

Appendix G

Clearwater Source

Clearwater Underground Water Conservation District

www.cuwcd.org

2019 Annual Newsletter

| October 2019

| Volume 15, Issue 1

A MESSAGE FROM CUWCD

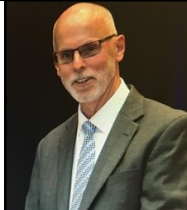
Clearwater Underground Water Conservation District has set the 19th Annual Water Bell County Water Symposium for November 6, 2019 in Killeen at the campus of Texas A&M University - Central Texas. The theme and objective of this year's event is "Collaborative Discussion and Planning Water Needs for the Future".

We have continued our annual event by focusing our efforts with Bell County Commissioners Court, Bell County Engineers Office, Texas AgriLife Extension Service in Bell County, and Texas A&M University Central Texas. We are also blessed to have such a beautiful campus and the newly named "Yowell Conference Center" hosting our event.

Dr. Robert Mace, Chief Water Policy Officer, with the Meadows Center for Water at Texas State University, will open the days event with an historical overview entitled: "Whiskey's for Drinkin', Water's for Fightin': The Tumultuous History and Collaborative Future of Water Management Texas." What's exciting about his presentation is that he will expand on how true peacemakers are the characters of the past that can be emulated for the future.

Dr. Mace has over 30 years of experience in hydrology, hydrogeology, stakeholder processes, and water policy, mostly in Texas. Before joining Texas State University in 2017, Robert worked at the Texas Water Development Board for 17 years ending his career there as the Deputy Executive Administrator for the Water Science & Conservation office. While at TWDB, Robert worked on understanding groundwater and surface water resources in Texas; advancing water conservation and innovative water technologies such as desalination, aquifer storage and recovery, reuse, and rainwater harvesting; and protecting Texans from floods.

Recent studies conducted by CUWCD addressed the unknowns concerning the depletion of artesian pressure in the Trinity Aquifer in the most southeastern portions of our County. Evidence is showing two things that are apparent: 1) Pumping from the Middle Trinity at current levels in both Bell and Williamson Counties is not sustainable and 2) the concern of our Board of Directors is that Williamson county is unmanaged (meaning they



Dirk Aaron, General Manager
Clearwater UWCD

have no groundwater district). This has been a hot issue in the Capital this last session, but now is the time to talk, discuss, and move forward with shared resolutions.

To address this issue, our own State Senator Dawn Buckingham, Representative Brad Buckley and Representative Hugh Shine carried legislation in both the house and senate to simply have the State fund a study to determine if the aquifer system sustainable. This issue will be discussed in a collaborative effort with our Legislators and the County Judges and Commissioners of both Bell and Williamson Counties. We know that a collaborative conversation is needed to move forward. Judge David Blackburn is leading the discussion and looks forward to the open dialogue with area wide leadership to discuss the many shared issues and proposed paths forward.

The current Chairman of the House Natural Resources Committee, Representative Lyle Larson, will give the noon Keynote Address this year following our panel discussions. Chairman Larson has a reputation and expectation that groundwater districts need to be science based and forward thinking on groundwater use. We look forward to his comments.

The afternoon session will have scientific discussions on managing groundwater. We will also hear from regional leadership and experts committed to supporting all the water related industries in Texas.

CUWCD, Board President, Leland Gersbach states that this event, fostered by local leaders the last 19 years, speaks to the issue itself "Water, what moves us forward or holds us back." He encourages all persons interested in our shared need to solve our water needs in the future to plan on attending. The beautiful conference center named after our dear friend, the late Bill Yowell, speaks to the issue. Mr. Yowell was a pioneer in Bell County that brought water to the needs of Ft. Hood, Killeen and all the surrounding areas. What better place than the Yowell Conference Center to address local concerns, local discernment, and local resolutions.

RSVP now by calling the Clearwater UWCD office at 254-933-0120 or emailing Tristin Smith tsmith@cuwcd.org.



Leland Gersbach, President
Clearwater UWCD

TEXAS WELL OWNERS NETWORK HIRES NEW COORDINATOR

Dirk Aaron, General Manager for Clearwater UWCD, is excited that AgriLife Extension has hired one of our own from the Groundwater Community. Joel Pigg, from the Real-Edwards Conservation and Reclamation District in Leakey, is combining his Texas A&M AgriLife Extension Service and water conservation district experiences in his new position as the Texas Well Owner Network, or TWON, coordinator. The TWON program, <http://twon.tamu.edu/>, provides private water well screenings and well-head protection educational trainings to private water well managers.

"I'm very excited to be back in the soil and crop sciences department after spending the last 12 years in Real County," Pigg said. "I look forward to working with our AgriLife Extension agents, groundwater district personnel and private water well owners across the state to help them learn about water quality and help them protect this valuable resource."

Pigg, a native of Brownfield, earned his bachelor's degree from Southwestern University and a master's degree from Texas Tech University in Lubbock. He worked for eight years as an AgriLife Extension associate in the soil and crop sciences department before spending almost four years as an AgriLife Extension county agent in Real County.

Dirk Aaron also has firsthand knowledge of Joel. He and I first worked together in Brownfield Texas in 1987-92 managing the Terry County Extension Program and providing support to the local groundwater conservation district there as well. Joel is one of the most qualified individuals in our state to expand the educational programs to all parts of Texas. He knows the facts and is a storied educator, stressed Aaron.

He has spent the past eight years as the general manager of the Real-Edwards Conservation and Reclamation District in Leakey, vice chair of the Plateau Regional Water Planning Group and coordinator and presiding officer for Groundwater Management Area No. 7.

Clearwater UWCD is excited to see Pigg as the leader knowing he is familiar with Groundwater Resources and Management. TWON will be an exhibitor at the 2019 Bell County Water Symposium on November 6th at Texas A&M University Central Texas. Aaron affirmed that "Plans are to continue to holding TWON events in Bell County with our Partners at Texas AgriLife Extension Service".



Joel Pigg, TWON Project
Coordinator

BOARD OF DIRECTORS

Leland Gersbach - Precinct 1
2013-Present (President)

Jody Williams - Precinct 3
2018-Present (Director)

Gary Young - Precinct 2
2014-Present (Secretary)

Scott Brooks - Precinct 4
2018-Present (Director)

David Cole - At large
2013-Present (Vice-President)

MISSION STATEMENT

To implement an efficient, economical, and environmentally sound groundwater management program to protect and enhance the water resources of the District.

WATER QUALITY SCREENING

The District's in-house lab offers registered well owners free screening for common constituents and bacteria. Annual screening is recommended.

WHO AND WHAT IS THE TEXAS WELL OWNER NETWORK

The Texas Well Owner Network (TWON) is an educational training program developed by the Texas A&M AgriLife Extension Service in the Departments of Soil & Crop Sciences and Biological & Agricultural Engineering in partnership with the Texas Water Resource Institute. Funded by the TSSWCB under CWA Section 319(h), TWON trains well owners regarding water quality BMPs for protecting their wells and surface waters, which will avert off-site transport of contaminants such as bacteria and nitrates, two of the most common contaminants in private water wells in Texas, as well as the most frequent cause of stream impairment or concern. TWON works with other project partners to support current watershed protection planning and implementation efforts.

