THE CITY OF AUSTIN 2017

State of Our Environment

REPORT

Prepared for
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Foreword

Welcome to the State of Our Environment report for 2017. Usually in my introduction, I talk about things you'll see later in this annual report, but this year I want to highlight something that isn't elsewhere in the report, CodeNEXT. As you may or may not know, CodeNEXT is a multi-year effort to rewrite Austin's Land Development Code. Those regulations are key in protecting our environment from the impacts of development and Austin has long been considered a national leader in balancing development and environmental protection.

CodeNEXT will go to the City Council for approval later in 2018. Much of the water quality, tree, and drainage regulations will remain unchanged, but there are two key proposals that I would like to highlight. First, there is a new emphasis on requiring "green" stormwater infrastructure (GSI). GSI uses natural systems (soil and plants) to remove pollutants from stormwater runoff from development. In addition to removing pollutants, it can also reduce water needed to irrigate landscape and GSI in the form of rain gardens that can be an amenity for new development. If the proposal is approved, I hope to see lots of rain gardens and vegetated filter strips around Austin in the coming years.

The second significant change proposed is in how runoff from development is managed to reduce the risk of flooding caused by development. As our city redevelops, we currently don't require old development to fix flooding caused by old, outdated drainage systems. The new proposal would require redeveloped property to contribute its "fair share" to address flooding that it may be contributing to.

In my opinion, these can provide significant benefits as our community continues to work to protect our environment and our residents from the impacts of new and old development, while respecting and understanding the need for a thriving, but affordable local economy. Take a look through the rest of our annual report and I hope you enjoy what your city government is doing to protect our environment. Click on a link or send us an e-mail if you would like to learn more!

Chuck Lesniak
Environmental Officer
Watershed Protection Department

Creeks

Figure 1. *Healthy creeks provide opportunities to connect with nature in ways that make our lives better.*

Importance

Creeks are cradles for the waters that flow into our drinking water supply, but our creeks offer much more than clean water to drink. Properly managed, they can support critical habitat for wildlife and provide a resilient landscape that transports floodwaters. Opportunities to hike, fish, swim, and relax alongside healthy streams with diverse vegetation make our community special. Development and pollution can quickly degrade the quality of these creeks and eliminate the benefits they provide, so the City conducts routine monitoring and special studies to inform policy decisions and solutions to preserve the integrity of our waters. The health of our creeks and floodplains is a barometer for our environmental stewardship.

Status and Trends

The "Ready, Set, Plant!" program, an important part of our creek restoration efforts, includes planting tree saplings to help grow future forests along our creeks. In collaboration with Tree Folks, Austin Parks Foundation, and Keep Austin Beautiful, thousands of dedicated volunteers brave cold winter days that are perfect for planting very young trees.

Figure 2. *Ready, Set, Plant! In February, volunteers planted saplings in Heritage Oaks Park.*

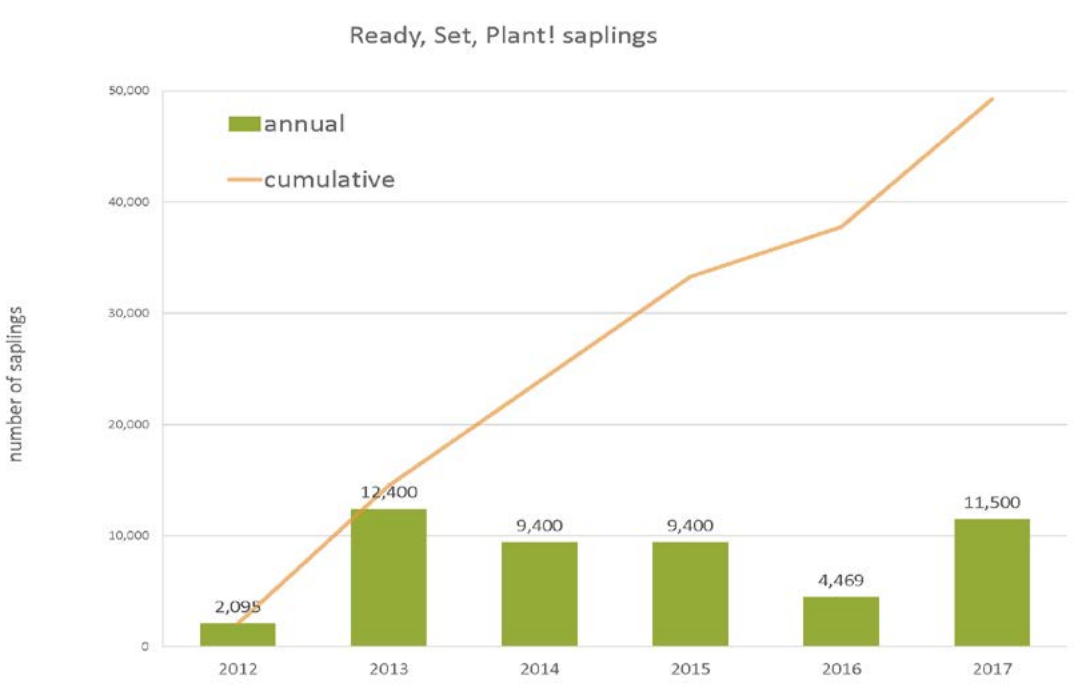


Figure 3. *Annual and cumulative number of saplings planted by volunteers at "Ready, Set, Plant!" events along our creeks. Since 2012, the "Ready, Set, Plant!" program, the City, and our partners have planted more than 45,000 saplings.*

The Environmental Integrity Index[1] (EII) is one of the programs used to evaluate the chemical, physical, and biological health of Austin's creeks. Routine sampling of 49 watersheds provides spatial and temporal resolution to aspects such as nutrients, bacteria, aquatic life, and pollutants in sediment. Although most watershed scores remained similar to the previous year, a few have increased and a few have decreased.

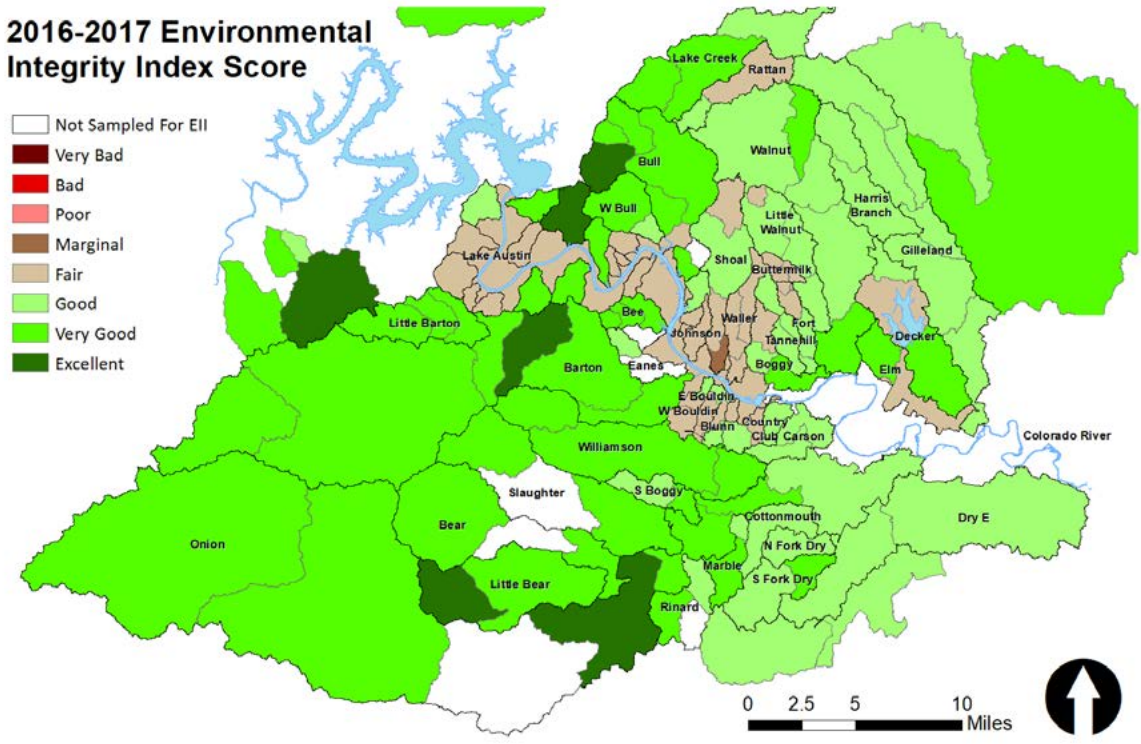


Figure 4. *2016-2017 Environmental Integrity Index Scores. Lower integrity scores are typical in urban areas due to intense development in the past that did not have progressive environmental rules.*

[1] *www.austintexas.gov/department/environmental-integrity-index*

Figure 5. *The Pollution Prevention and Reduction (PPR) team responds to chemical spills, sewage leaks, sediment discharges, petroleum spills, illegal dumping, tanker accidents, and much more.*

Annual Focus

The City's Pollution Prevention and Reduction (PPR) team of investigators is charged with protecting waterways by enforcing local, state, and federal water quality regulations. Through the Spills & Complaints Response Program (SCRP) this group implements the 24-Hour Pollution Hotline.

Investigators are on call 24/7, responding to pollution emergencies to identify the causes of pollution and the responsible parties. When they find pollution problems, investigators recommend corrective actions to mitigate environmental impacts and return the site to "pre-spill" conditions. For example, in August 2017, investigators received notice of a spill through the 24-Hour Pollution Hotline. Upon arrival, investigators found a storage tank that had exploded within a milk-processing plant, resulting in a spill of thousands of gallons of milk sludge. That sludge entered nearby storm inlets and flowed into the Colorado River.

Figure 6. *Milk sludge trapped in storm pipe*

Figure 7. *Milk discharging to Colorado River*

Figure 8. *Colorado River returned to "pre-spill" conditions*

PPR met with facility engineers and learned that the catastrophic failure occurred overnight. Investigators worked with the facility management, who immediately began containment and recovery efforts. A contractor who specializes in environmental cleanup removed milk sludge trapped in a storm pipe by flushing fresh water into the pipe and pumping out the contaminated water at the end of the pipe. These efforts recovered an estimated 12,000 gallons of milk waste by the end of the day.

When not responding to emergencies, the PPR team helps prevent discharges under the Stormwater Discharge Permit Program, conducting routine environmental inspections at local businesses to ensure compliance. Permitted sites include industrial and high-risk businesses such as auto repair shops, salvage yards, and various manufacturing and processing facilities. When problems are found, inspectors provide direction on how to stop discharges and perform remediation.

CITY OF AUSTIN
WATERSHED PROTECTION
24 HOUR POLLUTION HOTLINE
512.974.2550

Obviously, PPR investigators never experience a dull moment. They often work with Austin Fire, Austin Water, the Law Department, law enforcement, and the Texas Commission on Environmental Quality (TCEQ). In 2017, PPR investigated 1,054 pollution complaints and inspected 370 permitted facilities. This resulted in the removal of nearly 400,000 gallons of pollutants from the environment.

