2020 Clean Rivers Program
San Antonio River Basin Highlight Report

WATERSHED CHARACTERIZATIONS FOR THE UPPER & LOWER SAN ANTONIO RIVER WATERSHEDS

PREPARED BY THE SAN ANTONIO RIVER AUTHORITY

The preparation of this report was financed through grants from and in cooperation with the Texas Commission on Environmental Quality.

In the creation of this report, all good faith effort was taken to meet accessibility standards as prescribed by the TCEQ. An accessible version of the 2020 Clean Rivers Program San Antonio River Basin Highlight Report is posted on SARA's website located at https://www.sara-tx.org/services/environmental-sciences/basin-reports.

Acronyms

AgriLife — Texas A&M AgriLife Extension
ALU — Aquatic Life Use
AU — Assessment Unit
BCRAGD — Bandera County River Authority and Groundwater District
BMP — Best Management Plans
BS — Biased Season
CWA — Clean Water Act
CMM — Coordinated Monitoring Meeting
CRP — Clean Rivers Program
CFS — Cubic Feet Per Second
EAC — Environmental Advisory Committee
EQIP — Environmental Quality Incentives Program
E. coli — Escherichia coli
EPA — U.S. Environmental Protection Agency
FM — Farm to Market
IDNFH — Inks Dam National Fish Hatchery
I-Plan — Implementation Plan
LDC — Load Duration Curve
LID — Low Impact Development
LSAR — Lower San Antonio River
MGD — Million Gallons per Day
MRMS — Mission Reach Mussel Survivability
NLCD — National Land Cover Database
NRCS — U.S. Department of Agriculture's Natural Resources Conservation Service
P-Hab — Physical Habitat
PHIS — Plant and Animal Health Index
RT — Routine Sampling
SARA — San Antonio River Authority
SMARC — San Marcos Aquatic Resource Center
SNARRC — Southwestern Native Aquatic Resource and Recovery Center
TCEQ — Texas Commission on Environmental Quality
TDS — Total Dissolved Solid
TWS — Texas Wildlife Services
TSSWCB — Texas State Soil and Water Conservation Board
TMDL — Total Maximum Daily Load
TSS — Total Suspended Solid
TKN — Total Kjeldahl Nitrogen
TSWQS — Texas Surface Water Quality Standards
QA — Quality Assurance
QC — Quality Control
QAPP — Quality Assurance Project Plans
UAA — Use-Attainability Analyses
USACE — United States Army Corps of Engineers
USAR — Upper San Antonio River
USDA — United States Department of Agriculture
USGS — United States Geological Survey
UV — Ultraviolet
WQMP — Water Quality Management Plans
WWTF — Wastewater Treatment Plant
WPP — Watershed Protection Plan

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INTRODUCTION

Texas Clean Rivers Program, Senate Bill 818, known as the Texas Clean Rivers Act, was enacted in 1991 by the 72nd Legislature to ensure the comprehensive regional assessment of water quality in each watershed and river basin of the State. This program was administered by the Texas Water Commission, now known as the Texas Commission on Environmental Quality (TCEQ) and at the time was very different from any other monitoring program in Texas.

The TCEQ Texas Clean Rivers Program (CRP) created a partnership with river authorities, local and special area agencies to create a network of monitoring stations that reported data to the TCEQ. Partnering with other agencies created an atmosphere of cooperation and built bonds and communication between the agencies. Another aspect of the CRP was the early use of stakeholders to guide the program. Currently, the San Antonio River Authority (SARA) uses an Environmental Advisory Committee (EAC) made up of stakeholders from various geographical areas within the basin who represent a variety of professional, scientific, and/or conservation interests. This group meets quarterly and is routinely contacted through email. The EAC provides input to the CRP and a variety of other SARA projects and programs that have an environmental component.

Figure 2:
Station 12908 San Antonio River at Woodlawn Avenue; biological monitoring station

Perhaps the most unique aspect of the CRP is the attention to quality assurance. Early on, the TCEQ provided quality control and data management training to its partners as part of its CRP program. By 1996, all work performed under a TCEQ contract involving the acquisition, generation and collection of environmental data was conducted in accordance with a TCEQ-approved Quality Assurance Project Plan (QAPP). Current QAPPs are formal documents that comprehensively detail the required quality assurance and quality control (QA/QC) and technical activities that must be implemented to ensure the work performed will satisfy the stated performance criteria. The QAPP must provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for TCEQ regulatory decisions and assessments. The QAPP identifies:

- The technical and quality objectives;
- The sampling and analytical methods and acceptable criteria to meet the projects objective;
- Any measurement(s) or information describing environmental processes, sampling locations and frequencies, conditions, and ecological conditions;
- All technical and quality aspects of a project, including planning, implementation, and assessment;
- How QA/QC is applied to assure the results obtained are of the type and quality needed and expected.

The CRP and SARA's stream monitoring, together with the TCEQ monitoring efforts, are the primary programs for the collection of water quality data in the San Antonio River Basin. Data generated from these programs are used in State assessments and compliance decisions. Therefore, these programs operate under a TCEQ-approved CRP QAPP.

Due to the high expense associated with collecting water quality data and limited funding, the importance of leveraging funds and maximizing regional efforts while minimizing duplicative efforts is paramount. To remain adaptable to economic and environmental changes, each year SARA conducts a coordinated monitoring meeting (CMM) with the TCEQ and other basin monitoring partners. During the meeting, resources are coordinated at the watershed level. This level of coordination provides monitoring that is spatially and temporally to identify water quality issues and changes in the San Antonio River Basin.

For the 2019 Coordinated Monitoring Schedule, the San Antonio River Basin was monitored by SARA, the TCEQ, and the Guadalupe-Blanco River Authority. The Bandera County River Authority and Groundwater District (BCRAGD), a sub-participant under SARA's CRP QAPP, collects routine water quality samples in the Upper Medina River, Medina Lake, and the Medina Diversion Lake Watersheds, Segments 1905, 1904, and 1909.

2018 TCEQ INTEGRATED REPORT

The 2018 TCEQ Integrated Report provides information on the States' surface waters, including concerns for public health, fitness for use by aquatic species, and specific pollutants and their sources. It is composed of several documents including the 303(d) List of Impaired Water Bodies, a list of water bodies evaluated, water bodies added and removed from previous 303(d) lists, as well as several other documents.

During SARA's annual CMM, held annually each spring, information from the TCEQ Integrated Report, CRP partners, and the EAC is used to select stations and parameters that enhance overall water quality monitoring coverage in the San Antonio River Basin. Water monitoring decisions made during the CMM are directed towards:

- Completing data sets where limited data indicates that a water quality criterion shows a standard is not supported;
- Concerns for water bodies that are near nonattainment;
- Waters with known water quality concerns;
- Specific priority for water bodies that have no known water quality problems or without current water quality data.

The TCEQ adopted the second submission of the Draft 2018 Texas 303(d) List on September 27, 2019. The EPA approved the second submission of the 2018 Texas 303(d) List on December 23, 2019.

TEXAS SURFACE WATER QUALITY STANDARDS

The Texas Surface Water Quality Standards (Title 30, Chapter 307 of the Texas Administrative Code) describes the chemical, physical, and biological conditions to be attained in the surface waters of Texas. The Texas Surface Water Quality Standards (TSWQS) are periodically revised to adjust designated uses criteria of individual water bodies, to incorporate new scientific data on the effects of specific chemicals and pollutants, and to address new provisions in the Texas Water Code, federal regulations and EPA guidance. Specific 2018 draft revisions include:

- Revisions to statewide toxic criteria to incorporate new data on toxicity effects and address revised EPA procedures;
- Revisions and additions to site-specific toxic criteria to incorporate local water quality data into criteria for selected water bodies;
- Revisions and additions to the uses, criteria, and descriptions of individual water bodies based on new data and results of recent use-attainability analyses (UAAs);
- Addition of site-specific recreational uses for selected water bodies as a result of recent recreational UAAs; and
- Revisions to provisions regarding coastal recreation waters to comply with the federal Clean Water Act.

The revisions were presented to the TCEQ commissioners during the August 23, 2017 agenda, and permission was granted to formally propose the rule revisions to the public for formal comment. The public notice was published in the Texas Register on September 8, 2017 with the public comment period ending on October 17, 2017. The revisions were once again presented to the TCEQ commissioners and adopted as a final rule on February 7, 2018. The final rulemaking was published in the February 23, 2018, issue of the Texas Register with an effective date of March 1, 2018. On February 27, 2018, the TCEQ submitted a package to the EPA in support of the 2018 TSWQS revisions.

The EPA approved of the revisions in an action letter dated November 2, 2018. The action letter did not address all outstanding portions of the rule requiring EPA review. Major sections still under consideration by the EPA include revisions to §307.2 regarding temporary standards, several revised site-specific criteria in Appendix A and D, and several site-specific recreational uses and criteria for unclassified water bodies in Appendix G. The TCEQ has provided a highlighted version of the EPA's 2018 standards rule language that clearly identifies which sections of the standards the EPA has approved, disapproved, will take no action on, or is still reviewing. For disapproved revisions and revisions where no action will be taken, the most current EPA approved TSWQS will remain in effect.

Although the Upper and Lower San Antonio River Watersheds were not affected by the 2018 TSWQS revisions, the Upper, Mid, and Lower Cibolo Creek watersheds were. The purpose of the Cibolo Creek Watershed Segment Boundary Re-Definition Use Attainability Analysis was to collect water quality and biological samples to assist the TCEQ in assigning more appropriate segment boundaries, flow type classifications, and aquatic life use designations for the three watersheds. In the EPA's action letter, the EPA indicated that they would take separate action at a later time for revising segment boundaries for the Lower Cibolo Creek, Mid Cibolo Creek, and Upper Cibolo Creek. As of this report, no EPA actions or approval of the revised segment boundaries for the Cibolo Creek has been received by the TCEQ. The EPA must approve the 2018 Standards before the TCEQ may use them for federal permitting programs and other Clean Water Act (CWA) purposes. Until that time, Cibolo Creek segment boundaries, as identified in the 2014 TSWQS, will remain in effect.

ASSESSMENT OF THE BASIN

The TCEQ Integrated Report is generated every two years in even-number years and satisfies the requirements of Federal Clean Water Act Sections 305(b) and 303(d). In producing the Integrated Report, the TCEQ utilizes historical water quality data to assess and identify water bodies that do not meet designated use criteria and standards as identified in the TSWQS. If the water quality data indicates that a designated use(s) is not supported, the segment will be identified as "impaired" and included in the Integrated Report's 303(d) List of Impaired Waters. If the data indicates good water quality, the water body is identified as "fully supporting" its designated uses. A "concern" may be identified if a limited amount of data indicates elevated levels of pollutants or if a screening level is exceeded.

In the TSWQS, the TCEQ has assigned five categories of designated uses for all classified water bodies in Texas: aquatic life, contact recreation, fish consumption, public water supply, and general use. Each water body in the San Antonio River Basin is evaluated against its designated aquatic life use, contact recreation standard and general use. Fish consumption use and public water supply use are assessed to specific water bodies.

Aquatic Life Use: Each classified segment in the TSWQS is assigned an aquatic life use (ALU), based on physical, chemical, and biological characteristics of the water body. The five ALU categories are exceptional, high, intermediate, limited, or minimal (no significant) aquatic life use.

Support of the ALU is based on assessment of dissolved oxygen criteria, toxic substances in water criteria, ambient water and sediment toxicity test results, and indices for physical habitat (P-Hab), benthic macroinvertebrate and fish community, provided that the minimum number of samples are available. Each set of criteria is generally evaluated independently of the others, and impairment of the ALU results when any of the individual criteria are not attained. For freshwater streams not classified in the TSWQS, the ALU and criteria are presumed based on the stream flow type. Perennial, intermittent with pools, or intermittent flow type is established from flow data associated with samples, information provided by local monitoring staff, previous assessments, or recent receiving water assessments.

Recreation Use: Recreation Use categories and criteria are assigned to all water bodies. Two organisms routinely analyzed in water samples to determine support of the recreation use are *Escherichia coli (E. coli)* in freshwater and Enterococci in tidal water bodies and certain inland water bodies. *E. coli* is used to assess recreation use attainment in the San Antonio River Basin. The Upper and Lower San Antonio River are designated for primary contact recreation. Primary contact includes activities presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting.

General Use: Water quality criteria for several constituents are established in the TSWQS to safeguard general water quality, rather than for protection of one specific use. Water temperature, pH, chloride, sulfate, total dissolved solids (TDS), and chlorophyll-a (for select reservoirs only) are the parameters protecting aquatic life, recreation, public water supply, and other beneficial uses of water resources. For the purpose of assessment, the criteria protecting these multiple uses are evaluated for attainment of a construct entitled, “general use.” Specific criteria for each of the other parameters are assigned to every classified segment in the TSWQS based on physical, chemical, and biological characteristics.

Concerns for general uses are identified with screening levels for nutrients and chlorophyll-a for both classified and unclassified water bodies with the exception of some classified reservoirs identified in the TSWQS for which chlorophyll-a site specific criteria were developed. Although other concerns are reported for general use, attainment of the general use for unclassified water bodies is not assessed and therefore not reported.

Fish Consumption Use: Fish consumption use attainment and concerns are evaluated with three assessment methods:

- Advisories, Closures, and Risk Assessments
- Human Health Criteria for Bioaccumulation and Fish Consumption Use
- Human Health Fish Tissue Criteria Concerns

For a full assessment of use attainment for fish consumption and a determination of fully supporting, a Texas Department of State Health Services (DSHS) risk assessment or advisory is required. Risk assessments are costly and conducted only on water bodies where the assessment has indicated a risk from consumption. Fish advisories and additional information may be found on the Texas Department of State Health Services website. In the San Antonio River Basin, a Fish Consumption Advisory 42 (ADV-42), has been issued for Leon Creek recommending that people should not consume any species of fish from Leon Creek. The advisory area begins at the Old U.S. Highway 90 Bridge and extends downstream to the Loop 410 Bridge.

Public Water Supply Use: Public water supply use is evaluated for surface water bodies that are designated in the TSWQS for public water supply use. Human health criteria from the TSWQS are used to determine whether the segment is supporting public water supply use. The human health criteria are based, in part, on the primary maximum contaminant levels adopted in the Texas Administrative Code (30 TAC §290). Segments designated for aquifer protection are capable of recharging the Edwards Aquifer. The principal purpose of this use designation is to protect the quality of water infiltrating into and recharging the aquifer and applies to designated portions that are on the recharge zone, transition zone, or contributing zone as defined in the TSWQS. Additional information on designated uses for all classified water bodies in Texas can be found in the most current Guidance for Assessing and Reporting Surface Water Quality in Texas.

