost as Vista Ridge.

Expansion of the Direct Non-Potable Recycled Water System

Presently, more than 130 miles of pipeline deliver high-quality recycled water for use by commercial and industrial customers, golf courses, and parks, as well as the River Walk. As the volume of wastewater treated by SAWS increases with population growth, SAWS

may consider further expansion of the recycled water system to offset future potable water needs.

Direct Potable Reuse of Treated Wastewater

The technology and techniques for treating wastewater to potable standards to be reused as drinking water are well established and mature. Texas leads the nation in direct potable reuse, with El Paso (pilot project), Wichita Falls (currently indirect potable) and Colorado River Municipal Water District (Big Spring) currently engaged in potable reuse to some degree. The largest obstacle to direct potable reuse of treated wastewater is public perception.

Desalination at the Gulf of Mexico

One day it may be economically feasible to desalinate seawater, manage the resulting brine in an environmentally responsible way, and pump the treated water inland to San Antonio. SAWS has not ruled out seawater desalination; however, the intent now, and for the foreseeable future, is to remain focused on brackish groundwater desalination in close proximity to Bexar County. The present obstacles to using brackish groundwater are primarily regulatory in nature, and SAWS intends to continue cooperating with those stakeholders considering state-wide regulatory reforms that facilitate responsibly making more brackish groundwater available for desalination.

Stormwater Capture

Stormwater capture includes practices such as on-site infiltration, on-site direct use, subregional infiltration, subregional direct use, green streets, and impervious replacement, to name a few. EAA is one of the most advanced and established groundwater regulators in the country. Infiltrating stormwater via recharge structures on the Edwards Aquifer Recharge Zone for subsequent production would require authorization from EAA, which the agency has never done. Injecting stormwater into the Edwards Aquifer would require treatment, and is also a strategy that EAA has never authorized. Directly using stormwater for irrigation would still require treatment. Stormwater capture requires entirely new and costly infrastructure to distribute the treated water, the supply is highly variable, and would frequently not be available during the times of highest demand from a water supply perspective. SAWS has not yet seen how stormwater capture can benefit SAWS' supply outlook in a significant manner.

Stormwater capture projects for purposes other than water supply are being pursued in San Antonio. The Edwards Aquifer is one of the most effective reservoirs in the country at recharging and storing stormwater. In fact, EAA operates four recharge dams on the Edwards Aquifer Recharge Zone, which have recharged approximately 210,000 acre-feet

since their construction in the 1970s/1980s. SAWS will continue to monitor industry developments in stormwater capture technology and evaluate potential applications.

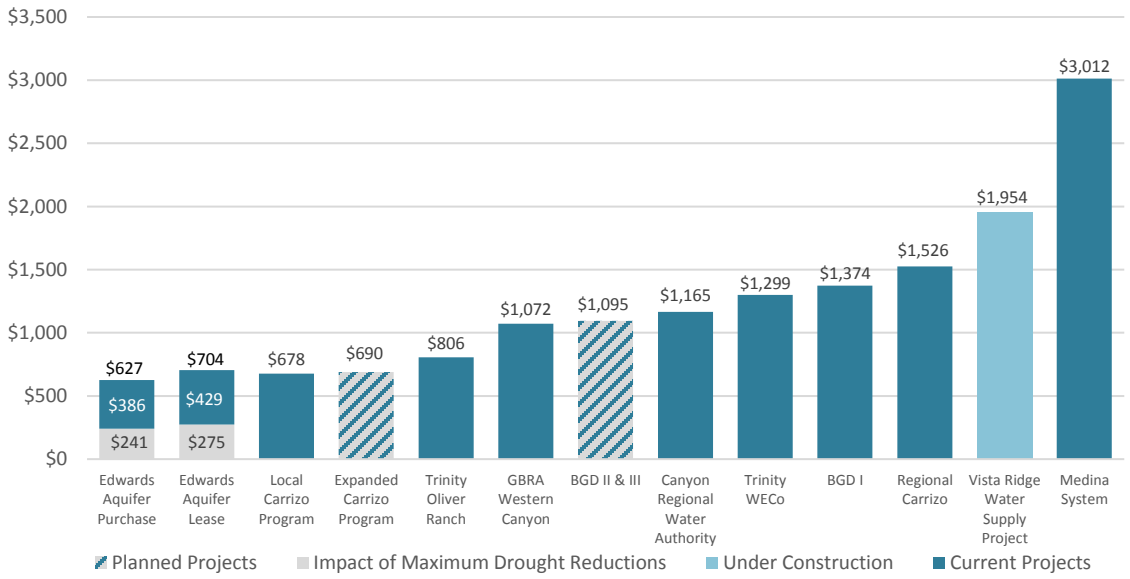
15 Financial Analysis

To allow for meaningful comparison, the updated costs per acre-foot of the water supply projects and the associated integration projects that have been described in this plan are presented here. Specifically, the costs for projects that have been completed will be presented alongside planned projects. This section also presents the impact on average residential monthly charges through the year 2020.

