AUSTIN WATER

Understanding the DROUGHT

February 2015

Austin WATER

Austin Water provides essential services for the community. We treat raw water and deliver drinking water. We collect and treat wastewater. And we recycle wastewater to provide reclaimed water.

Austin Water also provides a number of other services beyond this, which are not always recognized by the public. For example, we protect public health and safety through drinking water protection programs and we ensure that there is always an adequate flow of water for firefighting purposes. We also protect the environment by treating wastewater to such a high standard that water quality immediately downstream of Austin's wastewater treatment plants is rated higher than upstream. We respond to sanitary sewer overflows to minimize negative impacts on the environment, and preserve over 40,000 acres of Wildlands, or open space, that helps protect water quality and endangered species. We even help advance the City of Austin's Zero Waste goals by combining biosolids generated in the wastewater treatment process with yard waste picked up curbside to make compost, including Dillo Dirt.

At the same time, Austin Water, like water utilities across the country, faces challenges in at least six critical areas:

- Water Supply
- Drought
- Water Conservation
- Infrastructure
- Financial Security and Rates
- Climate Change

This document will be organized around the above elements as related to the ongoing drought though later information will be delivered to provide further details on Austin Water's finances and rates and the Austin Water system.

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Austin WATER
Clearly Reliable

Austin's water supply remains secure, but the drought has required dramatically increased conservation and drought response from Austin as well as an increased emphasis on the management of the lakes.

Water Supply

As the City of Austin's water utility, Austin Water has the responsibility to ensure that the citizens of Austin have an adequate and safe water supply—which includes making every effort to conserve that water supply. Because Austin planned ahead, the City has water rights and long-term contracts that amount to more than twice as much water as we currently use. A core element of securing Austin's water supply was a 1999 agreement between the City and the Lower Colorado River Authority (LCRA) (see sidebar next page).

Even with water rights and long-term contracts, the lakes are dependent on rainfall and inflows and also critically on protective management of the water in the lakes. The Austin area, and particularly the region upstream of Austin that flows into the Highland Lakes, has been in the grip of an epic drought since 2008.

Austin's water supply remains secure, but the drought has required dramatically increased conservation and drought response from Austin as well as an increased emphasis on the management of the lakes, in particular the LCRA's Water Management Plan (WMP). The drought, the City's drought response, the WMP, and other related issues are covered in upcoming chapters. This section provides some key information on the Highland Lakes system.

All of Austin's drinking water comes from the Colorado River, which includes water stored by the LCRA in the region's drinking water reservoirs, Lakes Travis and Buchanan. Lakes Travis and Buchanan are managed by LCRA, as is the entire lower Colorado River system from the watersheds flowing into Lake Buchanan down to Matagorda Bay on the Texas Coast.

Here is how the lakes system works.

Lake Travis is formed by Mansfield Dam and Lake Buchanan by Buchanan Dam. Tom Miller Dam creates Lake Austin. Travis and Buchanan vary in their level and stored water volume depending on the amount of rain, inflows, evaporation, and releases from the dams.

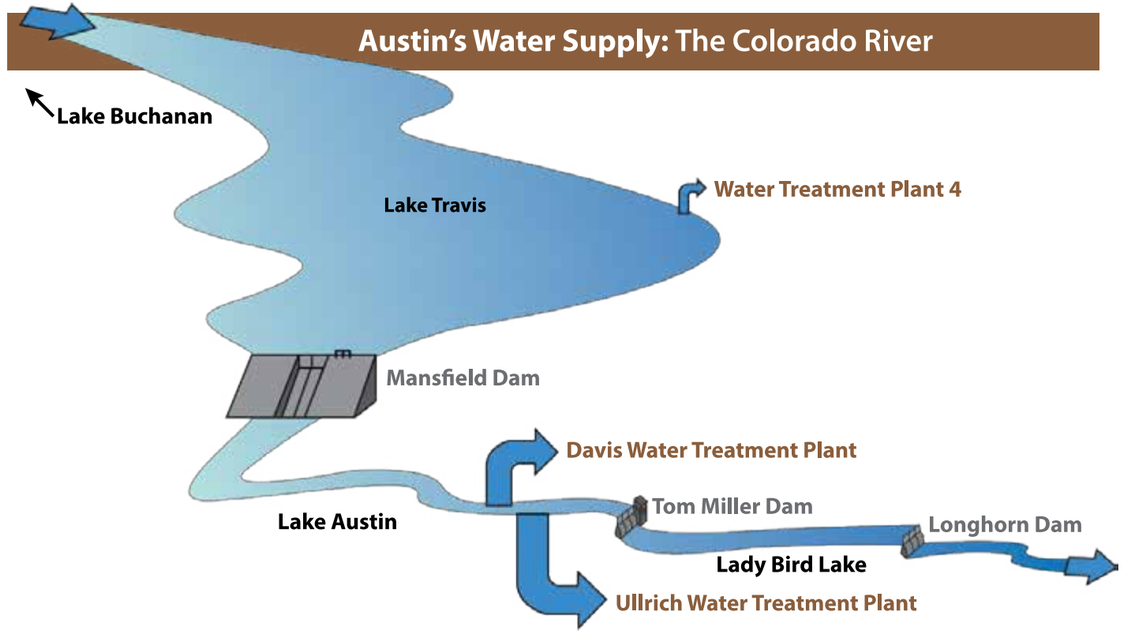
In contrast, Lake Austin is much smaller and LCRA operates the dams downstream and upstream of Lake Austin to maintain it at a relatively constant level. This means that when water is being diverted by the City from Lake Austin for the City's use, or as other users take water from Lake Austin, that water is replaced by releasing water through Mansfield Dam. This happens unless there are sufficient inflows into Lake Austin at the time to replace the diversions. Austin's Lady Bird Lake is also a near constant level lake, although it is not considered one of the Highland Lakes.

Austin's Water Supply Agreement with LCRA

Austin's water supply is from a combination of State-granted water rights and water supply contracts with LCRA. In October 1999, the City of Austin entered into a key water supply agreement with LCRA. This agreement was an amendment to a previous 1987 agreement. The 1999 agreement provides firm backup for Austin's run-of-river rights and additional water totaling up to 325,000 acre-feet/year through the year 2050 with an option for Austin to extend the agreement to 2100. In 2014 Austin's diversions for municipal purposes totaled approximately 137,500 acre-feet.

Under the 1999 agreement, Austin prepaid $100 million for reservation and use fees. Future water use payments to LCRA will be triggered when annual average use for two consecutive calendar years exceeds 201,000 acre-feet per year.

(One-acre foot is 325,851 gallons.)



The Drought

LCRA considers three criteria for declaring a drought worse than the 1950s Drought of Record.