The Texas Well Owner Network is delivered in two forms including *“Well Educated,”* which is a day long course and *“Well Informed,”* which is an hour long program. The *“Well Educated”* course covers aquifers, household wells, improving and protecting water resources, groundwater resources, septic system maintenance, well maintenance and construction, water quality and water treatment. The *“Well-Informed”* program is one hour in length and focuses on wellhead protection and recommendations for remediating well contamination. For both types of programs, well owners can bring in water samples for screening for fecal coliform bacteria, nitrate-nitrogen and salinity.

The TWON curriculum is compiled into a full-color handbook that includes course material, as well as a comprehensive glossary of terms and three appendices providing detailed information on federal, state, and local water quality agencies and organizations; national primary drinking water standards with maximum contaminant levels (MCL) and potential health effects listed; and an index of water issues and their symptoms, possible sources and treatment options. The program is delivered through training events by a team of professionals using high-quality visual aids and hands-on teaching stations. Those team members include Joel Pigg, TWON Project Coordinator; Dr. Diane Boellstorff, Associate Professor and State Water Resources Specialist; John W. Smith, Program Specialist-Water; and Ryan Gerlich, Extension Program Specialist.

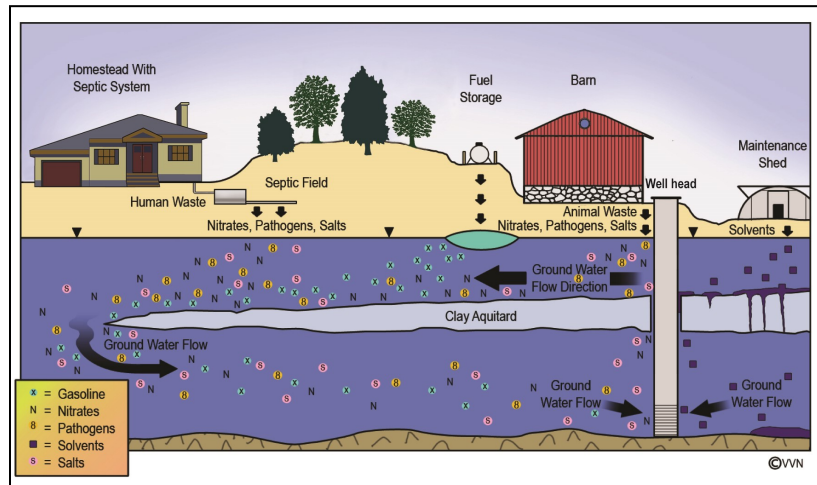
To date, thirty “Well Educated” and sixty-three “Well Informed” training

programs have been conducted. In all, more than 9,500 private water well owners have been trained and/or their samples have been screened. Results from pre and post-test evaluations indicate that knowledge was increased for 100% of the participants. On average, participants increased their program test scores from 52% pre-program to 79% post-program. When asked how much the program was worth to them personally, participants indicated an average of about \$786 per participant, for a total of \$7,467,000 across all participants.

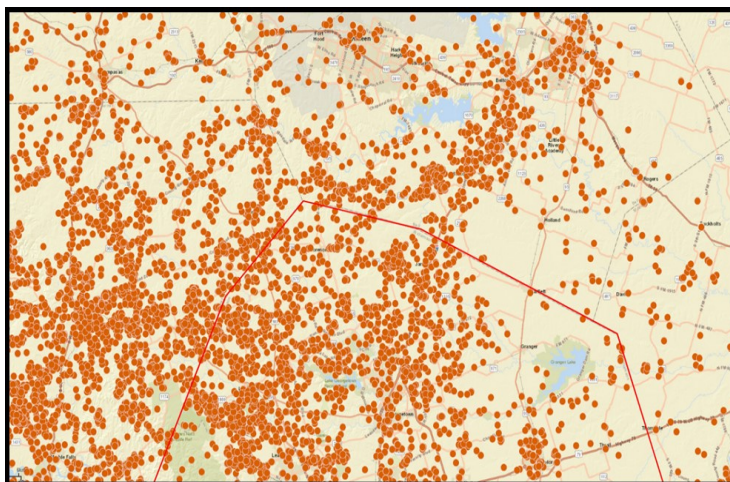
The TWON Website <http://twon.tamu.edu> contains a copy of the training manual along with many fact sheets and Texas A&M AgriLife Extension publications that are relevant to water issues across the State of Texas.

Feel free to contact Joel Pigg in the Department of Soil & Crop Sciences at Texas A&M University: 354-B Heep Center, College Station, TX 77843-2474 or by phone 979-845-1461 or on my cell 830-275-3866.

Joel Pigg, Project Coordinator
Texas Well Owner Network

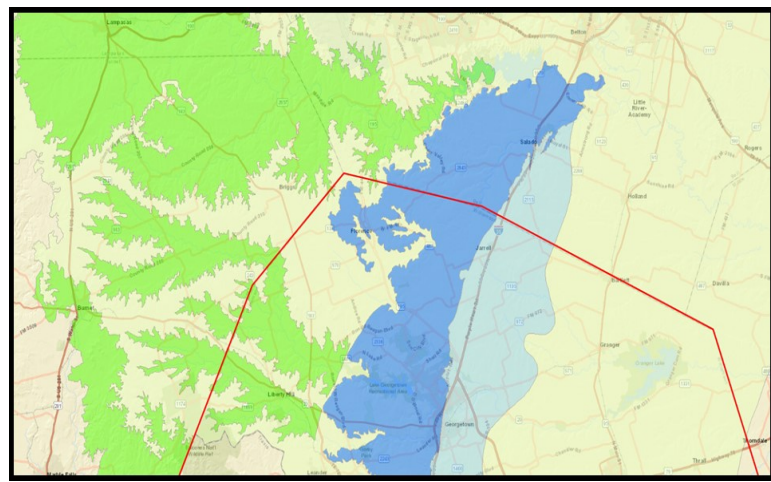


A PICTURE SPEAKS A THOUSAND WORDS



Do we have a large number of wells in Bell, Williamson, Burnet and Coryell Counties?

The above data is from the Texas Water Development Board's Water Well Driller Reports, a public data base for all of Texas.



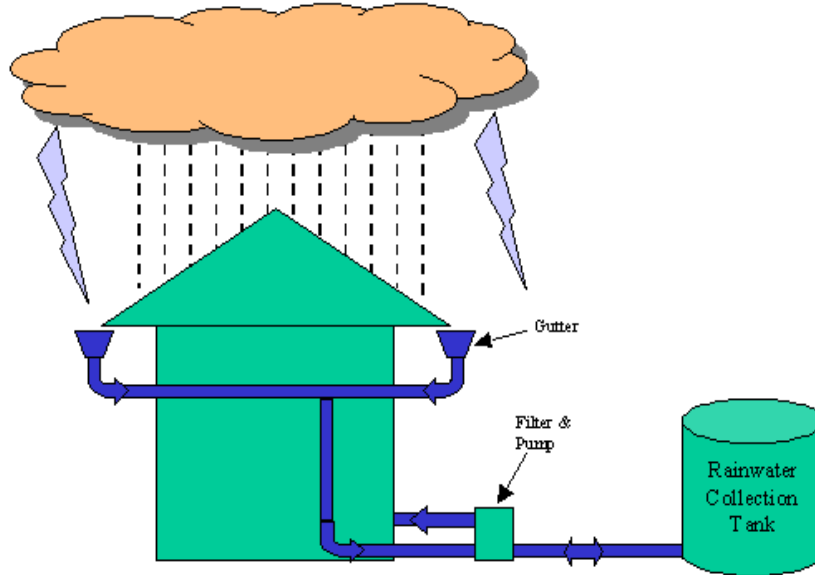
The source aquifers are the Edwards BFZ (Blue/Blue) and the Trinity (Green/Green). The map illustrates the complex and variable system of underground water resources shared by more than just a few counties (Bell, Burnet, Coryell, Milam and Williamson Counties).

