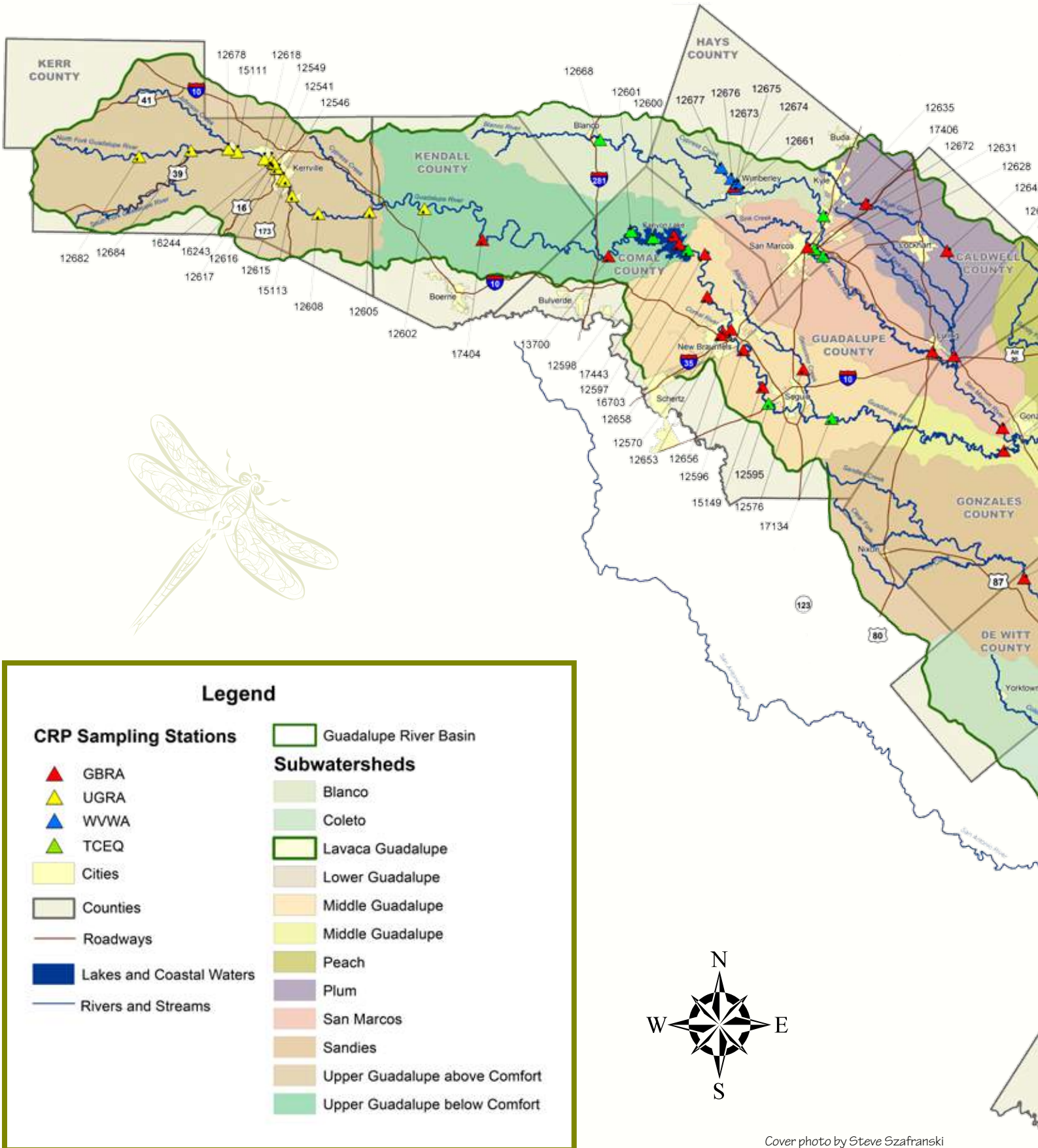


2014 Clean Rivers Program Basin Highlights Report

**Guadalupe River and
Lavaca-Guadalupe Coastal Basins**



Guadalupe River Basin



Legend

CRP Sampling Stations

- ▲ GBRA
- ▲ UGRA
- ▲ WWWA
- ▲ TCEQ
- Cities
- Counties
- Roadways
- Lakes and Coastal Waters
- Rivers and Streams

Subwatersheds


- Blanco
- Coledo
- Lavaca Guadalupe
- Lower Guadalupe
- Middle Guadalupe
- Middle Guadalupe
- Peach
- Plum
- San Marcos
- Sandies
- Upper Guadalupe above Comfort
- Upper Guadalupe below Comfort

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Introduction



This report highlights the activities of the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under the Clean Rivers Program (CRP) in 2013. The CRP is managed by the Texas Commission on Environmental Quality (TCEQ). The state-wide program is funded by fees assessed to water rights and wastewater discharge permit holders. The Guadalupe-Blanco River Authority (GBRA), together with the Upper Guadalupe River Authority (UGRA), carry out the water quality management efforts in the Guadalupe-Blanco River Basin under contract with TCEQ. The activities described in this report include water quality monitoring, a review of the 2012 list of impaired water bodies (303d List), public communication, watershed planning and stewardship activities. Information on other issues and activities that could affect water quality is also included in the *2014 Basin Highlights Report*. Information on the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin Clean Rivers Program can be found at www.gbra.org/crp.

Overview of Water Quality Monitoring

One of the key roles of the Clean Rivers Program is fostering coordination and cooperation in monitoring efforts. Coordinating monitoring meetings are held annually and are attended by the entities collecting water quality data on the Guadalupe River and its tributaries. By coordinating these efforts and discussing the areas in need of additional monitoring, more data will be collected,

maximizing the limited resources available to these entities. Table 1 outlines the types and amounts of water quality monitoring conducted in the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under a TCEQ-approved Quality Assurance Project Plan for September 2012 through August 2013.

Guadalupe River Basin Water Quality Sampling FY 2013 (September 2012 through August 2013)

Table 1. Summary of water quality sampling in the Guadalupe River Basin. DO = dissolved oxygen.

Sampling Entity	Field	Conventional	Bacteria	Biological and Habitat	24 Hr DO	Metals in Water	Metals in Sediment	Organics in Water	Organics in Sediment
GBRA	19 stations monthly; 8 stations quarterly	19 stations monthly; 8 stations quarterly	19 stations monthly; 8 stations quarterly	2 stations 2X per year	2 stations 2X per year	1 station 2X per year; 1 station annually	1 station annually	2 stations annually	4 stations annually
UGRA (Kerr Co)	11 stations quarterly; 9 stations monthly	11 stations quarterly	11 stations quarterly; 9 stations monthly						
TCEQ	10 stations quarterly	10 stations quarterly	10 stations quarterly			2 stations 2X per year	1 station 2X per year	1 station 2X per year	1 station 2X per year
WWWA	7 stations 8X per year	7 stations 8X per year	7 stations 8X per year		1 station annually				
TSSWCB-Plum Creek	5 stations monthly; 40 stations targeted for wet and dry weather quarterly; 3 stations quarterly for storm water; 7 wastewater effluents monthly; 3 springs quarterly	5 stations monthly; 40 stations targeted for wet and dry weather quarterly; 3 stations quarterly for storm water; 7 wastewater effluents monthly; 3 springs quarterly	5 stations monthly; 40 stations targeted for wet and dry weather quarterly; 3 stations quarterly for storm water; 7 wastewater effluents monthly; 3 springs quarterly		8 stations monthly during index period				
TSSWCB Geronimo Creek	7 stations monthly; 14 stations targeted for wet and dry weather quarterly; 3 spring quarterly	7 stations monthly; 14 stations targeted for wet and dry weather quarterly; 3 spring quarterly	7 stations monthly; 14 stations targeted for wet and dry weather quarterly; 3 spring quarterly		8 stations monthly during index period				

Continued on the following page

Overview of Water Quality Monitoring (cont.)

In addition to the monitoring programs conducted by the GBRA and the UGRA, the Wimberley Valley Watershed Association is conducting water quality monitoring in the Lower Blanco and Cypress Creek watersheds. The goals of these programs include establishing baseline water quality data; identifying potential pollution problems; documenting spatial and temporal changes; determining impacts of point and nonpoint source pollution; and assessing compliance with

water quality standards. These programs will also provide recommendations for local planning efforts to protect water quality. In addition to laboratory analyses, GBRA provides technical assistance and oversight of the quality assurance aspects of each program. The complete monitoring schedule is available at <http://cms.lcra.org>.

Guadalupe River Basin Water Quality Inventory and 303(d) List FY 2012 (December 2003 through November 2010)

Table 2. 2012 draft Texas Water Quality Inventory and 303(d) List (Guadalupe River Basin) assessed using data collected in 12/1/2003 through 11/30/2010.