Two have already been met—and far exceeded.

1. **24 months since Lakes Travis and Buchanan last full**
   Yes, were last full in March 2008—or over 83 months ago

2. **Prolonged inflow deficit exceeds Drought of Record**
   Yes, inflows during current drought have shattered records of 1950s drought

3. **Combined storage in lakes falls below 600,000 acre-feet (or 30%)**
   Not yet, though lakes fell to 637,000 acre-feet (or 32%) in 2013

The new Council takes office in the midst of a multi-year, epic and historic Texas drought. The current drought is generally considered to have begun in March 2008 and is approaching the seven-year mark. While there has been some significant rainfall in the city during the last year and a half, rain has not fallen in the watersheds of the lakes in any manner to significantly increase lake storage.

This is not your grandfather's drought

A widely discussed, and important, issue is how does the current drought compare to the famous Texas drought of the 1950s. The ten-year-long drought of the 1950s (actually 1947-1957) is generally considered to be the worst drought in recorded state history. It was long ago designated as the "Drought of Record" and is used as the basis to measure the severity of droughts.

When declaring a drought worse than the Drought of Record, LCRA looks at three key indicators (see side bar). Although the current drought has not—at least of yet—been declared by LCRA's Board to be worse than the Drought of Record, two of these indicators have been met. First is the length of time since the lakes were last full. At 83 months and counting, the 24-month minimum criterion is well exceeded. Second is whether the amount of water flowing into Lakes Buchanan and Travis is worse than in the Drought of Record. Inflows during this drought have shattered records from previous droughts. The third criterion is related to the combined storage level of Lakes Buchanan and Travis, which has fortunately not been met, so far.

Clearly, this drought is rivaling the 1950s Drought of Record.

Different Measures and Categorizations of Droughts

There are multiple ways to categorize and compare the severity of droughts. For example, the US Drought Monitor currently describes Travis County as "abnormally dry" but the state's Emergency Disaster Proclamation declares that Austin and the Highland Lakes area are experiencing "exceptional drought." These different terms may lead to some misunderstanding among the public, but all are important in understanding the drought and its impacts to the fullest extent possible.

Austin Water is most concerned about what affects water supply. Therefore, while the utility monitors and incorporates information from these other drought designation systems, the most important readily quantifiable indicators of drought severity to Austin Water are the amount of water flowing into Lakes Travis and Buchanan and the combined storage volume of those two lakes.

Current inflows even lower than during Drought of Record

The accompanying 'Top 10 Lowest Years of Inflows' table speaks for itself but it is worth pointing out that six of the ten lowest years for inflows in the history of the lakes have been during the current drought (which started in 2008). Additionally, not only was 2011 the lowest year for inflows ever, 2011 inflows also only totaled about 127,000 acre-feet—which is only about 10% of the annual average inflow amount of approximately 1.22 million acre-feet.

In terms of annual inflows, this drought has produced inflows that are clearly far worse than in any drought that has occurred since the lakes were built in 1942.

Lowest Years Of Inflows Into Lakes Travis And Buchanan Since Lakes Built In 1942

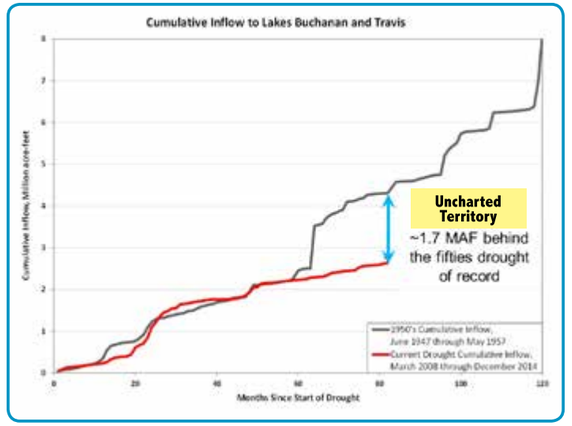
Years highlighted in blue are those from current drought. For comparison, average annual inflow between 1942 and 2014 is 1,216,295 acre-feet.

Rank	Year	Annual Total in Acre-Feet
1	2011	127,801
2	2014	207,535*
3	2013	215,138
4	2008	284,462
5	2006	285,229
6	1963	392,589
7	2012	393,163
8	1983	433,312
9	1999	448,162
10	2009	499,732

**2014 data is provisional and subject to minor adjustments*

The Current Drought = Uncharted Territory

The 'Cumulative Inflow' graph (or 'Uncharted Territory' graph as Austin Water staff calls it) compares historical inflows into the lakes during the current drought to inflows during the 1950s Drought of Record. (The 1950s inflows in this graph have been adjusted to simulate the presence of upstream reservoirs that exist now but did not exist at that time and these modeled inflows are referred to as "reference inflows.")



The gray line shows cumulative monthly reference inflows for the ten years of the 1950s drought, which began in June 1947. The red line shows cumulative monthly historical inflows for the current drought, which began in March 2008.

As you will see during the first five years of this drought, cumulative inflows tracked closely to those of the 1950s. But, at around 60 months into the 1950s drought, heavy storms boosted lake levels by more than a million acre-feet, temporarily replenishing them. A drought pattern then resumed until significant rains eventually lifted the drought after ten years.

We are now more than 83 months, or almost seven years, into the drought of our era and there has been no lift of anywhere near the magnitude that occurred five years into the ten-year-long Drought of Record. In fact, there is a 1.7 million acre-foot difference between cumulative inflows during this drought and cumulative model-adjusted "reference inflows" of the 1950's drought.

(The 'Top 10 Lowest Years of Inflows' table depicts historical inflows based on adjusted flows measured at four stream gauges upstream of Lakes Travis and Buchanan. However, new reservoirs have been built upstream of Lake Buchanan since the 1950s (most notably O.H. Ivie) which complicates historical comparisons. Therefore, models are used to further adjust historical inflows to represent inflows as if the new upstream reservoirs had existed in the 1950s drought. The 'Uncharted Territory' graph shows a comparison of the cumulative historical inflows of current drought compared to the cumulative model adjusted inflows.)

Continue next page

According to the combined lake storage level forecast LCRA issued on January 1, 2015, if the next six months follow an “extreme drought” pattern, the lakes will be barely above 600,000 acre-feet by mid-April, just before the summer heat begins to take hold.

This means that Austin’s water supply lakes could reach their lowest levels ever during the first year of the new Council’s tenure.

The Drought, cont.

Drinking water reservoirs only 1/3 full, or 2/3 empty

The other component, directly related to inflows, is combined storage in the lakes. As of this writing on February 1, the lakes are at 710,408 acre-feet or 35% of capacity, and have been hovering in that range since early fall, actually slightly below 700,000 acre-feet until recent rains.

