

The Meadows Center for Water and the Environment  
March 2018



# TEXAS STREAM TEAM FINAL REPORT

CONTRACT #17-70209  
9/1/16 — 2/28/18



THE MEADOWS CENTER  
FOR WATER AND THE ENVIRONMENT

TEXAS STATE UNIVERSITY

TEXAS STREAM TEAM

MEMBER THE TEXAS STATE UNIVERSITY SYSTEM™

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*Performing Agency:*

Texas State University, and  
Texas Stream Team at  
The Meadows Center for Water and the Environment

Jenna Walker, M.A.Geo., Program Coordinator



*March 2018*



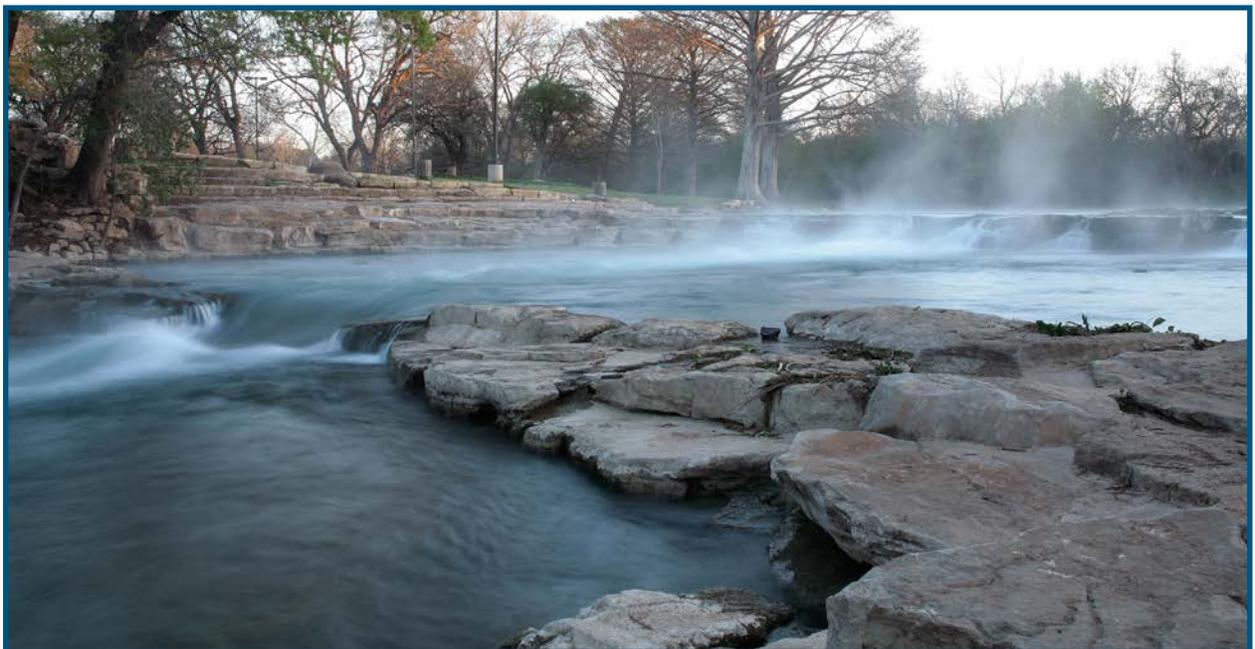
**THE MEADOWS CENTER  
FOR WATER AND THE ENVIRONMENT**

TEXAS STATE UNIVERSITY

**TEXAS STREAM TEAM**

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## MEETING TEXAS STREAM TEAM (TST) GOALS

### Short-term Goals

- Data collection and assessment.
- Education and outreach (with a focus on high priority nonpoint source pollution-impacted watersheds).

### Long-term Goals

- Focus Texas Stream Team resources on impaired watersheds.
- Support the implementation of state, regional, and local programs to prevent nonpoint source pollution through Texas Stream Team monitoring, assessment, and education.
- Support state, regional, and local programs during the implementation of strategies defined in total maximum daily load implementation plans and watershed protection plans.
- Develop partnerships to facilitate collective and cooperative approaches to manage nonpoint source pollution.
- Increase overall public awareness of nonpoint source pollution issues and prevention strategies.
- Enhance public participation and outreach by providing forums for citizens and industry to share their ideas and concerns about water quality.

## TRAININGS AND EDUCATION

- Conducted 95 Core Water Quality Trainings.
- Certified 565 new Texas Stream Team citizen scientists.
- Conducted eight Advanced Trainings.
- Conducted six Riparian Trainings.
- Certified 40 Texas Stream Team citizen scientists in Advanced monitoring.
- Participated in 20 education and outreach events.
- Gave water quality presentations to approximately 1,516 individuals.
- Certified seven new Texas Stream Team water quality instructors.

## RESOURCES FOR TEACHERS

- Participated in to teacher workshops.

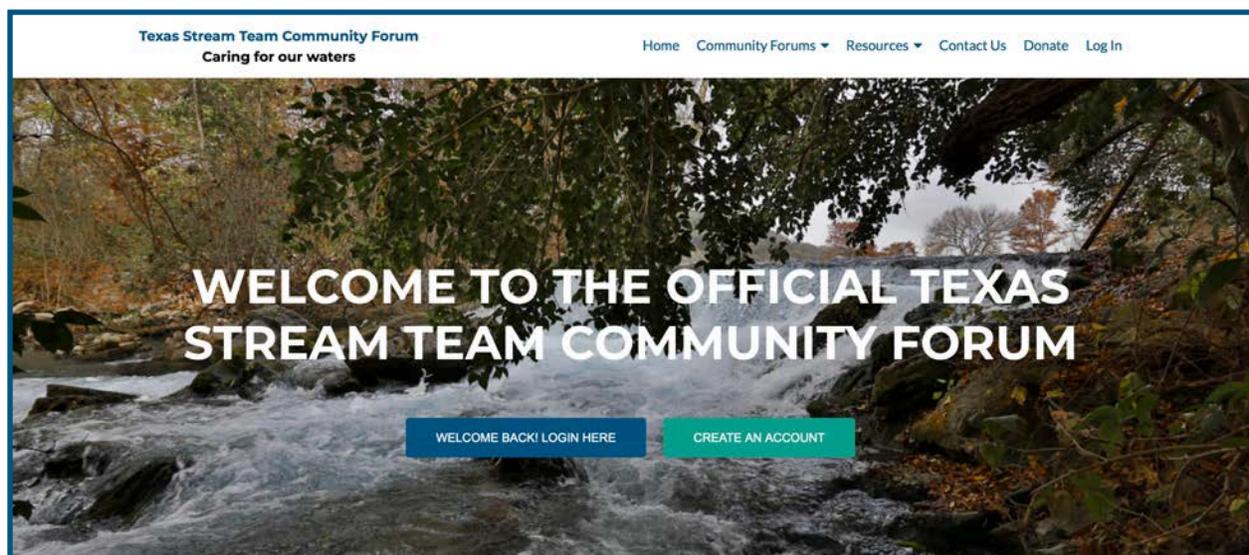
## CITIZEN SCIENTISTS WATER QUALITY MONITORING

- 3,062 monitoring events.
- 5,964 hours spent sampling.
- 61,305 miles traveled.
- 241 sites monitored.

## RESOURCES FOR PARTICIPANTS

### TST Website and Online Community Forum Objective

Texas Stream Team (TST) built an online community of practice forum for those working in areas related to water and/or citizen science in Texas and those interested therein. The platform allows for discussions to be organized into topic areas and subgroups based on specific interest areas or regions. The community of practice forum is designed to allow dynamic interaction among community members through member profiles, shared calendars, discussion forums, file sharing, and other tools.



The TST Community Forum was launched in December 2017 to our citizen scientists, groups, and partners. It includes four pages of forums for each kind of member: citizen scientists, partners, groups, and general discussion. Text, resources, and pictures can be uploaded onto the forums.

Membership to the community forum is required to take part in any forum discussion. Once registered, members can customize profiles, create groups amongst members, message between members, and access all content on the community forum website. The TST Community Forum also includes resources which do not need a membership to access.

Registered members have their own personal wall where they can post text, pictures, resources, stories, events

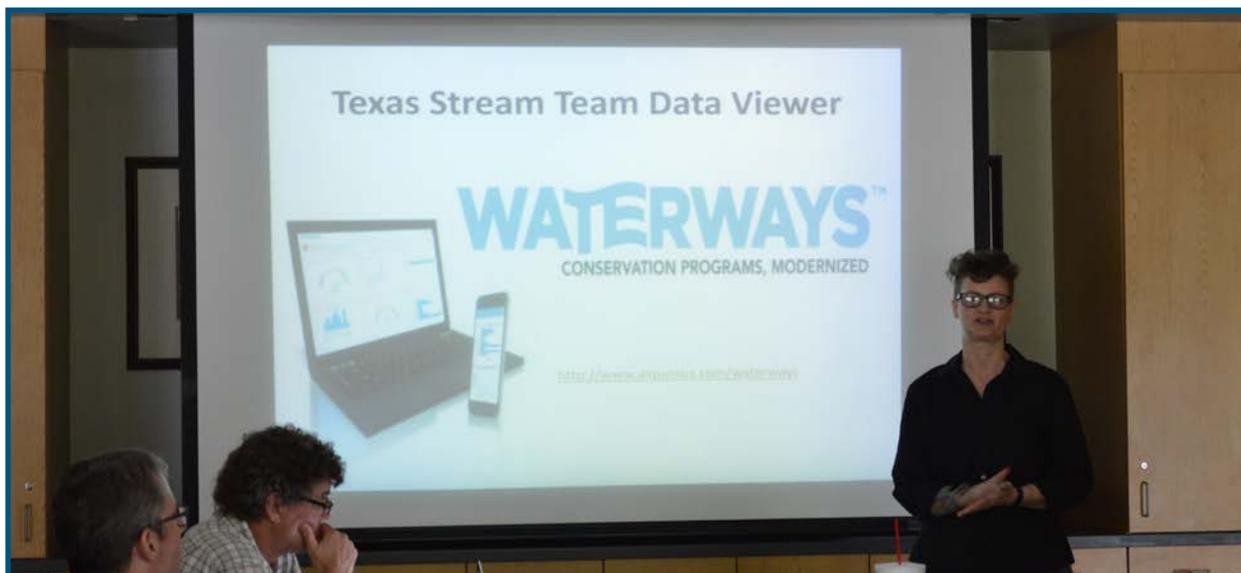
TST. Members can also use their wall to ask questions. Registered members can view these posts when they visit a specific member's personal walls and on the new activity stream page. The new activity stream page acts similarly to Facebook, all user activity and posts are displayed on one page for all to see. Privacy settings have also been activated so that members can choose who they want their posts and contents to be available to. These privacy settings only apply to the member's personal wall and content, but not on the community forum pages.

## WATER QUALITY DATA COLLECTION

### Objective

All submitted data collected under the TST Program Volunteer Water Quality Monitoring Quality Assurance Project Plan (QAPP) is entered into the TST Database and is included in the TST Dataviewer. Data summary reports assess data to show the status of water quality at reporting monitoring sites.

### Dataviewer



*Texas Stream team staff Laura Parchman explains Dataviewer features at a partner meeting. (September 28, 2017)*

TST at The Meadows Center for Water and the Environment at Texas State (TXST) University is the receptacle for all of the data collected by TST citizen scientists. The data undergo quality assurance by a quality assurance officer and are then displayed on the Dataviewer. The Dataviewer is a Structured Query Language (SQL) server database that has an interactive Google Maps-based interface where the public can go and look at TST activity across Texas. Each monitoring site is represented on the map, and viewers can click on a site to see the historical water quality data for that area. Citizen scientists can also log on to the Dataviewer and submit their water quality data to TST online, making the process from data collection to public dissemination quicker and more efficient.

TST citizen scientists monitored 241 sites and submitted a total of 3,062 monitoring events in the state between September 2016 and January 2018. TST submitted this monitoring data to the United States Environmental Protection Agency (EPA) STORage RETrieval (STORET) Database. STORET is EPA's repository for water quality, biological, and physical data. The database is used by state and federal agencies, universities, and private citizens.

## Data Summary Reports

Data summary reports are watershed-wide analyses of selected TST citizen water quality data. These reports look at the average values of the parameters collected for the watershed, as well as provide an analysis of each site monitored. The reports cite the Texas Surface Water Quality Standards to give the reader a reference as to the quality of the water in the watershed, but these reports are not used as an assessment of water quality by the state. Instead, these reports are used to notify the public about the quality of water in Texas, provide long-term baseline data, and to provide resource managers with supplemental data that can help with the decision-making process. Once a data summary report is completed, it is sent to Texas Commission on Environmental Quality (TCEQ) for review. After addressing TCEQ's comments, the report is distributed to TST partners and citizen scientists. All TST data summary reports are [available online on the TST website](#) to the public.

The data presented in data summary reports should be considered in conjunction with other relevant water quality reports in order to provide a holistic view of water quality in the water body. Such sources include, but are not limited to:

- Texas Surface Water Quality Standards.
- Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d).
- Texas Clean Rivers Program partner reports, such as Basin Summary Reports and Highlight Reports.
- Total maximum daily load reports.
- Texas Commission of Environmental Quality and Texas State Soil and Water Conservation Board Nonpoint Source Programs' funded reports, including watershed protection plans.

Data summary reports completed by TST between September 2016 and February 2018:

- Middle Guadalupe River Watershed Data Report (Guadalupe River below Guadalupe River State Park and above Seguin, Comal River)
- San Gabriel River Watershed Data Report (San Gabriel River, Brushy Creek, Berry Creek)
- White Rock Creek Watershed Data Report (White Rock Creek above White Rock Lake)
- Rowlett Creek Watershed Data Report (Rowlett Creek, Spring Creek, Cottonwood Creek)
- Wimberley Valley Watershed Data Report (Blanco River, Cypress Creek, Wilson Cree, Lone Man Creek)

## CITIZEN SCIENCE

### Objective

Engage a statewide network of a minimum of 400 citizen scientists annually in activities related to water quality. The citizen scientists will monitor at least 250 sites across Texas.

### Participants

An average of 405 people participated in TST monitoring each month between September 2016 and February 2018. These citizen scientists volunteered 5,964 hours of time to monitoring and drove a total of 61,305 miles. Many groups are organized so that at least two people go out to monitor a site for efficiency and safety.



