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Roland Ruiz EAA General Manager

Merriam-Webster offers these words to help define the word balance for us: "stability" or "an esthetically pleasing integration of elements."

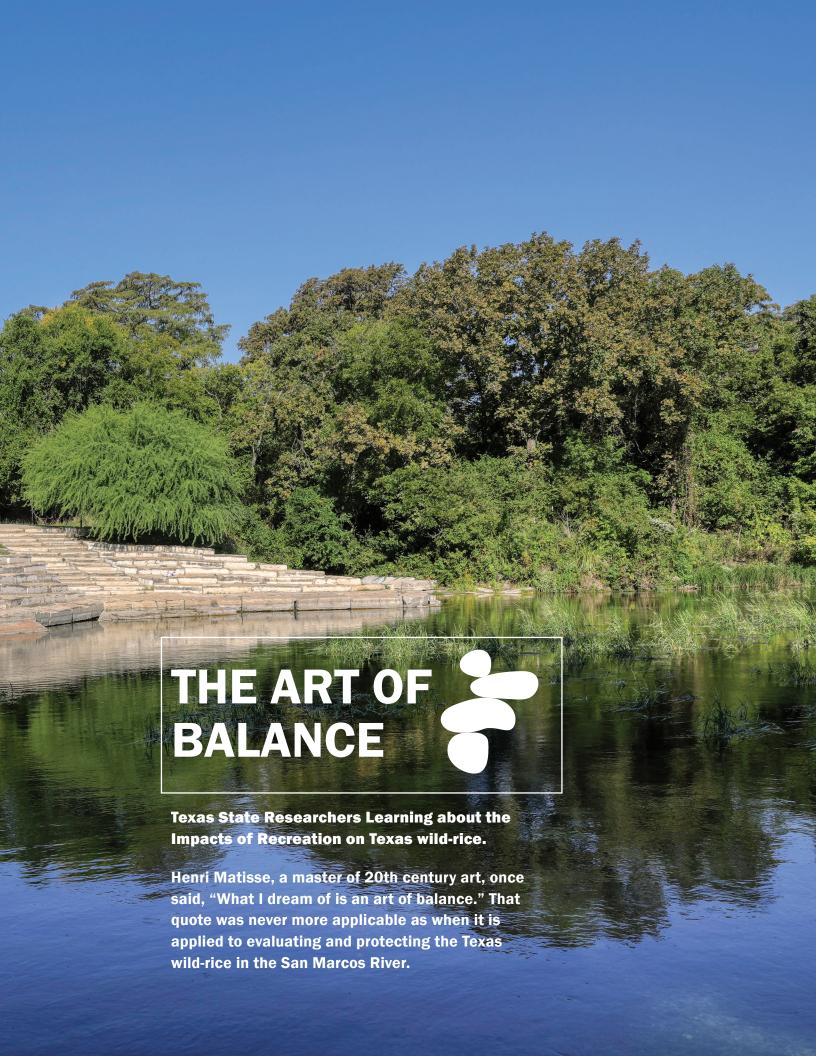
Partly by design and partly by necessity, balance has been the underlying influence, if not the intent, of the EAA's work for a quarter century. It was such balance that legislators sought in crafting a solution to the issue of uncertainty around the Edwards Aquifer when they created and passed the Edwards Aquifer Authority Act in 1993, and which then led to the beginning operations of the EAA in 1996.

Ever since, we have further learned that maintaining balance can serve as an antidote to the instability that uncertainty often creates. Indeed, the wisdom of the Texas Legislature in its thoughtful approach over a quarter century ago has been affirmed through experience, as time and again we've realized the value of balance in carrying out the EAA mission. This is the balance realized between regulation and selfmanagement; between education and understanding; and between conservation and enhancement.











ver the summer, Texas State University Geography Department faculty and graduate students took advantage of the COVID-19-reduced recreation on the San Marcos River to take a close look at how Texas wild-rice fared with practically no human contact. Observations made during this study have introduced the groundwork for a future community discussion regarding the proper balance of recreation and the preservation of the ecological system.

"We took the opportunity of the COVID restrictions on recreation in the river to learn more about Texas wild-rice and how it recovers from people swimming through it, wading on it and floating over it," said Dr. Kimberly Meitzen, an associate professor with Department of

Geography at Texas State. "Additionally, we worked with Dr. Jason Julian in our department and his team who are studying the social aspects of the river. We all know that the San Marcos River is one of the most popular places in this part of Texas for tubing and other recreation. But, there is no escaping the fact that the river is also part of an environmentally-sensitive ecosystem home to many endangered species, including Texas wild-rice.

