ANRA

Angelina & Neches River Authority

2017 Basin Highlights Report

For the Upper and Middle Portions of the Neches River Basin

The Texas Clean Rivers Program

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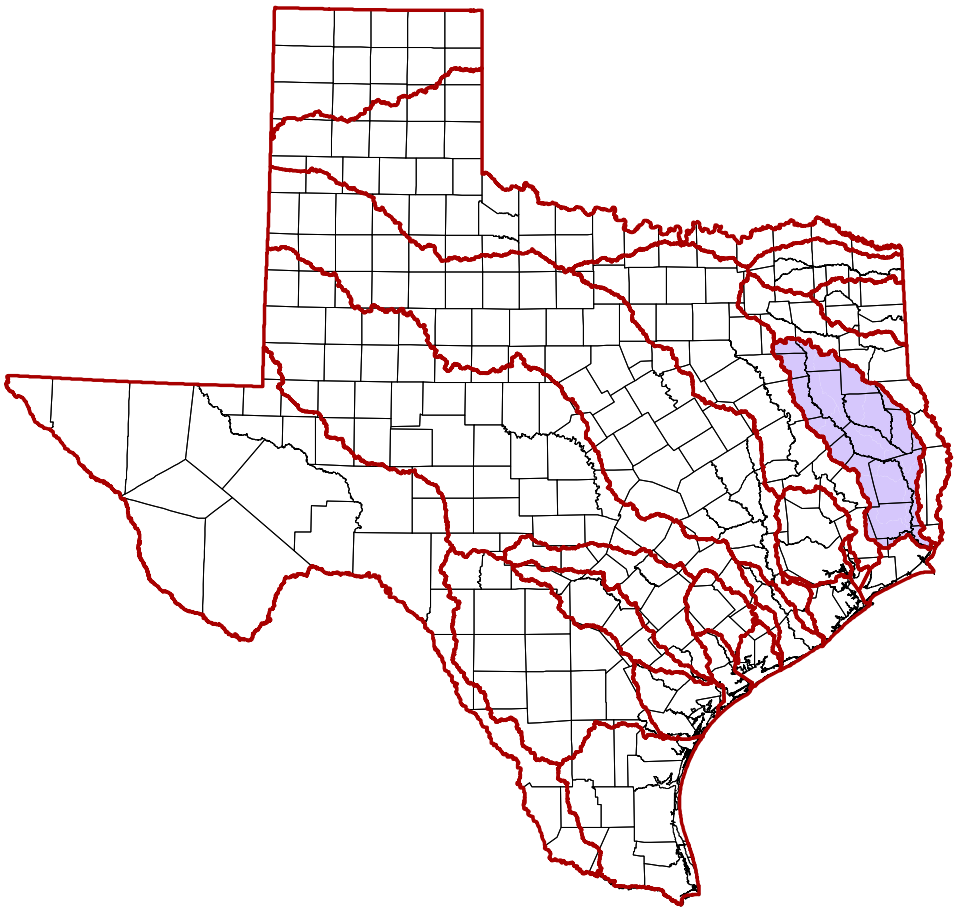
Introduction

About the Angelina & Neches River Authority

The Angelina & Neches River Authority (ANRA) is a political subdivision of the state of Texas created by the state legislature under the authority of Article 16, Chapter 59 of the Texas state constitution. It is recognized as an independent governmental agency authorized to construct, maintain, and operate any and all works necessary for the purpose of controlling, storing, and preserving water resources in the 17 county jurisdiction in the Neches River Basin. ANRA receives no tax revenues from the state nor can it levy any taxes. Authority revenues are derived solely from services provided. It is authorized to issue revenue bonds for the purpose of financing projects to be paid by and through customer contracts which obligate the customer to pay its share of the debt obligation.

ANRA is governed by a nine member Board of Directors appointed by the Governor of Texas to six year terms. The Directors are residents of the Neches River basin and one third of the Board is appointed every two years. The Board sets policy, provides oversight, and employs a General Manager. The major functions of ANRA are water quality management, water resource development, and conservation of water resources. ANRA administers several water quality related environmental programs including the Upper Neches basin surface water quality monitoring programs, permit compliance monitoring programs, industrial pretreatment program, and a water/wastewater sample collection and testing program.

ANRA's central office is located in Lufkin, Texas. The Authority's territorial jurisdiction of 8,500 square miles lie wholly or in part of the following counties: Van Zandt, Smith, Henderson, Newton, Cherokee, Anderson, Rusk, Houston, Nacogdoches, San Augustine, Shelby, Angelina, Trinity, Sabine, Polk, Jasper, and Orange.



About the Clean Rivers Program

The Texas Clean Rivers Act, enacted in 1991 by the Texas legislature, requires that each Texas River Basin conduct ongoing water quality assessments, integrating water quality issues using a watershed management approach. The Clean Rivers Program (CRP) implements the Clean Rivers Act through water quality monitoring, assessment, and public outreach. Currently, monitoring in the state of Texas includes over 1800 sites and regional water quality assessments within the 23 major river and coastal basins and their sub-watersheds.

The mission of the CRP is to maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the Texas Commission on Environmental Quality (TCEQ), river authorities, other agencies, regional entities, local governments, industry, and citizens. The program's watershed management approach is designed to identify and evaluate water quality issues, establish priorities for corrective action, work to implement those actions, and adapt to changing priorities.

As a department within ANRA's Environmental Division, the Clean Rivers Program staff conduct water quality monitoring activities within the basin. The staff also evaluates water quality data and prepares assessment reports related to the water quality in the Neches Basin. ANRA actively coordinates with other entities within the basin to ensure that monitoring activities are spatially represented throughout the basin and that important water quality concerns are addressed.

THE TEXAS CLEAN RIVERS PROGRAM

About the Basin Highlights Report

This 2017 Basin Highlights Report is intended to provide a brief overview of the previous year's events and ongoing programs in the upper and middle portions of the Neches River Basin that are relevant to the Clean Rivers Program. For a more comprehensive look at the basin, please refer to the 2015 Basin Summary Report. For information regarding the lower portion of the Neches River Basin, please refer to the Lower Neches Valley Authority's Basin Highlights Report.

The 2017 Basin Highlights Report was prepared by the Angelina & Neches River Authority in cooperation with the Texas Commission on Environmental Quality under the authorization of the Texas Clean Rivers Act.

Angelina River at SH 204
Monitoring Station 10633

Angelina River at SH 21

This Year's Highlights

ANRA Welcomes New Quality Assurance Officer

The Angelina & Neches River Authority hired Hannah Lucia as its Quality Assurance Officer (QAO), starting September 6, 2016. Hannah's duties are split between the Environmental Laboratory and the Clean Rivers Program. The Texas Commission on Environmental Quality formally recognizes Mrs. Lucia as Quality Assurance Officer and Technical Manager (satisfying the requirements in TNI Standard EL V1 2009, 5.2.6.1) for the ANRA Environmental Laboratory. Hannah is also the Quality Assurance Officer for ANRA's Clean Rivers Program. Additionally, Hannah will be leading the field portion of ANRA's surface water quality monitoring activities.

Hannah is a native of southeast Texas, were she obtained a Bachelor of Science degree in Environmental Science from Lamar University of Beaumont, TX. Mrs. Lucia also attended graduate school at Lamar University, where she continued her education in Environmental Studies. Mrs. Lucia became involved with TCEQ's Clean Rivers Program in 2008 while working for the Sabine River Authority (SRA). Her professional experience includes an internship as a Biological Science Technician for Big Thicket National Preserve, where she assisted in visitor and resource protection through engagement in boundary, river, and land patrol duties. Mrs. Lucia continued her career as a Lab Analyst at SRA and was promoted to Deputy Technical Director/Senior Lab Analyst for their NELAP-accredited laboratory. Prior to joining ANRA, her professional work experience included coordinating surface water quality monitoring program activities and reviewing/managing water monitoring data for inclusion in TCEQ's Surface Water Quality Monitoring Information System (SWQMIS) database. She will be functioning in that same role at ANRA.

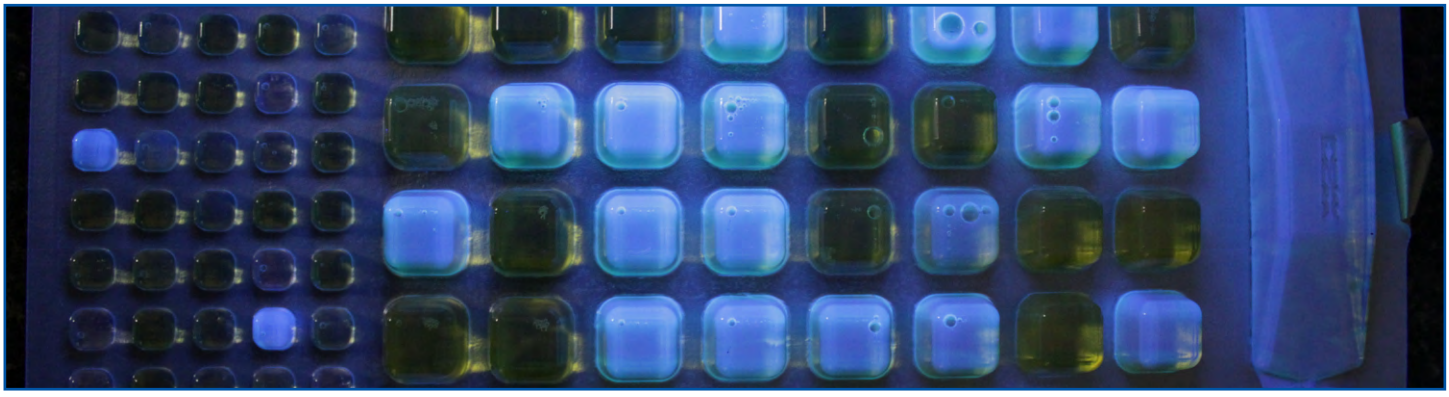
Mrs. Lucia currently holds a TCEQ Water Operator Class D License and a TCEQ Wastewater Operator Class D License.

ANRA's Environmental Laboratory QAO responsibilities include:

- maintaining a laboratory Quality Assurance (QA) System that meets the standards of the National Environmental Laboratory Accreditation Program;
- monitoring the implementation of the Quality System within the laboratory to ensure complete compliance with the QA objectives as defined by the accreditation standard, regulatory rules and guidance, contracts, and Quality Assurance Project Plans;
- establishing and maintaining Standard Operating Procedures (SOPs) for all laboratory activities;
- conducting in-house audits to identify potential problems and ensures compliance with written SOPs and accreditation standards;
- supervising all aspects of Quality Assurance/Quality Control in the laboratory; and
- performing validation and verification of laboratory data.

ANRA's Clean Rivers Program QAO responsibilities include:

- coordinating the implementation of the Quality Assurance program;
- writing and maintaining the Quality Assurance Project Plan (including amendments) and monitoring its implementation.;
- identifying, receiving, and maintaining project QA records;
- coordinating with the TCEQ QA Specialist to resolve QA-related issues;
- coordinating and monitoring deficiencies and corrective action;
- coordinating and maintaining records of data verification and validation;
- coordinating the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques;
- ensuring that field staff is properly trained and that training records are maintained;
- coordinating ANRA's surface water quality monitoring program activities, including maintaining the monitoring schedule and conducting monitoring activities.



ANRA Environmental Laboratory

ANRA's Environmental Laboratory comprises the first floor of ANRA's Central Office, located at 210 E. Lufkin Avenue in downtown Lufkin. The Environmental Laboratory operations include the chemical and microbiological analyses of drinking water, wastewater, and ambient surface water. This includes analysis of municipal and industrial wastewater, lake and stream water quality, and public and private drinking water samples.

ANRA's Environmental Laboratory provides environmental testing services to numerous clients throughout the East Texas area. These clients include municipalities, industrial facilities, government agencies, water supply corporations, and private individuals. The Environmental Laboratory also provides analytical services and project support for other ANRA programs, such as the Clean Rivers Program.

ANRA's Environmental Laboratory is accredited by the National Environmental Laboratory Accreditation Program (NELAP) in the State of Texas through the Texas Commission on Environmental Quality. The laboratory is NELAP-accredited for the chemical and microbiological analysis of surface water, wastewater, and drinking water.

It is the mission of the ANRA Environmental Laboratory to produce scientifically valid and defensible data for its clients in a timely and efficient manner. The laboratory operates under a NELAP-approved Quality System to maintain the highest level of data integrity.

The laboratory staff has a combined 46+ years of experience with the analysis of environmental samples. ANRA's Environmental Laboratory staff is available to consult on sampling procedures, analytical methodology, quality control procedures, regulatory requirements, well disinfection, and other needs of our clients.

Implementing New Laboratory Methods

Beginning in FY 2017, The ANRA Environmental Laboratory began researching the possibility of analyzing Total Kjeldahl Nitrogen (TKN) utilizing its existing SEAL AutoAnalyzer 3. TKN is the U.S. EPA-approved parameter used to measure organic nitrogen and ammonia. Collecting data to determine total nutrients is important to fully characterize the trophic condition of water bodies and to directly relate the effect of nutrient loadings to instream conditions. Core parameters include paired nitrogen parameters nitrate, nitrite (or nitrate+nitrite), ammonia, and TKN as well as Total Phosphorus (TP) and Secchi-disk transparency.

The ANRA Environmental Laboratory is currently NELAP-accredited for Total Phosphorus and Nitrate+Nitrite-N using this autoanalyzer. The ANRA Environmental Laboratory is currently in the acquisition process for upgrading the laboratory equipment to add an additional manifold and colorimeter to our autoanalyzer to perform TKN analysis. The Clean Rivers Program has provided funds to cover 40% of the cost of the equipment upgrade. In exchange, ANRA will perform TKN analysis for all CRP monitoring stations. The ANRA Environmental Laboratory plans to submit a NELAP application in late FY 2017 or early 2018 to add TKN to our scope of accreditation.

For more information regarding the ANRA Environmental Laboratory, including services offered by the Laboratory, please contact:

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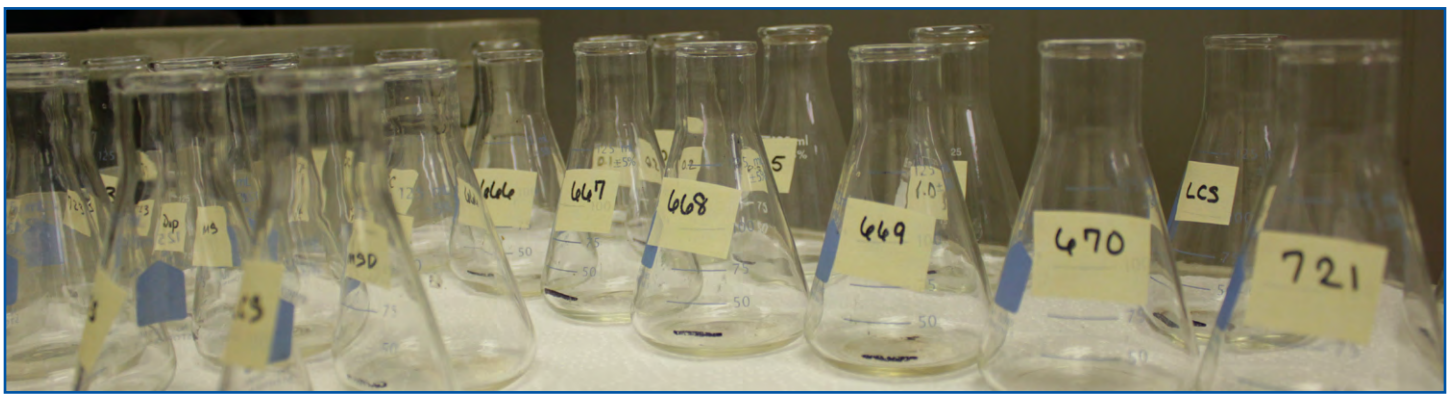


This Year's Highlights

Amendments to the Quality Assurance Project Plan

Two amendments have been made to the Upper Neches Basin Clean Rivers Program Quality Assurance Project Plan (QAPP).

Amendment #1, approved in June 2016, updated the QAPP to reflect changes to TCEQ personnel. This amendment also updated the sample design rationale, monitoring sites, and maps for FY 2017 monitoring conducted under the QAPP.

Amendment #2, approved in February 2017, updated the QAPP to reflect changes to ANRA personnel, including the hiring of a Quality Assurance Officer. This amendment also modified the Measurement Performance Specifications to remove test methods that were voluntarily removed from the ANRA Environmental Laboratory's NELAP-recognized Fields of Accreditation. These test methods were no longer being performed by the ANRA Environmental Laboratory due to the availability of automated analytical equipment with which to perform the test procedures. Due to the ability of the Laboratory to analyze these parameters more efficiently and at lower detection limits with automated methods, the classical wet chemistry methods for Total Phosphorus, Nitrate+Nitrite-N, Chloride, and Sulfate were removed from ANRA's Fields of Accreditation. Changes were also made to the method names for *E. coli* analysis to reflect changes in the way this parameter is NELAP-accredited.

New Field Monitoring Equipment

In FY 2017, the TCEQ, through a long-term equipment loan program, provided ANRA with a new FlowTracker2 and display unit for use in Clean Rivers Program monitoring activities. The FlowTracker2 measures flow velocities with a range as low as 0.001 m/s (0.003 ft/s) and up to 4.0 m/s (13 ft/s). When combined with a wading rod, the FlowTracker2 is used to measure the total discharge across wadeable streams, creeks and rivers. The new FlowTracker2 is a welcome addition to ANRA's water quality monitoring program. The new equipment allows for reduced ongoing maintenance costs, better data storage/transfer/management capabilities, and faster response times.

New Field Monitoring Vehicle

In December 2016, ANRA purchased a new Chevy Silverado to replace its aging vehicle used for Clean Rivers and other environmental monitoring activities. The new vehicle, purchased from ANRA general funds, replaced a 2001 model truck with over 184,000 miles. The new vehicle has four wheel drive capabilities for going off-road to reach monitoring stations. The truck has a lockable camper shell to allow for the protection and safe storage of monitoring equipment and sampling gear.

Incorporating Panoramic Photography into ANRA's Monitoring Program

For the past several years, ANRA has been taking panoramic photographs of our monitoring stations. This past year, ANRA acquired a PANONO camera for generating these images. The PANONO contains 36 individual cameras to produce 360° x 360° images at 108 megapixels with just one click. The camera also uploads images to the cloud for processing, eliminating the need to assemble images later through software applications. These images allow for an enhanced viewing experience as compared to traditional photographs, and are accessible through ANRA's web page, where they are integrated with Google Maps.

For more information on the PANONO camera, please visit https://www.panono.com/en.

To view panoramas of ANRA's monitoring stations, please visit https://www.anra.org/divisions/water_quality/crp/monitoring_sites/.

Specific brands of equipment referred to in the Basin Highlights Report are identified for informational purposes only. Identification of specific products/brands does not imply recommendation or endorsement by the Angeline & Neches River Authority, the Texas Commission on Environmental Quality, or the Texas Clean Rivers Program, nor does it imply that the products so identified are necessarily the best available for the purpose indicated.

Lake Sam Rayburn OSSF Program Support and Attoyac Bayou OSSF Remediation

Project Background

Based upon data collected through CRP monitoring activities and discussions with CRP Steering Committee members, a collaborative project was initiated in 2010 to develop a watershed protection plan for the Attoyac Bayou. Partners for this project included the Texas State Soil and Water Conservation Board, Texas Water Resources Institute, Texas AgriLife Research, Angelina & Neches River Authority, Stephen F. Austin State University College of Forestry and Agriculture, Castilaw Environmental Services, LLC, and several Soil and Water Conservation Districts. The *Attoyac Bayou Watershed Protection Plan* (WPP) was subsequently approved by the Environmental Protection Agency.

Beginning in FY 2013, ANRA received funding though a TCEQ Clean Water Act Section 319(h) grant to address and remediate water quality issues within the Attoyac Bayou watershed. ANRA's project, entitled *Lake Sam Rayburn On-Site Sewage Facility (OSSF) Program Support and Attoyac Bayou OSSF Remediation*, implemented portions of the *Attoyac Bayou WPP*, which identified failing on-site sewage facilities as one of the leading potential sources of elevated bacterial levels in Attoyac Bayou.

Identification and Replacement of Failing or Non-Existent OSSFs

Through this project, ANRA was able to install 23 aerobic OSSFs in the watershed, replacing either failing or non-existent systems and removing sources of sewage entering the water bodies. Taking into consideration the state of some of the systems being replaced (and the fact that several of the properties had no sewage treatment system at all), this project should result in a significant decrease in the amount of bacterial loading entering the Attoyac Bayou.

Data Collection and Analysis - Surface Water Quality Monitoring

As a component of this project, surface water quality monitoring was performed at five monitoring stations on a monthly basis for the period of October 2014 through May 2016. The monitoring stations chosen represent sites on both the main stem of the Attoyac Bayou as well as tributaries. These sites had been monitored previously as part of the project that developed the *Attoyac Bayou WPP*.

OSSF Database Development

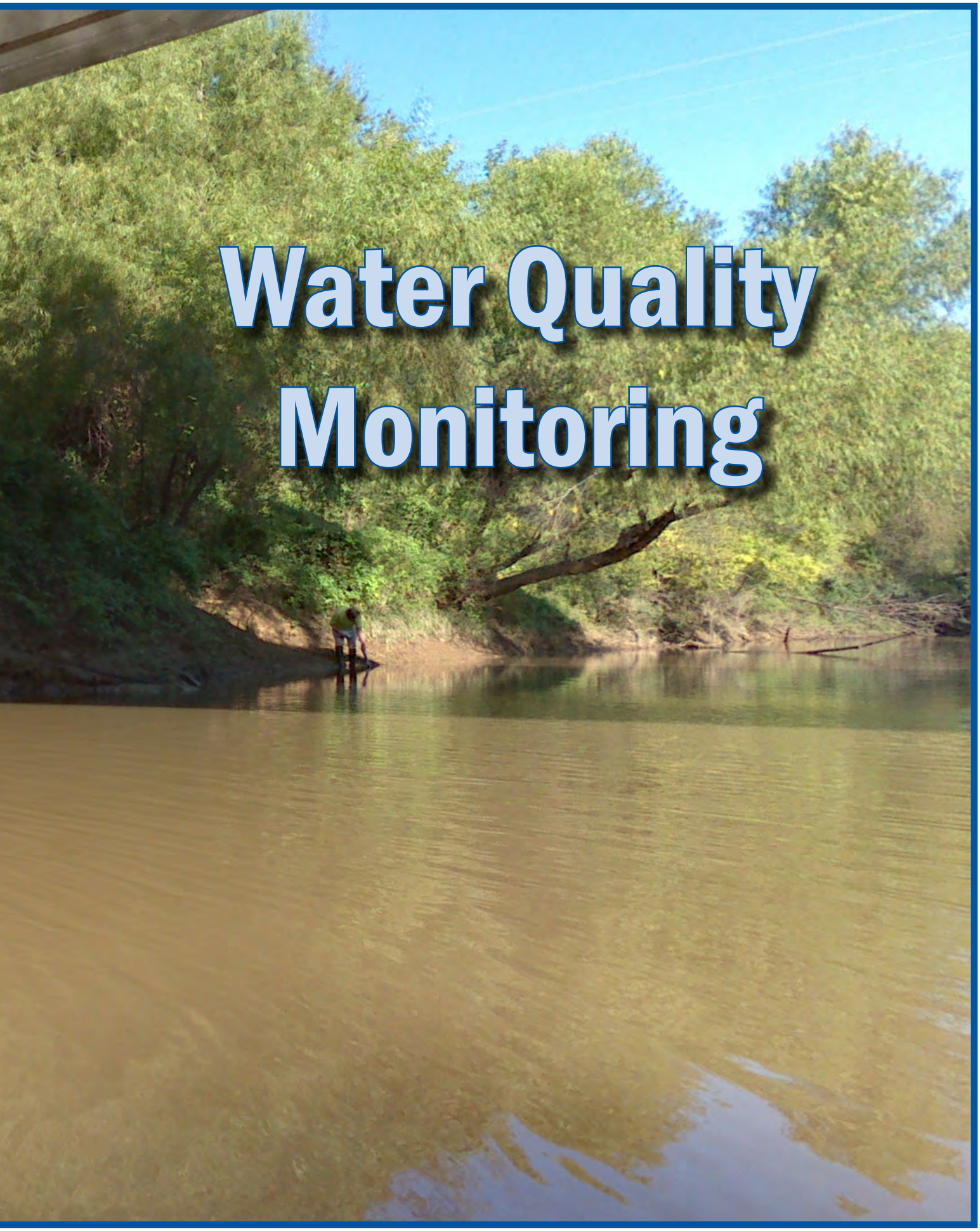
As a task of this project, ANRA developed a database for storage and retrieval of OSSF information for permitted systems in counties in the Control Zone Rayburn (CZR), the 2000-ft buffer zone around Sam Rayburn Reservoir, as well as the unincorporated portion of San Augustine County (including the portion within the Attoyac Bayou watershed). Since the project began, ANRA became the Authorized Agent for permitting OSSFs within Angelina County, and was able to incorporate that county into our database as well.