## Trainings

Texas residents become certified citizen scientists with TST by undergoing the Core Water Quality Monitoring Training. This is a three-phase training process during which the trainee learns how to measure water quality parameters including temperature, dissolved oxygen, pH, and conductivity. The trainee also learns why these parameters are important and how nonpoint source (NPS) pollution can impact the quality of water. Between September 2016 and February 2018, 95 Core Water Quality Monitoring Trainings were conducted, 25 of which were conducted by TST staff. These trainings resulted in 565 people getting certified. TST citizen scientists can increase their involvement with TST by taking the Advanced training. Once certified, an Advanced monitor can begin taking samples to test for nitrate-nitrogen, orthophosphate, turbidity, *E. coli* bacteria, and streamflow. These measurements, in addition to the Core water quality parameters, provide a more complete profile of the water quality at a monitor's site. TST staff conducted three Advanced trainings and certified a total of 13 citizen scientists during this period.

TST's ability to monitor water bodies across the state is due, in large part, to its ever-expanding network of TST certified instructors. Certified instructors are citizen scientists who have undergone an official "Train the Trainer" Certification. The first phase of the certification is to assist a certified instructor in a training workshop. The second phase is to lead a training workshop under the supervision of a certified instructor. Once the two phases are completed and the citizen scientist is certified as an instructor, they can schedule and conduct trainings as needed. TST staff supports certified instructors by loaning kits when necessary, assisting in monitoring plans, and entering the newly certified citizen scientists' information into the database. Six Certified Instructor Trainings were held and seven TST citizen scientists became certified instructors during this period.

	Number of Events	Number of Participants
<b>Core Trainings</b>	95	565
<b>Core Trainings by TST</b>	25	207
<b>Core Trainings by Partners/Volunteers</b>	70	358
<b>Advanced Trainings</b>	8	40
<b>Advanced Trainings by TST Staff</b>	8	40

*Trainings held between September 2016 and February 2018.*

# ANGLER PROGRAM

TST’s Angler Program includes teaching citizen scientists the TST basics as well as basic angling techniques and proper usage of the ExTech ExStik II “Probe” kits to monitor water quality and report additional field observations related to healthy fish populations.

TST partnered with the non-profit organization Fishing’s Future with the aim of connecting more children to nature and family activities; teaching environmental stewardship; increasing awareness for the protection, conservation and restoration of aquatic natural resources; and increasing participation in recreational angling activities.

TST partnered with the TXST – Wildlife Society and will provide TXST students with information on monofilament removal and how to teach others about the importance of protection, conservation, and restoration of aquatic natural resources. TST will supply Wildlife Society members with collection bags and a location to drop off monofilament line that has been collected. TST will help the Wildlife Society students organize a cleanup day in the Spring of 2018.

	Number of Events	Number of Participants
Angler Events by TST Staff	2	210

TST attended the Oktoberfisch Fly Fishing Festival in Junction, TX in October 2016 to officially kick off the Angler program. In February 2017, TST presented informational materials on monofilament removal at Troutfest in New Braunfels. In June 2017, TST presented informational materials on monofilament removal as well as monofilament activities. Activities included rescuing the turtle trapped in monofilament and try to free your “fins” from fishing line. [Angler and monofilament materials are publicized on the TST website](#), as well as with Core TST trainings and all TST education programs and awareness campaigns.



# PARTNERS

TST continues to develop new partnerships with organizations across the state. The partnerships are focused on collaborations where TST water quality monitoring activities and TST educational materials are in line with the partner’s goals. These partnerships are critical to reaching the maximum number of stakeholders possible. The following are new partnerships that were initiated between September 2016 and March 2018.

Following a successful regional meeting in Arlington, Texas, TST staff began exploring ways to improve communication and coordination between partners in Dallas, Fort Worth, and the surrounding counties. Kelly Albus, a longtime TST monitor and trainer with Texas A&M AgriLife Research and Extension Center of Dallas, will be working in concert with TST staff as we develop an initiative that will include partners from the city of Dallas, city of Fort Worth, city of Denton, the Trinity River Authority (TRA), and the North Central Texas

Council of Governments (NCTCOG). The goal is to assist these local partners in developing a coordinated strategy to prioritize water quality monitoring activities in the region. To this end, TST has applied for a grant from the Communities Foundation of Texas (CFT) to fund a regional conference and training in early 2018.

In recent years, there has been an increase in monitoring activity from members of various Texas Master Naturalist (TMN) chapters. We are studying ways to effectively disseminate TST information to these groups and to encourage their members to engage with TST partners in their area. TST staff traveled to Corpus Christi to attend the Texas Master Naturalist 18th Annual Meeting and Texas Waters Day Event in October of 2017 to present on TST volunteer opportunities. During the 2017 Annual Meeting, TST conducted a water quality monitoring training at Del Mar College and organized a riparian evaluation training at the KEDT Radio Station and Oso Creek.

### **Angelina & Neches River Authority (ANRA)**

Angelina & Neches River Authority (ANRA) is a Clean Rivers Program (CRP) partner. ANRA continued to support TST citizen scientist environmental monitoring in the Neches River Basin, including Lake Palestine. ANRA used funds from CRP to provide TST water quality monitoring kits, training, and replacement supplies and reagents to active TST citizen scientist environmental monitors. ANRA's TST monitoring plan helped support regional water quality assessments in the Upper Neches River Basin Study Area. Brian Sims, environmental division manager, who manages the Environmental Laboratory, OSSF program, and the CRP, as well as state and federal grant-based projects pertaining to water quality and watershed protection, coordinated TST activities in the basin.

### **Ark-Tex Council of Governments (ATCOG)**

The goal of the Ark-Tex Council of Governments (ATCOG) Water Quality Monitoring Program is to strengthen existing, and build new, TST citizen scientist surface water quality monitoring efforts in the nine-county ATCOG region. These counties include parts of the Sulphur River, Cypress Creek, and Red River basins. TST trainings in water quality monitoring build on local knowledge thereby strengthening the ability of ATCOG-area residents to participate in protection of their water resources. ATCOG partnered with the local TST chapter, the Texarkana Earth Club at Texarkana College, in this effort. American Recovery and Reinvestment Act (ARRA) 604(b) funds allowed ATCOG to provide a range of programmatic support, tailored to meet the needs of the different groups.

### **Austin Canoe and Kayak (ACK)**

Austin Canoe and Kayak (ACK) set up hubs in Austin and Houston where trained participants could pick up a TST monitoring kit and hit the water. ACK kept several of the kits in their store so that the volunteers could pick them up for their testing day and return them for others to use.

### **Austin Youth River Watch**

Austin Youth River Watch is an after school program that transports students from school to monitoring sites, River Watch EcoHouse, or other program locations. River Watchers experience the benefits of nature every week while they monitor the water quality at 27 stream and river sites in the Austin area. The River Watch has been conducting water quality monitoring for nearly 25 years. Their data has developed baselines at all of their sites and they are able to document water quality changes and screen for potential water quality issues. River Watchers deliver their data to the Lower Colorado River Authority (LCRA) and the city of Austin for public use. River Watchers learn and follow a sampling protocol at each site to maintain consistency in our long-term monitoring program.

## **Baylor University**

Baylor University Center for Reservoir & Aquatic Systems Research partnered with the city of Waco Lake Waco Wetlands and Central Texas Master Naturalists to coordinate TST Educator Workshops at Lake Waco Wetlands Research and Education Center. These workshops teach citizen scientists to monitor the water quality of local water bodies. Plans for 2018 include Core Water Quality Monitoring and Rapid Macroinvertebrate Bioassessment workshops to be offered to educators – those working with youth or adult audiences that can become involved in monitoring efforts.

## **Bayou Preservation Association**

Bayou Preservation volunteers participated in TST by measuring water and habitat quality and photographing the streams and bayous in the Houston area. Bayou Preservation Association is leading a water quality restoration process that seeks to understand how much bacteria enters or regenerates in our bayous, the sources of the bacteria, the types of bacteria and their effects on humans and wildlife, and how bacteria loads from wastewater, stormwater and other sources can be reduced. In a fast-growing urban area like Houston, it is critical that we understand our watersheds and the factors that affect water quality. Bayou Preservation Association is committed to solving water quality issues in our bayous and working with partners, policy makers and local governments. TST has let the certified TST Instructor, Steve Hupp, borrow Advanced water quality monitoring kits for him to use at larger training events that require additional kits.

## **Capital Area Council of Boy Scouts of America**

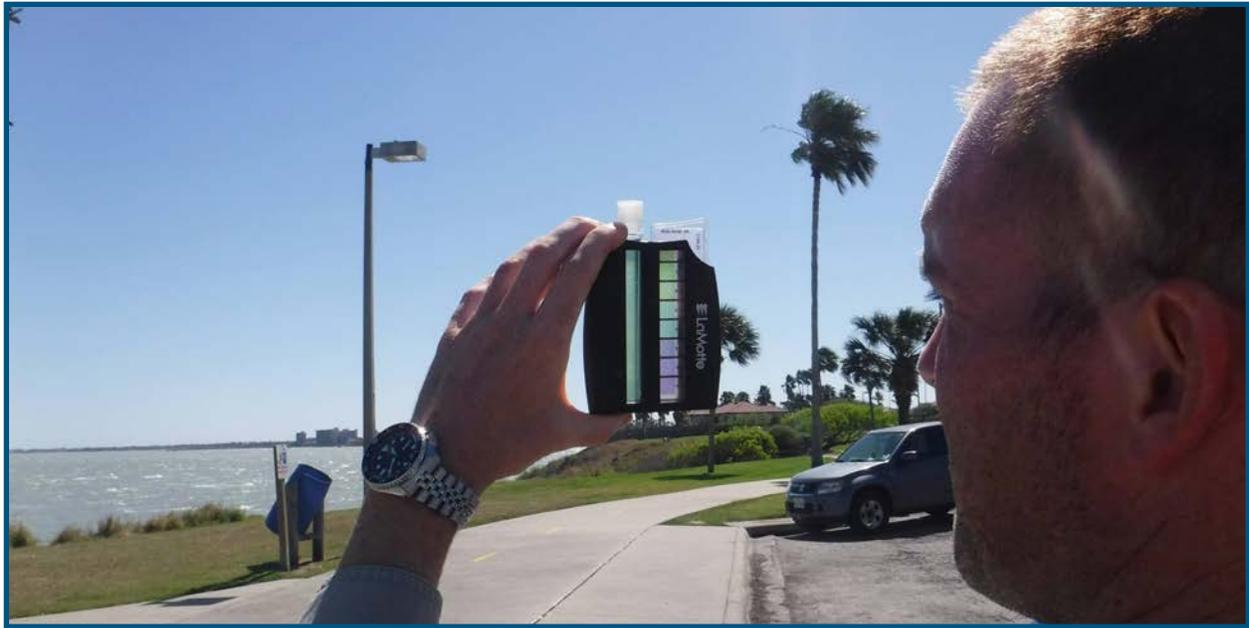
TST partnered with the Capital Area Council to participate in community restoration projects in Hays County that utilize TST for watershed characterization and protection. Boy Scouts can become certified by the certified Capital Area Council trainer or TST staff and dedicate themselves to a monitoring plan in order to receive an official Boy Scouts of America TST patch. The plan is to expand this opportunity to other Boy Scout Councils located across the State and have the patch become recognized statewide.

## **The Center for Coastal Studies (CCS), Nueces River Authority (NRA), and Coastal Bend Bays Foundation (CBBF)**

TST partnered with The Center for Coastal Studies (CCS), Nueces River Authority (NRA), and Coastal Bend Bays Foundation (CBBF) to support citizen scientists in the Corpus Christi area. These organizations are involved in the Petronila Creek TMDL, Oso Creek/Oso Bay TMDL, Corpus Christi Bay TMDL, and the Lower Nueces River WPP. TST worked with these partners to recruit and train citizen scientists who will monitor sites in these watersheds to collect water quality data and inform the public on water quality issues. The partners provided support by equipping the citizen scientists and assigning them sites to monitor. In the future, these organizations will have trained TST Instructors on their staff that will be able to certify additional citizen scientists.

## **Cibolo Nature Center (CNC)**

Donna Taylor, Environmental Research Scientist at the Cibolo Nature Center (CNC), led a TST group to monitor Cibolo Creek which is supplemented by treated water from the Boerne water treatment plant. CNC have been long time participants in TST, monitoring about 10 sites to help support the Upper Cibolo Creek WPP. Several sites found within the effluent dominated stretch of Cibolo Creek have reported consistent nitrate-nitrogen concentrations that have maxed out with TST kits at 15 mg/L.



*A citizen scientist in Corpus Christi measuring pH using a core water quality monitoring kit.*

### **City of Dallas**

The Dallas Stormwater Division supports TST citizen scientists within the Dallas city limits with monitoring equipment and supplies. Christopher Morris has led several Core and Advanced TST water quality monitoring trainings at the Trinity River Audubon Center in Dallas.

### **City of Denton**

The Environmental Services and Sustainability Division of the city of Denton support citizen scientists in Denton by purchasing kits and supplies for TST monitoring. A city staff member schedules and conducts trainings, and assigns newly certified monitors to sites in accordance with the city's TST monitoring plan. The city of Denton has several certified TST Instructors.

### **City of Fort Worth**

The city of Fort Worth's Environmental Department has set aside funds to support a new monitoring group. Two Standard kits have been purchased to initially support the group.

### **City of Fort Worth Nature Center**

Fort Worth Nature Center and Refuge hosts TST training events. The Nature Center hosts a TST kit that can be used by certified TST citizen scientists.

### **City of Grand Prairie**

The Environmental Quality Division with the city of Grand Prairie supports TST citizen scientists by purchasing monitoring equipment and supplies. A city staff member schedules and conducts trainings, and assigns newly certified monitors to sites in accordance with the city's TST monitoring plan.

### **City of Irving**

The city of Irving supported TST citizen scientists by purchasing monitoring equipment and supplies. A city staff member assisted with trainings and supported for citizen scientists.

### **City of Killeen**

The city of Killeen, as part of the Nolan Creek Watershed stakeholders group, coordinated TST training events.

### **City of Plano**

Heather Firm and Carolyn Russell, city of Plano stormwater specialists in environmental health & sustainability, entered water quality data collected by volunteer high school students. The city of Plano is starting bacteria sampling within Rowlett Creek and Russell Creek watersheds. The Stormwater Management Plan 2016-2020 involves an interim bacteria reduction plan that addresses discharges to water quality impaired receiving waters. TST citizen scientists can help identify hot spots in the watershed with significant concentrations of bacteria.

