WATERLINES

FALL 2017

North Harris County
REGIONAL WATER
Authority

North Harris County REGIONAL WATER Authority

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WATERLINES

Summer 2017

TABLE OF CONTENTS

GREAT EXPECTATIONS

North Water Authority Builds System Today to Ensure Ample Water Tomorrow

LAKE HOUSTON AT SUNRISE

America's past is filled with tales of people of all cultures, backgrounds, ethnicities and skills ploughing through the frontier to get where they needed to go to make a better life for themselves and future generations. Challenges faced by today's leaders are not as fraught with physical peril, in a sense, but they do continue to carry the weight of responsibility of ensuring a bright future for the earth's booming population.

Zooming in from a global view to the Houston/Harris County region, there is a shining example of a long line of visionaries planning far into the future to ensure that their grandchildren, great-grandchildren and beyond were assured an ample and safe supply of a valuable resource that no human can go without: Water.

Almost a century ago, City of Houston leaders secured water rights in the San Jacinto and Trinity river basins even though they did not need the water at the time. Houston was not the enormous city it is today and most of it's drinking water came from wells that tapped large reservoirs of underground water. But just as early American pioneers did in their day, the city leaders of the early 20th Century saw the huge potential for growth, the limitations of the region's groundwater supply and the need to act early to avoid major problems later.

Fast forward to the 21st Century, and sure enough, the Houston region now requires the water resources secured so long ago. Following in the footsteps of Houston's forefathers, a new group of visionaries has stepped up to develop and construct the systems needed to capture, treat and deliver water from the two rivers to people's homes and businesses throughout the region, as well as to plan for the needs of future generations. The industrious alliance of regional water providers that has taken on that role includes the City of Houston, North Harris County Regional Water Authority, West Harris County Regional Water Authority, Central Harris County Regional Water Authority, North Fort Bend Water Authority and the Coastal Water Authority.

The North Harris County Regional Water Authority (the "Authority") has played a key role in securing a long-term water solution for hundreds of neighborhoods in north Harris County, and is responsible for building the water pipelines that will deliver treated water to the doorsteps of municipal utility districts (MUDs) that serve more than 700,000 residents in an area equal in size to the city of Fort Worth. That's no small task.

"It is something that we must do," said Al Rendl, the Authority's Board President and water visionary. "If you don't have an adequate supply of water that you can project into the future, people and businesses will not stay. We have to ensure a future water supply to maintain the value of our community."

NOT THE NHCRWA'S FIRST RODEO

The Authority was created 17 years ago to guide about 160 north Harris County MUDs and the City of

Continued on page 4

GREAT EXPECTATIONS

Continued from page 3

Tomball through a surface-water conversion process mandated by the Harris-Galveston Subsidence District. For the past 15 years, it has been constructing pieces of a massive pipeline system that supplies water from Houston's northeast water treatment plant on Lake Houston to MUDs in the Authority's boundaries, which include U.S. 290 on the west, the Harris County line/Spring Creek on the north, FM 1960 and Bammel-North Houston Road on the south and the western shores of Lake Houston on the east. The process has been thoughtful, precise and deliberate.

By 2035, the MUDs within the Authority's boundaries will get about 80 percent of their water supply from surface water. This is in sharp contrast to the 100 percent groundwater that was pumped from underground aquifers prior to the 21st Century.

The first phase of the Authority's surface water system – the 2010 conversion program - was completed in 2009. It included construction of approximately 100 miles of pipelines, a pump station and water storage facility on Spears Road, and the Authority's share of a City of Houston 66-inch-wide water line that runs from Greenspoint Mall near the Sam Houston Tollway to the northeast plant's home on Lake Houston.


SPEARS ROAD WATER PLANT

While phase one was in its infancy, it was discovered that several MUDs were experiencing well problems in the south part of the Authority. Instead of drilling new wells, the Authority included the MUDs in what was dubbed the "Groundwater Transfer Program." Pipelines were constructed between MUDs with water to sell and the MUDs that were experiencing well problems. Eventually, the interconnecting pipelines were enveloped in the Authority's larger 2010 conversion pipeline system and the MUDs shifted from groundwater to surface water.

"We did not construct any pipelines that were not needed for the 2010 conversion system," Rendl said. "It was a real win-win for everyone."

The Authority is currently neck-deep in the planning and engineering stage of the multi-pronged 2025 conversion system project that will put more than 107 miles of water pipelines in the ground and build a pump station and water storage facility near State Highway 249 and Gessner Road over the course of the next seven years. Construction is scheduled to start in 2018.

"When the 2025 conversion project is completed, we will start delivering surface water from Lake Houston to another 60 to 70 MUDs," said Jimmie Schindewolf, P. E., the Authority's General Manager. "That is in addition to the 60-plus MUDs that already receive surface water today."

A PROJECT WITH MANY LAYERS

Jun Chang, the Authority's Deputy General Manager, said the Authority team is designing the network of smaller lines that will take water from the State Highway 249 pump station and deliver it to those MUDs. They are studying development patterns and the area's future needs to see where surface water is needed most.

"We want to make sure we get the surface water where it needs to go and that MUDs with challenges are taken care of," Chang said.

In addition to the 107 miles of distribution lines, the Authority will invest its fair share of funding and construction expertise alongside the City of Houston, and the Central and West water authorities, into a new, massive 108-inch-wide pipeline that will be constructed alongside the existing 66-inch pipeline that runs between the city's northeast water treatment plant and the Beltway

8/Interstate 45 interchange near the Greenspoint area. From there, the Authority will construct its own 84-inch-wide pipeline along Beltway 8 to the new pump station at State Highway 249 and Gessner Road. The storage facility at this location will be able to hold 67 million gallons of water.

Construction will be a carefully orchestrated project because everything needs to be up and running by 2021, when the City of Houston's northeast water treatment plant's expansion is complete, treating and pumping an additional 320 million gallons of water per day from Lake Houston into the massive new transmission lines that branch off to the north and west.

By 2025, the Authority will be delivering up to 87 million gallons of surface water a day to MUDs. Then work starts on the 2035 conversion system.

UP TO THE CHALLENGE

It will be a challenge to construct such a massive system in a relatively short period of time, but leaders in north Harris County have never backed away from a challenge.

Long before north Harris County MUDs were charged with weaning themselves from groundwater, neighborhood leaders along the fast-growing FM 1960 corridor located outside of Houston city limits were working to protect and preserve the community they were building. They formed the "Spirit of 1960 Coalition" to ward off potential annexation efforts by the city, and were successful. Then the group turned its attention to other challenges, such as future water supply and subsidence issues facing north Harris County, which had been reliant on groundwater for several years.

The Harris-Galveston Subsidence District, which was created in 1975 to regulate groundwater usage in Houston and Galveston counties to prevent additional land subsidence, had already placed mandates on portions of the City of Houston and Galveston County to reduce groundwater use. Subsidence is the sinking – or compacting – of land into the empty space where water


Sen. Jon Lindsay

was once stored naturally. Over-pumping groundwater leads to subsidence. The alternative was surface water, which the city got from its Lake Livingston reservoir on the Trinity River.

Retired state **Sen. Jon Lindsay**, a longtime resident of north Harris County, said the coalition morphed into a water users group, and with Rendl at its helm, recognized that it was inevitable that north Harris County MUDs would soon enough be under the gun to make the same shift to surface water. Because there was no central entity governing the MUDs, the idea was born to form a single entity that would lead a cooperative effort to find an alternative source of water and to build the system to deliver surface water where it needed to go.

Though the MUDs had successfully operated reliable, independent groundwater supply systems for years, most did not have the financial resources to build a transmission line to tie into the City of Houston's surface water system. To get an abundant supply from the city's Lake Houston reservoir to hundreds of smaller municipal utility districts that supplied water to neighborhoods in north Harris County meant building a huge network of pipelines and pumping stations, and a large water treatment plant on Lake Houston.

Soon enough, the Harris-Galveston Subsidence District mandated the conversion in the north and west sections of unincorporated Harris County, and local leaders went to the Texas Legislature to formally create the North Harris County Regional Water Authority.

"It took three sessions to get the bill passed to form the Authority," said Lindsay, whose senatorial district encompassed north Harris County. "We couldn't convince people that this was needed to ensure the area's future water supply."

The group persisted with the help of elected officials, including Lindsay, the late state Rep. Paul Hilbert and retired state Rep. Peggy Hamric. It was a matter of

Continued on page 6

GREAT EXPECTATIONS

Continued from page 5

public necessity and demand.

In the 1999 legislative session, the bill passed. North Harris County voters confirmed the Authority's creation in a 2000 election, as well as its first five-member board of directors.

After much debate, a water supply contract with the City of Houston was secured. The long-term deal, which was the first of its kind in the City of Houston's history, covered the Authority's share of the cost of getting water from city-owned water sources to the northeast water treatment plant on Lake Houston, testing and treatment systems, and the Authority's share of the transmission pipeline from the water plant to U.S. 59.

Things fell into place after that. The Authority submitted its groundwater reduction plan to the Harris-Galveston Subsidence District by a Jan. 1, 2003 deadline. Later that year, construction started on the Authority's first construction projects.

SWIFT AND SECURE FUNDING

The Authority issued bonds to pay for those inaugural projects. In subsequent years, the Authority applied for low-interest loans made available after the creation of the State Water Implementation Fund for Texas (SWIFT), which is administered by the Texas Water Development Board. Municipalities, counties, water authorities and other water providers whose projects have been adopted into the regional and state water plans can apply for the loans.

"We give tremendous credit to Texas residents for voting to allow money out of the state's 'rainy day' fund to go toward loans for water projects," Rendl said. "The Authority is the largest recipient of subsidized funding through the SWIFT Program in the state."

Mark Evans, the Authority's Planning and Governmental Affairs Director, said that according to the estimates of the Texas Water Development Board, the lower interest rates offered through the SWIFT loans will save the NHCRWA $58,795,794 in interest payments over the next 30 years.

Schindewolf said innovative programs such as SWIFT, cooperative agreements such as that which has been forged between the City, the Authority and West and Central authorities, and visionary leaders of past and present are what will ensure a successful conversion to surface water for the Houston region.

THERE TRULY IS NO END IN SIGHT

Though all the foresight in the world could not have predicted the twists and turns that happened along the way, the fact is that most of the residents in Harris County will have water from the San Jacinto and Trinity rivers flowing from their faucets by 2035. Even more to the point, visionary Houstonians today are looking 50-plus years into the future to determine where their grandchildren, great-grandchildren and beyond will get their water.

"The decisions our forefathers made have made the difference between Houston being a great city and an average city," Rendl said. "We want to – we have to – continue that tradition."