INTRODUCTION TO RAINWATER COLLECTION: CONTROLLING YOUR WATER SUPPLY DESTINY

There will always be homeowners who want to live away from the bustle of cities and public utility infrastructure. A dependable source for household water supplies is probably one of the most important issues for these homeowners.

Groundwater wells are expensive to drill and maintain, are difficult to monitor water availability and quality, may have water groundwater rights restrictions and can be impacted by other adjacent landowner's water wells.

A rainwater collection system can supplement or totally supply the household needs of these rural homes, is secure, able to be easily monitored, has no restrictions and cannot be impacted by adjacent landowners. The system would have a charging connection for delivered water in case of serious drought.



Rainwater Collection Overview

The rainwater collection system storage also provides a reliable emergency water supply and a local fire-fighting resource. Rainwater collection systems can be used for both potable and non-potable water demands. For potable water systems, metal or tile roofs are required. The collected rainwater passes through micron filters and ultraviolet light or ozone systems for purification, no chlorination is required. Collection roofs systems include the home, garage and/or utility buildings.

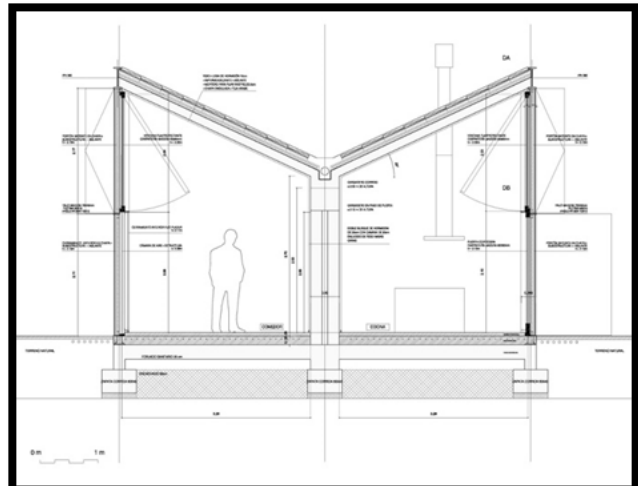
As a rule of thumb, 0.6 gallons can be collected for every square foot of collection area with a one inch rain. A 1,000 square foot roof therefore collects 600 gallons of water. Rainfalls less than 0.1 inches generally do not contribute to storage.

After the roof, storage is the most expensive component of a rainwater collection system. Metal, fiberglass, concrete and certain plastic storage tanks are acceptable. A minimum storage is 5,000 gallons per person for a household potable water supply. Assuming 125 gallons per day for a 5,000 gallon tank, this would supply one person 40 days of water with no additional rainfall. Larger storage is recommended.

Building a new home Checkout: [Bartolacci blog an inspiration to build a home that Catches the Rain](https://architizer.com/blog/inspiration/collections/rainwater-collection/)

(<https://architizer.com/blog/inspiration/collections/rainwater-collection/>)

Architectural Opportunities must include Rainwater Catchment Systems:



This house is one of many illustrated by James Bartolacci, at his blog with design focused on rainwater-collection.

4-H WATER AMBASSADORS, INDUSTRY PARTNERSHIP SHOWS PROMISE FOR OUR WATER FUTURE

WATER. “I don’t have to explain you its vital role (literally, becoming non-renewable resource in some part of the country) in our daily lives as you live through it within Clearwater Underground Water Conservation District (CUWCD). Conservation of this irreplaceable and precious resource is in the minds of water managers, legislators, county agents, city managers, water users, community leaders and everyone who lives and works in the Bell County Area,” says Dr. Askarali Karimov, Technical Director with KPA, LP in Temple.

He further states, “education through public outreach has always been and is, in the core of the water conservation and management discussions and the main instrument we utilize to cater awareness to the public on the latest research in groundwater quantity or quality as well as the latest legislature and its impacts on our communities and the state.”

The following is Dr. Karimov’s thoughts as he describes the challenges we are faced with in Texas. “Often, it is difficult to change our mindsets and attitudes towards water conservation and management. I worked as Extension and Research Associate at Texas A&M University System in the last 15 years and gained tremendous experience. After conducting many educational and outreach programs as well as design and implementation of water quality and quantity related engineering projects throughout Texas, I came to conclusion that we must focus our resources and attention to train and educate our youth and equip them with all the tools necessary to prepare them managing our water resources.”

The Texas 4-H Water Ambassador program has been created to such needs and develop next generation of water leaders for Texas. Dr. Karimov exalts the program by saying, “there is no such program in the nation as Water Ambassadors to address State’s water conservation and management issues.”

Dr. Karimov, known as Askar to his friends, was recruited and hired by Rick Kasberg and David Patrick at Kasberg, Patrick & Associates, LP, engineering and consultancy firm in Temple back in May 2019 and has been working and living in Bell County ever since. His son, Jahongir Karim is a Water Ambassador and his daughter will apply and hopefully be selected to the program next year.

KPA is going to be the first engineering company to be a permanent legacy sponsor of the program and Askar will continue serving as a volunteer in the program. He and his family enjoy being part of this program and living in Bell County which makes it more special.

David Smith, 4-H2O Program Coordinator with Texas A&M AgriLife Extension Service, is the core leader of the Texas 4-H Water Ambassador Program and recently reported to the Clearwater UWCD Board of Directors the following:

Now in its third year, the Texas 4-H Water Ambassador Program has grown to include 74 youth representing 43 counties across the state, including three youth in Bell County. Luke Read, a junior at Belton High School, is serving his second year as water ambassador, while Sarah Wood (homeschooled sophomore) and Jahongir Karim (freshman at Belton High) have started their first year of service.

This past summer, Luke participated in the Tier II 4-H2O Leadership Academy where he toured the Texas Gulf Coast and learned about the water issues unique to marine ecosystems, bays and estuaries. Sarah and Jahongir attended the Tier I 4-H2O Academy which focused on groundwater and surface water rights, water districts, water law, and water resources in the central, southwest and High Plains region of Texas. Luke participated in this tour during his first year as water ambassador.

As ambassadors, youth commit to educating others in their communities about relevant water issues, such as conservation and protection. Since the program began in 2017, water ambassadors have reported more than 2,200 hours of service and have reach nearly 40,000 youth and adults statewide. Many of these service opportunities are a collaboration with local groundwater districts and others who have existing education outreach programs and have on hand educational exhibits, activities and resources that they can use.