Water Supply Project Costs per Acre-Foot

The annual costs per acre-foot of current and planned projects in the 2017 Water Management Plan are shown below in Figure 15-1. Please note that the costs are presented *without* integration costs.

Figure 15-1: Annual Cost per Acre-Foot by Project



Integration Costs

Major transmission pipelines are necessary to transport water from several water supply projects to distribution lines serving SAWS customers. Since these transmission lines may support multiple projects, it is difficult to allocate the costs of integration infrastructure directly to specific projects. Consequently, integration capital costs are not included in Figure 15-1 above. Separate integration costs per acre-foot are shown in the below table in Figure 15-2. Calculation of the integration costs per acre-foot follow the same assumptions used to develop the project costs shown in Figure 15-1 above, to include debt service payments, pump station energy costs and maintenance on the pump stations and pipelines.

Figure 15-2: Integration Costs per Acre-Foot

Integration Project	Cost per AF	Capacity (MGD)
Eastern (Complete)	$212.17	50
Western Phase I (Complete)	$226.74	50
Western Phase II (Future)*	$458.55	25
Northern (Future)*	$316.61	45
*O&M cost estimates are not final		

Impact on Water Supply Fee Charges

In November 2015, to ensure that sufficient resources are available to implement the Vista Ridge Regional Supply Project, the City Council approved in advance five consecutive years of Water Supply Fee (WSF) rate adjustments (2016 through 2020). The fee adjustments approved for the four years from 2017 through 2020 are maximum allowable adjustments. If the projected costs in these years are less than the anticipated costs, the rate adjustment will be lowered accordingly.

Please see the table in Figure 15-3 below. The maximum anticipated increases to the WSF each year are expressed in terms of its impact on the projected total average residential bill for a customer using 7,092 gallons of water and 5,668 gallons of wastewater. The table below shows the maximum adjustments authorized each year through 2020.

***Figure 15-3**: Projected Maximum Monthly Bill Impact of WSF Through 2020*

Authorized Adjustments

	% Change	WSF Charge
2016	1.8%	$ 10.73
2017	1.3%	$ 11.46
2018	3.1%	$ 13.30
2019	4.4%	$ 16.15
2020	9.7%	$ 23.00

Based on Average Residential Bill:
7,092 gal. water & 5,668 gal. sewer

16 Community Input

SAWS' Board of Trustees and Executive Management committed early in the process to expand the outreach to not only inform the public of the process of updating the utility's Water Management Plan, but also to solicit feedback concerning the priorities that form the basis for planning the utility's water future through 2070.

In its continued commitment to transparency, SAWS started previewing information on the upcoming Water Management Plan to the SAWS Citizens Advisory Panel and Community Conservation Committee.

A public relations campaign was launched to begin soliciting input from previously underrepresented groups. The website WaterCitySA.com featured overview videos of the Water Management Plan and included opportunities for input from those who would normally not attend homeowner or public meetings.

Water-related information disseminated through the WaterCitySA.com site allowed SAWS to better reach the community. To further reach the community, information was promoted through social media platforms including Twitter, Facebook, and Nextdoor. Communications also reached out to the city's extensive bloggers groups (influencers), who then shared information via their social channels, increasing SAWS' reach.

Continued outreach by SAWS Water Resources and Communications solicited input from homeowner associations as well as leadership groups including:

- San Antonio City Council
- City of San Antonio
- Chambers of commerce
- Various environmental groups
- Industry and trade organizations

In a SAWS first, during March of 2017, SAWS conducted a Facebook Live broadcast of a community meeting on the Water Management Plan's importance. Viewers were able to ask questions and include their input during the live broadcast, which reached about 2,400 people.

To date, WaterCitySA.com visitors have exceeded 5,000.

17 Summary

San Antonio Water System's path toward water supply diversity began in the 1990s with the onset of state regulation of San Antonio's only water source, the Edwards Aquifer.

With regulation of the Edwards Aquifer, what was once an unlimited source of water became a permitted supply that alone couldn't sustain the long-term needs of the region. Rapidly increasing population, coupled with the threat of another extended drought, stressed the capacity of available water.

Once perceived as a city with limited water availability, San Antonio leadership has worked for the last 20 years to radically change the water supply situation.

Once perceived as a city with limited water availability, San Antonio leadership has worked for the last 20 years to radically change the water supply situation, thereby sustaining a thriving economy. Development of numerous water supply projects constructed over that time frame, combined with progressive conservation efforts, place San Antonio in an enviable position.

In fact, San Antonio has stepped forward to provide primary or backup water services to the city's water-challenged military bases, ensuring bases can sustain current and future missions and accommodate growth.