The database allows for the storage of all data related to a system, including the property owner, maintenance records, inspections, and complaints/violations. The ability to query this information makes operation of ANRA's OSSF program much more efficient in its day-to-day operations. Additionally, the ability to map complaints/violations may be useful to address water quality issues in the future.

The full report for this project is available on ANRA's website at www.anra.org.

Project Funding
Funding support for this project was provided in part through a Clean Water Act §319(h) Non Point Source Grant from the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA). Federal ID# 99614618, Contract # 582-14-40162.

Field measurements at Angelina River at SH 21


Water Quality
Monitoring

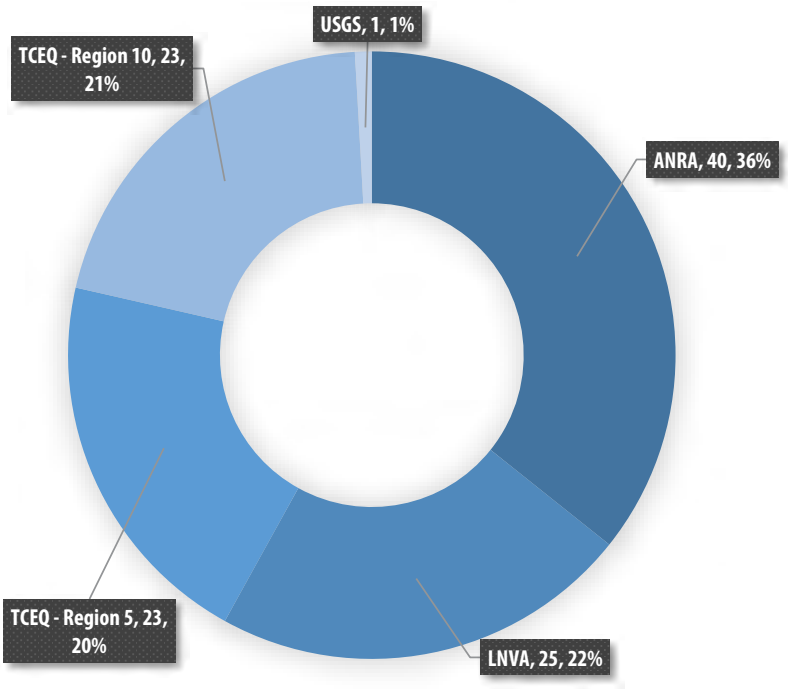
Water Quality Monitoring in the Neches Basin

In FY 2017, the Angelina & Neches River Authority monitors 40 sites quarterly for field, conventional parameters, and bacteria. The Texas Commission on Environmental Quality also has a robust sampling program in the basin, with monitoring being conducted by both Region 5 (Tyler) and Region 10 (Beaumont) staff. The Lower Neches Valley Authority (LNVA), which monitors primarily in the lower portion of the basin, also monitors Sam Rayburn Reservoir in the upper portion of the basin. The United States Geological Survey (USGS) monitors one station for conventional parameters, flow, and metals in water. Stephen F. Austin State University (SFASU) is currently monitoring 5 stations as part of a short-term special study.

Number of Routine Monitoring Stations in the Upper Neches Basin for FY 2017

Sampling Entity	Field	Conventional	Bacteria	Flow	24-Hr DO	Metals in Water	Metals in Sediment
ANRA	40	40	40	32	0	0	0
TCEQ - Region 5	23	23	23	9	0	0	0
TCEQ - Region 10	20	20	20	5	3	0	6
LNVA	25	25	25	20	0	0	0
USGS	1	1	0	1	0	1	0

Routine Monitoring Stations in the Neches Basin for FY 2017



ANRA performs monitoring on 4 classified segments:

Neches River Below Lake Palestine (0604)
Sam Rayburn Reservoir (0610)
Angelina River Above Sam Rayburn Reservoir (0611)
Attoyac Bayou (0612)

ANRA also monitors water quality on 17 unclassified waterbodies, including:

Cedar Creek, Hurricane Creek, Jack Creek, Piney Creek, Biloxi Creek, Buck Creek, Lake Ratcliff, Ayish Bayou, Bayou Carrizo, La Nana Bayou, Mud Creek, Lake Nacogdoches, Lake Striker, Bowles Creek, Johnson Creek,West Creek, and Lake Naconiche

Coordinated Monitoring Schedule

Every year, entities in the Neches Basin conducting water quality monitoring hold a Coordinated Monitoring Meeting. The purpose of this meeting is to plan and discuss monitoring activities for the upcoming year to minimize duplicity of effort, to make sure there is sufficient coverage in the basin, and to meet any data needs that TCEQ may need for assessment purposes. Due primarily to changes in project management at TCEQ, we were not able to meet in person this year to conduct this meeting. However, coordination was done through email and telephone to establish and update the Coordinated Monitoring Schedule for next fiscal year.

The complete Coordinated Monitoring Schedule (CMS) is available at cms.lcra.org.

Routine Water Quality Monitoring Parameters

ANRA monitoring personnel collect both field and conventional parameters at monitoring stations, with stations being monitored on a quarterly basis. The following table lists the parameters that ANRA collects and monitors.

Parameters for Routine Quarterly Monitoring
Field Parameters
Dissolved Oxygen
Days Since Last Significant Rainfall
Flow Severity
Instantaneous Stream Flow
pH
Present Weather
Secchi Transparency
Specific Conductance
Total Water Depth
Water Temperature
Conventional Parameters
Ammonia-N
Chloride
Chlorophyll-*a*
Nitrate-N
Nitrite-N
Pheophytin-*a*
Sulfate
Total Phosphorus
Total Suspended Solids (TSS)
Bacteriological Parameters
E. coli

THE TEXAS CLEAN RIVERS PROGRAM

Collection of a bucket grab sample from the bridge at Ayish Bayou at SH 103 (Monitoring Station 15361)

Water Quality Monitoring

Field measurements are collected on-site by direct monitoring in the water body. These are collected using multiprobe instrumentation (pH, DO, Conductance, and Temperature) or with a Doppler flow meter (in-stream flow measurements).

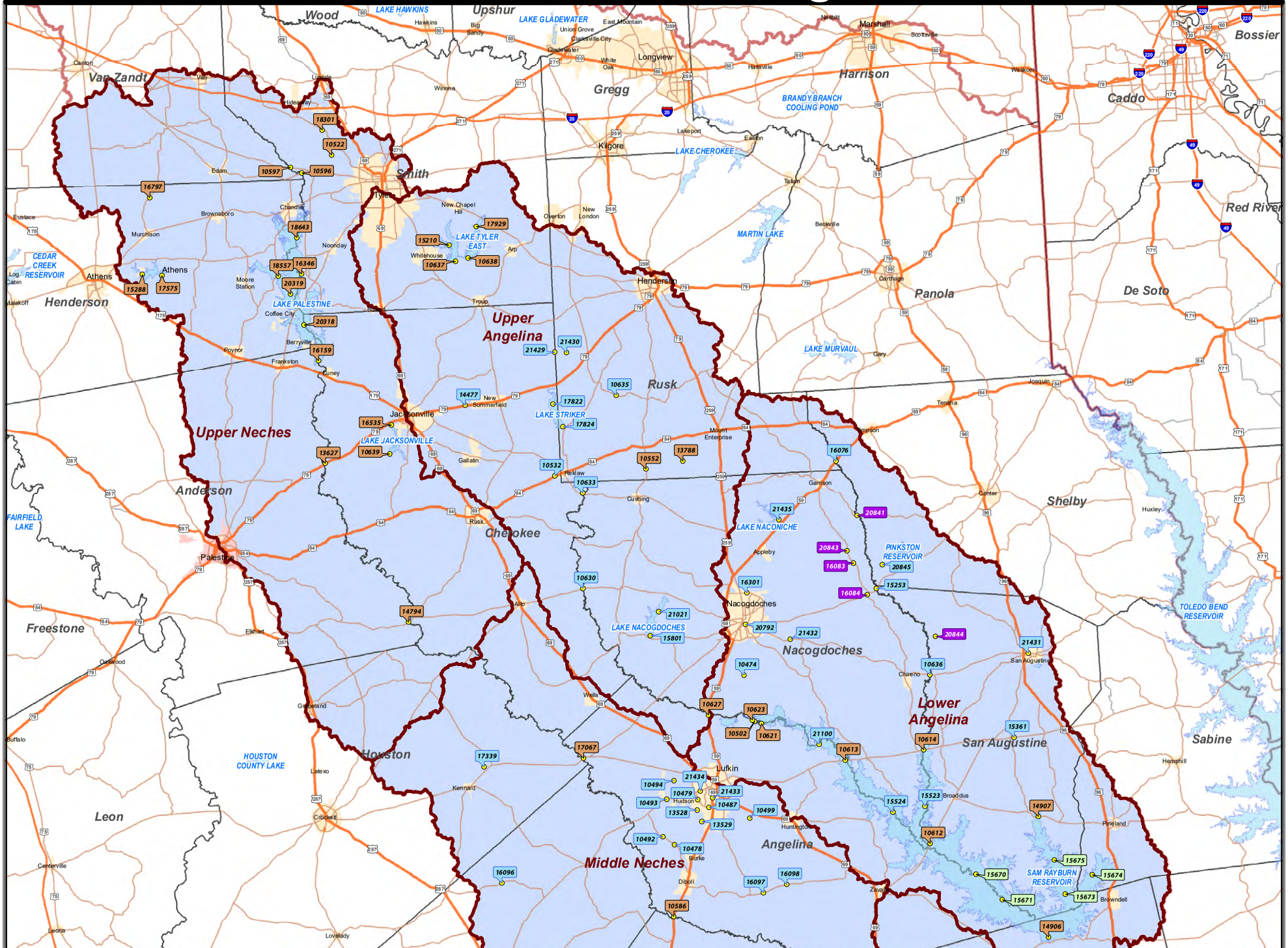
Field Parameters		
Parameter	**Potential Impacts**	**Possible Sources/Causes**
pH	pH is a measure of the acidity or basicity of an aqueous solution. Most aquatic organisms are adapted to live within a specific pH range. pH can also affect the toxicity of many substances, which generally increase in solubility as pH decreases. The ability of water to resist changes in pH (its buffering capacity) is essential to aquatic life.	pH can be affected by industrial and wastewater discharges, runoff, and accidental spills. Natural variation in seasons may also affect pH.
Dissolved Oxygen (DO)	DO is a measure of the amount of dissolved oxygen that is available in the water. DO is vital for aquatic organisms to live. Where DO is too low, aquatic organisms may have insufficient oxygen to live.	DO is temperature-dependent, with water being able to hold more dissolved oxygen at lower temperatures due to the solubility of gases increasing as the temperature decreases. The amount of oxygen present usually decreases with depth, rising temperatures, and with the oxidation of organic matter and pollutants. Bacteria and algal blooms may cause DO to decrease as decomposition of organic matter consumes oxygen in the water, resulting in hypoxic (low oxygen) areas.
Specific Conductance	Specific Conductance is the measure of the water's capacity to carry an electrical current and is indicative of the amounts of dissolved solids present in a water body.	Dissolved salt-forming substances such as sulfate, chloride, and sodium increase the conductivity of the water.
Temperature	Water temperature affects the oxygen content of the water (dissolved oxygen). Temperature also has an impact on cold-blooded animals.	Water temperature may be affected by alterations to the riparian zone, changes in ambient temperature, and discharges.
Flow	Flow is a measurement of the velocity of the water, measured in cubic feet per second (CFS). Flow combined with other parameters can be a good indicator of water quality.	Flow can be affected by both natural and man-made sources.

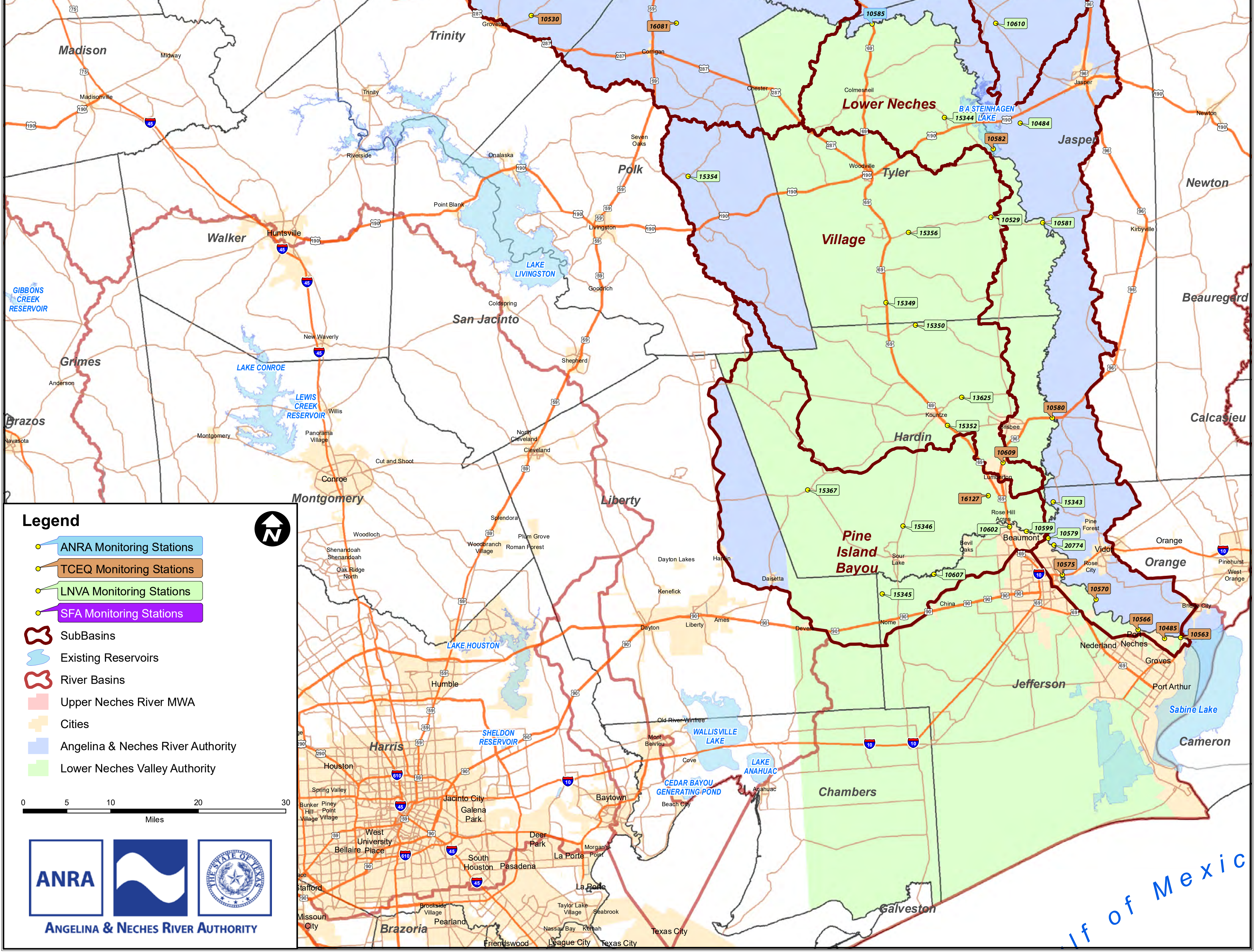
Calibration of the multiprobe sonde used for measuring pH, dissolved oxygen, specific conductance, and temperature.

Conventional parameters are also evaluated as part of the monitoring plan. During routine monitoring events, water samples are collected for laboratory analysis of conventional parameters. Conventional parameters include nutrients, minerals, and particulates. For routine monitoring stations, ANRA collects and analyzes samples for the following conventional parameters:

Conventional Parameters and Bacteria		
Parameter	**Potential Impacts**	**Possible Sources/Causes**
Ammonia-Nitrogen	Ammonia, which is produced from the breakdown of nitrogen-containing compounds, is found naturally in waters. In excess, algal blooms may occur. Elevated ammonia levels are indicative of organic pollution. These elevated levels can cause stress on aquatic organisms, as well as damage to tissue and gills.	Ammonia enters into a body of water via excretion of nitrogenous wastes, decomposition of plants and animals, and runoff. Ammonia is an ingredient in many fertilizers. It is also present in sewage, wastewater discharges, and storm water runoff.
Chloride	Chloride is one of the major inorganic ions in water and wastewater. It is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can adversely affect survival, growth, and/or reproduction of aquatic organisms.	An elevated chloride concentration can be indicative of natural or man-made pollution. Natural sources of chloride include the weathering and leaching of sedimentary rocks, soils, and salt deposits. Other possible sources include oil exploration and storage, sewage and industrial discharges, and landfill runoff.
Chlorophyll-*a*	Chlorophyll-*a* is an indicator of algal biomass in a water body. Increased concentrations indicate potential eutrophication or nutrient loading. Diurnal shifts in DO and pH resulting from increased photosynthesis and respiration can cause stress to aquatic organisms.	Chlorophyll-*a* is a photosynthetic pigment that plays a vital role in photosynthesis. It is found in most plants, cyanobacteria, and algae. When chlorophyll-*a* levels are consistently high or variable, this may be indicative of algal blooms.
Escherichia coli (*E. coli*)	*E. coli* is an indicator of fecal contamination. Fecal contamination is a health concern to the general public, and its presence indicates a risk for contact recreation. The presence of *E. coli* in the water indicates that pathogenic organisms may be present.	*E. coli* is abundant in the gastrointestinal tract of warm-blooded animals. Elevated bacterial levels are indicative of a potential pollution problem. Reasons for the presence of fecal coliforms such as *E. coli* include failing septic systems, animal wastes, and inadequately treated sewage.
Nitrate + Nitrite-Nitrogen	Elevated levels of nitrite and nitrate can produce nitrite toxicity in fish ("brown blood disease") and methemoglobinemia ("blue baby syndrome") in infants by reducing the oxygen-carrying capacity of blood. In surface water, high levels of nitrates can lead to excessive growth of aquatic plants. High levels of nitrates are also indicative of human-caused pollution.	As part of the nitrogen cycle, nitrogenous compounds are converted from ammonia to nitrite and then to nitrate by bacterial and chemical processes. Potential sources include effluent discharges from wastewater treatment plants, fertilizers, and agricultural runoff.
Total Phosphorus	Phosphorus is essential to the growth of organisms, and is considered a growth-limiting nutrient. Elevated levels in water may stimulate the growth of photosynthetic aquatic macro- and microorganisms. Elevated phosphorus levels contribute to eutrophication and may cause algal blooms.	Phosphorus is commonly known as a man-made pollutant. It is present in industrial and domestic wastewater discharges, as well as agricultural and storm water runoff. It is a an ingredient in soaps and detergents, and is used extensively in the treatment of boiler waters. Phosphates are also used by some water supplies during treatment.
Total Suspended Solids (TSS)	TSS, reported in mg/L, is a measure of the total suspended particles in water. High levels of TSS increase the turbidity of the water, reducing light penetration which subsequently decreases oxygen production by plants.	Elevated TSS can result from multiple point and non-point sources. Soil erosion and runoff are two primary sources.
Sulfate	Sulfate is essential for plant growth, and low levels (under 0.5 mg/L) can be detrimental to algal growth. Excessive levels of sulfate can form strong acids and change the pH of the water. Excessively high levels may be toxic to cattle and other animals. Sulfate can also affect drinking water quality.	Sulfate occurs in almost all natural waters due to an abundance of elemental and organic sulfur in the environment. It usually enters into water bodies by water passing over rock or soil containing minerals like gypsum, as well as runoff from agricultural lands, industrial discharges, and sewage treatment plant discharges. Sulfate can also enter water bodies from atmospheric deposition from such sources as burning fossil fuels.

Neches River Basin Monitoring Sites FY 2017





Legend
ANRA Monitoring Stations
TCEQ Monitoring Stations
LNVA Monitoring Stations
SFA Monitoring Stations
SubBasins
Existing Reservoirs
River Basins
Upper Neches River MWA
Cities
Angelina & Neches River Authority
Lower Neches Valley Authority
0
5
10
20
30
Miles
ANRA
ANGELINA & NECHES RIVER AUTHORITY
Lower Neches
Village
Tyler
Hardin
Pine Island Bayou
Jasper
Newton
Orange
Jefferson
Chambers
Liberty
Polk
Trinity
Walker
San Jacinto
Montgomery
Harris
Madison
Grimes
Brazos
Brazoria
Galveston
Beauregard
Calcasieu
Cameron
LAKE LIVINGSTON
LAKE CONROE
LEWIS CREEK RESERVOIR
GIBBONS CREEK RESERVOIR
B A STEINHAGEN LAKE
LAKE HOUSTON
SHELDON RESERVOIR
WALLISVILLE LAKE
LAKE ANAHUAC
CEDAR BAYOU GENERATING POND
Sabine Lake
Gulf of Mexico
10530
16081
10585
10610
15344
10484
10582
15354
10529
10581
15356
15349
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13625
15352
10580
10609
15367
16127
15343
15346
10602
10599
10579
20774
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10566
10485
10563

Monitoring Stations in the Upper and Middle Portions of the Neches Basin

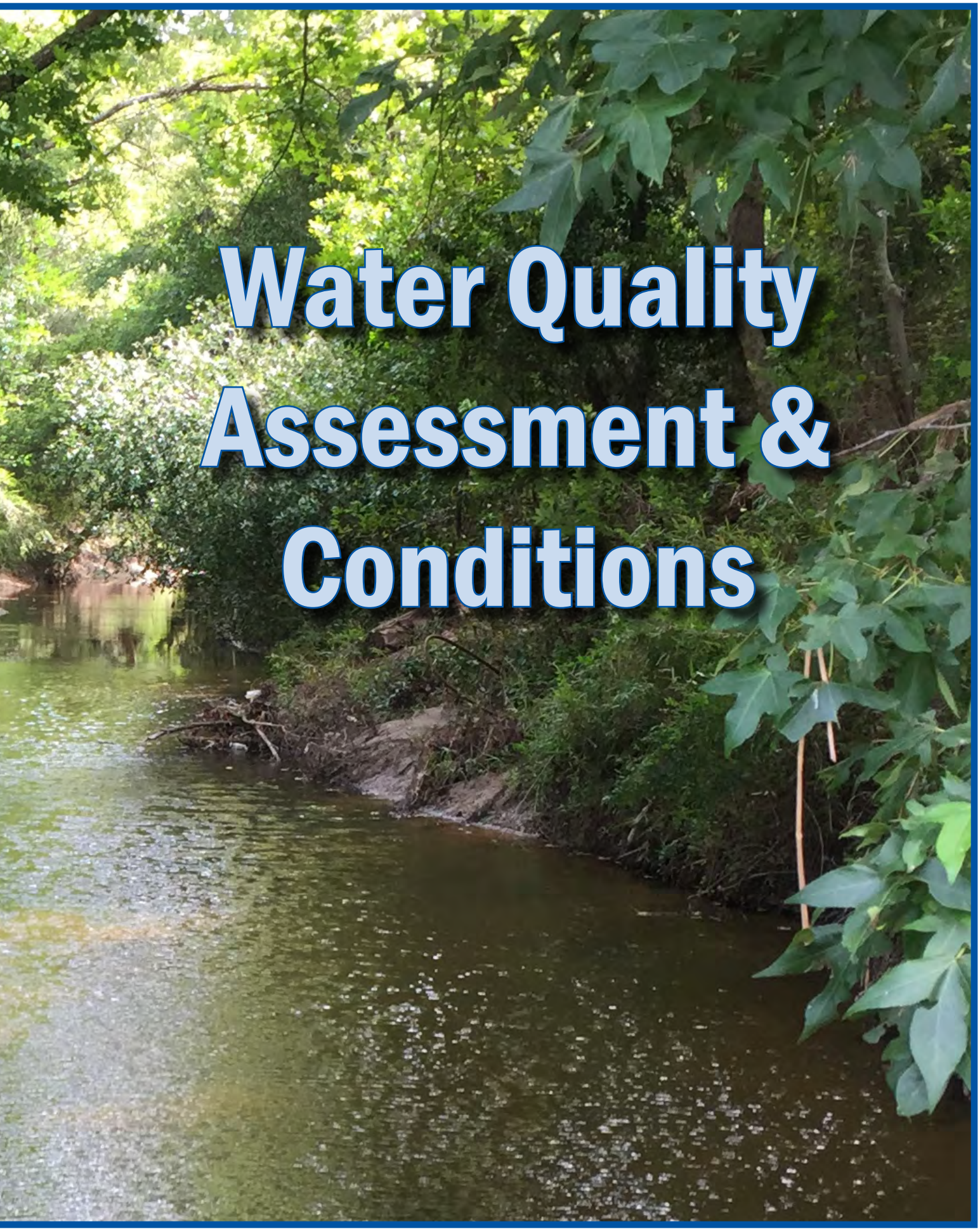
Below are lists of the monitoring stations in the upper and middle portions of the Neches Basin as monitored by ANRA, TCEQ Region 5, TCEQ Region 10, LNVA, and SFASU. While shown on the map, monitoring stations in the lower portion of the basin which are monitored by LNVA and TCEQ Region 10 are not listed. For more information on those stations, refer to the Coordinated Monitoring Schedule (cms.lcra.org) or to LNVA's Basin Highlights Report.