Segment Number	Water Body	Impairment (303(d) List)	Concern
1801	Guadalupe River Tidal		Depressed Dissolved Oxygen; Nitrate-Nitrogen
1802	Guadalupe River below San Antonio River		Nitrate-Nitrogen
1803	Guadalupe River below San Marcos River		Bacteria
1803A	Elm Creek	Depressed Dissolved Oxygen	
1803B	Sandies Creek	Depressed Dissolved Oxygen; Impaired Macrobenthic and Fish Communities; Bacteria	Impaired Habitat
1803C	Peach Creek	Depressed Dissolved Oxygen; Bacteria	Chlorophyll a
1804A	Geronimo Creek	Bacteria	Nitrate-Nitrogen
1805	Canyon Lake	Mercury in Edible Fish Tissue	
1806	Guadalupe River above Canyon Reservoir	Bacteria	Impaired Habitat
1806D	Quinlan Creek	Bacteria	
1806E	Town Creek	Bacteria	Depressed Dissolved Oxygen
1810	Plum Creek	Bacteria	Depressed Dissolved Oxygen; Impaired Habitat; Nitrate-Nitrogen; Orthophosphorus; Total Phosphorus
1811A	Dry Comal Creek	Bacteria	
1813	Upper Blanco River		Depressed Dissolved Oxygen
1814	Upper San Marcos River	Total Dissolved Solids	
1815	Cypress Creek		Depressed Dissolved Oxygen; Impaired Fish Habitat; Impaired Fish and Macrobenthic Communities

Guadalupe River Basin Inventory of Events January through December 2013



Event	Segment/Sub Watershed	Comments
Proposed Solid Waste Disposal Sites under Review by the TCEQ	1804, 1810	Permit applications for two solid waste disposal sites have been submitted to the TCEQ. The permits are currently in the review process. The Post Oak Municipal Solid Waste Landfill (proposed permit no. 2378), located in eastern Guadalupe County in the Nash Creek subwatershed, is being strongly protested by local landowners and stakeholders in the county. The second location, 130 Environmental Park (proposed permit no. 2383) is in Caldwell County near the City of Lockhart.
New Wastewater Treatment Facilities planned for the Plum Creek Watershed	1810	The Walton Development has been approved for a new wastewater treatment discharge permit (WQ0015064001). The facility will be permitted to discharge up to 1.5 million gallons to Clear Fork Plum Creek. The facility which will provide wastewater treatment for a planned development in the Uhland area, is proposed to be located between Maxwell and Lockhart, near the intersection of CR 229 (Misty Lane) and CR 230 (Jolly Road). Additionally, the Walton Development renewed the permit for the Ranch at Clear Fork wastewater treatment plant (permit no. WQ0014439001). This permit is for the discharge of treated wastewater to the Clear Fork Plum Creek not to exceed 0.7 million gallons.
Guadalupe River above Canyon Reservoir stops flowing due to severe drought	1806	The Guadalupe River above Spring Branch could not be sampled in September 2013 due to the intense drought that has plagued the area since 2012. The same situation occurred in September 2011, demonstrating that the relief from drought in 2012 was very short-lived.
Fish Kill on Cypress Creek	1815	On September 9, 2013, a fish kill was reported on the Cypress Creek in Wimberley. TPWD investigated and estimated 25 largemouth bass and sunfish were killed by low dissolved oxygen conditions. Afternoon thunderstorms and high temperatures likely resulted in low dissolved oxygen concentrations leading to a fish kill.
Waterhyacinth treatments in the Guadalupe River and Diversion System	1801, 1804	TPWD and GBRA led treatment of waterhyacinth that blocked public access and created poor water quality conditions in the Lower Guadalupe River and Diversion System. More than 2,000 acres of bayous and lower river were treated with glyphosate in August and September 2013. GBRA has used the extremely cold weather to treat waterhyacinths in the hydro lakes in the mid-basin area. By lowering the water levels in Lakes Gonzales and Wood, hyacinths and seed beds are exposed to freezing temperatures. In addition to the cold freeze, GBRA manually removed 0.1 acres of waterhyacinths from Meadow Lake near Seguin. (See article on page 6).
Kyle WWTP reports spills	1810	Spills or illegal releases of untreated wastewater were reported by the operators of the city's wastewater treatment facility. Spills were reported on 10/13/2013 and 10/31/2013. Spills and plant upsets continue to be a problem at this facility. Additional spills were investigated and fines issued in November and December 2012.
Record flood hits upper Guadalupe River Basin	1806, 1809	A typical early fall flood event occurred from the evening of October 30 through late afternoon on October 31, 2013. There was widespread rainfall of 2-4 inches across portions of eight counties; substantial areas of 6-10 inches across Hays, western Comal, and central Travis counties; and a bull's eye of 12-14 inches in a narrow swath from Wimberley to Driftwood in Hays County. The rainfall resulted in major flash flooding along the I-35 Corridor from Georgetown to New Braunfels (NOAA). Canyon Reservoir saw a rise of 4 feet overnight due to the flood event.
Grass Carp Released in the Guadalupe River	1804	In November, GBRA, Guadalupe County and the Texas Parks and Wildlife Department partnered to control hydrilla by stocking the Guadalupe River downstream of the City of Seguin with 3270 triploid grass carp. TPWD personnel surveyed the river and found that over 100 acres of hydrilla was growing in the river channel, impeding flows and blocking public access. (See article on page 6).

GBRA Uses All “Tools” in the Integrated Pest Management Tool Box to Control Invasive Aquatic Vegetation

Hydrilla

In summer 2013, GBRA began receiving reports from landowners along the Guadalupe River, downstream of the City of Seguin that a large amount of rooted aquatic vegetation was in the river, blocking flows and river access and trapping debris in the plant mass. GBRA investigated and found that hydrilla was back... with a vengeance. The Texas Parks and Wildlife Department (TPWD) completed a survey of the Guadalupe River below Seguin to determine the approximate acreage of hydrilla in that portion of the river. TPWD mapped the stretch of the Guadalupe River from Nolte Dam, downstream of the City of Seguin, to just upstream of the crossing at Hwy. 80, near Belmont. The upper half dozen or so stretches were almost completely covered yet coverage in the remaining stretches was highly varied.



Hydrilla was found in 179 acres in this section of the Guadalupe River. Due to the clumpy, sometimes sporadic growth of hydrilla in the river, TPWD used a correction factor to better estimate hydrilla coverage. TPWD staff estimated hydrilla comprised 109 total acres.

Hydrilla is an invasive aquatic plant that if left unchecked will out-compete native vegetation, impede water flow and restrict public access and recreation. Based on the experience in the Rio Grande, the watermaster has reported that 30 percent more water had to be released from storage in order to deliver the purchased water downstream due to the “damming” effect of hydrilla. Hydrology studies by the Lower Colorado River Authority concluded hydrilla increased drag on transported water enough to increase the chances of flooding homes during high water events in Lake Austin.

This infestation was not GBRA's first experience with hydrilla. In 1996, GBRA participated in a project to control hydrilla in the upper two hydroelectric lakes. The three-prong attack included using two types of aquatic herbicides

and stocking triploid (sterile) grass carp, which eat the plant. The aquatic herbicide, *Aquathol*, was used in areas of moving water but it was recognized that this herbicide would provide limited control (45- 90 days). Another herbicide, *Sonar*, was used in the large open water “lake” portion of Lake McQueeney, but again, the effectiveness of the herbicide



Photos by Janet Thome

was limited to approximately one year. Grass carp proved to be the most effective control option. After grass carp were stocked hydrilla was eliminated from Lakes Dunlap and McQueeney, and has not returned in the past 17 years.

For the treatment in 2013, TPWD recommended a stocking rate of 30 grass carp per vegetative acre. Their recommendation was based on the experience they had on other waterbodies in the state, including Lake Conroe and Lake Austin. In order to stock grass carp, GBRA applied for a stocking permit issued by TPWD. Additionally, GBRA held a public meeting in the area to hear from concerned citizens and recreationists that are affected by the infestation. Those attending the public meeting were in full support of using the sterile grass carp as a means of control.

Over 3,200 sterile grass carp were stocked in the Guadalupe River in early November. Stocking occurred in the fall because stocking is not recommended in the hot summer months because high temperatures have shown to result in increased fish mortality and reduced effectiveness.

In the past GBRA has worked with homeowner associations and TPWD to fund vegetation control activities, but it was not an option this time. TPWD participated in the project by offering valuable technical expertise on control methods, approving the permit to purchase sterile grass carp and participating in public meetings. The Guadalupe County Commissioners Court funded half of the cost for the fish.

Control Invasive Aquatic Vegetation (cont.)

Waterhyacinths

Waterhyacinths have long been a nuisance in the Guadalupe River Basin. The floating aquatic plant has beautiful purple flowers that attracted homeowners to use the plant in decorative water features. They soon learned the plant grows at alarming rates.