### **City of Sugarland**

The city of Sugar Land and Keep Sugar Land Beautiful formed a Sugar Land Texas Stream Team group in partnership with the Houston-Galveston Area Council to monitor local creeks and streams. Sugar Land Texas Stream Team is an essential part of the community's approach to gather information concerning water quality in our waterways. Water quality monitoring kit, for each site, are provided upon completion of training.

### **City of Waco**

Nora Schell helped coordinate TST training events and stormwater volunteer studies. Keep Waco Beautiful hosted education events that recruited citizens interested in getting involved to protect local streams, rivers, and lakes.

### **City of Wimberley – Parks & Recreation**

TST partnered with the city of Wimberley Parks & Recreation to host training events at Blue Hole Regional Park and the Wimberley Community Center which will help support the Cypress Creek WPP. City of Wimberley Parks & Recreation staff members were trained to test for Core water quality parameters and *E. coli* bacteria along the Cypress Creek Nature Trail Park.

### **Guadalupe-Blanco River Authority (GBRA)**

Guadalupe-Blanco River Authority (GBRA) is a CRP partner and supported TST with purchasing monitoring equipment and supplies for citizens and the Lindheimer Master Naturalists (LMN) that monitor the Guadalupe and Comal Rivers and Canyon Lake. The city of New Braunfels wrote TST citizen science activities into their WPP and worked to support monitoring in the region in and surrounding New Braunfels.

### **Hays County Parks & Recreation**

TST partnered with Hays County Parks & Recreation to host training events at Jacob's Well Natural Area which will help support the Cypress Creek WPP. Hays County Parks & Recreation staff members were trained to test for Core water quality parameters and *E. coli* bacteria at Hays County Parks.

### **Houston-Galveston Area Council (H-GAC)**

Houston-Galveston Area Council (H-GAC) supported TST by managing one of the state's largest TST monitoring groups. They maintained a website, published a newsletter, worked with TST on expanding programs and seek external funding, as well as purchased monitoring equipment and supplies. An H-GAC staff member managed regional data, schedules and conducted trainings, and assigned newly certified monitors to sites.

### **Lavaca Navidad River Authority (LNRA)**

Lavaca Navidad River Authority (LNRA) is a CRP partner. They used a portion of their CRP funds to purchase monitoring equipment and supplies for TST citizen scientists that monitor Lake Texana.

### **Lower Colorado River Authority (LCRA) Colorado River Watch Network (CRWN)**

The Colorado River Watch Network (CRWN) is an autonomous citizen scientists group supported by LCRA to monitor sites in the Colorado River Basin. CRWN citizen scientists undergo their own training and operate under a slightly different protocol. TST and CRWN collaborated by sharing data, and engaged citizen scientists in the Colorado River Basin to participate in events that promote the enhancement of water quality.

### **Lower Neches Valley Authority (LNVA)**

Lower Neches Valley Authority (LNVA) is a CRP partner. They used a portion of their CRP funds to purchase monitoring equipment and supplies for citizen scientists in the Neches River Basin.

### **Midwestern State University**

Radiette Ghion from the Kimbell School of Geosciences, submitted a TST monitoring plan to learn more about the water quality in the Wichita Falls area. The goal of their organization is to develop high school and college students interest in watershed stewardship through water quality monitoring and field-based research activities.

### **Nueces River Authority (NRA)**

The Nueces River Authority (NRA) is a CRP partner. They used a portion of their CRP funds to purchase monitoring equipment and supplies for monitors in the Nueces River Basin. The new riparian evaluation training was developed through the *Your Remarkable Riparian* Field Guide and Owner's Manual, Third Edition, published by the NRA.

### **Recreational Equipment, Inc. (REI)**

TST partnered with Recreational Equipment, Inc. (REI), a sporting goods and outdoor recreation services cooperative. REI offers outdoor education classes to the public, and the REI store in Austin is offered the TST Paddlers training on a quarterly basis. Those who attended the class trained on how to conduct water quality monitoring according to the TST Paddlers protocol. The trainings took place in the REI classroom at the store, then the group took kayaks out to Lady Bird Lake completed their training.

### **The River Legacy**

The River Legacy is a nature center on the Trinity River in Arlington. The organization had staff and volunteers that were certified TST citizen scientists who performed water quality demonstrations for visitors. The River Legacy also has a monitoring plan for the Trinity River within the city limits of Arlington.

### **Sabine River Authority (SRA)**

The Sabine River Authority (SRA) is a CRP partner. They used a portion of their CRP funds to purchase monitoring equipment and supplies for monitors in the Sabine River Basin.

### **San Marcos Lions Club**



*San Marcos Lions Club presents a check to Texas Stream Team. (December 15, 2017)*

The San Marcos Lions Club supported local TST water quality and environmental initiatives with funding that has resulted in the purchase of several kits over the years.

### **San Marcos River Foundation (SMRF)**

The San Marcos River Foundation (SMRF) is a non-profit organization dedicated to protecting the San Marcos River. They supported the San Marcos River Rangers by purchasing monitoring equipment and supplies. A staff member of SMRF scheduled and conducted trainings, and assigned newly certified monitors to sites in accordance with the San Marcos River Rangers' monitoring plan. The San Marcos Watershed Initiative (SMWI) began in 2012 as a multi-year process of research and information gathering with the end goal of implementing a community approved and federally accepted WPP for the Upper San Marcos River.

### **Science and Spanish Club Network (SSNC)**

TST partner Science and Spanish Club Network (SSNC) Coordinator Richard Gonzales of Ingleside helped TST lead training and education events.

### **Student Conservation Association (SCA)**

TST partnered with the Student Conservation Association (SCA) to create a report on an environmental education program for the Houston community. EPA awarded SCA nearly \$77,000 to support the program that provides hands-on experience that will give students a greater understanding of water conservation and the environmental challenges facing our communities.

### Texas Conservation Alliance (TCA)

Texas Conservation Alliance (TCA) partnered with TST to develop “stream teams” for East Texas rivers. TCA is creating stream teams for the Sabine and Sulphur River basins and expanding its Neches River Stream Team. TCA will hold training sessions to certify volunteers to test water in rivers, creeks, and lakes in East Texas.

### Texas Parks and Wildlife Department (TPWD)

TST partnered with Texas Parks and Wildlife Department (TPWD) to offer Core trainings at McKinney Falls State Park in Austin, TX and Blanco State Park in Blanco, TX. TPWD is involved in promoting citizen science activities in state parks across Texas. TST worked with TPWD to recruit citizen scientists who will monitor sites on the Blanco River at Blanco State Park, Onion Creek at McKinney Falls State Park, San Solomon Springs at Balmorhea State Park, Limpia Creek at Davis Mountains State Park, Bee Creek at Meridian State Park, and Leon River at Mother Neff State Park. TPWD provided citizen scientists with monitoring equipment, when able, and had one certified instructor with plans to train more.

### Texas Tech University (TTU) – Junction

TST partnered with Texas Tech University (TTU) – Junction to support citizen scientists within Junction, Kerrville, and Fredericksburg. This organization is primarily involved in both Core and Advanced citizen scientist activities in the Upper Llano River WPP. TST worked with TTU-Junction to recruit citizen scientists who monitored sites in the Upper Llano River and surrounding watersheds as part of the effort to collect water quality data and inform the public on water quality issues. The partners provided support by equipping the citizen scientists and submitting data to TST.

### Texas State University (TXST) – Bobcat Stream Team



*Bobcat Stream Team trains Texas State University students. (March 26, 2017)*

The Bobcat Stream Team is a new student-led TST chapter that was established at the TXST campus in San Marcos, with assistance from TST student workers Stacey Haddad, Dyhanara Rios, and Michael Jones, as well as the Chemistry and Geography departments. The group monitors sites in San Marcos with guidance

from SMRF and the San Marcos River Rangers. The organization purchased one kit with funds donated by the American Chemistry Society (ACS), another student group on campus who will work in close partnership with the Bobcat Stream Team. Bobcat Stream Team continued to recruit students to become citizen scientists at various events on-campus and in the San Marcos community.

### Texas Water Resources Institute (TWRI)

Texas Water Resources Institute (TWRI) is a research institute that works within Texas A&M University and collaborates with The Meadows Center on projects that address critical water resources issues. TWRI partnered with TST to support water quality improvement programs to restore impaired water bodies in Texas. TST citizen scientist groups and data helped TWRI during the development and implementation of WPPs and TMDLs to increase water quality data, and engaged local stakeholders in the watershed protection process. TWRI supported the TST groups by purchasing monitoring equipment and supplies. TWRI staff members helped coordinate with TST groups to schedule and conduct trainings, and assigned newly certified monitors to sites in accordance with the monitoring plan. TWRI has three certified TST trainers on staff who conduct trainings as needed and also coordinate monitoring across many watersheds in Texas. TST participated in the Watershed Planning Short Course and the Texas Watershed Coordinator Roundtable Meetings to encourage the incorporation of TST into monitoring and community outreach efforts.

### TreeFolks



TST launched a community partnership with TreeFolks to expand citizen science activities along the Blanco River and in Central Texas. TreeFolks partnered with TST to conduct riparian evaluation trainings, water quality monitoring trainings and watershed protection efforts. TreeFolks also plans to collaborate with TST and The Meadows Center on other events, such as the Mermaid Society SMTX Aqua Faire. TreeFolks focuses on the Blanco River to work with landowners, especially those affected by the 2015 Labor Day floods. Their work includes providing tree plantings, one-on-one consultations, and developing written materials to educate landowners on the long-term benefits of investing in the health of our natural resources. TreeFolks empowers Central Texans to build stronger communities through planting and caring for trees.

### **Town of Flower Mound**

The Environmental Services Department with the town of Flower Mound supported TST citizen scientists by purchasing monitoring equipment and supplies. A city staff member scheduled and conducted trainings, and assigned newly certified monitors to sites in accordance with the town's TST monitoring plan.

### **Trinity River Authority (TRA)**

The Trinity River Authority (TRA) is a CRP partner. They used a portion of their CRP funds to purchase monitoring equipment and supplies for TST citizen scientists in the Trinity River Basin.

### **University of Texas at Austin (UT) – Longhorn Stream Team**

The University of Texas at Austin's Division of Recreational Sports (UT RecSports) partnered with TST to create a Longhorn Stream Team. The UT RecSports has an outdoor leadership class to teach students outdoor skills such as backpacking, camping, rock climbing, wilderness survival, first aid/CPR, kayaking, swift water rescue, and environmental stewardship. UT RecSports decided to also include water quality monitoring as part of the curriculum. All of the students trained in the TST Paddlers water quality monitoring protocol and joined the Longhorn Stream Team. Students participated in kayaking trips to rivers around Texas including the Colorado, Pedernales, Guadalupe, Frio, and an annual trip to the Rio Grande in Big Bend. While out on these river trips, the Longhorn Stream Team conducted water quality monitoring at designated stations and submitted the data to TST.

### **Upper Guadalupe River Authority (UGRA)**

TST partnered with the Upper Guadalupe River Authority (UGRA) to support local citizen scientists with TST kits, *E. coli* monitoring, and analysis supplies to provide data that helped with the Upper Guadalupe TMDL above Canyon Lake.

### **Wimberley Valley Watershed Association (WVWA)**

The Wimberley Valley Watershed Association (WVWA) partnered with TST to support monitoring efforts within the Wimberley Valley. David Baker, executive director of WVWA, had sub-contracted TST to do CRP monitoring for WVWA and GBRA.

## **GROUPS**

TST encourages its citizen scientists to seek involvement with other interested people to form monitoring groups. Monitoring groups range from a handful of interested citizens organizing on a grass-roots level, to existing groups of volunteers, such as the Texas Master Naturalists, that want to make water quality monitoring a part of their program. TST seeks to work with and recruit existing groups whenever possible.

### **Aquatic Alliance**

Aquatic Alliance is a TST group that also acts as a partner by assisting TST with education and outreach events, connecting TST with other continued alliances acting around Dallas, and providing kits and supplies. The local TST partner monitored water in Dallas and Collin counties, including collecting and testing water at White

Rock Lake and its streams. Aquatic Alliance also trained and coordinated teams who monitored water quality in the forks of the Trinity River. Richard Grayson is a certified TST instructor who conducted several full TST Phase 1-2-3 training classes, including Advanced TST water quality monitoring. Several non-profit groups in North Texas support the Aquatic Alliance including For the Love of the Lake (FTLOTL), a group of volunteers dedicated to the preservation and enhancement of White Rock Lake Park as an urban oasis. FTLOTL provides volunteers, office space, and financial support.

### **Bandera Stream Team**

The Bandera Stream Team acts as a local monitoring group northwest of San Antonio. A recently trained individual in Core and Riparian Evaluation from Bandera plans to reactivate the sites on the Medina River and raise funds for TST kits for the Bandera Stream Team.

### **Balcones Canyonlands Master Naturalists – Travis County, TX**

The Balcones Canyonlands Master Naturalists have undergone Core and Advanced trainings and will begin to monitor within the Colorado River Watershed. Their current activities are supported by TST, but they may be folded into LCRA/CRWN monitoring activities in the future.



*Texas Master Naturalists from Brownsville, TX measure orthophosphates in an Advanced training. (May 23, 2017)*

### **Central Texas Master Naturalists (CTMN)**

The Central Texas Master Naturalists (CTMN) acts as a local monitoring group in Central Texas. CTMN is revamping their TST efforts by replacing chemicals in unused kits. In October of 2017, Thomas Salmi met with TST in San Marcos for advice on reactivating TST sites and future TST monitoring. The Board of the CTMN voice continued and active support. The group shows keen interest in participating, by adding new sites and reactivating existing sites. The Central Texas Chapter has a substantial number of Core and Advanced members trained and is working to build proficiency in sampling and records processing. TST provides resources and suggestions about getting their program operating in an efficient and effective manner. Furthermore, TST has provided information regarding training, equipment, and sampling records for the Central Texas Chapter in Bell and surrounding counties.

### **Friends of the River San Bernard (FOR)**

The Friends of the River (FOR) San Bernard Texas Stream Team was responsible for the monthly water quality testing on the river. The FOR San Bernard worked together with TST to make water quality data publicly available in an effort to get the mouth of the San Bernard reopened. News about the San Bernard River and aerial photos of the San Bernard mouth are shared with TST monthly.