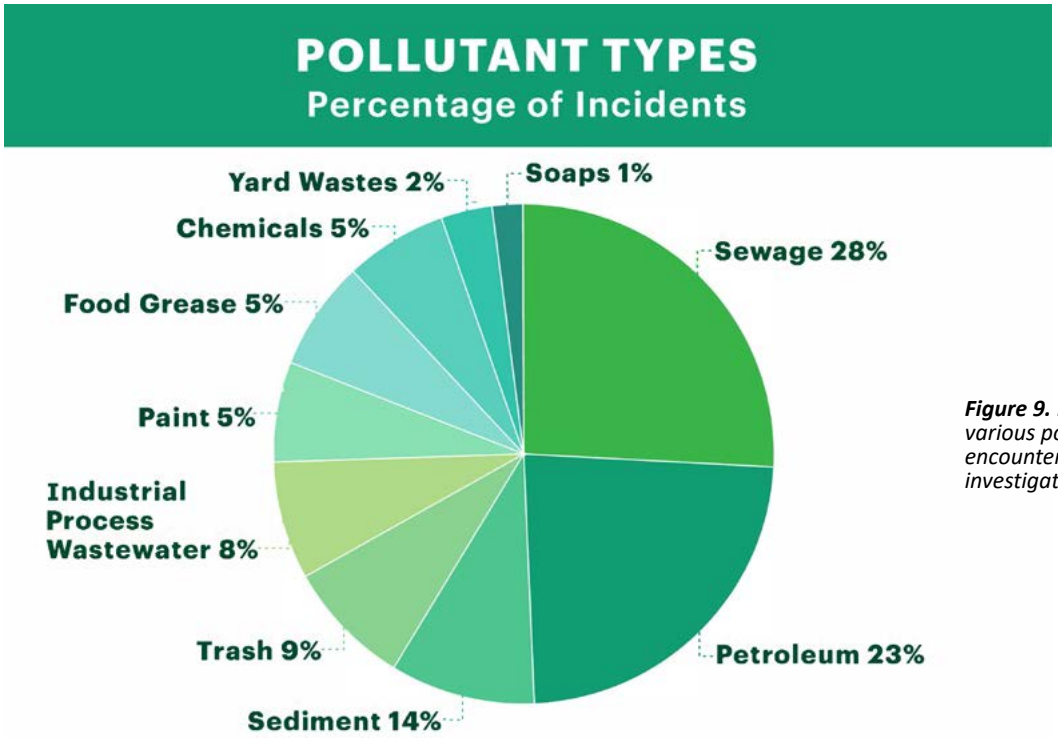


Figure 9. *Distribution of various pollutant types encountered during SCRP investigations, 2011-2016*

Lakes and Rivers

Importance

Austin's reservoirs - Lake Austin, Lady Bird Lake, and Lake Walter E. Long - are essential providers of ecosystem benefits necessary and desired for a successful city. While drinking water remains one of the most important resources provided by the reservoirs, they also provide flood control, recreational opportunities, and aesthetics that enrich the region at large. Watershed Protection Department (WPD) staff monitor and study the City's reservoirs to gauge ecosystem health. The results of these studies drive policy changes related to development and land use, as well as remediation and restoration projects to protect and enhance these valuable resources.

Status and Trends

Staff utilize the Austin Lake Index (ALI) as a tool to convey the general condition of the reservoirs through the routine sampling of biology, habitat, water quality, and sediment chemistry. In 2017, WPD staff observed a general increase in the condition scores from poor-marginal to marginal-fair across all reservoirs relative to 2016. One important measure of water quality is the diversity of aquatic life found within the reservoir, especially benthic invertebrates such as insect larvae, aquatic worms, mussels, and other small lifeforms. Another important measure

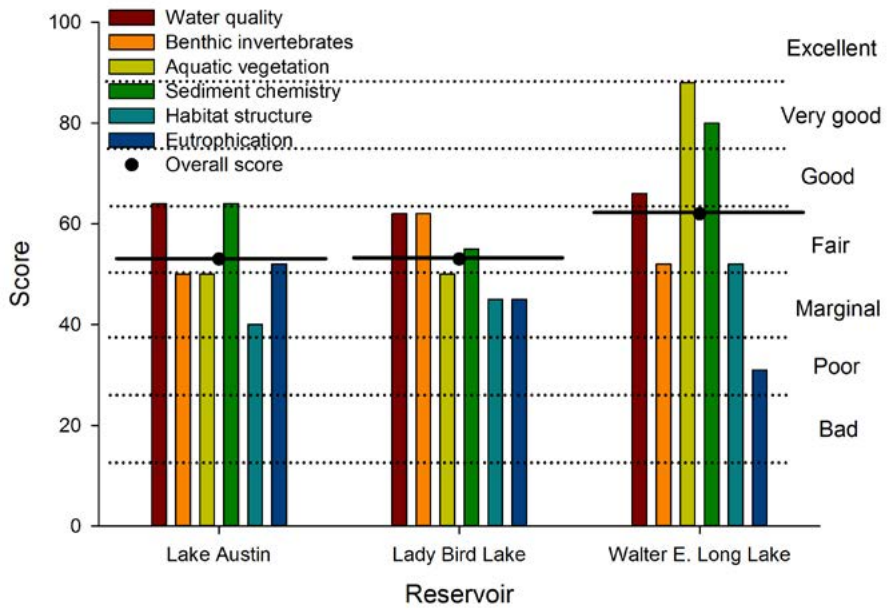


Figure 1. *Austin Lake Index components monitored include nutrients, benthic invertebrates, aquatic plants, sediment toxins, shoreline habitat, and phytoplankton communities. The target score is 64 or "good" condition, which was almost realized in Lake Walter E. Long in 2017 (62). More information on scoring can be found at www.austintexas.gov/lakesindex.*

Figure 2. *Lake Austin downriver of the Pennybacker Bridge (Loop 360) during the January 2017 drawdown. The exposed sand flat is covered by the non-native Asian clam, Corbicula.*

Figure 3. *Mussel species collected in the 2017 survey included: giant floater, paper pondshell, fragile papershell, Tampico pearlymussel, southern mapleleaf, and Texas Lilliput. In 2011, only the giant floater and paper pondshell were observed.*

of water quality is the "eutrophication" score, which examines the amount of excess nutrients in the water. In both Lake Austin and Lady Bird, both of these scores were higher this year, indicating improving water quality. Part of the reason for this improvement may have been a result of increased flows due to higher rainfall amounts. Water quality scores improved in Lady Bird Lake and Lake Walter E. Long. Habitat and vegetation continue to depress the Lake Austin and Lady Bird Lake scores; the eutrophication score had the largest negative influence on Lake Walter E. Long.

The Lower Colorado River Authority, at the City's request, lowered Lake Austin 10 feet in January 2017 for the first time since 2011. The lower water level was fortuitous for some lakeshore residents, who took the opportunity to repair docks and bulkheads. The exposed lakebed also allowed WPD staff to conduct a survey of native mussels.

In 2017, WPD staff found native mussels at 100 percent of all survey sites (compared to 58 percent in 2011), a total of six species (compared to only two species in 2011), and a greater number of shells in 2017 (3,118 shells) relative to 2011 (153 shells).

Mussel abundance increased moving from the upper to the lower reservoir. Findings suggest that mussel populations had been negatively impacted by frequent winter drawdowns of the lake, but the six-year hiatus allowed populations to rebound.

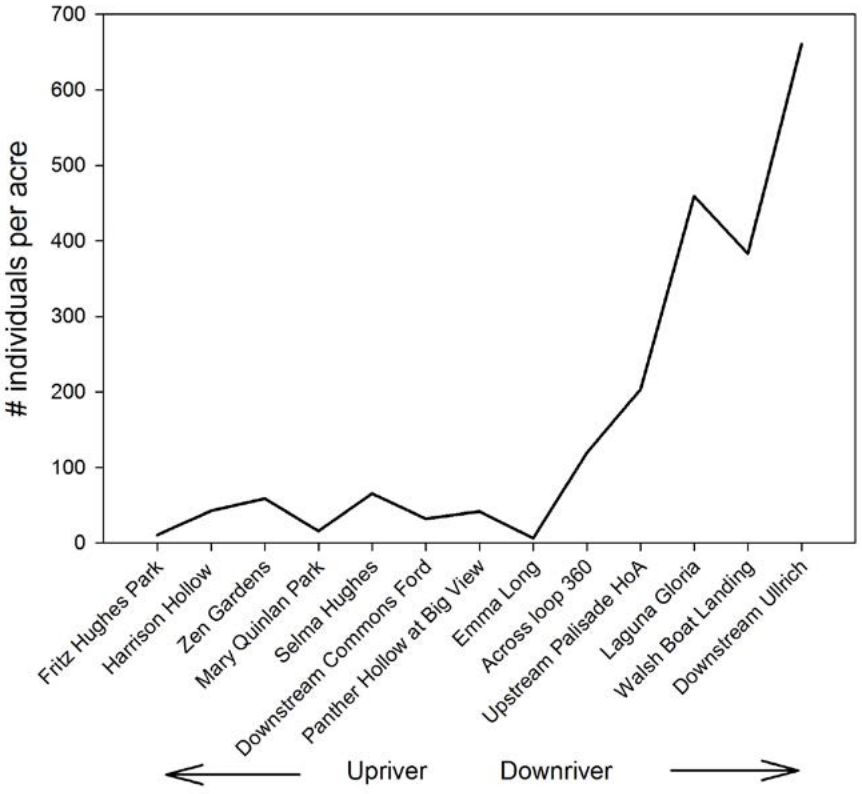


Figure 4. *Mussel density (individuals/acre) by location within the mainstem of Lake Austin from upriver to downriver*

***Figure 5**. Live zebra mussels growing on a rock from Lake Belton (left). Dead zebra mussel shells remain attached to a ladder that had been submerged in Lake Belton (right). Zebra mussels in Lake Austin could result in negative impacts to recreation, water intake pipes, native mussel populations, and food web/nutrient cycling dynamics. Photos provided by the Army Corp. of Engineers Lake Belton office.*

Although the abundant native mussels found during the drawdown was encouraging, in late summer the Texas Parks and Wildlife Department confirmed the presence of the non-native, highly invasive zebra mussel.

While initially few zebra mussels were found near the Tom Miller Dam, they were subsequently discovered at multiple sites and Lake Austin is now considered to be infested by the Texas Parks and Wildlife Department. As of February, Lady Bird Lake is also suspected of containing zebra mussels. WPD staff, with state and local partners, are developing monitoring plans to ensure zebra mussel population changes can be documented and associated with any broader aquatic ecosystem changes.

Annual Focus

WPD's Environmental Resource Management and Field Operations Divisions collaborated with the City of Austin's Parks Department to address the crumbling bulkhead wall at Emma Long Metropolitan Park. The old wall reflected waves, which exacerbated wave action and caused erosion. The new shoreline has been designed to absorb wave energy, restore ecological function, and provide some water quality treatment for the parking lot.

The Lake Austin shoreline has historically been smothered by vertical walls, which reduced water quality by limiting plant growth and increasing sediment suspended in the water. These walls also degraded habitat by disconnecting the aquatic and riparian shoreline habitat. In 2010, City regulations were improved in an effort to reverse this trend and as a response to the conclusions of the EPA National Lakes Assessment. This report found that poor lakeshore habitat is the most significant stressor in lakes and that poor biological health is three times more likely in lakes with poor lakeshore habitat.