The emergency level for the lakes is 600,000 acre-feet, or 30% capacity. At that point LCRA will call for pro rata curtailment, or a 20% reduction in water use from each of its firm water customers. If that occurs, Austin will go to Stage 3 and watering hours will be further reduced, consistent with drought response stages developed through a public stakeholder process.

Because of the severity of the drought in 2011 LCRA asked its firm customers, including Austin, to submit pro rata curtailment plans. Austin’s plan was approved by LCRA in July 2012.

As part of the pro rata process, cities are given credit for conservation that has already taken place and is still ongoing. Austin is already using less water than would be allowed under the 20% reduction plan as a result of the City’s conservation, reuse and leak reduction programs, as well as the City’s drought restrictions (primarily the one-day-per-week watering limitation).

Specifically, LCRA gave the City of Austin credit for conserving more than 26,000 acre-feet per year through the City’s ongoing conservation programs. Additionally, LCRA estimates that Austin has saved at least an average of another 26,800 acre-feet per year because of the City’s Stage 2 drought response, which as noted includes one-day-per-week watering restrictions, as well as prohibitions on car washing at home and on charity car washes. (A state administrative judge also cited Austin’s savings in a recommendation to TCEQ commissioners during the 2014 LCRA emergency order process).

Based on LCRA information, Austin Water estimates that just since September 2011, **Austin has saved a total of at least 160,000 acre-feet, or 52.1 billion gallons of water.** Given that the lakes dropped to a combined storage volume of 637,123 acre-feet in September 2013, it is almost certain that the lakes would have fallen below the emergency level of 600,000 acre-feet if not for the City of Austin’s conservation and drought response efforts.

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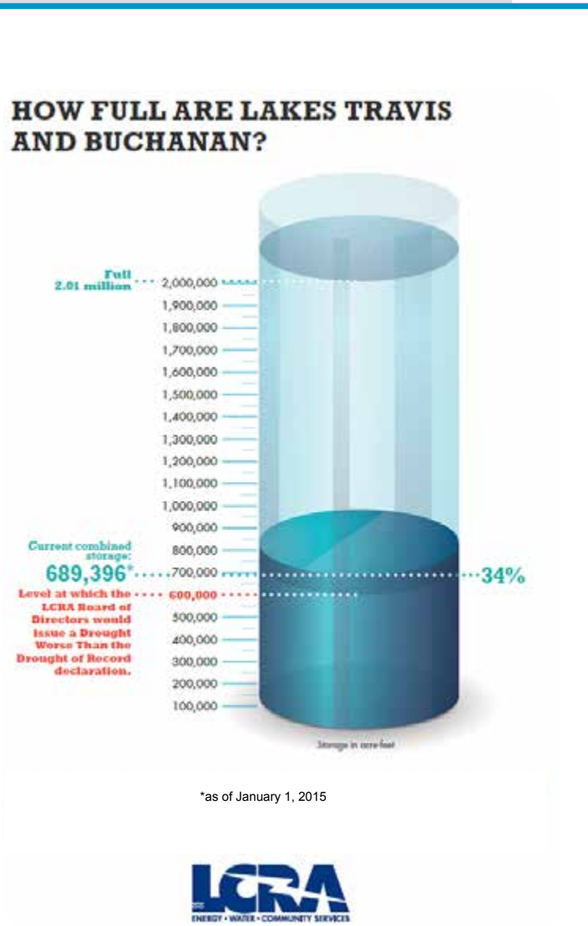
Combined Storage

What is it and why is it important?

A key measure, or term, in lake management is the combined storage of Lakes Travis and Buchanan. The combined storage of Lakes Travis and Buchanan is measured in acre-feet. An acre-foot is the amount of water needed to cover one acre of land one foot deep in water and it equals 325,851 gallons.

Following are several key lake storage levels:

- The total combined storage capacity of Lakes Travis and Buchanan is 2.01 million acre-feet.
- As of February 1, combined storage was approximately 710,408 acre-feet, or 35% of the capacity of the lakes.
- When combined storage drops below 900,000 acre-feet, Austin goes to Stage 2, which includes one-day-per-week watering, no car washing at home and other measures. Austin has been in Stage 2 almost continuously since September 2011, all but approximately two of the last 41 months. This means that Austin has had one-day-a-week watering considerably longer than any other community in the region.
- The lowest combined storage level since the lakes were built in 1942 was 621,221 acre-feet, which was recorded on September 9, 1952.
- The lowest combined storage level during the current drought was 637,123 acre-feet, or 32%, which was recorded on September 19, 2013, and was the second lowest level ever. (The third lowest was 639,141 acre-feet, recorded on September 16, 1964.)
- If the lakes fall to 600,000 acre-feet, a level they have never reached, the LCRA will call for 20% pro rata reduction in water use from its customers and Austin will go to Stage 3, which further reduces hours for irrigation. Through conservation and drought response, Austin has already met the 20% reduction but the City will go to Stage 3 regardless and make further reductions.



The Drought, cont.

Continuous Monitoring of the Drought

Due to the nature of droughts, some of the impacts will not be fully understood until the drought is over. While the current drought clearly rivals and in some ways exceeds the ten-year Drought of Record of the 1950s, the 1950s drought is still used as the basin's yardstick for water supply planning, water supply management, and TCEQ water rights permitting. However, as the current drought continues to unfold, water planners and engineers, including here at Austin Water and at key agencies such as LCRA, TCEQ, and the Texas Water Development Board, will continue to closely monitor hydrologic and water supply conditions to determine the extent and water supply impacts of the ongoing drought.

Tree ring studies point to harsher and longer Texas droughts in earlier centuries

Austin Water officials are attuned to the possibility that the drought might be a permanent shift to a drier climate—and part of climate change (which is discussed later). Whether or not the drought is related to climate change though, recent studies conclude that some droughts in Texas have lasted considerably longer than both the 1950s drought and the current drought so far. Further, the studies challenge whether the 1950s Drought of Record is the best measure and planning tool for dealing with droughts.

Specifically, a 2011 peer-reviewed study published in the *Texas Water* Journal analyzed tree ring data to reconstruct climate for a wide swath of Texas, including the Austin region, back to 1500. Among the study's conclusions:

- "Decadal or longer droughts appear to be randomly distributed and occur frequently. . ."
- "[T]he 1950s drought was severe but…there have been periods when drought was more severe and/or more protracted…"
- "The recurrence of severe prolonged drought in [the region studied, which included Austin] appears to be the norm, not the exception."
- "It would be a questionable strategy for civil authorities to assume that the 1950s drought represents the worst-case scenario to be used for planning purposes in water resources management, at least for western and central Texas. This especially holds true when water managers consider the possible impacts of climate change, combined with a rapidly growing population and new demands on water resources."