### **Galveston Bay Foundation (GBF)**

Galveston Bay Foundation's (GBF) Water Monitoring Team (WMT) is filled with citizens who care about Galveston Bay's waters and are working to help protect it. Trained volunteers conducted monthly water quality sampling at specific locations around Galveston Bay. These volunteers served as advocates for the Bay and connected their community to local water quality concerns. Their efforts provided data that helps promote clean water for everyone to enjoy. Data collected by the WMT is displayed publicly on and can be downloaded from the [Gulf of Mexico Citizen Science Data Portal](#). Recent bacteria concentrations collected by the WMT can be viewed on [GBF's Bacteria Results page](#).

### **Good Water Master Naturalists – Williamson County, TX**

The Good Water Master Naturalists acts as a local monitoring group in North Central Texas. Watersheds include: San Gabriel River, Brushy Creek, Berry Creek, and Salado Creek. The Good Water Master Naturalists established Core and Advanced monitoring activities in Williamson County. Their current activities are supported by TST and talks are ongoing to potentially partner with the region in the future.

### **Hays County Master Naturalists (HCMN)**

TST supported the Hays County Master Naturalist (HCMN) chapter by assisting with education and outreach events and conducting trainings. Tom Jones started a monitoring group that focuses on the Upper Cypress Creek Watershed during storm events. Tom Jones provided interpretations of geology around Jacob's Well on nature walks provided monthly, which supported the Cypress Creek Project.

### **Stephen F. Austin University (SFA)**

Stephen F. Austin (SFA) students formed a new TST group. The group monitored in the Angelina and Neches River Basins and is supported by TST partner the Texas Conservation Alliance (TCA).

### **Texarkana College**

Delores McCright and her TST group have led an outstanding effort to collect water quality data for more than 20 years.

### **The University of Texas at Rio Grande Valley (UTRGV) – Vaquero Stream Team (VST)**

The Vaquero Stream Team (VST) at the University of Texas at Rio Grande Valley (UTRGV) acted as a local monitoring group in the Rio Grande Valley and worked with college students to conduct regular and specialized monitoring to support the CRP. VST has several certified TST instructors that can lead water quality monitoring training events.

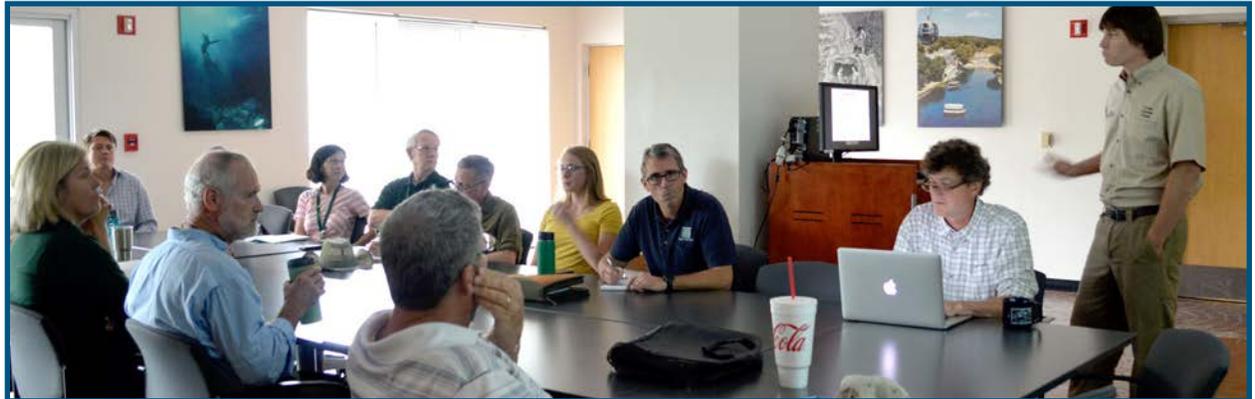
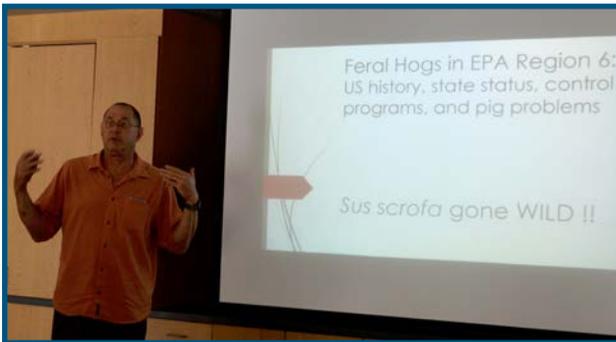
## The University of Texas at San Antonio (UTSA) – Roadrunner Stream Team

Brian Laub, watershed processes professor, plans to start a University of Texas at San Antonio (UTSA) TST chapter in 2018. A water quality monitoring training was conducted at UTSA on January 13th, 2018. The Roadrunner Stream Team will monitor water quality of watersheds in the San Antonio area.

## PARTNER MEETINGS

### September 28, 2017

A TST partner meeting was held on September 28, 2017 at The Meadows Center's main office in San Marcos, Texas. TST Headquarters presented on new TST Citizen Science Programs, educational events and opportunities, the TST Community Forum, and TST Fundraising Campaign. TST facilitated a discussion about what is happening in watersheds across the state and allowed for input and feedback for the TST program. TST led a guided walk around Spring Lake and the Wetlands Boardwalk. Attendees also had a chance to hear from Mike Bira, who is an environmental scientist at the EPA – Region 6. Approximately 14 people attended.



*Attendees discuss resources for citizen scientists at the Texas Stream Team Partner Meeting. Mike Bira (EPA Region 6) gives a special presentation about invasive species and discusses the importance of citizen science programs. (September 28, 2017)*

Participants included:

- Texas Stream Team
- Guadalupe-Blanco River Authority
- San Marcos River Foundation
- Texas Parks and Wildlife
- Texas Tech at Junction
- Baylor University
- Aquatic Alliance
- United States Environmental Protection Agency

- Good Water Master Naturalists
- Texas Commission on Environmental Quality
- City of Dallas
- City of Fort Worth
- City of Denton

## REGIONAL MEETINGS

### February 15, 2018

A regional meeting of Dallas/Ft. Worth Partners was held on February 15, 2018 at the NCTCOG’s headquarters in Arlington, TX. TST staff Michael Jones provided an overview of the current TST citizen scientist programs within the Upper Trinity and discussed improvements with the coordination between the partner organizations and citizen scientists. An update on what is new from the TST headquarters was given. Approximately 24 people attended.

Participants included:

- Texas Stream Team
- Texas A&M Agrilife Extension Service
- City of Dallas
- City of Fort Worth
- City of Denton
- North Central Texas Council of Governments
- Trinity River Authority
- Tarrant Regional Water District
- Jefferson County
- Texas Commission on Environmental Quality
- City of Irving
- City of Arlington
- Texas Parks & Wildlife Department
- Dallas/Fort Worth International Airport
- Trinity Waters
- City of Richardson
- North Texas Municipal Water Districts
- City of Plano
- Dallas County Cities Municipal Utilities District

### February 24, 2017

A regional meeting of Dallas/Ft. Worth Partners was held on February 24, 2017 at the NCTCOG’s headquarters. TST staff Will Butler reviewed the year’s activities and Kelly Albus presented an overview of the Upper Trinity River Basin Vision Project and TST’s participation. Approximately 12 people attended. A Core training was held the following day at the Trinity River Audubon Center.

Participants included:

- Texas Stream Team
- Texas A&M Agrilife Extension Service
- City of Dallas
- City of Fort Worth
- City of Denton
- North Central Texas Council of Governments

# WATERSHED EDUCATION AND OUTREACH



## Objective

Provide watershed education on NPS pollution and other water quality issues.

## Spring Lake Education Program

The Meadows Center uses its location at Spring Lake – the headwaters of the San Marcos River – to offer watershed education to visitors. The Meadows Center’s Spring Lake Outdoor Education Program provides educational activities to visiting students from schools across the state. TST has a suite of activities targeted for elementary schools, middle schools, and high schools. These activities include using the 3D EnviroScape(R) Watershed/Nonpoint Source (NPS) Model and a TST water quality monitoring kit to demonstrate water quality sampling. TST staff reached a total of 3,902 people. TST staff gave 15 water quality presentations to 519 students at Spring Lake between September 2016 and February 2018 and 27 education and outreach events around the state to another 3,383 people. An additional 23,769 students received water quality and NPS pollution education at Spring Lake with the 3D EnviroScape(R) Watershed/NPS Source Model and/or macroinvertebrate collecting activities.

	# of Events	# of Participants
All Events	42	3,902
Events at Spring Lake	15	519
Events Statewide	27	3,383

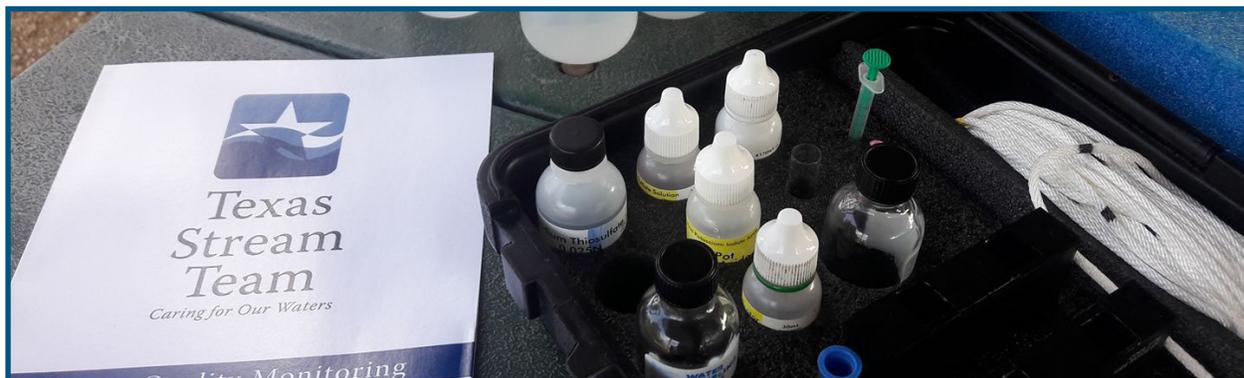


*Texas Stream Team staff Valerie Villarreal and Dyhanara Rios attend STEAM Expo at Hernandez Elementary School. (January 2018)*

<b>Date</b>	<b>Event</b>	<b>Location</b>	<b># of Participants</b>
9/7/2016	Water Quality Demo for The International School of the Americas	Spring Lake – San Marcos	135
9/16/2016	Stone Forest Preschool Program	Spring Lake – San Marcos	6
9/17/2016	Mermaid SPLASH Festival	San Marcos	100
10/4/2016	National Night Out	Florence	10
10/11/2016	Edwards Aquifer Conservancy Water Forum	San Antonio	20
10/14/2016	Stone Forest Preschool Program	Spring Lake – San Marcos	6
10/15/2016	Oktoberfish	Junction	30
11/9/2016	Hill Country Science Mill Homeschool Day	Johnson City	75
11/15/2016	2016 Blue Hole Field Trip	Blue Hole Regional Park, Wimberley	100
11/18/2016	Stone Forest Preschool Program	Spring Lake – San Marcos	6
12/16/2016	Stone Forest Preschool Program	Spring Lake – San Marcos	6
1/14/2017	Water Quality Demo for UTSA Environmental Sciences Program- Watershed Processes Laboratory	Spring Lake – San Marcos	36
1/28/2017	STAT Mini-CAST	San Marcos	1
2/7/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	37
2/7/2017	SAWS Confluence	San Antonio	180
2/10/2017	Hernandez STEAM Expo	San Marcos	500

<b>Date</b>	<b>Event</b>	<b>Location</b>	<b># of Participants</b>
2/11/2017	STEM in San Marcos	San Marcos	100
2/18/2017	Water Quality Demo for Capital Area Master Naturalists	Spring Lake – San Marcos	32
2/18/2017	TroutFest	New Braunfels	180
2/25/2017	Out in Space, Down to Earth STEM Educator Conference	San Antonio College	45
3/1/2017	Water Quality Demo for Elgin K-1-2 GT	Spring Lake – San Marcos	40
3/8/2017	Water Quality Demo for Elgin K-1-2 GT	Spring Lake – San Marcos	40
3/21/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	12
3/22/2017	Texas Water Day at the State Capitol	Austin	30
3/30/2017	Spring Concert Series- City of San Marcos	San Marcos	20
4/23/2017	72° Festival	San Marcos	25
4/23/2017	Earth Day at the Meadows Center for Water and the Environment	Spring Lake – San Marcos	60
5/10/2017	Water Quality Demo for Dripping Springs High School	Spring Lake – San Marcos	48
5/10/2017	Hill Country Science Mill Homeschool Day	Johnson City	30
5/24/2017	Water Quality Demo for Young Women's Leadership Academy	Spring Lake – San Marcos	77
6/6/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	68
6/13-6/15/2017	Groundwater to Gulf Teacher Conference	Austin	50
6/24/2017	Super Saturday: A Gulf Full of Whales!	San Antonio	50
6/26/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	20
7/11/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	20
7/12/2017	Water Quality Demon for J.C. International Youth Campers The San Marcos Lions Club	Spring Lake – San Marcos	46
7/13/2017	Blanco River/Onion Creek Water Forum	Wimberley	30
8/8/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	35
9/16/2017	Mermaid Aqua Faire	San Marcos	200
10/10/2017	Groundwater Day at The Meadow Center	Spring Lake – San Marcos	60
10/11/2017	Carnegie Vanguard High School	Houston	20

Date	Event	Location	# of Participants
10/12/2017	All School Water Assembly - Carnegie Vanguard High School	Houston	640
10/23/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos	79
11/4/2017	Keep Lockhart Beautiful	Lockhart State Park	150
11/10/2017	Water Quality Demo for St. Francis School	Spring Lake – San Marcos	65
11/14/2017	2017 Blue Hole Field Trip	Blue Hole Regional Park, Wimberley	150
11/27/2017	Water Quality Demo for The Girls School of Austin	Spring Lake – San Marcos	22
12/22/2017	Professional Development Training for Teachers and Students - Carnegie Vanguard High School	Houston	10
1/8/2018	Spring Lake Homeschool Day	Spring Lake – San Marcos	26
1/12/2018	Hernandez STEAM Fair	San Marcos	596
1/20/2018	San Marcos CISD Inaugural Science Showcase	San Marcos	50
2/5/2018	Spring Lake Homeschool Day	Spring Lake – San Marcos	14
2/10/2018	San Marcos CISD S.T.E.M Fair	San Marcos	125
2/10/2018	Water Quality Demo for Capital Area Master Naturalists	Spring Lake – San Marcos	30
2/10/2018	Austin Cave Festival	Austin	200
2/21/2018	Wildlife Viewing & Nature Tourism Academy	McAllen	20
		Total participants	4763



# INTERPRETATIVE SIGNAGE AND GREEN INFRASTRUCTURE DEMONSTRATIONS

Interpretive signage exploring water quality, water quantity, and native-escape techniques were installed at Spring Lake between September 2016 and February 2018. Five signs introduce audiences to TST, water conservation techniques, rain gardens, watershed education and NPS. These large signs are bilingual, including content in Spanish and English. The demonstration gardens at the entrance to the natural area show the beauty and resilience of native plants in the yard. Roughly 125,000 people visit Spring Lake each year and will see these signs.