***Figure 6.** The decaying wall at Emma Long Park had degraded the shoreline and was not compliant with current City code.*

***Figure 7.** The new shoreline shows that modern methods can provide stability and ecological function in harmony with recreation.*

Figure 8. *The progressive vision for the shoreline materialized as crews from the Field Operations Division demolished the old wall and installed the new structure during the winter of 2017.*

Figure 9. *The new shoreline maximizes diversity and density of plants.*

A diversity of native plants along the shoreline is important for many reasons. Dense roots stabilize the soil and thick vegetation protects the soil from erosion. The leaves create shade and the plant parts that fall in the water become both habitat and food for animals. Wetland plants create habitat for juvenile fish, provide food for turtles and waterfowl, and offer habitat for aquatic life such as dragonflies and mayflies.

Figure 11. *The new shoreline requires less maintenance because mowing is no longer necessary. The young shrubs and trees will grow past the grasses to provide habitat, shade, and scenic beauty.*

Some of the benefits of the project are already apparent. Birds, lizards, and butterflies are frequently seen in the vegetated terraces, and small fish that had been absent from the old shoreline are now commonly found seeking shelter in the rocky shallows. In addition, boulders replace the wooden fence. This reduces the annual maintenance burden and makes the shoreline safer because of no vertical bulkhead from which to fall.

WPD's environmental scientists hope that this progressive shoreline design will serve as an example for landowners who desire protection from erosion while maintaining ecological function.

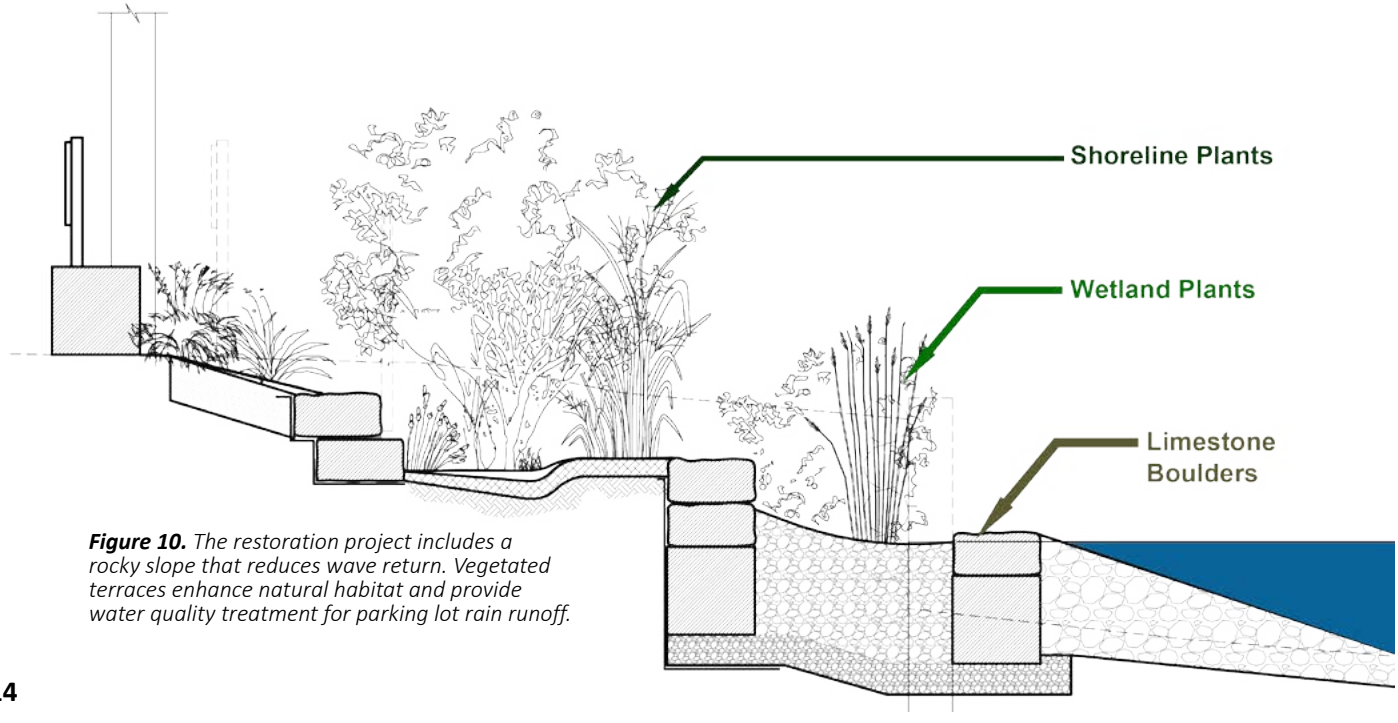


Figure 10. *The restoration project includes a rocky slope that reduces wave return. Vegetated terraces enhance natural habitat and provide water quality treatment for parking lot rain runoff.*

Aquifers

Importance

The Edwards and Trinity aquifers are integral parts of the unique landscape of the western portions of our city. They consistently provide large volumes of clean water to well-owners, springs, swimmers, and rare and endangered species. About 75 percent of all known springs and seeps in the Austin area occur in the Edwards and Trinity aquifers (Figure 1). Understanding our natural resources is a critical step toward protecting the resources that we cherish and utilize.

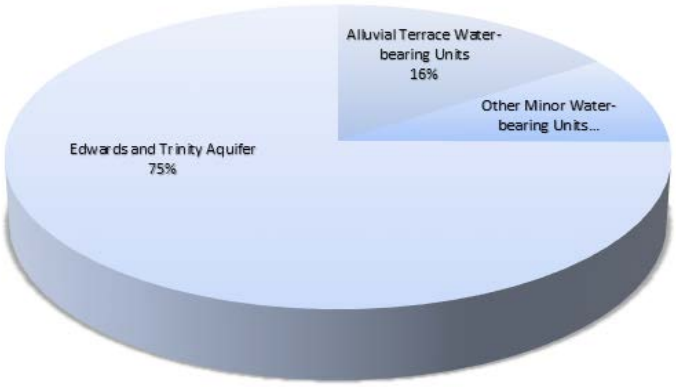


Figure 1. *Percentage of spring occurrence for major and minor aquifers in the Austin area*

In East Austin, near-surface water-bearing units of gravel, sand, and clay deposited on top of clay-rich limestone contain groundwater that is perched above the impermeable layer. Springs and seeps discharging from these geologic units supply the baseflow for our eastern creeks (Figure 2). These old river alluvial layers were deposited during the ice age when the river known now as the Colorado River flowed at a higher elevation. Now, these units form isolated ridges or hillside terraces and contain about 16 percent of the Austin area's springs and seeps.

Figure 2*. Alluvial Terrace Springs along Terry Creek, a small tributary to the Colorado River, at the Upper Mill Dam Waterfall*

Status and Trends

Staff biologists and geologists provide technical assistance during the City review process for the identification, evaluation, and protection of critical environmental features (CEFs) such as karst recharge features (caves and sinkholes), springs, wetlands, rimrocks, and bluffs (Figure 3). The biologists also monitor populations of threatened and endangered salamanders.

CEFs Identified by Watershed Protection Review Staff Fiscal Year 2017

CEF Type	No. Identified	Identified Year to Date	Area or Length Year to Date	Units
Spring & Seeps	23	1281		Count
Karst Features	702*	1957		Count
Wetlands	63	1408	837	Acres
Rimrocks & Bluff	7	1034	208,775	Linear feet
CEF Buffer Area	47	1741	6808	Acres

*All karst feature location information was merged into one feature tracking database in FY17

Figure 3. *CEFs identified by Watershed Protection Department review staff, fiscal year 2017*

Accomplishments this year include creating a comprehensive database of more than 700 karst features and conducting a water tracer study to fine tune our knowledge of surface water recharging the Edwards Aquifer in Onion and Little Bear creeks (Figures 4 and 5).

Tracers arrived at Barton Springs in five to six days (Figure 6), demonstrating high migration velocities common for water in karst aquifers and underscoring the sensitivity of these systems to stormwater runoff.

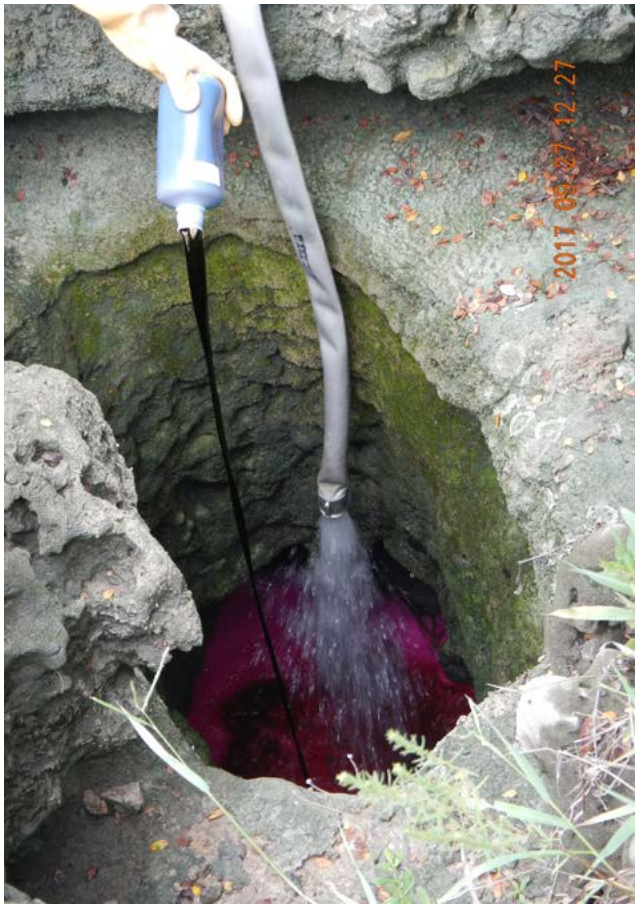


Figure 4. *Adding tracer and water to recharge sinkhole. Photo by: Saj Zappitello.*