What has Austin Water done to respond to the drought?

Austin Water began strengthening its water conservation programs in 2007, before the drought began. (For more details, see later chapter on Water Conservation.) The utility also has a drought contingency plan in place as required by the Texas Commission on Environmental Quality (TCEQ). During the drought, however, Austin Water has taken actions on an array of fronts that go even further than our water conservation programs and drought contingency plan, although both have been central to drought response and to maintaining water in the lakes. Below are some of the actions that Austin Water has taken during the drought and several are discussed further in other sections of this book.

Working to Strengthen LCRA's Water Management Plan and Assert the City's Contract Rights

- As called for in a 2007 settlement agreement concerning various City of Austin-LCRA water supply matters, Austin Water has worked closely with LCRA throughout the drought. Austin Water has vigorously asserted the City's position, while also working cooperatively with LCRA and others in the basin.
- As the drought worsened, Austin Water worked with LCRA, TCEQ, area stakeholders and state legislators to support approval of emergency orders by TCEQ that resulted in the cut off of large volume releases of water stored in Lakes Travis and Buchanan to downstream, "interruptible," agricultural users—which occurred for the first time ever in 2012. Austin Water did not support such an action lightly, but felt it was critical in order to protect the City's water supply and contractual rights. These emergency orders have now been approved three years in a row: in 2012, 2013 and 2014. It is anticipated that these irrigation districts will likely again be cut off in 2015. (For more on agricultural interruptible water releases and emergency orders, see Lakes Management chapter.)
- Throughout the drought Austin Water staff has worked to advocate for a stronger Water Management Plan from LCRA that better protects firm water interests of the City of Austin and other firm customers. LCRA has developed a new Water Management Plan, which went through a basin-wide stakeholder process and is now being considered by the TCEQ.

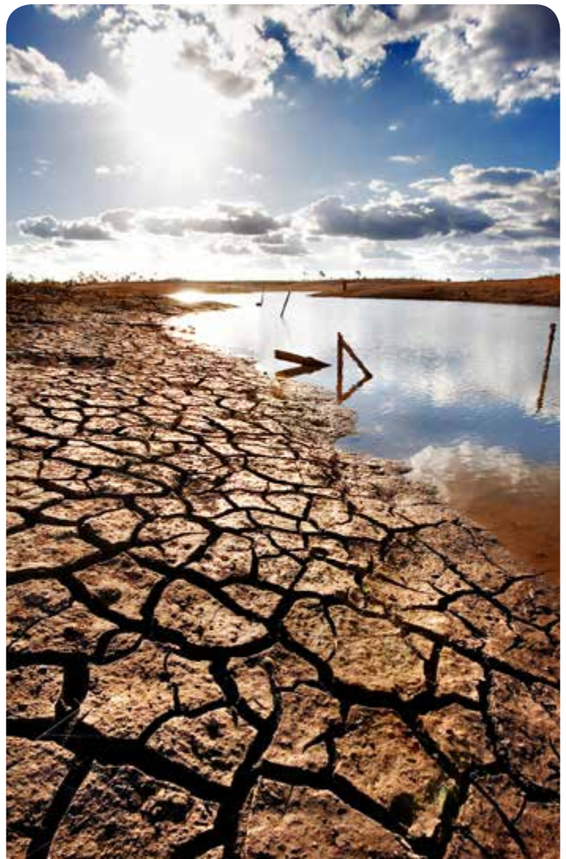
Strengthening and Implementing the City's Drought Response Plan

- In 2012, drawing on lessons learned and responding to citizen input, Austin Water convened a new drought response, or drought contingency plan process. That process engaged an array of stakeholders including environmental activists, landscapers, irrigators, car wash owners, pressure washers, pool company owners and other citizens. The results reflected citizen calls to 'do more earlier' and resulted in the current drought response stages. Because of that effort, the City has been in Stage 2, which limits watering to one day per week, almost continuously since September 2011..
- In an ongoing effort to protect Austin's tree canopy and other vegetation, Austin Water has recommended an enhancement to Stage 3, which as mentioned occurs if lake levels drop to 600,000 acre-feet and further reduces watering hours. Since Stage 4 prohibits all outdoor watering, even if done by hand, the enhancement to Stage 3 would create a transitional stage that would allow outdoor watering, but by hand only. The 'interim' stage would be triggered at 500,000 acre-feet, or sooner.

The Drought, cont.

Given that the lakes dropped to a combined storage volume of 637,123 acre-feet in September 2013, it is almost certain that the lakes would have fallen below the emergency level of 600,000 acre-feet if not for the City of Austin's conservation and drought response efforts.

- Austin Water commissioned an outside study of the City's auxiliary water regulations, culminating in changes to regulations to make the use of auxiliary waters like reclaimed water, graywater and rainwater less difficult. For example, a requirement to replace existing white pipe with purple pipe when switching from potable to reclaimed was eliminated and as a result, Austin Water expects more customers will now connect to the reclaimed system.
- As noted, Austin Water staff submitted a pro rata curtailment plan to LCRA that outlines how the City will reduce water use by 20% if the lakes reach 600,000 acre-feet. Through its conservation and drought response efforts, Austin is already reducing water use by more than would be required and would not be required to make further reductions if the lakes fall to 600,000 acre-feet. However, if such occurs, the City still plans to continue reducing water use given the severity of the drought.



Moving to Augment the City's Water Supply

In 2014, Austin Water presented the Council with a number of options for augmenting water supply. The Council appointed a task force to, among other charges, evaluate these options and additional conservation possibilities. The task force recommended several of the options including:

- Utilizing Lake Walter E. Long as an off-channel reservoir by filling the lake with reclaimed water and by diverting water from the river during storms to fill Lake Long. Water from Lake Long would then be released to meet downstream needs, including water for environmental flows, rather than LCRA having to release water from Lakes Buchanan and Travis. (This option is dependent on how Austin Energy proceeds in the future regarding the Decker Power Plant. The two utilities are working closely on the issue.)
- Fluctuating the level of Lake Austin in non-peak recreational months (October through May) if the lakes drop to 600,000 acre-feet so that potential local rainwater can be captured in Lake Austin and used to reduce releases from Lake Travis.
- Capturing local inflows to Lady Bird Lake, including Barton Springs, and piping them upstream to the Ullrich Water Treatment Plant for treatment.
- Implementing indirect potable reuse, if the combined storage of the lakes falls to 400,000 acre-feet, by releasing reclaimed water into Lady Bird Lake then drawing water out through a floating pump intake barge and pipeline that would be built below Tom Miller Dam (which separates Lake Austin and Lady Bird Lake) and pumping it to Ullrich Water Treatment Plant for treatment and distribution into the City's potable water system.