## Rain Garden

In November 2017, TST staff installed two rain garden beds at Spring Lake. Permission to dig on the peninsula is required before any construction can be done on site since The Meadows Center is located in an area that is covered by the Antiquities Act. As a result, TST opted to build a raised-bed rain garden on site that will utilize water from rain gutters and, in dry periods, from rain barrels. In addition, a resource guide and plant list was created consisting of suitable plants for Central Texas from Rain Garden Austin Grow Green Native and Adapted Landscape Plants - an Earthwise guide for Central Texas created by the city of Austin, The Texas AgriLife Extension, and The Lady Bird Johnson Wildflower Center.



*I rain garden was installed by Texas Stream Team staff at Spring Lake. (November 2017)*

## Rainfall Simulator

TST staff installed a rainfall simulator at Spring Lake near the rain garden for educational purposes. It is a wonderful tool to demonstrate the impacts of land management, stewardship, and natural resource protection on water quality and quantity. The simulator shows how different types of land cover and impervious surfaces affect the flow and quality of rainwater inside a watershed. It allows students to compare water quality and quantity between different types of land covers.

Land cover can be a representation of what is found in your watershed, such as native grasses, turf grasses, desert landscapes, xeriscapes, overgrazed lands, well-managed rotational grazed lands, bare soil, conventional tilled lands, over-tilling, no till and cover crops, and development of impervious cover such as roads, parking lots, buildings, and housing.

## TEACHER WORKSHOPS



*TST staff demonstrate the 3D EnviroScape(R) Watershed/NPS Source Model at the STAT Mini-Cast. (January 28, 2017)*

This spring, The Meadows Center and TST began offering a new program for homeschool families. Almost 50 parent, educators, and children participated in visits in February and March 2017. Activities for younger children (prek-3rd grade) included lessons on how water moves, while older students (4th-12th grade) were taught on the 3D EnviroScape(R) Watershed/NPS Source Model and led on a guided tour of the wetlands.

The following are teacher workshop and training events in which TST staff participated:

## Out in Space, Down to Earth

The TST booth at the Out in Space, Down-to-Earth STEM Educator Conference on February 25 at San Antonio College drew in 40 visitors. The booth included the 3D EnviroScape(R) Watershed/NPS Source Model, water quality kits, and several brochures. TST staff conducted a workshop that highlighted water quality kits, curriculum, and the 3D EnviroScape(R) Watershed/NPS Source Model. The ten K-12 teachers who attended the workshop were given lesson plans as well as information about The Meadows Center and TST.

## Groundwater to the Gulf (G2G)

In March 2017, TST staff began preparations for Groundwater to the Gulf (G2G), a three-day field-trip based institute for Central Texas teachers that emphasizes techniques for teaching water-based curricula. Participants follow the path of water from its origins in Central Texas to its final destination in the Gulf of Mexico. Topics included: hydrology, groundwater, urban watersheds, water quality, water protection, and water conservation.

On June 13-15, 2017, TST staff attended and helped coordinate the three-day teacher workshop in Austin. The G2G Teacher Conference is a free conference for 50 teachers. On the first day, TST staff Meagan Lobban led part of the Hydro Models session. She presented the 3D EnviroScape(R) Watershed/NPS Source Model for the teachers. On the second day, Lobban and the Austin Youth River Water introduced TST and demonstrated the Standard kit at Barton Springs. Three groups of teachers rotated through all the morning activities. Teachers were supplied with the datasheet to complete during testing to demonstrate what can be done in the classroom or on a field trip with their students. Teachers were given lesson plans for all the activities and information about The Meadows Center and TST.



*TST staff Valerie Villarreal and Meagan Lobban, and Houston Mayor Sylvester Turner presented at an all school water assembly at Carnegie High School. (October 10, 2017)*

## Carnegie High School

In December 2017, TST staff Meagan Lobban traveled to Houston on December 22, 2017 to lead a professional development workshop for teachers and students at Carnegie Vanguard High School. The professional development workshop was broken down into four parts: sections one and two of the professional development consisted of the TST water quality citizen scientist trainings. Section three included multiple lesson plans for teachers to use in their class rooms and activities for the students to lead at neighboring elementary schools.

Activities included “Is THIS Water?” and “Beginnings of Water Quality Analysis” from the TST Water Education Curriculum. The third activity used the anticipatory set from “How Much Drinking Water?” A

globe was tossed around the room, and the group recorded how many times the globes landed on water and land. Staff used this as the opening for a Meadows Center Spring Lake education activity called “All the Water in the World,” where students decide which locations has the most and the least amount of water.

Section four was called “Clouds” in which students were created “rain” in their environment. Students received clear jars filled with water. Next, they created clouds by filling the tops of the jars with shaving cream. Students then used food coloring and dripped it over the clouds. When the clouds were full of the food coloring, the colors would fall through the clouds as precipitation. The students would then draw what was happening in their environment.

Another activity that TST showed focused on pH, which highlighted acids and bases. Students had samples showing various pH levels to demonstrate at elementary schools. They then attempted to organize everyday items in order from a high acid to a high base. The group also discussed what happens to a water source if the water pH level changes.

## Spring Lake Education Programs

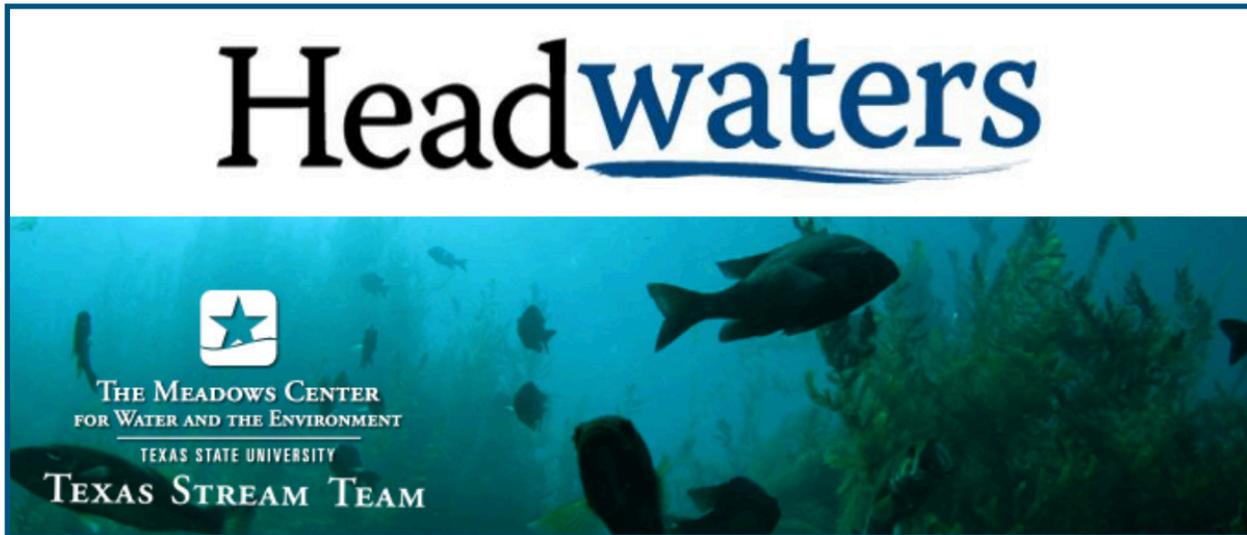
Roughly 30,000 students visit Spring Lake annually, and hundreds of additional people have received water quality education at special events, conferences, and programs.

The Meadows Center and TST began offering a new program for homeschool families. Almost 50 parent educators and children participated in February and March 2017. Activities for younger children (prek-3rd grade) included lessons on how water moves, while older students (4th-12th grade) were taught on the 3D EnviroScape and led on a guided tour of the wetlands.



## HEADWATERS NEWSLETTERS

TST published six newsletters between September 2016 and February 2018. The TST Headwaters newsletters contain information on recent activities held in the past quarter and articles regarding partnerships across the state. In addition, a section to spotlight an outstanding citizen scientist is included. This section focuses on one individual that has gone above and beyond with regards to their participation with TST. This allows us to show our appreciation for the great work and dedication our citizen scientists put in to protecting our waterways.

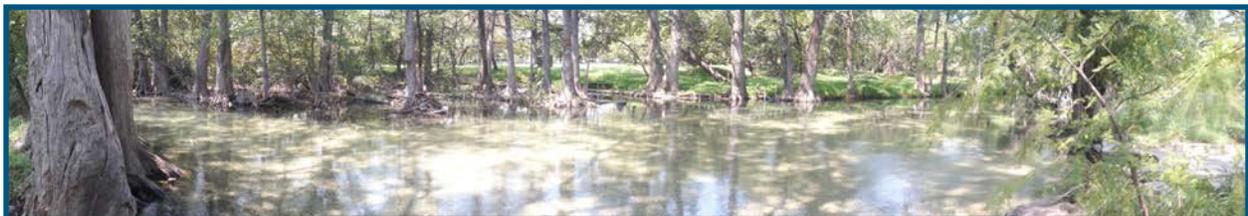


*TST's Headwaters newsletter banner. (December 2017)*

## TST IN THE NEW

Date	Title	Featured in	Link to article
10/21/2016	The Trinity Project: Epilogue (Where are we Going?)	D Magazine	<a href="https://www.dmagazine.com/frontburner/2016/10/the-trinity-project-epilogue-where-are-we-going/">https://www.dmagazine.com/frontburner/2016/10/the-trinity-project-epilogue-where-are-we-going/</a>
10/29/2016	Walk in the Park	Walk in the Park blog	<a href="http://walkinthepark-padimus.blogspot.com/2016/10/cool-clear-water.html">http://walkinthepark-padimus.blogspot.com/2016/10/cool-clear-water.html</a>
11/08/2016	Confetti for Graduation Photos Harms the Environment	The University Star	<a href="https://star.txstate.edu/2016/11/08/confetti-for-graduation-photos-harms-the-environment/">https://star.txstate.edu/2016/11/08/confetti-for-graduation-photos-harms-the-environment/</a>
3/22/2017	Texas Stream Team – Monitoring Water Quality in Texas Waters	Taylor Press	<a href="http://taylorpress.net/lifestyles/article_e15b531e-0f0e-11e7-9cee-8f1e43e066d5.html">http://taylorpress.net/lifestyles/article_e15b531e-0f0e-11e7-9cee-8f1e43e066d5.html</a>
7/5/2017	EPA Awards Nearly \$77,000 to the Student Conservation Association for Environmental Education Projects in Houston Area	EPA News	<a href="https://www.epa.gov/newsreleases/epa-awards-nearly-77000-student-conservation-association-environmental-education">https://www.epa.gov/newsreleases/epa-awards-nearly-77000-student-conservation-association-environmental-education</a>

Date	Title	Featured in	Link to article
7/5/2017	Houston ISD's Carnegie Vanguard High School Developing Environmental Leaders	Houston Patch	<a href="https://patch.com/texas/houston/houston-isds-carnegie-vanguard-high-school-developing-environmental-leaders">https://patch.com/texas/houston/houston-isds-carnegie-vanguard-high-school-developing-environmental-leaders</a>
7/5/2017	EPA Awards Nearly \$77,000 to the Student Conservation Association for Environmental Education Projects in Houston Area	WebWire	<a href="http://webwire.com/ViewPressRel.asp?ald=210504">http://webwire.com/ViewPressRel.asp?ald=210504</a>
9/24/2017	Meadows Center Partners with TreeFolks for Riparian Assessment	Texas State University News Service	<a href="http://www.txstate.edu/news/news_releases/news_archive/2017/September-2017/MeadowsCenter092517.html">http://www.txstate.edu/news/news_releases/news_archive/2017/September-2017/MeadowsCenter092517.html</a>
10/09/2017	MSU Geosciences School Receives \$400,000 Grant for high School Outreach	Times New Record	<a href="http://www.timesrecordnews.com/story/news/education/2017/10/09/msu-geosciences-school-receives-400-000-grant-high-school-outreach/747278001/">http://www.timesrecordnews.com/story/news/education/2017/10/09/msu-geosciences-school-receives-400-000-grant-high-school-outreach/747278001/</a>



## TST WATERSHED SERVICES

### Watershed Protection Plans (WPPs)

TST citizen scientists are currently monitoring in the following watersheds that are developing or implementing WPPs:

- Arroyo Colorado
- Attoyac Bayou
- Bastrop Bayou
- Cedar Bayou
- Comal River/Dry Comal Creek
- Cypress Creek (Wimberley)
- Cypress Creek (San Jacinto River Basin)
- Dickinson Bayou
- Geronimo Creek
- Lake Arlington and Village Creek
- Lake Granbury
- Lake Lavon
- Leon River
- Lower Laguna Madre
- Onion & Barton Creeks
- Mid and Lower Cibolo Creek

- Mill Creek
- Moses-Karankawa Bayous
- Plum Creek
- San Bernard River
- Shoal Creek
- Upper Cibolo Creek
- Upper San Antonio River
- Upper San Marcos River
- Upper Llano River
- West Fork of San Jacinto and Lake Creek

## Total Maximum Daily Loads (TMDLs)

TST Citizen Scientists are currently monitoring in the following watersheds that are developing or implementing Total Maximum Daily Load (TMDLs) Plans:

- Austin Area Watersheds
- Carters Creek
- Colorado River
- Dallas – Fort Worth Area Total Maximum Daily Loads
- East and West Forks of the San Jacinto River
- Gilleland Creek
- Houston Area Total Maximum Daily Loads
- Lake Austin
- Lake Worth
- Lower San Antonio River
- North Bosque
- Orange County Watersheds
- Oso Creek/Oso Bay
- Salado Creek
- Spicewood Springs and Walnut Creek
- Spring Creek and Cypress Creek
- Trinity River
- Upper Coast Oyster Waters
- Upper Guadalupe River