Figure 5. *Adding tracer to quarry pond. Photo by: Sylvia Pope.*

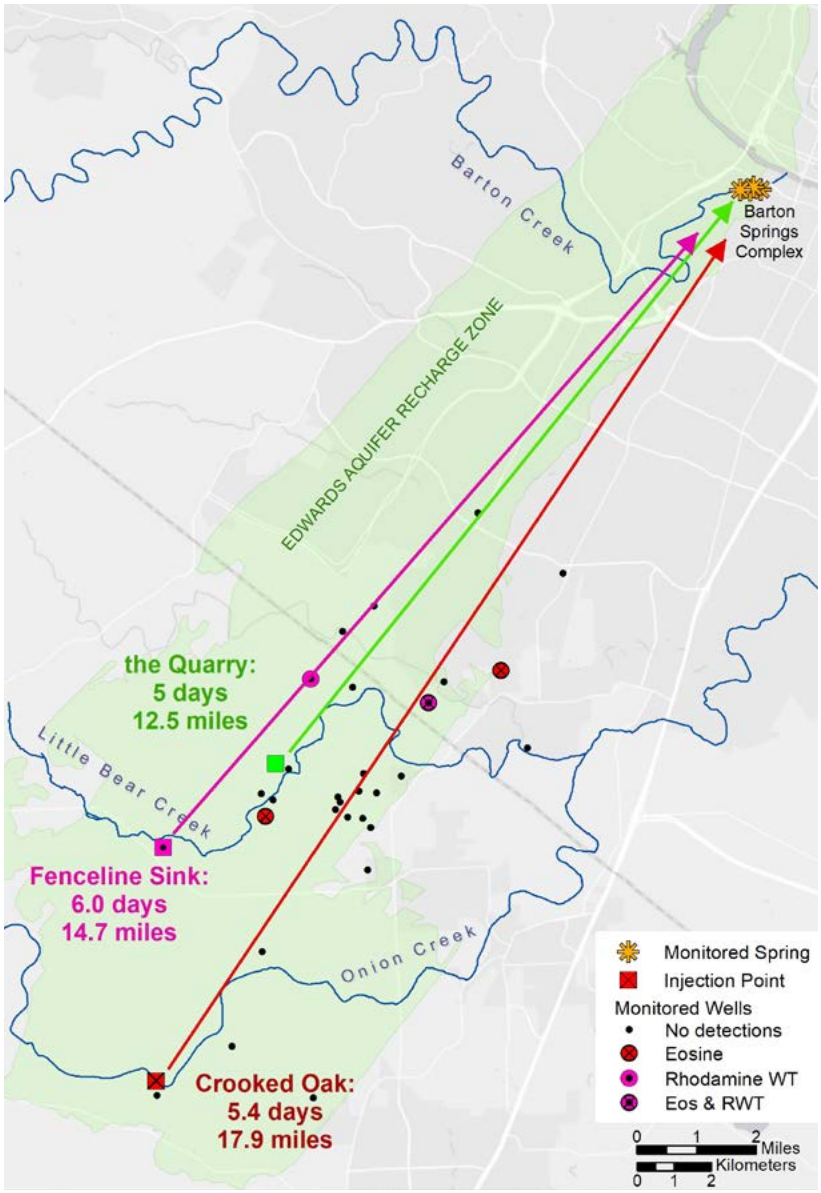


Figure 6. *Preliminary results of 2017 tracer test from Onion Creek and Little Bear Creek. Data sources: Grayscale basemap from ESRI and partners (2017), Edwards Aquifer boundary from Texas Commission on Environmental Quality (2005).*

Did you know that Barton Springs salamanders also occur outside of Barton Springs? This year, staff biologists documented the presence of this endangered species at four springs along Barton and Onion creeks where they had never been seen before. DNA sequence data are being collected from salamanders to determine whether they migrate between different springs and watersheds. These species serve as an indicator of water quality for the springs and aquifer. During surveys, biologists captured, photographed, and released the salamanders. These amphibians' unique markings allow us to track individuals over time as they are recaptured (Figure 7). From these data, we can estimate the population size (Figure 8) and assess whether migration is occurring between the springs. Results of this work will provide new insights about ecosystem health and integrity in the Barton Springs segment of the Edwards Aquifer.

Figure 7. *Photo of Barton Springs salamander recently documented at a spring on Barton Creek, noting the unique marking used to identify individual salamanders*

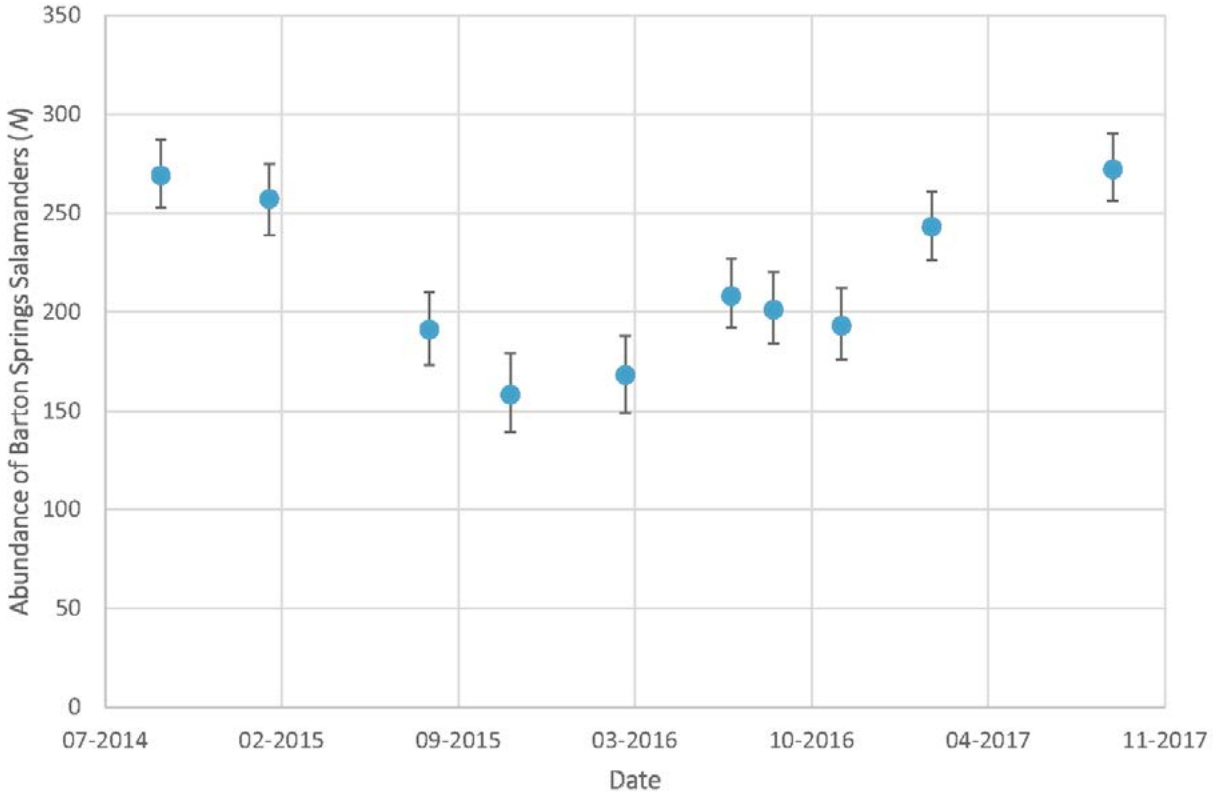


Figure 8. *Estimated abundance (with 95 percent confidence intervals) of Barton Springs salamanders at Eliza Spring from October 2014 to September 2017*

Annual Focus

Eliza Spring is one of four springs in Zilker Park where endangered Barton Springs salamanders live. Prior to human disturbances, trees and wetland plants shaded Eliza Spring and its stream (Figure 9). In 1903, Andrew Zilker built a concrete amphitheater around Eliza Spring for the Elks Club. The original amphitheater allowed spring water to flow through a "keyhole" to the stream (Figure 10). Limestone masonry filled in the keyhole in the 1920s (Figure 11). The stream habitat was eliminated by re-routing the water underground through a metal pipe. The pipe was more than 80 years old and at risk of failing, threatening the salamander habitat in the amphitheater.

Figure 9. *The natural state of Eliza Spring before the amphitheater was built in 1903*

Figure 10. *The original configuration of the Eliza amphitheater in 1903. The "keyhole" where water exited between the steps was filled in the late 1920s.*

Figure 11. *The Eliza Spring amphitheater after the keyhole was filled and stream buried into a pipe*

The Eliza Stream Daylighting Project removed the failing pipe (Figure 12) and restored approximately 250 square feet of salamander stream habitat, allowing more endangered salamanders to live here and thereby improving the resiliency of the species. The stream design included considerations that ensure suitable salamander habitat conditions, including ideal water speed and depth, type and size of rocks, and native stream vegetation. Water was released into the new stream on September 2, 2017 (Figure 13). Following the water release, the salamander habitat in the amphitheater saw immediate benefits. The water depth decreased in the amphitheater, which reduced the amount of sediment and increased the area that salamanders can inhabit. By mid-September, WPD biologists found aquatic moss and several species of invertebrates in the new stream. Finding the invertebrates is important because they comprise the salamanders' food source and are necessary for the salamanders to survive in the stream. The stream is protected for salamanders with fencing that enables pool users to view the stream, including an overlook area that provides an educational opportunity for the public to see more natural Barton Springs salamander habitat. This project is included in the City's U.S. Fish and Wildlife permit, which allows Barton Springs Pool to remain open for recreation. It is also part of the Barton Springs Pool Master Plan and was sponsored by the City's Parks and Recreation Department.

Figure 12*. Eliza stream construction showing wall foundations, rock walls for the slope and stream channel, and stream channel being built*

Figure 13. *The re-created Eliza stream shortly after opening in 2017, showing the stream from the pool sidewalk*

Urban Forest

Figure 1. *Austin celebrated Arbor Day with a family friendly event at Austin Nature & Science Center. Photo by Jennifer Chapman, Austin Nature & Science Center.*

Importance

Our community recognizes that the urban forest provides social, ecological, and economic benefits that enhance the quality of life for Austin residents. Just like the parks where we play and the bike lanes we use to commute to work, our urban forest is a community asset. It is an important part of Austin's infrastructure, but it is not static. The forest's health can change due to insect and disease infestations, invasive plants, aging trees, population growth, and land development.

To maintain the health and integrity of our community's urban forest, the City strives to preserve and maintain trees and vegetation during land development; promote the many benefits trees provide our community; offer information about tree care; and replant trees and vegetation.

Status and Trends

For more than 25 years, our city has followed tree preservation and replanting ordinances to balance land development with protecting trees and green space that bring so many people to our community. Keeping Austin's tree canopy intact is important for our community's quality of life.

Protected trees: Thanks to the City's tree preservation ordinances, we have protected hundreds of thousands of trees from being removed or damaged during development.

Tree Removals: Trees are removed every year for a number of reasons, including land development and declining tree health. In 2017, more than 80,000 inches were removed because of development (12 percent decrease from 2016) and almost 42,000 tree inches were removed this year due to declining health (8 percent increase from 2016).

Tree Planting: The City tracks tree planting that happens on development sites and on city-sponsored initiatives. Trees planted through the development process totaled more than 30,000 inches in 2017. Tree planting on park property, riparian areas along creeks, rights-of-way, and private property has remained consistent over the past 5 years, averaging 6,600 new tree inches per year (6,400 in 2017). The majority of these trees are provided to Austinites free of charge through the City-sponsored NeighborWoods program (www.treefolks.org/nw). Tree species are chosen for ecosystem function and site suitability, and include large shade, small ornamental, and fruit and nut species.