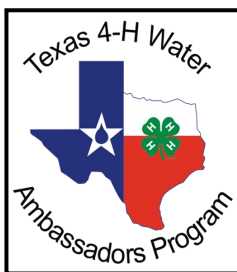
Recently, eight water ambassadors representing Bell, Williamson, Milam, McLennan and Hill Counties, as well as Whitney Grantham (Bell County Extension Agent) and Shelley Franklin (Williamson County Extension Agent) met with Dirk Aaron at the Clearwater UWCD office to learn about the District’s water education resources, such as its mobile aquifer trailer and rainfall simulator. Discussion also included on future collaboration between the District and regional water ambassadors.

Due in large part to the support of the water industry, particularly groundwater districts such as Clearwater, the 4-H Water Ambassadors Program is making a significant impact and growing a new generation of water leaders. Existing state water leaders are starting to take notice. In May 2019 the Program was named ‘winner’ of the prestigious Texas Environmental Excellence Award by the Texas Commission on Environmental Quality. Thanks to Clearwater UWCD for your continued support of this program!



David W. Smith
4-H2O Program Coordinator
Extension Program Specialist II
Texas A&M AgriLife Extension Service

Askarali K Karimov, PhD
Technical Director
Water Resources & Hydrologic Engineering
Kasberg, Patrick & Associates, LP



Top row (L to R): David Cole, Gary Young, Scott Brooks, Jody Williams.
Bottom row (L to R): David Smith, Leland Gersbach, Sarah Wood, Jahongir Karim, Luke Reed.



David and Dirk presented Water Ambassador Program at the KPA Engineers head office in Temple, TX on September 27, 2019.

Groundwater Conservation Districts

FAQs



What is a Groundwater Conservation District?

GCDs are political subdivisions of the state created to protect and balance private groundwater interests with the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and the control of subsidence caused by withdrawal.

What does a GCD do?

- Establish rules for the spacing and drilling of all water wells
- Consider and permit non-exempt water wells
- Maintain records of non-exempt wells in a district
- Submit management plans to Texas Water Development Board for approval
- Collaborate regionally in joint planning for the establishment of DFCs
- Collect water level and water quality data on aquifers
- Educate stakeholders on water conservation
- Work to prevent harm to the aquifer due to pumping or contamination



How do GCDs allocate their budgets?



Education & Outreach



Science & Research



Operations



Conservation



Regional Planning

How many GCDs are there in Texas?

Currently, there are **98** GCDs plus 2 subsidence districts.

What rules must a GCD follow?

GCDs are governed by Chapter 36 of the Texas Water Code. As political subdivisions of the state, they are also subject to Chapter 49 of the Texas Administrative Code. Based on the rules established by the State, each GCD creates policies to accomplish the goals of their District.

Do I have to register my well with my GCD?



Yes, state law requires all wells to be registered with the GCD. This does not mean that all wells require a permit. All domestic wells and livestock wells that produce less than 25,000 gallons per day are exempt from permits. A GCD has the ability to exempt others in their rules.

More GCD FAQs

What is a management plan?

A management plan outlines a GCD's goals and course of action to achieve those goals. The management plan is submitted to TWDB for approval, and rules necessary to implement the management plan are adopted by each district.

What is a Desired Future Condition?

The desired future condition is a metric that is established during the joint planning process by GCDs in a common Groundwater Management Area (GMA). The DFCs provide for consistency in groundwater management in the GMA and a balance between groundwater protection and production.

How are GCDs funded?

GCDs are funded through property taxes, permitting fees and/or usage fees.

Groundwater Terms

Aquifer

An underground geological formation able to store and yield water in useable amounts. Aquifers in Texas can consist of sand, gravel, limestone, granite, and many other rock types that have pores or spaces for water to pass through.

Aquitard

An aquitard, or confining layer, is a zone within the earth that restricts the flow of groundwater.

Total Dissolved Solids (TDS)

TDS refers to the total concentration of dissolved constituents in solution. A TDS level of less than 1000 ppm is often considered freshwater, although many Texans' drinking water has a higher TDS.

Cone of Depression

A cone of depression is a conically shaped area of decreased water level (or pressure) that occurs when water is withdrawn from an aquifer. If wells are too close to each other, these cones may overlap and cause interference resulting in abnormally low water levels in those wells. In areas that withdraw more water than is recharged or flows to that area, a semi-permanent regional cone of depression may occur.

Abandoned Wells & Water Quality

There is a high environmental risk associated with abandoned or deteriorated wells, as they are a direct conduit from the surface to our groundwater resources. Because of this risk, it is highly recommended to have abandoned or deteriorated wells plugged. Some GCDs have established programs to assist landowners in plugging abandoned wells.

How often should I have my well water tested?

It is recommended that well owners have their water professionally tested annually or when an observed change in water quality occurs.

Who can disinfect my well water?

It is recommend to contact a licensed water well driller or a pump installer to professionally disinfect your well.

SALADO SALAMANDER UPDATE FOR 2019

The Texas Fish and Wildlife Conservation Office (TXFWCO); branch of the U.S. Fish and Wildlife Service) began monitoring the Salado salamander in 2015. The Salado salamanders in Bell County are at the northern edge of the range for *Eurycea* spp. in Texas. Monitoring sites include the downtown Salado springs (Anderson, Big Boiling, Little Bubbly, and Side springs) and at Robertson Springs in collaboration with Texas Parks and Wildlife Department. This year we have added monitoring at Solana Ranch which has a stable population of Salado salamanders. After five years of monitoring, more information about the species is known than in previous years.



Data from the monitoring work indicate Salado salamanders associate with cobble and gravel substrates and occasionally within watercress flowing over these areas. The Salado salamanders known habitat expanded in 2015 when they were found at Anderson Spring, the most downstream spring in the downtown area. Although know to be within the same flow path as Big Boiling, salamanders had not been previously captured from Anderson Spring. Finding other springs with Salado salamanders is one of the long term goals for this monitoring effort.

Since 2015, 151 Salado salamanders have been documented at Anderson, Side, and Big Boiling springs, along with numerous spring outlets from Robertson Springs. Although the species can be found on the surface, surface numbers are low when compared to other sites to the south of this area. Forty six percent of the 151 salamanders were caught exiting the spring outlets, not on the surface. As with most *Eurycea* spp. in Texas, the population lives underground in the aquifer.

The TXFWCO is collaborating with Dr. Chris Nice of Texas State University on a population genetics project processing the genomic data of 180 salamanders for approximately 10,000 genomic markers. The data will provide information on how to manage, and if need be, prioritize the springs regarding salamanders. This project will determine which spring sites contribute more to the diversity of the species, providing more ecological resiliency. Data will be used to quantify patterns of gene flow between spring sites and provide rough estimates of population size overall and within spring sites.

We are grateful for the partnership and support from the Coalition (Clearwater Underground Water Conservation District, Bell County, Village of Salado, and the Salado Water Supply Corporation).

Pete Diaz, Aquatic Biologist
U.S. Fish and Wildlife Service

WHY DOES MY WELL WATER SMELL LIKE ROTTEN EGGS?

The question is often coming from private well owners across Bell County who have reached out to us for an explanation. One famous well driller's answer has been "it is what it is!" While that answer is justifiable it does not explain why the water smells or how to get rid of the smell.