Austin Water is in the process of moving forward on all of the above options. All of these options have challenges or some level of undesirability, but were brought forward because of the severe drought in this region.

Downstream rice farmers have historically used over three times as much water in a year as the City of Austin.

With the lakes that supply water to a million people near their lowest levels ever, this had to be re-examined.

Lake Management & Agricultural Releases

Many people assume the City of Austin is the largest diverter of water from the Colorado River, but historically the largest users have been rice farmers near the Gulf Coast. In the past, downstream rice farmers have used more than three times as much water in a year as the City of Austin.

When there was adequate rainfall and the lakes were full, this was not a problem. However, with the lakes that supply water to a million people near their lowest levels ever and inflows to those lakes also setting records for the lowest inflow levels ever, these practices have had to be re-examined.

Releases in 2011 illustrate the need for a new LCRA Water Management Plan

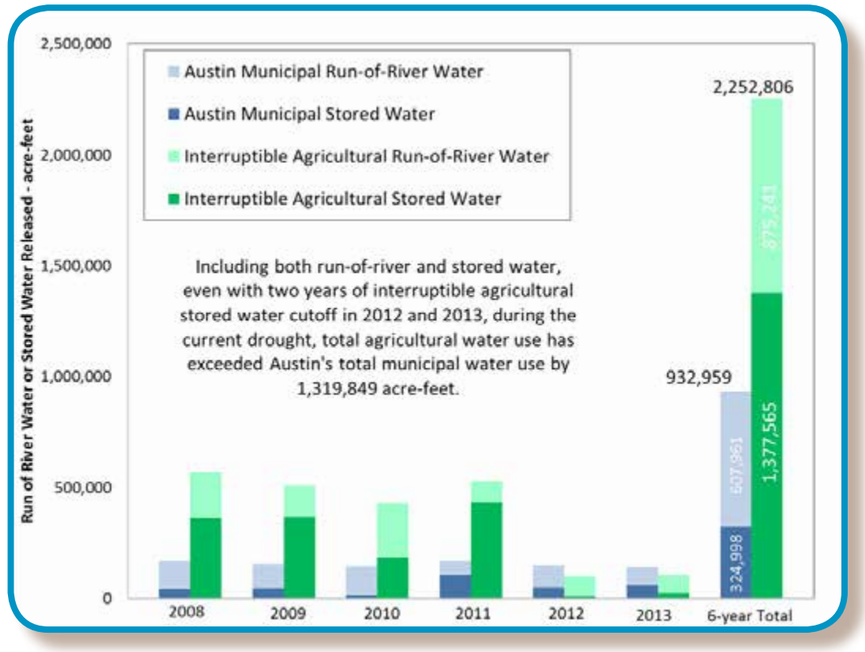
As mentioned, 2011 was a record-breaking year in terms of the severity of the drought. In 2011, inflows to the lakes were the lowest ever recorded (even lower than any year during the Drought of Record) and 2011 was a year of unrelenting heat when temperatures in Austin rose above 100 degrees a record-setting 90 days.

Yet, 433,251 acre-feet of stored water was released to downstream rice farmers that year, along with 96,329 acre-feet of run-of-river water for a total of 529,580 acre-feet for agricultural irrigation. By contrast, the City of Austin diverted 106,622 acre-feet of stored water in 2011, along with 61,712 acre-feet of run-of-river water for a total of 168,334 acre-feet.

So in 2011, 529,000 acre-feet of water was diverted for downstream rice farming irrigation districts versus 168,000 acre-feet of water diverted for the City of Austin.

Working with LCRA and others on new Water Management Plan

Although devastating to lake levels, the stored water releases in 2011 to downstream agricultural districts were permitted under the current Water Management Plan (WMP). Allocation of water up and down the river basin is based on water rights and



contracts, but LCRA's management of water in Lake Travis and Buchanan is governed by the WMP. The plan, which must be approved by the Texas Commission on Environmental Quality (TCEQ), is binding and LCRA manages Lakes Travis and Buchanan in accordance with this WMP. The WMP is developed by LCRA via a stakeholder process involving interests from throughout the region.

Since 2010, the LCRA has worked with the City of Austin and other stakeholders the basin to develop a new WMP. Also, after 2011, LCRA, with Austin's support, sought emergency orders from TCEQ, that resulted in the cut off of releases of stored water to downstream agricultural irrigation districts. (One agricultural irrigation district, Garwood, has not yet been cut off from stored water because they have special long-term contracts with LCRA.)

TCEQ approved the emergency order and downstream agricultural districts (save for Garwood) were cut off from stored water in 2012—and also again in 2013 and 2014. Prior to this drought, agricultural releases had never been interrupted. A fourth request that would cut off stored water to downstream agricultural uses again in 2015 has already been submitted to TCEQ by LCRA, and will likely be considered by TCEQ Commissioners at a meeting in early March.

While the City reluctantly advocated for these actions and understands the importance of agriculture as well as its importance to the downstream economy, and the importance of agricultural water releases as related to downstream environmental flows, the water needs of nearly one million people, and Austin Water's responsibility in that regard, had to take precedence. Along with Austin's conservation programs, and those of some other entities, LCRA's actions to cut off water to downstream agricultural district have significantly slowed down the drop in lake levels, which have continued to trend lower each year as the drought persists.

Emergency orders however are not the best way to manage the water supply and for several years, Austin Water has also worked with LCRA and other stakeholders to develop a new WMP that is more protective of firm water customers and that incorporates recorded hydrological activity through 2013. As part of these efforts, Austin has sat at the table with other firm customers, representatives of upstream communities on the Highland Lakes, rice farmers and environmental interests to try and work out regional solutions.

Continue next page

Since 2010 LCRA has worked with Austin and other stakeholders to develop a new Water Management Plan for the lower Colorado River basin.

As a result, the new plan recently approved by LCRA and pending before TCEQ is more favorable to firm customers, including Austin.

Lake Management, cont.

As a result, the Water Management Plan recently approved by the LCRA Board and pending before the TCEQ is more favorable to firm customers, including Austin. Although the pending Water Management Plan does not have all the protections Austin sought, it is a vast improvement over the current one in protecting Austin's water supply. Austin Water continues to be deeply involved in the WMP process and is closely monitoring events and participating in critical discussions as the plan moves forward.

Difference between firm and interruptible customers reflected in pricing

Since a state-required adjudication of water rights was completed in the late 1980s, rice farmers have been categorized as "interruptible customers," meaning their supply must be interrupted to whatever extent necessary to assure the demands and contractual water rights of "firm customers," including Austin, can be met, especially during times of drought or other emergencies.