So, in the end, we hope our research helps create the dialogue between the San Marcos community, Edwards Aquifer Habitat Conservation Plan team and other stakeholders on how visitors and the ecosystem viably coexist."



Texas wild-rice (TWR) is a perennial aquatic grass. It is only found in the San Marcos River and was one of the first Texas plants listed (1978) on the U.S. Environmental Protection Agency's Endangered Species List. The full range for Texas wild-rice extends from the

headwaters of the San Marcos Springs to the just upstream of the San Marcos River's confluence with the Blanco River. However, it is most abundant in the first two miles of the upper San Marcos River.

The plant grows submerged underwater and becomes emergent when the leaves and flowering stalk grow above the water surface. The TWR leaves are referred to as "culms" and can grow 1-2 meters in length. TWR only flowers in its

TEXAS WILD-RICE
REPRODUCES
SEXUALLY THROUGH
SEED PRODUCTION OR
THROUGH ASEXUAL
PROPAGATION BY
TWR FRAGMENTS
BREAKING OFF
AND REPLANTING
DOWNSTREAM.

emergent state, with separate male and female flowers on the flowering stalk.

The plant grows submerged underwater and becomes emergent when the leaves and flowering stalk grow above the water surface.







Texas wild-rice can grow in a range of flow depths from 0.5 - > 2 meters, and requires clear, cool, and good-quality flowing water to survive which the San Marcos Springs provide. TWR an important part of the river's ecosystem as it enhances oxygen in the water and creates physical habitat for a diversity of aquatic organisms.



"Although we were specifically looking at changes linked to varied recreation pressures on Texas wild-rice from different phases of the river parks opening and closing, we want to use the data we've gathered over that past few months as means to create a long-term research effort," Meitzen noted. "We want to observe seasonal changes in the growth and reductions of TWR based on recreational concentrations.

The drone data we are gathering with Dr. Jennifer Jensen in the Geography Department and her flight crew will also help us with defining areas in the river that may need more conservation attention.

FOR EXAMPLE, WE MIGHT **DISCOVER THAT OUR SCIENTIFIC AREAS WHICH TUBERS MUST GO AROUND MIGHT NEED TO** BE INCREASED IN NUMBER, **ENLARGED OR MAYBE MOVED UP** OR DOWN THE RIVER TO BETTER PROTECT THE [PLANT].



We'll also be keeping track of how various flow levels play into the overall evaluation of how we best protect Texas wild-rice. But, one thing is for certain, we must work hand-in-hand with how the community views the river in order to hopefully find that proper balance for everyone."

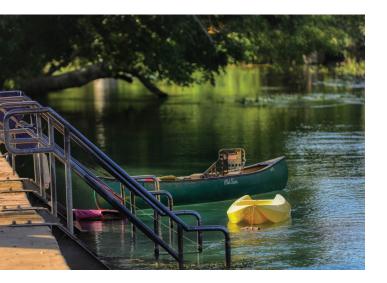
Dr. Julian explained that his team has been looking at the social demand aspects of the San Marcos River since 2015. Since then, they have conducted approximately 3,200 surveys with people visiting the river. "We know that there has been a great deal of ecological research on the San Marcos Springs and the river. And we know that this is a hugely popular place to recreate.

But, what we haven't really dug into too deeply is what the people who come here want from the river," Julian commented. "Our survey was 49 questions long and took 15-20 minutes to complete, so you can image the time our team has put into gathering this data. But, when you break it all down, visitors don't want to see the river full of people and they love the clear, clean water in the river."