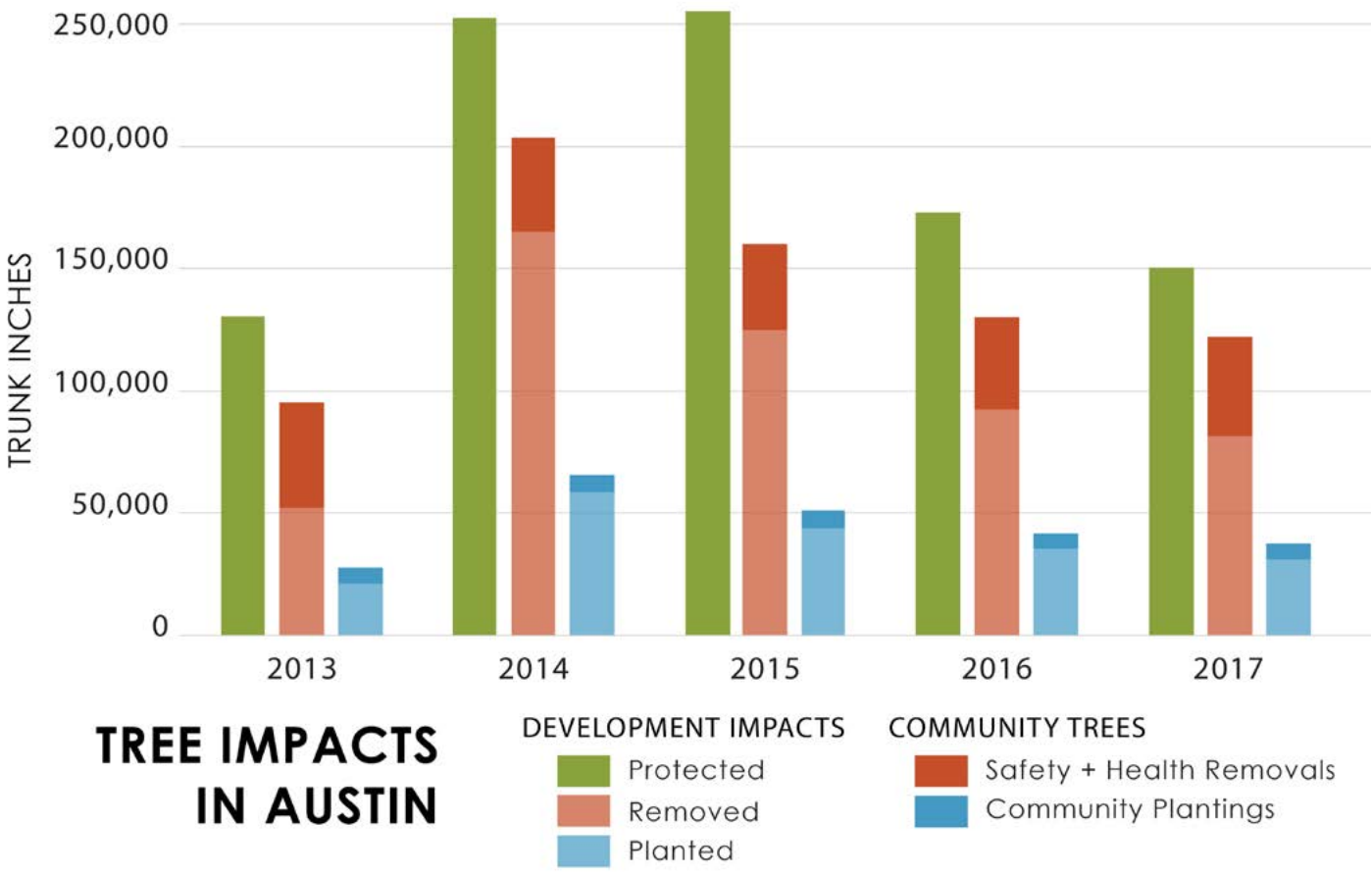


Figure 2. *Five year tracking of tree impacts in Austin provided by the Community Tree Preservation Division in the Development Services Department*

Figure 3. *Flyover view of downtown Austin, Texas*

Annual Focus

Austin's tree ordinance, established in 1983, has provided tree protection for more than 34 years. This protective ordinance is one method the City uses to support Austin as a livable community. Trees are valued and recognized for their ability to provide shade during hot summer months, reduce energy use, and make outdoor spaces more comfortable. They also provide millions of dollars annually in ecosystem services through reduced energy use, flood risk reduction, and cleaner air and water. Austin's Urban Forest Report, 2014, (www.tinyurl.com/2014UFReportATX).

At the State Capitol this year, during the 85th legislative session and special session, local tree protection ordinances received considerable attention by the legislature. During the regular and special session, legislators filed bills that would have prevented cities from protecting trees in their communities. Texas has more than 100 cities and towns with some form of tree protection ordinance. Hours of testimony by engaged citizens from across the state resulted in the legislature passing only a bill that affects tree mitigation fees.

To raise awareness of the issue at the special session, local singer-song writers collaborated with environmental partners to host a Music Tribute to Texas Trees. State representatives Carol Alvarado (D-Houston) and Wayne Faircloth (R-Galveston) read "The Lorax" on capitol grounds under one of the historic oak trees. Key legislators received copies of the book to raise awareness of the public's support for tree protection.

At the end of the special session, House Bill 7 passed and the governor signed it. The new law does not impact the City of Austin's tree protection ordinance, but it does affect how tree mitigation fees are assessed. The law requires that once the maximum number of replacement tree inches have been planted on a development site, any remaining tree inches must be accounted for and may be satisfied through fees. These fees are held for future community tree planting and care activities. The community may access this fund through the Urban Forest Grant (www.austintexas.gov/ufgp) for tree planting and care projects.

Figure 4. *The Lorax Storytime on capitol grounds under a historic live oak. Photo by Michael Embesi, Community Tree Preservation Division.*

Public Open Space

Importance

Parks provide a critically important oasis and respite in the midst of Austin's rapidly growing urban area. The green spaces within parks provide a multitude of health benefits for individuals, and a growing body of research suggests that unstructured nature play in green spaces is essential for the healthy development of children. Perhaps less recognized are the powerful benefits of parks at the community level. Parks are associated with safer neighborhoods, decreased crime rate, more close-knit communities, and increased property values.

Austin's 20,000+ acres of parkland provide opportunities and challenges. The Austin Parks and Recreation Department (PARD) strives to facilitate meaningful experiences and programs that mitigate the effects of overuse. The state of PARD's park system is a primary indicator of the value that the City and its residents place on their environment.

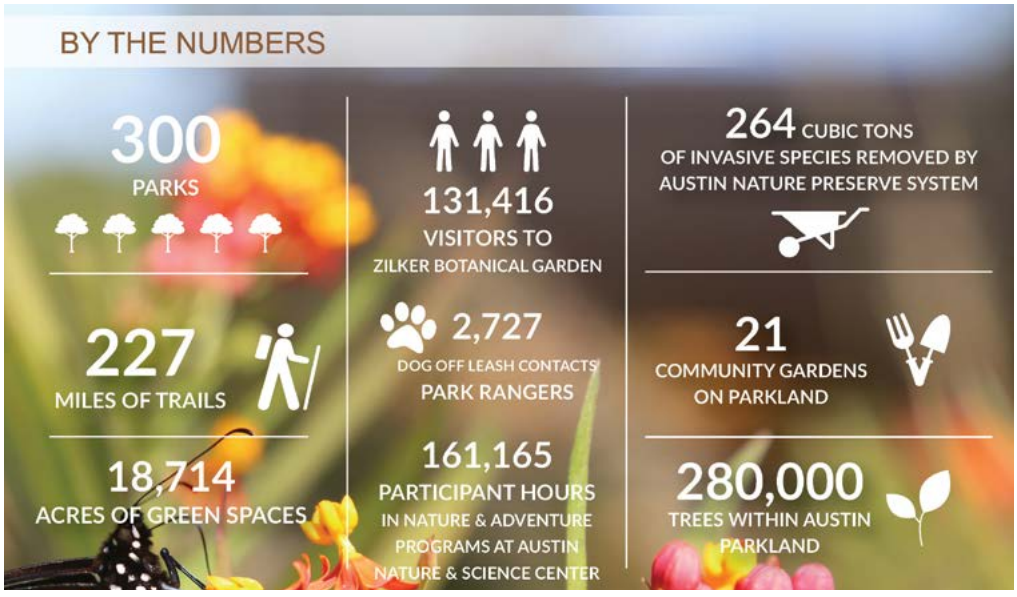


Figure 1. *Austin Parks and Recreation Department environmental resources by the numbers*

Status and Trends

Urban growth and engaged stakeholders require recreational programming that is adaptive despite limited resources. PARD units collaborate to maintain urban park environments, preserve greenbelts and nature spaces, and provide a diverse array of enriching programs.

Park Rangers are the face of PARD's Leave No Trace initiative. The program aims to educate people about their recreational impact on nature based on the Leave No Trace principles. Every Ranger-led activity is focused on conserving Austin's natural spaces and recreating responsibly.

Figure 2. *Zilker Botanical Garden renovated a poorly functioning stream, creating a new riparian streambed that saves thousands of gallons of water daily and uses native riparian plants to create a new educational space and wetland garden.*

Figure 3. *More than 1,200 visitors enjoyed Monarch Appreciation Day, with many participants lining up to ride the Monarch Bike. The Zilker Botanical Garden partnered with Grow Green, the Austin Butterfly Forum, and other partners to present Monarch Appreciation Day.*

Figure 4. *Through unique, engaging environmental events such as the Woodland Faerie Trail, the Zilker Botanical Garden engages children and families in the wonder of nature.*

Figure 5. *In 2017, Park Rangers held 560 programs with 20,911 total contacts. Programs focused on the conservation of native habitat and wildlife, such as snakes, bats, and native flora. Here, Rangers Chaiken and Tucker represent the Wildlife Austin program, offering pollinator information and activities.*

The Austin Nature Preserve System (ANPS) is comprised of 5,800 acres and faces significant pressure to balance population growth with the public's desire for recreational green space. Unfortunately, this compromises spaces with overuse, and inappropriate use such as off-trail biking and dog walking within the preserves. Partnerships with the Austin Fire Department, Austin Park Rangers, and the University of Texas have provided essential resources to meet key maintenance and research needs in the preserves.

Figure 6. *ANPS established an interagency partnership with AFD, which helps create fuel breaks and conduct prescribed burns such as this one at Indiangrass Preserve, mitigating the potential for wildfire and protecting neighborhoods.*

The Urban Forestry unit recycled more than 1,300 tons, or 2.5 million pounds of brush in 2017. They also implemented quarterly Wood Reclamation Days, making logs available to the general public for art projects and milling.

The Community Gardens Program partnered with the Austin Independent School District (AISD) to encourage the development of more community gardens at schools. This has provided neighbors with increased access to space where they can grow fresh, local, healthy, affordable food while strengthening community ties. Community gardens at schools help address challenges with garden sustainability as more neighbors are invested beyond teachers and parents alone. AISD works with the Sustainable Food Center to offer trainings for teachers on lessons and strategies for using gardens in their curriculum.

Figure 7. *The Urban Forestry program provided a Kid's Climb at the 2017 Arbor Day celebration at the Austin Nature & Science Center, stimulating a fascination with trees as well as a novel physical challenge.*

Annual Focus

Green schoolyards provide a powerful opportunity to create community by addressing a wide array of community and environmental benefits simultaneously. In 2016, the City of Austin was selected as one of six cities nationwide to receive a planning grant from the National League of Cities and the Children & Nature Network for "Cities Connecting Children to Nature" (CCCN) (www.nlc.org/cities-connecting-children-to-nature). The work conducted to identify how Austin might provide abundant and equitable nature access for all children in Austin. This resulted in the Austin City Council's unanimous approval of the "CCCN Implementation Plan" (bit.ly/2G0al4m) and the "Children's Outdoor Bill of Rights" (www.austintexas.gov/cobor).

One focus to bring the "Children's Outdoor Bill of Rights" to life is the implementation of a Green School Parks system on Austin's public school grounds. This will provide daily access to rich nature environments for underserved students. As the backbone organization of the CCCN Implementation Plan, PARD is focusing on elementary schools with jointly used schoolyards. These new nature spaces will act as outdoor learning and nature play environments for students and teachers during the school day, and rich nature environments for the surrounding community to enjoy outside of school hours.