## Education and Outreach Events



*TST staff Valerie Villarreal attends Keep Lockhart Beautiful at Lockhart State Park. (November 4, 2017)*

The following education and outreach activities were held within watersheds that are developing or implementing a WPP:

Date	Event	Location
9/7/2016	Water Quality Demo for The International School of the Americas	Spring Lake – San Marcos
9/16/2016	Stone Forest Preschool Program	Spring Lake – San Marcos
9/17/2016	Mermaid SPLASH Festival	San Marcos
10/4/2016	National Night Out	Florence
10/11/2016	Edwards Aquifer Conservancy Water Forum	San Antonio
10/14/2016	Stone Forest Preschool Program	Spring Lake – San Marcos
10/15/2016	Oktoberfisch	Junction
11/9/2016	Hill Country Science Mill Homeschool Day	Johnson City
11/15/2016	2016 Blue Hole Field Trip	Blue Hole Regional Park, Wimberley
11/18/2016	Stone Forest Preschool Program	Spring Lake – San Marcos
12/16/2016	Stone Forest Preschool Program	Spring Lake – San Marcos
1/14/2017	Water Quality Demo for UTSA Environmental Sciences Program- Watershed Processes Laboratory	Spring Lake – San Marcos
1/28/2017	STAT Mini-CAST	San Marcos
2/7/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
2/7/2017	SAWS Confluence	San Antonio
2/10/2017	Hernandez STEAM Fair	San Marcos
2/11/2017	STEM in San Marcos	San Marcos
2/18/2017	Water Quality Demo for Capital Area Master Naturalists	Spring Lake – San Marcos
2/18/2017	TroutFest	New Braunfels
2/25/2017	Out in Space, Down to Earth STEM Educator Conference	San Antonio College
3/1/2017	Water Quality Demo for Elgin K-1-2 GT	Spring Lake – San Marcos
3/8/2017	Water Quality Demo for Elgin K-1-2 GT	Spring Lake – San Marcos
3/3/2017	Crockett Science fair	San Marcos
3/21/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
3/22/2017	Texas Water Day at the State Capitol	Austin
3/30/2017	Spring Concert Series- City of San Marcos	San Marcos
4/23/2017	72° Festival	San Marcos
4/23/2017	Earth Day at The Meadows Center	Spring Lake – San Marcos
5/10/2017	Hill Country Science Mill Homeschool Day	Johnson City, TX
5/10/2017	Water Quality Demo for Dripping Springs High School	Spring Lake – San Marcos

Date	Event	Location
5/24/2017	Water Quality Demo for Young Women's Leadership Academy	Spring Lake – San Marcos
6/6/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
6/7/2017	TST Riparian Workshop for Upper San Marcos River, Cibolo Creek, Dry Comal/ Comal River, Texas Parks & Wildlife, Nueces River Authority	San Marcos
6/13-6/15/2017	Groundwater to Gulf Teacher Conference	Austin
6/24/2017	Super Saturday: A Gulf Full of Whales!	San Antonio
6/26/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
7/11/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
7/12/2017	J.C. International Youth Campers the San Marcos Lions Club	San Marcos
7/13/2017	Blanco River/Onion Creek Water Forum	Wimberley
8/8/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
9/6/2017	Cypress Creek Riparian Workshop	Wimberley
9/16/2017	Mermaid Aqua Faire	San Marcos
10/10/2017	Groundwater Day at The Meadow Center	Spring Lake – San Marcos
10/11/2017	Carnegie Vanguard High School	Houston
10/12/2017	All School Water Assembly -Carnegie Vanguard High School	Houston
10/19/2017	Riparian Workshop at Texas Master Naturalist Annual Meeting	Corpus Christi
10/23/2017	Spring Lake Homeschool Day	Spring Lake – San Marcos
11/4/2017	Keep Lockhart Beautiful	Lockhart State Park
11/10/2017	Water Quality Demo for St. Francis School	Spring Lake – San Marcos
11/14/2017	2017 Blue Hole Field Trip	Blue Hole Regional Park, Wimberley, TX
11/27/2017	Water Quality Demo for The Girls School of Austin	Spring Lake – San Marcos
12/22/2017	Professional Development Training for Teachers and Students - Carnegie Vanguard High School	Houston
1/8/2018	Spring Lake Homeschool Day	Spring Lake – San Marcos
1/12/2018	Hernandez STEAM Fair	San Marcos
1/20/2018	San Marcos CISD Inaugural Science Showcase	San Marcos
2/5/2018	Spring Lake Homeschool Day	Spring Lake – San Marcos

Date	Event	Location
2/10/2018	San Marcos CISD S.T.E.M Fair	San Marcos
2/10/2018	Water Quality Demo for Capital Area Master Naturalists	Spring Lake – San Marcos
2/10/2018	Austin Cave Festival	Austin
2/21/2018	Wildlife Viewing & Nature Tourism Academy	McAllen



*TST staff Jenna Walker and Michael Jones lead a Riparian Assessment Workshop in Wimberley, Texas. (September 5, 2017)*

## Partner Collaborations

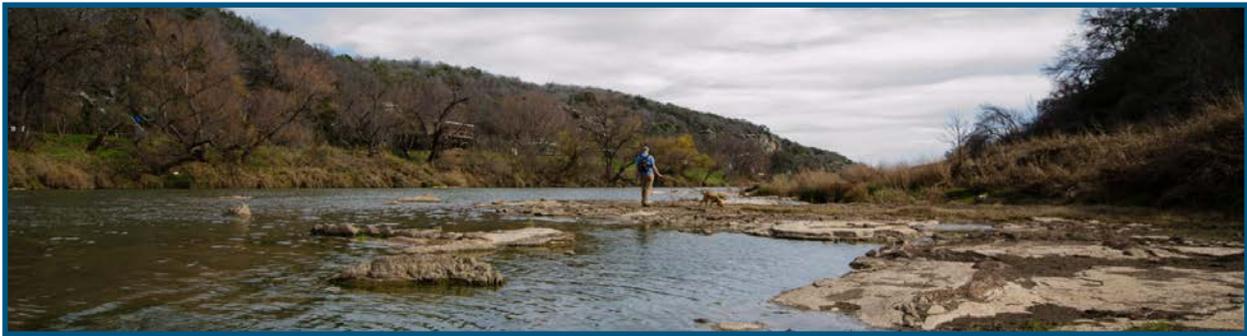
TST is collaborating with the following partners who are either facilitating or developing WPPs and TMDLs:

- Center for Coastal Studies – Texas A&M University Corpus Christi
- Clean Rivers Program Steering Committee
- Cibolo Nature Center
- City of New Braunfels
- Coastal Bend Bays Foundation
- Collins Academy
- Cypress Creek Watershed Protection Plan Stakeholder Group
- Guadalupe-Blanco River Authority
- Hays Trinity Groundwater Conservation District
- Houston-Galveston Area Council
- North Central Texas Council of Governments
- Nueces River Authority
- Plum Creek Stakeholder Committee
- San Antonio Clean Tech Water Forum
- San Antonio River Authority
- San Marcos River Foundation
- Shoal Creek Conservancy
- Texas Water Resource Institute – Texas A&M University
- Wimberley Valley Watershed Association

## Presentations on Watershed Management and Planning

- Texas State University: guest lecture for a geography graduate class on watershed planning and implementation. (February 2017 - Miller)
- Hill Country Alliance Texas Water Symposium “Watershed Protection Plans: Creating and Maintaining Healthy Waterways at a Community Scale.” (February 2017 - Miller)
- San Antonio presentation about watershed planning. (March 2017 - Miller)
- Texas Stream Team information about citizen science programs, applications for water quality data in watershed planning, Texas Stream Team watershed services (including assistance with developing baseline data, education and outreach, community engagement, and creating and tracking matching funds through volunteer citizen science efforts) presented at a Watershed Coordinator Round Table Meeting. (January 2017 - Walker)
- Participation in Shoal Creek Advisory Group Planning Meeting and Team. (January 2017 - Miller)
- Planning for Growth in Comal County - presentation “Protecting Watersheds and Water” and panel participation. (February 2017 - Miller)
- Texas State University: guest lecture for Geography Water Resources class on water quality monitoring and community awareness. (February 2017 - Jones)
- Clean Rivers Program Annual Meeting – “Watershed Planning Progress, Next Steps, Using New Technology and Collaboration.” (March 2017 - Miller)
- Hill Country Chapter of the National Organization for Women – Watershed Planning 101. (March 2017 – Parchman)
- Guadalupe-Blanco River Authority Clean Rivers Program Basin Steering Committee Meeting – presentation “Wimberley Valley Watershed Association Clean Rivers Program Monitoring.” (March 2017 - Butler/Jones)
- Good Water Master Naturalists Meeting – presentation “Texas Stream Team and the Good Water Master Naturalists: An Evaluation of Citizen-Led Water Quality Monitoring in Williamson County.” (March 2017 - Butler)
- Texas Stream Team information about citizen science programs, applications for water quality data in watershed planning, Texas Stream Team watershed services (including assistance with developing baseline data, education and outreach, community engagement, and creating and tracking matching funds through volunteer citizen science efforts) presented at a Watershed Coordinator Round Table Meeting. (July 2017 – Jones)
- Teaching Environmental Science Institute at Lamar University – *E. coli* Monitoring and Analysis Procedures Workshop. (July 2017 - Jones)
- Texas Parks and Wildlife Department Texas Waters Day – presentation “Texas Stream Team Citizen Scientist Programs and Volunteer Opportunities.” (October 2017 - Jones)
- Texas Water Resource Institute Texas Watershed Planning Short Course – presentation “Water Quality Monitoring: Practical Guidelines & Lessons Learned.” (November - Jones)
- University of Texas at San Antonio – guest lecture Watershed Processes Lab “Water Quality Monitoring and Watershed Assessments.” (January 2018 - Jones)
- Texas Stream Team information about citizen science programs, applications for water quality data in watershed planning, Texas Stream Team watershed services (including assistance with developing baseline data, education and outreach, community engagement, and creating and tracking matching funds through volunteer citizen science efforts) presented at a Watershed Coordinator Round Table Meeting. (January 2018 – Walker/Jones)
- Upper Trinity River Basin Coordinating Committee Meeting – presentation “Texas Stream Team Citizen Science Environmental Monitoring to Support Healthy Waterways at a Community Scale.” (February 2018 - Jones)
- Texas State University: guest lecture for Geography Water Resources class on water quality monitoring and community awareness. (February 2018 - Jones)

## Watershed Planning Efforts



- Arroyo-Colorado: Certified Texas Stream Team trainers to train and provide resources to implement monitoring and coordinate workshop events. Texas Stream Team will play a substantive role in helping to make projects successful. Our current focus aims to fulfill recommendations associated with the Arroyo-Colorado Watershed Protection Plan Partnership. The main objective is to coordinate citizen scientist water quality monitoring activities at sites and help bring partnerships together to conduct workshops. (Jones/Haddad)
- Dry Comal Creek/Comal River: Assist city of New Braunfels with development of watershed protection plans – serve on Education and Outreach Technical Committee and Stakeholder Committee. (Walker)
- Cypress Creek: Water quality monitoring and data acquisition support, education/outreach and information sharing. Participating at teacher workshops and educational events hosted at Jacob's Well. Conducting citizen scientist water quality monitoring training events and educational workshops at Jacob's Well Natural Area, Blue Hole Regional Park, and the Wimberley Community Center. Establishing partnerships with the Hays County Parks & Recreation and city of Wimberley Parks & Recreation departments to help support new citizen scientist water quality and environmental monitoring groups within the Cypress Creek Watershed. (Miller/Jones)
- Middle Guadalupe River: Host yearly Quality Assurance/Quality Control refresher training on Texas Stream Team Water Quality Monitoring at AgriLife Extension Service-Comal County, New Braunfels, TX. (Jones)
- Middle and Lower Cibolo Creek: Conduct first Texas Stream Team Citizen Scientist Water Quality Monitoring Training Event at Crescent Bend Nature Park in Schertz. Establish Texas Stream Team water quality monitoring sites downstream from Wastewater Treatment Plant outfalls along Cibolo Creek and provide water quality monitoring equipment to citizen scientists. (Jones)
- Mill Creek Watershed: Conduct first Texas Stream Team Citizen Scientist Water Quality Monitoring Training Event at Winedale. Support new Texas Stream Team monitoring group with resources necessary to conduct monitoring to help support Mill Creek Watershed Partnership. (Jones)
- Shoal Creek: Austin Youth River Watch, Watershed Planning preparation and grant writing. (Miller)
- Upper San Antonio Watershed – efforts to reengage monitoring in Greater San Antonio, (San Antonio River Authority, Witte Museum, Schertz, Boerne, Alamo Area Master Naturalists). (Walker/Jones)
- Upper San Marcos: providing education and outreach support and materials, training and support of citizen science-based water quality and environmental monitoring, technical support and assistance with water quality analyses as well as coordinated water quality monitoring at strategic watershed locations. (Miller/Jones/Walker)
- Upper Trinity Watershed – Attend Upper Trinity River Basin Coordinating Committee Meeting to give updates to stakeholders within the Upper Trinity Watersheds. Coordinate training events and workshops with the North Central Texas Council of Governments to support partnerships within the region. Provide resources to become available on the North Central Texas Council of Governments website to share with partners and monitoring groups. Create Texas Stream Team Watershed Data Reports on citizen scientist water quality monitoring within the Upper Trinity Watershed. (Walker/Jones)
- Work with Blanco stakeholders regarding positioning for regional watershed planning and supporting Hill Country Alliance in efforts to promote watershed stewardship and education. (Miller/Jones/Walker)

## Lessons Learned

The watershed services activities are an integral part of Texas Stream Team program – we provide these services to partners, new and old, in areas of the state that have an engaged group of stakeholders as often as possible when our schedule and budget allow. We promote our services in multiple ways – word of mouth, TCEQ, partner organizations, watershed coordinator roundtables, Master Naturalist groups, Texas Trib+Water, The Meadows Center social media platforms, website, and more.