Since the 2012 Water Management Plan, SAWS has implemented a number of water supply and conservation initiatives securing San Antonio's water future:

- Over 1.6 million square feet of water-intensive grass was replaced with low water-use plants or permeable patios through WaterSaver Landscape Coupon programs
- Regional Carrizo Water Project was brought on line in 2013, providing more than 10,000 acre-feet of water in both 2015 and 2016 from the Carrizo Aquifer in Gonzales County to San Antonio
- In January 2017, SAWS held the grand opening of the SAWS H_2Oaks Desalination Plant and water center, Phase I of which is capable of producing 12 million gallons of drinking water daily from desal operations
- Irrigation Consultations providing home irrigation and landscape education visits have reduced household usage by 84 million gallons every year
- The GardenStyleSA.com website and e-newsletter providing timely San Antonio-focused low water use landscape information to reduce outdoor watering
- SAWS' ASR at H_2Oaks has reached a record storage volume of 125,000 acre-feet, representing over a half-year of SAWS potable demand
- SAWS has partnered with University of Texas at Austin-based Pecan Street to develop an integrated conservation platform that will expand water conservation opportunities in the future
- Public-private partnership with Vista Ridge LLC for up to 50,000 acre-feet per year of groundwater from Burleson County by 2020, recognized globally as a benchmark agreement in water projects

All this has been achieved by implementing continuous planning, with the Water Management Plan as the road map for San Antonio's water future. SAWS will continue to expand on its previous successes in implementing the 2017 Water Management Plan using a two-pronged approach. It begins with reducing demand through its industry-leading conservation programs and investment in reducing its nonrevenue water.

These efforts will ultimately lead to a decrease in the total gallons per capita per day (GPCD) in an average year from 126 GPCD in 2017 to 88 GPCD in 2070, with additional savings during drought from outdoor watering restrictions.

Conservation coupled with the timely development of diversified water supply projects will provide water security for SAWS ratepayers through 2050 with current supplies and water supply projects currently under construction.

Meeting demands beyond 2050 requires continued implementation of key elements in this plan to include: progressive GPCD goals, further diversification of supply, and targeted investment in infrastructure to reduce nonrevenue water loss. Implementing the 2017 Water Management Plan ensures water security for San Antonio through 2070.

Time Frame	Action
Near Term (2017-2025)	Reduce total planned GPCD in an average year from 125 GPCD in 2017 to 112 GPCD in 2025
	Secure up to 50,000 acre-feet per year of Vista Ridge groundwater
	Reduce nonrevenue water to 14 percent by total production volume
Mid Term (2026-2040)	Reduce total planned GPCD in an average year from 112 GPCD in 2026 to 98 GPCD in 2040
	Expand treatment capacity at H_2Oaks Center for ASR recovery and Local Carrizo production
Long Term (2041-2070)	Reduce total planned GPCD in an average year from 98 GPCD in 2040 to 88 GPCD in 2070
	Build out Brackish Groundwater Desalination, for a total yield of 33,600 acre-feet per year
	Develop the 21,000 acre-feet per year Expanded Carrizo project

18 Glossary

AACOG	Alamo Area Council of Governments
AF	acre-foot (325,851 gallons)
ASR	Aquifer Storage & Recovery facility
BGD	Brackish Groundwater Desalination
BMA	Bexar-Medina-Atascosa Water Control & Improvement District #1
BexarMet	Bexar Metropolitan Water District
BSR	Bulverde Sneckner Ranch
CoSA	City of San Antonio
CAP	Citizens Advisory Panel
CCC	Community Conservation Committee
CCN	Certificate of Convenience and Necessity
CPSE	CPS Energy
CRWA	Canyon Regional Water Authority
DFCs	Desired Future Conditions
DOR	Drought of Record
EAA	Edwards Aquifer Authority

EAHCP	Edwards Aquifer Habitat Conservation Plan
EAPP	Edwards Aquifer Protection Program
EARIP	Edwards Aquifer Recovery Implementation Program
GBRA	Guadalupe-Blanco River Authority
GMA	Groundwater Management Area
GPCD	Gallons per Capita per Day
ILI	Infrastructure Leak Index
MAG	Modeled Available Groundwater
MGD	Million Gallons per Day
MPO	Metropolitan Planning Organization
NRW	Nonrevenue Water
RCP	Regional Carrizo Project
SARA	San Antonio River Authority
SAWS	San Antonio Water System
SB	Senate Bill
SSLGC	Schertz-Seguin Local Government Corporation
TAZ	Transportation Analysis Zone
TCEQ	Texas Commission on Environmental Quality
TSDC	Texas State Data Center
TWDB	Texas Water Development Board
USFWS	U.S. Fish and Wildlife Service
VR	Vista Ridge LLC
VRIP	Vista Ridge Integration Program
WECo	Water Exploration Company
WMP	Water Management Plan
WRIP	Water Resources Integration Program