SURFACE WATER QUALITY MEASUREMENTS

Every five years, SARA publishes a Basin Summary Report as required by the CRP. This report, last published in 2018, provides a detailed review of parameters analyzed, designated uses and associated water quality concerns and impairments in the San Antonio River Basin. A major CRP monitoring objective is to provide the TCEQ enough data to support the assessment of surface water quality, water quality standards and wastewater permits. Monitoring decisions are made considering the monitoring types, parameters analyzed, and the minimum number of samples needed to assess water bodies in the San Antonio River Basin.

Under the SARA CRP, there are two types of sampling events conducted throughout the Basin. **Routine Sampling** (RT) events are scheduled in advance without intentionally trying to target any certain environmental conditions. Keeping safety in mind, samples are collected regardless of the conditions encountered that day. Parameters collected and analyzed for RT sampling events include:

Bacteria and Conventional Chemical Parameters

- *E. coli*
- Chloride
- Sulfate
- Total Kjeldahl Nitrogen (TKN)
- Total Suspended Solids (TSS)
- Ammonia Nitrogen
- Nitrite-Nitrogen
- Nitrate-Nitrogen
- Total Phosphorus
- Chlorophyll-a
- Temperature
- pH
- Conductivity
- Dissolved oxygen
- Secchi depth
- Flow
- Biological Oxygen demand and Metals in water (Specific sites throughout the basin)

Figure 3:
2019 Hutton Intern, Jenna Lopez
Flathead catfish (Pylodictis olivaris)
Lower San Antonio River

Biased Season (BS) sampling events are scheduled for a certain time of year and are meant to capture the conditions characteristic of that time of year. Keeping safety in mind, BS samples are collected regardless of the flow condition encountered that day. Parameters collected and analyzed for BS sampling events include biological (fish and benthic), habitat, 24 hour dissolved oxygen and flow measurements.

The purpose of the **2020 CRP Watershed Characterization Report** is to review activities within the Upper and Lower San Antonio River Watersheds. Characterizations such as segment descriptions, hydrology, land uses, maps, and ongoing projects, are discussed. Potential sources of impairments and concerns based on the 2018 Texas Integrated Report are identified and recommendations to improve water quality are suggested. For the purposes of this characterization report, use support is reported at both the segment and assessment unit level. The TCEQ and CRP partners, including SARA, use this report and others submitted throughout the State to develop and prioritize programs that will protect the water quality of healthy water bodies and improve the quality of impaired water bodies.

A **classified segment** is a water body or portion of a water body that is individually defined in the TSWQS. 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 TCEQ. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs. Classified segments are protected by site-specific criteria as stated in the TSWQS. 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. For example, Segment 1905 is in basin 19 (San Antonio River Basin) and 05 represents the Medina River above Medina Lake from a point immediately upstream of the confluence of Red Bluff Creek in Bandera County to the confluence of the North Prong Medina River and the West Prong Medina River in Bandera County.

Because of the great extent of waters in the state, not all bodies of water are classified in the standards. For example, when managing a classified segment of the Medina River above Medina Lake, 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 tracking number that is referred to as an **unclassified segment**. This unclassified tributary will be designated with the number of the classified segment in whose watershed it is located, along with a letter. Example 1905A North Prong Medina River is a tributary of the Medina River above Medina Lake. Unclassified segments are small and often intermittent water bodies, typically not assigned specific water quality standards.

Unclassified segments are generally assessed on the flow and the criteria for the classified segment into which they flow, but in some cases may be assigned specific water quality standards.

Each segment is further broken down into smaller subsections called **assessment units**. An assessment unit (AU) is defined as the smallest geographic area of use support reported in the assessment. Each AU within a segment is assigned a number such as 1905_**01**. All AUs include the underscore symbol which distinguishes them from segments. A segment may consist of more than one AU, 1905_**01**, 1905_**02**, and so on. Support of criteria and designated uses are evaluated for each AU. To address water quality regulatory activity such as permitting, standards development, and remediation, use support information applies at the AU level. The 303(d) List is reported at the AU level for each water body.

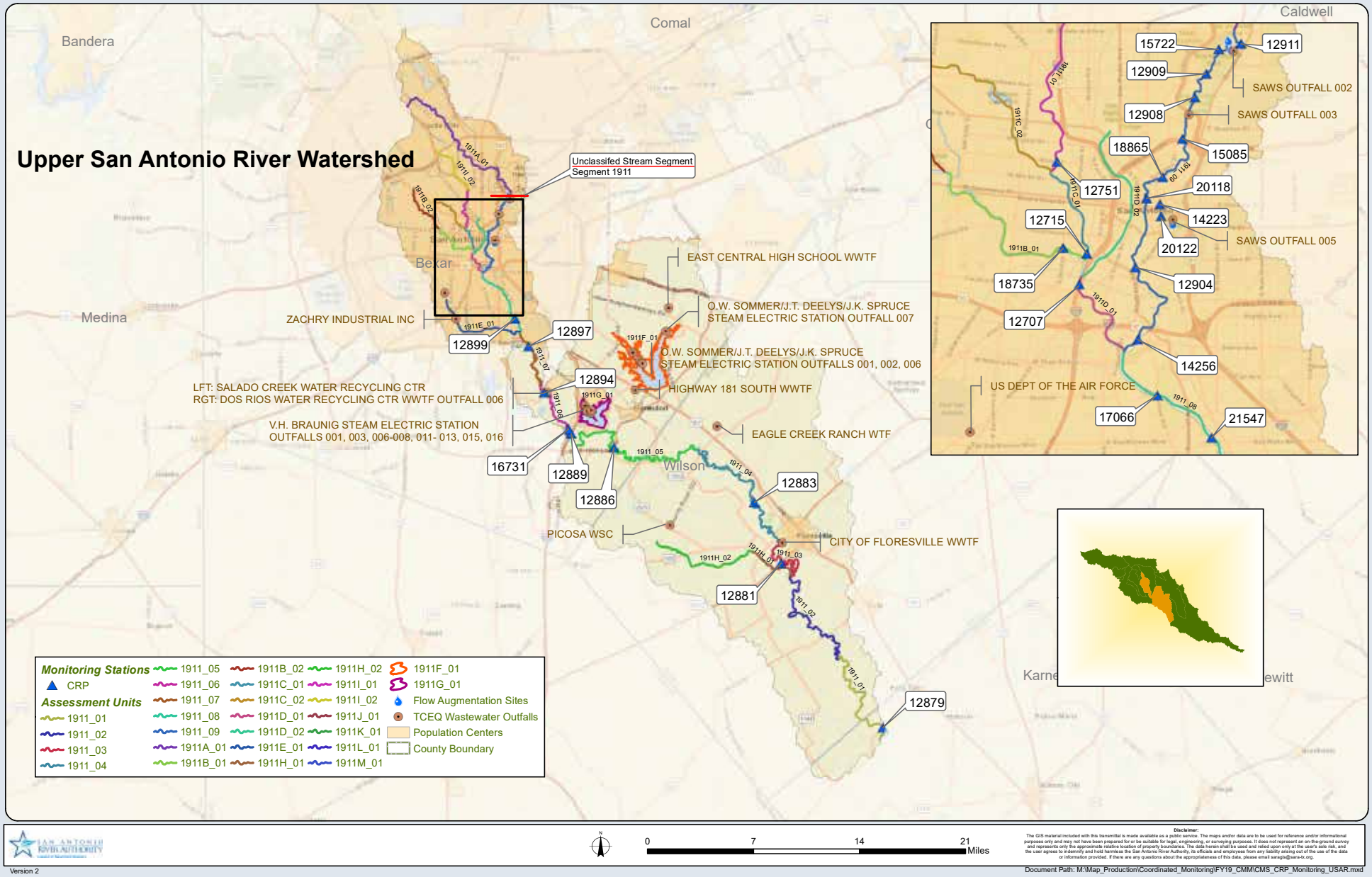

Figure 1911-1: FY2019 Coordinated Monitoring in the Upper San Antonio River

Segment 1911 – Upper San Antonio River

SEGMENT DESCRIPTION

The Upper San Antonio River Segment 1911 extends from a point 600 meters (660 yards) downstream of FM 791 at Mays Crossing near Falls City in Karnes County to a point 100 meters (110 yards) upstream of Hildebrand Avenue at San Antonio in Bexar County. The segment is approximately 85 miles long and has a drainage area of 543 square miles. See Table 1911-1 for the stations and number of sampling events collected between September 2018 and August 2019. In the table, red text identifies biased season sampling events.

Major tributaries to the Upper San Antonio River (USAR) include Medina River and Salado Creek. The San Antonio River originates as natural spring flow from the Edwards Aquifer south of the Balcones Fault Zone then flows over the Gulf Coastal Plains of the Central Plains Province. According to the U.S. Climate Data website, the watershed has an average yearly rainfall of 29 inches in the southern part of the watershed to 34 inches in the northern part. At its headwaters, the San Antonio River is heavily urbanized and is a small narrow stream sparsely lined with native vegetation. For a short distance the San Antonio River flows through Brackenridge Park as it makes its way through the heavily urbanized downtown district of San Antonio. As the San Antonio River flows past Loop 410 it becomes wide and deep and takes on the natural characteristics of South Texas streams influenced by the geology of the Gulf Coastal Plains. The upper portion of the watershed is largely developed; land use in the lower portion is agricultural and rangeland. In June 2011, the grand opening of the San Antonio River Mission Reach was held. The $271.4 million Mission Reach project was funded by Bexar County, the City of San Antonio, the U.S. Army Corps of Engineers, and through private donations collected by the San Antonio River Foundation. Funding for utility relocations was provide by the San Antonio Water System. The Mission Reach extends approximately eight miles from South Alamo Street to Mission Espada just below Loop 410 and provides stable, maintainable flood control while increasing recreational and economic development opportunities for the community.

Unclassified segments of the USAR assessed in the 2018 Integrated Report include:

- Segment 1911A Olmos Creek
- Segment 1911B Apache Creek
- Segment 1911C Alazan Creek
- Segment 1911D San Pedro Creek
- Segment 1911E Sixmile Creek
- Segment 1911H Picosa Creek
- Segment 1911I Martinez Creek
- Segment 1911J Pajarito Creek
- Segment 1911K Seguin Branch
- Segment 1911L Unnamed Tributary of Upper San Antonio River
- Segment 1911M Calaveras Creek

See Table 1911-2 for Site-Specific Uses and Criteria for Segment 1911.

HYDROLOGIC CHARACTERISTICS

According to the United States Geological Survey Current Streamflow Conditions for Texas, accessed on December 10, 2019:

- The 57-year median flow at USGS gage 08181800 San Antonio RV near Elmendorf, TX, is 294 cubic feet per second (cfs), with a flow range of 133 (2015) to 461 (2003) cfs.
- The 94-year median flow at USGS 08183500 gage station, San Antonio RV near Falls City, TX, 267 cfs, with a flow range of 39 (1957) to 2020 (2019).

Although there are many USGS gage stations located throughout the USAR basin, the two gage stations mentioned above are long term stations SARA utilizes to obtain quick and big picture flow trends in the upper and lower portions of the USAR. Base flow of the USAR is artificially maintained with well water discharges from the San Antonio Zoo and reuse water from the City of San Antonio Water Recycling Centers. Groundwater in the area is primarily associated with the Edwards and Carrizo-Wilcox aquifer systems. Unusual features in this watershed are the flood control tunnels on the San Antonio River and San Pedro Creek. The tunnels collect flood water north of the historic downtown area and divert it 150 feet underground through two 24-foot diameter tunnels and release the flood waters south of the downtown area.

IMPAIRMENT/AREA OF INTEREST

Segment 1911 is located in the Edwards Plateau, Texas Blackland Prairies and East Central Texas Plains Ecoregions and is identified in the 2018 TCEQ Integrated Report as being a freshwater perennial stream with a high aquatic life use designation. The USAR is not classified for domestic water supply use. Like all segments in the San Antonio River Basin, this segment is designated for primary contact recreation. Primary contact includes activities presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Impairments and concerns in Segment 1911 include:

UPPER SAN ANTONIO RIVER

- **Assessment Unit 1911_01:** Concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1911_02:** Concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1911_03:** Concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1911_04:** Concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1911_05:** Concern for fish community, ammonia, habitat, nitrate nitrogen and total phosphorus.
- **Assessment Unit 1911_06:** Concern for nitrate nitrogen.
- **Assessment Unit 1911_07:** Concern for habitat and nitrate nitrogen.

- **Assessment Unit 1911_08:** Impaired for bacteria; concern for nitrate nitrogen and fish community.
- **Assessment Unit 1911_09:** Impaired for bacteria and fish community; concern for nitrate nitrogen and total phosphorus.

UNCLASSIFIED SEGMENTS OF THE UPPER SAN ANTONIO RIVER

- **Assessment Unit 1911A_01:** No Impairments or Concerns (Limited Data).
- **Assessment Unit 1911B_01:** Impaired for bacteria; concerns for nitrate nitrogen and dissolved oxygen screening level.
- **Assessment Unit 1911C_01:** Impaired for bacteria.
- **Assessment Unit 1911C_02:** Impaired for bacteria; concern chlorophyll-a.
- **Assessment Unit 1911D_01:** Impaired for bacteria; concern for nitrate nitrogen.
- **Assessment Unit 1911D_02:** Impaired for bacteria; concern for nitrate nitrogen.
- **Assessment Unit 1911E_01:** Impaired for bacteria.
- **Assessment Unit 1911H_01:** Impaired for 24 hour dissolved oxygen minimum and average.
- **Assessment Unit 1911I_01:** Impaired for bacteria; concern for dissolved oxygen grab screening level.
- **Assessment Unit 1911J_01:** Concern for bacteria.
- **Assessment Unit 1911K_01:** Concern for bacteria.
- **Assessment Unit 1911L_01:** Concern for dissolved oxygen grab screening level

Details of the impairments and concerns for the USAR Watershed, as identified in the TCEQ 2018 Integrated Report, can be seen in Table 1911-3 and Table 1911-4. A map of impairments and concerns can be seen in Figure 1911-2.