Monitoring Station ID	Segment	Description
10585	0604	NECHES RIVER AT US 69
10586	0604	NECHES RIVER AT US 59
17067	0604	NECHES RIVER AT SH 7
14794	0604	NECHES RIVER AT SH 294
13627	0604	NECHES RIVER DOWNSTREAM LAKE PALESTINE AT US 79
13528	0604A	CEDAR CREEK AT FM 1336
10478	0604A	CEDAR CREEK AT FM 2497
21434	0604A	CEDAR CREEK AT ELLIS AVE IN LUFKIN
10479	0604A	CEDAR CREEK AT LOOP 287
13529	0604B	HURRICANE CREEK AT FM 324
21433	0604B	HURRICANE CREEK DOWNSTREAM OF KIWANIS PARK DRIVE
10487	0604B	HURRICANE CREEK AT LOOP 287
10492	0604C	JACK CREEK AT FM 2497
10493	0604C	JACK CREEK AT SH 94
10494	0604C	JACK CREEK AT FM 3150
16096	0604D	PINEY CREEK AT FM 358 EAST OF PENNINGTON
16097	0604M	BILOXI CREEK AT FM 1818
10499	0604M	BILOXI CREEK AT ANGELINA CR 216
16098	0604N	BUCK CREEK AT FM 1818
17339	0604T	LAKE RATCLIFF NORTHWEST ARM
16159	0605	LAKE PALESTINE AT DAM
20318	0605	LAKE PALESTINE, MIDLAKE
16346	0605	LAKE PALESTINE AT TYLER INTAKE
18557	0605	LAKE PALESTINE IN FLAT BAY
18643	0605	UPPER LAKE PALESTINE NE
20319	0605	LAKE PALESTINE CWQMN SITE, MID-LAKE
16797	0605A	KICKAPOO CREEK AT FM 773
15288	0605F	LAKE ATHENS DOWNSTREAM OF WATER TREATMENT PLANT INFLOW WEST ARM OF LAKE
17575	0605F	LAKE ATHENS NEAR NORTHEAST END OF DAM
10596	0606	NECHES RIVER AT FM 279 WEST OF TYLER AND NE OF CHANDLER
10597	0606	NECHES RIVER UPSTREAM LAKE PALESTINE AT SH 64 WEST OF TYLER
18301	0606A	PRAIRIE CREEK AT SH 110
10522	0606D	BLACK FORK CREEK AT SMITH CR 46
14906	0610	SAM RAYBURN RESERVOIR AT MAIN POOL
15671	0610	SAM RAYBURN RESERVOIR USGS SITE FC 7.21 KM SOUTHWEST OF FM 3173/FM 705 INTERSECTION
15670	0610	SAM RAYBURN RESERVOIR USGS SITE GC 9.84 KM SOUTHEAST OF SH 147 6.56 KM NORTHEAST OF FM 2743/ FM 3373 INTERSECTION
10612	0610	SAM RAYBURN RESERVOIR AT SH 147 BRIDGE
15524	0610	SAM RAYBURN RESERVOIR NEAR SHIRLEY CREEK IN THE ANGELINA RIVER CHANNEL \
15523	0610	SAM RAYBURN RESERVOIR ADJACENT TO ALLIGATOR COVE IN THE ATTOYAC RIVER CHANNEL
10614	0610	SAM RAYBURN RESERVOIR WEST SHORE AT SH 103 6.6 MILES EAST OF ETOILE
21100	0610	SAM RAYBURN RESERVOIR ON ANGELINA RIVER CHANNEL 0.75 KM DOWNSTREAM OF MARIONS FERRY BOAT RAMP 4.2 KM NORTH AND 2.2 KM EAST OF FM 1669/ SH 103 INTERSECTION NEAR LUFKIN
10613	0610	SAM RAYBURN RESERVOIR AT SH 103 3.73 KM WEST-SOUTHWEST OF ETOILE
15674	0610	SAM RAYBURN RESERVOIR USGS SITE LC 1.7 KM NORTHWEST OF MILL CREEK PARK SWIMMING AREA 3.96 KM NW OF ST LOOP 149/ US 96 INTERSECTION
15673	0610	SAM RAYBURN RESERVOIR USGS SITE AC 2.5 KM EAST NORTHEAST OF FM 705/FM 3127 INTERSECTION
15675	0610	SAM RAYBURN RESERVOIR USGS SITE MC 4.86 KM EAST NORTHEAST OF FM 3173/FM 705 INTERSECTION 8.8 KM DOWNSTREAM OF FM 83
14907	0610	SAM RAYBURN RESERVOIR AT FM 83 BRIDGE CROSSING

ANRA
TCEQ
LNVA
SFA

Monitoring Station ID	Segment	Description
15361	0610A	AYISH BAYOU AT SH 103 0.8 KM EAST OF FM 705
21431	0610A	AYISH BAYOU AT WEST COLUMBIA STREET IN CITY OF SAN AUGUSTINE
21432	0610P	BAYOU CARRIZO AT SH 21 NEAR NACOGDOCHES
10627	0611	ANGELINA RIVER AT US 59
10630	0611	ANGELINA RIVER AT SH 21
10633	0611	ANGELINA RIVER 340 METERS UPSTREAM OF SH 204
10635	0611	ANGELINA RIVER AT FM 1798
13788	0611A	EAST FORK ANGELINA RIVER AT RUSK CR 3218
10552	0611A	EAST FORK ANGELINA RIVER AT FM 225
10474	0611B	LA NANA BAYOU AT NACOGDOCHES CR 526
20792	0611B	LA NANA BAYOU EAST MAIN STREET/STATE HIGHWAY 7/ STATE HIGHWAY 21 IN NACOGDOCHES
16301	0611B	LA NANA BAYOU AT LOOP 224 NORTH IN THE CITY OF NACOGDOCHES
14477	0611C	MUD CREEK AT US 79
10532	0611C	MUD CREEK AT US 84
18302	0611D	WEST MUD CREEK AT US 69
15801	0611Q	LAKE NACOGDOCHES AT DAM
21021	0611Q	LAKE NACOGDOCHES NEAR ISLAND IN UPPER LAKE
17822	0611R	LAKE STRIKER UPPER LAKE
17824	0611R	LAKE STRIKER SE OF POWERPLANT
21429	0611V	BOWLES CREEK AT CHEROKEE CR 4608/RUSK CR 4194
21430	0611W	JOHNSON CREEK AT RUSK CR 476
10636	0612	ATTOYAC BAYOU AT SH 21
15253	0612	ATTOYAC BAYOU AT SH 7
16076	0612	ATTOYAC BAYOU AT US 59
20841	0612	ATTOYAC BAYOU AT FM 138
16084	0612A	TERRAPIN CREEK AT SH 95
16083	0612B	WAFFELOW CREEK AT FM 95
20843	0612C	NACONICHE CREEK AT FM 95
20844	0612E	BIG IRON ORE CREEK AT FM 354
20845	06112F	WEST CREEK AT FM 2913
21435	0612G	NACONICHE LAKE NEAR THE DAM
10637	0613	LAKE TYLER MIDLAKE AT DAM
15210	0613	LAKE TYLER AT LANGLEY ISLAND
10638	0613	LAKE TYLER EAST NEAR DAM
17929	0613	LAKE TYLER EAST UPPER MID LAKE
10639	0614	LAKE JACKSONVILLE SOUTHWEST CORNER
16535	0614	LAKE JACKSONVILLE UPPER LAKE
10623	0615	SAM RAYBURN RESERVOIR AT CONFLUENCE OF ANGELINA RIVER 0.75 KM NORTHWEST OF PAPER MILL CREEK
10621	0615	SAM RAYBURN RESERVOIR NEAR ANGELINA RIVER 0.7 KM DOWNSTREAM OF CONFLUENCE WITH PAPER MILL CREEK LOWER CHANNEL
10502	0615A	PAPER MILL CREEK UPPER BIFURCATION CHANNEL IMMEDIATELY UPSTREAM OF ANGELINA RIVER CONFLUENCE

Hurricane Creek at Loop 287 in Lufkin


Water Quality
Assessment &
Conditions

Texas Surface Water Quality Standards

Texas Surface Water Quality Standards (TSWQS) are state rules adopted by the TCEQ that are designed to establish numerical and narrative goals for water quality throughout the state. TSWQS are developed to maintain the quality of surface waters in Texas so that they support public health and enjoyment, and protect aquatic life, consistent with the sustainable economic development of the state. TSWQS describe the physical, chemical, and biological conditions to be attained in waters in the state, as well as identifying uses and criteria associated with those uses. The standards also provide a basis on which the TCEQ regulatory programs [such as Permitting, Total Maximum Daily Load (TMDL), Non-Point Source (NPS), and Monitoring/Assessment] can establish reasonable methods to implement and attain the state's goals for water quality.

Section 304(a)(1) of the Federal Clean Water Act (CWA) requires development of criteria for water quality that accurately reflects the latest scientific knowledge. Criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects. Section 304(a) also provides guidance to states and tribes in adopting water quality standards. Criteria are developed for the protection of aquatic life as well as for human health. Numerical criteria are numbers representing a specific use for the water body. For example, for high aquatic life use, the dissolved oxygen 24-hour minimum criteria is 3.0 mg/L. Impairments occur when water quality conditions do not meet assigned uses/criteria as defined in the TSWQS.

Designated Uses

As defined in the TSWQS, a water body can be assigned specific uses including aquatic life, public water supply, and contact recreation use. Designated uses typically have corresponding numerical criteria. General criteria cover the entire state, but if sufficient information is available for a given water body, then site-specific standards may be developed and assigned to that water body.

Aquatic Life Use (ALU) has corresponding 24-hour dissolved oxygen criteria. Water bodies have assigned/presumed ALU. ALU categories are exceptional, high, intermediate, limited, and minimal.

Neches River at US 69

General Use criteria are used to protect overall water quality rather than a single specific use. Parameters used to gauge support for this use include chloride, sulfate, total dissolved solids (TDS), pH, and temperature. A water body is classified as Fully Supporting for general use if it meets all of these criteria. Parameters such as ammonia, nitrates, phosphorus, and chlorophyll-*a* are used in the assessment to screen for nutrient concerns.

Public water supply use includes criteria for chlorides, sulfates, and TDS in drinking water. Criteria for these parameters are set so that public water supplies are capable of treating and delivering water of acceptable quality.

Contact recreation use is assessed using criteria for bacteria indicators such as *E. coli* (for freshwater). Contact recreation use refers to the ability of the water body to support activities that involve physical contact with the water, such as swimming and wading. There are both primary and secondary contact recreation uses. Primary contact recreation activities, such as swimming, are presumed to involve a significant risk of ingestion of water. Secondary contact recreation activities, such as fishing, are presumed to involve a less significant risk of water ingestion than primary contact recreation due to limited body contact incidental to shoreline activity. The difference between secondary contact 1 and 2 are the frequency that the secondary contact recreation activities occur due to physical characteristics of the water body or limited public access.

Many of our state's water resources do not currently meet their existing, designated, presumed, and attainable uses because of pollution problems from a combination of point sources, such as sewage treatment plants and industrial dischargers, and nonpoint sources, such as pollutants carried by rainfall runoff from forests, agriculture lands, abandoned mine lands, etc.

Through the Clean Rivers Program, the TCEQ and its partners continually monitor and evaluate the quality of water bodies throughout the state by collecting data on parameters such as dissolved oxygen, temperature, pH, dissolved minerals, toxic substances, and bacteria.

The Texas Integrated Report

In the United States, each state is required by the federal Clean Water Act Sections 305(b) and 303(d) to identify all water bodies where required pollution controls are not sufficient to attain or maintain applicable surface water quality standards. In Texas, this list is compiled by the TCEQ and is a part of the *Texas Integrated Report of Surface Water Quality* (formerly known as the *Texas Water Quality Inventory and 303(d) List*). This report is prepared by TCEQ and submitted to the US Environmental Protection Agency (EPA) every two years in even numbered years.

The *Texas Integrated Report* describes the condition of all surface water bodies that were evaluated for the assessment period. For the 2014 assessment, which is the most recent completed assessment, the TCEQ included data collected during a seven-year period (December 1, 2005 – November 30, 2012). The time frame was extended to ten years, if needed, to attain the minimum number of data points (at least 10, or in the case of bacteria, 20) needed for the assessment.

If the measured values for a water body are found to be consistently exceeding the criteria for its use, then that water body must be listed as impaired, which simply means that the water body is not supporting its use. When a water body is determined to be impaired, several things must occur:

- The water body must be listed on the 303(d) list.
- An evaluation must be undertaken to discover what is preventing the water body from supporting its use(s) or if the use(s) are inappropriate for the water body.
- Steps must then be taken to either remedy the problem, by collecting additional data or information, or evaluating which uses are appropriate for the water body in question. These steps can include:
    - additional monitoring
    - development of a Total Maximum Daily Load (TMDL)
    - preparation of a Watershed Protection Plan (WPP)
    - a review of the water quality standards

The most recent version of the *Texas Integrated Report*, as well as draft reports and reports from previous years, can be found at the following website:

http://www.tceq.texas.gov/waterquality/assessment/305_303.html

Classified Segments & Unclassified Waterbodies

For the purpose of managing Water Quality Standards, water bodies in the state are divided into classified segments and unclassified waterbodies. A classified segment is a water body or portion of a water body that is individually defined in the Texas Surface Water Quality Standards.

A segment is intended to have relatively homogeneous chemical, physical, and hydrological characteristics. A segment provides a basic unit for assigning site-specific standards and for applying water quality management programs of the agency. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs. The classified segments are assigned four-digit numbers. The first two digits correspond to the major basin in which they are located. The last two digits distinguish individual segments within the particular basin.

Because of the great extent of waters of the state, not all bodies of water are classified in the standards. For example, when managing a classified segment of the Neches River, it may be necessary to examine water quality in the tributaries that flow into that segment. Some of these tributaries may not be part of the classified segment system. When that happens, for management purposes, the tributary is assigned a unique number that is referred to as an unclassified waterbody. This unclassified tributary will be designated with the number of the classified segment in whose watershed it is located, along with a letter; for instance, tributaries of Segment 0604 would be 0604A, 0604B, and so on. The same numbering system applies to unclassified lakes.

Impairments and Concerns

Bacterial impairments are the most common reason for water bodies in the upper and middle portions of the Neches River Basin to be listed on the 303(d) List. Three classified segments (Neches River Above Lake Palestine, Angelina River Above Sam Rayburn Reservoir, and Attoyac Bayou) have a bacterial impairment listed in the 2014 Integrated Report. Additionally, thirteen unclassified waterbodies have impairments or concerns for *E. coli* bacteria. Generally, most bacterial impairments are due to nonpoint sources of pollution.

Numerous segments had concerns for nutrients, particularly Ammonia-Nitrogen and Total Phosphorus.

Depressed Dissolved Oxygen levels were common in the basin. These impairments and concerns are most likely due to a combination of low flows and elevated nutrient levels.

Impairments and Concerns in the Upper Neches Basin (as listed in the 2014 Texas Integrated Report)			
Segment ID	**Segment Name**	**Impairment(s)**	**Concern(s)**
0604	Neches River Below Lake Palestine	Mercury in Edible Tissue Dioxin in Edible Tissue	Chlorophyll-*a*
0604A	Cedar Creek	*E. coli*	Ammonia-Nitrogen Nitrate-Nitrogen Total Phosphorus
0604B	Hurricane Creek	*E. coli*	Ammonia-Nitrogen
0604C	Jack Creek	No Impairments	Depressed Dissolved Oxygen Ammonia-Nitrogen Total Phosphorus
0604D	Piney Creek	Depressed Dissolved Oxygen	Depressed Dissolved Oxygen Ammonia-Nitrogen
0604M	Biloxi Creek	*E. coli* Depressed Dissolved Oxygen	Depressed Dissolved Oxygen Ammonia-Nitrogen Total Phosphorus
0604N	Buck Creek	No Impairments	No Concerns
0604T	Lake Ratcliff	Mercury In Edible Tissue	No Concerns
0605	Lake Palestine	pH	Depressed Dissolved Oxygen Chlorophyll-*a* pH (High)
0605A	Kickapoo Creek	*E. coli* Depressed Dissolved Oxygen	Depressed Dissolved Oxygen Ammonia-Nitrogen
0606	Neches River Above Lake Palestine	*E. coli* Depressed Dissolved Oxygen pH (Low)	*E. coli* Depressed Dissolved Oxygen Nitrate-Nitrogen Total Phosphorus Zinc in Water
0606A	Prairie Creek	*E. coli*	No Concerns
0606D	Black Fork Creek	*E. coli*	Ammonia-Nitrogen
0609	Angelina River Below Sam Rayburn Reservoir	Mercury in Edible Tissue Dioxin in Edible Tissue	No Concerns
0610	Sam Rayburn Reservoir	Mercury in Edible Tissue Dioxin in Edible Tissue	Depressed Dissolved Oxygen Ammonia-Nitrogen pH Iron in Sediment Manganese in Sediment Mercury in Edible Tissue
0610A	Ayish Bayou	*E. coli*	No Concerns
0611	Angelina River Above Sam Rayburn Reservoir	*E. coli* Aluminum in Water	Lead in Water
0611A	East Fork Angelina River	*E. coli*	*E. coli*
0611B	La Nana Bayou	*E. coli*	*E. coli* Ammonia-Nitrogen Nitrate-Nitrogen Total Phosphorus
0611C	Mud Creek	*E. coli* Aluminum in Water	*E. coli* Depressed Dissolved Oxygen
0611D	West Mud Creek	*E. coli*	Ammonia-Nitrogen Nitrate-Nitrogen
0611Q	Lake Nacogdoches	No Impairments	Ammonia-Nitrogen
0611R	Lake Striker	No Impairments	Ammonia-Nitrogen
0612	Attoyac Bayou	*E. coli*	Depressed Dissolved Oxygen Ammonia-Nitrogen
0615	Angelina River/Sam Rayburn Reservoir	Depressed Dissolved Oxygen Impaired Fish Community Mercury in Edible Tissue Dioxin in Edible Tissue	Nitrate-Nitrogen Total Phosphorus
0615A	Paper Mill Creek	*E. coli* Aluminum in Water	No Concerns

Segment 0604 - Neches River Below Lake Palestine

Segment Description:

This 231 miles-long freshwater stream extends from a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/Tyler County to Blackburn Crossing Dam in Anderson/ Cherokee County. Contact recreation, public water supply, general, and high aquatic life use are the designated uses for this segment.

Segment Concerns:

This segment has impairments for mercury and dioxin in edible fish tissue listed in the 2014 *Texas Integrated Report*.

Actions to Address Concerns:

A comprehensive Fish Consumption Advisory (ADV-51) was issued on January 24, 2014. The Texas Department of State Health Services recommended consumption advice for six species of fish.

Segment 0604A - Cedar Creek

Segment Description:

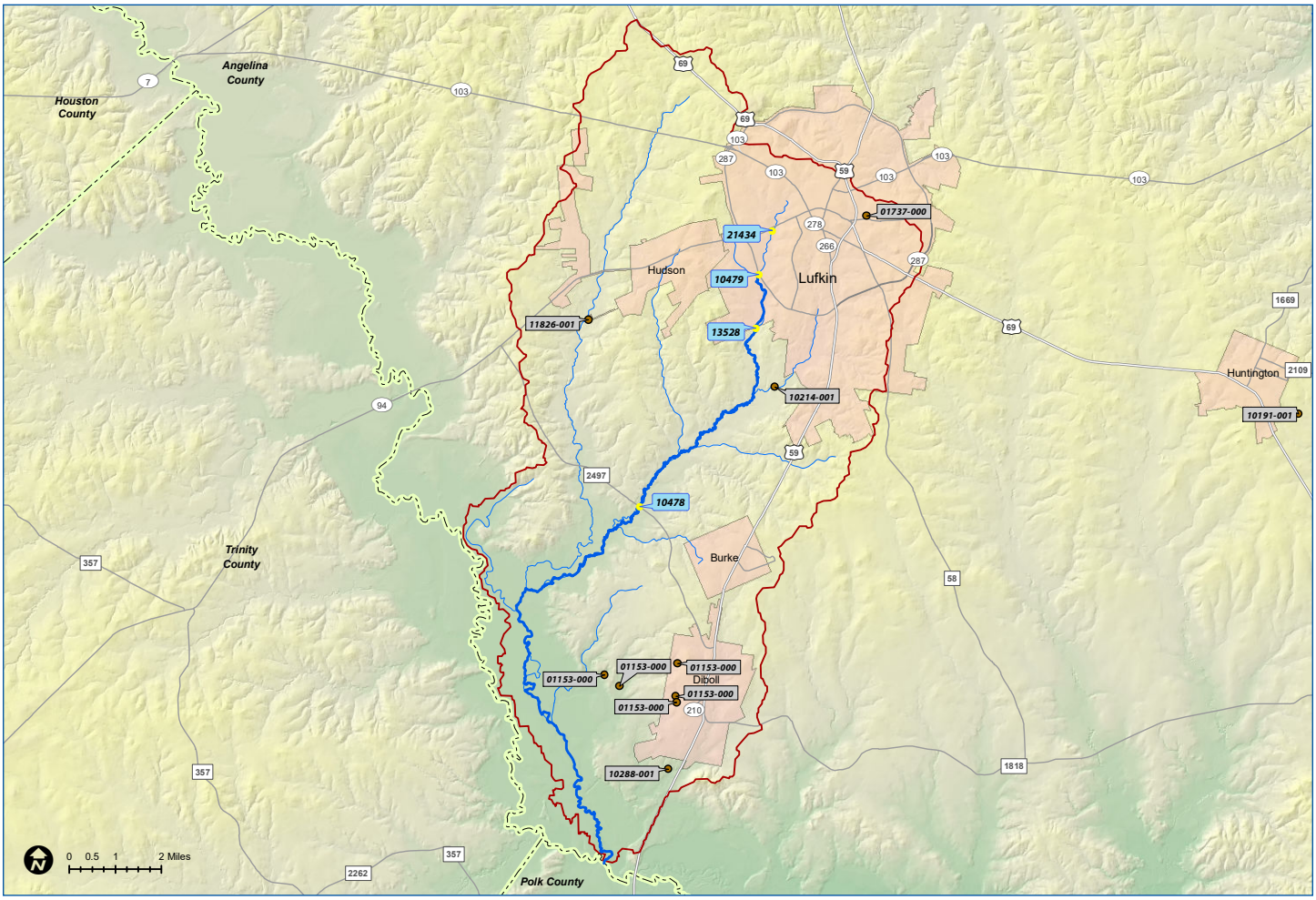
Cedar Creek is a 24-mile length freshwater stream that extends from the confluence of the Neches River southwest of Lufkin to the upstream perennial portion of the stream in Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use.