The positive outcomes of these activities are as follows:

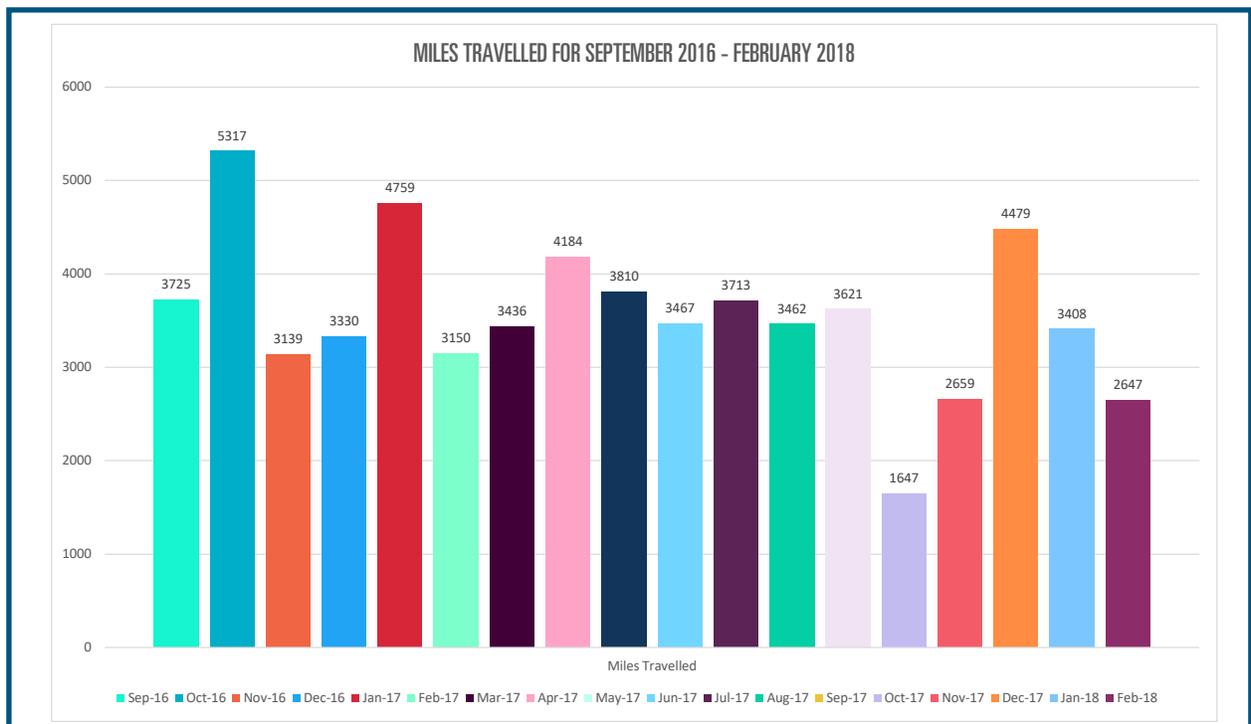
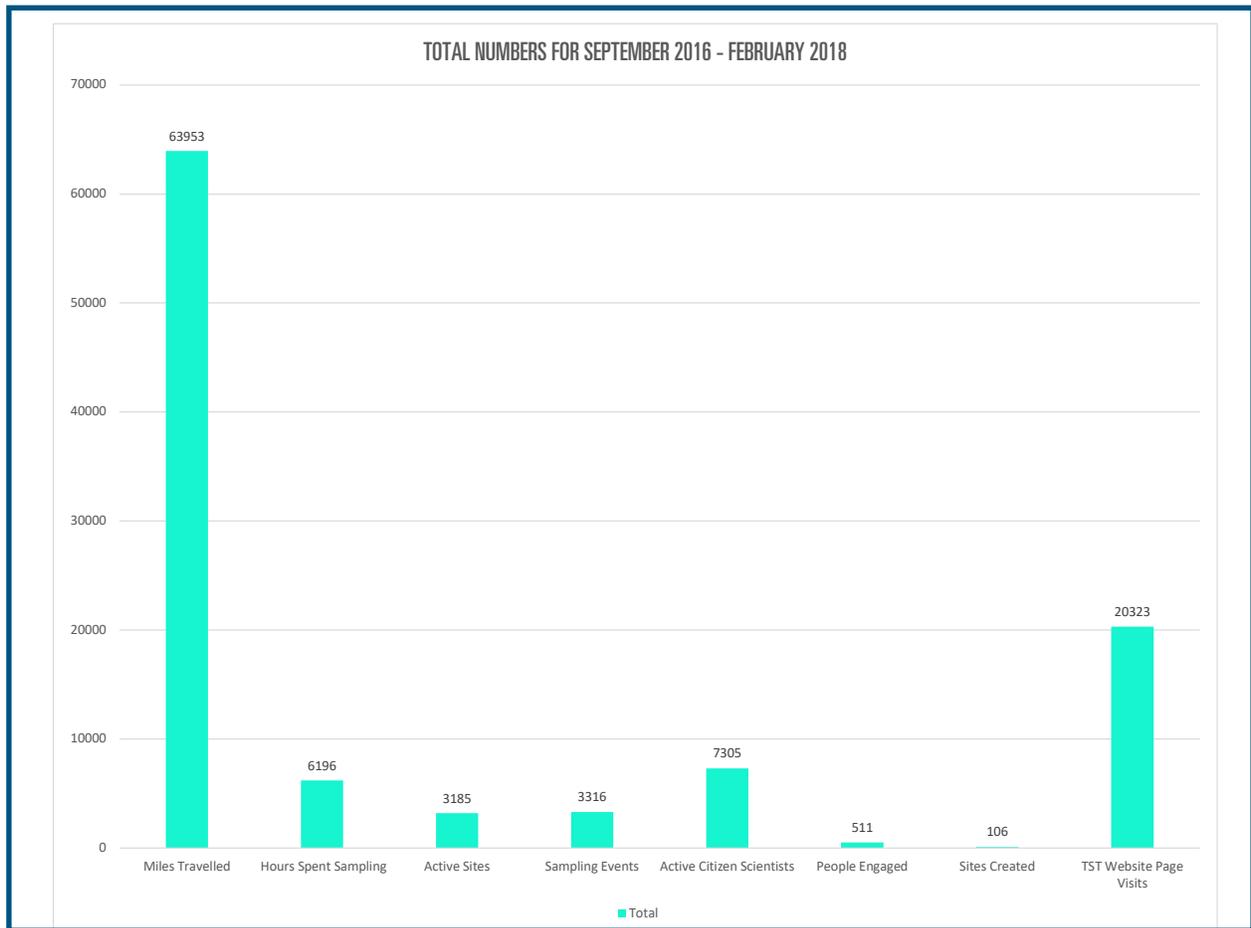
- Increased number of education events.
- Increased number of monitoring sites established.
- Increased number of citizen scientists trained.
- Increased number of partnerships/groups established.

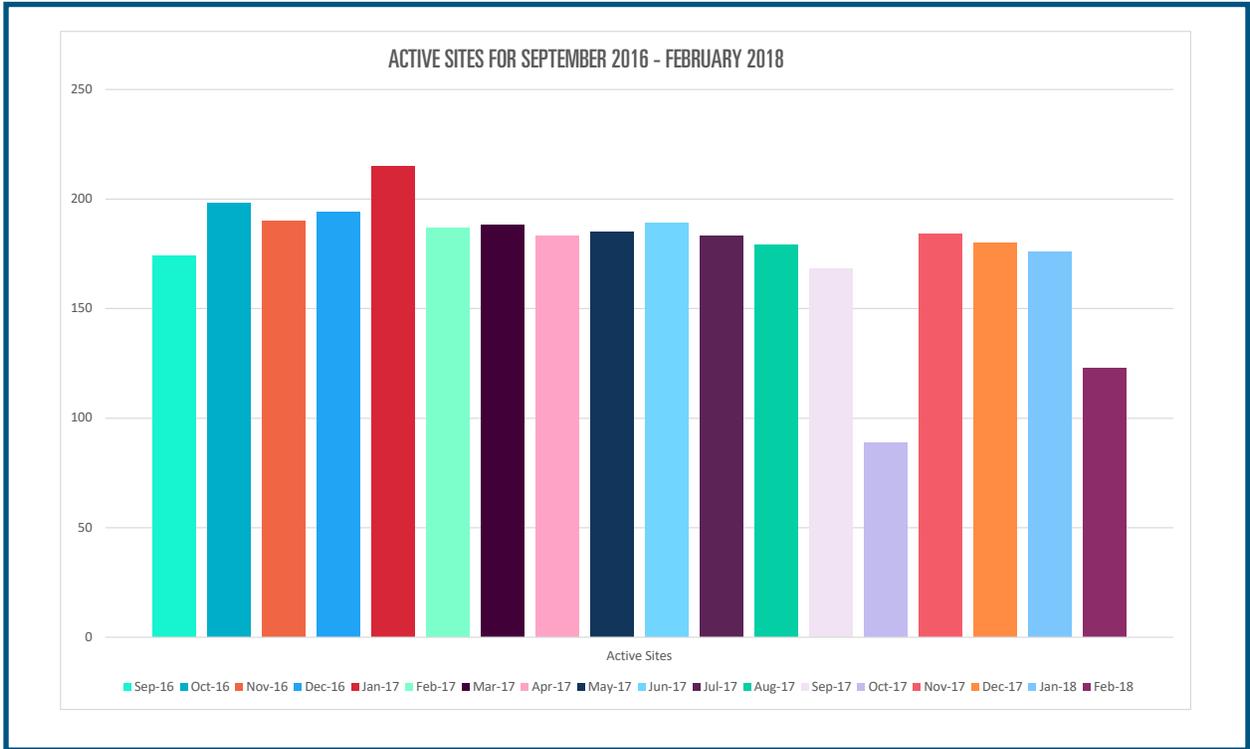
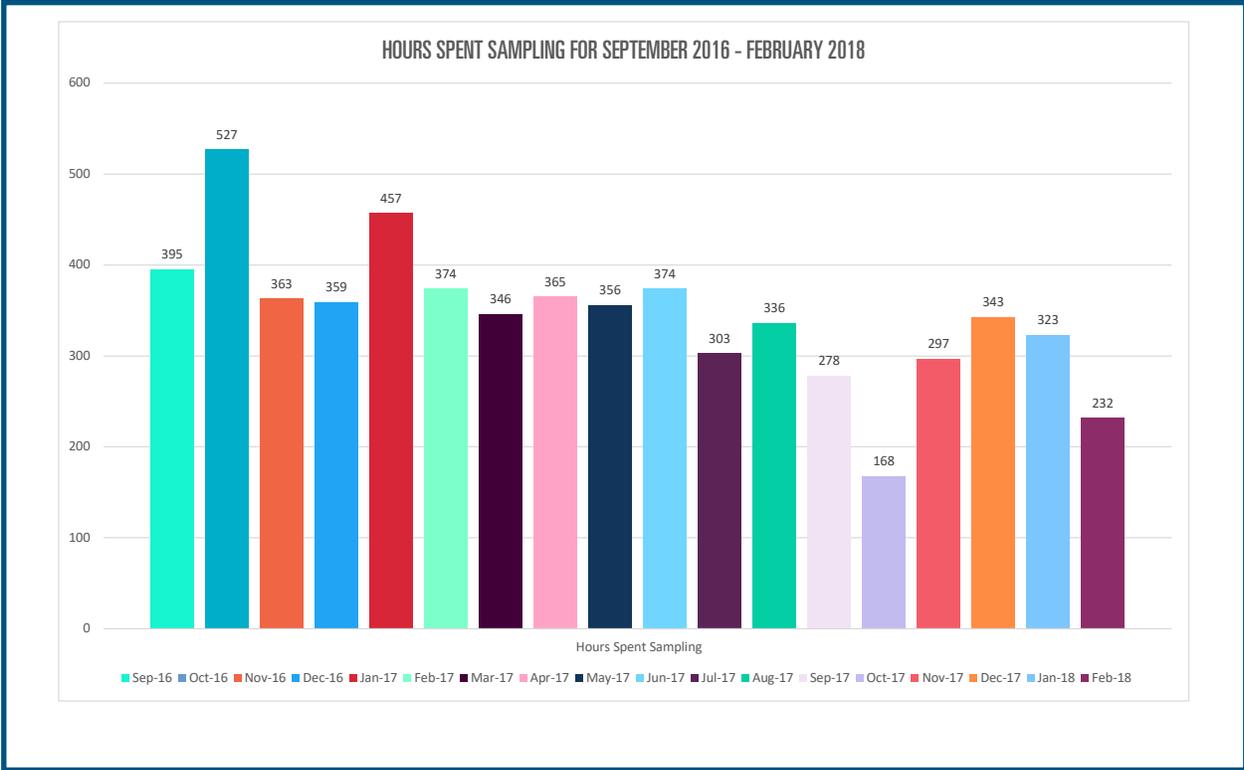
The main challenges we have faced over the past 18 months are as follows:

