

Recreational Use Attainability Analysis for
Kickapoo Creek in Henderson County (0605A),
the Neches River Above Lake Palestine (0606),
Prairie Creek (0606A), Mud Creek (0611C), and
West Mud Creek (0611D)
in the Neches River Basin

Prepared for:
Texas State Soil and Water Conservation Board
Project 14-52

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TR1503
September 2015

Acknowledgements

Funding for this project was provided through a Texas State Soil and Water Conservation Board (TSSWCB) State General Revenue Nonpoint Source Grant, project number 14-52, Recreational Use Attainability Analysis for Ten Creeks in the Red River and Neches River Basins. This project was sponsored by the TSSWCB through Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in Stephenville, Texas.

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CHAPTER 1

INTRODUCTION

Problem Statement

The Neches River Above Lake Palestine, Kickapoo Creek in Henderson County, Prairie Creek, Mud Creek, and West Mud Creek are water bodies located in primarily rural watersheds within the Neches River Basin (Table 1.1 and Figure 1.1). All are unclassified waterbodies, except the Neches River Above Lake Palestine (Segment 0606). These water bodies are listed on the 2012 Texas 303(d) list as impaired for primary contact recreation due to elevated bacteria concentrations (TCEQ, 2013).

- Kickapoo Creek in Henderson County (0605A) extends from the confluence of Lake Palestine northwest to the confluence with an unnamed tributary about 1 mile north of Farm-to-Market (FM) 858 in Van Zandt County. The watershed stretches between Van Zandt and Henderson Counties, and includes portions of the cities of Edom, Murchison, Chandler, and Brownsboro. See chapter 3 for a complete overview of Kickapoo Creek (0605A).
- Neches River Above Lake Palestine (0606) extends from the northeast arm of Lake Palestine about 1.4 miles downstream of State Highway (SH) 31 upstream to Rhines Lake Dam in Van Zandt County. The watershed encompasses the City of Van and portions of the City of Chandler. A full description of the watershed is presented in chapter 4.
- Prairie Creek (0606A) extends from the confluence with the Neches River in Smith County to about 0.4 miles downstream of US 69 south of the City of Lindale. The Prairie Creek watershed encompasses the cities of Lindale and Tyler.
- Mud Creek (0611C) flows from the confluence with the Angelina River in Cherokee County about 2,000 ft from the confluence with Blackhawk Creek northwest of Troup in Smith County. The Mud Creek watershed is the largest of the five watersheds. It encompasses the cities of Reklaw, Gallatin, New Summerfield, Jacksonville, Troup, Whitehouse, Arp, New Chapel Hill, and portions of the City of Tyler (chapter 6).
- West Mud Creek (0611D) extends from the confluence with Mud Creek in Cherokee County to about 0.2 miles upstream of the northern most crossing of US 69 in the City of Tyler in Smith County. The West Mud Creek watershed encompasses minimal portions of the cities of Bullard and Whitehouse and a large portion of the city of Tyler. A more in depth description of the West Mud Creek watershed is presented in chapter 7.

The project's classified segment and unclassified water bodies have a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2014). Prior to June 2010 only two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the Texas Commission on Environmental Quality (TCEQ) adopted revisions to the

TSWQS that expanded the designation of contact recreation into three categories (primary contact recreation, secondary contact recreation 1, and secondary contact recreation 2) based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30 Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010). As a result of these revisions to the TSWQS, all waterbodies listed as impaired based on bacteria for contact recreation are scheduled to undergo a standards review to determine if primary contact recreation is appropriate or if a revision to the recreation use category should be considered for the water body.