Why does my water suddenly smell like rotten eggs? The reason your water probably smells like rotten eggs is because it contains some traces of hydrogen sulfide. Even extremely small amounts of hydrogen sulfide can cause your water to have quite the odorous smell. In most cases this smell occurs due to a build-up of hydrogen sulfide in your hot water heater. Hydrogen sulfide gas can result from a number of different sources. It most often occurs naturally in our source aquifer known as the Trinity. It can also be produced by certain sulfur bacteria in the groundwater, in the well, or in the water distribution system.

Then how can I remove the hydrogen sulfide from my well water? Methods to reduce or remove hydrogen sulfide include activated carbon filtration, shock chlorination, ion exchange, manganese greensand filtration, oxidation, oxidizing filtration, ozone treatment, and water heater modification. Shock treatment of your well on a regular basis can be helpful.

For more information on shock chlorination, go to: <https://agrillifeextension.tamu.edu/library/water/shock-chlorination-of-wells/> and read the article authored by Dr. Mark McFarland and Dr. Monty Dozier with Texas A&M AgriLife Extension.

Join the District for the 19th Annual Bell County Water Symposium

November 6, 2019 8:00 A.M. --- 4:00P.M.
Texas A&M University - Central Texas

****This event is free but requires RSVP by November 1st****

"Collaborative Discussion and Planning Water Needs for the Future"

8:00 a.m. - Registration

Welcome, Introduction & Theme of the Day

Honorable David Blackburn, Bell County Judge
Leland Gersbach, Board President, Clearwater UWCD

State of the District: Successes, Concerns and Actions

Dirk Aaron, General Manager, Clearwater UWCD

Whiskey's for Drinkin', Water's for Fightin': The Tumultuous History and Collaborative Future of Water Management Texas

Dr. Robert Mace, Interim Executive Director & Chief Water Policy Officer, Texas State University

Texas Water Development Board Update: Science, Infrastructure & Support

John Dupnik, Deputy Executive Administrator, Office of Water Science and Conservation, TWDB

Bell and Williamson County Leadership Panel

Moderator: Leah Martinsson, Executive Director, TAGD
Honorable David Blackburn, Bell County Judge
Honorable Bill Gravell, Jr., Williamson County Judge
Commissioner Valerie Covey, Williamson County Commissioner, Pct. 3
Commissioner Bobby Whitson, Bell County Commissioner, Pct. 2

Bell and Burnett County Legislative Panel

Moderator: Leah Martinsson, Executive Director, TAGD
Senator Dawn Buckingham, District 24
Representative Brad Buckley, District 54
Representative Hugh Shine, District 55
Representative Terry Wilson, District 20

12:00 p.m. - Lunch

Welcome Address, Legislative Update and Special Recognitions

Representative Lyle Larson, Chairman of House Natural Resource Committee, District 122

Caring, Collaboration and Outreach for the Future - Hill County Alliance
Charlie Flatten, Water Policy Program Manager, Hill County Alliance

State of the Brazos River Basin and BRA

David Collinsworth, General Manager/CEO, BRA

Groundwater Science for Sound Policy

Dr. Joe Yelderman, P.G., Professor of Geology, Baylor University

GCD Case Study of Management and Policy

Doug Shaw, General Manager, Upper Trinity GCD
Dirk Aaron, General Manager, Clearwater UWCD

----- Event Sponsors -----

Bell County Engineers Office **Lloyd-Gosselink Attorneys at Law**
HALFF Associates **LRE Water, LLC**
KPA Engineers **WSP USA**
Clearwater Underground Water Conservation District
Texas AgriLife Extension Service
Texas A&M University - Central Texas



P.O. Box 1989
Belton, TX 76513



SUMMER INTERNSHIP...THE SO WHAT?

This is the final fall of my time at Texas Tech university in Lubbock Texas. I come from many parts of the Midwestern United States. I graduated high school from a farmer community in Marion Texas.

For 3 months this summer I completed an internship at your groundwater conservation district in Bell County. Clearwater Underground Water Conservation District, otherwise known as CUWCD, in Belton. CUWCD is responsible for the management of groundwater in Bell County.

According to General Manager, Dirk Aaron, their mission is to, "develop and implement an efficient, economical and environmentally sound groundwater management program to protect and enhance the water resources of the district." This internship has been instrumental in my college career and has provided invaluable knowledge that will help me in the future as I potentially pursue jurisprudence degree in Water Law.

The elected Board of Directors supported the internship financially but had specific expectations lined out by Mr. Aaron. Three main goals and specific tasks were outlined for me by Clearwater Underground Water Conservation District as follows:

1. Develop Communication platform such as Mail Chimp or alternative option based on my current research and recommendation.
2. Assist in developing water conservation monthly conservation bullets with CUWCD logo in place. (sources TWDB, TWCA and Texas Water Foundation/ TAGD)
3. Research the Water Education and Outreach Communities in Texas and develop social media recommendation for ongoing GM plug and play efforts.

To accomplish these prompted goals and tasks, I used numerous resources such as Mail Chimp Marketing Platform, TWDB, TWCA, social media outlets (Twitter and Instagram), US Drought Monitor, TCEQ, CUWCD and many other resources to gather as much pertinent information that could be included in our monthly electronic newsletter that would be an outreach source to our general public and water conservation enthusiasts.

I was also privileged to travel with the Clearwater staff to educational learning events that focused on youth knowledge in water, environment

and basic science to increase the awareness of water conservation. I also was very active in meetings, seminars and conferences across the state to get a grasp on the water industry and network with business professionals that have the same goals at CUWCD that will directly correlate with my future pursuing a law degree in water law.

The final report to the Board of Directors was presented on my behalf on August 28, 2019 in Belton. My report, findings and conclusions can be viewed on Clearwater's website <http://www.cuwcd.org>

When you read my formal report you will find that I have learned a great deal of knowledge while I have been here but there are three taken away points from this experience that I was not aware of when I started and were standout findings that young professionals need to be engaged with in the context of Water!

1. The disconnect of information between the legislators, water experts, and the general public is so vast and disturbing, necessitating the need for engagement of peacemakers. We need a new generation of experts willing to tackle the problems with engineered solutions that direct policy.
2. The political divide in the Texas Legislature was shocking. It was eye-opening to see politicians be combative towards issues when they refuse to learn all the angles of the concept or understand the real facts of the situation instead, they tended to lean towards convenient facts, an emotional view or stance on the matter that was simply defensive.
3. The push and desire to store and conserve is a battle when times are plentiful. As many have realized, the last few months we have received more moisture than we have received in a very long time. Practices like Aquifer Storage and Recovery otherwise known as ASR are unique and innovative ways to store water that we can be using when we are in severe drought.

In the future, I believe that Clearwater will stay engaged on social media, especially Twitter, as well as keep the electronic newsletter updated as much as possible. Twitter serves as a platform that they can push out real-time news to the general public. Staying engaged with help merge the gap between our experts and our citizens.

Reagan Langemeier, Summer Intern
Texas Tech University (Class of 2019)



Site visit to SAWS ARS facility in Bexar and Wilson Counties.