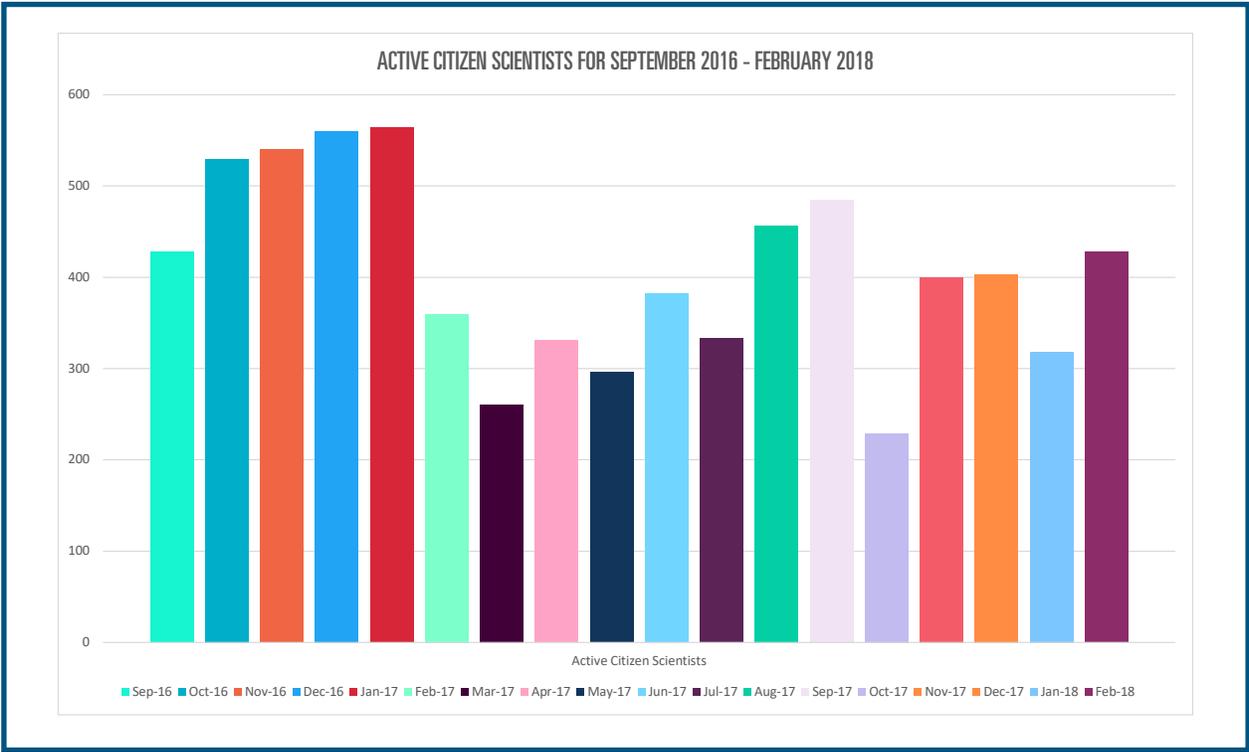
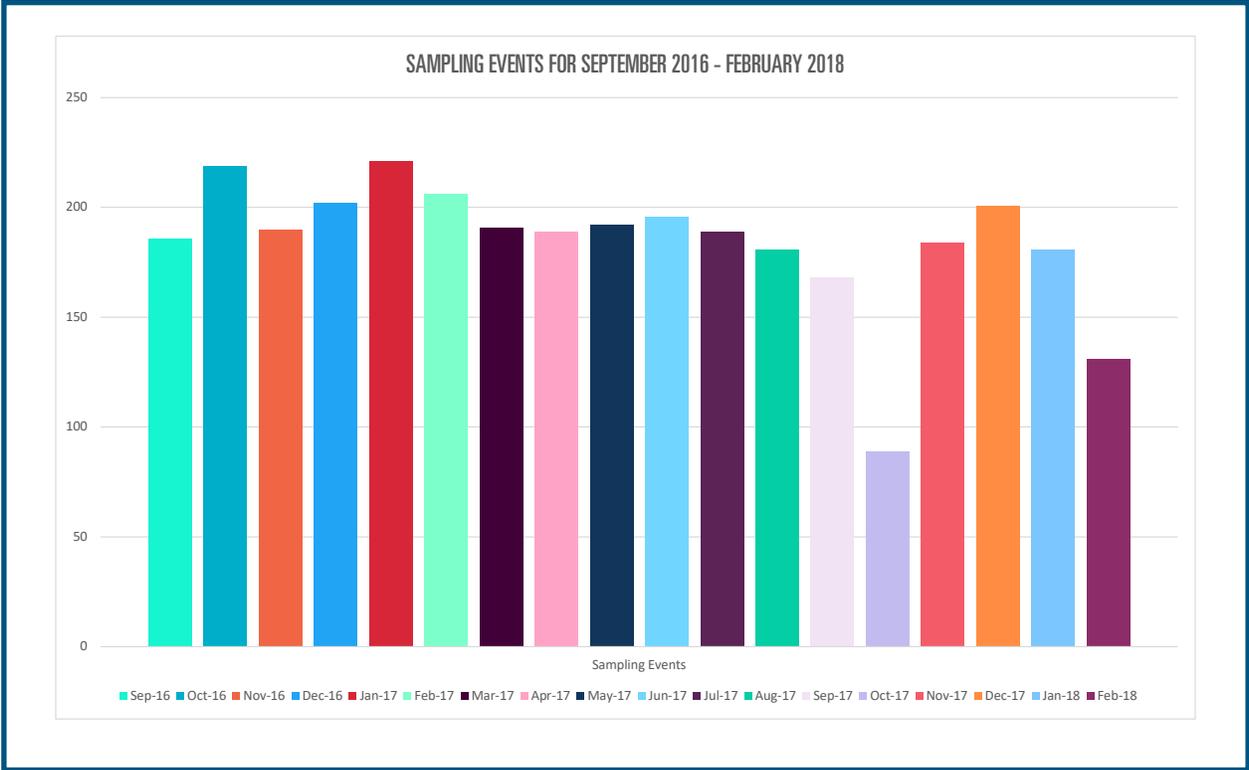
- Lack of funds to support the desired growth of new monitoring programs (ability to purchase additional monitoring kits and supplies).
- The need to decline invitations due to lack of travel funds or limited staff availability.

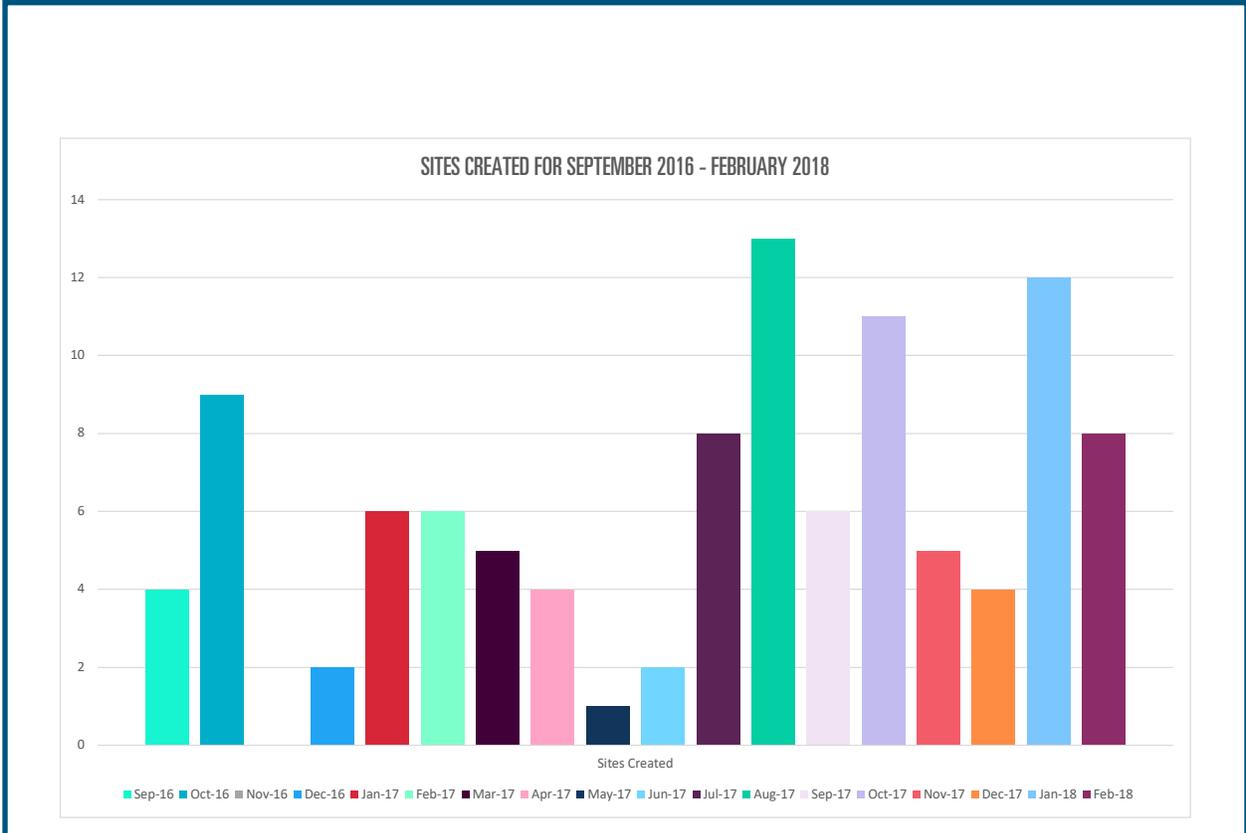
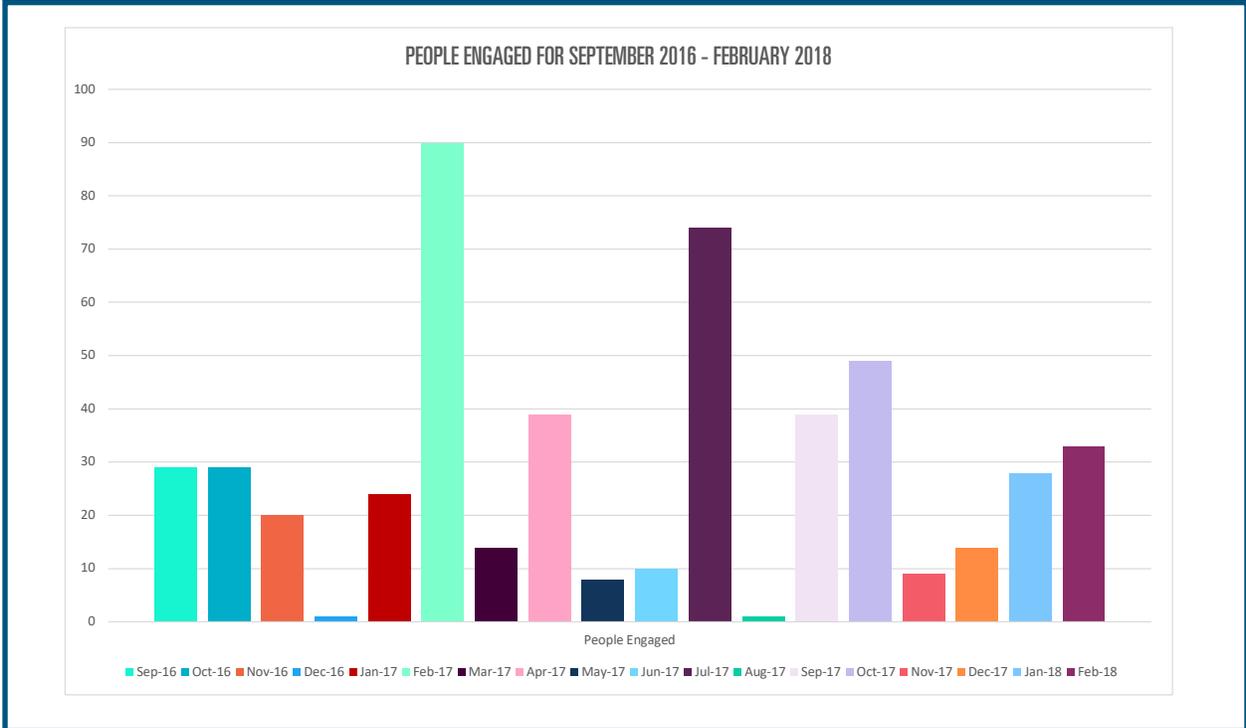
The team at TST has learned that it is crucial to involve regional partners for support and representation of Texas Stream Team if we have to decline an invitation to participate in an educational event due to a time or cost constraint, lack of funding to support the growth of existing monitoring efforts or the start-up of new monitoring efforts. Working with TCEQ staff to prioritize watersheds will allow for a heightened focus of efforts geographically speaking.

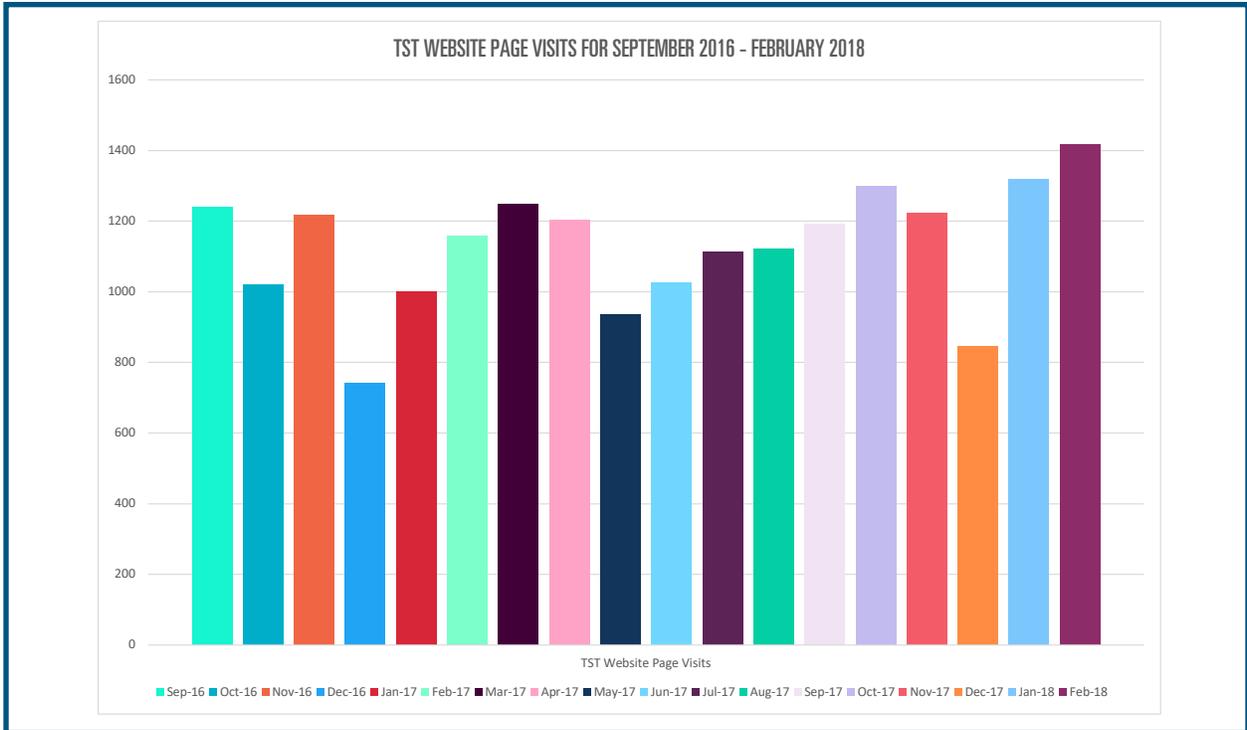
# TST METRICS











## CONCLUSION

TST staff looks forward to expanding the program through strengthened partnerships, additional monitoring, and more education and outreach events with the Nonpoint Source Program at TCEQ to continue its mission of improving watershed stewardship through citizen science and environmental education.



*Spring Lake. Photo by Jenya Mendelenko.*