This invasive plant affects water quality by covering the water surface, blocking sunlight and oxygen and reducing the growth of other aquatic plants and organisms. The state recognized the dangers of waterhyacinths and declared them a nuisance species. TPWD established regulations that provide penalties for possession, transport and placement of these species in public waters.

In 2013, as in other years, GBRA took advantage of the opportunity offered by Mother Nature. When the forecast predicted two days or more of freezing temperatures, GBRA lowered water levels on Lakes Gonzales and Wood enough to expose the plants to the subfreezing temperatures. By lowering lake levels 6-18 inches, acres of waterhyacinths were exposed and died.

The Lower Guadalupe River Basin and Diversion System have been highly susceptible to excessive stands of waterhyacinths. Elevated river flows bring mats of waterhyacinths downstream to the lower reaches of bayous, canals and estuaries. GBRA manually removed mats of plants in the diversion system when mats blocked canal checks. In 2013, landowners and recreationists contacted GBRA with concerns about the excessive growth throughout the system. At a meeting of the Guadalupe and San Antonio Bay and Basin Area Stakeholders Committee, a scientist doing surveys of the Lower Guadalupe River and Delta for the Texas Water Development Board pointed out the excessive stands and their potential impact to water entering the bays. According to the IUCN Global Invasive Species Initiative, "Waterhyacinths increase evapotranspiration well above that of open water (often over 3 times "open pan" evaporation) thus causing significant water loss to dams, reservoirs and wild waters."

The Lower Guadalupe River and Delta is the portion of the river below the Hwy. 35 bridge that flows to San Antonio Bay. The natural bayous located in this area, (Hog Bayou and Goff Bayou), are accessed by recreationists and is the final leg of the Texas Water Safari canoe race each summer. These areas are surveyed by volunteers participating in the



Photos by Bryan Gerold

Christmas bird count each year. Schwings Bayou is part of the Lower Guadalupe River and Delta area accessible by boat from Mission Lake. All of these areas have experienced severe infestations of waterhyacinths, becoming almost impassible by boat.

GBRA held a "vegetation summit" in early 2013, and learned that stakeholders were in full support of taking action for control of waterhyacinths. GBRA, in partnership with TPWD, initiated a vegetation management project in the Lower Guadalupe River Basin. The project was a two-prong attack on the invasive plant. Aerial application of the herbicide *AquaNeat*, with the active ingredient, glyphosate, was applied on approximately 208 acres of waterhyacinths, including the TPWD Wildlife Management Area. A second application of herbicide was made by boat in order to treat those plants that were not reached in the first phase.

The lower basin will always be susceptible to infestations of nuisance aquatic vegetation. Flows from the upper basin bring mats of waterhyacinths downstream from the lakes and backwater areas of the river to the nutrient-rich water in the lower basin. These quiescent areas are perfect for the waterhyacinth to amass. In an effort to establish a means for continued control, the San Antonio Bay Foundation (SABF) suggested establishing a Cooperative Weed Management Area (CWMA). CWMAs are local organizations that bring together landowners and land and water managers to coordinate action and share expertise and resources to manage common weed species (National Network of Invasive Plant Centers). These collaboratives function under the authority of a mutually developed memorandum of understanding or cooperative agreement. Governed by a steering committee, the CWMA partners develop a comprehensive weed management plan. SABF is working with the Texas Agrilife Extension Service offices located in Calhoun, Refugio and Aransas counties to get a CWMA established in the Lower Guadalupe River Basin.

Status of the EARIP Habitat Conservation Plan



Habitat Protection Measures - Comal Springs

- Old Channel Restoration
- Flow Split Management
- Aquatic Vegetation Restoration
- Non-Native Animal Species Control
- Decaying Vegetation Removal
- Restoration of Riparian Zones & Riffle Beetle Riparian Improvement
- Gill Parasite Control
- Household Hazardous Waste Program
- Litter Control and Floating Vegetation Management
- Golf Course Management Plan

Habitat Protection Measures - San Marcos Springs

- Texas Wild Rice Enhancement and Restoration
- Sediment Removal
- Control of Non-Native Plant Species
- Management of Floating Vegetation Mats and Litter
- Sessom Creek Sand Bar Removal
- Non-Native Species Control
- Designation of Permanent Access Points/ Bank Stabilization
- Native Riparian Habitat Restoration
- Management of Household Hazardous Waste
- Management of Recreation in Key Areas
- Septic System Registration and Permitting System
- Minimizing Impacts of Contaminated Run-off
- Diversions of Surface Water
- Diving Classes and Research Programs in Spring Lake
- Boating in Spring Lake
- Management of Golf Course and Grounds

Flow Protection Measures

- Voluntary Irrigation Suspension Program Option (VISPO)
- Regional Municipal Water Conservation Plan Stage V Critical Management Period
- Use of SAWS Aquifer Storage and Recovery (ASR)

Supporting Measures

- National Fish Hatchery and Technology Center Applied Research Facility
- LID/BMP Regional Measures
- Prohibition of Hazardous Materials Transport Across Rivers
- Water Quality and Protection
- NFHTC Refugia
- Ecological Modeling
- Biological Monitoring

Texas Wild Rice

After five years of data collecting, studying, theorizing, compromising and negotiating, stakeholders of the Edwards Aquifer Recovery Implementation Program (EARIP) emerged in December 2012 with a scientifically developed habitat conservation plan (HCP) that will aid in the recovery of federally listed species dependent on the aquifer. In March 18, 2013, with the approval of the U.S. Fish and Wildlife Service (USFWS), the Edwards Aquifer HCP and Incidental Take Permit went into effect.

The struggle of over-pumping from the Edwards Aquifer is decades old, recent history on this issue can be traced to 1991 when the Sierra Club filed a lawsuit under the Endangered Species Act (ESA) that ultimately resulted in the creation of the Edwards Aquifer Authority (EAA). The Texas Legislature directed the EAA to regulate, among other things, pumping from the aquifer, to implement critical period management restrictions, and pursue a program “to ensure the continuous minimum springflows of the Comal and San Marcos Springs are maintained to protect endangered and threatened species to the extent required by federal law...”

Balancing the use of water from the Edwards Aquifer remained a contentious issue particularly in years where drought conditions hit the state. In the fall of 2006, the USFWS brought together 26 stakeholders from throughout the region. The stakeholders represented diverse and sometimes conflicting interests spanning from the Hill Country to the Gulf Coast. They participated in a collaborative process to develop a plan to aid in the recovery of federally-listed species dependent on the aquifer. This process became known as the EARIP.

In May 2007, the Texas Legislature codified the EARIP in state law and directed the EAA and certain other stakeholders to participate in the EARIP and to prepare a USFWS-approved plan for managing the aquifer to preserve the federally-listed species by 2012. The Legislature directed that the plan include, among other things, recommendations regarding withdrawal adjustments during critical periods that ensure that federally-listed species associated with the aquifer would be protected.

Through a deliberative process, EARIP stakeholders recommended that the EAA, the City of San Antonio, acting by and through its San Antonio Water System (SAWS), City of San Marcos, City of New Braunfels, and Texas State University apply for an Incidental Take Permit (ITP) under section 10(a)(1)(B) of the ESA. The agreed-upon HCP is intended to support the issuance of an ITP, which would allow the “incidental take” of threatened or endangered species resulting from the otherwise lawful activities involving regulating and pumping of groundwater from the Edwards Aquifer within the boundaries of the EAA for beneficial use for irrigation, industrial, municipal and domestic and livestock uses, and the use of Comal and San Marcos springs and river systems for recreational and other activities.

The minimization and mitigation measures included within the HCP are designed to ensure that incidental take resulting from the covered activities will be minimized and mitigated to the maximum extent practicable and will not appreciably reduce the likelihood of the survival and recovery of the species associated with the aquifer, Comal and San Marcos springs and rivers ecosystems. Measures being implemented by the partners in the Edwards Aquifer HCP are listed in the sidebar. The EARIP’s HCP can be viewed online in its entirety at www.eahcp.org.



GBRA River Network – Access to Real-Time Monitoring Data

In 2010, GBRA received a Clean Water Act section 319(h) non-point source grant administered by the TCEQ to create a network of continuous water quality monitoring stations throughout the Guadalupe River Basin. This network is collectively termed the Guadalupe River Basin Monitoring Network (GBRMN). The initial locations for the water quality monitoring devices in the network were strategically targeted to fill in data gaps in water bodies with active watershed protection plans (WPPs) or total maximum daily load studies (TMDLs). GBRA maintains continuous water quality monitoring stations on Plum Creek, Geronimo Creek, Sandies Creek and Cypress Creek. The WPPs and TMDLs have been developed to address known water quality impairments or concerns. The monitoring equipment of the GBRMN allows stakeholders and assessors to observe and document real-time water quality changes in the targeted water bodies over extended periods of time. The hourly data from all of the stations in the GBRMN can be viewed on the TCEQ webpage at http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html or www.texaswaterdata.org.