LAND USE AND COVER

The USAR Watershed lies within Bexar, Wilson and Karnes Counties, and is characterized by a mixture of land uses and cover. Its headwaters are in southeastern Bexar County within the City of San Antonio. The river runs north to south, from the southern end of San Antonio, past Floresville and Poth, to FM 791 near Falls City in Karnes County. According to the United States Census Bureau, Explore Census Data, the upper third of the watershed is home to the second most populous incorporated city in the State of Texas, the City of San Antonio with an estimated population of 1.5 million. Unclassified perennial and intermittent water bodies contributing flow to this portion of the watershed include Olmos Creek, Apache Creek, Alazan Creek, San Pedro Creek, Sixmile Creek, Picosa Creek, Martinez Creek, Pajarito Creek, Seguin Branch, Unnamed Tributary of Upper San Antonio River, and Calaveras Creek. The lower two thirds of the watershed are characterized by a mixture of hay, pasture, and cultivated land, with a mixture of medium to low urban development southwest of the City of San Antonio and around the cities of Floresville, La Vernia, and Poth. There are small areas of mixed and deciduous forest throughout the middle portion of the watershed.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority's GIS Department, and includes National Land Cover Database (NLCD) 2016 data created by the Multi_Resolution Land Characteristics Consortium, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality. See Figure 1911-3 for more detail. According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls Viewer there are 11 permitted and one pending permitted dischargers with a total of 29 outfalls in Segment 1911. See Table 1911-5 for details. Permittees maybe listed more than once to identify the total number of discharge outfalls in their jurisdiction. Specific outfall names are not identified in the TCEQ Outfalls Viewer.

POSSIBLE CAUSES OF IMPAIRMENT AND CONCERNS

Fish Impairment and Habitat Concerns: Efforts to address flooding in San Antonio between the 1920s and 1960s focused both on San Antonio and downstream of the city. During this time, the San Antonio River was extensively widened and straightened the river channel south of downtown. These flood control measures removed the rivers natural sinuosity, instream physical features and vegetation. In its place, the river channel was straightened and lined with concrete rubble, leaving a flat pathway for the river's flow. Although this effort was successful in expediting flood water out of the city, it was extremely detrimental to the riparian habitat, fish and macrobenthic communities. In 1998, a concerted community effort to revitalize the river began. Bexar County, the City of San Antonio, and SARA created the San Antonio River Oversight Committee. The 22 civic and neighborhood leaders appointed to the committee were given the responsibility of overseeing the planning, design, project management, construction and funding necessary to complete the San Antonio River Improvements Project (SARIP). The SARIP was completed in 2013 and restored and enhanced the San Antonio River. SARIP is comprised of four distinctive reaches: The Museum Reach, a four-mile segment of the river from Hildebrand Avenue south to Lexington Avenue; the Downtown Reach, a segment of the original River Walk from Lexington Avenue to Houston Street; the Eagleland Reach, a one-mile segment from South Alamo to Lonestar Boulevard; and the Mission Reach, an eight-mile section of the river extending from Lonestar Boulevard south to Loop 410 South. Improvements along the Mission Reach focused on ecosystem restoration using a technique known as fluvial geomorphology. This technique transformed the straightened river to replicate the original flow of the river while maintaining flood control, reducing erosion, re-introducing native vegetation and creating an environment more suitable for recreation, wildlife, and aquatic communities. The Mission Reach ecological features included restoring the natural pool, riffle, run sequences; reconnection of two historic river remnants; restoration of natural backwater habitats; and restoration of the native riparian corridor, including the planting of over 20,000 young trees.

Bacteria Impairment: The Upper San Antonio River and Salado Creek were first identified as impaired due to bacteria in the 2000 Texas Water Quality Inventory and 303(d) List. Walzem Creek was added to the list in 2002. In response to the listing, the TCEQ developed the **Three Total Maximum Daily Loads for Bacteria in the San Antonio Area** to establish the bacteria loading reductions necessary to bring the Upper San Antonio River, Salado Creek, and Walzem Creek back into compliance with the Texas Surface Water Quality Standards. The TCEQ adopted the Three Total Maximum Daily Loads (TMDL) on July 25, 2007 and the EPA approved the TMDLs on September 25, 2007. In April 2016, the TCEQ adopted **Addendum One to the Three Total Maximum Daily Loads for the Upper San Antonio Watershed**. The addendum included new information

on seven bacterial impaired assessment units in Menger Creek, Apache Creek, Alazan Creek, San Pedro Creek, and Sixmile Creek. The EPA approved the addendum on August 9, 2016. In July 2019, the TCEQ began working on a **Technical Support Document** to add Martinez Creek to the TMDLs. As of this Basin Highlight Report, the Martinez Creek Technical Support Document has not been approved. The TMDL report identifies both regulated and unregulated sources of pollution. Possible sources and/or causes of contamination sited in the report include:

- discharges from wastewater treatment facilities and other institutions
- discharges from urban storm sewer systems
- runoff from undeveloped lands
- wildlife deposition
- pets and livestock deposition
- leaking sewer infrastructure
- failing septic systems

Dissolved Oxygen Impairment: Dissolved oxygen impairments in the unclassified water bodies of the USAR are attributed to intermittent low flows, poor riparian buffer vegetation, low channel sinuosity and shallow depth.

POTENTIAL STAKEHOLDERS

- City of San Antonio
- City of Elmendorf
- City of Floresville
- Edwards Aquifer Authority
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Trinity Glen Rose and Evergreen Underground Water Conservation Districts
- Alamo and Wilson Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

SARA should continue routine, biological and stormwater monitoring and provide quality assured data to TCEQ for assessment. SARA should also work with partners to implement and monitor best management practices identified in the Upper San Antonio River TMDL's, Watershed Protection Plan, and TMDL Implementation Plan for Bacteria in the Upper San Antonio Watershed.

Critical components of habitat quality and a healthy fish community are substrate stability and instream cover. Large woody debris and instream cover are important components of rivers and streams, providing varying degrees of channel stability and habitat diversity. Introductions of large woody debris and other instream cover can have significant effect on the production of juvenile and adult fish while also providing habitat for aquatic invertebrates. Given the high flows experienced during stormwater events, SARA should explore ways of permanently installing structures to promote a diverse and ecologically sound environment for fish and aquatic invertebrates in the upper part of the watershed.

MAJOR WATERSHED EVENTS

The City of San Antonio and SARA partner up on a roughly biennial basis to dewater portions of the San Antonio Riverwalk. This dewatering, while unsightly to tourists and residents, serves as an invaluable opportunity to accomplish a tremendous amount of work including infrastructure revitalization, beautification, and biological enhancement. There is a great deal of collaboration and planning that goes into these events that includes environmental permitting, media disclosure, technical scopes of work and more. It is a highly choreographed dance that is designed to not only improve this highly regarded stretch of river, but to make it safe for enjoyment. The next dewatering even should occur in January 2020.

The primary reason for the dewatering is to improve and repair infrastructure such as gates and walls. The dewatering allows City and SARA staff a unique opportunity to access a major water body which no longer has water. This grants access for trash removal and the excavation of sediment that has built up in the channel over the years. While the water is receding, SARA biologists enter the channel to remove native fish and other aquatic organisms and safely relocate them to suitable habitat. This also allows biologists the opportunity to remove invasive non-native aquatic organisms, such as Tilapia and Plecostomus, which pose a threat to the natural ecosystem and contribute to the fish community impairments in the Upper San Antonio River. Urban reaches like the San Antonio Riverwalk are typically prone to invasion from non-native species due to human-driven impacts on habitat and water quality. These non-native species frequently outcompete native species which can cause a shift in aquatic communities and is often followed by an unnatural alteration in the local food web or a reduction in native species richness and abundance. A new non-native example is the Giant Applesnail which was recently discovered on the Museum Reach by City staff. These snails, likely introduced by an aquarist, associate with slow moving water with abundant aquatic vegetation. They are voracious eaters and that could potentially decimate the aquatic vegetation stands that exist in these reaches of the river. Fortunately, they are unlikely to spread downstream into more natural portions of the river due to faster flowing waters and lower food availability. The January 2020 river dewatering event comes at a very opportune time due to this new invader. It is rare to have the opportunity for such a complete overhaul of a river system like

this one and be able to remove such a large proportion of invasive species at once. This allows SARA biologists to maintain a healthier ecosystem within the Riverwalk which has positive implications for downstream communities as well.

PROJECTS IN THE UPPER SAN ANTONIO RIVER WATERSHED

Upper San Antonio River Watershed Protection Plan and the Implementation Plan for Three Total Maximum Daily Loads for Bacteria in the Upper San Antonio Watershed: In response to the Three Total Maximum Daily Loads for Bacteria in the San Antonio Area, SARA, TCEQ, and Texas A&M AgriLife worked with communities, interest groups, and local organizations to involve stakeholders with the development of the Upper San Antonio River Watershed Protection Plan (WPP) and the Implementation Plan for Three Total Maximum Daily Loads for Bacteria in the Upper San Antonio Watersheds (I-Plan). The WPP and I-Plan contain management measures designed to guide activities that will improve water quality, identify and describe Best Management Plans (BMP) that will be implemented and tracked to reduce bacteria in the watershed, and establish a timeline for implementation. Follow-up tracking and monitoring plans are also included to determine the effectiveness of the BMPs. The ultimate goal is to meet primary contact recreation uses in the identified segments by reducing concentrations of E. coli bacteria to levels established in the TMDLs. Some of the Management Measures in the USAR I-Plan include:

- Advancement of Low Impact Development.
- Wastewater collection and transmission system operation and maintenance programs to reduce sanitary sewer overflows.
- San Antonio Zoo UV treatment system implementation.
- Avian management for the river walk and other riparian areas.
- Increase awareness and enforcement of pet control ordinances and expansion of pooper scooper program.

Guadalupe Bass Reintroduction Effort: Under a National Fish and Wildlife Foundation Grant, SARA, TPWD and Texas State University began reintroducing Guadalupe Bass *(Micropterus treculi)* into the Mission Reach of the Upper San Antonio River. Between 2013 and 2016, approximately 84,000 Guadalupe Bass were stocked at four sites in the Mission Reach and San Juan Remnant areas of the Upper San Antonio River. Although stocking has stopped, SARA biologists continue to capture, document, and release Guadalupe Bass captured during biological collection events as far down as Conquista Crossing in Karnes County. Genetic information from fin clippings confirms that there is now a sustainable and expanding population of Guadalupe Bass in the Upper San Antonio Watershed. With the growing population of Guadalupe Bass, species richness (number of species in a defined area) and species abundance (relative number of species) should help address the fish community impairment and concerns in the Upper San Antonio River.

The River Road Eco-Restoration Project: The United States Army Corps of Engineers (USACE) and SARA have partnered to conduct an aquatic ecosystem restoration feasibility study on the last unchannelized reach of the Upper San Antonio River in Brackenridge Park, stretching from Mulberry Street to Highway 281. According to the TCEQ Integrated Report, this

portion of the river has been identified as having a fish community impairment and a habitat concern. Erosion, invasive flora and fauna, degrading river stability and the declination of natural riparian buffer have also been identified in this section of the river. Solutions being evaluated include the addition and modification of natural channel structures, bank stabilization, invasive species removal and their replacement with native vegetation, the removal of artificial structures hindering natural stream and fish movement, and the increase and restoration of the riparian zone. These potential solutions could improve river health through the reduction of silt, erosion, and bacteria, while improving water quality and aquatic communities.

Mission Reach Intensive Fish Study: In March 2019, SARA staff initiated the multiyear Mission Reach Intensive Fish Survey. The survey's objective is to establish fish abundance, examine fish species-habitat-instream cover relationships, and determine benthic macroinvertebrate community health, diversity, and density throughout the Mission Reach. The Mission Reach was divided into five individual sampling reaches based on what are believed to be significant barriers to fish passage. Each reach was sampled using a combination of electrofishing and seining as deemed appropriate for each type of habitat encountered. At each habitat, captured fish were identified, counted, measured, and released. A variety of detailed habitat observations and measurements were also recorded for each habitat. A single benthic macroinvertebrate sample was collected for each sampling reach by compositing samples from each of five randomly selected riffles. Staff sampled 76 individual habitats and collected 878 individual fish representing 21 species. Among the highlights of the effort were the wide distribution of multiple ages of Guadalupe Bass throughout the Mission Reach. Additionally, this effort documented the first two ever captured and released Texas Logperch in the Upper San Antonio River Mission Reach. The Logperch is a very pollution intolerant fish species and is an indicator of good water quality. As of this report, the benthic macroinvertebrate sampling is still being processed.

OTHER PROJECTS AND EFFORTS

SARA Holistic Freshwater Mussel Project: During the fall of 2014, SARA initiated a basin wide mussel survey to determine mussel densities and species richness for the native mussel community in the San Antonio River Basin. Data collected is distributed to regulatory agencies to assist in decision-making for listing or delisting candidate mussel species. Although previous studies in the San Antonio River Basin from the early 1990's has provided SARA with invaluable information, SARA designed and implemented a robust qualitative and quantitative mussel sampling regiment along the San Antonio River main stem and its tributaries, including Cibolo Creek, Salado Creek, Lower Leon Creek, Salitrillo Creek, Martinez Creeks, Lower Medina River, Medio, Alazán, Apache, Martínez, and San Pedro Creeks. As of fall 2019, SARA biologists have completed 100% of the qualitative and quantitative sampling in the Lower Cibolo Creek watershed and 95% of the qualitative in the Upper and Lower San Antonio River, Medina River (55%), Salado Creek (60%), and Leon Creek (95%). As of this report, biologists have sampled over 226 river miles, collected data and released over 1000 individual mussels from more than 200 sample sites. There is still work to be done within the basin to determine the overall condition of the mussel community, but mussel integrity appears to be pretty good.

Mission Reach Freshwater Mussel Survivability Study: Freshwater mussels are filter-feeding, sedentary organisms that provide a tremendous amount of ecosystem services. The Holistic Mussel Project has provided scientists with evidence

that native freshwater mussels once existed far into the headwaters of the San Antonio River long before anthropogenic alteration drove them out. The Mission Reach Restoration, an ecosystem restoration of an eight mile stretch of river just downstream of downtown, was completed in 2013 and has provided a tremendous lift in ecosystem functionality and resiliency. This restoration has allowed SARA biologists to determine how effective a large-scale urban river restoration can be by looking at an assortment of biological responses. SARA scientists have a small number of adult mussels held at two sites within the newly restored reach and one control site in the Lower San Antonio River which is known to sustain a healthy mussel population. Biologists are comparing survival and growth of these two study populations to determine if water quality is improved enough to allow mussels to survive and thrive. Mussels at one of the Mission Reach sites have better survival and higher growth than those at the control site after two years in the study. There are quite a few unanswered questions to explore; however, it is a promising step forward towards a mussel reintroduction into this restored reach. Scientists are addressing these questions to ensure that all concerns for a reintroduction of this scale have been addressed in a holistic manner.