Table 1.1 Water bodies targeted for RUAAs

TCEQ ID	WaterBody Name	Water Body Description	Stream Type	Listed Assessment Miles	Watershed Area (Acres)
0605A	Kickapoo Creek in Henderson County	From the confluence of Lake Palestine east of Brownsboro in Henderson County upstream to confluence with unnamed tributary about 1 mile north of FM 858 in Van Zandt County	Intermittent with pools	41	178,000
0606	Neches River Above Lake Palestine	From a point 1.4 miles downstream of SH 31 in Henderson County/Smith County to Rhines Lake Dam in Van Zandt County	Perennial	33	90,100
0606A	Prairie Creek	From the confluence with the Neches River to an unnamed tributary about 0.4 miles downstream of the US 69 bridge crossing south of the City of Lindale	Perennial	11.8	57,300
0611C	Mud Creek	From the confluence with Angelina River upstream about 2,000 feet from the confluence with Blackhawk Creek northwest of Troup in Smith County	Perennial	56	502,000
0611D	West Mud Creek	From the confluence with Mud Creek in Cherokee County to about 0.2 miles upstream of the northern most crossing of US 69 in the City of Tyler in Smith County	Perennial	22.5	59,200

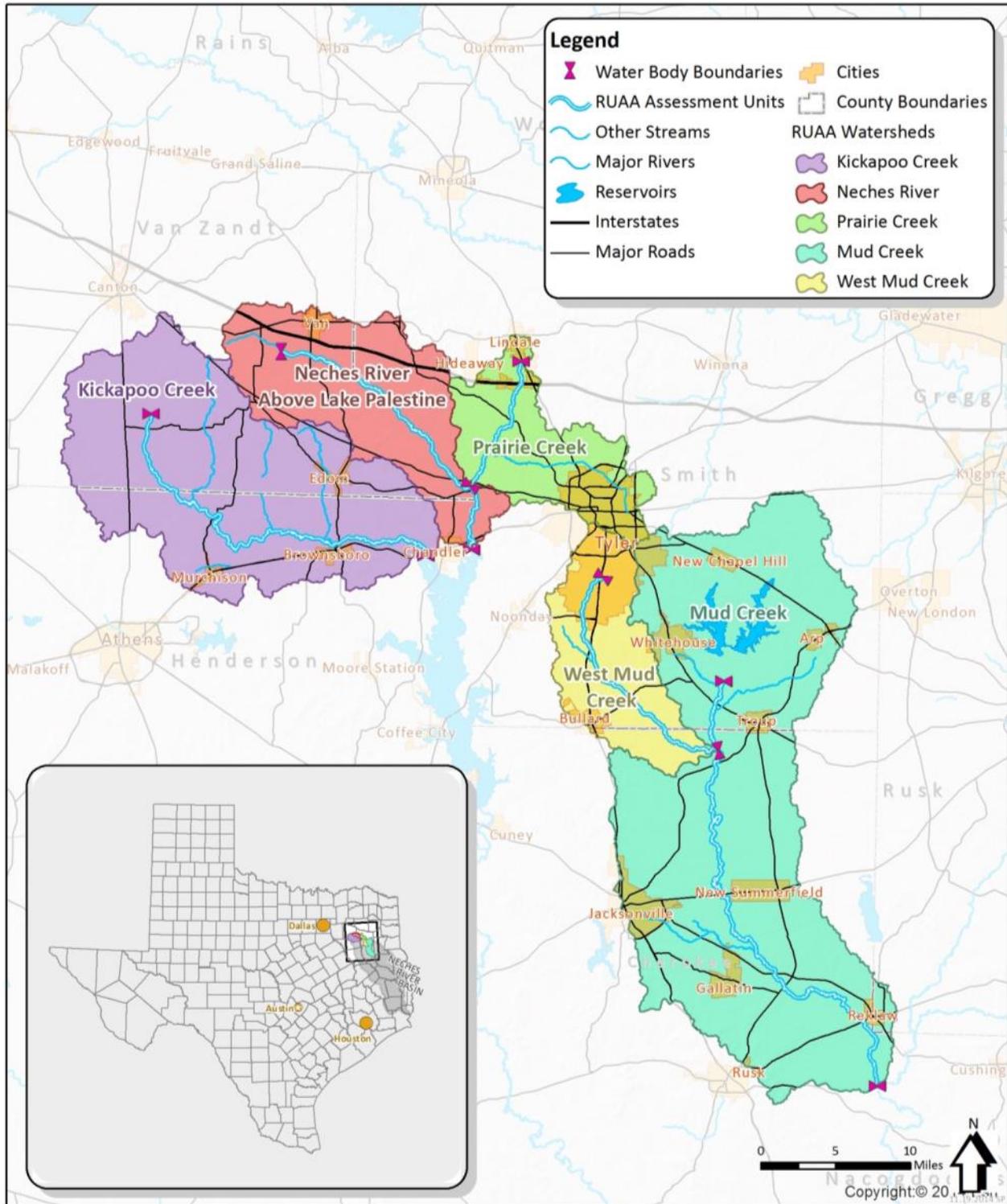


Figure 1.1 Map showing location of Kickapoo Creek in Henderson County, Neches River Above Lake Palestine, Prairie Creek, West Mud Creek, and Mud Creek watersheds.