2004 GROUNDBREAKING -- NHCRWA BOARD MEMBERS AND GENERAL MANAGER

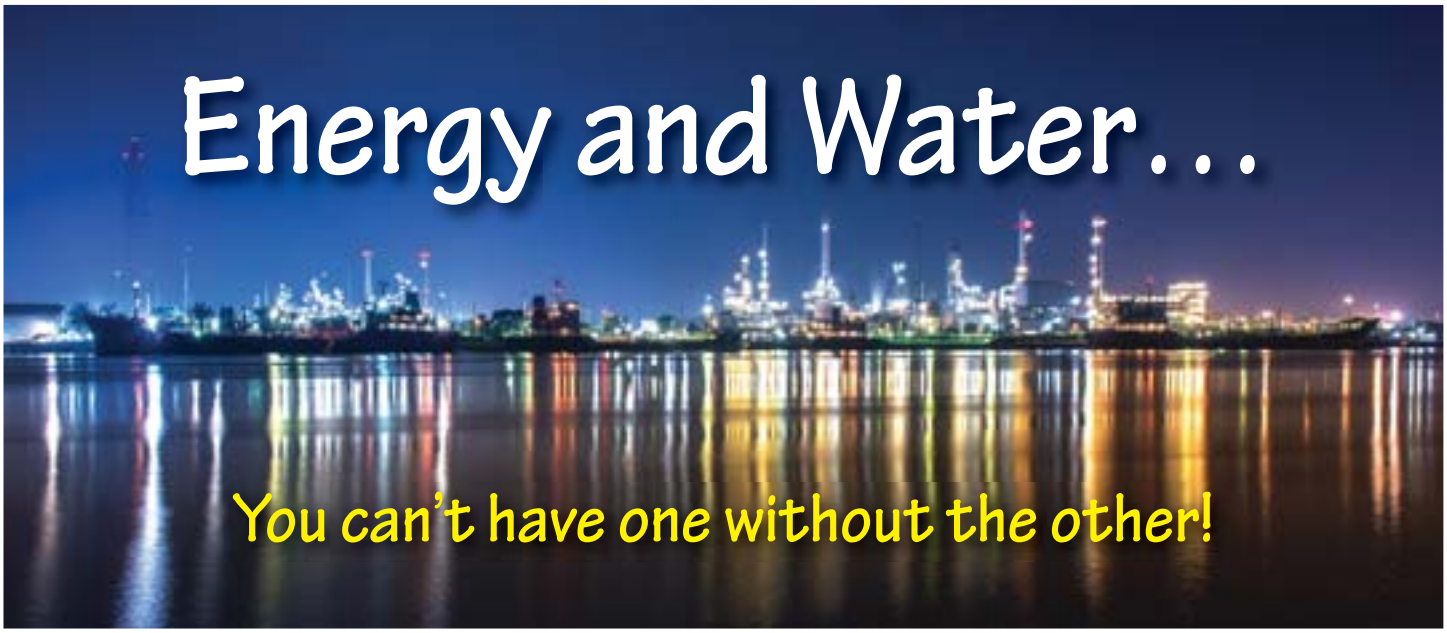
No WATER, No LIFE.
No BLUE, No GREEN.

-- Sylvia Earle, American oceanographer and explorer

Every living thing needs water to survive.

Let's make every day
Earth Day!

The water we conserve today can serve us tomorrow!



For decades, Houston -- known as the *Energy Capital of the World* -- has been at the center of innovation in the oil and natural gas business. The Port of Houston's 25-mile network of public and private docks serves the second largest petrochemical complex in the world, and is the busiest seaport in the country in terms of ship traffic.

Have you ever thought about the ***nexus*** of water and energy? Probably not. But, in addition to the fact that we take both of these important resources in our lives for granted, it takes water to generate electricity, for example...and it takes electricity to produce our drinking water -- and the cost of both is likely to increase in the future.

There is a growing urgency to "spend" our water and energy supplies more efficiently and to do that, we will have to become better "stewards" of our dwindling resources. The more we understand about how we use water and energy in our homes, the more we realize that very often saving one results in saving the other. Many of the things that use the most water around the house also have a high energy consumption...like water heaters, washing machines and dishwashers. And showers use a huge amount of hot water.

Let's take a look at the basics. In the U.S, electricity is generated using a number of different energy resources; including fossil fuels (coal, oil and natural gas), nuclear, and hydroelectric power...and to a lesser extent solar and wind power. Each of these use a significant amount of water to extract (fossil fuels), create, and produce the different kinds of energy we rely on everyday.

It also takes a significant amount of energy to treat and move water to where it is needed for household use and for irrigating crops and lawns. Electricity is used to collect, treat and dispose of wastewater, and we use energy to cook our food, and to heat the water for washing ourselves and clothing. Energy is also consumed when water is used by households or industries for heating and cooling.

We rely on having an adequate supply of water and energy in our daily lives and -- until an emergency like a hurricane or drought can demonstrate so dramatically -- few of us ever stop to think what life would be like without them. When there are shortages of these vital resources each impacts the other. A shortage of water, for example, can affect the production of energy since power plants in this country use billions and billions of gallons of water every day. A shortage of energy -- such as power outages during storms or periods of extreme demand that can occur during the hot summer months -- can impact operations at water plants.

There are many things each of us can do to help conserve water *and* energy at home. Focus on the activities that use both. An average household uses 32 percent of its heated water for washing clothes; 20 percent goes down the shower drain; another 20 percent is used for bathing (sink and bath tub use); dishwashing takes another 12 percent; which leaves 5 percent for preparing food and 4 percent for washing hands.

It isn't life-altering to use our finite water and energy resources more efficiently -- it just requires some good, old fashioned common sense and a commitment.

Remember, the water and energy we conserve today can serve us tomorrow!

WHAT A TALE EACH DROP COULD TELL

Billion-Dollar Project Will Expand Nucleus of Regional Water Treatment System

"We are fortunate that we have formed a strong and enduring partnership with water authorities in Harris and Fort Bend counties that are dedicated to upholding the responsibility we all have as regional water providers. This joint project will ensure that clean water continues to flow when our existing and future residents turn on the tap."

***Yvonne Forrest**, Deputy Director for the City of Houston's Public Utilities Division in the Public Works and Engineering Department*

Water is life. Whether used to wash clothes, water lawns, bathe children, quench thirst – it is one of the only things on earth that humans cannot live without. Houston is fortunate that its leaders - past and present - have had the vision to plan for the water needs of future generations.

It seems hard to imagine that the water that runs from faucets today is the same water that a T-Rex drank from an ancient stream or that was one of billions of crystals that formed icebergs during the Ice Age. The fact that there is a finite source of water on earth – that has been coursing through the water cycle for billions of years – can be mind-boggling.

This line of thought highlights the driving need for stringent, reliable and advanced water treatment systems to ensure that earth's water is safe to drink. A clean and abundant water supply should never be taken for granted, but we have become accustomed to it. If the water flows freely when we turn on the faucet, little thought is given to how it gets there.

For decades, the City of Houston has done its part to ensure that an ample, clean supply of water is available to residents in the Houston region. A $1.3 billion water treatment expansion project for the city's Northeast Water Purification Plant on Lake Houston, planned and funded by five regional water providers, will enable it to treat more water from Lake Houston, as well as a future supply that will be pumped from the Trinity River more than 25 miles away. The water is needed to meet growing demand in north, central and west Harris County, where the population is exploding and municipal utility districts are reducing reliance on well water in a regional effort to arrest subsidence.

HOUSTON'S WATER WORKS

Houston's H_2O history is an intriguing one. When the city was in its infancy, residents got their water from the bayous and creeks that drained water from the swampy city, cisterns that captured rain, and even shallow wells.

In the late 1800s, the private Houston Water Works Company dammed part of Buffalo Bayou and began delivering water through pipes to Houstonians. Loud, angry complaints about tainted bayou water quality caused the company to look for other water sources, and it hit blue gold after tapping into an ample supply of fresh water pumped from an underground reservoir.

Houston Water Works tried to keep up with growing demand for fresh water that grew with Houston's booming population, but big city problems came with that growth. Buffalo Bayou became a dumping ground for a lot more than rainwater, so when the water company started mixing bayou water with well water to meet water demand, residents took notice. As the situation worsened, the City of Houston made the bold decision to purchase the Water Works Company in 1906, and to assume responsibility for providing residents with a safe, clean and plentiful water supply. The new City of Houston Water Department added 66 new wells to the 55 existing wells, installed water meters, and constructed three new

Continued on page 10

PLANT EXPANSION

Continued from page 9

pumping plants while enlarging the existing Central Water Plant on Buffalo Bayou.

That forward momentum has not slowed since. City leaders kept pace with growing the system while planning for the needs of future generations. Land was purchased in northeast Harris County for a future reservoir (now Lake Houston), and water rights were acquired in the San Jacinto River and lower Trinity River. Three reservoirs were created by damming portions of those rivers – Lake Houston and Lake Conroe on the San Jacinto River and Lake Livingston on the Trinity River.

As it grew increasingly clear that the Houston-Galveston region needed to reduce its dependence on groundwater, the City of Houston started deactivating its water wells and building water treatment plants that could purify surface water from lakes and rivers. The East Water Purification Plant near the Houston Ship Channel was the first to treat water from Lake Houston in 1954. After Lake Livingston was created in 1969, water flowed to the east plant, and then later to the city's Southeast Water Purification Plant, which was built near Ellington Airport in 1989.

The Northeast Water Purification Plant is the baby of the bunch. It was built on the shore of Lake Houston in 2005, and has been a key player in providing surface water to Houston's thirsty northern and northwestern suburbs in recent years.

Houston's surface water trio has operated intrepidly through the years. They pull in water from sometimes turbid lake water sources and literally wring out sediments, toxins and bacteria to produce safe drinking water for a growing population. The three plants, and some regional water wells, currently produce more than 160 billion gallons of drinking water each year, which is distributed through more than 7,500 miles of pipes.

However, in the grand tradition of planning for future generations, regional water providers realized even that was not enough.

BUILDING TO MEET THE DEMAND

Houston is not falling short on the water supply side of the equation. The City of Houston has over 1.2 billion gallons per day of reliable surface water rights (a 70 percent share of Lake Livingston, a 70 percent share of Lake Conroe, 100 percent ownership of Lake Houston and a 70 percent share of the future Allens Creek Reservoir). That, combined with its groundwater supply, is enough to serve customers in the city and surrounding counties through approximately 2050.

The key to meeting demand is tapping into some of the **unused** water supply on the Trinity River and getting it to where it is needed most – in west, central and north Harris County and north Fort Bend County. That means constructing new pipelines, pump stations and water treatment plant capacity. Houston and the regional water authorities responsible for delivering a safe and plentiful water supply to municipal utility districts in those areas joined forces at the start of the 21st Century and embarked on construction of a multi-faceted system that will get the job done. The nucleus of that system is the city's Northeast Water Purification Plant.

The plant currently purifies about 70 million gallons of water a day. It will need to treat more than 400 million gallons a day to meet the 2040 demand projected by the North Harris County Regional Water Authority, Central Harris County Regional Water Authority, West Harris County Regional Water Authority and North Fort Bend Water Authority.