Freshwater Mussel Propagation Project: Early indications of the Mission Reach Mussel Survivability (MRMS) study suggest that both water and sediment quality are sufficient to sustain the four species assessed. As the MRMS study progresses, biologists will be able to make more definitive conclusions on overall health and viability of the mussels and determine if reintroduction of mussels into the Mission Reach is practical. In order to prepare for this potential re-introduction, it is critical to develop propagation methodology for all four species included in the MRMS study, and subsequently use reared individuals to assess instream juvenile survivability. Juvenile survivability is an important factor in determining if mussel reintroduction is possible. While propagation methodologies for many species have been developed, there has been little to no work done on the species with the conditions present in the San Antonio River basin. The project is broken down into five major objectives:

- Develop propagation methodology for the Pimple Back, Pistol Grip, Yellow Sandshell, and Threeridge to include information on host fish, feeding regimen, grow out equipment, etc.
- Develop and evaluate feasibility of methods for inducing captive spawning.
- Conduct applied research on physiological limitations of mussels to potential pollutants and general water quality to aid in restoration and habitat management.
- Develop re-introduction genetic management plan for all species deemed viable for re-introduction.
- Determine size at release for each species and approximate amount of time needed to reach viable stocking size.

Freshwater mussels begin life as parasitic larvae known as glochidia. When these larval mussels are expelled by the female, they must find a suitable host fish to develop. They attach themselves to the fish's gills. And after several weeks, the larvae transform into juvenile mussels. They then fall off the host fish and settle on the bottom of the creek. If they settle on suitable habitat, their journey to adulthood begins. In order to accomplish these objectives, SARA staff have partnered with three United States Fish and Wildlife Service (USFWS) facilities; 1) the San Marcos Aquatic Resource Center (SMARC) in San Marcos, TX, 2) the Inks Dam National Fish Hatchery (IDNFH) in Burnet, TX, and 3) the Southwestern Native Aquatic Resource and Recovery Center (SNARRC) in Dexter, New Mexico. SMARC will be focusing on propagation methodology, and

conducting applied research on physiological limitations, SNARRC will conduct genetic sequencing on mussels found in the San Antonio River basin to establish genetic diversity and structure and IDNFH will serve as the production facility should River Authority staff decide to move forward with a full scale re-introduction.

Lone Star Street Erosion Repair Effort: In January 2020, SARA initiated the Lone Star Street Erosion Repair Effort to install root wads at an erosion sites on the Upper San Antonio River just downstream of Lone Star Boulevard. Installing root wads is a riverbank protection technique that provides immediate riverbank stabilization through use of root wads, in combination with other interlocking tree parts, to protect the toe-of-slope and prevent erosion. Root wads move the water current away from the riverbank so that it is less susceptible to erosion through hydraulic forces. With less riverbank/water interaction, especially during high flow events, riparian and aquatic habitat can be established to further reduce the chances of erosion. The Lone Star Street Erosion Repair Effort will utilize approximately 40, 20 to 25 feet long tree trunks with attached root wades harvested from the Truehart Ranch, a SARA owned property. Fast growing live transplants, such as willows, will be planted to provide stability throughout the upper portion of the structure. In addition to erosion control, root wads also reduce sediment deposits and creates excellent fish habitat, especially for juvenile fish. The continued use of root wads to control erosion along the San Antonio River Mission Reach will promote a diverse and ecologically sound environment for fish and aquatic invertebrates. Use of root wads will go a long way to help address the fish impairments and habitat concerns in Segments 1911_08 and 1911_09.

2019 Coordinated Monitoring Schedule for Segment 1911 - Upper San Antonio River													
Seg_AU	Station Number	TCEQ Station Description	Collection Entity	Monitoring Type	24 Hour DO	Habitat	Benthic	Nekton	Metals in Water	Conventional	Bacteria	Flow	Field
1911_01	12879	SAN ANTONIO RIVER AT FM 791 SW OF FALLS CITY	SARA	RT						6	6	6	6
1911_03	12881	SAN ANTONIO RIVER AT SH 97 NEAR FLORESVILLE	SARA	RT						6	52	52	6
1911_04	12883	SAN ANTONIO RIVER AT DIETZFIELD ROAD CR 117 NORTHWEST OF FLORESVILLE	SARA	RT						6	6	6	6
1911_05	12886	SAN ANTONIO RIVER MID CHANNEL 30 M DOWNSTREAM OF ST LOOP 1604 WEST OF ELMENDORF RT/CONTINUOUS MONITORING SITE CAMS 715	SARA	RT						6	6	6	6
	12889	SAN ANTONIO RIVER AT IH 37 SE OF SAN ANTONIO	SARA	BS/RT	1					6	6	6	6
1911_06	12894	SAN ANTONIO RIVER AT BLUE WING RD SE OF SAN ANTONIO	SARA	RT						6	6		6
	16731	SAN ANTONIO RIVER APPROX 835 METERS UPSTREAM OF THE MEDINA RIVER CONFLUENCE	SARA	BS/RT	2	2		2		6	6	6	6
1911_07	12897	SAN ANTONIO RIVER AT IH 410 LOW WATER CROSSING CAMINO COAHUILATECHAN 0.25 KM BELOW THE BRIDGE IN SAN ANTONIO	SARA	RT						6	52	52	6
1911_08	12899	SAN ANTONIO RIVER AT LOW WATER CROSSING FOR PADRE RD NEAR END OF ASHLEY RD	SARA	BS/RT	1	1	1	1		6	6	6	6
	17066	SAN ANTONIO RIVER AT MISSION ROAD IMMEDIATELY UPSTREAM OF RIVERSIDE MUNICIPAL GOLF COURSE	SARA	RT						6	52	52	6
	21547	SAN ANTONIO RIVER AT VFW BOULEVARD	SARA	BS/RT	1	1	1	1		6	6	6	6
1911_09	12904	SAN ANTONIO RIVER AT ALAMO ST IN SAN ANTONIO	SARA	RT						6	6	6	6
	12908	SAN ANTONIO RIVER AT WOODLAWN AVE IN SAN ANTONIO	SARA	BS/RT	1	1		1		6	6	6	6
	12909	SAN ANTONIO RIVER AT MULBERRY ST IN SAN ANTONIO	SARA	BS/RT	1	1		1		6	6	6	6
	12911	SAN ANTONIO RIVER AT WELL NO. 2 AT JOSKES PAVILLION	SARA	RT						6	6	6	6
	14223	SAN ANTONIO RIVER AT NORTH PRESA STREET NEAR HYATT REGENCY IN SAN ANTONIO	SARA	RT							6		6
	14256	SAN ANTONIO RIVER AT W. MITCHELL STREET IN DOWNTOWN SAN ANTONIO	SARA	RT					3	6	52	52	6
	15085	SAN ANTONIO RIVER AT NEWELL AVE UPSTREAM OF IH 35 IN SAN ANTONIO	SARA	RT						6	6		6
	15722	SAN ANTONIO ZOO OUTFALL NO 1 DISCHARGE CHANNEL 27 M DOWNSTREAM OF DISCHARGE CULVERT AT SOUTHEAST CORNER OF ZOO OUTSIDE ZOO PROPERTY	SARA	RT							6	6	6
	18865	SAN ANTONIO RIVER 57 METERS UPSTREAM OF LEXINGTON STREET BRIDGE AND APPROXIMATELY 1.3 KILOMETERS DOWNSTREAM OF IH 35	SARA	RT						6	6		6
	20118	SAN ANTONIO RIVER AT HOUSTON STREET APPROXIMATELY 129 M DOWNSTREAM OF TRAVIS STREET	SARA	BS/RT	1					6	6		6
	20122	SAN ANTONIO RIVER LOOP 111 METERS DOWNSTREAM OF MARKET STREET AT LITTLE RHEIN STEAKHOUSE IN SAN ANTONIO	SARA	BS/RT	1					6	6		6
1911B_01	18735	APACHE CREEK AT BRAZOS STREET APPROXIMATELY 0.7 KM UPSTREAM OF THE CONFLUENCE WITH ALAZAN CREEK	SARA	RT						6	6	6	6
1911C_01	12715	ALAZAN CREEK AT TAMPICO ST IN SAN ANTONIO	SARA	RT						6	6	6	6
1911D_01	12707	SAN PEDRO CREEK AT FURNISH ST IN SAN ANTONIO PERMIT 0000968 UNION STOCK YARDS	SARA	RT					3	6	6	6	6
1911I_01	12751	MARTINEZ CREEK AT RUIZ STREET IN SAN ANTONIO	SARA	RT						6	6	6	6

Site-Specific Uses and Criteria for Segment 1911 - Upper San Antonio River and Tributaries																				
		Uses			Criteria										Nutrient Screening Levels				
Segment	Segment Name	Recreation	Aquatic Life Use	Domestic Water Supply	Chloride (mg/L)[4]	Sulfate (mg/L)[4]	Total Dissolved Solids (mg/L)[4]	Dissolved Oxygen Grab Screening Average (mg/L)	Dissolved Oxygen Grab Minimum(mg/L)	24 Hour Dissolved Oxygen Average (mg/L)	24 Hour Dissolved Oxygen Minimum (mg/L)	pH Range (SU)[4]	Temperature[1,4] (°C)	*E. coli* geomean[3] (CFU/100ml)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Ortho Phosphorus (mg/L)	Total Phosphorus (mg/L)	Chlorophyll-a (µg/L)[4]
1911	Upper San Antonio River	PCR1	High	--	150	150	750	5.0	3.0	5.0	3.0	6.5-9.0	32.2	126	0.33	1.95	0.37	0.69	14.1
1911A	Olmos Creek	PCR1[2]	High	--	--	--	--	5.0	3.0	5.0	3.0	--	--	126	0.33	1.95	0.37	0.69	--
1911B	Apache Creek	PCR1[2]	High	--	--	--	--	5.0	3.0	5.0	3.0	--	--	126	0.33	1.95	0.37	0.69	--
1911C	Alazan Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1911D	San Pedro Creek	PCR1[2]	High	--	--	--	--	5.0	3.0	5.0	3.0	--	--	126	0.33	1.95	0.37	0.69	--
1911E	Sixmile Creek	PCR1[2]	Minimal	--	--	--	--	2.0	1.5	2.0	1.5	--	--	126	0.33	1.95	0.37	0.69	--
1911H	Picosa Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1911I	Martinez Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1911J	Pajarito Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1911K	Seguin Branch	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1911L	Unnamed Tributary of the Upper San Antonio River	PCR1[2]	Limited	--	--	--	--	2.0	1.5	2.0	1.5	--	--	126	0.33	1.95	0.37	0.69	--
1911M	Calaveras Creek	PCR1[2]	High	--	--	--	--	5.0	3.0	5.0	3.0	--	--	126	0.33	1.95	0.37	0.69	--

1 Temperature was converted from °F to °C, the criteria for temperature are listed as maximum values at any site within the segment.

2 For unclassified water bodies not specifically identified in the TSWQS, a primary contact recreation 1 is the presumed use except where site-specific information indicates that recreational activities that involve a significant risk of ingestion have little to no likelihood of occurring.

3 The indicator bacteria for freshwater is *E. coli* .

4 Water temperature, pH, chloride, sulfate, TDS and chlorophyll *a* criteria developed for classified segments do not apply to unclassified water bodies.

TCEQ 2018 Texas Integrated Report: Impairments and Concerns for Segment 1911 - Upper San Antonio River															
Segment Name	**Seg_AU**	**Designated Use**	**Method**	**Parameter Description**	**Criteria**	**# of Samples Assessed**	**Mean or Geomean of Samples Assessed**	**# of Samples Exceeding Criteria**	**Mean of Samples Exceeding Criteria**	**Data Set Qualifier**	**Integrated Level of Support**	**Data Carried Forward**	**Impairment Category**	**Is there an EPA approved TMDL**
Upper San Antonio River	1911_01	General Use	Nutrient Screening Levels	Nitrate	1.95	66	---	66	10.34	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	66	---	52	1.23	AD	CS	---	---	---
	1911_02	General Use	Nutrient Screening Levels	Nitrate	1.95	---	---	---	---	ID	CS	YES	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	---	---	---	---	ID	CS	YES	---	---
	1911_03	General Use	Nutrient Screening Levels	Nitrate	1.95	65	---	64	10.96	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	65	---	59	1.26	AD	CS	---	---	---
	1911_04	General Use	Nutrient Screening Levels	Nitrate	1.95	14	---	14	11.60	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	14	---	12	1.76	AD	CS	---	---	---
	1911_05	Aquatic Life Use	Fish Community	Fish Community	41.00	5	37.00	---	---	TR	CN	---	---	---
		Aquatic Life Use	Habitat	Habitat	20.00	5	18.00	---	---	TR	CS	---	---	---
		General Use	Nutrient Screening Levels	Ammonia	0.33	116	---	28	0.93	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	117	---	113	12.15	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	115	---	97	1.45	AD	CS	---	---	---
	1911_06	General Use	Nutrient Screening Levels	Nitrate	1.95	110	---	30	2.74	AD	CS	---	---	---
	1911_07	Aquatic Life Use	Habitat	Habitat	20.00	6	19.00	---	---	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	54	---	23	3.62	AD	CS	---	---	---
	1911_08	Aquatic Life Use	Fish Community	Fish Community	41.00	3	34.00	---	---	AD	CN	---	---	---
		Recreation Use	Bacteria Geomean	*E. coli*	126	330	228.78	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	62	---	51	4.41	AD	CS	---	---	---
	1911_09	Aquatic Life Use	Fish Community	Fish Community	41.00	3	38.00	---	---	AD	**NS**	---	5c	
		Recreation Use	Bacteria Geomean	*E. coli*	126	919	509.58	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	402	---	356	8.56	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	404	---	208	1.30	AD	CS	---	---	---

Dataset Qualifier Codes

AD =Adequate Data (10 or more samples)

LD = Limited Data (less than 9, greater than 3 samples)

ID = Inadequate Data (less than 4 samples) **TR =** Temporally Not Representative

Integrated Level of Support (Int LOS) = Integrated level of support. This is the overall level of support for this use, method, and parameter group:

CS= Screening level concern **CN**=Use Concern

NS=Not Supporting **NA=**Not Assessed

--- = Data not necessary or unavailable

Impairment Category

4a = All TMDLs have been completed and approved by EPA

5a = TMDLs are underway, scheduled, or may be scheduled for one or more parameters.

5c = Indicating that additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected.