The continuous ambient monitoring station (CAMS) on the Geronimo Creek at State Highway 123 is located in Geronimo, Texas. This station was put into place in order to support the efforts of the ongoing Geronimo Creek WPP to address concerns with rising bacteria levels and nitrate-nitrogen in the Geronimo and Alligator creeks watersheds. The River Network CAMS station #741 on Geronimo Creek provides hourly data updates of stream level, stream velocity, stream flow, water temperature, specific conductance, pH, dissolved oxygen and turbidity. Stream flow and gage height parameters were added to this site on the Geronimo Creek because no continuous U.S. Geological Survey (USGS) stream flow gage data was available in this watershed.

A CAMS site on the Cypress Creek is near the confluence with the Blanco River in Wimberley. This station was targeted to assist with the development of a Cypress Creek WPP to address concerns with bacteria and sediment in the Cypress Creek Watershed. The River Network CAMS station #797 on the Cypress Creek provides hourly data updates of water level, water temperature, specific conductance, pH, dissolved oxygen and turbidity. This station supplements the data provided by the USGS station at the upper end of

the watershed in Jacob's Well with data from downstream of the populated areas of Wimberley.

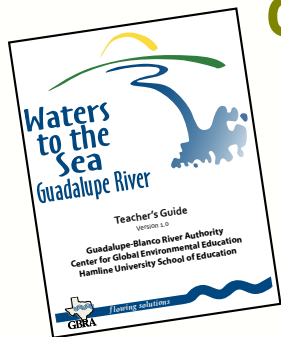
A CAMS site on the Sandies Creek is located on Cheapside Road near Westhoff. This station was targeted to assist with the Sandies Creek TMDL and to address concerns about bacteria in the Sandies Creek Watershed. The River Network CAMS station #732 on the Sandies Creek provides hourly data updates of water temperature, specific conductance, pH, dissolved oxygen and turbidity. This station supplements the flow data provided by the USGS station directly adjacent to this CAMS station with real-time water quality data. The data provided has become even more useful as the data is scrutinized to assist with identifying surface water quality trends associated with hydraulic fracturing activities in the Eagle Ford Shale Play underlying the Sandies Creek Watershed.

GBRA has plans to deploy a depth profiler on Canyon Reservoir in 2014. The profiler will provide water quality data at one meter intervals, from the surface to the deepest parts of the reservoir daily. Additionally, GBRA is applying for a grant that will establish a real-time monitoring site in the diversion system in the Lower Guadalupe River Basin.



Photos by Lee Gudgell

CRP Partners Emphasize Public Education



GBRA's award-winning fourth grade program, *Journey through the Guadalupe River Basin*, maintains a strong presence in schools throughout the river basin. This Texas Science and Social Studies Education Standards TEKS-correlated program takes an interdisciplinary approach to the subject of water, placing an emphasis on watersheds and water quality, specific to the Guadalupe River Basin. In addition, the curriculum touches on the water cycle, water uses in the basin, population growth, and water conservation. GBRA continues to offer teacher trainings for this program.

Waters to the Sea, Guadalupe River is a new multi-media middle school program that was introduced by GBRA during school year 2012-2013. Education staff worked on development of this new program with the Center for Global Environmental Education (Hamline University, St. Paul, Minnesota). This new interactive learning program highlights relationships between human activities and water resources within the Guadalupe Watershed from the river's headwaters to San Antonio Bay. The program meets TEKS through numerous short videos, animations, simulations, and multimedia interactives that draw from the region's rich history. Modules focus on themes ranging from traditional Native American uses of natural resources, to the importance of water for agriculture, to the impacts of urban growth on surface water runoff, to the importance of wetlands at the bay. The program was completed in summer 2012. Teacher trainings began immediately and will continue until all school districts have been trained.

Education staff makes a concerted effort in both the Plum Creek and Geronimo Creek watersheds. Water quality education and monitoring are introduced to fourth- and fifth-grade students in these target watersheds. School year 2012-2013 was the sixth consecutive year GBRA Environmental Education Administrator Cinde Thomas-Jimenez led efforts in public elementary schools in the Plum Creek Watershed. Working side-by-side with teachers and students, Jimenez spent

two weeks in classrooms presenting information using a tabletop watershed model to discuss watersheds, nonpoint source pollution and the Plum Creek project directly with the students. All needed supplies were donated to the schools, including water monitoring test kits, watershed map posters and student workbooks. About 850 students and 32 teachers conducted water quality testing in late spring. Using the Texas Stream Team methods as a model for their monitoring, students have tested water from Plum Creek for the following parameters: temperature, dissolved oxygen, pH, turbidity, nitrates, and phosphates (bacteria also was an option). The results of the student monitoring indicate a slight decrease in dissolved oxygen and increases in phosphates and nitrates as the creek moves from the urban area in the northern portion of the watershed to the more rural southern area. This effort continues in eleven Plum Creek schools during 2013-2014.

Public education efforts are ongoing in the Upper Guadalupe Basin as well. UGRA has an active education program designed to give Kerr County residents a better understanding of the Upper Guadalupe River and its watershed. UGRA staff prepares presentations for area schools, clubs, organizations and summer camps to teach about water quality, conservation, the water cycle, and the importance of the Guadalupe River to the community. UGRA publishes a monthly column in the local newspapers about water quality and the aquatic environment and has an active public awareness campaign to keep the community informed on water issues. Above all, UGRA is a resource and advocate for the community on water quality, surface water, and the Guadalupe River. Please contact UGRA with comments, questions or concerns at (830) 896-5445 or www.ugra.org.



Rodriguez Elementary School - Photo by Elizabeth Aguilar



Travis Linscomb with UGRA measuring flow in Johnson Creek
Photo by Tara Bushnoe

Watershed Protection Activities Going Strong in the Guadalupe River Basin

When asked to describe the Guadalupe River Basin geographically, an image of the main stem of the Guadalupe River might come to mind. But most would not picture the landscape divided into the many watersheds that make up the river basin. A watershed describes an area of land where all the streams drain into a single larger body of water. The map on the inside cover of this publication shows the major watersheds that make up the Guadalupe River Basin. The latest approach to water quality protection is the watershed approach. According to *EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, "The watershed approach is a flexible framework for managing water resource quality and quantity within specified drainage areas, or watersheds. This approach includes stakeholder involvement and management actions supported by sound science and appropriate technology." The watershed approach has been used to address water quality issues in several watersheds in the Guadalupe River Basin. Beginning with Plum Creek in 2003, watershed protection plans have been or are being developed that address water quality issues or "impairments," with the goal of restoring water quality. WPPs are strategies that assess a waterbody and after determining the possible sources of pollution, prescribe best management plans (BMPs) that, if put in place, will reduce pollutant loadings. Most of the plans in the Guadalupe River Basin have been developed on streams that have been designated as impaired by the TCEQ. An impaired waterbody does not meet water quality criteria, which can affect the stream's designated uses, such as recreation.

The following sections describe watershed protection plans and their associated stakeholder partnerships that are active in the Guadalupe River Basin. A list of all of the segments of the Guadalupe River Basin that have been designated as impaired can be found on page 4 of this *Basin Highlights Report*.

Watershed Protection Activities are continued on the following pages

Watershed Protection Activities (cont.)

Bacteria Reduction Plan for the Upper Guadalupe River

The Upper Guadalupe River in Kerr County remains listed as impaired due to bacteria in a small section in Kerrville. In 2011, UGRA partnered with the City of Kerrville, Kerr County, and the Texas Department of Transportation (TXDOT) to implement the Bacteria Reduction Plan for the Upper Guadalupe River through a Clean Water Act Section 319(h) grant from TCEQ. The ultimate goal of this project is to reduce bacteria concentrations in the Upper Guadalupe River to levels that meet the contact recreation criteria defined in the Texas Surface Water Quality Standards. The Bacteria Reduction Plan includes strategies to address the primary sources of bacteria pollution that have been identified in this section of the Guadalupe River including birds nesting under bridges, large flocks of domestic waterfowl congregating in the lakes, septic systems, and pollution from general urban runoff.

During the past year, much progress was made to implement the

management measures outlined in the Bacteria Reduction Plan. Netting was installed on the SH16 Bridge in Kerrville to prevent birds from roosting directly over the Guadalupe River and routine street sweeping was carried out throughout the watershed by the City of Kerrville. In 2013, a total of 26,025 pounds of litter was removed from the watershed through UGRA's river crossing cleanup and annual river cleanup programs. In addition to regular radio commercials and newspaper articles promoting understanding of water quality issues, an interactive kiosk supporting education programs about storm water runoff was introduced to the community.