In 2015, the city and water authorities came together and worked out a mutually-beneficial plan so that the Northeast Water Purification Plant could be expanded to treat the additional water supply. The five groups forged a partnership – the Northeast Plant Expansion Team – and hammered out a cost-sharing agreement so that each paid its fair share of the two-phase expansion project.

"We take a consensus vote on all major decisions," said Jun Chang, P.E., D.WRE, the North Harris County Regional Water Authority's Deputy General Manager and former Deputy Director for the City of Houston's Public Utilities Division in the Public Works and Engineering Department. "All participants have a voice."

The **Houston Waterworks Team**, a joint venture between CH2M and CDMSmith, was hired to design and build the project. Their chosen name was a nod to Houston's original water provider.

Chang said the project is under design and on schedule to start construction in early 2019. The first phase needs to be finished by the end of 2021 to start delivering water from the Trinity River to north, central and west Harris County. The second phase of the project will allow the plant to treat up to 400 million gallons of water a day by 2024. It is considered the largest design-build project of its kind underway in the U.S.

"We continually revise plans as we move forward," said Chang. "We use the best data that can be gathered and put it together in the best way possible."

After the first phase is complete, the plant will double its current water treatment capability. The Coastal Water Authority is currently building a pump station at Capers Ridge near Dayton to be able to feed that additional Trinity River water supply through canals and underground pipelines to north Lake Houston.

After it is treated, water will run through two separate, yet equally massive, transmission pipelines to points north and west. From there, the water authorities will distribute the water through their own pipeline networks to water districts.

"Visionary leaders, past and present, have brought us where we are today, and we are moving forward with our partners to ensure that we do the same for future generations," said Forrest. "This is a partnership that will stand the test of time."


Lake Houston

THE LUCE BAYOU CONNECTION

A River, A Lake and Pipes Big Enough to Drive a Truck Through

Driving east from Lake Houston, the crowded and congested FM 1960 quiets as it passes through miles of flat, green pastures east of the Atascocita and Huffman lakeside communities. The road comes to a discreet end at State Highway 321 in Dayton, a city of about 7,200 that was once bisected by the Trinity River, with the two halves called West Liberty and Liberty until West Liberty morphed into Day's Town around 1854, and then Dayton 30 years later. Liberty proper still exists across the Trinity River, with a slightly larger population than Dayton as the Liberty County seat. Not unlike a lot of cities and towns nestled in riverbends, the landscape that envelops these Texas towns is lush and green with trees as far as the eye can see.

While many Houstonians have traveled the piney woods northeast of the vast metropolis, they may not be aware of the connection that exists between the Trinity River water that flows through its veins and the city of Houston, which lies miles to the west of the river. They might be surprised to learn that about 10 miles north of Dayton and Liberty on the Trinity River, crews are working steadily on a project that will one day bring up to 500 million gallons of water a day (the equivalent of what it would take to fill up 250 elevated storage tanks) from the Trinity River to homes and businesses in north and west Harris County, north Fort Bend County, and Houston. Why? Because the city and its suburbs need it. In this context, the term "need it," means, "they won't be able to survive without it."

If the water is that important, then how does the City of Houston get it from Point A (Trinity River) to Point B (Lake Houston) so that it can be delivered to current and future water users in unincorporated Harris County, which now has almost as many residents as the city itself? It is a question that Houston's forefathers pondered long ago…and came up with a clever plan that is being carried out today.

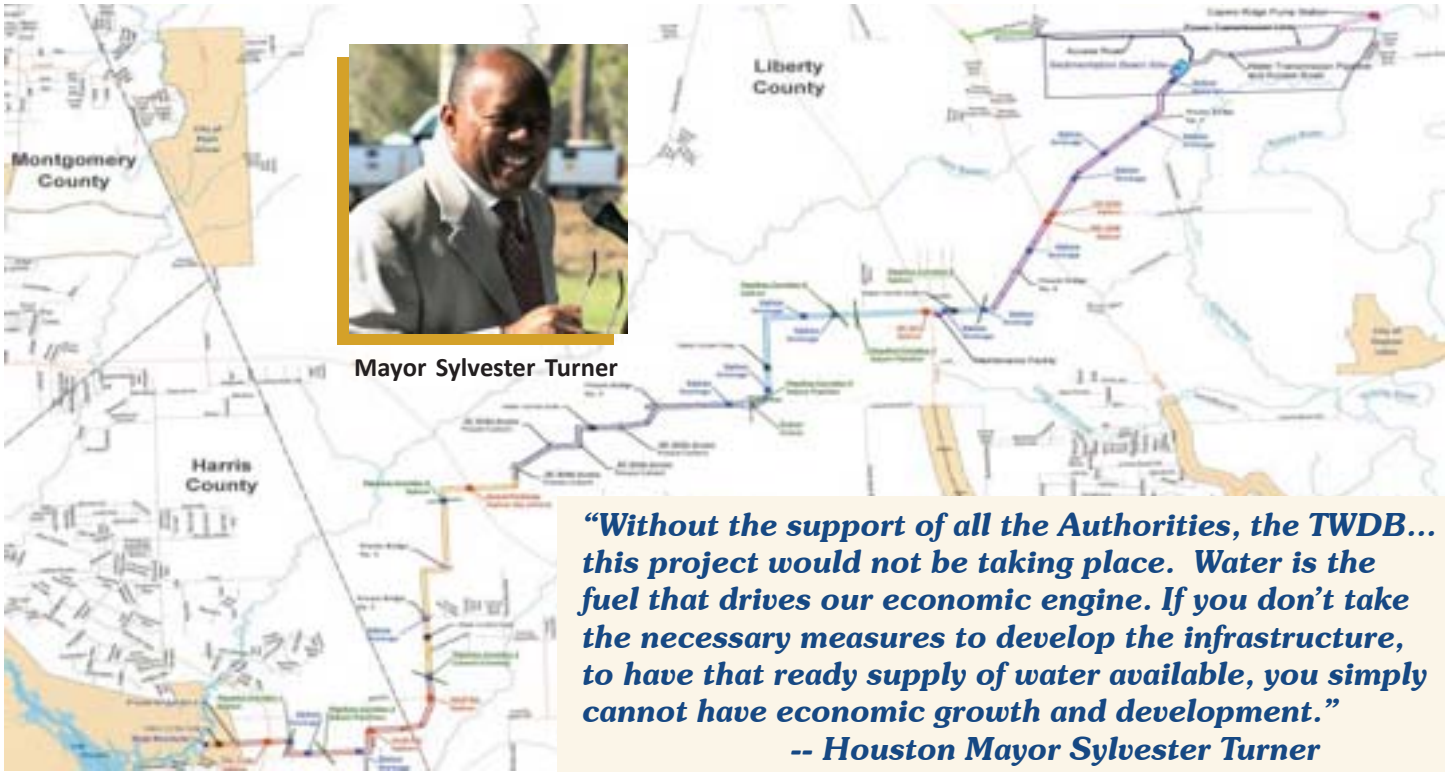
Groundbreaking ceremony

LBITP is Not Something to LOL About

The $350 million **Luce Bayou Interbasin Transfer Project** – or **LBITP** – is a complex name for a straightforward and well-planned water delivery project that held a Groundbreaking Ceremony in February 2017 . The Coastal Water Authority (CWA), a conservation and reclamation district created by the State in 1967, is managing the project in its role as the City of Houston's surface water provider; i.e., the city owns the water and the CWA builds, operates and maintains the systems, and gets the water where it needs to go. The City of Houston, **North Harris County Regional Water Authority**, West Harris County Regional Water Authority, Central Harris County Regional Water Authority, and North Fort Bend Water Authority are partners in the LBITP, and are paying their fair share for equipment and pipelines that will treat, transport and deliver the water from Lake Houston to points beyond.

"Water is the fuel that drives the economic engine," said Houston Mayor Sylvester Turner at the project's groundbreaking ceremony in February. "Without it, not only will you not grow, but you will be paralyzed where you are."

Turner said he is grateful that the regional



Mayor Sylvester Turner

"Without the support of all the Authorities, the TWDB... this project would not be taking place. Water is the fuel that drives our economic engine. If you don't take the necessary measures to develop the infrastructure, to have that ready supply of water available, you simply cannot have economic growth and development."
-- Houston Mayor Sylvester Turner

partners are working together, because otherwise it would be difficult to carry out the massive Luce Bayou project.

"If we can dream it we can do it, and we are getting it done," Turner said.

The North Harris County Regional Water Authority (NHCRWA) is currently planning the system of pipelines and pumping and storage equipment that will deliver a portion of that surface water to municipal utility districts (MUDs) in north and northwest Harris County, according to Jimmie Schindewolf, the NHCRWA's general manager. The NHCRWA and partner water providers have identified opportunities to share costs where there is common ground.

"It makes sense for us to collaborate with partners who have the same end goal that we have, which is to secure an ample, long-term supply of water for our residents and businesses," Schindewolf said. "We are grateful to the west and central authorities, City of Houston and Coastal Water Authority for doing their part to ensure a successful conversion to surface water throughout Harris County."

Crews are currently constructing the 90-acre Capers Ridge Pump Station on the river's west bank that, when fully functional, will be able to divert up to 500 million gallons of water a day from the river and pump it into side-by-side pipelines that could each easily fit a Ford F150 pickup truck with room to spare (8 feet in diameter). The water will flow underground through these dual pipelines for about 3.6 miles to a 20-acre storage and sedimentation basin near the secluded FM 1008, and then into a 100-foot-wide canal that runs 23.5 miles in a slightly southwestern direction across former rice paddies to the northeastern tip of Lake Houston.

A Project 80 Years In The Making

The Luce Bayou project dates back to the late 1930s, when visionary Houston leaders realized the need to identify water sources for future Houstonians. Like fortune-tellers, they gazed into their crystal ball and saw people flocking to the city by the bay in search of the American dream. They realized that the water they were pumping from underground sources would not satisfy the appetite of future generations, and that waiting 20, 30 or even 50 years to find other water sources could mean real problems for their successors.

They looked north, south, east and west for options.

Continued on page 14

LUCE BAYOU

Continued from page 13

The saltwater to the southeast in Galveston Bay was plentiful, but expensive to convert to drinking water, and there was the issue of pumping it uphill to where it was needed. Nearby rivers flowing from places north had potential. The San Jacinto River and its two "forks" flowed directly through Harris County on their winding pathways to Galveston Bay. The Trinity River to the east had potential also. The planets started to align when former Houston Mayor Richard H. Fonville wrote a personal check to purchase the land that is now Lake Houston during his 1937-38 term in office. Next, the city acquired water rights in both rivers, and by 1973 had created three reservoirs – Lake Conroe on the San Jacinto River's West Fork in north Montgomery County, Lake Houston on the San Jacinto River's East Fork in northeast Harris County, and Lake Livingston on the Trinity River near Huntsville.Wayne Klotz, the Coastal Water Authority's board president, said the Luce Bayou project is the culmination of that 80-year effort to provide water to the Houston region.

Why Water From The Trinity River?