Segment Concerns:

Cedar Creek is listed as impaired for *E. coli* bacteria in the 2014 *Texas Integrated Report*. Concerns are also listed for Ammonia, Nitrate, and Total Phosphorus.

Actions to Address Concerns:

Additional monitoring stations were added in FY 2014 within the city limits of Lufkin to help identify potential sources.



Segment 0604B - Hurricane Creek

Segment Description:

Covering a length of 3.3 miles, this water body stretches from the confluence of Cedar Creek south of Lufkin to the upstream perennial portion of the stream in Lufkin in Angelina County. General and recreation use are designated uses for this segment.

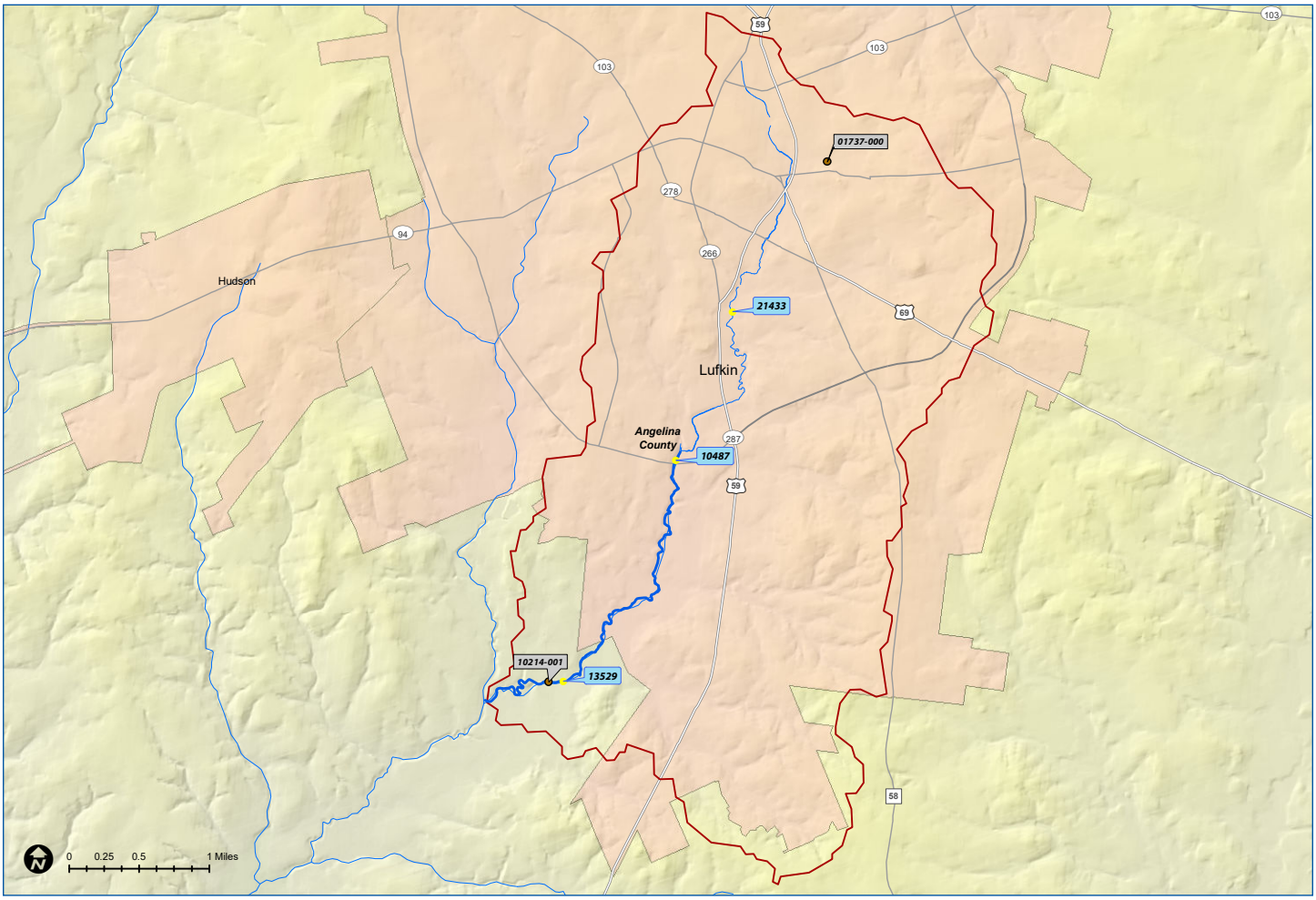
The City of Lufkin's wastewater treatment facility discharges to Hurricane Creek.

Segment Concerns:

Hurricane Creek is listed as impaired for *E. coli* bacteria, with a concern for Ammonia.

Actions to Address Concerns:

Additional monitoring stations were added in FY 2014 within the city limits of Lufkin to help identify potential sources.



Segment 0604C - Jack Creek

Segment Description:

This freshwater stream extends 16 miles from the confluence of Cedar Creek southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in northeast Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use.

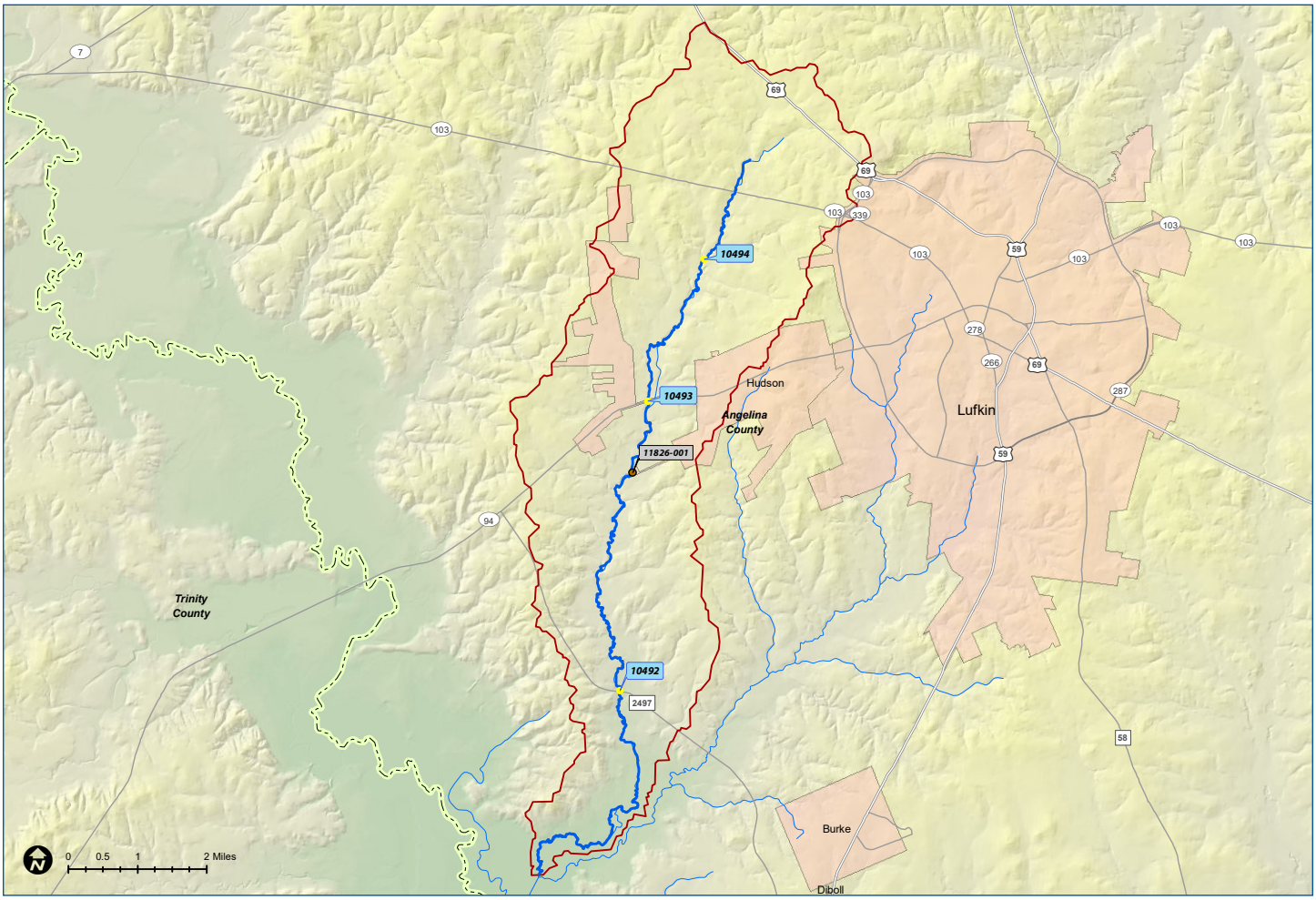
The City of Hudson's wastewater treatment facility discharges to Jack Creek.

Segment Concerns:

Jack Creek has no impairments listed in the 2014 *Texas Integrated Report*. However, there are concerns for Ammonia, Total Phosphorus, and depressed Dissolved Oxygen.

Actions to Address Concerns:

Additional monitoring stations were added in FY 2014 to help identify potential sources.



Segment 0604D - Piney Creek

Segment Description:

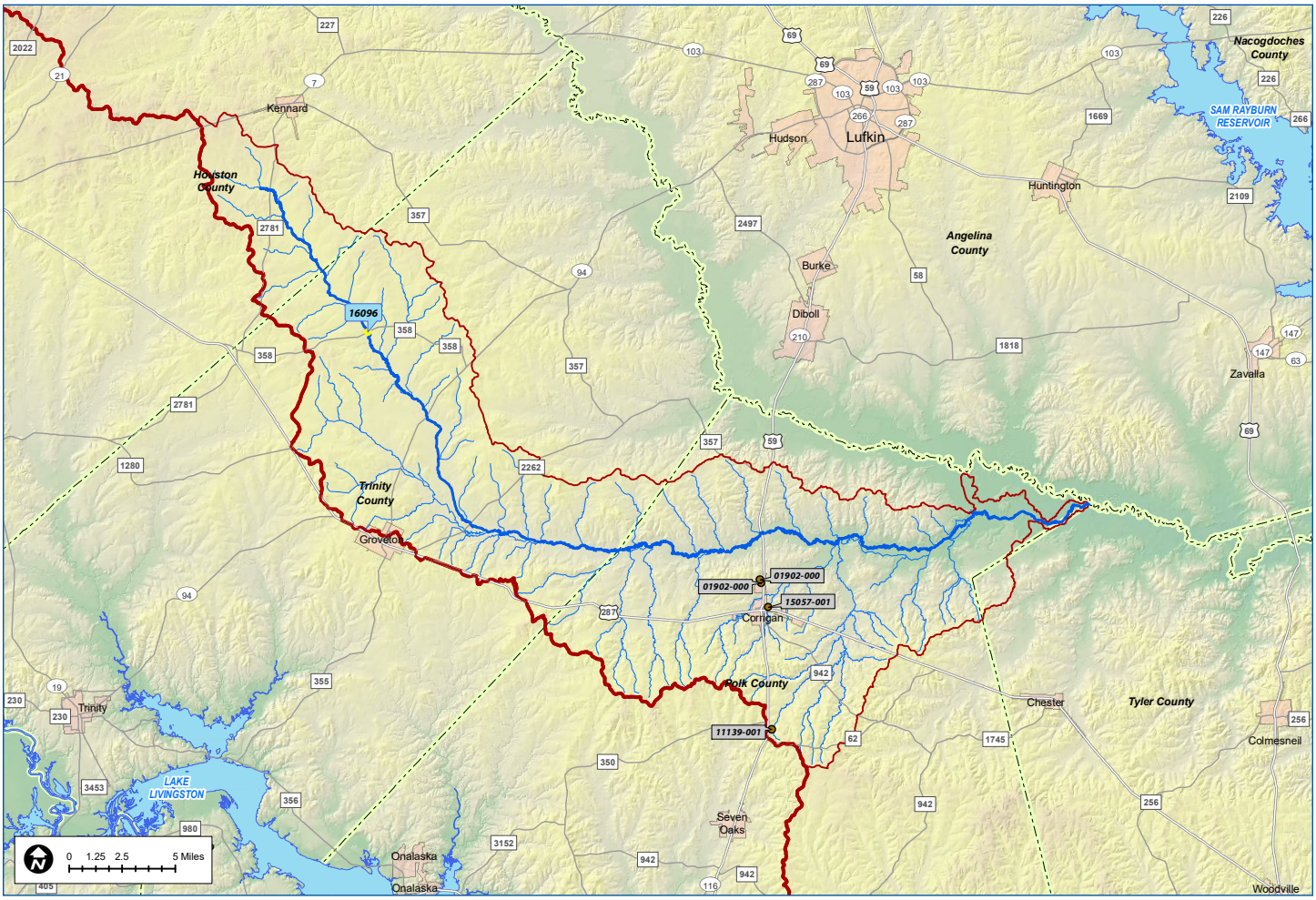
This freshwater stream encompasses 70 miles in stream length from the confluence of the Neches River at the Polk/Tyler/Angelina County lines east of Corrigan to the upstream perennial portion of the stream east of Crockett in Houston County. This segment is designated for contact recreation, general use, and aquatic life use.

Segment Concerns:

Piney Creek has an impairment for depressed Dissolved Oxygen, with a concern for Ammonia.

Actions to Address Concerns:

TCEQ Region 10 (Beaumont) staff are conducting a series of 24-hour Dissolved Oxygen measurements at three monitoring stations on Piney Creek in order to address the DO impairment.



Segment 0604M - Biloxi Creek

Segment Description:

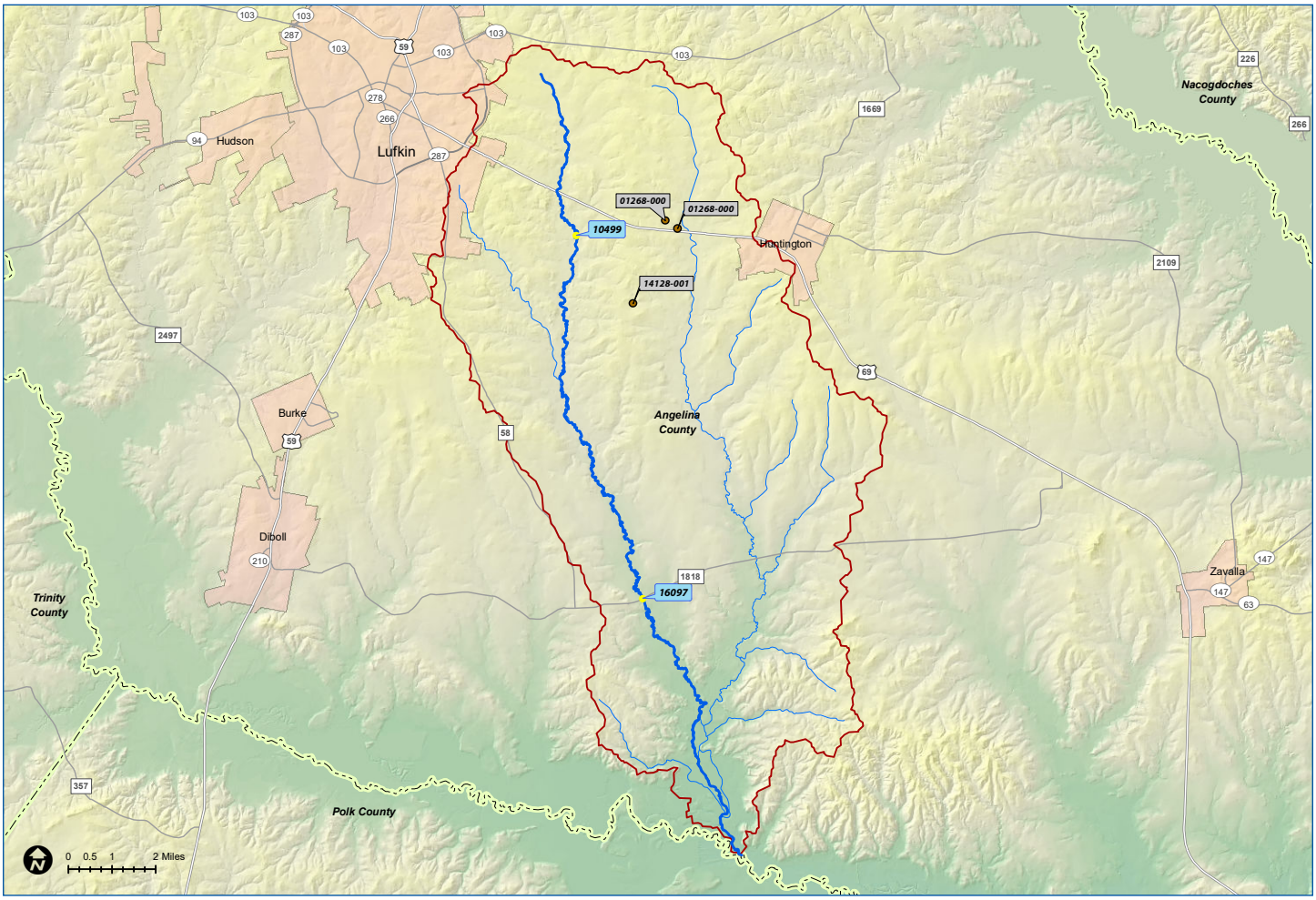
Biloxi Creek is 28.3 miles in length and is from the confluence with the Neches River southeast of Diboll to FM 325 east of Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use.

Segment Concerns:

Biloxi Creek has impairments for *E. coli* and depressed Dissolved Oxygen, as well as concerns for Ammonia and Total Phosphorus.

Actions to Address Concerns:

ANRA will continue routine monitoring. Pollution from illegal dumping (tires, debris, animal carcasses, etc.) is a focus of concern.



Segment 0604N - Buck Creek

Segment Description:

Buck Creek includes 23 miles of freshwater stream from its confluence with Biloxi Creek south of Huntington to a point 2.1 miles upstream of FM 1475, northwest of Huntington in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use.

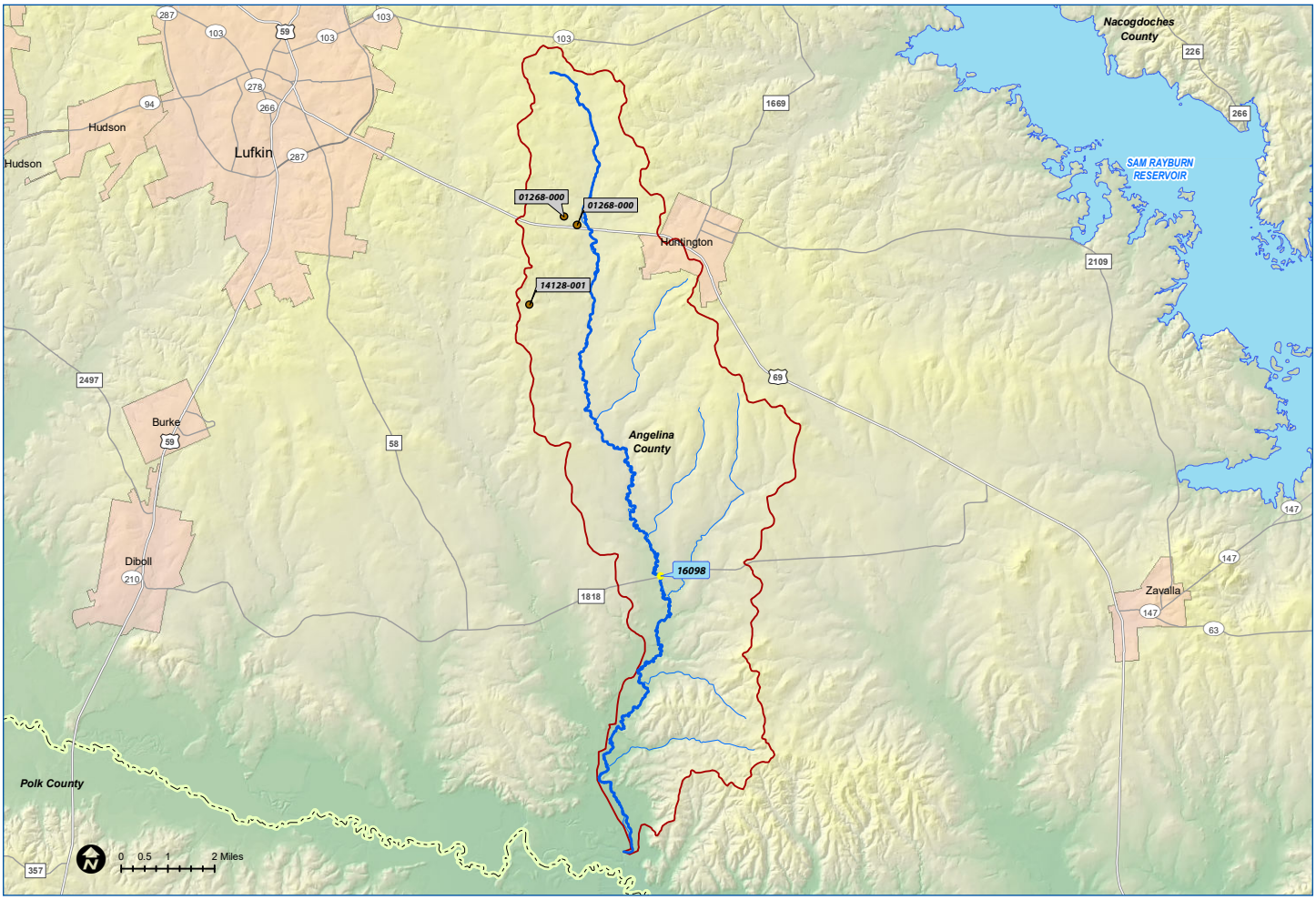
The City of Huntington's wastewater treatment facility discharges to Buck Creek. There is also an industrial wastewater treatment facility that discharges to this segment.

Segment Concerns:

Buck Creek has no impairments, but there is a concern for Ammonia.

Actions to Address Concerns:

ANRA will continue routine monitoring. Pollution from illegal dumping (tires, debris, animal carcasses, etc.) is a focus of concern.



Segment 0604T - Lake Ratcliff

Segment Description:

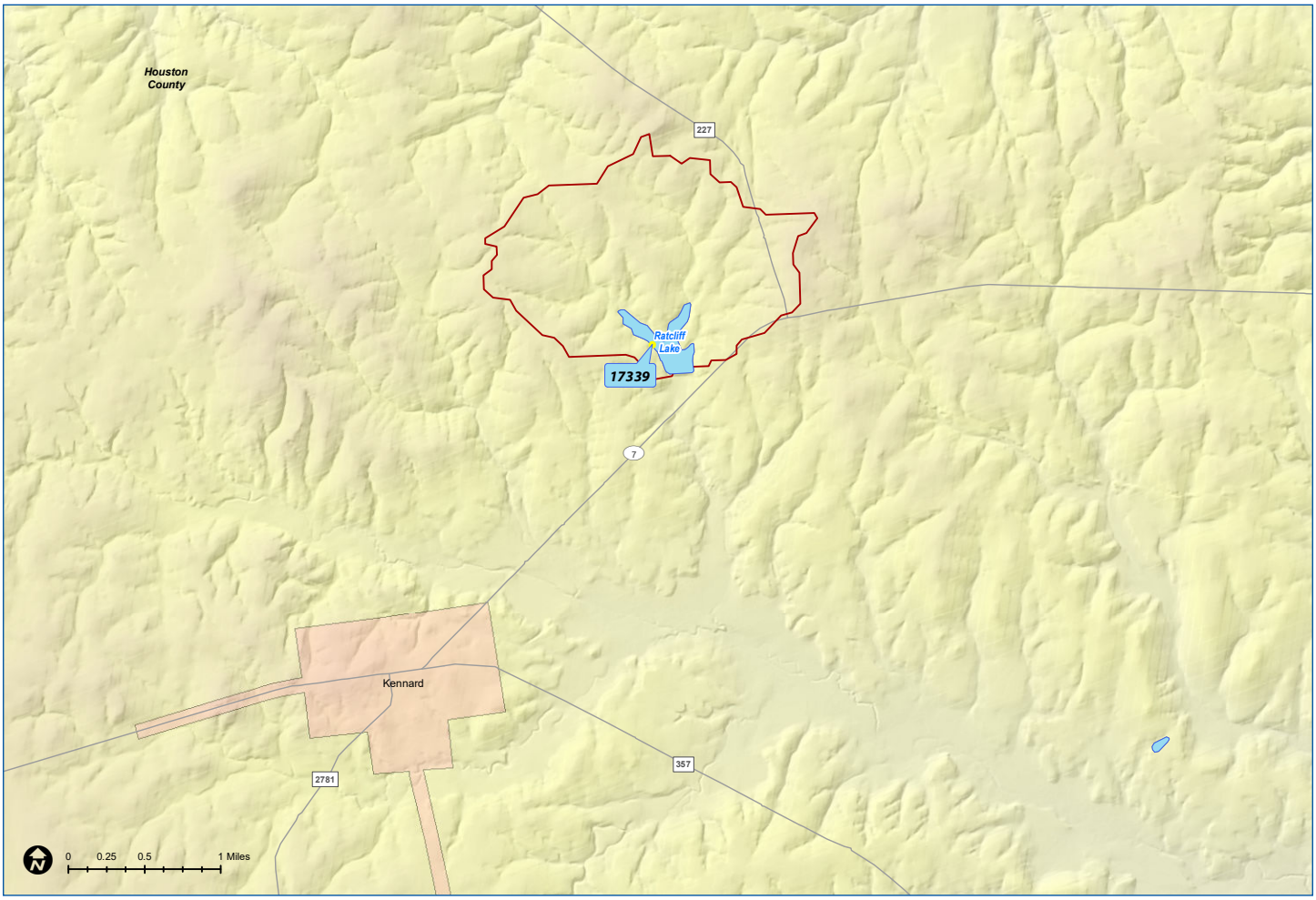
The 53-acre reservoir is located within Houston County, 3.4 miles northeast of Kennard. This segment is designated for contact recreation, general use, and aquatic life use. The lake has a designated camping area, swimming area, and a concession area for summer visitors.