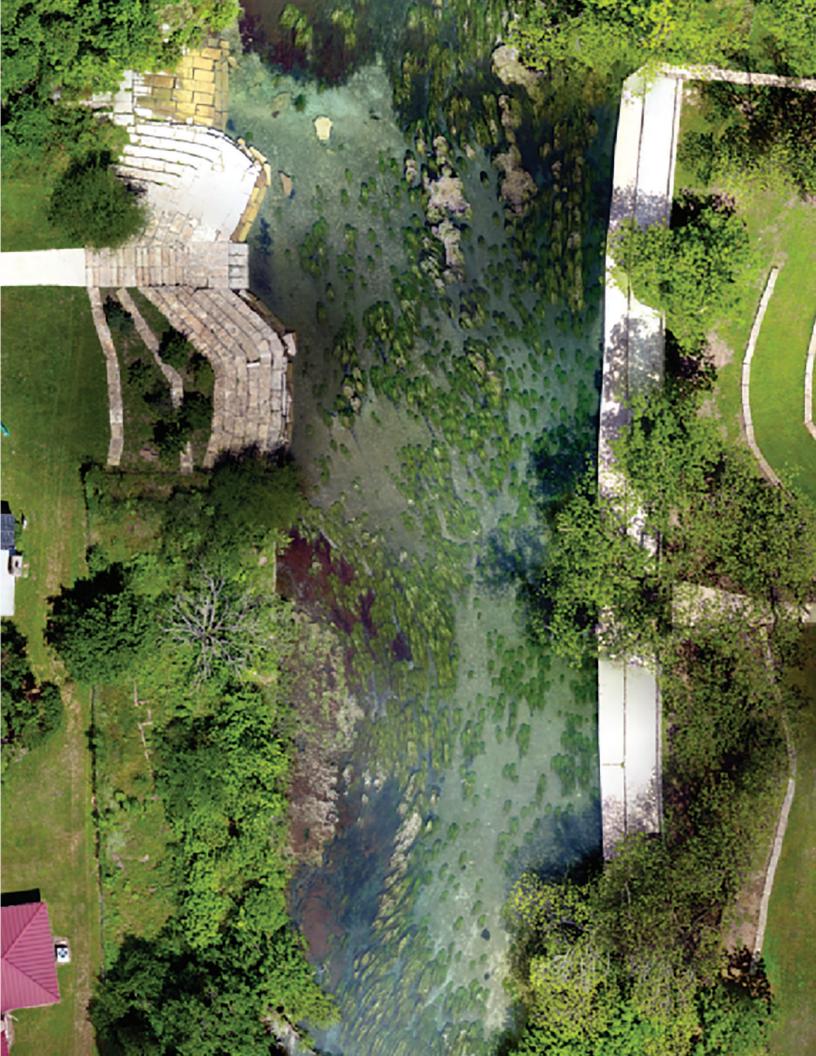
Using drone images of the river, Julian's team was able to calculate that the river has a recreational capacity of about 2,100 people at one time when you include the protected areas of the river where visitors are not allowed.

"There are some places like Jacob's Well, Hamilton Pool and the Blue Hole which have limited visitor access to preserve those special natural resources," Julian said.

"CURRENTLY, THERE ARE NO LIMITS ON VISITORS TO THE SAN MARCOS RIVER AND WE KNOW THAT THE POPULATION **IS ONLY GOING TO GROW** OVER TIME. ESSENTIALLY. **VISITORS AND THE TEXAS WILD-RICE WANT** THE SAME THINGS... **FEWER PEOPLE AND CONSISTENTLY CLEAR WATER. HOW WE MAKE** THEM BOTH HAPPY OVER THE LONG RUN WILL BE A GREAT DISCUSSION TO HAVE."











Out of Sight But Never OUT OF MIND

Bioretention basins come in all shapes and sizes. Some can look like a mere swale in the landscape and others can be highly-landscaped and decorative components of a city's infrastructure. Whatever the outward appearance each bioretention project might be, the engineered water filtering functionality predominantly takes place below ground and out of sight.





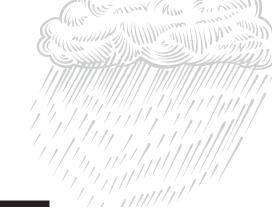
implementing stormwater treatment practices or green stormwater infrastructure back in the early 1990s to help protect the water quality of streams and rivers flowing through communities," explained Mark Enders, the City of New Braunfels Watershed Program Manager.

"Over time, bioretention ponds were studied and proven to be effective at filtering out many pollutants that gather in streets and parking areas and washed away by rainfall. And that is why we located the bioretention pond on the dead-end street of North Houston Avenue that emptied into the Upper Comal [River] Spring Run."

Enders explained that the design of city drainage systems collects stormwater runoff and directs it toward the nearest creek, river or waterbody. The difficult part of that equation is that streets and other impervious surfaces also collect dirt, car oils and grease, pet waste, pesticides from yards and other pollutants as well.