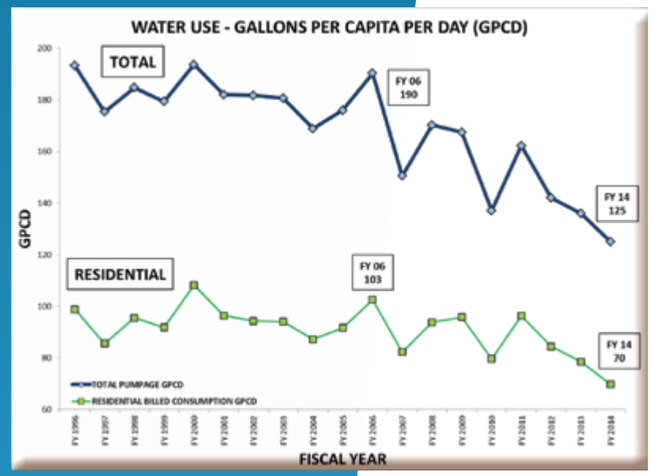
The difference between firm and interruptible customers is reflected in the prices charged by LCRA for water from the river. Firm customers pay roughly 23 times more for water than interruptible customers.

As of December 2014, firm customers paid $151 per acre-foot while interruptible customers were last charged $6.50 per acre-foot, although additional delivery charges increase the cost to between $25 and $40 per acre-foot. In January, firm water rates increased to $175 per acre-foot. The LCRA Board considered higher rates for interruptible customers but did not institute new interruptible rates because most interruptible customers are currently cut off (consequently the $151-per-acre-foot-firm rate is used for comparative purposes here). (Austin does not currently pay this per acre-foot rate because the City prepaid $100 million for water as part of the 1999 agreement. As part of that agreement, the City negotiated a provision intended to encourage water conservation whereby the City does not have to pay LCRA anything additional for water until the year after average annual use for two consecutive years exceeds 201,000 acre feet.)

Water Conservation & Drought Response

GPCD has fallen from 190 in FY 2006 to 125 in FY 2014.

That's a 22% decrease in eight years.



Conservation Progress

During the last eight years, Austin's increasing focus on water conservation led to a dramatic drop in water usage. This is the result of a series of programs and initiatives by Austin Water and a resounding response from Austin citizens. Austin Water's approach encompasses incentives, regulation, conservation pricing, water reclamation and education.

As a result:

- Austin's per capita use, as measured in Gallons per Capita per Day (GPCD), has dropped 22% since 2006*, the last year before the Council acted to strengthen water conservation programs.
- Since 2006, Austin Water's service area has added over 130,000 new residents but total water use did not go up. Rather, it significantly declined. For example in FY 2006 Austin pumped 56.6 billion gallons of treated water into the distribution system to serve its customers. In FY 2014 that number dropped to 43.2 billion.
- The 2006-07 Council-appointed Water Conservation Task Force set 10-year goals to reduce peak day summer demands. Those goals were met in half the time and overall water use declined as well.
- The 2010 Citizens Water Conservation Implementation Task Force also set a goal that has already been met ahead of schedule. That group recommended that total water use be reduced to 140 gallons per capita per day (GPCD) by 2020 (based on a five-year rolling average). The GPCD five-year rolling average hit 140 after fiscal year (FY) 2014 and GPCD was 138 in FY 2013 and 125 in FY 2014.
- Residential GPCD has dropped correspondingly, from 103 in 2006 to 70 in 2014.
- Austin's proactive conservation efforts are helping to delay future additional raw water payments to LCRA.

** Based on a five-year rolling average to normalize for weather. As a comparison, in 2008 California set a goal to reduce GPCD 20% by 2020.*

Conservation History

Austin's water conservation programs began in the mid-1980s, and were primarily focused on residential, indoor uses. New technologies in the 1990s led to more consumer rebates, but savings plateaued by the end of the decade. In a 2005 City reorganization, the water conservation program was moved to Austin Water.

Beginning in 2007, the Council directed that water conservation programs be strengthened and prioritized. The location of the Water Conservation Division within the water utility ultimately helped to integrate conservation into utility operations and aided Austin Water's efforts to establish a water conservation consciousness throughout the utility. This included an increased focus on leak detection, leak response, and water loss, all of which have been a key part of recent conservation gains.

In 2007, Council directed staff to implement the water management strategies recommended by the Water Conservation Task Force, aimed primarily at peak use reduction. These included expansion of the reclaimed water system, enhanced watering restrictions and rate restructuring. In 2009, a follow-up citizen's task force examined ways to reduce annual water use, which led to Council adoption in 2010 of a goal to reach 140 GPCD by 2020.

With an eye to the persistent drought in Central Texas, Austin Water began a public process in 2011 to revise its water use management codes. Changes included strengthening water restrictions earlier in a drought, and providing some relief to water-using businesses and increased facilitation of efficient technologies in later drought stages.

In 2014, Council convened the Austin Water Resources Planning Task Force to make recommendations regarding future water planning and potential water resource management scenarios. The task force generally recommended maximizing conservation and existing supplies before seeking water outside of Austin.

Looking Ahead, Next Frontiers

Austin Water continues to look for ways to expand and enhance water conservation and ensure available, high quality water at a reasonable cost that covers operational needs. Particular areas where we think more progress can be made include:

Increased rainwater harvesting

Austin's rebate program has encouraged rainwater harvesting at a homeowner level, but there is still much untapped potential, including in commercial operations. Austin Water is working with the Watershed Protection Department and other departments to incorporate rainwater harvesting into the cityscapes.

Landscaping

Austin Water offers rebates for switching to drought tolerant landscapes, and citizens are responding. However, this is an area where continuing progress is essential to continue transforming the way people

Continue next page

Water Conservation, cont.

look at water use. With other City departments and stakeholders, Austin Water is considering potential code amendments for new development that could aid in a much broader transformation to drought tolerant landscapes.

Reclaimed water, expansion of uses

Austin Water continues to build out the reclaimed water system in the eastern and central parts of the City. Additionally, the utility recently brought forward amendments to the City's reclaimed water regulations that were approved by Council and should lead to more customers connecting to the reclaimed system. In addition to using reclaimed water for landscape irrigation and cooling towers in existing properties, Austin Water is actively working to encourage broader uses of reclaimed water, such as toilet flushing in new construction.

Austin Water's Tree Gator Distribution Program saves water. Some of the tree gators distributed were used for new trees to replace those lost to drought

GPCD
What It Is and What It Isn't

Gallons per capita per day (GPCD) is a common measure of conservation progress.