Figure 8. *The new Climbing Tower at the Austin Nature & Science Center's Outpost provides high adventure programming training teens for rock climbing in nature; support provided by Disney, ESPN and Austin Parks Foundation.*

Figure 9. *Green schoolyards offer a surprising array of benefits both to students and families and to the surrounding communities, with many uses in and out of school.*

The first Green School Park pilot started in January 2017 at Barrington Elementary, and will be completed by March 2018, followed by Wooldridge Elementary and Cook Elementary. The program aims to expand the model across AISD over the next five to ten years. The "Nature Equity Score," GIS mapping for identifying high-needs schools, is available at http://bit.ly/2CgGpqM.

Creating community with Green School Park systems helps expand the City of Austin's park access for residents to enjoy a park within a quarter mile of their home - an Imagine Austin goal and an Austin City Council resolution. Greening schoolyards is an untapped solution for neighborhoods to help foster healthier, happier, smarter children, and to strengthen the community's overall well-being. As Austin's Mayor Adler said, *"The vision guiding us forward is that children's equitable access to nearby nature ensures future sustainability and environmental stewardship. Simply put, we take care of what we know and what we love."*

Figure 10. *The Children's Outdoor Bill of Rights establishes Austin's intent to insure that all children in our city have an innate right to be connected to and enriched by the outdoor environment in which they live. Photo by the ANSC.*

Wildlands

Importance

Austin is known and celebrated for its protection of open space and habitat. Austin's open spaces and preserves shape city planning, reduce infrastructure costs, and provide recreation, clean air and water, cooler temperatures, biodiversity and cultural preservation.

Wildland Conservation Division Status*
41,971 total acres
28,361 WQPL acres
13, 610 BCP acres

Figure 1. *Wildland Conservation Division properties including voluntary conservation partnerships and dual managed tracts*

Austin prioritizes the protection of open spaces and environmentally sensitive areas through Austin Water's Wildland Conservation Division (Wildlands). Wildlands encompasses two programs: Water Quality Protection Lands (WQPL) and Balcones Canyonlands Preserve (BCP). The primary goal of the WQPL is to produce the optimal level of high-quality water to recharge the Barton Springs segment of the Edwards Aquifer by restoring prairie-savanna ecosystems and healthy riparian corridors. The Balcones Canyonlands Conservation Plan provides a fast-track solution to habitat mitigation for Endangered Species Act compliance. Through the permit issued by U.S. Fish and Wildlife Service to the City of Austin and Travis County, development in the potential habitat that dominates the western portion of the county is permitted. The goal of the BCP is to protect and enhance the habitat of endangered and rare species as mitigation for that development.

Figure 2. *WQPL Land Stewards contributed to grassland diversity by increasing the mix of ten grass species typically purchased to more than sixty species this year.*

Status and Trends

Volunteer Land Stewards help tremendously on the Wildlands. A native plant nursery is up and going at the Vireo tract to support bird habitat on the BCP. WQPL Land Stewards contributed to grassland diversity by increasing the mix of ten grass species typically purchased to more than sixty species this year. Thanks to many volunteer hours of hand-harvesting out on the grasslands, staff can use these seeds to spread biodiversity native to the WQPL more quickly than it might on its own, allowing greater protection of land during drought, fire, and flooding. These savannas may be a source of additional biodiversity to surrounding lands, as they keep native plant genes flowing in disparate areas.

Figure 3. *A portion of the Slaughter Creek Trail on the Mary Gay Maxwell Management Unit – covered in snow on its first morning under the new name. Photo by: Tom and Toni Guckert, WQPL Land Stewards.*

As snow began to fall on December 7, 2017, the Austin City Council recognized the legacy of Mary Gay Maxwell by renaming the Water Quality Protection Lands along Slaughter Creek that protect Barton Springs in her honor. As a long time Environmental Commissioner and volunteer, Maxwell collaborated in many roles to resolve sensitive ecological issues, and pioneered volunteer steward and hike guide programs to connect citizens with the lands she loved.

The community will celebrate the 20th anniversary of the Water Quality Protection Lands in 2018. Find out about special hikes focused on native plants, restoration, and recharge at www.austintexas.gov/wildlandevents.

20 YEAR CELEBRATION
WATER QUALITY PROTECTION LANDS

Restoring caves increases aquifer recharge for wells and springs, reduces flooding, can increase rare karst species habitat, and returns a heritage of education resources and natural landscape features back to the public.

Historically, most caves in the Austin area were filled in and residents sought to keep water at the surface for livestock and to maintain flow to mills. Seen as potential falling hazards for livestock, caves were regularly used to dispose of ranch trash.

Filling in caves was also seen as a solution by landowners and agencies in places where caves became a magnet for trespassing. A common perception held by landowners was that caves devalued lands intended for future development. Urban expansion covered many known and unknown caves. From the 1960s to 1990s, the Texas Speleological Survey documented 163 caves in Travis County, most of which were excavated of fill and 20 percent of which were re-filled in or destroyed by 1990.

Figures 5 & 6.
Bucket by bucket, fill comes of out Wade Cave.

Figure 7. *The new handrail and steps make it easier for educational groups to visit Wade Cave's underground habitat.*

Goat Cave Karst Preserve provides a connection between the citizens of Austin and the underground frontier. This small strip of land has at least four caves within its boundaries, ranging from a nearly 25-foot sinkhole that provides the preserve's namesake, to a little underground room called Hideout that seems right out of a yarn about Tom Sawyer. Like nearly all of Austin's caves, Wade, Hideout, and Maple Run caves were all filled in with trash and ranch fill prior to City acquisition in the early 1990s. From 2012 through 2016, the Watershed Protection Department excavated Wade and Hideout caves. In 2017, Balcones Canyonlands Preserve staff contracted an environmental consultant to remove the remaining ranch fill and trash, stack rock steps, and install handrails for safer access into Wade Cave. Balcones Canyonlands biologists will continue monitoring these underground habitats for invertebrate species unique to Austin, and programs staff from Austin Parks and Recreation, Watershed Protection Department, and Wildland Conservation Division hope to provide more opportunities for the public to experience and learn about these dark and amazing corners of Austin's wildlands.

Figure 8. *For years before Wade Cave was restored, broken glass and ranch trash filled the entrance. Now the entrance is filled by big limestone steps leading to this underground habitat.*

Air Quality

Importance

Promoting healthy outdoor air quality for all residents is the goal of the City of Austin's Air Quality Program. The primary air quality concern in Austin is ground-level ozone. Ozone forms when nitrogen oxides (NOx) and volatile organic compounds (VOCs) interact with sunlight and mix like a thin soup in the outdoor air. Many everyday activities and man-made sources of NOx and VOCs, such as vehicle engines, electric generation units and industrial facilities, contribute to this process.

Elevated ozone levels can have a significant impact on human health, causing many individuals to experience increased respiratory illnesses. Vulnerable populations, including children, older adults and those with lung diseases such as asthma, are more likely to be affected by increased ozone levels. Learn more air quality basics at aircentraltexas.org/en/regional-air-quality/what-is-ground-level-ozone.

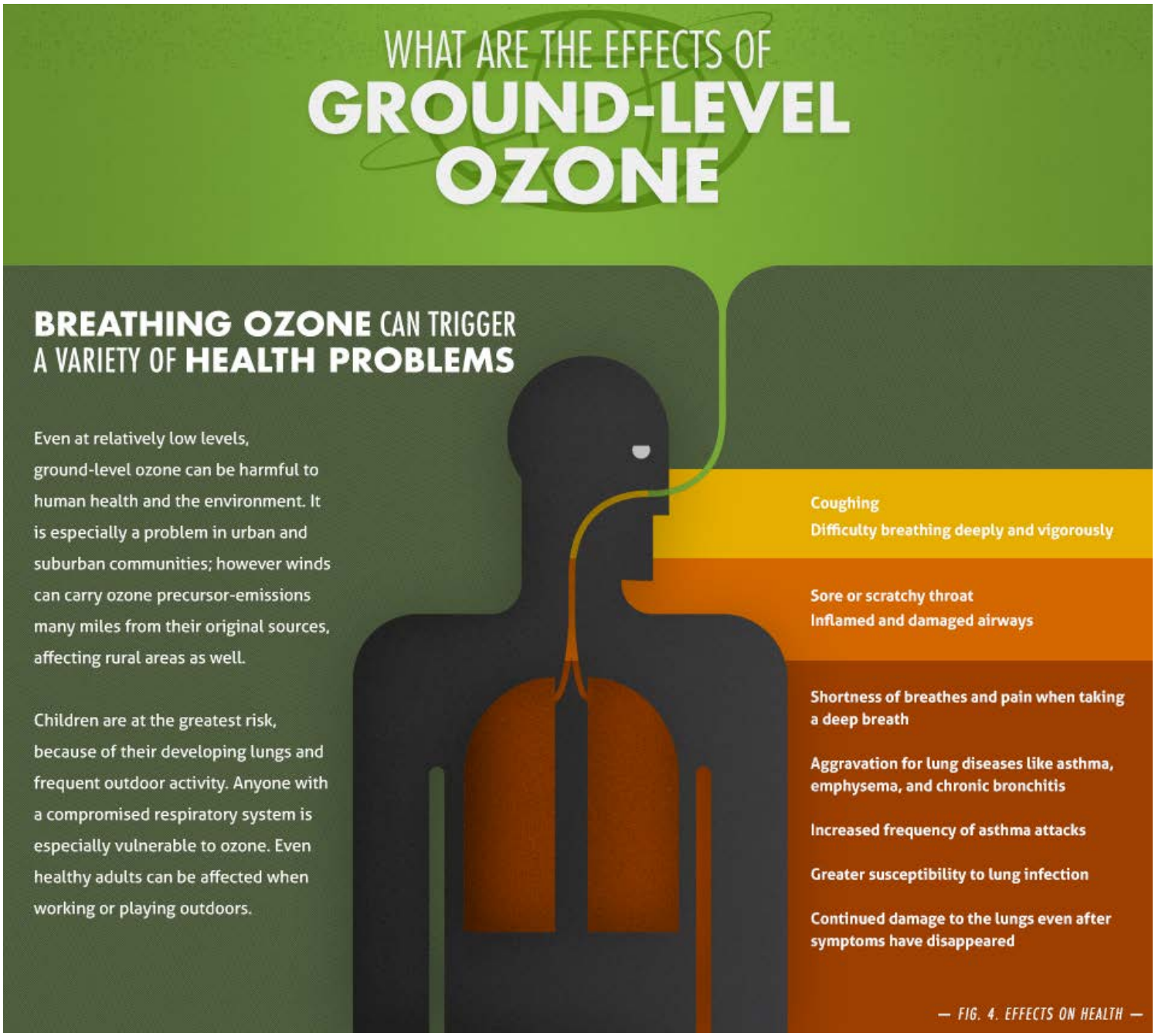


Figure 1. *Effects of Ground-Level Ozone*

Status and Trends

On November 6, 2017, the U.S. Environmental Protection Agency (EPA) announced its initial air quality designations. The Capital Area, which includes Bastrop, Caldwell, Hays, Travis, and Williamson counties, was designated in attainment of the 2015 National Ambient Air Quality Standards (NAAQS). According to a study by the Capital Area Council of Governments, the region has avoided a cost of roughly $900 million to $1.4 billion to our local economy by maintaining its attainment designations through many regional air quality planning efforts. To learn more about the potential cost of ozone nonattainment designations to Central Texas, visit capcog.org/documents/airquality/reports/2015/Potential_Costs_of_a_Nonattainment_Designation_09-17-15.pdf.