THE GREATEST BENEFIT OF BIORETENTION PONDS IS IN CAPTURING AND TREATING THE "FIRST-FLUSH" OF A STORM EVENT. THE FIRST-FLUSH IS THE INITIAL RUNOFF FROM A STORM EVENT THAT TYPICALLY TRANSPORTS THE MOST POLLUTANTS FROM IMPERVIOUS SURFACES SUCH AS STREETS AND PARKING AREAS.

After a rain, all of those pollutants are swept up in the stormwater runoff and flow directly into a waterbody. That decreases the water quality of the receiving stream and is doubly problematic for environmentally-sensitive areas like the headwaters of the Comal Springs that are home to endangered species.

The North Houston Bioretention Pond Project in New Braunfels involved the removal of approximately 2,000 square feet of street pavement. The existing asphalt was replaced with a bioretention pond that is designed to collect, filter and treat stormwater runoff prior to entering Landa Lake at the Upper Spring Run. Engineers calculated that the bioretention pond would prevent approximately 700 pounds of sediment, solids and associated pollutants from entering Landa Lake each year.

"The project was coordinated through the Edwards Aquifer Habitat Conservation

Plan (EAHCP) as it helps the City of New Braunfels to meet endangered species protection requirements in the Edwards Region's permit with the U.S. Fish and Wildlife Service," Enders said. "In fact, the EAHCP contributed approximately \$100,000 to the project which covered both design and construction". The City of New Braunfels will be responsible for its maintenance in the future.

In San Marcos, the city incorporated several bioretention ponds into a project near its city hall and the San Marcos River which included street improvements, large multi-use paths, reoriented crosswalks and drainage improvements. As part of the project, San Marcos rehabilitated one large bioretention pond and added several other small facilities, planted 50 trees and directed much of the stormwater runoff created east of the San Marcos River to the bioretention ponds for filtering out pollutants before the water eventually reached the San Marcos River.

"We located the bioretention ponds along CM Allen Parkway because it stands between downtown San Marcos and the San Marcos River," City of San Marcos Senior Engineer Greg Schwarz explained. "The downtown area obviously contains a lot of impervious cover that collects and directs stormwater toward the San Marcos River. The filtering ponds are situated and designed to slow down the flow of water and filter out pollutants before the below ground drainage pipes carry a better quality of water to the river."

Schwarz noted that constructing a bioretention pond is not extremely difficult but does require care in making sure the work is done properly and according to specifications. Using an incorrect type of filter fabric between the media and gravel layer, or installing gravel that includes fines, or inadvertently compacting the subgrade where infiltration is wanted can lead to improper function at best or failure at worst.

Proper installation will allow as much water as possible to sift through the underground filtering media while also capturing maximum pollutants. "Most of the funding for the large pond came from the EAHCP and a TCEQ grant acquired by the Meadows Center at Texas State University," Schwarz said. "But now, the City of San Marcos is responsible for maintaining these facilities, and that really is a key piece of this water quality enhancing puzzle.

We will be transitioning the maintenance work from the original contractor to the city. We are studying their techniques and others to make sure that we can efficiently take care of the ponds over time. The effectiveness of the ponds keeping pollutants out of the San Marcos River is only as good as how well they are maintained."

Schwarz talked about how the city continues to focus on aligning development regulations and city projects with the EAHCP goals.

In 2018 the city's Land Development Code was revised to include regulations calling for more post construction stormwater pollution prevention facilities to be included with each project in areas considered to be environmentally sensitive. One unique component of the regulations includes an opportunity for development projects located in and near the downtown area where higher development density is allowed to pay a fee instead of constructing their own water quality structures.

The city uses those dollars to build a regional stormwater pollution reducing system to gather stormwater from a larger area. Additionally, the city looks at creative ways to incorporate stormwater controls in their Capital Improvement Projects.

"These bioretention ponds are a part of a larger effort to ensure we protect our overall environment and especially the most sensitive areas which include the springs systems supporting the endangered species in San Marcos and New Braunfels," Schwarz concluded.

"WE KNOW THAT THE GENERAL PUBLIC IS MORE AWARE OF THESE ISSUES TODAY AND ARE DEFINITELY SUPPORTIVE OF MEASURES WE ARE IMPLEMENTING TO IMPROVE THE NATURAL ENVIRONMENT WHICH SUSTAINS US ALL. THAT IS WHAT WE STRIVE TO DO EACH DAY AND FINDING NEW AND BETTER WAYS TO GET THAT JOB DONE IS ALWAYS TOP OF MIND."