Appendix H

CUWCD 2019 Education and Outreach Events

Date	People	Event Information	Presentation	Booth
1/22/19	225	Texas A&M AgriLife Crops Conference		X
2/20/19	120	Saegert Elementary S.M.A.R.T. Day	X	X
3/7/19	50	Miller Heights Elementary Career Day	X	X
3/29/19	60	Nolan Creek School Earth Day Event	X	X
4/5/19	150	Month of the Military Child Earth Fest (Fort Hood)		X
4/12/19	220	Fort Hood Earth Day	X	X
4/15/19	12	Committee of 12 (C12)	X	
4/16/19	37	Killeen Lions Club	X	
5/29/19	25	Blackland Research & Extension Field Day		X
5/31/19	133	Killeen Rotary Club	X	
6/12/19	570	STEAM Day Event at Harker Heights Library	X	X
7/16/19	22	Texas A&M - Central Texas STEM Camp	X	X
7/19/19	50	Killeen Rotary Club	X	X
8/28/19	20	Soil Regen Forum		X
8/29/19	140	Soil Regen Forum	X	
9/19/19	65	Texas A&M AgriLife Conservation Expo		X
10/19/19	65	Bell County Master Gardener's Plant Sale		X
10/21/19	125	North Belton Middle School	X	X
10/22/19	107	North Belton Middle School	X	X
10/31/19	140	North Belton Middle School	X	X
11/6/19	157	19 th Annual Bell County Water Symposium	X	X
Total reach	2,493			