Segment Concerns:

Lake Ratcliff is listed as impaired due to mercury in edible fish tissue.

Actions to Address Concerns:

A comprehensive Fish Consumption Advisory (ADV-23) was issued on May 10, 2002. The Texas Department of State Health Services recommended consumption advice for largemouth bass.



Segment 0605 - Lake Palestine

Segment Description:

Lake Palestine is a 23,500-acre reservoir from the Blackburn Crossing Dam in Anderson/Cherokee County to a point 6.7 km (4.2 miles) downstream of FM 279 in Henderson/Smith County, up to normal pool elevation of 345 feet (impounds Neches River). It was impounded in 1962. Designated uses for this segment are general, public water supply, contact recreation, fish consumption, and high aquatic life use.

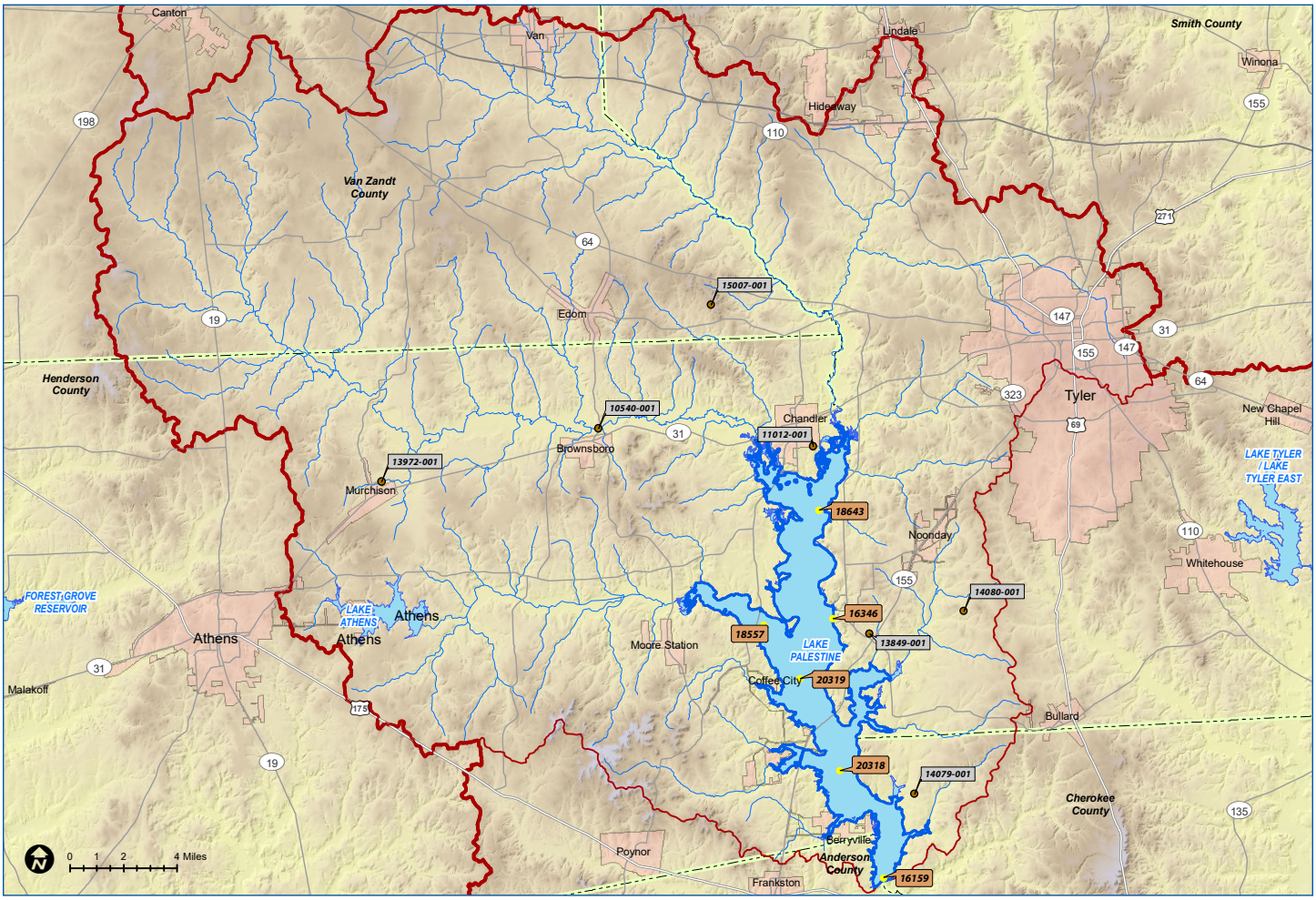
Lake Palestine is a popular angler site and houses several largemouth bass tournaments annually. Predominate fish species located within the lake include largemouth bass, spotted bass, white and hybrid striped bass, crappie, flathead and channel catfish, and sunfish. Vegetation within the reservoir is moderate in the upper end and creek arms, especially near Kickapoo Creek. The upper lake is shallow and has heavy aquatic vegetation.

Segment Concerns:

Lake Palestine is listed in the *Texas Integrated Report* as impaired for elevated pH levels. There are also concerns for depressed Dissolved Oxygen levels and Chlorophyll-*a*.

Actions to Address Concerns:

Possible sources of the elevated pH include eutrophication and low alkalinity, which results in a reduced pH buffering capacity. The factors contributing to the low pH are most likely naturally occurring.



Segment 0605A - Kickapoo Creek

Segment Description:

Kickapoo Creek extends 42.6 miles from the confluence of Lake Palestine east of Brownsboro in Henderson County to the upstream perennial portion of the stream northeast of Murchinson in Henderson County. Aquatic life, general, and contact recreation are the designated uses for this segment.

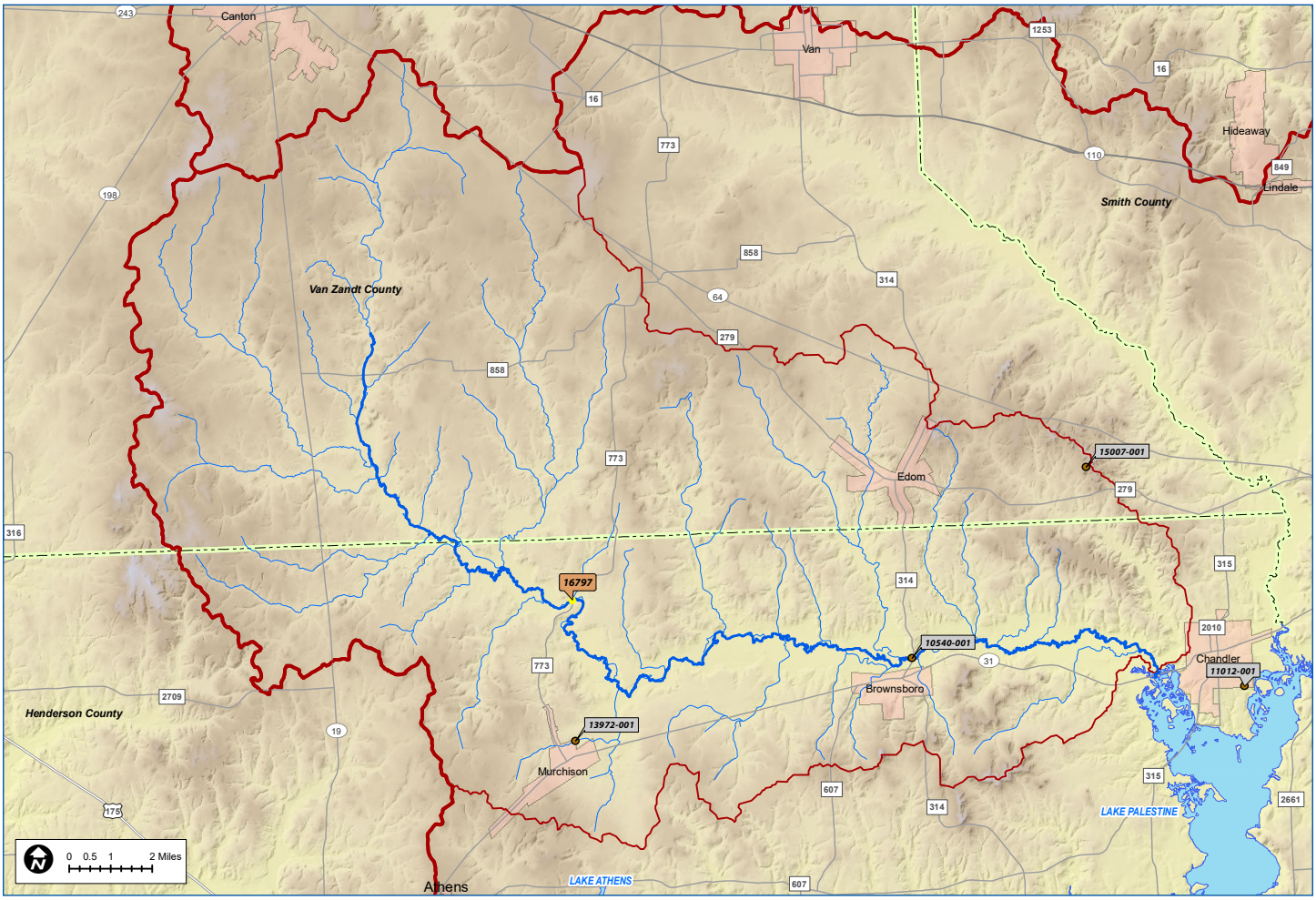
Segment Concerns:

Kickapoo Creek is listed in the 2014 *Texas Integrated Report* as not supporting primary contact recreation due to elevated *E. coli* bacteria.

Concerns for depressed Dissolved Oxygen and Ammonia have also been identified.

Actions to Address Concerns:

Monitoring will continue on this segment. 24-hr DO measurements are necessary to address the depressed Dissolved Oxygen values.



Segment 0606 - Neches River Above Lake Palestine

Segment Description:

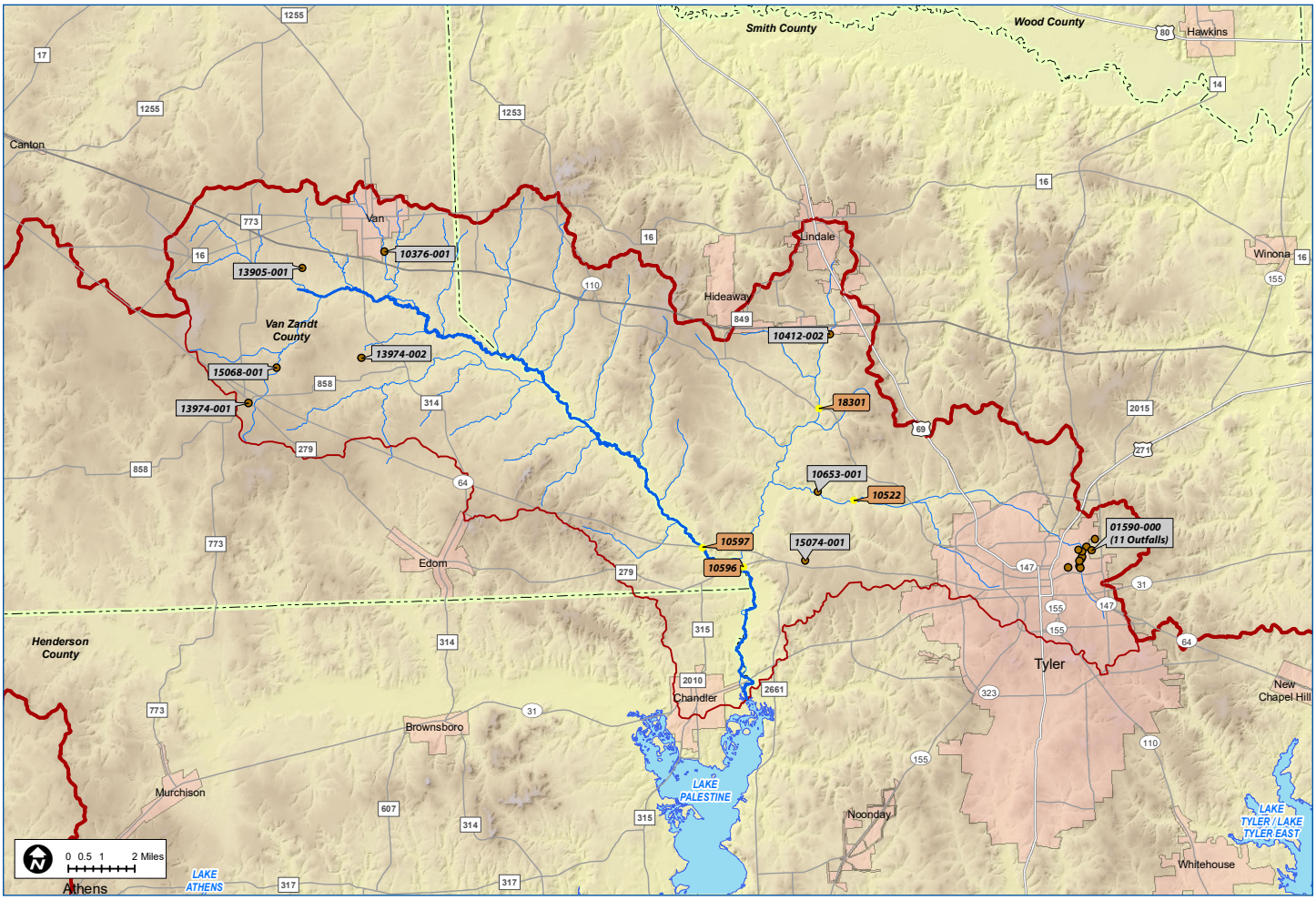
This freshwater stream includes 27 miles from a point 6.7 km (4.2 miles) downstream of FM 279 in Henderson/ Smith County to Rhines Lake Dam in Van Zandt County. Aquatic life, general, contact recreation, and public water supply are the designated uses for this segment.

Segment Concerns:

For the Neches River Above Lake Palestine, one assessment unit has an impairment for *E. coli* bacteria. Nutrient concerns are also listed for Total Phosphorus and Nitrate. There are impairments for depressed Dissolved Oxygen and pH (low), as well as concerns for *E. coli* bacteria and Zinc in water, in one assessment unit.

Actions to Address Concerns:

A Recreational Use Attainability Analysis (RUAA) has been conducted.



Segment 0609 - Angelina River Below Sam Rayburn Reservoir

Segment Description:

The Angelina River below Sam Rayburn Reservoir stretches from a point immediately upstream of the confluence of Indian Creek in Jasper County to Sam Rayburn Dam in Jasper County.

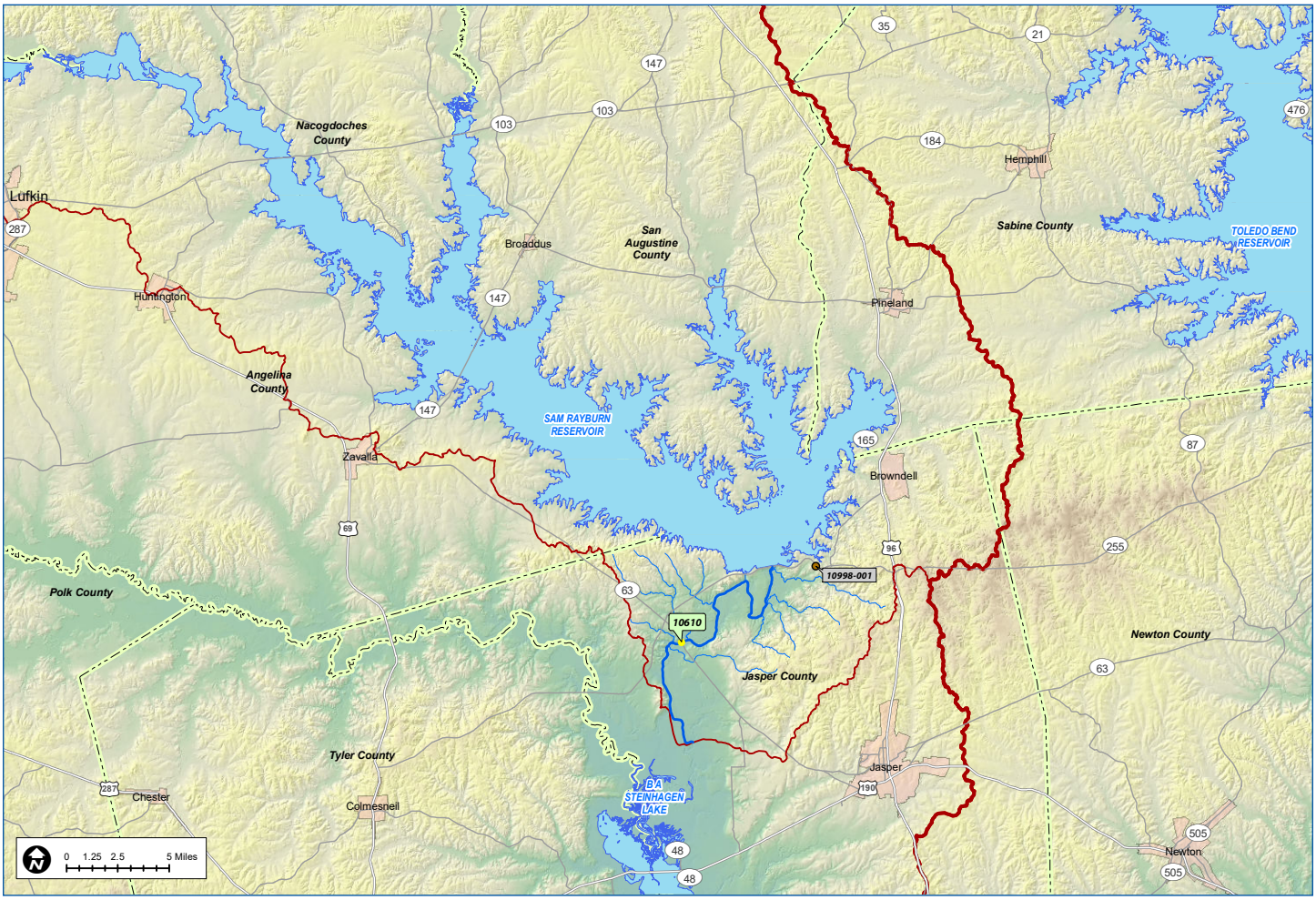
Segment Concerns:

There are impairments for Dioxin in edible tissue and Mercury in edible tissue listed for Segment 0609 in the 2014 *Texas Integrated Report*. No other impairments or concerns were identified.

Actions to Address Concerns:

There is one monitoring station on this segment (Monitoring Station 10610 - Angelina River at SH 63). Monitoring at this station is conducted quarterly by LNVA for conventional parameters, field parameters, flow, and E. coli bacteria.

For more information about this segment, please refer to the LNVA's most recent Basin Highlights Report or Basin Summary Report.



Segment 0610 - Sam Rayburn Reservoir

Segment Description:

Sam Rayburn Reservoir includes the area from Sam Rayburn Dam in Jasper County to a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry on the Angelina River arm in Angelina/Nacogdoches County and to a point 3.9 km (2.4 miles) downstream of Curry Creek on the Attoyac Bayou arm in Nacogdoches/San Augustine County, up to the normal pool elevation of 164.4 feet (except on the Angelina River arm). Sam Rayburn Reservoir impounds both the Angelina River and Attoyac Bayou.

Sam Rayburn Reservoir is designed for flood regulation and control, hydroelectric power generation, and water conservation for municipal, industrial, agricultural, and recreational purposes.

The designated uses are general use, high aquatic life use, public water supply use, primary contact recreation, and fish consumption. Located around Sam Rayburn are various contact recreational areas including trails, campgrounds, boating ramps, marinas, designated swimming areas, and group areas.

Segment Concerns:

In the 2014 *Texas Integrated Report*, all assessment units of Sam Rayburn Reservoir are listed as impaired due to Dioxin and Mercury in edible tissue.

Concerns for Iron and Manganese in sediment have also been listed for all assessment units of the reservoir.

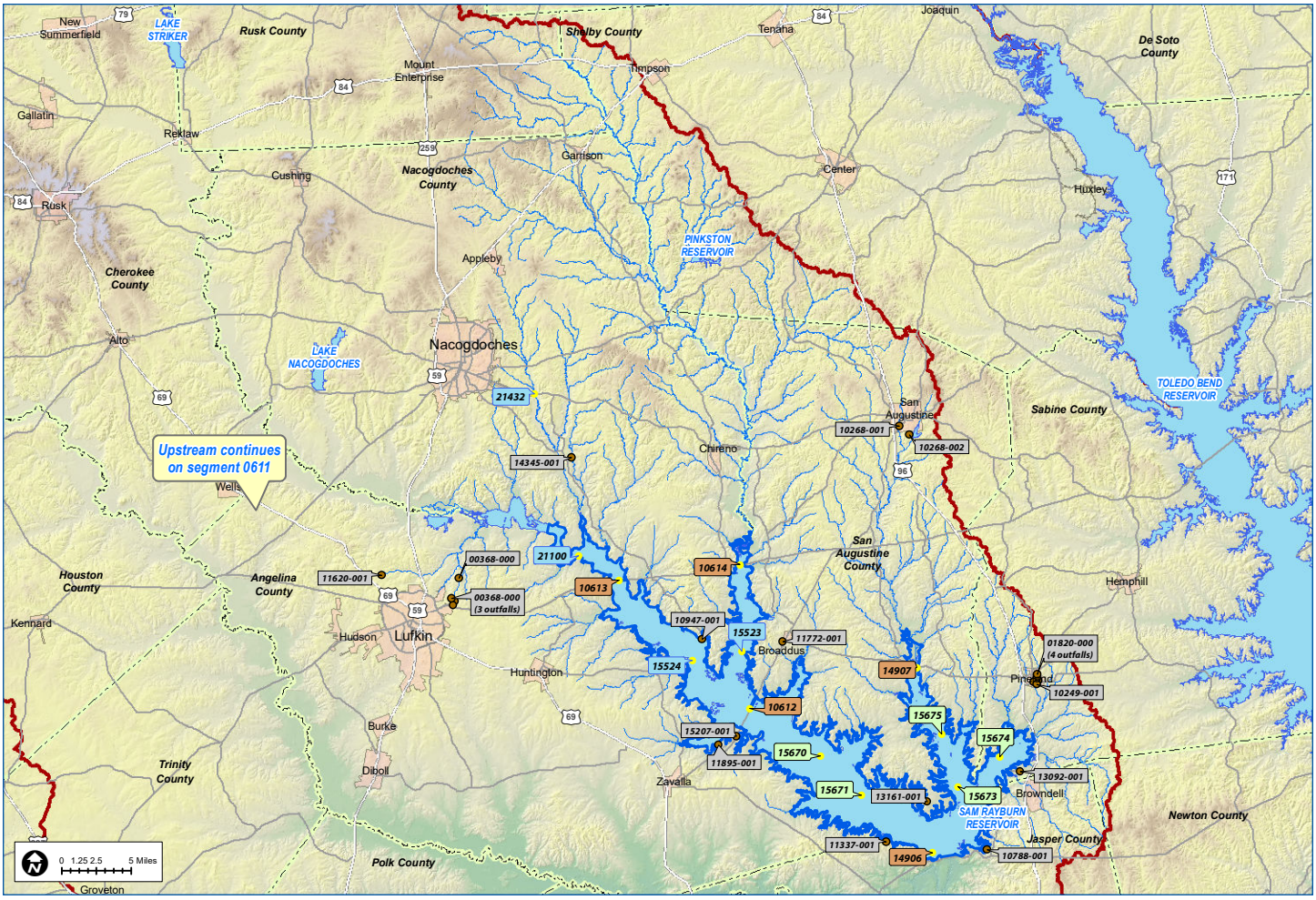
Two assessment units have concerns for depressed Dissolved Oxygen, and one assessment unit has a concern for pH.