FOR A CLEAN

There aren't many university campuses that can claim they are home to a world-famous and unique environmental landscape like the San Marcos Springs and River system. But, Texas State University in San Marcos certainly can, and it's that allure of biodiversity, importance of endangered species protection and sheer natural beauty that seem to have brought the current Meadows Center Habitat Conservation Plan (HCP) Crew together.



he Meadows Center for Water and the Environment at Texas State sits on the shore of Spring Lake and is where the HCP Crew offices. At that site, more than 200 springs discharge fresh water from the Edwards Aquifer that feed both Spring Lake and the San Marcos River. The springs and river have been designated a critical habitat for five endangered species: fountain darter, Texas blind salamander, San Marcos

salamander, Comal Springs riffle beetle, and Texas wild-rice.

However, due to the Crew's care and persistence, more than 35,000 square meters of non-native plants have been removed bringing nonnative coverage to about 45 percent. The HCP Crew also replaces the non-natives with native plants including the endangered Texas wild-rice.

"When we first started out, pretty much all you could see in the river were non-natives," explained Thomas Heard, who manages the HCP Crew for the Meadows Center. "And because most of the work we do is by hand, we knew that this would be a major challenge. But, over time, we've managed to clear large areas of non-natives and the Texas wildrice we've planted has really taken off. That's been really nice to see."

IN 2013, WHEN THE HCP CREW
BEGAN ITS WORK AS A MAJOR
INITIATIVE OF THE EDWARDS
AQUIFER HABITAT CONSERVATION
PLAN, MORE THAN 70 PERCENT
OF THE AQUATIC ENVIRONMENT
HAD BEEN TAKEN OVER BY NONNATIVE PLANTS, WHICH SEVERELY
REDUCED THE NATURAL HABITAT
FOR THE ENDANGERED SPECIES.

To accomplish its field work, the HCP work from the headwaters to downstream, removing non-natives such as hydrilla and hygrophila as they go. The trailer loads of extracted plants are then taken to a composting site near the campus. The native aquatic plants are grown in the Freeman Aquatic Building at Texas State, and replanted in the river by the HCP Crew.

"What we've found with this top-down approach is that as we clear an area upstream of non-natives and replant with native plants, that the native plants will spread downstream without us having to plant them," Collin Garoutte explained. "While we do have certain square meter goals to meet with planting Texas wild-rice and other native plants in certain reaches of the river, we don't have to do as much active planting of other native plants





because the natives are now filling out the river on their own as they should."

Hydrilla is the primary invasive species in the San Marcos River and can live for up to four years below the substrate of the riverbed if the roots of the plant are not removed. To address that issue, divers must ensure they uproot the plant entirely to prevent it from growing back at a later time.

Hygrophila is another aquatic, invasive species that has the capacity to grow in riparian conditions along the bank, and while not as aggressive as Hydrilla, Hygrophila still poses a threat to the native submerged aquatic vegetation in the San Marcos River.

In addition to battling non-native plants, the HCP members remove floating vegetation mats that originate in Spring Lake and float downstream. Due to the large areas of submerged aquatic vegetation and high rate of growth, regular Spring Lake maintenance



operations include the use of an aquatic harvester to help keep the growth from reaching the surface. This vegetation clearing is done to facilitate glass bottom boats tours, educational classes and dive training programs within the lake.

The aquatic harvester is used to keep the top meter of water clear of vegetation in designated areas and removes approximately 15 to 20 boatloads per month. Consequently, the combination of harvester activities, standard lake operations, and the growth rate of the aquatic vegetation result in large amounts of the vegetation becoming dislodged or broken off, which float downstream and into the San Marcos River.

These large vegetation mats can block sunlight from Texas wild-rice stands which eventually can kill the endangered plant and reduce overall habitat for other species.

"THE JOB THE CREW DOES IS VERY DEMANDING,"
HEARD NOTED. "WE WORK YEAR-ROUND WHICH
MEANS THERE ARE SOME VERY COLD DAYS
WE'RE OUT IN THE RIVER PULLING OUT NONNATIVE PLANTS. THE SAN MARCOS RIVER IS
ALSO A PLACE THE PUBLIC LOVES TO VISIT SO
WE HAVE TO WORK AROUND CROWDS AT TIMES.
THERE ARE AREAS OF THE RIVER THAT ARE
DIFFICULT TO ACCESS.