Why is there a need to build this project to get water from the Trinity River when there are two lakes in Houston's backyard (Conroe and Houston), and in Lake Livingston just outside of Huntsville? The answer is somewhat complicated. In Houston's early days, its water supply came from wells that pumped water from underground aquifers, and that took its toll on the very land that homes and businesses were built on. As the water underneath diminished, the ground above began to compact and sink – or subside – into the empty space where water was once stored naturally. Fast forward through some very rough times in terms of sinking land and even a neighborhood disappearing into the Ship Channel, and city leaders started proactively taking steps to replace groundwater with surface water from lakes and rivers.

In 1975, the Texas Legislature created the Harris Galveston Subsidence District(HGSD) to regulate groundwater usage in Houston and Galveston counties to prevent additional land subsidence. The HGSD set deadlines for Harris County water providers to convert to primarily using surface water by 2035. That meant building a huge network of pipelines and pumping stations, and an enormous water treatment plant on Lake Houston, to get the surface water to hundreds of small municipal utility districts that supplied water to neighborhoods in north, central and west Harris County, and north Fort Bend County.

The water in the three existing reservoirs is sufficient for existing water customers for several decades. Beyond that, water supplies in the three lakes could fall short of what water suppliers need to convert their water users, particularly if the region falls into drought mode. With regional planners predicting that Harris County will add another 2 million residents by 2040, it is necessary to use the untapped capacity the City of Houston owns in the Trinity River to quench that added thirst.

It is important to plan NOW to build the system that will deliver the water THEN.

In 2005, the City of Houston tasked the CWA with planning, building and operating the Luce Bayou project. It was a logical move, as the CWA is already delivering 640 million gallons of water a day from the Trinity River to customers in east and southeast Harris County, and is a regional intermediary that can bring the project pieces and partners together because it does not sell or buy water.

"The CWA is the largest water authority in Texas that doesn't own water," said Klotz.

The Project Won't Touch Luce Bayou

Though Luce Bayou is a key component of the LBITP moniker, it is important to note that the project will not disturb the natural drainage channel that is known as Luce Bayou, which meanders from the Sam Houston National Forest south to the East Fork of the San Jacinto River near upper Lake Houston.

Don Ripley, CWA's Executive Director, said that the in-depth environmental studies carried out long before any dirt was turned on LBITP found that using the bayou as an avenue to carry the water from the Trinity River to Lake Houston could disturb its natural environment. The Coastal Water Authority would be required to make up for – or mitigate – those changes, which would mean the project's cost would skyrocket. The alternative was to dig a new canal to carry water from the pipelines to the lake. The canal would parallel Luce Bayou, with the two

Pump station materials

approaching each other near FM 2100 where the bayou drains into the East Fork of the San Jacinto River.

Ripley said the CWA conducted a full environmental impact study on the canal option, and purchased a 3,000-acre site on the San Marcos River to mitigate impacts along the canal's path, which primarily runs through old rice fields. The CWA donated the mitigation land to the U.S. Fish and Wildlife Service, which has property across the river.

So if the bayou is no longer part of the project, why is Luce Bayou still part of the project's name? It is a nod to the project's history, which is impressive and extensive. The concept of transporting water from the Trinity River through Luce Bayou was envisioned early in the city's history, and in fact, was mentioned as a future option for water management in an article in the *Houston Chronicle* in 1938. In the 1970s, a population boom spurred by Houston's red-hot oil and gas market prompted Houston city leaders to move the Luce Bayou concept to the project planning stage. The plan that emerged in the early 1980s supported moving water through Luce Bayou because no environmental studies had yet been carried out, and the concept made sense. The vision gained traction after the City of Houston obtained a permit allowing the transfer of up to 940,000 acre-feet of water from the Trinity River Basin to the San Jacinto River Basin each year (one-acre foot equals 326,000 gallons, enough to serve two typical Texas families for one year).

Ripley said the Luce Bayou project plan was shelved in the mid-1980s because of the oil bust that followed the boom.

"There was no demand for the project at that time because the population growth that was once projected was not there anymore," Ripley said. "The plan was put on the shelf for close to 30 years."

Time to Face the Music

The Luce Bayou project was resurrected recently for two reasons: One, of course, was the need to set the wheels in motion to secure more water for future generations; and the other involves the not uncomplicated matter of weaning Harris County water providers and users off groundwater. Ripley said the LBITP project under construction today mirrors the water demand, which has shifted to north and the west over the years.

After breaking ground on the project in October 2016, construction started immediately on the Capers Ridge Pump Station and the canal's first segment. The entire project – pump station, canal and pipelines – is on schedule to be completed by June 30, 2019, just a blink of the eye in today's fast-paced world.

When the project is done, Klotz said, the CWA will turn on the pumps and let water flow to Lake Houston. The amount that is pumped through the pipelines and canal will be determined by demand at that time.

"This project will take care of Houston for 100 years," Klotz said. "We will have a stable, plentiful supply of water that will affect generations."

Capers Ridge Pump Station site

RAINFALL AND FLOODIN

It's safe to say that most Houstonians feel a little unnerved when rain seemingly innocent rain showers that quickly ballooned into massive storms been a relatively quiet year for the massive metroplex, the previous two yea in between May 2015 and June 2016. North and west Harris County felt th barely a month apart.

So why? Why do some parts of Houston flood frequently while othe answer is simple, but frustrating. There is no way to predict where or when how quickly it moves (or doesn't move) and how much rain falls on a ne Houston/Harris County covers a massive area –-about 1800 square miles – one of tremendous size and strength. Even storms that affect a large part of H They move through the area dumping different rainfall amounts on neighb strong the storm is at that point in time.

TAX DAY TURMOIL –

For example, overnight April 16-17, 2016, approximately *240 billio* amounts averaged 14 -17 inches over far west/northwest Harris County (K Harris County (Spring, Greenspoint) and southwest Houston (Stafford, M (Cypress, Klein, Tomball) and west Houston (Spring Branch, Memorial). Amaz for north, northwest and west Harris County, a month later a less intense bu Meyerland in southwest Houston is another example of a neighborhood tha experiencing four floods in two years. Prior to that, Meyer

Flooding is all about the rain: where it falls, how long it falls and how they, too, would have experienced similar flooding. Yes, some homes and b or ditch than others; or they were constructed before governmental entitie bayous or creeks (pre-1970s) without building up ie. elevating the home. flood-prone homes in parts of the city that have not flooded in years. Wh Nature's wrath.

FLOODING IS

It's important to remember that the Houston region has flooded for ce Harris County recognized the flooding issues that would plague the regio described his visit in his journal by writing, *"May 15. We landed at Housto about six feet, and the neighboring prairies were partly covered with water..*

As the population of the City of Houston grew, many homes and bus of Harris County unknowingly built their homes and businesses in areas that were, and are, vulnerable to flooding. The Flood of 1929 covered all bridges many residents in Alief with 4 feet of water inside their homes. One day of he

WH

Harris County's drainage system described in its simplest form: storm tributaries and large tributaries, ultimately emptying into bayous, which carry this intricate drainage network, flooding is the natural hazard for Harris Cou Gulf of Mexico, the region is prone to tropical storms, hurricanes and year-ro inundating drainage systems. In 1979, 43 inches of rain fell over Alvin, Texa slope of terrain is equivalent to putting dimes under two legs of a 6-foot poo drain. 3) Harris County has impermeable clay soils that don't absorb a

Even if a system of channels and stormwater detention basins that c there is always a larger rainfall event that could overwhelm what the creeks a time, the storm sewers and roadside ditches back up because they do not ha bayous and creeks.

For these reasons, it is wise for Houston/Harris County residents to possibility of flooding at any time. Have a family flood emergency plan; co broadcast emergency information during heavy storms. Don't leave it up to

G IS A GAME OF CHANCE

is in the forecast. The city's past is peppered with stories – and memories – of s that, unfortunately, flooded streets, homes and businesses. While 2017 has rs were hard on many residents in Houston with four floods wreaking havoc he worst of it in April and May 2016, with back-to-back floods that occurred

rs seem to escape unscathed? Is it location? Elevation? Sheer bad luck? The it is going to flood in Houston. It simply depends on where a storm sets up, eighborhood or part of town while under the shadow of the storm clouds. so it is almost impossible for one storm to affect the city entire city unless it is Houston – such as the Tax Day Storm in April 2016 – do not do so all at once. oring communities based on how long the storm sits over an area and how

NOT FOR EVERYONE

n gallons of rainwater fell over Harris County in a 12-hour period. Rainfall Katy, Addicks, Waller), more than 10 inches over parts of north and central eyerland), and between 4-7 inches over most of northwest Harris County zingly, the rest of the Houston area saw very little to zero rainfall. Unfortunately t still large storm caused repeated flooding in some of those neighborhoods. t has had a run of very bad luck, with some sections of that large community land had not seen widespread flooding for about 30 years. much falls. If that same damaging rainfall had hit other parts of the county, usiness are more flood-prone because they are built closer to a bayou, creek s and developers were fully aware of the impact of building close to those However, the homes can't flood without rain. There are actually some very y? Because their neighborhood has been lucky enough to escape Mother

HISTORICAL FACT

enturies. Even the first visitors to and settlers of what would become Houston/ n for years to come. In 1837, John James Audubon visited Houston and *n, the capital of Texas, drenched to the skin…The Buffalo Bayou had risen .*"

sinesses were built along the life source of the land – the bayous. The settlers would be later identified as floodplains. As a result, many of these structures over Buffalo and White Oak bayous west and northwest of Houston and left avy rains caused the Flood of 1935 that covered two-thirds of Harris County.

HY?

water travels through storm sewers and roadside ditches and flows into small the water to the Houston Ship Channel and then to Galveston Bay. Despite unty for three main reasons: 1) Because of Harris County's proximity to the ound thunderstorms that drop large amounts of rain in short periods of time, s in 24 hours – a national record. 2) Harris County's topography is ***flat***. The l table. As a result, floodplains are large, and it takes a long time for water to lot of water, forcing stormwater to run off into area bayous and streams. ould handle a storm the magnitude of the Tax Day Storm were constructed, nd bayous can handle. Also, when there is heavy rainfall in a short period of ave capacity to handle the massive runoff, even when there is capacity in the

know/recognize their risk and to take steps to prepare their families for the nsider purchasing flood insurance; and stay tuned to local news sources that chance!!!

Texas is recognized as having one of the most comprehensive state water plans in the country. In fact, decades before water became the global issue that it is today, the state of Texas had begun taking aggressive measures to preserve and protect this finite natural resource.

The Gulf Coast Aquifers -- the source we have traditionally relied upon for our drinking water -- are made up of many layers of clay, rocks and sand. Over geologic time, these layers naturally compacted. Sadly, the area's steadily increasing population and voracious demand for water sped up this natural process. Decades of aggressive groundwater pumping not only resulted in a decline of the aquifers, but also triggered land-surface elevation loss, or what is called *subsidence*.