Strategies to reduce bacteria pollution from pet waste were some of the first implementation measures established in the Upper Guadalupe River watershed through the installation of

twelve pet waste stations. Seven of the stations are installed at Flat Rock Park in Kerrville, including four stations in the associated off-leash dog park. The pet waste stations continue to be used frequently at Flat Rock Park and the quantity of waste collected in the pet waste station trash cans is weighed by UGRA staff on a weekly basis. In 2013, a total of 1,334 pounds of pet waste was documented at the seven stations. An additional ten pet waste stations were recently purchased for use by the City of Kerrville in Louise Hays Park and along the planned river trail.



Geronimo and Alligator Creeks Watershed Protection Plan

In 2007, the Texas State Soil and Water Conservation Board (TSSWCB) Regional Watershed Coordination Steering Committee, using established criteria, ranked Geronimo Creek in the top three watersheds for selection of WPP development. Geronimo Creek and its tributary Alligator Creek are located in Comal and Guadalupe counties. The approximately 70-square-mile watershed begins on the west side of IH35 near New Braunfels, flows southeasterly through the rapidly developing area between Austin and San Antonio and confluences with the Guadalupe River near the City of Seguin. As development and population growth

continue, the conversion of rural land uses to urban land uses will increasingly impact the hydrology and water quality in the watershed (Extension, 2012).

Historical data identified a bacteria impairment and a concern for nitrate-nitrogen in Geronimo Creek. The TSSWCB project titled, *Development of a Watershed Protection Plan for Geronimo Creek*, was begun in June 2008. The project included water quality monitoring, water quality modeling and WPP development. The development of the WPP for Geronimo and Alligator Creeks has been a stakeholder driven process, in partnership with the EPA, TSSWCB, Texas A&M AgriLife

Extension and GBRA. The Geronimo and Alligator Creeks Watershed Partnership (the Partnership) Steering Committee includes local officials, landowners, business owners and citizens, and is supported by state and federal agency partners. With technical assistance from project staff, the Partnership identified issues that are of particular importance to the surrounding communities. They contributed information on land uses and activities that was helpful in identifying the sources of nutrient and bacterial impairments. Potential sources of *E. coli* and nutrients identified through the development

Watershed Protection Activities (cont.)

Geronimo and Alligator Creeks Watershed Protection Plan

of the WPP include: urban runoff, dog waste, wastewater collection systems, failing on-site sewage facilities (OSSFs), livestock, deer, and feral hogs. The Geronimo and Alligator Creek Watershed Protection Plan (GACWPP) was accepted by the EPA in September 2012.

The completion of a WPP does not end the process. In many respects, it is just the beginning. The watershed planning process in Geronimo and Alligator creeks has moved into the implementation phase. During this phase, entities are using the watershed protection plan to help secure grant funding that will implement the Best Management Practices (BMPs) identified in the plan. The timeline for full implementation of all the management measures in the GACWPP is 10 years. The Partnership continues to meet quarterly, hearing presentations on local and statewide initiatives, and receiving updates about projects that are underway in the watershed.

GBRA continues to build on the data collected by the Clean Rivers Program, monitoring eight sites monthly under routine conditions and 14 sites under dry and wet weather targeted conditions. Drought conditions over the past several years have created very low flows in the upper end of the

watershed, with several sites that do not have measurable flow.

As part of implementation, Texas A&M AgriLife Extension and GBRA continue to facilitate the Partnership. Additionally, the partners facilitate and coordinate education and outreach activities in the watershed to promote public participation and implementation of the WPP. Their efforts include active use of local media outlets to communicate project planning efforts and activities; contributions to the project website; development and dissemination of fact sheets and other educational resources and, coordination of local meetings and educational events. The educational events that have been held or will be held in the coming months include workshops on the operation and maintenance of on-site septic systems, workshops on the control of feral hogs, and workshops on low impact development practices directed toward municipal and county officials. Extension has conducted a Texas Watershed Stewards Workshop, the first Texas Well Owner Network Workshop, and agricultural nutrient management seminars. Extension has partnered with GBRA to provide informational booths at environmental events. Information on upcoming workshops can be found on the project website: www.geronimocreek.org.

To educate and increase awareness of water quality issues in the watershed, GBRA assisted the Seguin High School's project-based summer class in the summers of 2012 and 2013. Students conducted studies on Geronimo Creek, such as benthic macroinvertebrate sampling and identification, water quality monitoring, and stream cleanup activities.

The Texas Water Resources Institute (TWRI), under the Texas State Soil and Water Conservation Board's Clean Water Act (CWA) section 319(h) Nonpoint Source Grant Program Project No. 12-07, *Statewide Delivery of Riparian and Stream Ecosystem Education Program*, conducted one of its 25 riparian workshops in the Geronimo Creek watershed.

The goals of the TWRI project include 1) promotion of healthy watersheds and improvement of water quality through the delivery of riparian and stream ecosystem education programs with a focus on priority watersheds; 2) increase citizen awareness, understanding, and knowledge about the nature and function of riparian zones, their benefits, and BMPs to protect them and minimize NPS pollution; 3) enhancement of

interactive learning opportunities for riparian education across the state; and, 4) establish a larger, more well-informed citizen base working to improve and protect local riparian and stream ecosystems.



Riparian Workshop - Photo by Nick Dornak

Watershed Protection Activities (cont.)

Comal-Guadalupe Soil and Water Conservation District

Nonpoint agricultural sources of pollutant loading may be addressed by implementing BMPs on agricultural operations. Agricultural producers, along with Soil and Water Conservation Districts (SWCDs), TSSWCB, the Natural Resource Conservation Service (NRCS) and EPA, have been collaborating to protect the natural resources in Texas for decades. Through the TSSWCB's Water Quality Management Plan (WQMP) program, farmers and ranchers routinely implement BMPs on their land utilizing financial and technical assistance programs from SWCDs who receive state and federal funds from TSSWCB, EPA, and NRCS. Expanding participation of agricultural producers in implementation of the GACWPP

is essential to achieve water quality improvement. As an established and well-known local entity, the Comal-Guadalupe SWCD is uniquely situated to engage and support agricultural producers in watershed restoration and protection efforts, including implementation of appropriate BMPs to address nonpoint source pollution.

A WQMP is a site-specific plan developed through, and approved by, SWCDs which includes appropriate land treatment practices, production practices, management measures, and technologies that prevent and abate agricultural and silvicultural nonpoint source pollution. SWCDs provide technical assistance to producers seeking to develop a WQMP.

TSSWCB and NRCS have various financial assistance programs that help producers implement a WQMP. TSSWCB administers federal CWA §319(h) funds through the Comal-Guadalupe SWCD #306 for support of one district technician who will provide technical assistance to agricultural producers in developing and implementing WQMPs and prescribed grazing plans in the Geronimo and Alligator creeks watersheds. Upon certification of the WQMP, the district technician will work with the landowners to implement the BMPs prescribed in the WQMP. The district technician will also assist landowners in applying for and obtaining financial assistance to aid in implementation of BMPs prescribed in WQMPs.

Cities of Seguin and New Braunfels

Upstream in the Alligator Creek watershed, New Braunfels has begun implementing components of its Phase II storm water permit, which will reduce bacteria and nutrient loading in storm water. The City of Seguin has begun a CWA section 319(h) grant, *Best Management Practice Implementation Project to Reduce Bacteria and Nitrate-Nitrogen Loading in the Geronimo Creek Watershed*. The project will provide funding for the decommissioning of failing on-site sewage facilities (OSSFs) in the Oak Village North Subdivision. The OSSFs in the project area can be a source of *E. coli* due to the high ground water

table, high failure rate, and the OSSFs proximity to Geronimo Creek. The city is extending sewage collection lines to the subdivision, but homeowners are only required to tie into the system based

on the age of their OSSF. Funding for decommissioning will provide an incentive to homeowners in the area to connect to the city's collection system sooner rather than later.



Seguin High School project-based summer class- Photo by Janet Thome

Watershed Protection Activities (cont.)

Irma Lewis Seguin Outdoor Learning Center

The GACWPP states “An aggressive outreach and education program will be vital to successful engagement of watershed stakeholders.” The proposed project, *“Taking Charge of Water Quality in the Geronimo and Alligator creeks watersheds through Outreach and Education,”* is a collaborative effort between GBRA, Texas A&M AgriLife Extension and the Irma Lewis Seguin Outdoor Learning Center (ILSOLC) to provide such outreach. The ILSOLC is an environmental and recreational learning center located in the heart of the Geronimo and Alligator creeks watersheds. Beginning with an initial donation of 23 acres from Carla Blumberg in 1995, the ILSOLC has grown to more than 115 acres. With incredible support from the community, the Seguin ISD, local businesses, public

and private foundations, and a legion of volunteers, the ILSOLC has provided the citizens of south central Texas with a multitude of recreational and educational opportunities. ILSOLC offers many exciting, hands-on science and nature activities for explorers and naturalists of all ages.