Utilities may calculate GPCD differently, but it is generally total annual water pumped from treatment plants divided by the population served, divided by 365 days.

Total GPCD, as opposed to residential GPCD, is usually higher than what one person uses at home because it includes commercial and industrial uses.

Since every city has different types of customers and water needs, GPCD isn't a useful way to compare the water use of communities.

GPCD is useful for gauging how well a community is doing on conservation over time.

The Arithmetic of Conservation & The Value of Water

Conservation advances bring with them a dilemma. Although water use drops, no one stops using water altogether and water still has to be treated and piped to every house, every business and institution. While less water usage results in some operational savings on energy and treatment chemicals, the cost savings are nowhere near the declines in revenue

Here's how the arithmetic of drought response and conservation works:

- Drought response and conservation lowers revenue.
- Treating and delivering less water reduces some costs, such as costs for treatment chemicals and pumping.
- But, savings are nowhere near lost revenue.
- Treatment plants, pumping stations and other infrastructure must still operate around the clock.
- Water must still be delivered to all customers through underground pipes to every faucet.
- Consequently, fixed costs are a very high portion of overall costs. In Austin's case, fixed costs are 80% of the utility's total costs. Fixed revenues are only 20%.

The Conservation Conundrum

Austin is not alone in this dilemma. In the water industry, this phenomenon has a name: "The Conservation Conundrum," and it is the subject of much discussion within the industry.

For example the 2013 California Water Plan Update explains: "The less water customers use, the less revenue the water supplier receives. . . This problem poses a hardship on the utility's ability to meet its revenue requirements and can undermine the financial viability of its systems and the ability to meet service needs and infrastructure maintenance."

Googling an *Austin American-Statesman* headline on increases in Austin's rates due to declines in use produced this 2013 headline from the Portland Oregonian.


MONDAY
FEBRUARY 18, 2013

The Oregonian

SUNRISE EDITION

Inside Portland's rising utility rates: Less water consumption means higher prices

By BRAD SCHMIDT

It's a strange concept. But in Portland, lower consumption is having an unsettling consequence on water and sewer bills: higher rates. . . because a large chunk of utility costs are fixed, city officials say they must raise rates to make up for the water customers aren't buying.

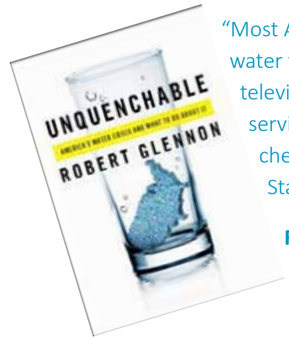
"Inside Portland's rising utility rates: Less water consumption means higher prices."

The story read much like the *Statesman* story. "It's a strange concept. But in Portland, lower consumption is having an unsettling consequence on water and sewer bills: higher rates. . . [B]ecause a large chunk of utility costs are fixed, city officials say they must raise rates to make up for the water customers aren't buying." The Oregonian 2-18-13

In Austin the "conundrum" has been more pronounced than in many places due to such rapid drops in water use from strengthened conservation programs and response to the drought.

Is Water Undervalued? A Topic of Discussion Internationally

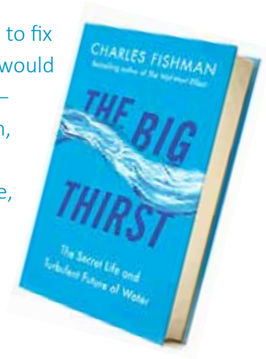
Still another part of the national, and international, water discussion is the true value of water. Many maintain that water is undervalued. For example here are two quotes from major books on the water situation in the United States.



"Most Americans pay less for water than they do for cable television or cell phone service. Water is ridiculously cheap in the United States."

Robert Glennon, "Unquenchable"

"If you had to pick one thing to fix about water, one thing that would help you fix everything else – scarcity, unequal distribution, misuse, waste, skewed priorities, resistance to reuse, shortsighted exploitation of natural resources – that one thing is price."



Charles Fishman, "The Big Thirst"

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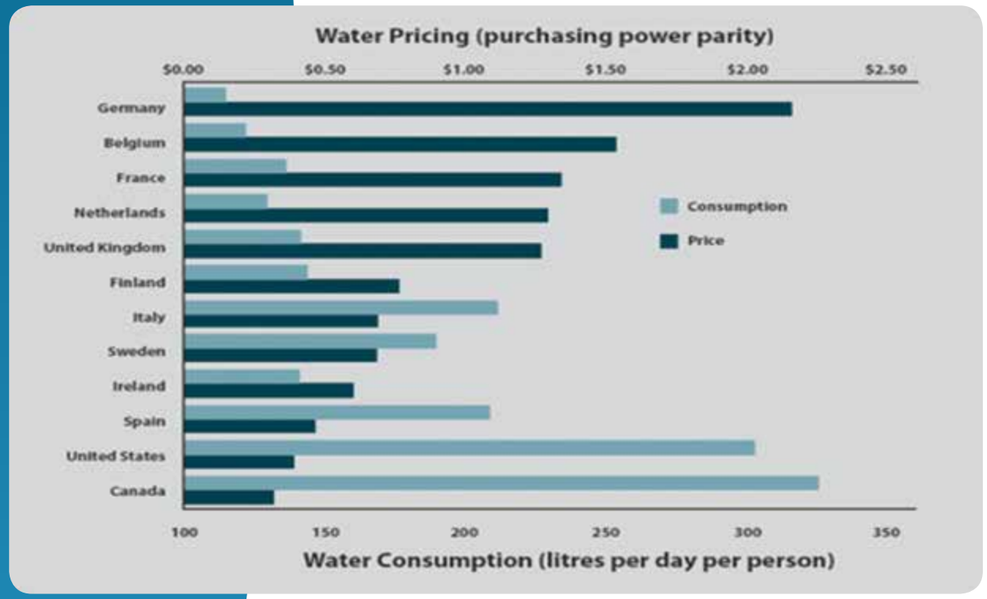
The Arithmetic of Conservation, cont.



Another interesting part of the discussion resulted from international research done as part of a study by the Council of Canadian Academies in 2009. This study found an inverse correlation in numerous developed countries between the cost of water and the amount of water used by their citizenry. The Academies offered the following disclaimer, or explanation: "Comparing water use statistics among countries presents challenges. However, the data used above are reasonably accurate and sufficient to illustrate that Canadians use more water than people in other developed countries and that there is a strong correlation with pricing." Some follow-up research by Austin Water staff has also led us to conclude that the data is reasonably accurate, so we include it here for consideration.

There is a distinct possibility that this drought is a consequence of climate change and that the region is shifting permanently to a drier climate–or at least one with less water availability.