The Harris-Galveston Subsidence District (HGSD) was created by the Texas Legislature in 1975 to study and control subsidence in Harris and Galveston counties. The District issued a groundwater regulatory plan requiring industries on the Houston Ship Channel to convert to surface water. The results were dramatic -- subsidence in the Baytown-Pasadena area was dramatically improved, and has since been largely halted.

The Subsidence District's success in reigning in the advance of subsidence in Galveston County provided the impetus to extend similar groundwater reduction mandates into north and west Harris County, where increasing levels of subsidence had also been measured. The District issued a phased timeline for northwest Harris County to reduce reliance on groundwater that began in 2010. The mandates were modified in the District's 2013 Regulatory Plan, to allow a little more time to meet the next milestone – 60% conversion to surface or alternate water by 2025.

The challenge of securing our future water supplies continues, however, with some of the biggest hurdles still ahead because there is not enough water in the San Jacinto River system to meet our 2025 needs and beyond. To remedy this, the regional water authorities have partnered with the City of Houston to construct the *Luce Bayou Interbasin Transfer Project*, with the capacity to bring nearly 450 MGD of raw water from the Trinity River to Lake Houston. With the availability of more raw water coming into the San Jacinto/Lake Houston reservoir, there was an urgent need for additional treatment capacity. A supplemental agreement for participation in the NEWPP expansion was successfully negotiated by the regional water authorities with the City of Houston.

Will we have enough water to meet the needs of a growing population and to sustain economic growth and development for future generations?The answer is a cautiously optimistic "Yes". We may not have all the water we want, but *we will have the water we need* if we all make a commitment to use water as efficiently as possible and to end wasteful practices such as excessive residential turf irrigation.

The NHCRWA is in the Texas Water Development Board (TWDB) Region H area. Region H encompasses all or part of fifteen counties in southeast Texas, and is an economic powerhouse that plays a crucial role in the State's sustained economic health and future growth.

Each year, the TWDB collects information from water systems around the state. This information is critical to ensure that we have adequate and affordable water supplies now and in the future. The Authority's reservations for future water supplies are based on these comprehensive population projections.

In 2000, when the NHCRWA was created, there were about 3.3 million people living in Harris County. People and businesses have flocked to north Harris County in record numbers since the early 1970's when about a quarter of a million people called the area home. The population boom has continued; the 2010 census recorded a staggering population of 601,000 for the northwest community.

Population overall in Harris County is expected to increase to 4.4 million in 2020, and then to 5.5 million in 2050. Experts forecast that Texas' population will increase more than 70 percent between 2020 and 2070, from 29.5 million to 51 million, with over half of this growth occurring in Regions C and H.

All of these factors -- coupled with the cost of constructing the NHCRWA's 2025 system -- will impact the future cost of water.

TWDB's *2017 State Water Plan* projects that our population will continue its rapid growth. Fortunately, this same plan provides a roadmap for how to address the water needs that accompany that growth.

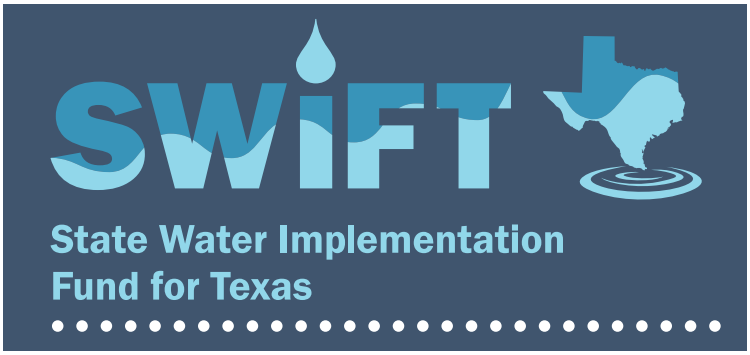
How will we pay for it?

The Authority is committed to efficient and conservative management of financial resources to minimize future cost increases as much as possible. Simply stated, the Authority has pledged to keep the cost of water as low as possible, for as long as possible.

The NHCRWA has no taxing authority so fees are charged for groundwater pumped by the utility districts and well owners within the NHCRWA's boundaries in order to pay Authority costs. Fees are also charged for surface water delivered to utility districts.

The 83rd Texas Legislative session marked the beginning of the State's *new approach to turning water plans into water supplies* by creating the State Water Implementation Fund for Texas (SWIFT) program to fund projects in the state water plan. With assistance from the SWIFT program, Texas now has the means to help meet the state's water needs far into the future.

The TWDB approved the Authority's 2015 and 2016 Financial Assistance Applications for SWIFT funding with multi-year financial assistance commitments totaling $1.25 billion. An application has been filed with TWDB for further funding. TWDB Chairman Bech Bruun recently stated that the North Harris County Regional Water Authority is now the single largest recipient of SWIFT funding in the state.



If you live in Houston, it is likely you have heard a chorus of frogs and toads singing in your yard after a good rain. Toads look a lot like frogs and, in fact, these amphibians are a special type of frog. There are some easy ways to tell them apart, especially if you don't mind touching them! Frogs have skin that is moist or wet, while toads have dry, bumpier skin.

Toads are thicker with stumpy legs and have eyes that don't bulge out as much as a frog's eyes does. Toads lay their eggs in long strings, instead of in thick bunches like frogs do.

Houston and much of the surrounding area was once home to at least two different types of toads — the **Houston Toad** and the **Gulf Coast Toad**. Both of them were thriving species until the 1970's when the Houston Toad was placed on the ***Endangered Species List***. The Gulf Coast Toad, on the other hand, still manages to thrive. Today, if you see a toad, it is probably a Gulf Coast Toad. Sadly, the Houston Toad can no longer be found here; they live mostly on privately owned property in nine Texas counties: Austin, Bastrop, Burleson, Colorado, Lavaca, Lee, Leon, Milam and Robertson. According to Texas State University researchers, in 2016 there were fewer than 500 adult Houston Toads in Bastrop County, and only about 2,000 of the adult toads overall.

Why did a species that once prospered in this area totally disappear while other toad species still do very well here? To answer that, we need to know more about the Houston Toad. First of all, it likes to live in sandy soil, under pine or oak trees. It lays its eggs in shallow water, where there are not a lot of fish or other predators. Houston Toads tend to avoid thick grass because it is hard for them to move around and pass through it. He's not a picky eater, in fact there's a nice variety of bugs on this toad's menu -- with mosquitoes being the primary entree -- which populate many Gulf Coast habitats.

When it comes right down to survival, however, if you are a "big city toad", you're going to have problems. Trees get cut down and – oops — your habitat is destroyed. Grassy lawns are planted, parking lots and streets appear, and there goes your neighborhood. It becomes hard to get around safely. Bugs are killed off by pesticides and chemicals that stormwater carries into the storm drains, that flows to local streams and creeks that ultimately get polluted and dangerous to live in.

Here's the bottom line – as Houston and its suburbs got bigger and bigger, the population of Houston Toads got smaller and smaller.

Luckily, the Gulf Coast Toad is less fastidious about its habitat and has managed to do much better

while facing the same challenges. This particular toad likes to hide in shady areas, live near water and eat a lot of bugs. It doesn't need sandy soil or pine trees, so it has adapted to Houston even as the area has changed.

The Gulf Coast toads are also being threatened as diseases and new predators -- like feral cats -- kill off more and more of them each year. Toads and other amphibians are very important to our ecosystem and need our protection.

Why should we protect toads and frogs?

Both frogs and toads are beneficial to the garden because their diet consists of many pests -- bugs,beetles, caterpillars, cutworms, grasshoppers, grubs, slugs, and a variety of other creepy crawlers. A single frog can eat over 100 insects in one night! Attracting and keeping frogs and toads in your garden will help minimize pest populations without the need for chemical or natural pesticides.

Depending on what kind they are and where they live, toads need to outsmart lots of predators in their quest for survival, including snakes, raccoons, foxes, skunks, dogs and cats, crows, owls, hawks, and even some songbirds. Toads can use a variety of techniques to avoid becoming another critter's dinner. This is a situation when smelling and tasting bad is a good thing!

Texans can help preserve these amazing creatures by protecting/creating pond habitats;landscaping with native plants to reduce water and pesticide use; and properly storing and disposing of household, gardening, and agricultural chemicals.

Continued on page 22

Here are several things you can do:

1. Create a place for toads to hide in your yard. Use natural materials to provide shelter in a garden or under bushes.
2. Conserve and protect our water supplies. Amphibians -- like people -- need access to clean, unpolluted water.
3. Monitor your pets. Cats are aggressive predators; they eat toads and frogs, birds, lizards and other small animals.
4. Avoid using pesticides and chemicals in your garden and lawns. Let these insect-eating amphibians control your bug population and help keep chemicals out of our rivers and streams.

Visit online: https://www.facebook.com/houstontoad/

Editorial and research assistance for this article provided by Dennis Huffman, Science Educator, Houston ISD.

PROVIDE A TOAD ABODE...

It doesn't matter if you create an elaborate natural "home" for your frogs and toads, or if you purchase a more fanciful dwelling from a hobby or plant store, the key is to offer them a clean,safe shelter they can live in and return to year after year. Start with a damp, quiet, shady area where they can hide from predators and escape the mid-day sun -- which, in Houston, is brutal to all living things. Consider using an old clay flowerpot... simply turn it upside down and prop it up with rocks or a stick, leaving enough room for the frog or toad to get inside.

It might surprise you to know that frogs and toads don't drink water through their mouth, but absorb moisture by sitting in water. Place several pot saucers in a shady area near the "abode" and add clean water weekly to avoid it becoming a hot tub where mosquitoes breed. Of course, if they do invade the amphibian's abode, the pesky, whining, biting insects will soon become dinner.

Toad and Frog Factoids

Frogs:

- ✓ Must live near water
- ✓ Their smooth, moist skin makes them look "slimy".
- ✓ Have a narrow body
- ✓ Have high, round, bulgy eyes
- ✓ Their hind legs are longer
- ✓ They take long, high jumps
- ✓ Have many predators

Toads:

- ✓ Don't need to live near water to survive
- ✓ Have rough, dry, bumpy skin
- ✓ Have a wider body
- ✓ Have lower, oval shaped eyes
- ✓ Have shorter, less powerful hind legs
- ✓ They don't jump, but take small hops instead
- ✓ They don't have many predators.
- ✓ A toad's skin emits a bitter taste and odor that burns the eyes and nostrils of its predators, much like a skunk does.

Neither frogs nor toads will give you warts!

Bastrop State Park, established in 1937 to protect a large stretch of trees known as the Lost Pines. is a glowing example of how Nature deals with tragedy and devastation. In 2011, a huge fire destroyed much of the forest and killed many of the animals living there. The Park began a massive restoration effort to replant the forest of loblolly pines. Today, new young trees show the healing power of Mother Nature as they take the place of the larger ones that burned.