Geronimo Creek flows through the facility and is used as part of an outdoor “classroom” for learning about nature and the environment. School children of all ages from the Seguin, San Marcos, New Braunfels and Comal independent school districts visit the facility annually. Classes rotate between stations to learn about fishing, kayaking, orienteering, outdoor recreation and creek ecology. The outreach project will expand that rotation by adding additional stations

that focus on the environmental health of the creek and its riparian habitat.

The project combines technology with on-the-ground demonstrations and outdoor education to implement behavioral change in stakeholders living and working in the Geronimo and Alligator creeks watersheds. Several of the project’s deliverables will highlight the Geronimo and Alligator creeks watersheds but will also be appropriate for use throughout the Guadalupe River Basin as well as across the state. The proposed project is the first step taken by the ILSOLC as part of implementing the GACWPP.



Geronimo Creek Cleanup - Photo by Bill Evans

Collecting bugs from Geronimo Creek at the Irma Lewis Seguin Outdoor Learning Center
Photo by Tammy Beutnagel

Watershed Protection Activities (cont.)

Geronimo and Alligator Creeks Annual Cleanup



TLU Students participating in the Geronimo Creek Cleanup
Photo by Ward Ling

The Partnership established an annual cleanup on Geronimo and Alligator creeks and the first event, held in the spring of 2013, was a huge success. Over 100 volunteers removed almost 3,000 pounds of trash and debris from the creek and drainage system that drain

into the creeks. Large items such as tires, appliances, and batteries were removed and recycled. The City of New Braunfels provided roll-off containers for collection and recycling of materials free of charge. Teams formed from area high schools, churches, Texas Lutheran University, Continental, Alamo Group, and others, cleaned areas identified by the planning committee. Planning for the 2014 cleanup is underway.

Isotope Study

Beginning in the fall of 2013, GBRA and the USGS began a project in both the Geronimo Creek and Plum Creek watersheds. Since monitoring of Plum Creek and Geronimo Creek began in the late 1990s, these creeks have shown elevated concentrations of nitrate-nitrogen. Because the state stream water quality standards are not numeric for nutrients, exceedences of a screening concentration of 1.95 mg/L nitrate-nitrogen have been used to designate a stream as having a concern for nitrate-nitrogen. The possible sources of nitrate are numerous. Plum Creek is effluent-dominated and is also fed by springs that come from the Leona Aquifer, known to have elevated concentrations of nitrate-nitrogen, while Geronimo Creek is also fed by springs from that same aquifer. Stakeholders in both watersheds have long suspected fertilizer use as a source of the nitrates in the Leona, but oddly enough, elevated concentrations of nitrates had been seen in well testing long before commercial inorganic fertilizers came into use. Septic systems, animal wastes, organic fertilizers, nitrifying

plants and atmospheric deposition, round out the list of possible sources.

The TCEQ has begun to develop numeric water quality standards for nitrate-nitrogen. At the end of that process, the standards established by TCEQ and the EPA could move Plum Creek and Geronimo Creek from a designation of "concern for nutrients" to the 303(d) List of impaired waterbodies due to elevated nutrients. The Plum Creek and Geronimo Creek Watershed Partnerships have not waited for "impaired waterbody" status to start working on best management practices that could reduce sources of nitrates. In order to help direct efforts and funding toward the most likely or most influential source(s) of nitrate, this project will look to isotopic signatures of nitrogen and oxygen in the nitrates. The ratios of the isotopes of nitrogen and oxygen in nitrate often are useful for determining sources of nitrates in groundwater and surface water. Isotopic ratios are expressed as the ratio of the heavier isotope to the lighter isotope relative to a standard in parts per thousand (USGS, 2011).



Measuring flows in the Geronimo Creek
Photo by Janet Thome

Sites in the Plum Creek and the Geronimo Creek watersheds will be sampled for major ions, and for selected nutrient species, including nitrate-nitrogen and oxygen isotopes. GBRA and USGS will conduct targeted surface water quality monitoring over a range in hydrologic conditions (wet and dry conditions) as well as monitoring of rainwater, groundwater and springs in both watersheds. The USGS will produce a final report at the end of the three year project.

Watershed Protection Activities (cont.)

Plum Creek Watershed Protection Plan

Plum Creek rises in Hays County north of Kyle and runs south through Caldwell County, passing Lockhart and Luling, and eventually joins the San Marcos River at their confluence north of Gonzales. Plum Creek is 52 miles in length and has a drainage area of 397 square miles. According to the 2012 Texas Integrated Report for Clean Water Act sections 305(b) and 303(d), Plum Creek (Segment 1810) is impaired by elevated concentrations of *E. coli* bacteria and exhibits concerns for depressed dissolved oxygen and impaired habitat, as well as nutrient enrichment concerns for ammonia, nitrate, orthophosphorus and total phosphorus. Because of the development and implementation of the WPP, TCEQ categorizes Plum Creek as a Category 4b stream, meaning that “other control requirements are reasonably expected to result in attainment of all standards”.

TSSWCB and AgriLife Extension established the Plum Creek Watershed Partnership (PCWP) in April 2006. The PCWP Steering Committee completed the “Plum Creek Watershed Protection Plan” in February 2008. Sources of pollutants identified in the Plum Creek WPP include urban storm water runoff, pet waste, failing or inadequate on-site sewage facilities (septic systems), wastewater treatment facilities, livestock, wildlife, invasive species (feral hogs), and oil and gas production.

Originally, the Plum Creek WPP was to be developed using only existing water quality data collected primarily under the Clean Rivers Program. However, discussions with stakeholders identified data gaps which would make source identification and establishment of water quality goals difficult.

Accurate source identification is key to prioritizing implementation projects for funding. Through TSSWCB funding GBRA has collected water quality data to fill the identified data gaps and to demonstrate improvements in water quality. Water quality data will be used in the adaptive management of the WPP in order to evaluate progress in implementing the Plum Creek WPP and achieving water quality restoration. GBRA collects surface water quality monitoring data to characterize the Plum Creek watershed, including the contributing wastewater effluents. Monitoring data will be used to assess and evaluate the effectiveness of the BMPs that have been or will be implemented in the watershed as a result of the Plum Creek WPP. The sampling regime will include diurnal, spring flow, storm event and targeted monitoring under more typical base flow conditions. To date, sampling of water quality data has been severely hampered by a prolonged drought that has covered the watershed, causing the tributaries to run dry and the springs to slow to almost negligible flow.

The Plum Creek Watershed Partnership continues to meet quarterly in Lockhart. The meetings bring to the stakeholders, news of activities that could impact water quality and/or the implementation of the Plum Creek WPP. For example, a municipal solid waste facility that is planned for the watershed is in the permitting process at TCEQ. Representatives of

the company, Green Group Holdings, were invited to the partnership meeting and answered questions about their plans from concerned stakeholders. Additional information on the activities of the Plum Creek Watershed Partnership can be found on the project website: <http://plumcreek.tamu.edu/>.

The cities of Kyle and Lockhart have received TCEQ CWA section 319(h) funding to retrofit detention facilities to improve water quality, stencil storm sewer inlets with an educational message, map existing storm water facilities, implement a dog waste collection station program, and coordinate city “housekeeping” activities designed to improve water quality (street sweeping, creek cleanup days, etc). Additionally, Lockhart mapped their existing storm water system, identified and prioritized upgrades to the city’s storm water management system including cleaning out and installing storm drain filters, and coordinated creek cleanup days, and household hazardous and electronic waste collection days.



Watershed Protection Activities (cont.)

Plum Creek Watershed Coordinator

Following the acceptance of the plan by EPA, implementation of the Plum Creek WPP continued for three years under facilitation by Texas AgriLife Extension. However, it was the desire of the PCWP to continue progress on implementing the Plum Creek WPP by establishing a local watershed coordinator. Beginning in 2012, 12 entities in the watershed contributed matching funds, along with funding provide by a CWA section 319(h) grant, to hire a full-time Plum Creek watershed coordinator (PCWC). The PCWC, under the direction of the PCWP, has been employed to facilitate continued progress throughout the 10-year implementation schedule identified in the plan. This position oversees project activities, seeks additional funding, organizes and coordinates regular updates for the PCWP, maintains the website, and coordinates outreach and education efforts in the watershed.

TSSWCB has provided technical and financial assistance through the local SWCDs to agricultural producers in developing and implementing WQMPs.