And then there are the usual things to look out for while working in a river like log jams, glass and fishing hooks, not to mention the occasional wildlife encounter. But, we all love this place.

We graduated from Texas State and now work here on this program. And despite the many challenges, each team member feels a kind of kinship with the San Marcos Springs and River and doesn't really see their work as a job but rather an opportunity to preserve this special environment."



The crisp October weather provided the perfect backdrop for Fall tours of the Educational Outreach Center (EOC) by members of the EAA board of directors, to view ongoing progress. EAA Chairman Luana Bucker and Vice Chairman Benjamin Youngblood III, along with district directors Byron Miller, Deborah Carington, Carol Patterson, Scott Yanta, and Rader Gilleland, were among those who took advantage of the opportunity to inspect the building and the nearby Field Research Park first-hand.

Michael De La Garza, Executive Director of Communications and Development, and Sarah Valdez, STEAM/Outreach Educator, recently hosted Duane Landes, Project Manager of Exhibit Concepts Inc., the exhibits builder, to meet the EAA Staff and plan the potential design and installment of exhibits. The exhibits and displays to be installed at the EOC will follow the guidelines set forth in the Interpretive Plan, which was driven by the EAA's mission to Manage, Enhance, and Protect the Edwards Aguifer. The evolving layout provides for a presentation area in one corner of the main exhibit hall, effectively maintaining a good flow space, in keeping with health precautions and COVID-19 safety guidelines.

The EOC has already begun the process of outfitting a staff of educators, interns, and community volunteers. Staff, led by Valdez, will interact with students, providing presentations, experiments, and experiential moments meant to engage and educate visitors. Preparations have also been made to supply the EOC offices with

everything staff will need, from desks to storage closets, as well as the latest in technology and supplies!

Outside of the EOC walls, a rainwater harvesting system is being installed to supply the demonstration garden with captured rainfall from the roof of the building. Harvest Rain, Inc., is installing 2 tanks, with the main tank holding up to 20,000 gallons, and the smaller tank holding up to 1,000 gallons of water. The smaller tank will be used for demonstration purposes and to teach lessons on rainwater harvesting. A grant provided by the Alliance for Water Efficiency will offer native plants for lessons on water conservation, in and around the typical home.





To continue educating students while the Education Outreach Center is under construction, Communications and Development interns have uploaded science experiments on the EAA's social media sites. Many of the experiments that are conducted come straight from the new EOC Curriculum, Aquifer Agents, and can be performed both in the classroom and at home. The EAA will continue to utilize its social media platform to serve as a virtual classroom while the EOC is being developed.

Just three-quarters of a mile from the EOC, Executive Director of Aquifer Management Services, Mark Hamilton has been setting up the highly anticipated Field Research Park. The western tract of the Field Research Park (FRP) is within walking distance from the EOC and will provide an opportunity for project collaboration



between the two sites. EAA staff at the FRP are designing a myriad of sustainable land management and field research activities, all designed to both improve our understanding of



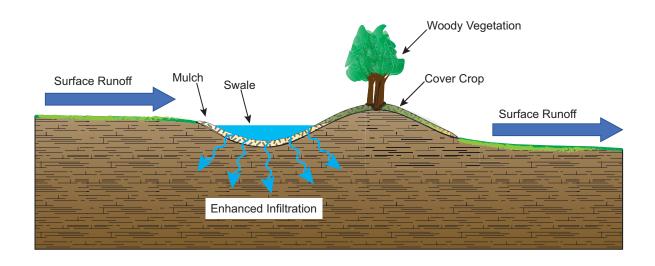
THE INTENT OF THE BERM AND SWALE IS TO SLOW SURFACE RUNOFF, WITH THE HOPE OF IMPROVING BOTH FILTRATION AND INFILTRATION OF THAT SURFACE RUNOFF.

the system and provide opportunity for sustainability of the water resource. Some of the land management strategies can be replicated on a smaller scale at the adjacent Education Outreach Center. To determine what techniques would work well, meticulous measurements and the collection of soil and core samples are also underway.

One of the primary land management strategies at the FRP is the berm and swale system. The intent of the berm and swale is slow surface runoff, with the hope of improving both filtration and infiltration of that surface runoff.

All of this is intended to contribute to improved quality and quantity of groundwater. Essentially, the berm and swale structures are designed to facilitate an improved soil profile by providing more moisture in the near surface, leading to more plant diversity and vegetation. Similarly, rock berms will be installed as another management technique that slows surface runoff and effectively enhance soil health and soil moisture, again – with the goal of improving water quality and quantity.