The Park is also home to the endangered **Houston Toad.** This species is attracted to the sandy soil and pine forests of the Park. For the past decade, the **Houston Zoo** has been working to save the Houston Toad by harvesting eggs and raising them until they are old enough to survive in the wild. Each year they release hundreds of young toads in Bastrop State Park to help keep the species from becoming extinct. Universities and conservation groups are also working with the Park to help these critters thrive again in the wild.

There is a mythical bird called the ***Phoenix*** that rose from its own ashes to be re-born and live again. Bastrop State Park, like the Phoenix, has risen from the ashes of its horrible fires and now stands as a testament to the forces of nature and recovery. Hopefully, the Houston Toad will enjoy the same destiny.

What is Stormwater Pollution and What Can We Do to Stop It

What do motor oil, lawn fertilizers, cigarette butts, grass clippings and pet poop all have in common? They all contribute to what the U. S. Environmental Protection Agency (EPA) warns is the number one threat to our drinking water supplies…**Nonpoint Source Pollution**. Today, most oil pollution in North America's coastal waters comes not from leaking oil tankers or oil rigs. Forty percent of it comes from countless oil leaks from the more than 264 million cars on the road in this country (2016). Drip, drop…cars make daily oil deposits on roadways, parking lots, driveways, and neighborhood streets. When it rains, stormwater runoff carries with it globs and sheens of oil from paved surfaces into the storm drains…on to creeks and streams… then into bays and estuaries…and finally into the sea, or the Gulf of Mexico, as is our case here in Texas.

Let's take a closer look at this sneaky kind of water pollution – some of the information may surprise you. Contrary to popular belief, most water pollution does not come from illegal dumping of chemicals and toxic waste. Twenty five years ago, most of the "pointsource" pollution — the kind where the source is easily identified — was eliminated when industries and wastewater treatment facilities cleaned up their discharge to public waters to comply with the Clean Water Act or face crippling fines. Today, water pollution comes from pastures, pets and parking lots, from construction sites, housetops, lawns, and driveways.

Surely this can't be legal? You bet it's not! But, since the pollution comes from so many diverse sources that may also vary by season, it is often difficult to determine the exact point of origin. And, consider who causes this pollution. It's you and me, doing things we do every day…without thinking about a more global impact. The local stream is probably the last thing on your mind when you pull the car into the driveway to give it a good washing, right? And, when you figure it's time to give the lawn a good fertilizing…you're probably not thinking about anything other than how nice and green your grass will be, does it?

Well, let's get one thing straight. There's a difference between a storm drain and a sewer. Storm drains collect water from outside our homes and commercial establishments and take it — untreated — directly to streams, creeks and rivers. Sewers, on the other hand, collect water from inside homes and businesses and carry it to treatment plants, where it is cleaned before being released back into nature.

Much has been written about the many causes of nonpoint-source pollution — lawn fertilizer, silt from construction projects, hazardous household chemicals, and pesticides. There have been major public information campaigns about the impact of 'pet poop' on local streams and waterways. People are getting the message from homeowner associations and parks that if their dog makes a 'deposit' in a public place, the owner has a responsibility to scoop the poop and deposit it in the trash or in receptacles provided. How bad a problem can this be, you ask? In the densely populated Washington, D.C. suburb of Arlington, Virginia, there's a community park (Four Mile Run) where scientists estimate that dogs deposit more than 5,000 pounds of poop each day!

There are two other MAJOR sources of nonpoint source pollution, however, that haven't received the same kind of attention: powerwashers and car washing. Powerwashers are powerful cleaning machines that use water under pressure to make quick work of cleaning commercial parking structures and asphalt surfaces as well as residential driveways, patios and homes. Powerwashers of all kinds generate approximately 10,000 to 20,000 gallons of wastewater for every 100,000 to 150,000 square feet of surface being cleaned.

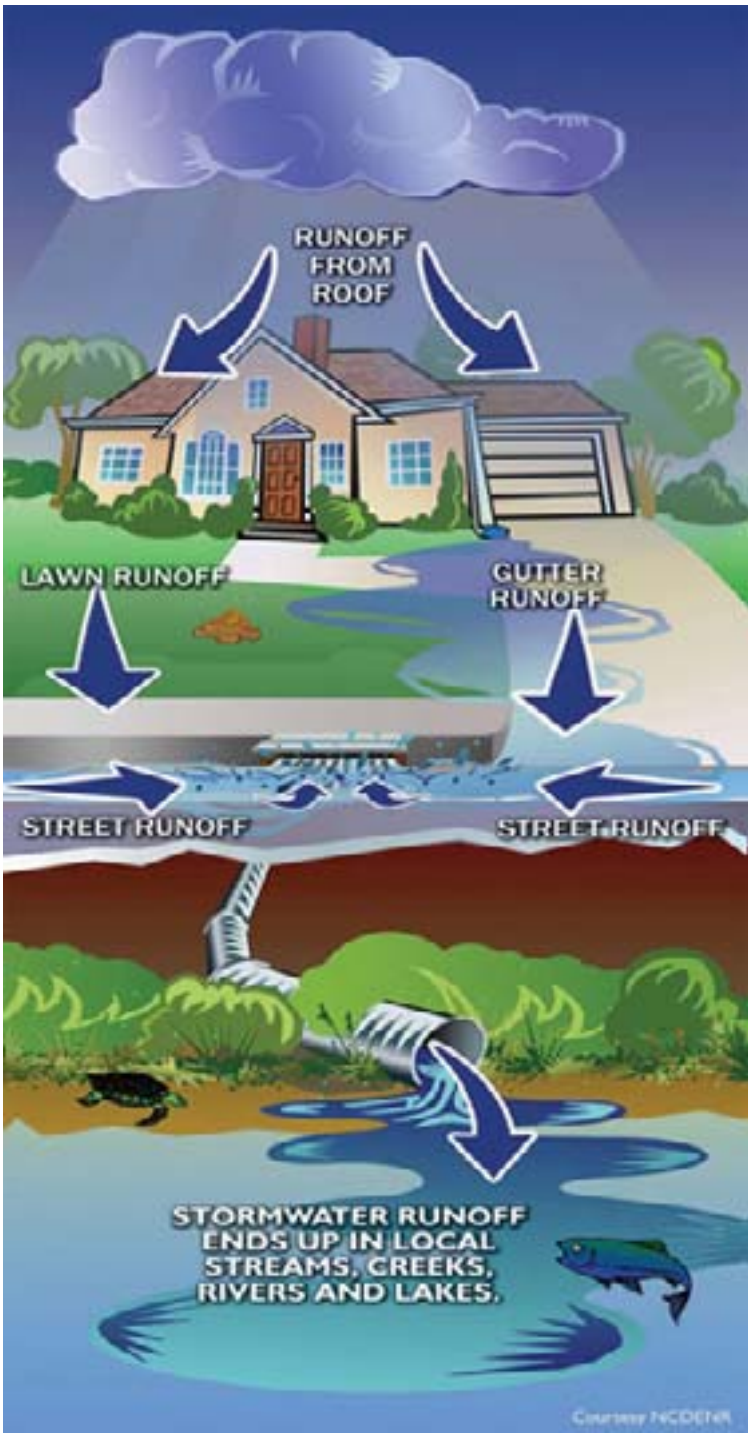
Since the largest source of water pollution comes from city streets, parking lots and neighborhoods, we

Continued on page 24

STORMWATER POLLUTION...

Continued from page 23

need to take a closer look at this water-power cleaning method. When the weather warms up, on any given weekend you can hear the distinct sound of the gasoline-generated power washers in the neighborhood. Residents wash driveway oils and deposits along with molds and other patio stains and discolorations right down the drain...the storm drain that is. If the noise alone weren't aggravating enough, rivers of waste — a veritable cocktail of toxic deposits — trickle down into the streets, stream along gutters to the nearest storm drain where it begins its journey to the sea.



There's more. The aggressive cleaning agents that are used in the commercial powerwashing endeavors — such as muriatic acid and degreasers — are incredibly toxic. Even simple motor oil contains lead, copper, cadmium and chromium — all toxic to humans and fish and wildlife — and yet they race ahead of the powerwash blast of water into the storm drains. If it is on the surface, the powerwash jet of water pushes it into the storm drain — a collection which could ultimately end up in your drinking water supply. Seventy six percent of our waterways are too polluted in which to fish or even swim in safely.

And then there is the simple matter of washing the family car. Just pull it up in the driveway, get out the hose and a bucket of soapy water and you're ready to begin. That may be what we've done since the day we got that much-anticipated driver's license and got behind the wheel of our first car, but things have changed over the years. Today, we pay a whole lot more attention to how we impact the environment — to sustaining our natural resources, and protecting our finite potable water supplies.

Think of it this way: all the soap scum and oily gunk that runs down your driveway while you're washing the car goes into the gutter and subsequently into a storm drain that runs directly — that is without any treatment whatsoever — into our lakes, rivers, creeks and streams...polluting everything along the way. It doesn't take a rocket scientist to realize that this ultimately becomes an enormous problem.

No one is saying, "Don't wash the car!" but it matters how and where you choose to do it. The average driveway car wash uses about 116 gallons of water! Commercial car washes, on the other hand, use about 60 percent less water in the entire washing process than a home wash uses just for rinsing! Commercial car washes generally recycle the water, as well.

That's just the quantity of water used...now consider the soap. Most soap contains phosphates and other chemicals that may be harmful to fish and marine life. Phosphates cause excess algae to grow that not only looks bad, but smells awful and harms water quality. As algae decays, it uses up oxygen in the water that fish need to survive.

How do you balance your desire to have a nice shiny automobile in your driveway with your interest in protecting the environment? When washing the car, use soap sparingly, pour the bucket of soapy water into the sink, not the storm drain; and consider washing the car while it is parked on a grassy area, not the driveway. Best of all choices, have your car washed commercially at a business that uses state-of-the-art environmentally friendly equipment and processes...and recycles the water, too.

Everyone knows that clean water is important to all of us; having access to clean water is of primary importance for our health and well-being, and to a healthy economy, as well. Not only does it supply a habitat for marine life, but clean water provides recreational opportunities, drinking water for our homes, businesses and manufacturing, and even provides the means to generate electricity.