Through a local presence in watershed, the PCWC serves as the primary conduit for interaction with landowners, citizens, and entities to facilitate the implementation of the WPP. The PCWC coordinates meetings with the PCWP Steering Committee and Work Groups to update them, seek their input and recommendations on needed activities, and continues to support and facilitate implementation efforts of the plan. The PCWC continues to assist the cities, counties, local boards and businesses to identify management measures to improve water quality and acquire resources to enable WPP implementation. The watershed coordinator works with state and federal agencies, as appropriate, to bring technical and financial assistance to the watershed.

As part of an adaptive management approach embraced by stakeholders, the Plum Creek Watershed Coordinator continues to evaluate progress toward achieving milestones established in the WPP, assesses water quality data in relation to achieving load reductions,

and publishes a biennial addendum to the Plum Creek WPP that describes updates to goals and milestones and successes.

Coordination of outreach and education efforts by the PCWC facilitates and supports public participation by private individuals and local officials in the implementation of the Plum Creek WPP. The watershed coordinator develops publications, such as a semi-annual newsletter, factsheets, website and social media content, that promote and communicate watershed pollution prevention efforts. Additionally, the PCWC coordinates and conducts outreach and education efforts across the watershed, organizing training programs, such as Lone Star Healthy Streams (agricultural component); conventional OSSF maintenance workshop for homeowners; aerobic system operation and maintenance workshops for homeowners; and a Nonpoint Source Education for Municipal Officials workshop.



Keep Lockhart Beautiful Town Branch Clean Up
Photo by Nick Dornak

Watershed Protection Activities (cont.)

Annual Cleanups and Community Collection Events

The sixth Annual Keep Lockhart and Plum Creek Watershed Beautiful Cleanup continues to grow, taking on new areas along Plum Creek. Almost 200 volunteers dedicated Saturday, September 28, 2013, to “Keeping Lockhart and Plum Creek Beautiful.” Volunteers spent the morning removing 1,580 pounds of refuse and 840 pounds of recyclable materials from 4.5 stream miles of Plum Creek and its tributaries. Volunteers also planted wildflowers at City Park and attended an environmental fair covering topics from litter prevention to aquatic invertebrates. The annual cleanup event is funded entirely by local individuals, families and businesses. Thanks to tremendous support from the community, funding for the event doubled in 2012 and once again in 2013! Thanks to the grassroots efforts of the Plum Creek Watershed Partnership, the City of Lockhart, the Guadalupe-Blanco River Authority and the dedicated volunteer cleanup leaders, the Lockhart community is

truly taking ownership of their parks, waterways and natural areas.

The City of Kyle’s Parks and Recreation Department sponsors an annual cleanup in early March, along the stretch of Plum Creek that flows through their city parks. The goal of their annual cleanup is to bring awareness to nonpoint source pollution especially pet waste.

East of IH35, Plum Creek runs through hundreds of acres of park land and open space. Trash and debris washed in by storm water are deposited in the creek and along the banks in the parks. Since 2004, this award-winning program has removed several tons of debris from Plum Creek. The city parks that are involved during this event are Steeplechase Park, Lake Kyle, Waterleaf Park and the Plum Creek Preserve and Nature Trail. To find out more about the Kyle Plum Creek Cleanup visit

<http://www.cityofkyle.com/recreation/plum-creek-watershed-clean>.

Through the efforts of the PCWP, Capitol Areal Council of Governments (CAPCOG) and key county officials, Caldwell County was able to provide residents with several opportunities over the past year to properly dispose of non-hazardous solid waste. The CAPCOG FY2012/2013 Regional Solid Waste Grants Program funded 4 community cleanup and collection events to address litter and illegal dumping in the cities and rural areas located within Caldwell County. The four event totals include: 80,000 lbs of solid waste collected, 2,459 tires, 267 participants and 72 volunteer hours donated.



Photo by Mike McGregor

Hillside Terrace

During the development of the watershed protection plan, failing septic systems in the upper watershed were identified as a possible source of bacterial impairment in Plum Creek. Over 265 homes in the Hillside Terrace subdivision, located near the City of Buda in Hays County, are on onsite sewage systems. The majority of lots are small and wastewater issues have been reported often to the Hays County Environmental Health Department. In 2011, residents of the subdivision voiced their desire to tie onto a public wastewater treatment system. A lift station for the Buda

WWTP is located across the road from the subdivision. The total project for infrastructure to connect these homes is estimated to cost \$5.6 million, with the planning and design phase estimated to cost approximately \$400,000. The Plum Creek Watershed Partnership facilitated the survey of the homeowners and found that the area qualifies as economically-disadvantaged, making it eligible for low interest loans and substantial principal forgiveness from the Clean Water State Revolving Fund (SRF) Loan Program available through the Texas Water Development Board. With strong

support and guidance from several PCWP Steering Committee members, an interlocal agreement between Hays County and the City of Buda secured the remaining portion of funding needed to complete the planning and design phase. Once the planning and design phase has been completed in 2014, the City of Buda can apply for another loan through the SRF program to build the infrastructure needed to remove the 263 homes from their existing on-site sewage facilities and connecting affected dwellings to the city’s centralized sewage collection system.

Watershed Protection Activities (cont.)

Caldwell County Feral Hog Task Force

As in most areas across the State of Texas, feral hog numbers appear to be increasing in the Plum Creek Watershed. These animals damage crops, livestock, pets, landscaping, and natural habitat in rural and urban areas alike. Feral hogs also have the potential to contribute to water pollution. Due to their numbers, distribution and behavior, feral hogs can increase the levels of sediment, nutrients, and bacteria in streams and lakes. Habitat analysis and landowner observations indicate this is the case in the Plum Creek

Watershed. A Texas AgriLife Extension feral hog specialist provides education and technical assistance to landowners in the watershed on strategies to reduce and manage feral hog populations. Over 15 publications have been produced and distributed to landowners in the watershed. These outreach materials cover all aspects of the control of feral hogs

including laws and regulations, impacts on flora and fauna in their range and effective use of traps, fences and baits.

To support AgriLife's efforts, as well as to take matters of feral hog control into their own hands, landowners in Caldwell County established the Caldwell County Feral Hog Task Force (CCFHTF). In less than a year the group has grown from an ad hoc group of a few concerned individuals to an organization recognized and supported by Caldwell County. Caldwell County Commissioner's Court, Resolution

16-2013, recognized the group as an official county task force and established technical and financial support for the CCFHTF for up to five years. Now partnering with concerned individuals in Hays County as well, the CCFHTF is headed by a leadership committee made up of local landowners, representatives for Caldwell and Hays Counties and technical experts. The CCFHTF hit the ground running when the organization received the first Texas Department of Agriculture (TDA) County Hog Abatement Matching



Program (CHAMP) grant awarded in the state. The CHAMP grant supports the development of low-cost, high-return, regionally-coordinated programs that leverage local resources to combat the growing feral hog population in Texas. Caldwell County, in partnership with Hays County, was awarded \$30,000 to support abatement efforts.

Funding from Texas Department of Agriculture grants along with additional contributions from a coalition of local landowners, businesses, agricultural groups, environmental organizations,

Hays County and Caldwell County have provided the necessary resources to implement year-one of a "Feral Hog Action Plan (Action Plan) for Caldwell and Hays Counties." The Action Plan, which was developed and is managed by the CCFHTF, establishes a short duration, high intensity, feral hog management program for Caldwell and Hays Counties that will attempt to get ahead of the very steep growth curve associated with the thriving feral hog populations in both counties.

The Action Plan includes a bounty program, aerial control, three wireless corral traps, and a 40' drop net. It includes services of a professional trapping company that operates a certified feral swine holding facility that coordinates food bank donations through USDA inspected processors. The CCFHTF is taking feral hog management to a new level by providing financial incentives, building coalitions and investing in the latest technologies

for feral swine control.

Implementation of the Action Plan began October 1, 2013. As of January 31, 2014, the documented feral hog harvest total stands at 1,722. More than 1,400 feral hogs have been removed through the bounty program, 116 were removed during three short aerial operations and 142 were removed through two months of a professional trapping program. To find out more information on the Caldwell County Feral Hog Task Force visit www.feralhogtaskforce.com.

Watershed Protection Activities (cont.)

Wastewater Treatment Failures

In late 2012, two wastewater treatment spills occurred in the upper Plum Creek watershed. The City of Kyle's wastewater treatment plant, operated by Aqua Texas, had disruptions in treatment plant operations that resulted in the discharge of unknown quantities of sludge and untreated wastewater. GBRA samples the wastewater effluent as part of a regular monitoring program and had found concentrations

of *E. coli* exceeding the contact recreation grab sample standard of 394 organisms per 100 milliliters in 12 of the 40 samples collected since May of 2008 (geometric mean of data set = 97 organisms per 100 mL; contact recreation standard geomean = 126 organisms per 100 mL). After several meetings between PC WP representatives and TCEQ, Aqua Texas made some improvements to the facility, one being a flow-paced

feed of chlorine for disinfection rather than chlorine being fed based on time. However, the plant continues to have problems. Inflow and infiltration problems caused a by-pass of untreated wastewater during the flooding that occurred on October 31, 2013. Another spill report was filed by Aqua Texas on Friday, January 24, 2014 due to the loss of power during an ice storm.