The EPA's current ozone design value standard, which is used to determine compliance, is 70 parts per billion (ppb). The Capital Area's design value falls just below the standard at 69 ppb, making it the largest region (by population) in Texas to be in attainment of the air quality standards.

Air quality can have a serious impact on human health. For instance, increased levels of ozone can reduce lung function and affect the respiratory system. Individuals can maintain their awareness of air quality levels by regularly checking the Air Quality Index at AirNow.gov during ozone season, March 1 through October 31. The Air Quality Index is a color-coded guide used nationwide that helps individuals understand how clean or polluted the air may be on a particular day. Figure 3 shows each air quality level related to health concerns and the matching color indicator.

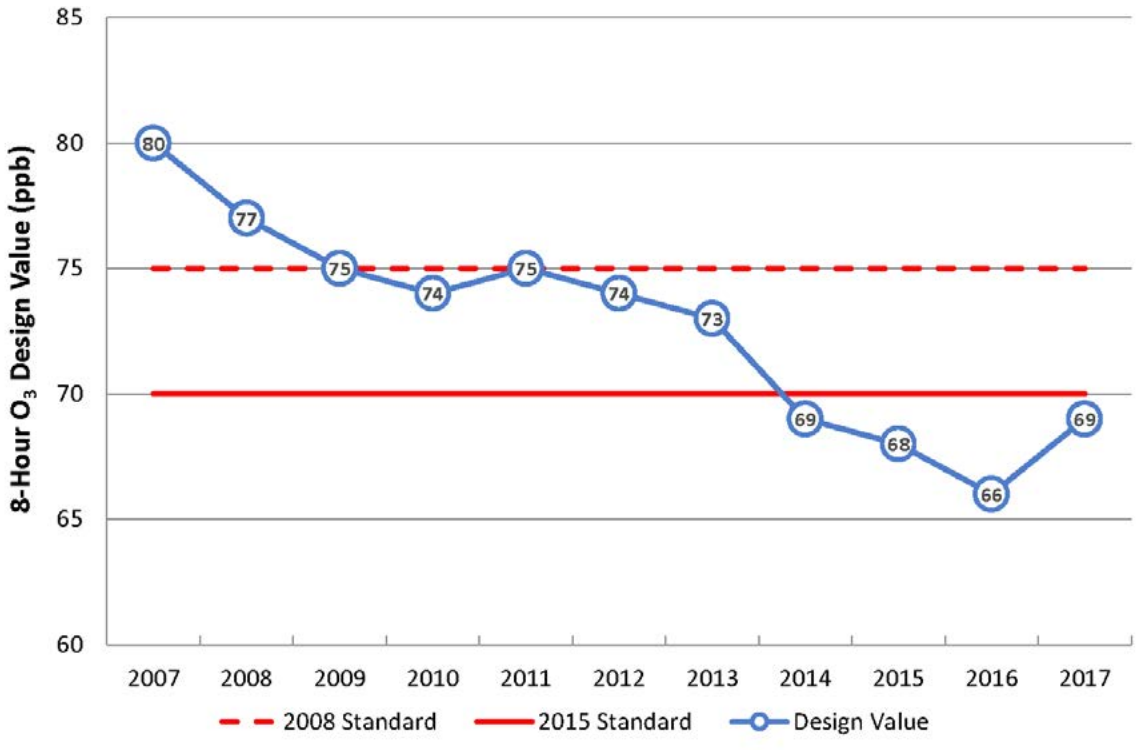


Figure 2. *Ozone Design Value Trend 2007-2017. Graphic courtesy of the Capital Area Council of Governments capcog.org.*

Air Quality Index for Ozone

(based on 8-hr average concentrations)

Index Values (Conc. Range)	Air Quality Descriptors	Cautionary Statements for Ozone
0 – 50 (0-59 ppb)	Good	No health impacts are expected when air quality is in this range.
51 – 100 (60-75 ppb)	Moderate	Unusually sensitive people should consider limiting prolonged outdoor exertion
101 – 150 (76-95 ppb)	Unhealthy for Sensitive Groups	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion
151 – 200 (96-115 ppb)	Unhealthy	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children should limit prolonged outdoor exertion.
201 – 300 (116-374 ppb)	Very Unhealthy	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.

Figure 3. *Air Quality Index. Graphic courtesy of AirNow.gov*

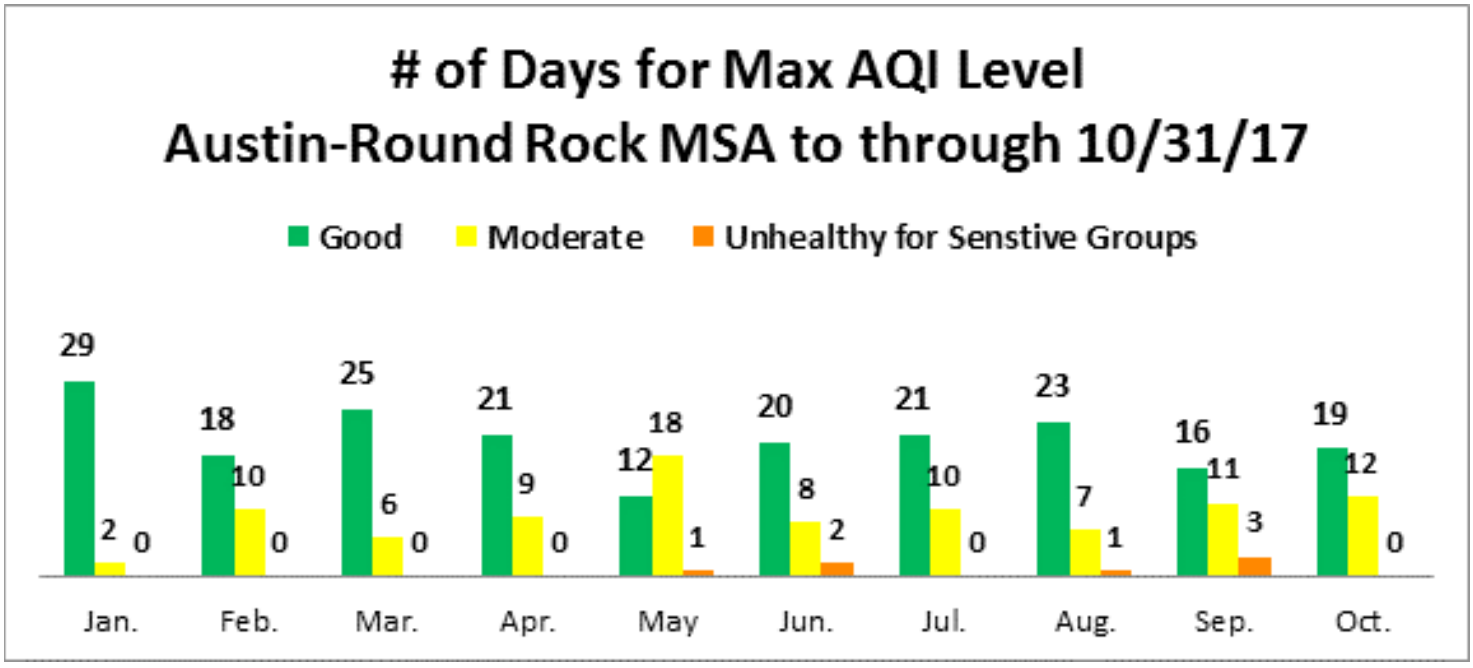


Figure 4. *Ozone Air Quality Index Trend. The yellow and orange bars in Figure 3 illustrate the number of days from January to December 2017 that the Central Texas region's ozone monitors exceeded a healthy reading. Graphic courtesy of the Capital Area Council of Governments.*

The Texas Commission on Environmental Quality (TCEQ) tracks current and historical local ozone levels. Ozone season in Central Texas runs from March 1 through October 31, with the highest ozone readings typically occurring in August and September. For more information about the region's air quality, visit aircentraltexas.org.

Graphic courtesy of the Capital Area Council of Governments.

Annual Focus

Unlike other areas in Texas, Austin doesn't have a large number of point sources like factories and refineries that can be blamed for its air pollution. Instead, pollution from cars and trucks is the leading contributor to ozone formation. For this reason, the City of Austin Air Quality program's primary focus in 2017 was to help reduce emissions from on-road vehicles and promote regional transportation demand management (TDM) opportunities. TDM is the application of strategies and policies to reduce single-occupancy vehicle trips by promoting sustainable modes of transportation like transit, biking, walking, telework and carpooling/vanpooling.

Providing information on a suite of transportation options, including carpooling/vanpooling, is key to managing our regional transportation challenges and maintaining air quality. In 2017, Commute Solutions, the regional trip reduction program, was revitalized. The City of Austin supports Commute Solutions through its participation in the newly formed Commute Solutions Coalition. The purpose of the Commute Solutions Coalition is to provide a "one-stop" sustainable transportation resource in the Central Texas area. Both private and public sector employers have access to resources including training for employee transportation coordinators, a comprehensive regional commute website, a ride-matching/data collection tool, and regional trip reduction contests and incentives. This program impacts thousands of commuters in our five-county area. To learn more about Commute Solutions, visit commutesolutions.com.

The City of Austin introduced the Commute Connections program in 2017 to help its employees rethink their commutes and access the trip reduction tools that the City provides. The City of Austin is one of the largest employers in Austin, and the manner in which employees commute to and from work has a large impact on traffic and air quality. One of the most effective ways to tackle traffic congestion and reduce harmful emissions is to reduce single-occupancy vehicle trips. This can be accomplished by encouraging employees to bike, walk, use transit options, carpool, vanpool, telework, work alternative hours, and work compressed schedules. The Commute Connections program is designed to help City departments reduce travel at peak commuting times by 30 percent by 2022.

A key component of increasing employee use of sustainable transportation modes under the Commute Connections Program is providing incentives for participation. Smart Commute Rewards launched for City of Austin employees on May 1, 2017, with the support of a grant from the Capital Area Council of Governments. In 2017, the program offered employees the opportunity to earn additional vacation hours and prizes for taking sustainable transportation options like telework, carpool, vanpool, transit, biking, and walking. More than 600 employees earned vacation hours at the end of the six-month pilot. Thanks to the program's success, tons of harmful pollutants were avoided and the City of Austin Transportation Department received the Air Central Texas Public Sector Award for its innovative approach to changing employee commutes.