A concern for Ammonia has been identified in five assessment units of the reservoir.

Actions to Address Concerns:

A comprehensive Fish Consumption Advisory (ADV-51) was issued on January 24, 2014. The Texas Department of State Health Services recommended consumption advice for six species of fish.

Addressing non-point sources of pollution (such as failing on-site sewage facilities) may be a useful strategy to reduce Ammonia loading.


New Summerfield
LAKE STRIKER
Rusk County
Shelby County
Tenaha
Joaquin
De Soto County
Mount Enterprise
Timpson
Gallatin
Reklaw
Garrison
Center
Cushing
Nacogdoches County
Huxley
Rusk
PINKSTON RESERVOIR
Appleby
Cherokee County
Alto
LAKE NACOGDOCHES
Nacogdoches
TOLEDO BEND RESERVOIR
Sabine County
San Augustine
Upstream continues on segment 0611
Chireno
Wells
San Augustine County
Houston County
Angelina County
Hemphill
Kennard
Hudson
Lufkin
Huntington
Broaddus
Pineland
Burke
Trinity County
Diboll
Zavalla
Browndell
SAM RAYBURN RESERVOIR
Newton County
Jasper County
Polk County
Groveton
0 1.25 2.5 5 Miles
21432
14345-001
10268-001
10268-002
00368-000
00368-000 (3 outfalls)
11620-001
21100
10613
10614
10947-001
15523
11772-001
15524
14907
01820-000 (4 outfalls)
10249-001
10612
15675
15674
15207-001
15670
11895-001
13092-001
15671
13161-001
15673
11337-001
14906
10788-001

Segment 0610A - Ayish Bayou

Segment Description:

Ayish Bayou (Segment 0610A) is an unclassified 32 mile-length perennial freshwater stream extending from the confluence with Sam Rayburn Reservoir south of San Augustine in San Augustine County to the dam impounding Bland Lake, approximately 0.1 km upstream of FM 1279 near the City of San Augustine.

The Ayish Bayou watershed is 123,540 acres (193 sq. miles) and drains into the northeast arm of Sam Rayburn Reservoir. It is primarily situated in San Augustine County, but does extend very slightly into Sabine (903 acres) and Shelby (13 acres) Counties.

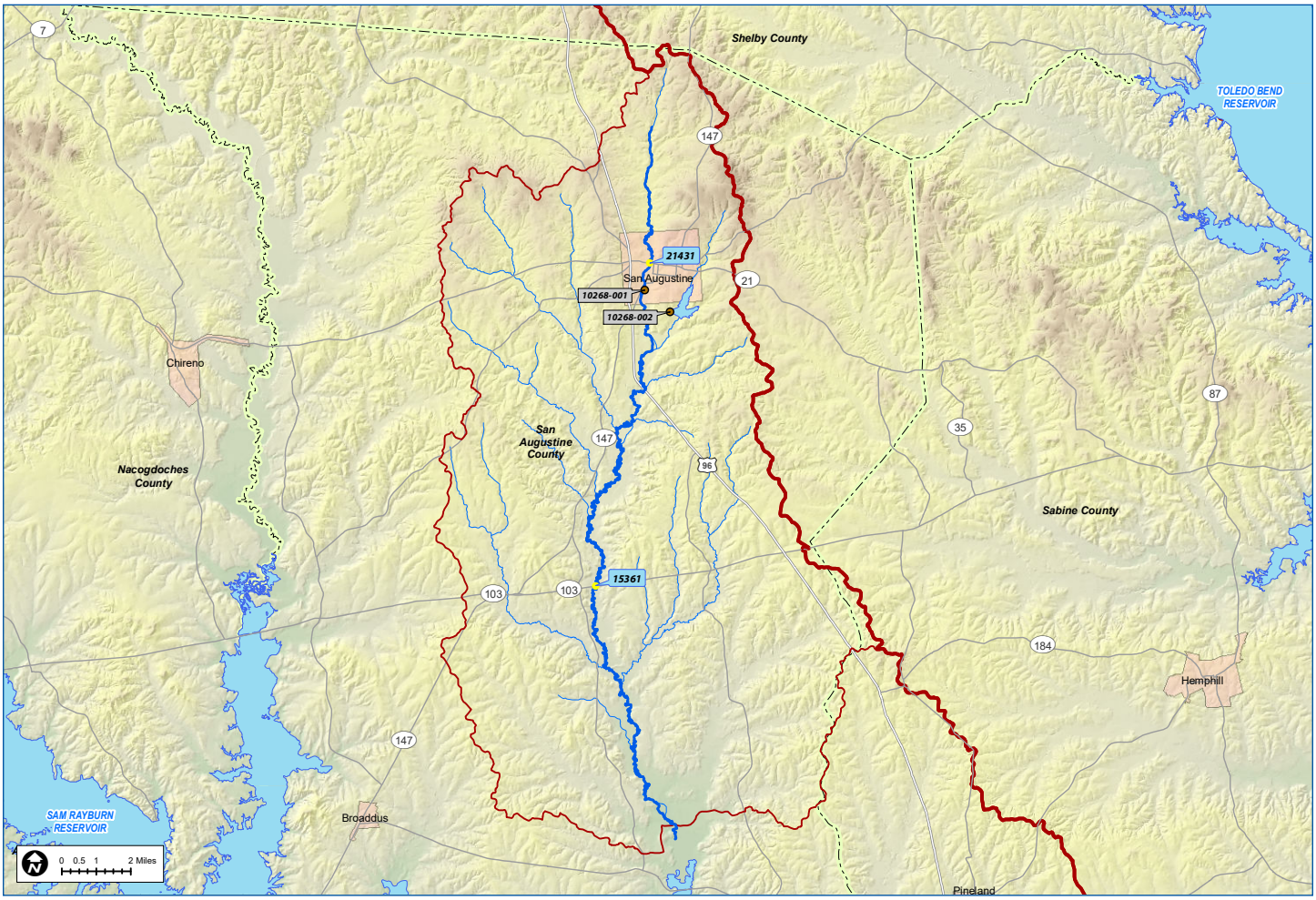
The City of San Augustine is the only incorporated city within the watershed and it is fully contained in the watershed.

Segment Concerns:

Ayish Bayou is listed as impaired for *E. coli* bacteria. Concerns for Ammonia identified in the 2012 *Texas Integrated Report* were removed in the 2014 report.

Actions to Address Concerns:

Ayish Bayou is currently being evaluated by TCEQ as part of the RUAA process to determine if a more appropriate contact recreation standard should be applied to the water body.



Segment 0611 - Angelina River Above Sam Rayburn Reservoir

Segment Description:

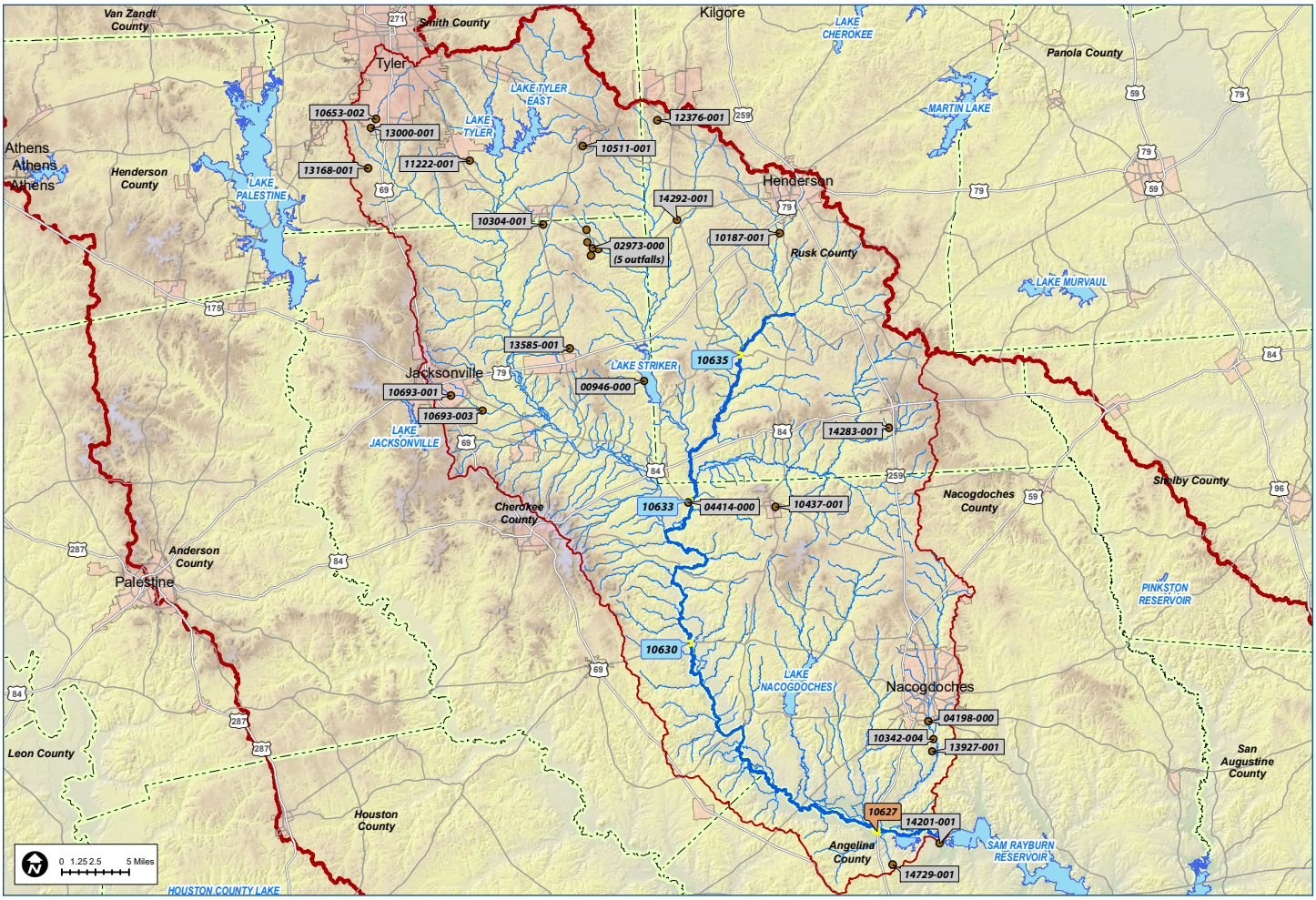
This freshwater stream encompasses a length of 104 miles and extends from the Upper Angelina sub-basin to the Lower Angelina sub-basin. Segment 0611 originates from the aqueduct crossing 0.6 miles upstream of the confluence of the Paper Mill Creek in Angelina/Nacogdoches County to the confluence of Barnhardt Creek and Mill Creek at FM 225 in Rusk County.

Segment Concerns:

This segment is listed as impaired for *E. coli* and Aluminum in water. A concern for Lead in water has also been identified.

Actions to Address Concerns:

Additional metals data needs to be collected and reevaluated.

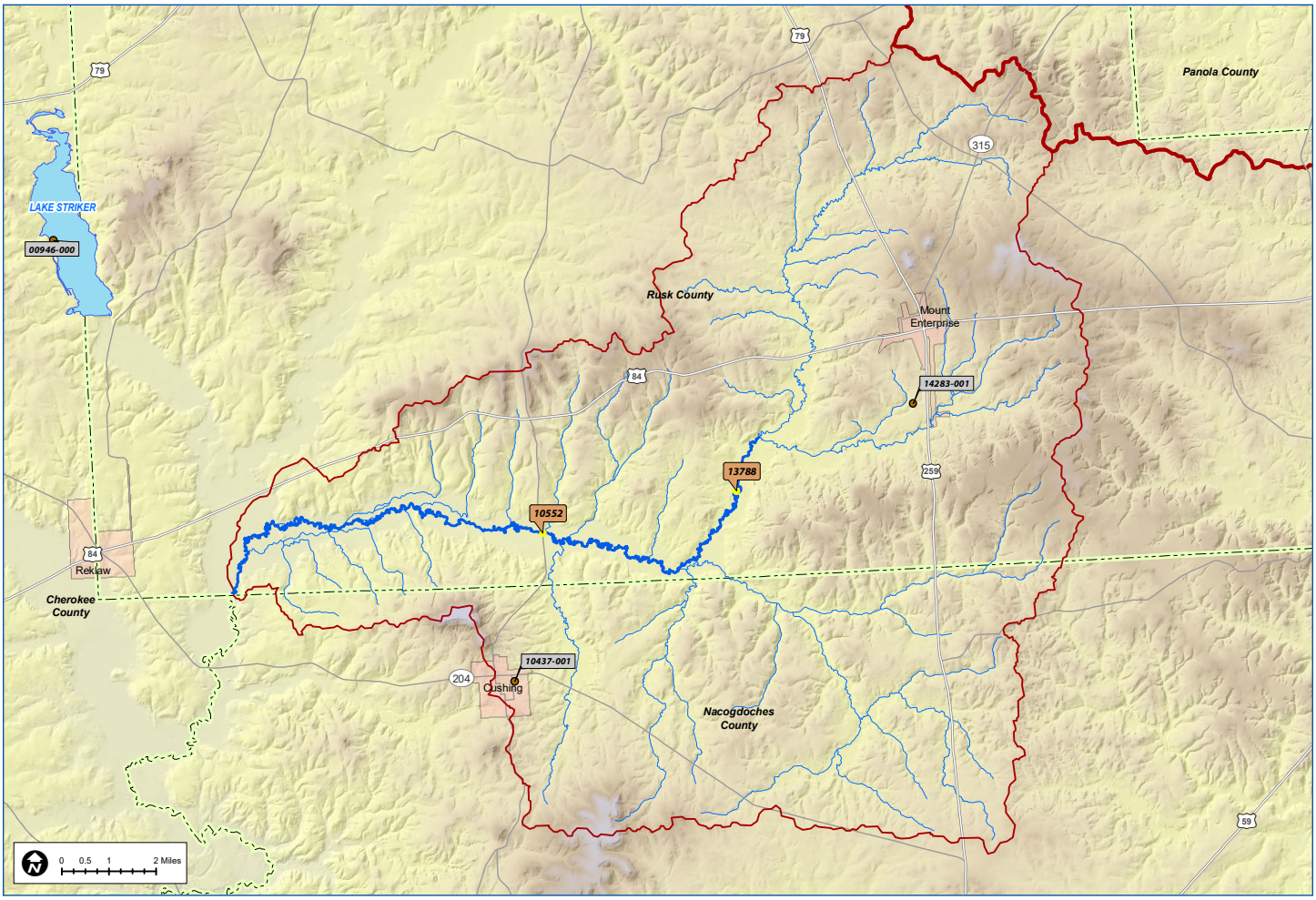


Segment 0611A - East Fork Angelina River

Segment Description: Segment 0611A extends from the confluence of the Angelina River at the Rusk/Nacogdoches County line to the upstream perennial portion of the stream west of Mount Enterprise in Rusk County. This unclassified waterbody extends 29.1 miles in length. The segment is designated for aquatic life, general, and recreation use.

Segment Concerns: The East Fork Angelina is listed as impaired for *E. coli*.

Actions to Address Concerns: A RUAA is being conducted by TCEQ on this water body to determine if the most appropriate contact recreation standard is being applied



Segment 0611B - La Nana Bayou

Segment Description:

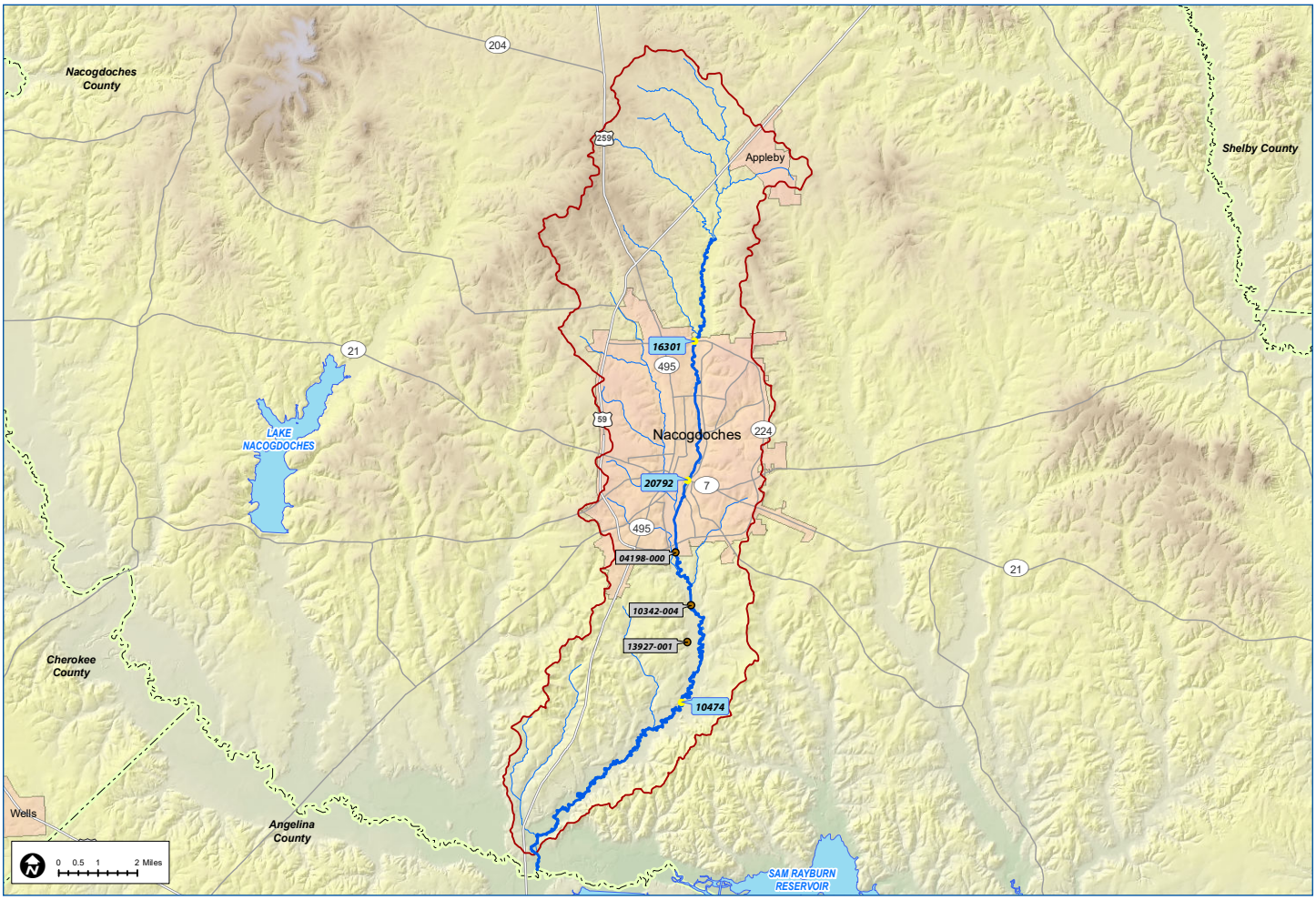
La Nana Bayou (Segment 0611B) is a 32 mile freshwater stream that extends from the confluence of the Angelina River south of Nacogdoches in Nacogdoches County to the upstream perennial portion of the stream north of Nacogdoches in Nacogdoches County.

Segment Concerns:

La Nana Bayou is listed on the 2014 303(d) List for not supporting primary contact recreation due to *E. coli* bacteria impairments. Concerns for Ammonia, Nitrate, and Total Phosphorus have also been identified in one assessment unit.

Actions to Address Concerns:

Beginning in FY 2018, ANRA will conduct more extensive *E. coli* monitoring as part of a Non-Point Source grant project.



Segment 0611C - Mud Creek

Segment Description:

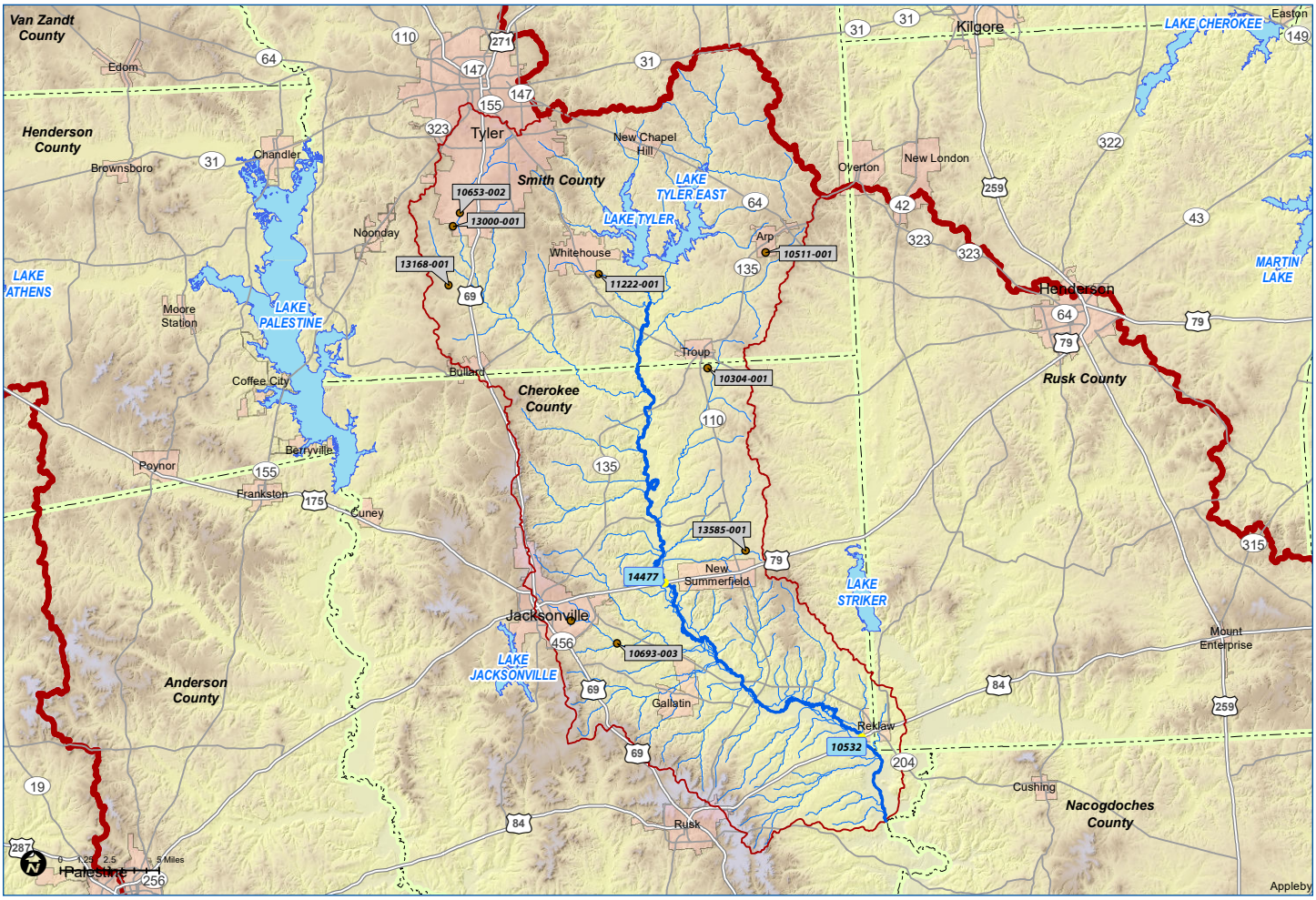
Segment 0611C is a 45-mile length freshwater stream extending from the confluence of the Angelina River east of Rusk in Cherokee County to the upstream perennial portion of the stream west of Troup in Smith County. It is designated for aquatic life, general, and recreational use.