TMDL= Indicates if there is an EPA Approved TMDL in Place.

TCEQ 2018 Texas Integrated Report: Impairments and Concerns for Segment 1911 -Upper San Antonio River Unclassified Water Bodies														
Segment Name	**Seg_AU**	**Designated Use**	**Method**	**Parameter Description**	**Criteria**	**# of Samples Assessed**	**Mean or Geomean of Samples Assessed**	**# of Samples Exceeding Criteria**	**Mean of Samples Exceeding Criteria**	**Data Set Qualifier**	**Integrated Level of Support**	**Data Carried Forward**	**Impairment Category**	**Is there an EPA approved TMDL**
Olmos Creek	1911A_01	No Impairments or Concerns (Limited Data)												
Apache Creek	1911B_01	Aquatic Life Use	Dissolved Oxygen grab screening level	Dissolved Oxygen grab	5.00	65	---	9	2.96	AD	CS	---	---	---
		Recreation Use	Bacteria Geomean	*E. coli*	126	65	458.75	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	62	---	26	3.25	AD	CS	---	---	---
Alazan Creek	1911C_01	Recreation Use	Bacteria Geomean	*E. coli*	126	50	357.25	1	---	AD	**NS**	---	4a	YES
	1911C_02	Recreation Use	Bacteria Geomean	*E. coli*	126	10	195.43	1	---	LD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Chlorophyll-*a*	14.10	8	---	2	22.00	LD	CS	YES	---	---
San Pedro Creek	1911D_01	Recreation Use	Bacteria Geomean	*E. coli*	126	136	235.72	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	50	---	20	2.56	AD	CS	---	---	---
	1911D_02	Recreation Use	Bacteria Geomean	*E. coli*	126	24	346.00	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	8	---	7	2.26	LD	CS	---	---	---
Sixmile Creek	1911E_01	Recreation Use	Bacteria Geomean	*E. coli*	126	8	442.76	1	---	LD	**NS**	YES	4a	YES
Picosa Creek	1911H_01	Aquatic Life Use	Dissolved Oxygen 24-hr Average	Dissolved Oxygen 24-hr Avg	3.00	10	---	9	0.52	AD	**NS**	---	5c	---
		Aquatic Life Use	Dissolved Oxygen 24-hr Minimum	Dissolved Oxygen 24-hr Min	2.00	10	---	9	0.29	AD	**NS**	---	5c	---
Martinez Creek	1911I_01	Aquatic Life Use	Dissolved Oxygen grab screening level	Dissolved Oxygen grab	3.00	42	---	6	2.45	AD	CS	---	---	---
		Recreation Use	Bacteria Geomean	*E. coli*	126	42	246.98	1	---	AD	**NS**	---	5a	---
Pajarito Creek	1911J_01	Recreation Use	Bacteria Geomean	*E. coli*	126	3	80.17	0	---	ID	CN	YES	---	---
Seguin Branch	1911K_01	Recreation Use	Bacteria Geomean	*E. coli*	126	6	236.87	1		LD	CN	---	---	---
Unnamed Tributary	1911L_01	Aquatic Life Use	Dissolved Oxygen grab screening level	Dissolved Oxygen grab	2.00	5	---	2	1.5	LD	CS	---	---	---

Dataset Qualifier Codes
AD =Adequate Data (10 or more samples)
LD = Limited Data (less than 9, greater than 3 samples)
ID = Inadequate Data (less than 4 samples) **TR =** Temporally Not Representative

Integrated Level of Support (Int LOS) = Integrated level of support. This is the overall level of support for this use, method, and parameter group:
CS= Screening level concern **CN**=Use Concern
NS=Not Supporting **NA=**Not Assessed
-- - = Data not necessary or unavailable

Impairment Category
4a = All TMDLs have been completed and approved by EPA
5a = TMDLs are underway, scheduled, or may be scheduled for one or more parameters.
5c = Indicating that additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected.
TMDL= Indicates if there is an EPA Approved TMDL in Place.

Municipal and Industrial Wastewater Outfalls in Segment 1911 - Upper San Antonio River		
Permittee	**Status**	**Type**
CITY OF FLORESVILLE	Current Permit	Domestic
CITY OF FLORESVILLE	Current Permit	Domestic
SAN ANTONIO WATER SYSTEM	Current Permit	Wastewater
SAN ANTONIO WATER SYSTEM	Current Permit	Wastewater
SAN ANTONIO WATER SYSTEM	Current Permit	Wastewater
ZACHRY INDUSTRIAL INC	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Wastewater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Wastewater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Wastewater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Wastewater
EAST CENTRAL ISD	Current Permit	Domestic
US DEPT OF THE AIR FORCE	Current Permit	Groundwater
SAN ANTONIO WATER SYSTEM	Current Permit	Wastewater
SAN ANTONIO WATER SYSTEM	Current Permit	Wastewater
TIGER SANITATION INC	Pending Permit	Wastewater
PICOSA WSC	Current Permit	Domestic
SAN ANTONIO RIVER AUTHORITY	Current Permit	Domestic
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Wastewater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
CITY PUBLIC SERVICE OF SAN ANTONIO	Current Permit	Stormwater
AQUA UTILITIES INC	Current Permit	Domestic

Domestic: Less than 1 Million Gallon per Day domestic sewage.
Wastewater: Greater than or equal to 1 MGD domestic sewage or process water including water treatment plant discharge.

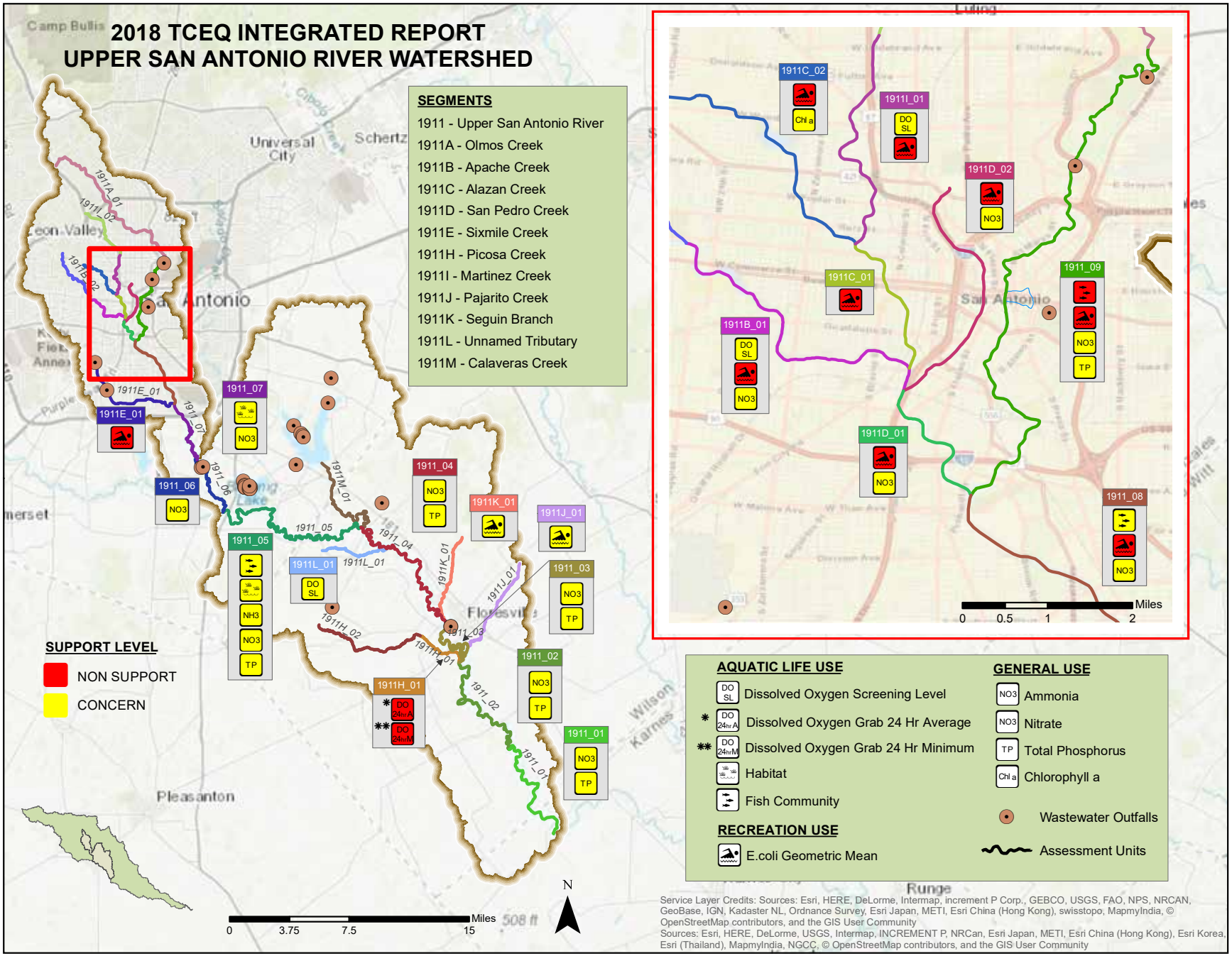

Figure 1911-2: 2018 Impairments and Concerns in the Upper San Antonio River Watershed

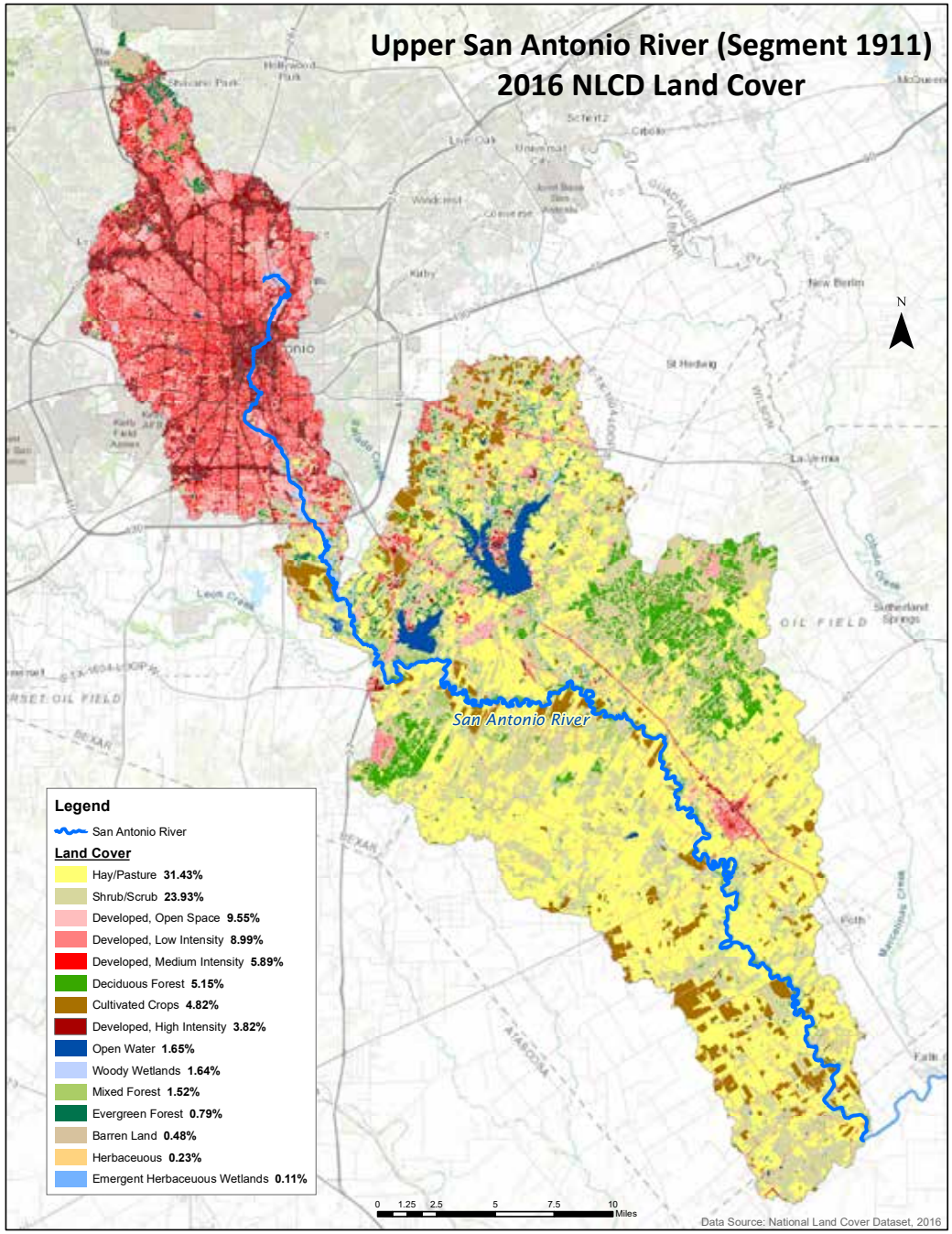

Figure 1911-3: Land Cover Map for the Upper San Antonio River Watershed

IMAGES

Figure 1911-4: *Station 12909 USAR at Woodlawn*

Figure 1911-5: *Station 12899 USAR at Padre Road*

Figure 1911-6: *Station 16731 USAR upstream Medina River*

Figure 1911-7: *Station 12881 USAR near Floresville Confluence*

IMAGES

Figure 1911-8: *Holistic Freshwater Mussel Project, San Antonio River*

Figure 1911-9: *Mission Reach Mussel Survivability, Silo Containment*

Figure 1911-10: *Freshwater Mussel Propagation Project, Gravid Female*

Figure 1911-11: *Deep Pool Mussel Collection*

 Figure 1911-12: 2019 Michael Gonzales Memorial Intern, Elizabeth Rosas, Longnose gar *(Lepisosteus osseus)*, Upper San Antonio River Basin

Figure 1911-13: *Adult Apple Snail, Upper San Antonio River*

Figure 1911-14: *Apple Snail clutch of eggs*

Figure 1901-1: FY2019 Coordinated Monitoring in the Lower San Antonio River

Segment 1901 – Lower San Antonio River

SEGMENT DESCRIPTION

The Lower San Antonio River (LSAR) starts from the confluence with the Guadalupe River in Refugio/Victoria County to a point 600 meters (660 yards) downstream of FM 791 at Mays crossing near Falls City in Karnes County. Segment 1901 is 153 miles long and has a watershed of approximately 1,628 square miles. See Table 1901-1 for the stations and number of sampling events collected between September 2018 and August 2019. In the table, red text identifies biased season sampling events.