Education and Outreach in the Plum Creek Watershed



Photo by Josh Oyer, TPWD

Outreach and education play critical roles in every watershed protection plan. In the Plum Creek WPP outreach activities are used to increase the public's awareness about water quality issues, implementations of the plan and to motivate individual actions to improve the water quality in Plum Creek. GBRA has a strong presence in the schools located in the watershed. Cinde Thomas-Jimenez, GBRA's Environmental Education Coordinator, has developed a water quality testing

module that is being used in classrooms, introducing the elements of good water quality to students in the Plum Creek watershed. In 2013, the program reached 41 classes and 850 students. Similar numbers will be reached in spring 2014 in Hays, Lockhart and Luling ISDs. The module includes

water quality testing, field trips to the creek (for those within walking distance), and demonstrations on nonpoint source pollution with a model of the Guadalupe River Basin. Students are taught that their actions and the actions of their family and friends can impact the health of the creek, both positively and negatively.

GBRA, under another CWA grant, installed a real-time water quality monitoring station in Plum Creek, near Lockhart. The station is part of the

TCEQ's Statewide Continuous Water Quality Monitoring Network. The station collects flow, dissolved oxygen, specific conductance, temperature, pH and turbidity every 15 minutes. The data can be accessed from any personal computer with internet capabilities. To visit the Plum Creek site or any site in the GBRA or TCEQ CWQMN's visit: http://www.tceq.state.tx.us/cgi-bin/compliance/monops/water_site_photo.pl?cams=763.

To improve access to water quality data and information on watershed protection, GBRA, under funding from a CWA grant, installed electronic kiosks in the libraries in Kyle, Lockhart and Luling. At the kiosks, residents of the area can log into the real-time monitoring station deployed near Lockhart. At a touch of a finger, they can access general information on water quality and watershed protection, put together an electronic puzzle of the Guadalupe River Basin and take a fly-over of the Plum Creek watershed, using Google Earth.

Watershed Protection Activities (cont.)

Upper San Marcos Watershed Protection Planning

In 2010, the Upper San Marcos River was listed as impaired because the concentration of total dissolved solids exceeded the stream standard for that parameter. The Upper San Marcos Watershed Protection Plan is being developed in order to address that exceedence, as well as proactively addressing other water quality concerns for bacteria, nutrients and sediments.

The headwater springs of the San Marcos River are located in Spring Lake on the campus of Texas State University. Subwatersheds that contribute to the flow and pollutant

load of the river include Purgatory Creek, Sessoms Creek, Willow Springs Creek and Sink Creek, located in the hill country above the City of San Marcos. The project area ends at the river's confluence with the Blanco River, just south of the San Marcos city limits.

The San Marcos Watershed Initiative is the partnership that is developing the watershed protection plan. The Core Committee is made up of representatives from the university, Hays County, the City of San Marcos, and GBRA. In addition to the governmental representatives, representatives of business,

agricultural, real estate development, cultural diversity, landowners and the community sit on the Core Committee. The Core Committee is supported by four subcommittees that address specific areas of stakeholder interest, including Economic Development and Water Quality and Quantity; Parks and Agriculture; Culture and Education/ Outreach; and, Data, Information and Technical Review. Additional information and a copy of the draft watershed protection plan, when available, can be found at <http://smwatershedinitiative.org>.



Spring Lake - Photo by Elizabeth Aguilar

Watershed Protection Activities (cont.)

Cypress Creek Watershed Protection Plan

(Excerpts from Cypress Creek Watershed Protection Plan, December 2013)

In January 2014, a draft watershed protection plan for Cypress Creek was submitted to TCEQ by the Meadows Center for Water and the Environment, on behalf of the Cypress Creek Stakeholder Committee. The main goal of the Cypress Creek Watershed Protection Plan is to ensure that the long-term integrity and sustainability of the Cypress Creek watershed is preserved and that water quality standards are maintained for present and future generations (Cypress Creek WPP, 2014). The Cypress Creek plan is a proactive plan that addresses likely future nonpoint source pollution impairments of nitrogen and total suspended solids (TSS). Although planning efforts focused primarily on surface water quality, the Stakeholder Committee felt it was important to acknowledge the importance of properly managed groundwater in this watershed protection plan. Accordingly, the plan incorporates groundwater and surface water components. The Cypress Creek Stakeholder Committee is made up of varying perspectives and interests. With partnership stakeholder input, the plan was developed to be comprehensive in its approach for maintaining the balance between natural resource management and economic development.

Cypress Creek is located in the Hill Country of central Texas. It has recognizable features of the region, rugged terrain, narrow canyons, and springs. The terrain also reflects the underlying karstic, faulted, and fractured limestone geology of central Texas that forms the basis of the

regional aquifers. These aquifers provide much of the base flows to Cypress Creek and the groundwater is used for residential and commercial water supplies in the area. The regional climate is temperate with hot dry summers and rainfall that ranges from infrequent and sparse to heavy downpours occasionally resulting in flash flooding. The Creek is habitat to a diverse number of species, including fishes, water fowl, reptiles and amphibians, mammals, and insects.

The Texas State Data Center projects that the population in Hays County will grow by approximately 300 percent by year 2040. This is significant and an important consideration for all future natural resources management, particularly water. Weighing the needs of the community - - to ensure sufficient quantity and quality for daily consumptive use and for the aesthetic, economic, and ecological value will be a challenge to community leaders in the future (Cypress Creek Watershed Protection Plan, 2014).



Photo by Lee Gudgell

In order to determine the load reductions that are needed to protect the creek, mathematical models called load duration curves were used to address the primary pollutants of concern: nitrogen, phosphorus, suspended sediments and *E. coli*. The load duration curves, combined with land uses in the subwatersheds, were used to calculate pollutant loads and identify potential sources of NPS pollution for existing and future conditions at the watershed and subwatershed level. This level of detail is beneficial to the implementation of the plan as it identifies the BMPs that will be most effective and where they should be located.

The Stakeholder Committee and experts agreed that meeting state water quality standards would be insufficient to maintain the desired health and historical nature of the creek as a spring-fed stream. In 2012 and 2013 the Stakeholder Committee decided upon a suite of best management practices that will be implemented for identified and potential problems in the watershed. The BMPs approved by the Stakeholder Committee were categorized for immediate implementation and future threats to water quality through adaptive management.

The first step of implementation will focus on storm water assessment, implementing demonstration BMPs, retrofitting and maintaining existing and recently built BMPs and coordinating existing community efforts in order to address current threats to water quality. These initial actions will demonstrate the value of the WPP to the community. BMPs were chosen

Watershed Protection Activities (cont.)

Cypress Creek Watershed Protection Plan

that will mitigate nitrogen and TSS from the effects of current urbanization in the watershed. Wimberley, Woodcreek and Hays County have each committed to implementing BMPs.

The Cypress Creek Watershed Protection Plan is unique in that it recognizes the importance of groundwater, not only in water quantity but to water quality. The watershed protection plan says "Efforts to maintain good water quality conditions are constrained by the reliance on adequate baseflows from Cypress Creek's artesian headwaters, Jacob's Well. Community expectations of maintaining a clean, clear, and flowing stream could succeed with an integrated management plan which incorporates groundwater and surface water components, spans agency jurisdictions, and is comprehensive in its approach for maintaining balance between natural resource management and economic development." The Cypress Creek Stakeholder Committee identified several potential components in a ground/source water protection strategy that include preserving the flow in the Cypress Creek with a target of 6 cubic feet per second; a watershed conservation campaign; implementation of tiered pricing to incentivize reduction of water use; and, to establish the means to determine recharge affecting the springs that provide the base flow of the Cypress Creek.

The Cypress Creek WPP identified the need for the continuation of monitoring of both surface and ground water, including the funding of the USGS monitoring station in Jacob's Well. The plan identified the need for additional monitoring of storm flows, biological

and environmental components and effectiveness monitoring as BMPs are implemented in the watershed. The stakeholders supported the use of bacterial source tracking as a means to identify the source of *E. coli* bacteria concentrations found in Cypress Creek.

As the watershed continues to urbanize, water modeling results, based on land use changes, will be used as a guide for detecting early signs of potential pollution concerns. Routine water quality monitoring data will

help to identify any new concerns. If target levels are exceeded regularly, the Stakeholder Committee will utilize adaptive management to address new concerns.

The draft plan is under review by the TCEQ. After their review the document will be submitted to EPA for acceptance. To access the draft plan and to get more information on the Cypress Creek Project visit <http://www.cypresscreekproject.org>.



Photo by Chase Fountain, TFPWD

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