Appendix I

Results of Groundwater Samples in CUWCD Lab

Test Date	District Well #	Latitude	Longitude	Elevation	Depth (ft)	Aquifer ²	Coliform Bacteria ¹	Ecoli	Conductivity (µs/cm)	Total Dissolved Solids	Salinity (mg/L)	pH	Alkalinity (mg/L)	Hardness (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Phosphate (mg/L)	Sulfate ⁴ (mg/L)	Fluoride ⁴ (mg/L)	
1/8/2019	E-02-2640G	30.934903	-97.408948	590.29	50	Alluvium	Presence	Presence	720	351		8.1	300	340	-0.004	13.2	0.07	19	0.27	
1/12/2019	E-18-016P	30.936491	-97.597305	700.45	870	Middle Trinity	Not Tested	Not Tested	1488	739		8.98	360	80	0.002	9.9	0.09	195	2.5	
1/21/2019	E-18-052P	30.945469	-97.802863	891.09	570	Middle Trinity	Not Tested	Not Tested	1602	802		8.84	400	80	0.005	6.4	0.06	162	5	
1/24/2019	N1-16-004P	30.928611	-97.666743	713.86	595	Middle Trinity	Not Tested	Not Tested	1952	978		8.89	360	120	0.004	6.4	0.12	488	5.5	
1/25/2019	E-18-095P	30.928611	-97.785277	861.83	500	Middle Trinity	Not Tested	Not Tested	1647	826		8.42	340	220	0.274	11	0.2	472	4	
2/13/2019	E-06-046P	30.97381	-97.48211	596.17	210	Edwards (BFZ)	Absence	Absence	2220	1123		8.69	380	100	0.003	1.21	0	370	5	
2/13/2019	E-10-051P	30.941054	-97.607789	726.4	870	Middle Trinity	Absence	Absence	1371	680		9.08	360	120	0.005	0.733	0.01	184	2.1	
2/26/2019	E-18-049P	30.965275	-97.791174	818.84	515	Middle Trinity	Not Tested	Not Tested	2172	1100		8.79	400	100	0.022	0.133	0.06	213	6	
2/27/2019	E-03-329P	30.923666	-97.587281	707.47	900	Middle Trinity	Not Tested	Not Tested	1337	665		8.96	340	80	0.009	1.26	0.86	163	2.85	
2/28/2019	E-17-061P	30.989825	-97.492237	534.66	120	Edwards (BFZ)	Not Tested	Not Tested	786	384		8.34	300	360	0.006	0	0.09	63	0	
2/28/2019	E-19-027P	30.9454	-97.59301	727.47	140	Edwards (BFZ)	Not Tested	Not Tested	734	356		7.84	360	320	0.003	12.4	0.24	10	0.5	
2/28/2019	E-19-026P	30.94128	-97.58615	701.51	120	Edwards (BFZ)	Not Tested	Not Tested	739	411		7.98	400	420	0.006	9.4	0.33	15	0.5	
3/18/2019	E-18-107P	30.883003	-97.607774	753.5	140	Edwards (BFZ)	Not Tested	Not Tested	552	271		8.14	280	260	0.007	0.095	0.24	19	0.1	
3/19/2019	E-18-108P	30.946559	-97.80302	893.14	635	Middle Trinity	Not Tested	Not Tested	1899	959		8.99	460	40	0.003	0.068	0.61	87	5.9	
3/26/2019	E-02-049P	30.924348	-97.579208	694.35	120	Edwards (BFZ)	Absence	Absence	724	352		8.54	320	360	0.003	5.18	0.15	18	0.2	
4/9/2019	E-18-032P	30.946428	-97.532952	564.23	80	Edwards (BFZ)	Not Tested	Not Tested	728	357		8.15	340	380	0.002	3.5	0.28	19	2.7	
4/9/2019	E-18-093P	30.990222	-97.433841	484.26	440	Edwards (BFZ)	Not Tested	Not Tested	2106	1064		7.83	440	400	0.4	300	0	59	0	
4/30/2019	E-15-059P	30.914851	-97.609598	665.24	800	Middle Trinity	Not Tested	Not Tested	1342	667		9.09	320	80	0.007	1.06	0.01	148	2.65	
5/13/2019	M-19-002P	30.965058	-97.788392	814.3	467	Middle Trinity	Not Tested	Not Tested	1363	677		9.65	180	40	0.02	35.6	0.57	182	3.6	
5/13/2019	E-18-094P	30.938629	-97.590658	697.71	900	Middle Trinity	Not Tested	Not Tested	1435	713		8.92	340	80	0.004	3.9	0.65	179	2.4	
5/13/2019	E-19-052P	30.939848	-97.59362	677.84	860	Middle Trinity	Not Tested	Not Tested	2188	1106		8.33	420	160	0.005	14.5	0.51	447	0	
5/13/2019	E-19-033P	30.911925	-97.669563	877.66	840	Middle Trinity	Not Tested	Not Tested	1532	767		8.33	320	120	0	6.2	0.42	290	2	
5/15/2019	E-19-038P	30.972992	-97.483887	576.83	200	Edwards (BFZ)	Not Tested	Not Tested	2149	1084		8.72	380	100	0.003	12.6	0.51	337	5.9	
5/15/2019	E-14-035P	30.974342	-97.484517	582.3	220	Edwards (BFZ)	Not Tested	Not Tested	1890	950		8.91	360	140	0.012	4.3	0.6	298	4.6	
5/21/2019	E-02-325AG	30.900815	-97.694857	852.94	760	Middle Trinity	Presence	Presence	3360	1730		8.41	420	340	0.004	2.15	0.01	1015	6.36	
5/22/2019	N1-18-003P	31.09707	-97.650341	764.65	605	Middle Trinity	Not Tested	Not Tested	545	265		10.51	120	40	0	0.059	0.36	51	0	
6/6/2019	E-12-014P	31.01826	-97.489361	578.22	160	Edwards (BFZ)	Absence	Absence												
6/7/2019	E-16-063GU	30.974858	-97.806488	825.12	445	Middle Trinity	Absence	Absence	1451	723		8.91	85	100	0.016	0.69	0	197	4.08	
6/10/2019	E-02-1149P	30.924643	-97.697798	797.53	520	Middle Trinity	Absence	Absence	749	373		8.15	280	340	0.003	28.7	0.38	69	0.5	
6/10/2019	M-19-001P	30.965003	-97.788677	815.37	637	Lower Trinity	Not Tested	Not Tested	2580	1312		8.31	460	80	0.007	3.2	0.5	140	5	
6/11/2019	E-19-051P	30.881601	-97.611559	737.09	887	Middle Trinity	Not Tested	Not Tested	1100	540		9.11	340	80	0.003	0.021	0.01	94	3.95	
6/14/2019	E-19-034P	30.88779	-97.60014	743.52	910	Middle Trinity	Not Tested	Not Tested	1132	560		8.85	320	80	0.009	0.004	0.04	102	2.45	
6/17/2019	E-19-031P	30.971247	-97.803921	822.52	635	Lower Trinity	Not Tested	Not Tested	2570	1306		8.56	440	60	0.003	1.6	0.52	122	5.5	
6/17/2019	E-19-046P	31.087682	-97.607789	737.84	725	Middle Trinity	Not Tested	Not Tested	5820	3070		8.36	460	460	0.183	0	0.28	1644	6.5	
6/24/2019	E-19-046P	31.087682	-97.607789	737.84	725	Middle Trinity	Not Tested	Not Tested	5790	3040		8.36	460	360	0.005	0	0.05	1458	6.5	
6/25/2019	E-17-016P	30.934955	-97.606342	725.51	865	Middle Trinity	Not Tested	Not Tested	1489	740		9.14	320	80	0.003	0	0.67	178	3.25	
7/11/2019	E-19-003P	30.996179	-97.489901	520.21	100	Edwards (BFZ)	Not Tested	Not Tested	775	380		8.41	280	340	0.005	0.002	0.08	61	0	
7/11/2019	E-19-113P	30.956087	-97.501746	588.96	130	Edwards (BFZ)	Not Tested	Not Tested	1141	703		9.03	340	120	0.003	0.015	0.14	149	0	
7/16/2019	E-04-027G	30.9373515	-97.5002268	610.67	170	Edwards (BFZ)	Absence	Absence	1189	586		8.99	300	220	0.005	1.4	0.5	134	3	
7/16/2019	E-19-078P	30.971301	-97.603127	783.1	100	Edwards (BFZ)	Not Tested	Not Tested	671	327		8.31	240	320	0.002	9.9	0.26	9	0	
7/16/2019	E-19-077P	30.942651	-97.512584	609.62	200	Edwards (BFZ)	Not Tested	Not Tested	842	413		8.55	260	200	0.008	4.9	0.55	73	3	
7/17/2019	E-18-048P	30.9737	-97.609548	829.99	100	Edwards (BFZ)	Not Tested	Not Tested	563	273		8.57	260	280	0.001	2.51	0.08	15	0.07	
7/26/2019	E-02-3413G	30.90922269	-97.38390795	557.43	30	Alluvium	Presence	Absence	716	349		8.21	320	240	0	9.47	0.07	21	1.01	
8/5/2019	E-19-119P	30.9451	-97.58626	722.78	900	Middle Trinity	Not Tested	Not Tested	1588	793		8.91	340	80	0.006	11.3	0.11	216	3	
8/6/2019	E-19-053P	30.816381	-97.331572	538.32	36	Alluvium	Not Tested	Not Tested	1495	715		8.73	380	440	0.001	17.6	0.08	97	2	
8/7/2019	E-09-032P	30.992059	-97.437151	500.15	520	Edwards (BFZ)	Not Tested	Not Tested	4030	2086		8.89	420	160	0.005	5.7	0.34	821	7.5	
8/8/2019	E-04-028P	30.928655	-97.606174	750.42	860	Middle Trinity	Absence	Absence	1628	815		7.95	340	100	0	0	0.05	258	2.72	
8/8/2019	E-19-129G	30.908338	-97.624081		400	Upper Trinity	Absence	Absence	2310	1168		7.52	380	400	0.016	1.33	0.05	512	2.6	
8/8/2019	E-16-007P	30.914133	-97.628186	743.45	438	Upper Trinity	Presence	Absence	2610	1328		7.46	480	460	0	1.94	0.09	599	3.24	
8/12/2019	E-19-120P	30.915171	-97.76474	896.94	720	Lower Trinity	Not Tested	Not Tested	1736	870		8.41	420	80	0.086	0.067	0.07	175	5.5	
8/16/2019	E-19-128P	31.079045	-97.444223	504.81	680	Alluvium	Not Tested	Not Tested	781	382		7.38	340	360	0	3.79	0.15	18	0.31	
8/26/2019	N1-18-004P	30.930386	-97.720773	789.05	685	Lower Trinity	Not Tested	Not Tested	2330	1180		8.73	400	20	0.004	0.093	0.03	37	5.5	
9/3/2019	N2-10-001P	30.927526	-97.429735	626.8	2585	Lower Trinity	Not Tested	Not Tested	1764	885		8.56	380	40	0.002	0.073	0	192	4.1	
9/12/2019	E-19-123P	31.050791	-97.536233	783.95	100	Edwards Equivalent	Not Tested	Not Tested	871	429		7.83	300	360	0.002	21.5	0.36	12	1.5	
9/12/2019	E-19-130P	31.00473	-97.481203	533.11	140	Edwards (BFZ)	Not Tested	Not Tested	770	376		7.67	320	400	0.005	7.6	0.53	58	1.5	
9/12/2019	E-19-218P	30.94555	-97.59123	726.29	900	Middle Trinity	Not Tested	Not Tested	1564	781		8.21	140	420	0.006	2.4	0.54	214	3.5	
9/17/2019	E-19-189GU	31.016854	-97.794178	869.97	610	Lower Trinity	Not Tested	Not Tested	2009	1013		7.84	380	320	0	0.977	0.02	533	7.2	
9/24/2019	E-19-005G	31.001348	-97.455168	469.56	140	Edwards (BFZ)	Presence	Absence	857	409		7.41	360	360	0.008	14.8	0.22	44	0.5	
9/24/2019	E-02-382G	30.989181	-97.484304	605.18	177	Edwards (BFZ)	Not Tested	Not Tested	1377	692		8.21	320	180	0.007	3.2	0.82	141	3.5	
9/25/2019	E-19-220G	30.916719	-97.161719	543.4	30	Austin Chalk	Absence	Absence	794	388		7.86	320	320	0.001	0.651	0.04	33	0.53	
10/7/2019	E-19-122P	30.942604	-97.602146	725.01	140	Edwards (BFZ)	Not Tested	Not Tested	682	332		7.49	340	340	0.007	13.5	0.15	7	0.2	
10/7/2019	E-19-035P	30.936161	-97.584979	681.6	120	Edwards (BFZ)	Not Tested	Not Tested	888	448		8	320	280	0.005	8.3	0.17	85	1.4	
10/8/2019	E-19-126P	30.9648	-97.61085	812.2	840	Middle Trinity	Not Tested	Not Tested	1294	643		8.78	340	100	0.001	0.037	0.06	169	2.5	
10/7/2019	E-17-039P	30.93394	-97.495587	688.82	400	Edwards (BFZ)	Absence	Absence	1988	1008		8.12	340	140	0	0	0.02	321	6.28	
10/9/2019	E-19-028P	30.856601	-97.569951	847.43																