The segment receives flows from two upstream segments: The Upper San Antonio River (USAR), Segment 1911, and Lower Cibolo Creek, Segment 1902. A very small edge of this watershed east of the Cibolo and San Antonio River confluence is in the Blackland prairie ecoregion. Most of the watershed is in the East Central Texas Plains. This ecoregion is also known as the South Texas Brush Country. This region has shallow clay and sandy loam soils, which are gently sloping to level. The predominant land use is grazing and crop production. Originally, this area was a post oak savanna; however, mesquite, acacia and prickly pear cactus are now more common. At the southern end of the watershed is the Western Gulf Coastal Plains. The watershed has an average yearly rainfall of 28 to 40 inches. The soils in this ecoregion are nearly level sands and sandy loams. Unclassified segments of the USAR assessed in the 2018 Integrated Report include:

- Segment 1901A Escondido Creek
- Segment 1901B Cabeza Creek
- Segment 1901C Hord Creek
- Segment 1901D Lost Creek
- Segment 1901E Manahuilla Creek
- Segment 1901F Ecleto Creek

See Table 1901-2 for Site-Specific Uses and Criteria for Segment 1901.

HYDROLOGIC CHARACTERISTICS

According to the United States Geological Survey Current Streamflow Conditions for Texas, accessed on December 10, 2019:

- The 85-year median flow at USGS gage 08188500 San Antonio River at Goliad, TX, is 359 cubic feet per second (cfs), with a flow range of 74 (1955) to 4310 (2017) cfs.
- The 14-year median flow at USGS gage 08188570 San Antonio River near McFaddin, TX, is 403 cfs, with a flow range of 145 (2013) to 8230 (2017).

Although there are many USGS gage stations located throughout the LSAR basin, the two gage stations mentioned above are long term stations SARA utilizes to obtain quick and big picture flow trends in the upper and lower portions of the LSAR. The Lower San Antonio River Total Maximum Daily Load indicates that the groundwater in the watershed is primarily associated with the Gulf Coast and Carrizo-Wilcox aquifer systems. The Gulf Coast Aquifer outcrop dominates the central and eastern portions of the study area. The maximum sand thickness of this aquifer ranges from 700 feet to 1,300 feet. The deeper part of The Carrizo-Wilcox covers the northwestern border of Karnes County. Sand and gravel layer in this aquifer range from less than 200 feet to 3,000 feet in thickness.

IMPAIRMENT/AREA OF INTEREST

Segment 1901 is identified in the 2018 TCEQ Integrated Report as being a freshwater perennial stream with a high aquatic life use designation. The LSAR is not classified for domestic water supply use. Like all segments in the San Antonio River Basin, this segment is designated for primary contact recreation. Primary contact includes activities presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Impairments and concerns in Segment 1901 include:

LOWER SAN ANTONIO RIVER

- **Assessment Unit 1901_01:** Concern for chlorophyll-a, nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901_02:** Impaired for bacteria and fish community; concern for habitat, chlorophyll-a, nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901_03:** Concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901_04:** Impaired for bacteria; concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901_05:** Concern for fish community, habitat, nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901_06:** Concern for chlorophyll-a, nitrate nitrogen, and total phosphorus.

UNCLASSIFIED SEGMENTS OF THE LOWER SAN ANTONIO RIVER

- **Assessment Unit 1901A_01:** Impaired for bacteria; concern for nitrate nitrogen and total phosphorus.
- **Assessment Unit 1901B_01:** Impaired for bacteria.
- **Assessment Unit 1901C_01:** No Impairments or Concerns (Limited Data).
- **Assessment Unit 1901B_01:** No Impairments or Concerns (Limited Data).
- **Assessment Unit 1901E_01:** Concern for bacteria.
- **Assessment Unit 1901F_01:** Impaired for dissolved oxygen minimum level: concern for dissolved oxygen screening level and chlorophyll-a.

Details of the impairments and concerns for the LSAR Watershed, as identified in the TCEQ 2018 Integrated Report, can be seen in Table 1901-3 and 1901-4. A map of impairments and concerns can be seen in Figure 1901-2.

LAND USE AND COVER

The LSAR, Segment 1901, is located primarily in Karnes and Goliad counties. The Upper and Lower San Antonio River division is at Mays Crossing near the Wilson/Karnes county line. As the LSAR flows southeast, it forms the boundary between Refugio and Victoria Counties before reaching its confluence with the Guadalupe River near San Antonio Bay. Urban areas account for only 4.28 percent of the watershed and are mainly centered around the cities of Kenedy, Karnes City, Goliad, and Runge. Forests and shrublands account for 47.6 percent of the watershed, and wetlands, open water and barren land account for 21.8 percent. Hay, pasture, and cultivated crops account for 50 percent of the watershed.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority's GIS Department, and includes National Land Cover Database (NLCD) 2016 data created by the Multi_Resolution Land Characteristics Consortium, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality. See Figure 1901-3 for more detail. According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls Viewer there are five permitted dischargers with a total of 6 outfalls in Segment 1901. See Table 1901-5 for details. Permittees maybe listed more than once to identify the total number of discharge outfalls in their jurisdiction. Specific outfall names are not identified in the TCEQ Outfalls Viewer.

POSSIBLE CAUSES OF IMPAIRMENT AND CONCERNS

Fish Impairment and Habitat Concerns: The LSAR, Segment 1901_02, was first identified as having a fish community impairment and habitat concern in the 2012 TCEQ Integrated Report. Given the expansive nature and lack of micro habitat types within this assessment unit, together with limited public access points, obtaining a representative sample has proven to be difficult. Station 12791 San Antonio River at US 77A in Goliad, is characterized as having poor habitat, with one big glide with no pools, runs or riffle habitats. Examination of data collected at this station identify a fish community structure with low species diversity with and no intolerant species (pollution sensitive) collected throughout the study area. To determine if the fish community impairment and habitat concern in 1901_02 is due to a site-specific limitation rather than to a pollutant, beginning in 2014, Station 12791 San Antonio River at US 77A in Goliad was replaced with Station 12792 San Antonio River at Southern Pacific Rail Road Bridge in Goliad. Although there is limited data available for Station 12792, the 2018 Integrated Report shows slight improvement in the fish community scores. The biological event collected in August of 2019 indicates the fish community met the high aquatic life use, which included the documentation of 24 individual species and two intolerant species, the Mimic Shiners (Notropis volucellus) and Texas logperch (Percina carbonaria). It is hoped this trend continues.

Bacteria Impairment: The Lower San Antonio River was first identified as impaired for not supporting the primary contact recreation use in the 2000 Texas Water Quality Inventory and 303(d) List. In 2006, the TCEQ contracted with James Miertschin and Associates Inc. to develop a TMDL on the Lower San Antonio River. The final TMDL report, **One Total Maximum Daily Load for Bacteria in the Lower San Antonio River**, identifies possible point and nonpoint sources of bacteria, and quantified the appropriate reductions necessary to comply with established standards for water quality. The goal of the TMDL was to determine the maximum bacteria loading the stream can receive and still support the contact recreation use. Indicator bacteria such as E. coli, although not generally pathogenic, indicate a possible risk to public health. The TCEQ used analyses of flow and load duration curves (LDCs) in the development of the TMDL. The TCEQ adopted the TMDL on August 20, 2008. The EPA approved the TMDLs on October 20, 2008, at which time they became part of the state's Water Quality Management Plan. The TMDL report identified possible sources or causes of contamination, including:

- Discharges from wastewater treatment facilities (WWTFs)
- Stormwater runoff from both the urban and non-urban landscapes
- Wildlife, pet, livestock, and other warm-blooded animal fecal deposition
- Leaking sewer infrastructure
- Failing septic systems

POTENTIAL STAKEHOLDERS

- City of San Antonio
- City of Karnes
- City of Kenedy
- City of Goliad
- City of Runge
- Landowners
- Texas A&M AgriLife Extension Service
- Texas Parks and Wildlife Department
- Natural Resource Conservation Service
- Texas State Soil and Water Conservation Board
- Goliad County Groundwater Conservation District
- Karnes County Groundwater Conservation District
- Goliad County Soil and Water Conservation District
- Karnes County Soil and Water Conservation District
- Texas Department of Agriculture
- US Fish and Wildlife Service

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

SARA should continue routine, biological and stormwater monitoring and provide quality assured data to TCEQ for assessment. SARA should also work with partners to implement and monitor best management practices identified in the Lower San Antonio River TMDL's and TMDL Implementation Plan for Bacteria in the Lower San Antonio Watershed.

In the 2018 Integrated Report, the average bacterial geometric mean for the two impaired assessment units (1901_02 and 1901_04) of the LSAR is 181 E. coli/100mL; only 55 E. coli colonies above the State's criterion of 126 E. coli/100mL. Efforts associated with the LSAR I-Plan are expected to restore, maintain, and improve water quality in the watershed. The LSAR fish community impairments are most likely due to limited microhabitats within the sample reach at Station 12791 San Antonio River at US 77A in Goliad, including limited riparian habitat, silty and sandy substrate, and extensive runs and glides. In the 2014 monitoring year, biological collection events were moved and are currently maintained at Station 12792 San Antonio River at Southern Pacific Railroad Bridge in Goliad. Although it is anticipated the fish community will continue to improve over time, because the Lower San Antonio River is an expansive watershed covering approximately 1,214 square miles, SARA will continue to look for additional biological sampling sites. It is also recommended that SARA continue routine and biological monitoring to provide quality assured data to TCEQ for assessment.

MAJOR WATERSHED EVENTS

Escondido Creek Parkway: Escondido Creek is a tributary of the San Antonio River in Karnes County. Over the last few years, SARA and the City of Kenedy have worked together to acquire a 1.25 mile stretch along Escondido Creek within the City limits for the purpose of creating a public park for its citizens. This parkway will serve the community by enhancing recreational opportunities while simultaneously preserving the creek. In 2016, SARA held a series of public meetings for the Escondido Creek Parkway Project to establish a vision of what the park could look like. The vision served as a guide to the development of a Master Plan. The linear park will connect Kenedy's City Park with the downtown district, allowing park users to directly access recreational areas without crossing US 181. Future residential development to the north will also be able to connect to the Parkway via the historic San Antonio and Aransas Pass railway bed. The Escondido Creek Parkway extends from the Joe Gully City Park to 5th Street, approximately 1.25 miles.

The project will be completed in phases. Phase I included the acquisition of property for the parkway. Phase II included planning and design of hike and bike trails, pavilion, playground, and other amenities. Development of a park in downtown Kenedy serves as a trailhead for the Parkway. There will also be Low Impact Development (LID) features and rainwater harvesting included in the design. Phase III is the construction phase. In 2017, SARA established the Escondido Creek Oversight Committee. This committee consists of representatives from the City of Kenedy, the 4B Corporation, the Chamber of Commerce, the Kenedy School Board, Kenedy Parks and Recreation Board, the San Antonio River Foundation and SARA. The purpose of the committee is to be ambassadors offering feedback to ensure the community is represented throughout the Escondido Creek Parkway Project.

Groundbreaking for the Escondido Creek Parkway project began on December 20, 2018. This includes the hike and bike trail, playground, splash pad, amphitheater and skate park. The parkway is expected to be open in the summer of 2020. The maintenance of the parkway will be carried out by SARA. This is the first linear park in Karnes County. This project will give the community many opportunities to get out and enjoy the creek.

PROJECTS IN THE LOWER SAN ANTONIO RIVER WATERSHED

In April 2006, the TCEQ initiated the **Lower San Antonio River TMDL**. In response to the TMDL, the Texas State Soil and Water Conservation Board (TSSWCB), District 3, and local landowners expressed interest in addressing the bacteria impairment in the LSAR. The TMDL identified grazing livestock as one of the potential sources of bacteria. In partnership with Karnes and Wilson Counties and funding provided by the Texas State Soil and Water Conservation Board (TSSWCB), U.S. Environmental Protection Agency (EPA), and with Environmental Quality Incentives Program (EQIP) funding provided by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) voluntary conservation plans and water quality management plans (WQMPs) were developed and implemented in ranches in the watershed. **Water quality**

monitoring data as a result of the WQMPs indicated the long-term E. coli geometric means were meeting the state water quality standard for primary contact recreation in several assessment units of the Lower San Antonio River. The applicable water quality standard requires that the geometric mean of E. coli not exceed 126 colony-forming units per 100 milliliters (cfu/100 mL). As a result of these efforts LSAR assessment units 1901_01 and 1901_05 were removed from the 2014 TCEQs 303(d) List of Impaired Water bodies.

In addition to the WQMPs, the TCEQ TMDL Program contracted with Texas A&M AgriLife Research to work with stakeholders to develop the **Implementation Plan for Five Total Maximum Daily Loads for Bacteria in the Lower San Antonio River Watershed Segment 1901 Assessment Units 1901_01, 1901_02, 1901_03, 1901_04, 1901_05**. The Lower San Antonio River Implementation Plan (LSAR I-Plan) describes the steps the watershed stakeholders and the TCEQ would take toward achieving pollutant reductions identified in the original TMDL report and outline the schedule for implementation activities. The ultimate goal of the LSAR I-Plan is to restore the primary contact recreation uses in Segment 1901 by reducing concentrations of bacteria to levels established in the 2008 LSAR TMDL. The original TMDL document was based on segment units (Segment 1901) but the TCEQ program now uses individual assessment units within segments. Although the LSAR I-Plan focuses on the five impaired TMDL Assessment Units within the segment, some information covers the entire LSAR watershed. On August 8, 2018, the TCEQ approved the LSAR I-Plan.