Climate Change & Austin's Water Future

As the authors of the tree ring study note, not only are long-term droughts a recurring feature of Texas climate, but climate change brings new risks and challenges. There is a distinct possibility that this drought is a consequence of climate change and that the region is shifting permanently to a drier climate–or at least one with less water availability. It is too early to know that for certain, and Texas has experienced many severe droughts over the centuries, but Austin Water takes the possibility of a shift to a drier climate due to climate change very seriously. This section explores this issue in more detail.

Changes in precipitation alone could cause regional stress: Austin is already on a continental hydrogeological divide, the 98th meridian that runs just west of town. As noted most prominently by the late Austin resident Walter Prescott Webb in his book "The Great Plains", the 98th meridian is the boundary between more than 30 inches of annual rainfall (east of the line) and less than 30 inches. This is reflected in local rainfall records.

Of course, the future impacts of climate change are uncertain and it is difficult to downscale predictions to a particular region. The City's Sustainability Office hired nationally respected climate scientist Katharine Hayhoe of Texas Tech University to conduct a downscaling study for Austin. Due to the availability of records and the scale of the study, Camp Mabry was the only weather station used in the study. Thus, the study did not speak specifically to the Highland Lakes. The study projected changes based on differing levels of future greenhouse gas emissions (that is, different scenarios of how much emissions can be cut). Then, projections were made for three 30-year time periods centered on the 2020s, 2050s, and 2080s.

Among the predictions

- Summer temperatures are "expected to increase, and days where maximum temperature exceeds 100º F and 110º F become more common."
- "Nighttime temperatures that drop below freezing are projected to become increasingly more rare, while [minimum] nighttime temperatures above 80ºF will become more common."
- "By the 2050s, projected changes in temperature are noticeably greater under the higher [emissions] scenario as compared to the lower [emissions scenario]."
- "Little change is expected in annual average precipitation, in the number of dry days per year, and in the average length of dry periods each year. All else being equal, though, warmer temperatures are expected to lead to drier conditions, particularly in summer."

All these predictions are consistent with UT and EPA climate projections reviewed by Austin Water. While some predict less precipitation and a few say more precipitation, all predict higher temperatures, which would likely translate into drier ground, less runoff, and more evaporation in the lakes.

Climate Adaptation

Austin Water has undertaken efforts across its divisions to assess and respond to future climate conditions. For example, staff in the utility's Pipeline Engineering Program Area participated in a national-level effort to develop climate-resilient design standards, which resulted in the Austin Water adopting changes in pipeline design to better tolerate shifts in soils as they go through cycles of high and low soil moisture. Divisions of Austin Water were also queried internally following the extreme heat and drought of 2011 to gain a better understanding of how operations were affected and what operational changes were made. Additionally, the utility is currently participating in a pilot effort with the EPA to utilize a planning tool that will help assess and prioritize climate-adaptive strategies necessary for ensuring consistent treatment and water quality under changed climate conditions. This effort will also inform the Integrated Water Management Plan which will be developed over the next few years.

Austin Water has also brought forward a number of options for augmenting the water supply; these are discussed in this briefing's section on the drought.

Mitigation of Energy Demand and Greenhouse Gas Emissions

Water utilities consume large amounts of energy to pump raw and treated water as well as to collect and treat wastewater. Austin's continued population growth has also required serving more customers at greater distances from our water supplies, and sometimes at higher elevations which requires more pumping. In response, Austin Water has implemented operational changes and capital improvements to improve system energy efficiency and reduce energy costs.

Continue next page

Climate Change, cont.

Some examples of major energy and energy cost-saving measures include

- Implementation of time-of-use electric rates and changes to pump operations at pump stations;
- Process changes at the Walnut Creek Wastewater Treatment Plant;
- Capital projects to improve the efficiency of the utility's water distribution system, including the new Water Treatment Plant 4, which is anticipated to further reduce the utility's water distribution energy usage.

Austin Water began tracking its greenhouse gas emissions in 2007 following the adoption of the COA Climate Protection Plan. Through this initial inventory, it was determined that annual emissions from Austin Water were approximately 130,000 metric tons of CO2-equivalents (MTCO2e), from the following sources:

Purchased electricity for buildings and equipment	**80%**
Fuel for fleet and stationary equipment	**3.5%**
Fugitive emissions from treatment	**16.5%**

(Fugitive emissions are uncontrolled releases of nitrous oxide and methane, primarily from wastewater treatment. The industry currently estimates these values due the cost and difficulty of accurate direct measurement. While fugitive emissions are a not insignificant portion of Austin Water's GHG emissions, they are currently managed using industrial best practices and there are no practical alternatives available to reduce these emissions further.)

Austin Water has reduced emissions from this 2007 baseline to approximately 30,000 MTCO2e primarily by purchasing Green Choice power through Austin Energy. This electricity is 100% wind and certified carbon-free but comes at a cost: roughly an additional $4 million per year. Purchasing carbon-free electricity also means that Austin Water's continued improvements in energy efficiency, while saving energy and costs, will not necessarily reduce GHG emissions.

Therefore Austin Water continues to pursue further reductions in its GHG emissions.

Additional actions include:

- Onsite generation of almost 1 MW of green electricity using a biogas-fueled 848kW generator at the Hornsby Bend Biosolids Management Plant and a 136kW rooftop solar photovoltaic system at Austin Water's Glen Bell Service Center (in southeast Austin).
- Fleet improvements to expand the use of alternative fuels and hybrid vehicles while reducing fleet age and improving overall fleet efficiency. Additionally, field crews have optimized service routes to reduce vehicle miles driven.

Higher Rainfall but Lower Inflow: A Climate Paradox

A paradox of the current drought is that although inflows are even lower than in the 1950s drought, rainfall is actually slightly higher over the lakes during this drought than during the 1950s, suggesting that higher temperatures are possibly leading to more rainfall being absorbed into the ground and/or that upstream impoundments like stock tanks are holding back significant amounts of rainfall from reaching the lakes.

Because inflows have remained so low, LCRA and other agencies have established a monitoring network to better track soil moisture in order to better understand the relationship between precipitation and inflows, or runoff. This study is underway and it is too early to draw conclusions but one of the possibilities being investigated is that anticipated future higher temperatures and the potential for more intermittent precipitation may lead to generally reduced soil moisture, which in turn may lead to the ground absorbing more water and thus decreased runoff or inflows – even during times of average precipitation.

In other words, the future may mean reduced water availability even with similar amounts of precipitation.

In closing, as outlined in this document, Austin Water and the City face multi-layered challenges posed by this historic drought. Austin Water looks forward to working with the Council and the community to meet these challenges as Austin responds to changing conditions and continues to adapt to further enhance our city's sustainability.

THANK YOU

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