Climate Change

Figure 1. *Drought and extreme temperatures increase the risk of wildfires. On Labor Day 2011, nine major wildfires raged across Central Texas, burning 47,000 acres and destroying more than 1,800 homes.*

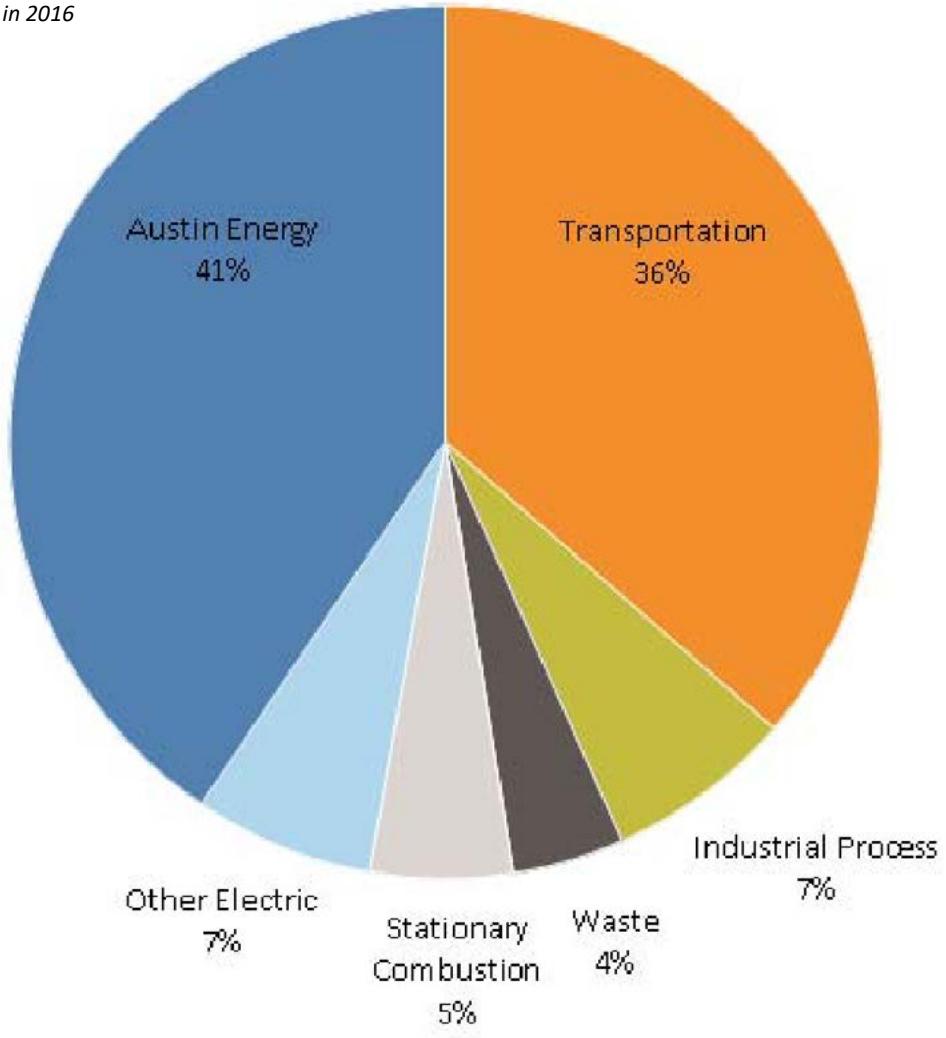
Importance

Ten years ago, the Austin City Council passed a groundbreaking Climate Resolution. The goal: to reduce greenhouse gas emissions in order to avoid the worst impacts of climate change. Since that time, Austin has set an aggressive net-zero goal for community-wide emissions by 2050. Despite these efforts, impacts from climate change are already being experienced in the form of ongoing and repeated severe weather events in Austin and the rest of the state, such as extreme heat, drought, flooding, and wildfire. Last year, Hurricane Harvey dropped record-breaking rainfall on southeast Texas, flooding multiple cities and causing an estimated $180 billion in damages. Hundreds of thousands of people were forced to evacuate their homes.

With U.S. withdrawal from the Paris Agreement, climate action at the local level is more important than ever. Austin has joined the international community in the fight against climate change with participation in the C40 Cities Climate Leadership Group, the Global Covenant of Mayors for Climate and Energy, and the Climate Mayors group.

13.5 Million Metric Tons CO2e

Figure 2. *Total greenhouse gas inventory for Austin-Travis County in 2016*



Status and Trends

The Office of Sustainability continues to track Austin's progress toward the net-zero goal by regularly calculating locally emitted greenhouse gases, often referred to as a carbon footprint. The major sources of greenhouse gas emissions in Travis County are:

- electricity generation from Austin Energy, Pedernales Electric Cooperative, and Bluebonnet Electric Cooperative;
- combustion of fossil fuels (primarily natural gas) by residential, commercial, and industrial buildings and facilities;
- transportation (miles driven per day and the amount of emissions per mile, based on fuel efficiency and traffic congestion);
- waste management (methane and carbon dioxide emissions from landfills); and
- industrial processes related to the semiconductor industry and lime manufacturing.

The two largest sources of greenhouse gas emissions in Travis County are electricity generation and transportation.

Using the most recent data available, the 2016 Austin-Travis County greenhouse gas inventory is calculated to be 13.5 million metric tons of carbon dioxide equivalent, as shown in Figure 2. This is a slight decrease from the 2013 community-wide total of 13.7 million metric tons.

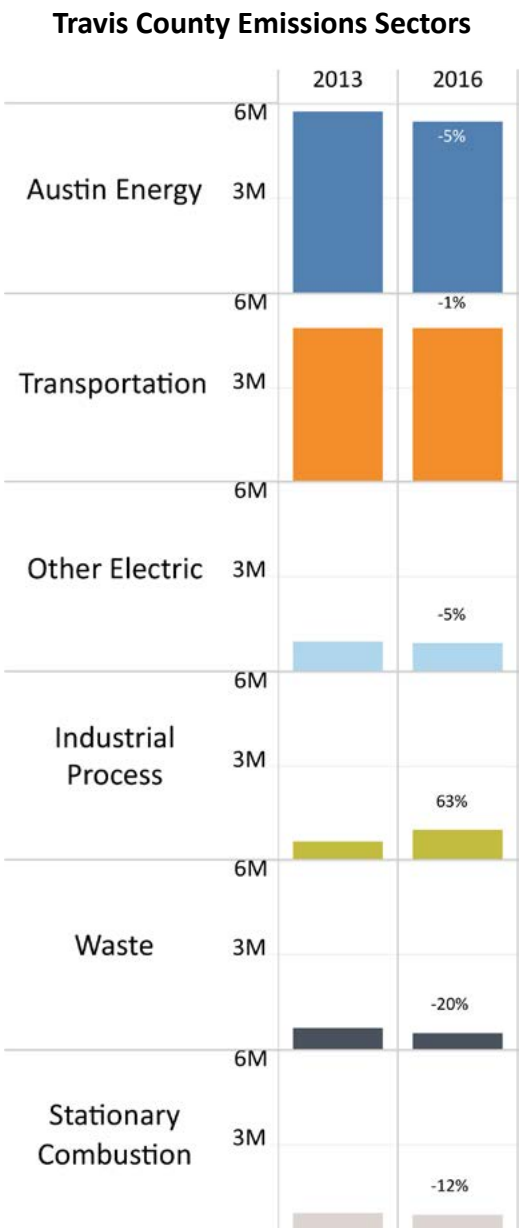


Figure 3. *Greenhouse gas emissions comparison by sector between 2013 and 2016*

Figure 3 compares emissions totals between 2013 and 2016 for each source, showing areas that have increased and decreased. Emissions from the following sources have decreased since 2013:

- **Electricity use from Austin Energy.** While electricity demand has increased, the City of Austin's commitment to an increasing portfolio of renewable and natural gas generation resulted in lower emissions.
- **Transportation**. A growing population resulted in additional cars on the road. However, emissions standards for vehicles have continued to improve fuel efficiency, which resulted in a slight decrease in overall emissions from transportation sources.
- **Electricity use from other regional utilities.** Electricity demand for other regional utilities increased four percent. Despite this increase, emissions are down five percent, mainly due to the Electric Reliability Council of Texas' (ERCOT) switch from coal to natural gas fueling.
- **Waste management.** Private landfill operators have reduced methane emissions, likely from improved emissions capture and destruction.
- **Stationary combustion.** Warmer winter weather in 2016 resulted in less natural gas usage and a reduction in emissions.

Emissions increased in one category:

- **Industrial processes.** While emissions in this category have increased since 2013, they still account for only seven percent of the total greenhouse gas inventory for Travis County. The increase is due to fluctuations in production, process changes, and changes in emissions accounting methods.

As shown in Figure 4, overall greenhouse gas emissions declined, despite a rapidly growing population. It is expected that emissions from the energy sector will continue to drop as the Austin Energy Resource, Generation, and Climate Protection Plan is implemented. This plan includes the goal of 65 percent renewable energy by 2027. Strategies to reduce emissions from transportation sources will be increasingly important to achieve Austin's goal of net-zero emissions by 2050.

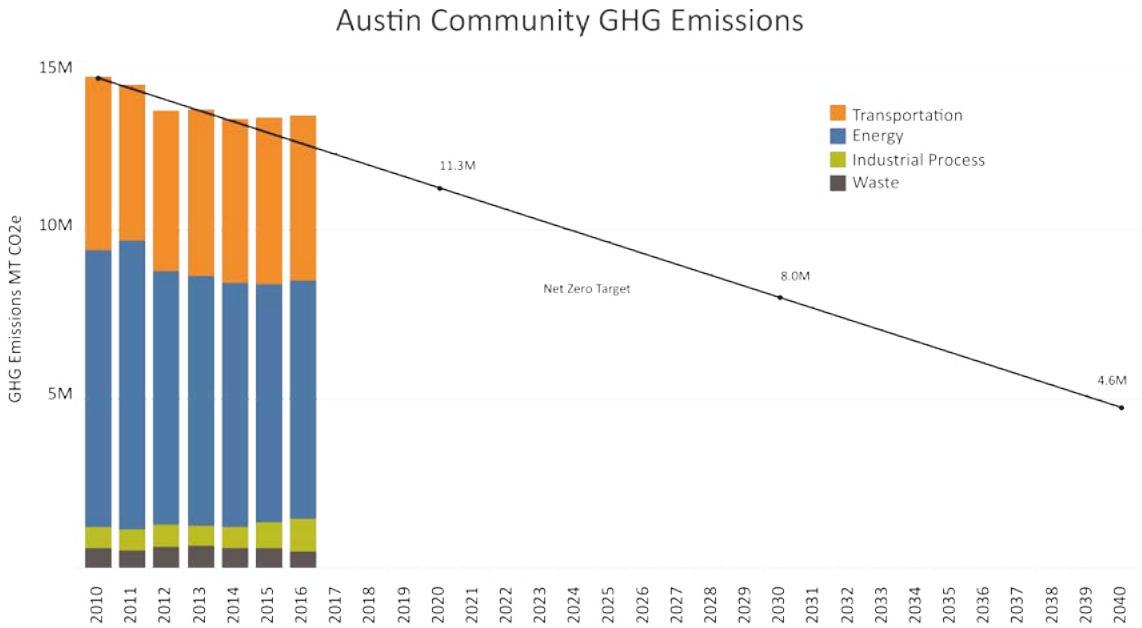


Figure 4. *Emissions and population trends for Travis County*

Figure 5. *Climate resilience refers to the ability to effectively manage both immediate shocks and long-term stressors related to climate change and weather extremes. A climate resilient Austin is prepared for and adapted to climate-related threats.*

Annual Focus

The Office of Sustainability, Austin Energy, Austin Transportation Department, and Austin Resource Recovery continue to lead in implementing specific actions related to emissions reduction as identified in the Austin Community Climate Plan. Current projections based on these activities suggest that Austin will meet the interim emissions reduction target of 11.3 million metric tons of carbon dioxide equivalent by 2020.

Creating a more climate-resilient city is also a recommendation from the Austin Community Climate Plan. In light of Hurricane Harvey's catastrophic impacts on the Texas Gulf Coast in 2017, as well as recent record-breaking extreme weather events in Austin – including drought (2007-2015), a heat wave (2011), wildfires (2011), and flooding (2013, 2015, and 2016) – increasing Austin's resilience to climate impacts will be a point of focus in the coming year in addition to emissions reduction.

2017