The LSAR I-Plan contain management measures designed to guide activities that will improve water quality, identify and describe Best Management Plans (BMP) that will be implemented and tracked to reduce bacteria in the watershed, and establish a timeline for implementation. Follow-up tracking and monitoring plans are also included to determine the effectiveness of the BMPs. The ultimate goal is to meet primary contact recreation uses in the identified assessment units. Some of the Management Measures in the LSAR I-Plan include:

- Develop and implement conservation plans in priority areas of the watershed; educate landowners on appropriate stocking rates and grazing plans. Remove and manage feral hogs.
- Promote the reduction of illicit dumping and proper disposal of wastes; utilize SARA's Environmental Investigators.
- Coordinate and expand existing water quality monitoring in the watershed.
- Explore re-designation of the flow type for Cabeza Creek.
- **SARA Feral Hog Management Project:** In 2015 the San Antonio River Authority partnered with Texas A&M AgriLife Extension (AgriLife) and the Texas Wildlife Services (TWS), a division of the United States Department of Agriculture (USDA), Plant and Animal Health Index (PHIS) to create and host a series of hands-on workshops in the district, as well as offer landowners in the district assistance with feral hog management. Feral hogs are a concern for SARA, because hogs can impact water quality and are often drawn to riparian habitats for the abundance of resources offered there. In 2015, three workshops were held, reaching 319 landowners, land managers, and government officials. In 2016, four workshops were held, reaching 365 landowners. Topics at these workshops included feral hog biology, agricultural

regulations regarding feral hog control, transportation regulations and disease, population dynamics and research, and novel techniques and recent technology for management. Two wildlife technicians were hired to work in Bexar, Wilson, Karnes, and Goliad counties using a variety of removal methods such as corral traps, aerial gunning, and infrared equipment. In 2015 TWS partnered with over 35 landowners to actively trap hogs from public and private property removing 1,099 hogs from Bandera, Bexar, Wilson, Karnes, and Goliad counties combined. In 2016, TWS partnered with over 62 landowners to actively trap hogs from public and private property removing 1,447 hogs from Bandera, Bexar, Wilson, Karnes, and Goliad counties combined. Although there are many hog trap designs, larger corral traps are effective at capturing larger groups of hogs and can be moved to different locations as needed. Corral traps are made with several 20 by 5-foot cattle panels, steel T-posts, and are simple and are relatively affordable to create. The most complicated and expensive part of the trap is the gate where the hogs enter the trap. As such, SARA has 20 loaner gates purchased for a gate loaner program. As of August 22, 2019, 12 are out in the field with landowners and eight are out in the field with the USDA-APHIS-TWS technician who was hired as part of the effort.

Figure 1901-1a: Feral Hog Management Project

OTHER PROJECTS AND EFFORTS

In 2012, ConocoPhillips collaborated with other oil and natural gas companies and the South Texas Energy and Economic Roundtable (STEER) to form the "Keep South Texas Roads Clean" program in response to the growing amount of roadside trash on highways. The initiative began with a crew and trash truck spending about 50 hours per week in Karnes and DeWitt counties. The program also partners with the DeWitt County tire recycling program to recycle discarded rubber and metal for other products.

In its first full year of operation, the truck collected 70,000 pounds of trash. Today, the truck has collected more than 450,000 pounds of trash that might have otherwise washed off into the Lower San Antonio River and its tributaries during rainfall events. ConocoPhillips continues to sponsor the program in partnership with Ensign Natural Resources, EOG Resources and Marathon Oil.

Figure 1901-1b: *Trash crew keeping the roads clean in the Lower San Antonio River Watershed (picture courtesy of ConocoPhillips)*

Figure 1901-1c: *Keep South Texas Roads Clean Program (picture courtesy of ConocoPhillips)*

Cabeza Creek Flow Type Re-Classification Effort: Cabeza Creek is a tributary of the San Antonio River that joins with the main stem approximately 6.2 miles west of Goliad, Texas, in Goliad County. The 2014 Texas Integrated Report describes Cabeza Creek flow type as intermittent with perennial pools. Data assessed in the Integrated Report indicates Cabeza Creek is not supporting the primary recreational use designation due to elevated levels of E. coli. During LSAR I-Plan process, stakeholders expressed concerns that there are no perennial pools throughout the creek and the bacterial impairment inaccurately represented the extent of impaired waters. In response to stakeholder comments, SARA initiated the Cabeza Creek Flow Type Re-Classification effort. The purpose of the effort is to accurately describe the flow type of Cabeza Creek and identify any breaks in flow type throughout the segment. SARA conducted bimonthly monitoring, every other month, between September 2017 and August 2018 at four stations throughout the Cabeza Creek Watershed. Field measurements and, if possible, instream flow measurements were collected. Results of the yearlong effort indicate Cabeza Creek's flow is intermittent with pools from the San Antonio River confluence to Station 16992 Cabeza Creek at FM 2043 and intermittent from Station 16692 through the rest of the waterbody. SARA submitted the data to the TCEQ and continues to conduct routine monitor at Station 16692 in support of the LSAR I-Plan.

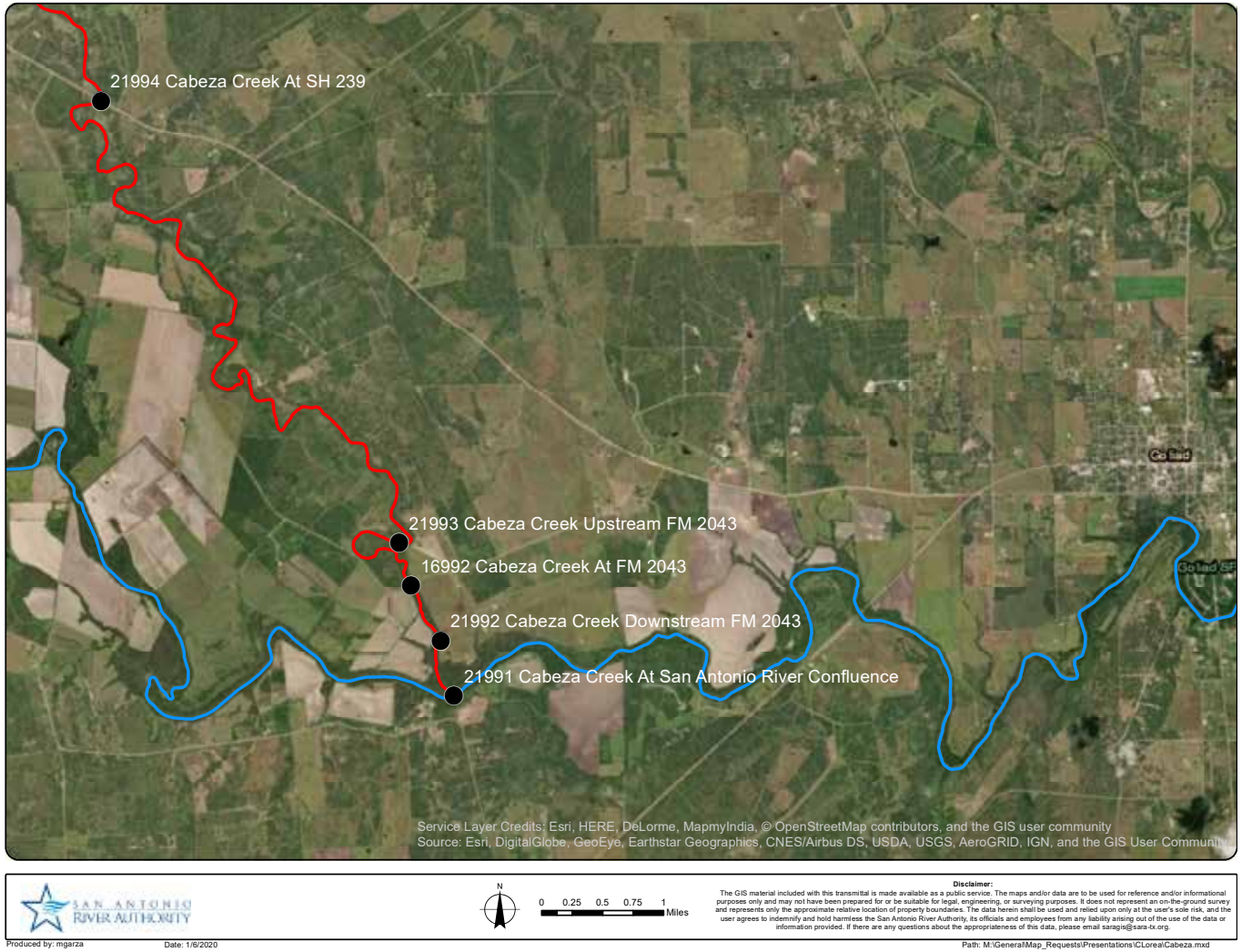

Figure 1901-1d: Cabeza Creek Flow Type Re-Classification Monitoring Stations

Table 1901-1: 2019 Coordinated Monitoring Schedule for Segment 1901 - Lower San Antonio River														
Seg_AU	Station Number	TCEQ Station Description	Collection Entity	Monitoring Type	24 Hour DO	Habitat	Benthic	Nekton	Metals in Water	Conventional	Bacteria	Flow	Field
1901_06	12789	SAN ANTONIO RIVER AT US 77 ON REFUGIO-VICTORIA COUNTY LINE	SARA	RT					3	6	6	6	6
1901_01	12790	SAN ANTONIO RIVER FM 2506 EAST OF FANNIN	GBRA	RT						12	12	12	12
1901_02	12791	SAN ANTONIO RIVER BRIDGE ON US 77-A AND 183 SOUTHEAST OF GOLIAD	SARA	RT					3	6	52	52	6
1901_02	12792	SAN ANTONIO RIVER AT SOUTHERN PACIFIC RR BRIDGE IN GOLIAD	SARA	BS	2	2		2				2	2
1901_03	12793	SAN ANTONIO RIVER AT SH 239 WEST OF CHARCO	SARA	RT						6	6		6
1901_04	12794	SAN ANTONIO RIVER AT SH 72 NEAR RUNGE	SARA	RT					3	6	52	6	6
1901_05	12795	SAN ANTONIO RIVER AT SH 80 SW OF HELENA	SARA	RT						6	6		6
1901_05	16580	SAN ANTONIO RIVER AT CONQUISTA CROSSING 2.4 KM DOWNSTREAM OF FM 791 SW OF FALLS CITY	SARA	BS/RT	2	2		2		6	6	6	6
1901_03	17859	SAN ANTONIO RIVER AT NORTH RIVERDALE RD 15 KM WEST OF GOLIAD TEXAS	SARA	RT						6	6	6	6
1901_05	17862	SAN ANTONIO RIVER IMMEDIATELY UPSTREAM OF US 181 0.5 KM SOUTHEAST OF FALLS CITY TEXAS	SARA	RT						6	6		6
1901A_01	18402	ESCONDIDO CREEK AT KARNES CR 331	SARA	RT						6	6	6	6
1901F_01	20539	ECLETO CREEK AT FM 81 424 METERS EAST AND 103 METERS NORTH TO THE INTERSECTION OF KARNES CR 334 AND FM 81	SARA	BS/RT	2					6	6	6	6

Site-Specific Uses and Criteria for Segment 1911 - Upper San Antonio River and Tributaries																			
		Uses			Criteria										Nutrient Screening Levels				
Segment	Segment Name	Recreation	Aquatic Life Use	Domestic Water Supply	Chloride (mg/L)[4]	Sulfate (mg/L)[4]	Total Dissolved Solids (mg/L)[4]	Dissolved Oxygen Grab Screening Average (mg/L)	Dissolved Oxygen Grab Minimum(mg/L)	24 Hour Dissolved Oxygen Average (mg/L)	24 Hour Dissolved Oxygen Minimum (mg/L)	pH Range (SU)[4]	Temperature[1,4] (°C)	*E. coli* geomean[3] (CFU/100ml)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Ortho Phosphorus (mg/L)	Total Phosphorus (mg/L)	Chlorophyll-a (µg/L)[4]
1901	Lower San Antonio River	PCR1	High	--	180	140	750	5.0	3.0	5.0	3.0	6.5-9.0	32.2	126	0.33	1.95	0.37	0.69	14.1
1901A	Escondido Creek	PCR1[2]	High	--	--	--	--	5.0	3.0	5.0	3.0	--	--	126	0.33	1.95	0.37	0.69	14.1
1901B	Cabeza Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1901C	Hord Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1901D	Lost Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--
1901E	Manahuilla Creek	PCR1[2]	Minimal	--	--	--	--	2.0	1.5	2.0	1.5	--	--	126	0.33	1.95	0.37	0.69	--
1901F	Ecleto Creek	PCR1[2]	Limited	--	--	--	--	3.0	2.0	3.0	2.0	--	--	126	0.33	1.95	0.37	0.69	--

1 Temperature was converted from °F to °C, the criteria for temperature are listed as maximum values at any site within the segment.

2 For unclassified waterbodies not specifically identified in the TSWQS, a primary contact recreation 1 is the presumed use except where site-specific information indicates that recreational activities that involve a significant risk of ingestion have little to no likelihood of occurring.

3 The indicator bacteria for freshwater is *E. coli* .

4 Water temperature, pH, chloride, sulfate, TDS and chlorophyll *a* criteria developed for classified segments do not apply to unclassified water bodies.

TCEQ 2018 Texas Integrated Report: Impairments and Concerns for Segment 1901 - Lower San Antonio River															
Segment Name	**Seg_AU**	**Designated Use**	**Method**	**Parameter Description**	**Criteria**	**# of Samples Assessed**	**Mean or Geomean of Samples Assessed**	**# of Samples Exceeding Criteria**	**Mean of Samples Exceeding Criteria**	**Data Set Qualifier**	**Integrated Level of Support**	**Data Carried Forward**	**Impairment Category**	**Is there an EPA approved TMDL**
Lower San Antonio River	1901_01	General Use	Nutrient Screening Levels	Chlorophyll-*a*	14.10	80	---	22	42.75	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	81	---	77	6.76	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	81	---	50	1.01	AD	CS	---	---	---
	1901_02	Aquatic Life Use	Fish Community	Fish Community	42.00	6	36.00	---	---	TR	**NS**	YES	5c	---
		Aquatic Life Use	Habitat	Habitat	20.00	6	16.00	---	---	TR	CS	---	---	---
		Recreation Use	Bacteria Geomean	*E. coli*	126	362	177.47	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Chlorophyll-*a*	14.10	45	---	12	39.25	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	67	---	65	7.65	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	67	---	39	1.10	AD	CS	---	---	---
	1901_03	General Use	Nutrient Screening Levels	Nitrate	1.95	125	---	122	7.97	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	125	---	81	1.07	AD	CS	---	---	---
	1901_04	Recreation Use	Bacteria Geomean	*E. coli*	126	64	184.47	1	---	AD	**NS**	---	4a	YES
		General Use	Nutrient Screening Levels	Nitrate	1.95	64	---	62	8.55	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	64	---	45	1.11	AD	CS	---	---	---
	1901_05	Aquatic Life Use	Fish Community	Fish Community	42.00	7	32.00	---	---	TR	CN	---	---	---
		Aquatic Life Use	Habitat	Habitat	20.00	7	19.00	---	---	TR	CS	---	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	189	---	187	10.05	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	189	---	139	1.20	AD	CS	---	---	---
	1901_06	General Use	Nutrient Screening Levels	Chlorophyll-*a*	14.10	---	---	---	---	ID	CS	YES	---	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	---	---	---	---	ID	CS	YES	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	---	---	---	---	ID	CS	YES	---	---

Dataset Qualifier Codes
AD =Adequate Data (10 or more samples)
LD = Limited Data (less than 9, greater than 3 samples)
ID = Inadequate Data (less than 4 samples)
TR = Temporally Not Representative

Integrated Level of Support (Int LOS) = Integrated level of support. This is the overall level of support for this use, method, and parameter group:
CS= Screening level concern **CN**=Use Concern
NS=Not Supporting **NA=**Not Assessed
--- = Data not necessary or unavailable

Impairment Category
4a = All TMDLs have been completed and approved by EPA
5a = TMDLs are underway, scheduled, or may be scheduled for one or more parameters.
5c = Indicating that additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected.
TMDL= Indicates if there is an EPA Approved TMDL in Place.