10/17/2019	E-19-223P	31.040275	-97.902062	907.59	408	Upper Trinity	Not Tested	Not Tested	3540	1885		8.26	340	240	0	0.001	0.04	664	4.2
10/29/2019	E-18-014P	30.91958	-97.61276	730.76	840	Middle Trinity	Presence	Absence	1348	672		8.58	320	80	0.002	0.025	0.04	153	3.7
11/19/2019	E-19-227P	30.972141	-97.613516	833.83	920	Middle Trinity	Not Tested	Not Tested	1208	599		9.8	360	80	0.001	12.8	0.37	2	
11/19/2019	E-19-226P	30.97325	-97.60672	816.29	120	Edwards (BFZ)	Not Tested	Not Tested	678	331		7.72	340	3450	0.006	14.2	0.06	7	0.2
11/26/2019	E-13-029P	31.159865	-97.466452	687.21	930	Middle Trinity	Absence	Absence	3320	1693		8.34	400	220	2.49	0.01	0.12	869	8.15
12/2/2019	E-19-230P	30.911142	-97.775581	868.19	580	Middle Trinity	Not Tested	Not Tested	2430	1253		7.95	360	260	0.008	0.054	0.07	691	5.1
12/9/2019	E-19-004P	30.986164	-97.516599	661.61	160	Edwards (BFZ)	Not Tested	Not Tested	638	321		8.23	300	300	0.004	0.042	5.17	36	1.17
12/10/2019	E-03-449P	30.993922	-97.49459	577.95	960	Middle Trinity	Absence	Absence	1825	924		8.51	360	120	0.001	0.021	0.04	311	3.4
12/16/2019	E-02-3141G	31.013652	-97.400789	502.04	30	Alluvium	Presence	Presence	1138	586		7.42	400	20	0.001	6.67	0.17	31	0
12/19/2019	E-19-045P	30.889829	-97.606535	734.17	80	Edwards (BFZ)	Not Tested	Not Tested	489	238		8.32	220	240	0.004	0.443	0.03	18	0.2

Appendix J

Rainwater Harvesting



Rainwater harvesting is an innovative alternative water supply approach anyone can use. Rainwater harvesting captures, diverts, and stores rainwater for later use.

Implementing rainwater harvesting is beneficial because it reduces demand on existing water supply, and reduces run-off, erosion, and contamination of surface water.

Rainwater can be used for nearly any purpose that requires water. These include landscape use, stormwater control, wildlife and livestock watering, in-home use, and fire protection.

A rainwater harvesting system can range in size and complexity. All systems have basic components, which include a catchment surface, conveyance system, storage, distribution, and treatment.

For more information, please visit the [Texas A&M AgriLife Extension – Rainwater Harvesting website](#) and the [Texas Water Development](#)

[Board – Rainwater Harvesting website.](#)

Related Resources



Rainwater Harvesting Book: Homeowners and landowners can construct systems to capture, store and use rainwater to water their landscape plants.



SEARCH CUWCD



Appendix K

Brush Control

Brush Busters is a cooperative program of the Texas AgriLife Research and Extension Service to expedite the adoption of Tactical Brush Management Systems (TBMS) technology.

Brush Busters methods are easily understood, even by those with little or no previous experience in brush control. We recommend only "select" treatments capable of killing at least 7 out of 10 of the plants treated. Brush Busters methods make every attempt to keep equipment costs and complexity to a minimum, and whenever possible, to use non-restricted herbicides. One-page pamphlets are available from most County Extension offices that describe, in a simple 3-step process, the Brush Busters control methods for mesquite, pricklypear and cedar. Videos are available for checkout through most County Extension offices that demonstrate the Brush Busters control methods. For those who are computer literate, a CD-ROM Brush Busters program is available that uses interactive video, audio and graphics to teach the use of Brush Buster methods for mesquite control.

• Cedar

- [Leaf Spray Method](#)
- [Spot Spray Method](#)
- [Top Removal Method](#)
- [How to Estimate Costs for Controlling Small Cedar](#)

• Cut Stumps

- [Cut Stump Spray for Hardwood Species](#)
- [Cut Stump Spray for Redberry Cedar](#)

• Huisache

- [Leaf Spray Method](#)
- [Stem Spray Method](#)

• Macartney Rose

- [Leaf Spray Method](#)

• Mesquite

- [Leaf Spray Method](#)
- [Stem Spray Method](#)
- [How to Estimate Cost for Controlling Mesquite](#)

• Pricklypear

- [Pad or Stem Spray Method](#)
- [Top Removal Method](#)
- [How to Estimate Costs for Controlling Pricklypear](#)

• Saltcedar

- [Leaf Spray Method](#)
- [Stem Spray Method](#)

• Tallowtrees

- [Leaf Spray Method](#)
- [Stem Spray Method](#)

• Yucca

- [Herbicide + Oil Whorl Spray](#)
- [Undiluted Whorl Spray](#)

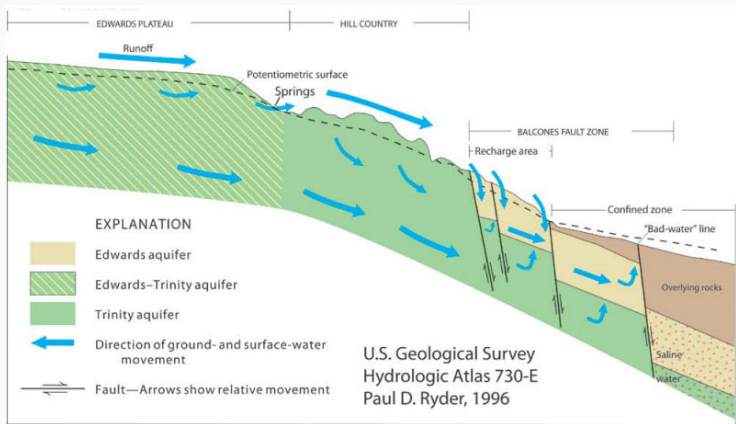
• Equipment



SEARCH CUWCD

Appendix L

Recharge Enhancement



Recharge enhancement is an important tool to help encourage recharge of our groundwater. Urban development decreases direct recharge from precipitation but introduces new sources of water which, in most instances, can increase groundwater recharge if applied properly.

[Best Management Practices for Recharge Enhancement](#)

[Onion Creek Recharge Enhancement](#)



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Appendix M

Aquifer	Adopted DFC	DFC Period	Annual DFC	Current Trend	Current Status
Edwards BFZ	Minimum of 100 ac-ft/mo of Salado Spring Discharge	50 Years	N/A	-0.2 ft/yr of Average Drawdown	
Upper Trinity	155 Feet of Average Drawdown		-3.1 ft/yr of Average Drawdown	-0.57 ft/yr of Average Drawdown	2.53 feet below DFC
Middle Trinity	286 Feet of Average Drawdown		-5.72 ft/yr of Average Drawdown	-3.17 ft/yr of Average Drawdown	2.6 feet below DFC
Lower Trinity	319 Feet of Average Drawdown		-6.38 ft/yr of Average Drawdown	-6.51 ft/yr of Average Drawdown	0.13 feet above DFC