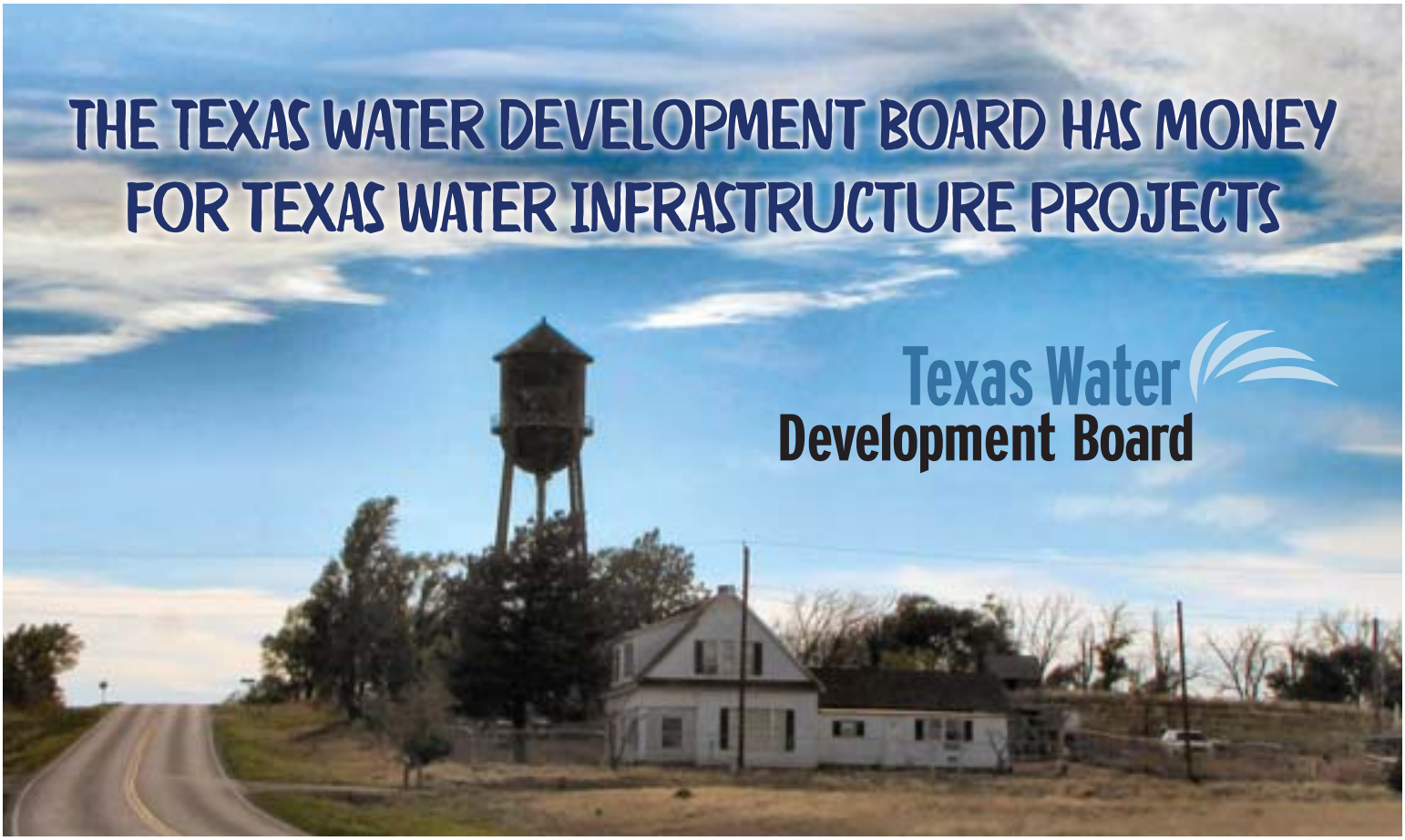
You can be part of the solution by learning as much as you can about nonpoint source pollution...and the things you can do to help stop it. Make a commitment to do everything you can to minimize the risk that your activities will endanger the environment. Guard the storm drains in your neighborhood. Don't allow anyone to sweep grass clippings or other debris into them. Recycle or properly dispose of household products that contain chemicals such as insecticides, pesticides, paint, solvents and used motor oil.

Here's a simple fact to remind you why *only rain goes in the drain*: ***"Don't take clean water for granted. If it is on the ground, it is in your water!"***

Please...scoop the poop!

Americans own about 75 million dogs and an estimated 40% of pet owners don't clean up their dogs' deposits - at home or when out for a walk. These piles don't disappear - rain washes 'em into storm sewers, which drain into local creeks, rivers and streams...contaminating the water with all kinds of bacteria.

THE TEXAS WATER DEVELOPMENT BOARD HAS MONEY FOR TEXAS WATER INFRASTRUCTURE PROJECTS



By Scott Galaway, Outreach Specialist
Texas Water Development Board

The **Texas Water Development Board** (TWDB) -- the state agency that is responsible for planning and development of water supplies -- has funds available for local districts and municipalities. The low-interest loan funds are available for drinking water, wastewater, and stormwater infrastructure projects. Funds are available for new construction, and repair and rehabilitation of existing facilities. The TWDB functions as a lending institution and their interest rates are below open market.

The North Harris County Regional Water Authority (NHCRWA) hosted a MUD Directors Workshop at the beginning of 2017, and invited participants to learn about the variety of funding options available through the TWDB. Since the workshop, many MUDs have followed-up by inviting TWDB Outreach Specialist Scott Galaway to present details of the programs at their monthly board meetings.Interest in the funding programs has been high and the information well received. The MUDs have been especially interested about reuse projects eligible to utilize TWDB funds.

The variety of low-interest loans includes two federal programs from the Environmental Protection Agency (EPA) that are administered by the TWDB and six programs utilizing state dollars. The diversity of programs and options available to water utilities make the TWDB a unique alternative for infrastructure funding.

Clean Water State Revolving Fund (CWSRF) – Federal

Assist communities by providing low-cost financing for a wide range of wastewater, stormwater, reuse, and other pollution control projects. Through Fiscal Year 2016, the program committed over $9.8 billion for projects across Texas.

Drinking Water State Revolving Fund (DWSRF) – Federal

Assist communities by providing low-cost financing for a wide range of water projects that facilitate compliance with drinking water standards. Through Fiscal Year 2016, the program committed over $1.8 billion for projects across Texas.

State Water Implementation Fund for Texas (SWIFT) – State

Affordable, ongoing financial assistance for projects in the identified in the state water plan. Through Fiscal Year 2016, the program committed over $4.6 billion for projects across Texas.

Texas Water Development Fund (DFund) – State

DFund is a state loan program that provides financing for various types of water and wastewater projects. Through Fiscal Year 2016, the program committed over $2.6 billion for projects across Texas.

Economically Distressed Areas Program (EDAP) – State

Financial assistance for water and wastewater projects in areas where service is unavailable or is inadequate to meet state standards. Through Fiscal Year 2016, the program committed over $848 million for projects across Texas.

Rural Water Assistance Fund (RWAF) – State

The program provides small, rural water utilities with low-cost financing for water and wastewater projects. Through Fiscal Year 2016, the program committed over $181 million for projects across Texas.

State Participation (SP) – State

The program's goal is to allow for the "right sizing" of projects in consideration of future needs. The program encourages the optimum regional development of projects by funding excess capacity for future use. Through Fiscal Year 2016, the program committed over $452 million for projects across Texas.

Agricultural Water Conservation Grant and Loan Programs (AG) – State

The programs provide financial assistance for agricultural water conservation projects in Texas that improve irrigation water use efficiency and conserve water. Through Fiscal Year 2016, the program committed over $100 million for projects across Texas.

For more information or to schedule a TWDB presentation, please contact:

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By the time most of us finish grade school, we've heard that "mighty oaks from little acorns grow" -- usually to remind us that even very large things in life can start out very small. On the topic of mighty trees....here's a question that you'll really have to stop and think about. Ready?

When you see a big, tall, heavy, mature tree, do you ever wonder where its *mass* -- its thick trunk, its branches, its canopy of leaves -- cames from? Trees are some of the largest organisms on our planet, but they start out as a seed, right? So, where does the wood and bark and limbs -- the tree's substance -- originate?

Some people guess that trees come from the soil, but upon further thought, that answer doesn't actually work. Many trees have massive roots that obviously take something from the soil. Some say that trees even look and feel solid like dirt. But why doesn't the soil around trees recede as the tree grows if that's the source of the large plant's mass?

Puzzled? If it makes you feel any better, scientists have been trying to answer the question about where trees get their mass since the early 1600's. One research project back then lasted over 5 years and involved measuring the amount of soil in a container over the period of time the tree "grew", and comparing it to what the tree itself weighed. The scientist discovered that even though the tree increased in size, it "took" only a very tiny portion of soil content over the years to sustain it.

So what else could contribute to a tree's growth? It's at this point that folks suggest it must be water from rain that is absorbed by the plant. Every living thing needs water to survive, so this must be at least part of the answer, and of course it is! And so is sunlight, right?

Let's introduce the word *photosynthesis*; we learned about that in elementary school, too. Sunlight is the energy that converts CO_2 (carbon-dioxide) from the air into O_2 (oxygen) and some H_2O (water). Plants *breathe in* carbon dioxide and *breathe out* oxygen -- for humans to breathe in and breathe out carbon dioxide that plants need. Very convenient. This *symbiotic* (mutually beneficial) relationship helps keep us alive! But sunlight energy is not "matter".

Back to the "mass" issue. What is the missing ingredient? It surprises almost everyone to discover that 95 percent of a tree actually comes from carbon dioxide. That means that trees are largely made up of air! That is exactly correct, according to **Richard P. Feynman**, who shared the 1965 Nobel Prize in Physics. "People look at a tree and think it comes out of the ground. The substance of a tree is carbon. But if you ask where does the *substance* of the tree come from, you discover trees come out of the air!"

How in the world did those heavy, branchy, giant, hard, bark-covered lifeforms get their substance from the AIR? Even Feynman said that sounds more like "sorcery than science." But here is the answer. Trees get their mass from air and water. They "eat" the air -- that is done by (literally) chomping down on airborne carbon dioxide. The process uses the sunshine to pull the carbon dioxide atoms apart, getting rid of the oxygen -- which it breathes out or exhales back into the air -- and what is left is the carbon and water -- the ingredients needed to make the substance of the tree. Trees take up water out of the ground -- which got there from the air as rain.

So...final answer...trees do indeed get their substance from the air.

5 Things a Licensed Irrigator Wants You to Know About Watering Your Grass

One of the most frequent questions homeowners ask about maintaining their lawns is, "*How much water is enough?*" Traditionally, the answer has been that an inch of water a week -- by rainfall or irrigation -- is the right amount. Others argue that even that is more than is really needed to sustain Texas turf.

Local research – obtained through a series of residential irrigation system evaluations – has demonstrated unequivocally that homeowners over-water their grass. In fact, the evaluations revealed that most homeowners set their irrigations systems to run three or more times a week, which is much more than is needed for Texas turf to survive and thrive. Yet, when asked about this, homeowners said they believe that their irrigation systems must run more than three days a week in order to sustain the desired landscape.

This mistaken opinion is contributing to a significant amount of water being wasted for landscaping purposes. Up to 80 percent of peak outdoor water use can be attributed to watering residential lawn turf and landscaped areas, and experts point out that 50 percent or more of this water is wasted. In this scenario, a typical residential property of 80 ft, x 120 ft. will waste approximately 111 THOUSAND gallons of water a year. The good news is that this waste can be minimized or eliminated...and here is some important information from **Doug Goodwin**, a highly regarded, licensed expert, to help you evaluate the efficiency of your irrigation system.

1. Your yard probably needs less than half of the amount of water your system is applying. Let's start with one important fact...only water when necessary. Sounds too simple, right? Step on the grass. If it springs back up when you remove your foot...it isn't thirsty. If the blades of grass start to curl, however, it is probably time for a drink.