TCEQ 2018 Texas Integrated Report: Impairments and Concerns for Segment 1901 - Lower San Antonio River Unclassified Water Bodies														
Segment Name	**Seg_AU**	**Designated Use**	**Method**	**Parameter Description**	**Criteria**	**# of Samples Assessed**	**Mean or Geomean of Samples Assessed**	**# of Samples Exceeding Criteria**	**Mean of Samples Exceeding Criteria**	**Data Set Qualifier**	**Integrated Level of Support**	**Data Carried Forward**	**Impairment Category**	**Is there an EPA approved TMDL**
Escondido Creek	1901A_01	Recreation Use	Bacteria Geomean	*E. coli*	126	60	765.47	1		AD	**NS**	---	5c	---
		General Use	Nutrient Screening Levels	Nitrate	1.95	55		42	12.63	AD	CS	---	---	---
		General Use	Nutrient Screening Levels	Total Phosphorus	0.69	55		53	2.37	AD	CS	---	---	---
Cabeza Creek	1901B_01	Recreation Use	Bacteria Geomean	*E. coli*	126	16	328.17	1		LD	**NS**	---	5c	---
Hord Creek	1901C_01	No Impairments or Concerns (Limited Data)												
Lost Creek	1901D_01	No Impairments or Concerns (Limited Data)												
Manahuilla Creek	1901E_01	Recreation Use	Bacteria Geomean	*E. coli*	126	13	129.72	1		LD	CN	YES	---	---
Ecleto Creek	1901F_01	Aquatic Life Use	Dissolved Oxygen grab screening level	Dissolved Oxygen grab	3.00	24	---	11	1.83	AD	CS	---	---	---
		Aquatic Life Use	Dissolved Oxygen grab minium level	Dissolved Oxygen grab	2.00	24	---	6	1.12	AD	**NS**	---	5c	---
		General Use	Nutrient Screening Levels	Chlorophyll-*a*	14.10	25	---	12	37.00	AD	CS	---	---	---

Dataset Qualifier Codes
AD =Adequate Data (10 or more samples)
LD = Limited Data (less than 9, greater than 3 samples)
ID = Inadequate Data (less than 4 samples)
TR = Temporally Not Representative

Integrated Level of Support (Int LOS) = Integrated level of support. This is the overall level of support for this use, method, and parameter group:
CS= Screening level concern **CN**=Use Concern
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5c = Indicating that additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected.
TMDL= Indicates if there is an EPA Approved TMDL in Place.

Municipal and Industrial Wastewater Outfalls in Segment 1911 - Lower San Antonio River		
Permittee	**Status**	**Type**
CITY OF FALLS CITY	Current Permit	Domestic
CITY OF GOLIAD	Current Permit	Domestic
CITY OF KARNES CITY	Current Permit	Domestic
CITY OF KENEDY	Current Permit	Wastewater
SOUTH CENTRAL WATER CO	Current Permit	Domestic
CITY OF KENEDY	Current Permit	Wastewater
Domestic: Less than 1 Million Gallon per Day domestic sewage. **Wastewater:** Greater than or equal to 1 MGD domestic sewage or process water including water treatment plant discharge.		

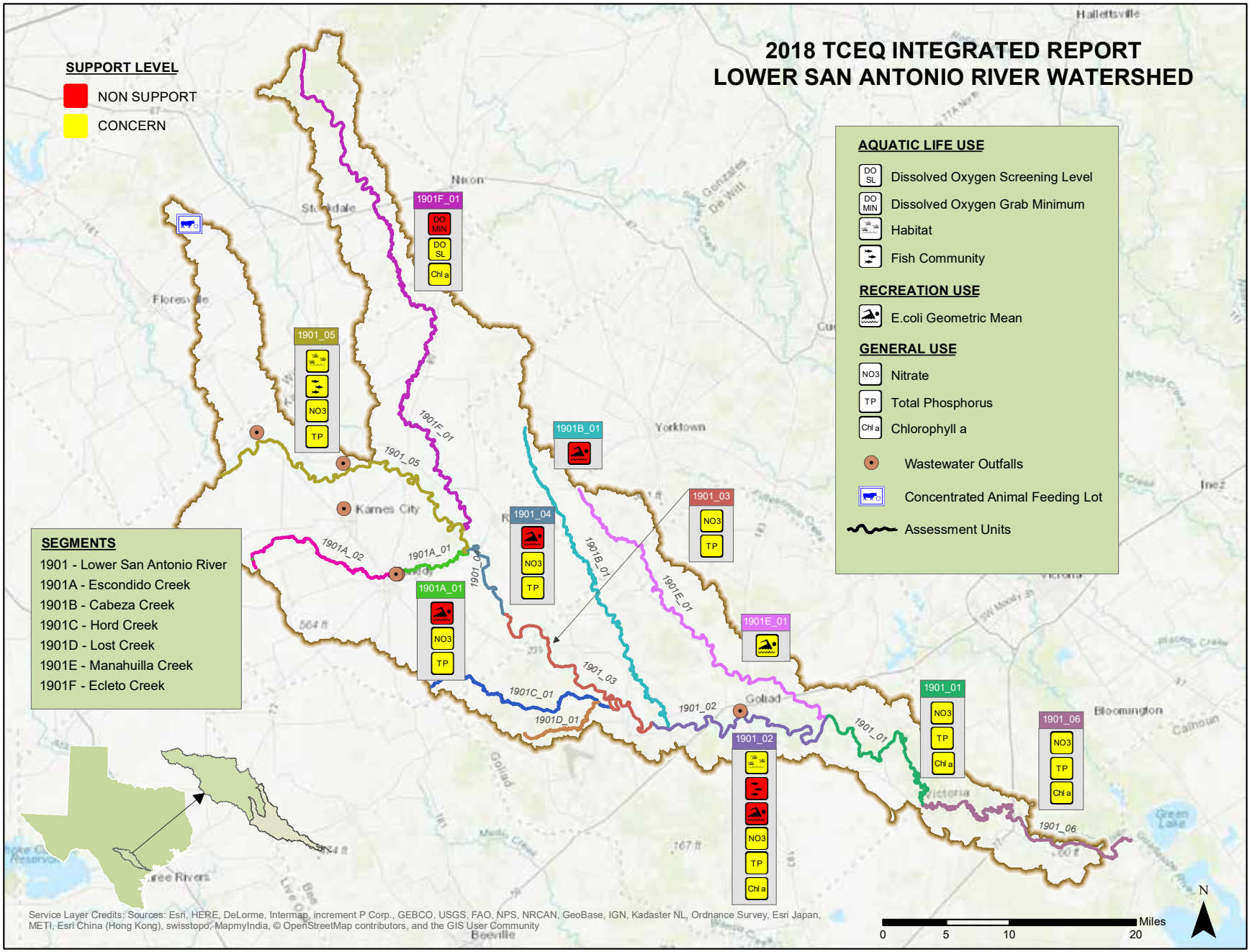

Figure 1901-2: 2018 Impairments and Concerns in the Lower San Antonio River Watershed

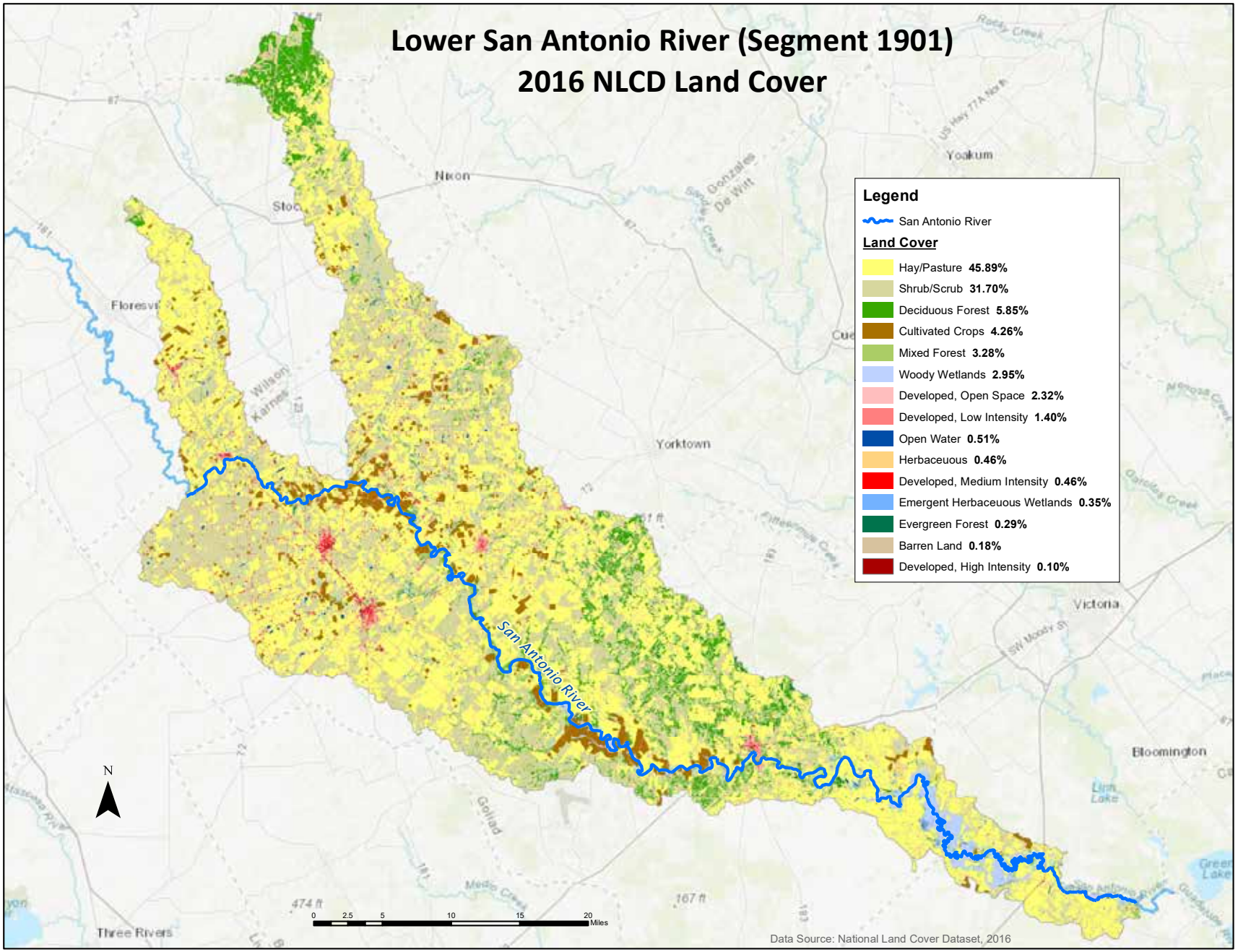

Figure 1901-3: Land Cover Map for the Lower San Antonio River Watershed

Fig 1901-4: 2019 ESD Intern Carly Martinez, Flathead catfish *(Pylodictis olivaris)*

IMAGES

Figure 1901-5: *Station 12792 LSAR the Southern Pacific RR Bridge, Goliad*

Figure 1901-6: *Station 16580 SAR at Conquista Crossing*

Fig 1901-7: *12790 Lower San Antonio River at SH 239 West of Charco*

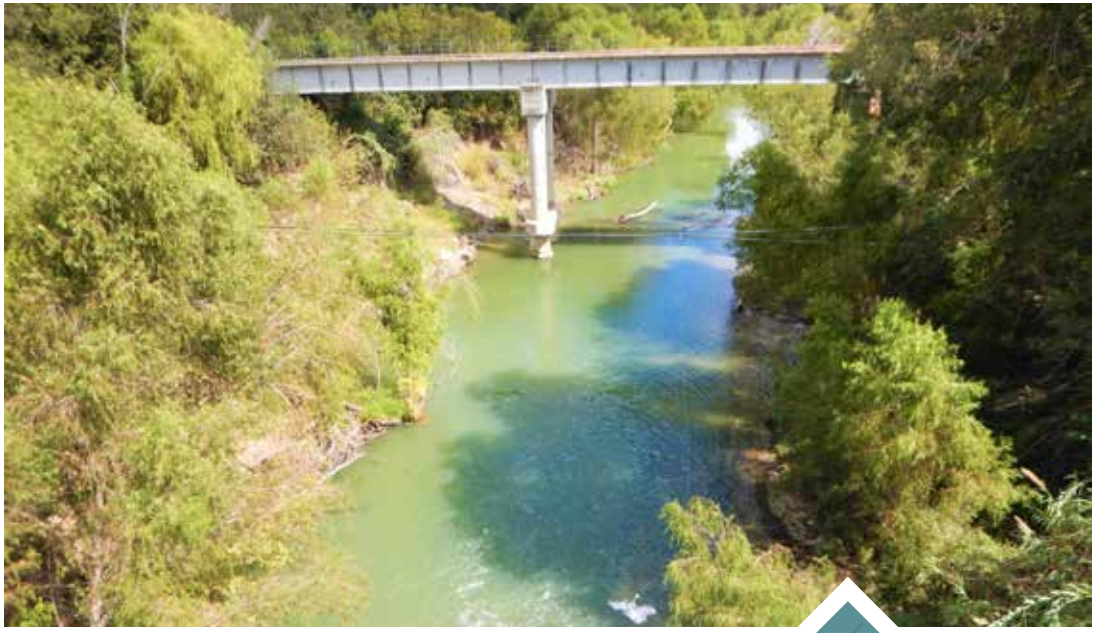

Fig 1901-8: *12795 LSAR at SH 72 near Runge*

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Front Cover: *Texas Logperch (Percina carbonaria); March 2019 Mission Reach Intensive Survey: First ever captured, documented and released Logperch in the upper portion of the Upper San Antonio River. The Logperch is very pollution intolerant fish species. Presence of this species indicates good water quality.*

Back Cover: *San Antonio River Mission Reach at dusk.*