Segment Concerns:

Mud Creek is listed as impaired for *E. coli* bacteria and Aluminum in water. Concerns have been identified for depressed Dissolved Oxygen.

Actions to Address Concerns:

A RUAA is being conducted to determine if the most appropriate contact recreation standard is being applied. 24-hr DO measurements and additional metals data should be collected and reevaluated.



Segment 0611D - West Mud Creek

Segment Description:

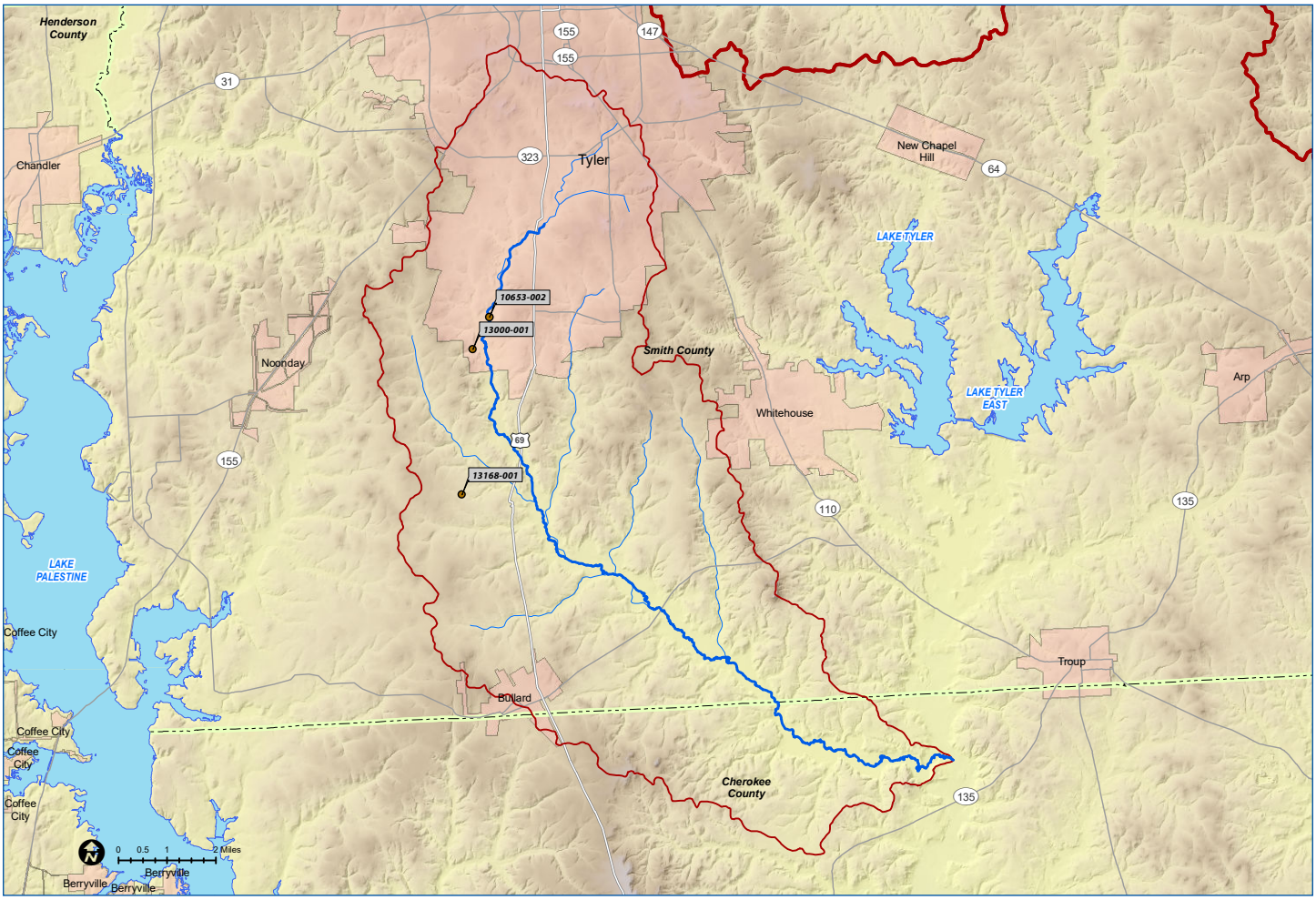
This segment is 23 miles in length from the confluence of Mud Creek southwest of Troup in Cherokee County to the upstream perennial portion of the stream south of Tyler in Smith County. The designated uses are aquatic life, general, and recreation use.

Segment Concerns:

West Mud Creek is listed in the 2014 *Texas Integrated Report* as being impaired for *E. coli* bacteria. Concerns have also been identified for Ammonia and Nitrate.

Actions to Address Concerns:

A RUAA is being conducted on this water body to determine if the most appropriate contact recreation standard is being applied.



Segment 0611Q - Lake Nacogdoches

Segment Description:

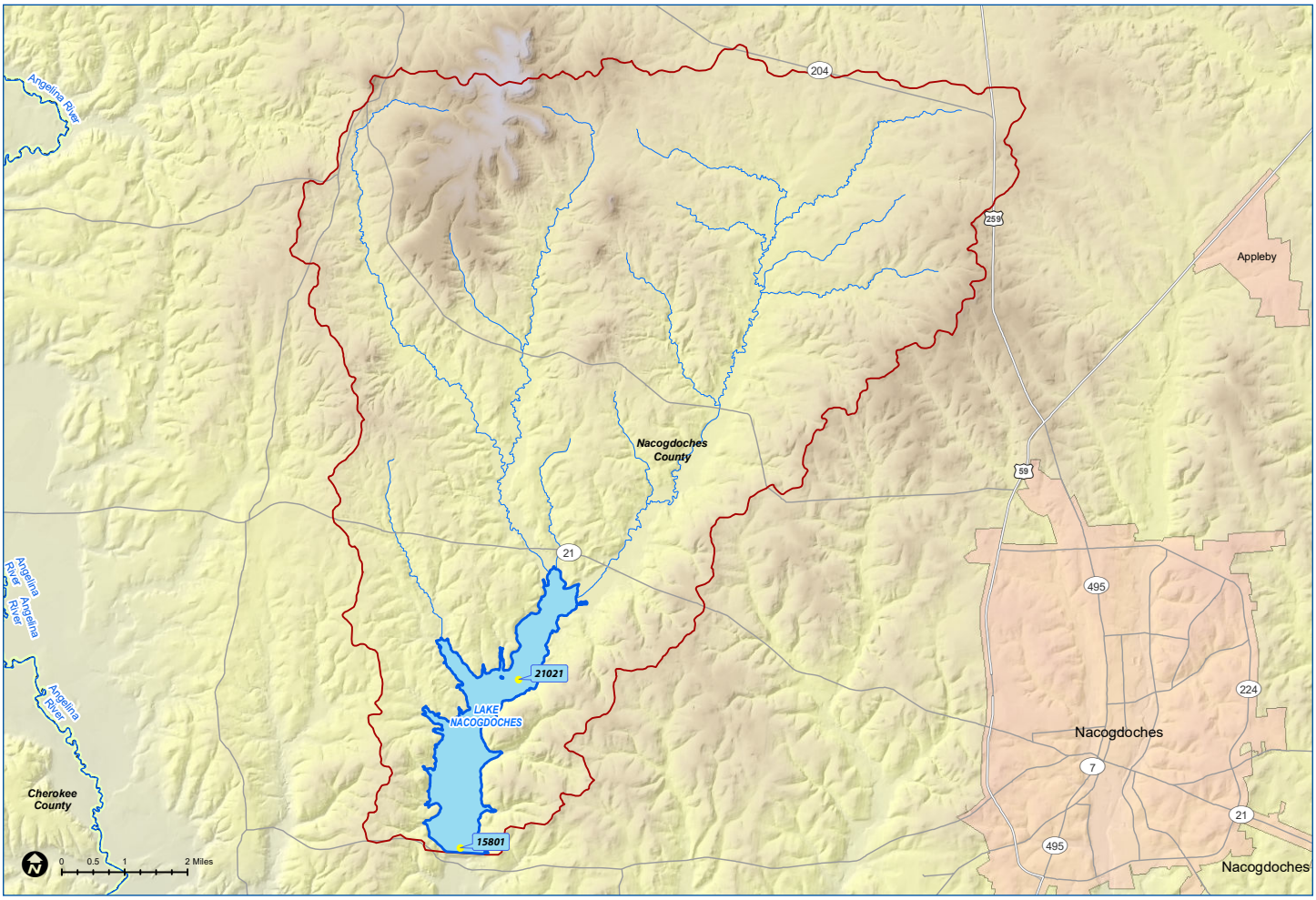
Lake Nacogdoches is a reservoir encompassing 2,210 acres located approximately 10 miles west of Nacogdoches in Nacogdoches County. The designated uses are aquatic life, general, and contact recreation use. It has a maximum depth of 40 feet and was impounded in 1976. Aquatic hydrillas are the primary vegetation on this reservoir. Largemouth bass, crappie, and sunfish are the predominant fish species inhabiting the reservoir.

Segment Concerns:

There are no impairments listed for Lake Nacogdoches. A concern for Ammonia has been identified.

Actions to Address Concerns:

Additional monitoring should be performed to determine possible sources of nutrient loading.



Segment 0611R - Lake Striker

Segment Description:

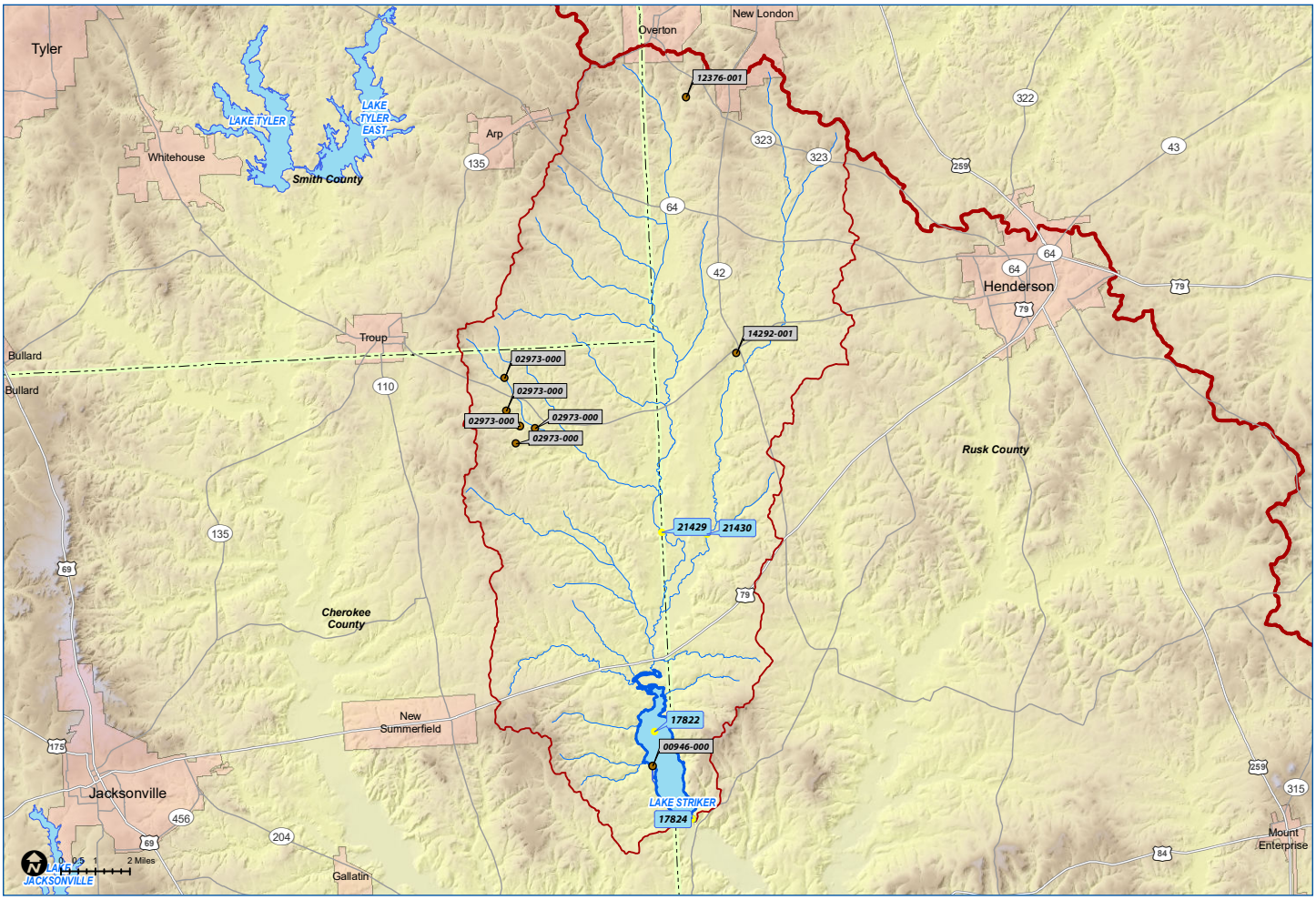
Lake Striker is a 1,863 acre reservoir extending from the dam approximately half a mile west of CR 2430 to the north end of the lake close to US HWY 79 in Rusk County north of Reklaw. The designated uses are aquatic life, general, and recreation use. Impounded in 1957, the reservoir has a maximum depth of 35 feet.

Segment Concerns:

There are no impairments listed for Lake Striker, but there are concerns for Ammonia. Although not assessed for pH, there are historical issues with low pH for this water body.

Actions to Address Concerns:

Two additional monitoring stations on Johnson Creek and Bowles Creek, which drain to Lake Striker, have been added to help determine possible sources of low pH values reported in the reservoir.



Segment 0612 - Attoyac Bayou

Segment Description:

The Attoyac Bayou is 92 miles long from the intermittent headwaters, all the way downstream to the riverine portion of Sam Rayburn Reservoir just north of where the Attoyac arm of Sam Rayburn crosses SH 103. The area surrounding the watershed is managed for agricultural (cattle and poultry), silvicultural, recreational, and wildlife uses.

The Attoyac Bayou flows from the north into Sam Rayburn Reservoir. Its watershed encompasses slightly more than 364,350 acres (569 square miles) and includes portions of four counties. Rusk and Nacogdoches County are on the west and Shelby and San Augustine County to the east. Approximately two thirds of the border between Rusk and Shelby Counties is demarcated by the Attoyac Bayou, as well as the entire shared border between Nacogdoches and Shelby Counties, and the shared border between Nacogdoches and San Augustine Counties.

Segment Concerns:

Attoyac Bayou is listed as impaired for *E. coli* bacteria. Concerns for depressed Dissolved Oxygen and Ammonia have also been identified.

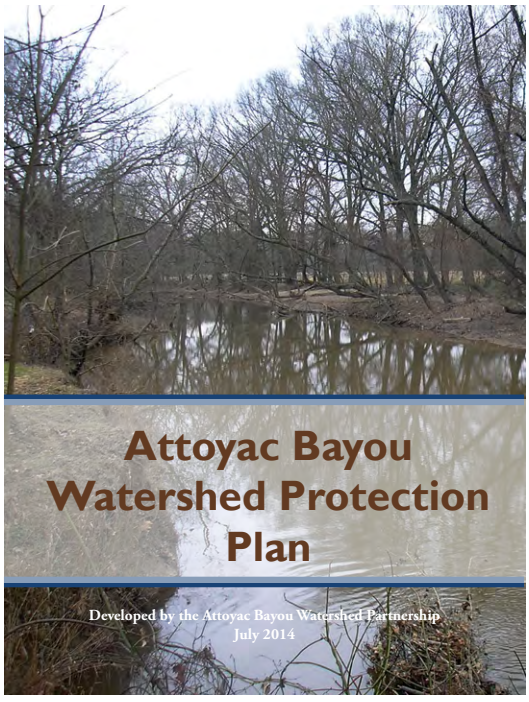
Actions to Address Concerns:

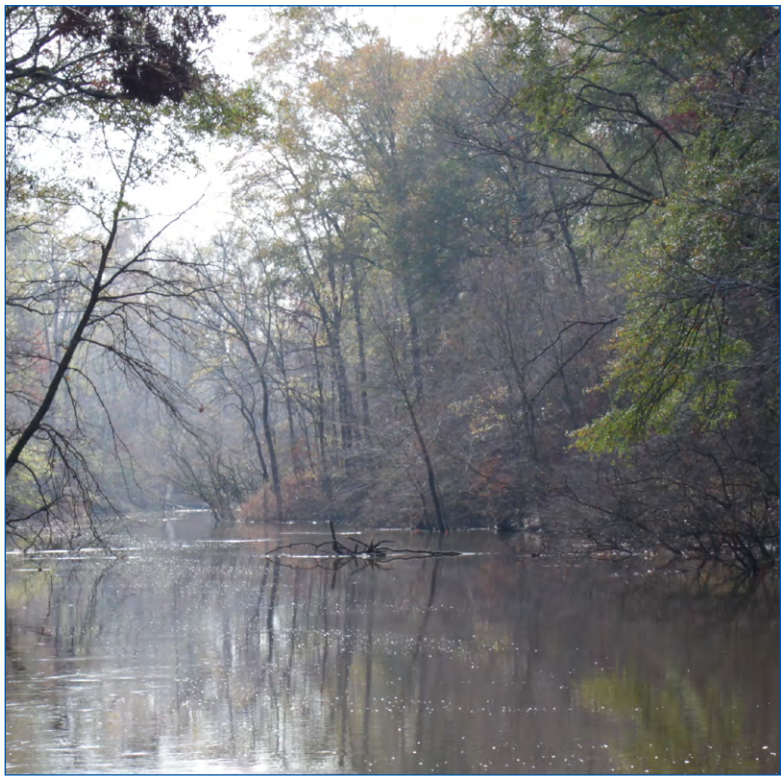
A TSSWCB-funded Clean Water Act §319 grant was used to assess nutrient parameters, develop load duration curves, perform bacterial source tracking, conduct a RUAA, and develop a watershed protection plan (WPP), which was submitted to and approved by the Environmental Protection Agency.

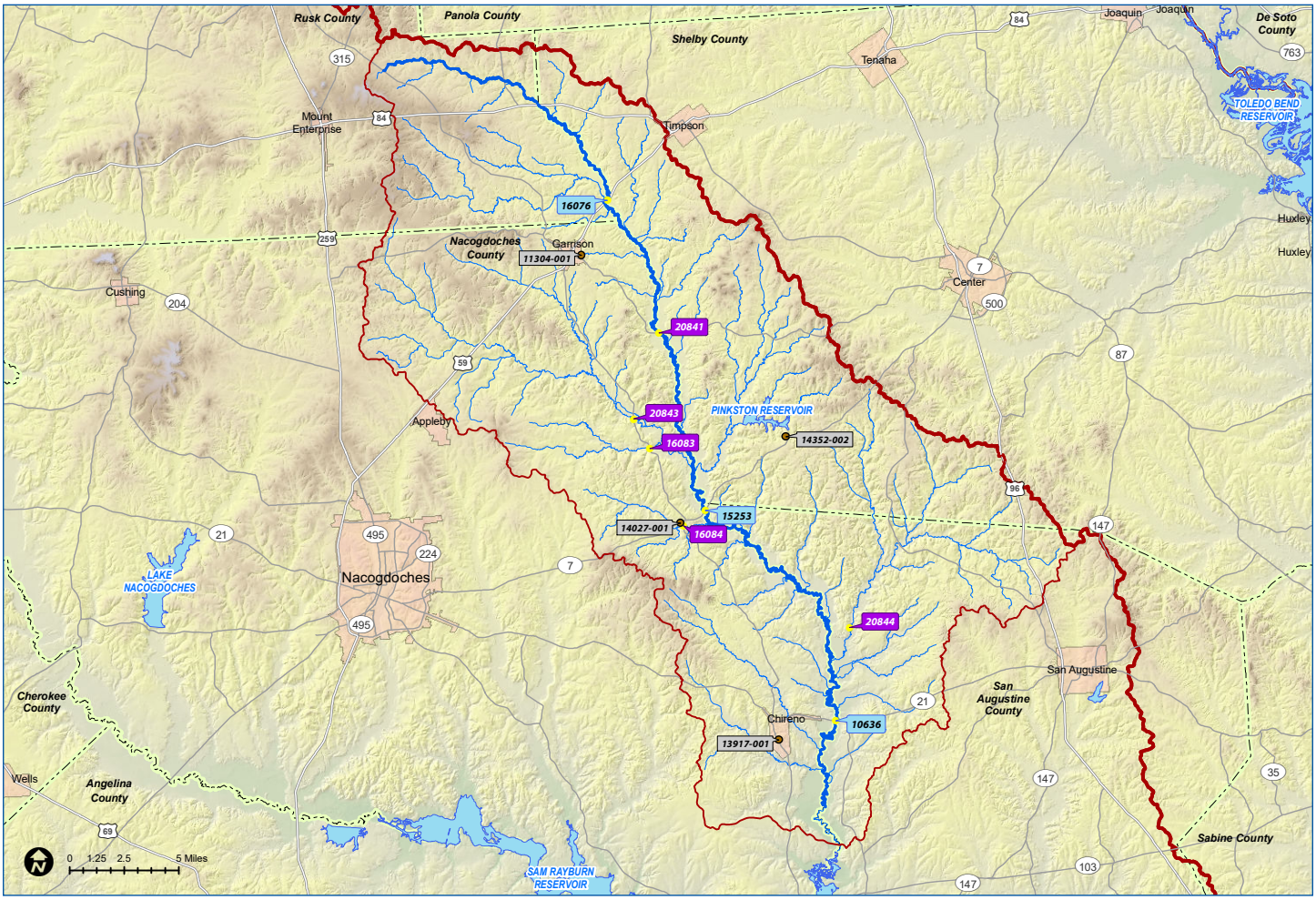
A RUAA was submitted to TCEQ for evaluation. TCEQ determined that primary contact recreation was the most appropriate designation for this water body.

Through a TCEQ-funded Clean Water Act §319 grant that implemented *The Attoyac Bayou Watershed Protection Plan*, ANRA replaced failing septic systems to address elevated bacteria levels within the watershed. Additional monitoring was conducted as part of this project.

In FY 2017 and FY 2018, additional §319 grant projects will replace additional failing septic systems and conduct more intensive water quality monitoring.






Rusk County
Panola County
Shelby County
De Soto County
Joaquin
Tenaha
Timpson
Mount Enterprise
TOLEDO BEND RESERVOIR
Huxley
Nacogdoches County
Garrison
11304-001
16076
Cushing
Center
20841
20843
16083
PINKSTON RESERVOIR
14352-002
Appleby
15253
14027-001
16084
LAKE NACOGDOCHES
Nacogdoches
20844
San Augustine
San Augustine County
Cherokee County
Chireno
10636
13917-001
Wells
Angelina County
Sabine County
SAM RAYBURN RESERVOIR
0 1.25 2.5 5 Miles

Segment 0615 - Angelina River/Sam Rayburn Reservoir

Segment Description:

The riverine portion of Sam Rayburn Reservoir extends from a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry to a point 2.75 kilometers (1.71 miles) upstream of the confluence of Paper Mill Creek. The segment includes 5,068 acres. The designated uses for this segment include intermediate aquatic life use, contact recreation, general use, and public water supply.