As these practices are implemented at the demonstration scale, EAA staff will be developing methodologies to assess the effectiveness of each practice over the coming years.



Walking around the Field Research Park, you will find weather stations that collect windspeed. solar radiation. rainfall. temperature, relative humidity, and soil moisture metrics. These data, combined with evapotranspiration data, groundwater levels, and surface runoff measurements, will be used to develop a detailed picture of the water balance at the demonstration site. Located adjacent to the FRP Headquarters building is a water well which draws from the Trinity Aguifer.

Research staff have added water level monitoring equipment to this well, often referred to as the Headquarters Well, so that baseline water levels can be established at the FRP. A second well, located on the western tract of the FRP will have water level monitoring equipment installed soon, too.

"PRODUCING SCIENCE EXPERIMENT VIDEOS FOR THE EAA HAS **BEEN AN INCREDIBLE OPPORTUNITY...OUR VIEWERS REALLY ENGAGE IN THE VIDEOS** AND APPRECIATE THE **KNOWLEDGE THAT WE PUT OUT ON SOCIAL** MEDIA."

- Communications and **Development Intern, Maegan** Martinez.

"During these strange times, students can have trouble focusing on school, so we make these fun and quick videos for the children, as

well as for people of all ages, to learn and try the activities at home themselves."

"At Morgan Wonderland Camp, the EAA is creating an Education **Outreach Center** for people of all ages and abilities. The Center is near completion, and visitors will be able to learn about the region's primary



Carol Patterson EAA Board Director - District 1 & Chair of the Research and Technology Committee

source of water, the Edwards Aquifer -- from rainfall on the contributing and recharge zones, through porous layers of limestone underground, to water supply wells and to springs and downstream flow.

The Center will have an aquarium with protected aquatic species, and learning opportunities as to how each of us can beneficially use, conserve, and protect the aguifer water supply from waste, pollution, and degradation.

In the Field Research Park just across the road from Morgan's Wonderland Camp, baseline data collection and scientific experiments are already underway. Documentation of baseline conditions, well monitoring, geologic mapping, evaluation of soils, surveys of vegetation, bird varieties, and types of ecosystems, are already in progress.

Magnificent berms and swales on land contours have been built, weather stations and equipment to measure Evapotranspiration installed, comparative plots planned with and without treatment, and the start of comparison between the cost of these strategies with the cost of increased pumping reductions that could cause the need for very expensive alternative water supply."







EAA Tees Off Fundraising through Champions Fore Charity

Champions fore Charity is a fundraising program that provides participating charities and schools the opportunity to generate contributions through the Valero Texas Open (VTO).

hampions fore Charity is a no-cost program that gives 100% of the funds raised back to the participating organizations, plus incentives including a 7% match. For the past several years the Edwards Aquifer Conservancy (EAC) has participated in this program to generate support for projects and initiatives. The EAC made some major

strides this year with projects like the EAA Education Outreach Center (EOC) slated to open at Morgan's Wonderland Camp in 2021, and the recent acquisition of a property that will be the future site for a field research park and observatory - all dedicated to cultivating an understanding of the **Edwards Aquifer for visitors** and attendees.



EAA December Holiday Commemorative **Medal Bundle** - Benefits go to the EAC Champions **Fore Charity** Fundraiser,

Each commemorative medal purchase will include candy, mask, sanitizer, and shatterproof holiday ornament - all for only \$10 when you choose curbside pick-up at EAA headquarters!

These projects would not be possible without the continued support and participation of the communities we serve and beyond!

The EAA EOC intends to:

- Educate / reach over 500 students and visitors a year
- Raise awareness for the Edwards Aquifer System
- Promote inclusiveness

The EAA Field Research Park / Observatory intends to:

- Continue researching land management practices that could prove to beneficial to the **Edwards Aquifer System**
- · Further data collection through the installation of equipment like weather stations
- Provide educational nature tours

How to donate

* Visit this link to contribute to the EAC.

How it works:

- Donors can make a one-time donation of any amount - any and every donation counts!
- Donors can pay in advance or be billed after the VTO tournament
- Donations are accepted from around the world and 100% tax deductible

https://valerotexasopen.com/championsforecharity/donate?code=EdwardsAquiferConservancy