According to a study by the Sierra Club*, determining how much water to apply to a yardscape is complicated by plant selection, soil depth, and day-to-day variations in weather. However, a growing body of evidence suggests that even poorly adapted landscapes could get by with a lot less water than is typically applied, especially if plants are well established in adequate soil.

With at least six inches of soil, once a week watering is sufficient to maintain a lawn's appearance in Texas. During severe droughts, a lawn with St. Augustine grass on six inches of soil can survive with watering once every two weeks. More drought-tolerant turf varieties such as Bermuda, Buffalo, and Zoysia can go even longer without water because they are capable of entering a dormant-like state. Native flowering plants, shrubs, and trees are adapted to long stretches without water.

Here are another few tips to consider: Use a sprinkler that emits large drops of water that remain close to the ground instead of sprinklers that spray a fine mist that will quickly evaporate. Use drip irrigation for landscaped areas if you're installing a new system. Set the controller to water during the very early hours, as watering in the heat of the day can result in up to a 60 percent higher evaporation loss. To avoid peak demand for other household uses -- like showers, kitchen chores, and the use of laundry appliances -- set the timer to complete the cycle before 4:00 am.

Continued on page 30

**Water Conservation by the Yard: Estimating Savings from Outdoor Watering Restrictions* is a joint publication of the Sierra Club, Lone Star Chapter and National Wildlife Federation.

Irrigation Advice from an Expert

Continued from page 29

Don't water on windy days, and make sure your sprinkler is set to water your lawn, not sidewalks and driveways. A rain sensor is also a great investment and will keep your lawn from being unnecessarily watered when Mother Nature has already done the job!

2. Why deep roots make a difference if your yard thrives in hot weather or during drought. Watering infrequently *and deeply* is the key to forcing grass and plants to grow deep roots. In doing so, you enable them to access water for a longer period of time so they will thrive through the long, hot summer. Experts say that homeowners who over-water are initiating a vicious cycle…shallow roots need more water. Why? Because water close to the surface evaporates long before the deeper moisture does. Air is forced out of the continually saturated soil and since roots need air they don't grow as deeply!

The photos above provide a visual comparison of turf grass that has been overwatered (top) and some that has received water only once a week or when it was needed, "training" it to grow deeper roots. Obviously the deeper roots will allow the grass to survive periods of little water. This deep root base is not accomplished overnight, but can be encouraged through efficient watering and properly amending and maintaing the soil.

3. It is 'when' and 'how' you water…not how much -- introducing the Cycle and Soak method. This method of irrigation applies water slowly so the soil actually absorbs all that is applied. Instead of running each sprinkler zone for 15 or 20 minutes each, run each zone only the amount of time that the soil can absorb the water (which means not running off onto the sidewalk or street). Depending on the slope of the yard, this could vary widely from zone to zone. You will have to visually test the zone run times to see when the water begins to run off.

Once you have determined the maximum amount of water each zone can take before runoff, split the total irrigation time into two or three parts. This involves irrigating the zone, shutting it off to allow time for the water to soak in and then watering a similar time to complete the process. Schedule the run times about one hour apart until the soil is moistened to a depth of 6-8 inches. Virtually all sprinkler system controllers can be programmed to automatically run the Cycle and Soak method.

You'll know that the lawn has been successfully watered during your test when about an hour after watering, you can push a soil probe (or a very long screwdriver) into the soil. It will slide easily through wet soil but will be impossible to push through dry clay. The landscape has been successfully watered when the probe easily slides to a depth of 6 – 8 inches.

By using the Cycle and Soak method, the plant's root system will reach for moisture deep within the ground and be well protected from the summer heat. It reduces the need to water frequently.

4. Taking control of your system's controller – equals efficient water use in all seasons. There are a number of things around the house that function well under the instruction, "***set it and forget it***," but the irrigation system controller isn't one of them. A properly maintained irrigation system is key to reducing wasted water, reducing pollution from run-off, and improving plant health by applying the correct amount of water for maximum utilization by the landscape.

At a minimum, a check of the irrigation system should be performed seasonally. Once at the beginning of the season when the system is first turned on, then mid-summer, and again when you shut it down when the grass goes dormant. Consider using the old Daylight Saving Time adage – "*Spring forward, fall back*" -- to manage your irrigation system controller. When you move clocks back in the fall, turn OFF the system controller. Autumn is also a good time to confirm that your irrigation system is working properly, and to find and fix any leaks and broken sprinkler heads. In the spring, when you adjust for getting that extra hour back, turn the system back on…this pretty much coincides with the yardscape growing season in Houston.

Here are some basics of irrigation maintenance:

- Inspect the controller and make sure it's plugged in and functioning
- Update the time and date.
- Check the connection on all of the wires – make sure that rain, wind, or soil moisture sensors are connected.
- Change the battery for backup of the time display. This ensures that the controller keeps the correct time in case of a power failure. It is found behind the display panel and is usually a 9-volt battery. It's good practice to use this biannual reminder to change the battery of the controller ***and*** your smoke detector at the same time.
- Change the schedule to reflect the current season and irrigation needs of the landscape.
- Turn on each zone and look for system damage.

5. Routine inspection of your system for leaks and damaged heads can save you hundreds of gallons of water a week! Broken sprinkler heads are often caused by pets, vehicle traffic, and perhaps poor installation. A visual inspection of the system should be done at least once a month through the growing season. With the system set to come on during the middle of the night, you may miss seeing leaks and broken system parts. Many of today's controllers have a test cycle built in that will allow you to run each station for as little as 2 minutes so it won't take you long during daylight hours to perform a test. Puddling, dry areas, low pressure, and runoff are all things that could be caused by a broken sprinkler.

Here's a good reason to perform the tests: *a broken sprinkler head could be wasting as much as 6 gallons a minute. Undetected, that could possibly add up to 300 to 500 gallons per week!*

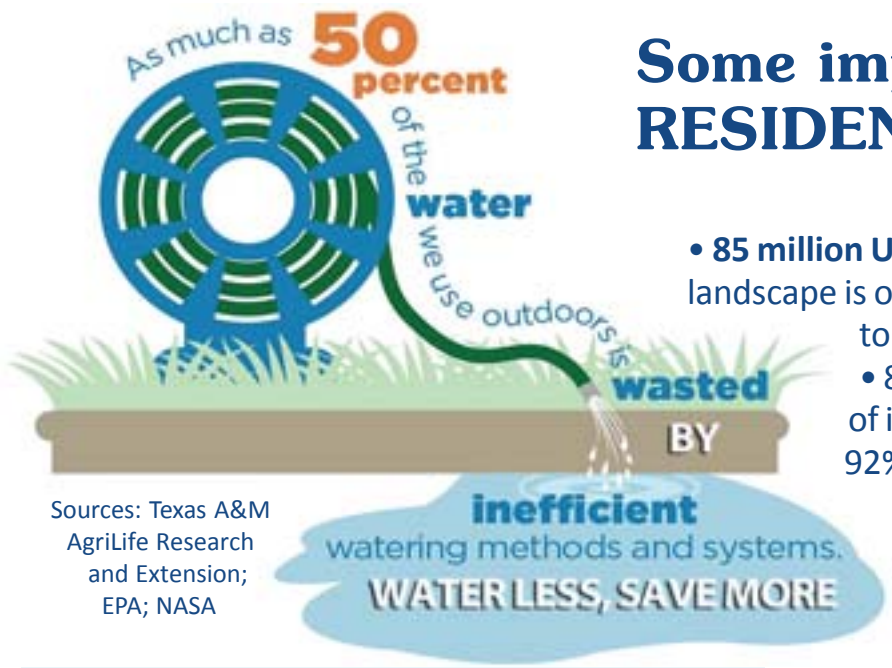
Nozzles, the part of a sprinkler head that actually emits the water, can become clogged or broken without damage to the sprinkler head itself. Sometimes, dogs have been known to chew on a sprinkler head sticking up in a flower bed, misdirecting or destroying it. Nozzles can also become clogged or damaged from weedeaters or other yard equipment, but nozzles can be unscrewed and replaced. A visual inspection of the system once a month during the growing season is the best method to ensure all parts of the system are working properly.

While you're at it, make sure the heads are only throwing water on the turf or bed areas -- NOT on driveways, sidewalks, fencing, or sides of buildings. Controller runtimes may often be lowered if more efficient coverage is attained. *Continued on back page*

MEET THE EXPERT…

Doug Goodwin earned a BS degree in Agricultural Economics from Texas A&M. He became a Texas Certified Nurseryman in 1983 and received his Texas Irrigator License in 1984. Doug became a Texas Commission on Environmental Quality (TCEQ) approved instructor for Basic Irrigation Training and Continuing Education classes, and is a Certified Texas Landscape Irrigation Auditor.

Doug served as President of the Houston Gulf Coast Irrigation Association in 1997, and was a member of the TCEQ Irrigation Advisory Council 2005 through 2010, and served as Chairman in 2009. He is one of the founders of the **W.I.S.E. Guys**, a company that evaluates the operation and efficiency of residential irrigation systems. To date, the company has provided over 16,500 evaluations.



Sources: Texas A&M AgriLife Research and Extension; EPA; NASA

Some important facts about RESIDENTIAL IRRIGATION

• **85 million U.S. homes have a lawn**. The average size landscape is one-fifth of an acre. All together, that adds up to **30 million acres of grass**.

• 89% of single family households use some kind of irrigation -- 95% of them use spray irrigation. 92% of the 95% do not understand how an irrigation system runs or how a controller works!

• The typical (U.S.) lawn/landscape soaks up more than 10,000 gallons of (primarily drinking) water a year, not including rainwater.

• Do the math -- that's 10,000 x 85 million = 850 billion gallons of water a year just for our lawns!

• The overall efficiency of an irrigation system depends on the design, what kind of equipment it uses, and how well it is maintained:

- Surface/subsurface drip -- 90% efficient
- Surface micro-drip -- 85% efficient
- Large rotors -- 70% efficient
- Small rotors -- 65% efficient
- Spray heads -- 50% (= 50% INEFFICIENT)

• During the summer months, it is estimated that 40 to 60 percent of water used by residential customers is applied to the landscape.

• Audit, repair and replace faulty irrigation equipment and adjust the controller to use the "Cycle and Soak" method to allow the water to seep into the ground and avoid runoff. More information at *www.SaveWaterTexas.org.* ■

IRRIGATION EFFICIENCY is a key component in water management strategies, and focuses on *doing more with less:*

• Irrigate according to your plants' water requirements and routinely adjust system controller seasonally.

• Replace water-thirsty turf with trees and shrubs and install 90% efficient drip irrigation wherever possible.

• Save time by installing low maintenance shrubs and mulch.

• Capture and use rainwater for container plants and other non-potable purposes.

• Choose the right plant for the right place.

• Reduce future water demand and create beautiful, drought-tolerant landscapes.

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The water we conserve today can serve us tomorrow!

North Harris County REGIONAL WATER Authority

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