Segment Concerns:

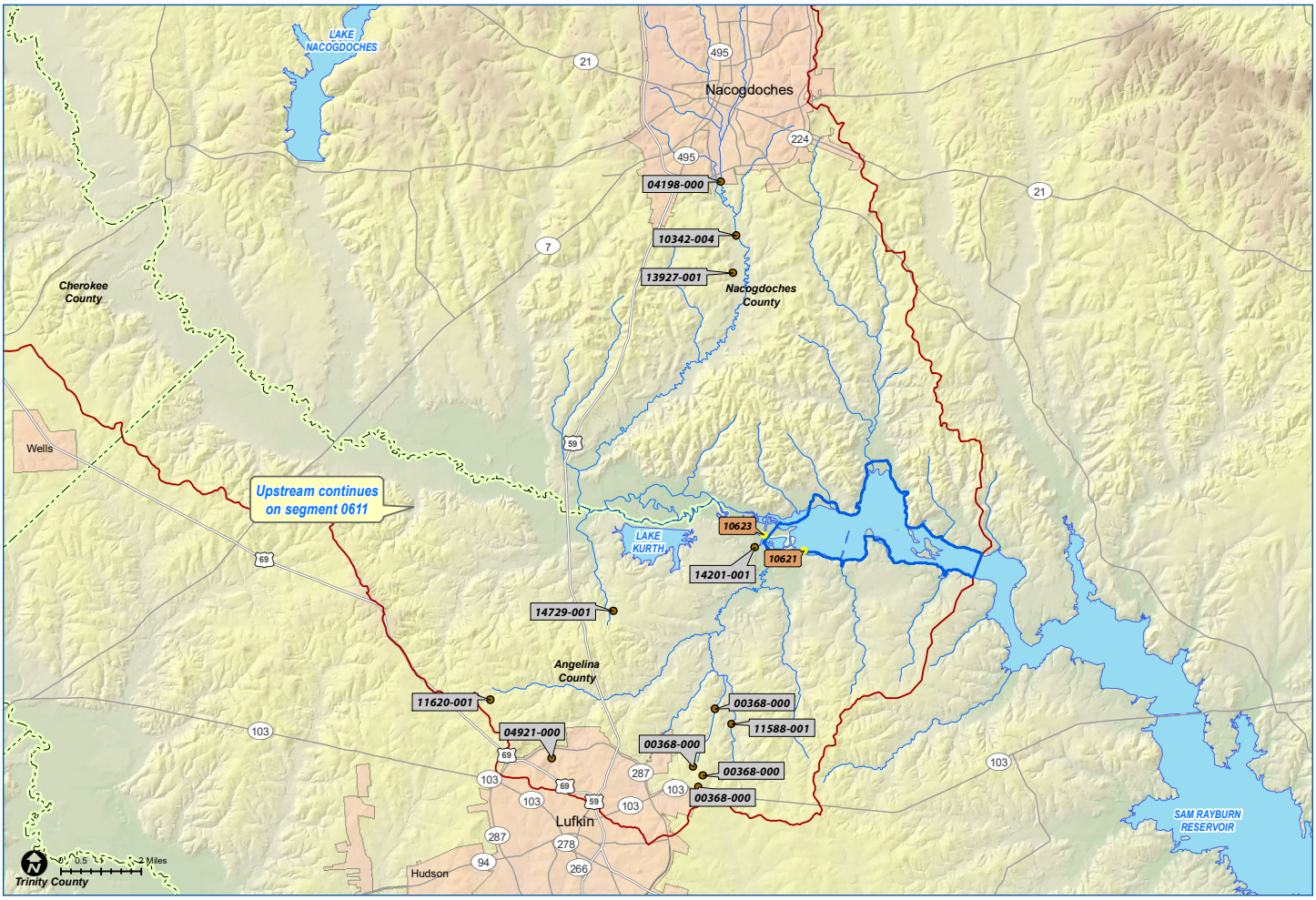
Segment 0615 is listed in the 2014 *Texas Integrated Report* as impaired for depressed Dissolved Oxygen. For its Aquatic Life Use, this segment is listed as Not Supporting for an impaired fish community. A fish consumption advisory is also in affect for Dioxin and Mercury in Edible Tissue.

For nutrient parameters, there are concerns for both Nitrate and Total Phosphorus.

Actions to Address Concerns:

A comprehensive Fish Consumption Advisory (ADV-51) was issued on January 24, 2014. The Texas Department of State Health Services recommended consumption advice for six species of fish.

It is recommended that 24-hr DO measurements and an Aquatic Life Use Attainability Analysis be conducted.



Segment 0615A - Paper Mill Creek

Segment Description:

This segment includes a total of 9 miles from the confluence of Sam Rayburn Reservoir (Angelina River arm) northeast of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County. The designated uses for this segment include aquatic life, general, and contact recreation use.

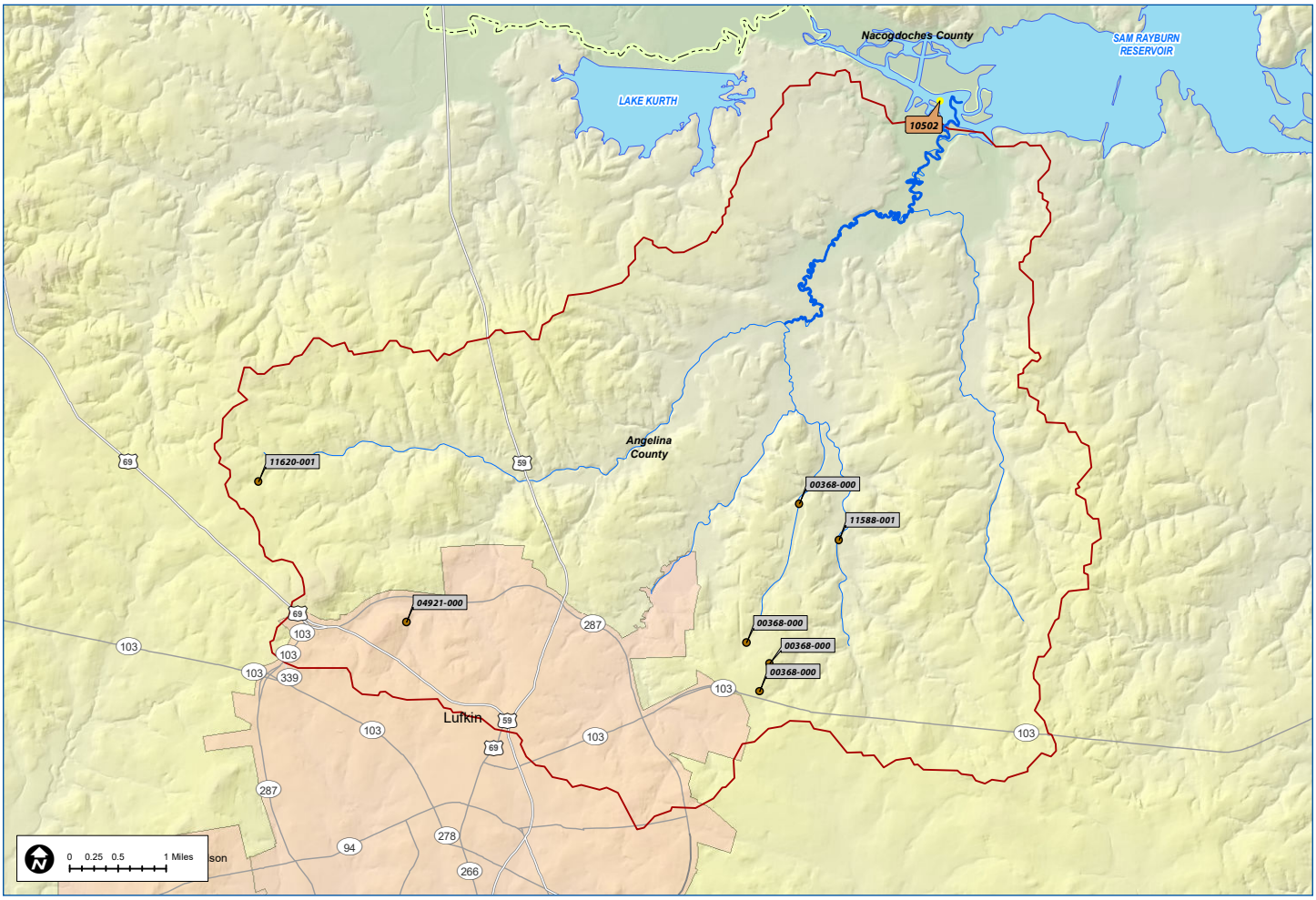
Segment Concerns:

Segment 0615A is listed as impaired for *E. coli* bacteria in the 2014 *Texas Integrated Report*. This segment is also listed as Not Supporting its Aquatic Life Use due to Aluminum in water.

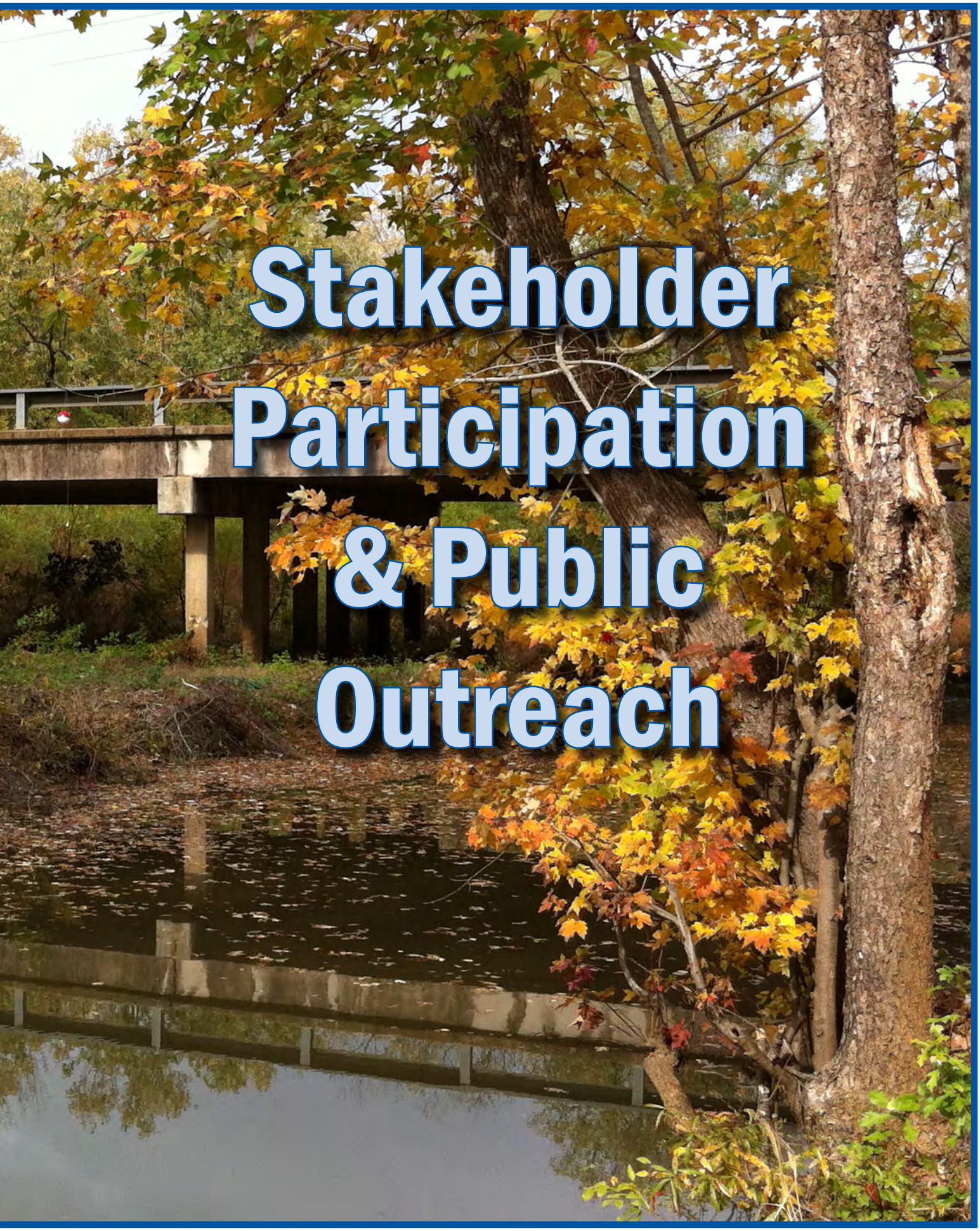
Actions to Address Concerns:

A RUAA is being conducted by TCEQ on this water body to determine if the most appropriate contact recreation standard is being applied

Additional metals data needs to be collected and reevaluated.



Mud Creek at US 84


Stakeholder
Participation
& Public
Outreach

Clean Rivers Program Steering Committee

Through the Clean Rivers Program, ANRA has established a Steering Committee of stakeholders to guide us in our monitoring activities. The Steering Committee's role is advisory in nature and involves assistance with the review of local issues and creation of priorities for the Upper Neches river basin. Committee members assist with the review and development of work plans, reports, basin monitoring plans, allocation of resources, and basin action plans. CRP Steering Committee meetings are held annually, typically in the spring. The committee is made up from a diverse group of stakeholders, including:

- Private citizens
- Fee-payers (identified in Texas Water Code TWC 26.0135(h))
- Political subdivisions (including local, regional, and state officials)
- Texas State Soil and Water Conservation Board
- Other appropriate state agencies including: Texas Parks and Wildlife Department, Texas Water Development Board, Texas General Land Office, Texas Department of State Health Services, Texas Department of Agriculture, Texas Railroad Commission, and Texas Department of Transportation.
- Other entities interested in water quality matters including: Texas Commission on Environmental Quality regional staff, business and industry, agriculture, environmental and other public interest groups.

One of the objectives of the CRP Long-Term Plan is to engage and inform stakeholders. The Steering Committee process gives stakeholders an opportunity to contribute their ideas and concerns through Steering Committee meetings, public meetings, and other forums. The process also allows for the communication of issues related to water quality so that priorities may be set which consider local, regional, state, and federal needs. The Steering Committee aids in increasing opportunities for citizens to identify pressing issues and concerns, contribute ideas to the CRP process, and functions to expand the public's role in water quality management issues.

ANRA's Clean Rivers Program Steering Committee last met on May 23, 2016 at ANRA's Central Office in Lufkin. The meeting had an excellent turnout, and was attended by representatives of ANRA, TCEQ, TPWD, the Texas Railroad Commission, the Texas Water Resources Institute, Castilaw Environmental, Stephen F. Austin State University, Nacogdoches County Environmental Health and Safety, Pineywoods Resource Conservation & Development, the Sentinels, and private individuals.

Presentations at the meeting included a discussion on ANRA's water quality monitoring activities, an update on the Attoyac Bayou watershed (including current and future projects to address nonpoint source pollution in the watershed), and an update on the current status of the development of the latest Integrated Report.

Contact Information

For more information on ANRA's Clean Rivers Program, including how to participate in the Steering Committee process, please contact:

Brian Sims
Environmental Division Manager
Angelina & Neches River Authority
210 E. Lufkin Ave
Lufkin, TX 75901
Phone: 936-633-7527
Fax: 936-632-2564
Email: bsims@anra.org

Basin Summary Report

Every fifth year, ANRA prepares a Basin Summary Report, which provides an assessment of the Neches River Basin. The summary report identifies concerns related to the watershed, including an identification of water bodies with impaired or potentially impaired uses. The report also discusses the cause(s) and possible source(s) of use impairment, and recommends actions that may be used to address those concerns. The summary report also discusses the public benefits of the water quality monitoring and assessment program, including efforts to increase public input in activities related to water quality.

The most recent Basin Summary Report was prepared in 2015. Much like the Basin Highlights Report, this report is prepared in conjunction with the Texas Commission on Environmental Quality and ANRA's Clean Rivers Program Steering Committee. This report is distributed to Steering Committee members, as well as other interested parties, in either print or electronic versions. Current and historical reports are available on ANRA's website at www.anra.org.

As required by Section 26.0135 of the Texas Water Code, this report is provided to the Governor, Lieutenant Governor, Speaker of the House, and the Executive Directors of the Texas State Soil and Water Conservation Board and of Texas Parks and Wildlife Department.

*For the 2015 Basin Summary Report, ANRA evaluated **165,112 data points** from **111 monitoring stations**, representing **34 stream segments**.*

*This data covered the period from **January 1, 2000** to **October 23, 2014***

Angelina & Neches River Authority

TCEQ

The Texas Clean Rivers Program

Angelina & Neches River Authority
P.O. Box 387 • Lufkin, TX 75902
936-632-7795 • 800-282-5634
www.anra.org • info@anra.org

ANRA

ANRA Operations

The Angelina & Neches River Authority promotes public involvement in the Upper Neches Basin through numerous operations and departments. In addition to monitoring water quality through the Clean Rivers Program, ANRA operates and maintains numerous public drinking water and municipal wastewater facilities, maintains the on-site septic system program for Sam Rayburn Reservoir, San Augustine County, and Angelina County, and operates an Environmental Laboratory offering services to the public. Additionally, ANRA produces and sells biosolids compost through our Neches Compost Facility.

Informational Literature

Numerous pamphlets, brochures, and other educational and informational literature on such topics as water quality, conservation, and on-site septic facilities are available to the public at ANRA's offices. ANRA supports the TPWD invasive species awareness campaign "Hello Giant Salvinia, Goodbye Texas Lakes" by making informational pamphlets available to the public.

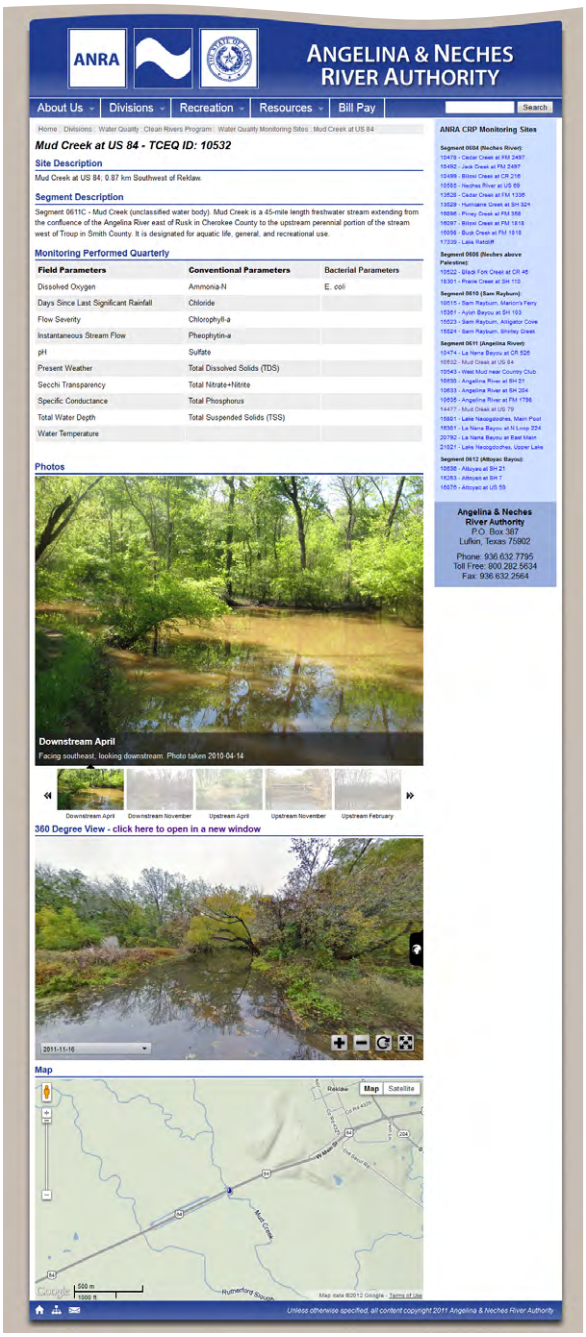
ANRA Publications

Every year, ANRA's Clean Rivers Program produces either a Basin Highlights Report or Basin Summary Report (every five years) that discusses water quality in the Neches River Basin. These reports are distributed to our Steering Committee members, interested stakeholders, and other interested parties.

ANRA Website

The Angelina & Neches River Authority provides the public with information concerning water quality issues on our website, which is updated frequently. The ANRA website provides public access to information on the Clean Rivers Program, current and historical Basin Summary and Basin Highlights reports, meeting agendas and minutes, maps, and water quality data.

Please visit us online at http://www.anra.org.



Additional Online Resources

For additional information related to topics discussed in this report, please refer to the following web pages:

The Texas Commission on Environmental Quality - www.tceq.texas.gov

The Texas Clean Rivers Program - www.texascleanrivers.org

Clean Rivers Program Guidance - www.tceq.texas.gov/waterquality/clean-rivers/guidance/index.html

Coordinated Monitoring Schedule - cms.lcra.org

2014 Texas Integrated Report - www.tceq.texas.gov/waterquality/assessment/14twqi/14txir

Texas Surface Water Quality Standards - www.tceq.texas.gov/waterquality/standards/eq_swqs.html

Clean Rivers Program Map Tool - www80.tceq.texas.gov/SwqmisWeb/public/crpmap.html

Clean Rivers Program Data Tool - www80.tceq.texas.gov/SwqmisWeb/public/crpweb.faces

Surface Water Quality Monitoring Procedures - www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html

Attoyac Bayou Watershed Protection Plan - attoyac.tamu.edu

Texas Stream Team - txstreamteam.rivers.txstate.edu

Texas Invasives - www.texasinvasives.org

Texas Department of State Health Services Fish Consumption Advisories - www.dshs.state.tx.us/seafood/survey.shtm

The Surface Water Quality Monitor Newsletter - www.tceq.texas.gov/compliance/monitoring/water/newsletter.html

EPA's Surf Your Watershed - cfpub.epa.gov/surf/locate/index.cfm

USGS The National Map Streamer - nationalmap.gov/streamer

US Drought Monitor - droughtmonitor.unl.edu/

List of Acronyms

ALU	Aquatic Life Use
ANRA	Angelina and Neches River Authority
AU	Assessment Unit
Ave	Avenue
Avg	Average
BMP	Best Management Practice
C	Celsius
cfs	cubic feet per second
Chl-*a*	Chlorophyll-*a*
Cl	Chloride
CMS	Coordinated Monitoring Schedule
CR	County Road
CRP	Clean Rivers Program
CS	Concern for Screening
CWA	Clean Water Act
CZR	Control Zone Rayburn
DO	Dissolved Oxygen
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
F	Fahrenheit
FM	Farm-to-Market Road
FS	Fully Supporting
FWSD	Freshwater Supply District
FY	Fiscal Year
GIS	Geographical Information System
hr	Hour
HUC	Hydrologic Unit Code
HWY	Highway
ISD	Independent School District
km	Kilometer
LNVA	Lower Neches Valley Authority
m	Meter
MAX	Maximum
mg/L	milligrams per liter
mi	Mile
MIN	Minimum
MPN	most probable number
MSW	Municipal Solid Waste
MUD	Municipal Utility District
N	Nitrogen
NA	Not Assessed
NCR	Non-Contact Recreation
NELAP	National Environmental Laboratory Accreditation Program
NH3	Ammonia-Nitrogen
NHD	National Hydrography Dataset
NO3/NO2	Nitrate+Nitite-Nitrogen
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NS	Not Supporting
OSSF	On-Site Sewage Facility
P	Total Phosphorus
PCR	Primary Contact Recreation
PWS	Public Water System
QAPP	Quality Assurance Project Plan
RC	Reach Code
RUAA	Recreational Use Attainability Analysis
RWA	Receiving Water Assessment
SCR1	Secondary Contact Recreation 1
SCR2	Secondary Contact Recreation 2
SFASU	Stephen F. Austin State University
SH	State Highway
SO4	Sulfate
Spec Cond	Specific Conductance
SU	Standard Units
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TIAER	Texas Institute for Applied Environmental Research
TMDL	Total Maximum Daily Load
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
TWDB	Texas Water Development Board
TWRI	Texas Water Resources Institute
UAA	Use Attainability Analysis
µg/L	micrograms per liter
US	United States Highway
µs/cm	microseiemens per centimeter
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WAP	Watershed Action Planning
WCID	Water Control and Improvement District
WLE	Wasteload Evaluation
WPP	Watershed Protection Plan
WQS	Water Quality Standards
WSC	Water Supply Corporation
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

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The 2017 Basin Highlights Report was prepared by the Angelina & Neches River Authority in cooperation with the Texas Commission on Environmental Quality under the authorization of the Texas Clean Rivers Act.