Use attainability analyses (UAAs) are studies that evaluate the designated or presumed uses of a water body. To identify and assign attainable uses and criteria to individual waterbodies, UAAs

evaluate physical, chemical, biological, and economic factors affecting use attainment of a water body (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a water body. An RUAA consists of three parts: field surveys to document water body characteristics and signs of recreation, interviews with stakeholders regarding past and current use of the water body, and a historical review regarding recreational use of the water body.

The objective of this report is to present the findings of a Comprehensive RUAA for Kickapoo Creek in Henderson County, the Neches River Above Lake Palestine, Prairie Creek, Mud Creek, and West Mud Creek following the TCEQ March 2014 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2014). All components of this RUAA were performed by the Texas Institute for Applied Environmental Research (TIAER), which is located on the campus of Tarleton State University in Stephenville, Texas. Field surveys and interviews for the RUAA were conducted under a Texas State Soil and Water Conservation Board (TSSWCB) approved Quality Assurance Project Plan (QAPP; TIAER, 2014).

Stakeholder and Agency Involvement

The TSSWCB and its collaborating entities maintain an inclusive public participation process. Stakeholder involvement is recognized as a key source of knowledge about each water body. Furthermore, it can facilitate the site selection process. From the inception of this project, the project team sought to ensure that stakeholders were informed and involved.

In addition to information and comments from watershed stakeholders, input was also solicited from the Angelina-Neches River Authority (ANRA), Clean Rivers Program (CRP), Texas Parks and Wildlife Department regional staff, TCEQ regional staff, local Soil and Water Conservation Districts (SWCD), and other local agencies about the need for the RUAA. Meetings with administrative stakeholders were held to give an overview of water quality issues within each of the five watersheds (Table 1.2).

Table 1.2 RUA introductory meeting dates and locations with administrative stakeholders

Watershed	Local Agencies	Meeting Date	Meeting Location
Kickapoo Creek in Henderson County	Trinity-Neches SWCD Van Zandt SWCD Chandler City Council Brownsboro City Council Henderson County Commissioners Van Zandt County Commissioners	January 8, 2014	Van, TX
The Neches River Above Lake Palestine	Trinity-Neches SWCD Van Zandt SWCD Henderson County Commissioners Van Zandt County Commissioners	January 8, 2014	Van, TX
	Smith County SWCD Tyler City Council	January 9, 2014	Tyler, TX
	Smith County Commissioners	January 28, 2014	Tyler, TX
Prairie Creek	Smith County SWCD Tyler City Council	January 9, 2014	Tyler, TX
	Smith County Commissioners	January 28, 2014	Tyler, TX
Mud Creek	Cherokee County Commissioners	January 7, 2014	Jacksonville, TX
	Smith County SWCD Tyler City Council	January 9, 2014	Tyler, TX
	Smith County Commissioners	January 28, 2014	Tyler, TX
	Cherokee SWCD	January 28, 2014	Jacksonville, TX
West Mud Creek	Cherokee County Commissioners	January 7, 2014	Jacksonville, TX
	Smith County SWCD Tyler City Council	January 9, 2014	Tyler, TX
	Smith County Commissioners	January 28, 2014	Tyler, TX
	Cherokee SWCD	January 28, 2014	Jacksonville, TX

Public meetings specifically targeting landowners in each watershed were held in an effort to inform them of the water quality impairments in the watersheds and the need for an RUA (Table 1.3). Watershed stakeholders were invited to attend the public meetings through mailed invitations, public announcements, TSSWCB webpages, and individual phone calls. Due to the logistics of the watershed areas, meetings combined multiple watersheds. This was done to better accommodate travel time and distance for stakeholders. At these meetings, attendees were given an opportunity to comment on proposed study sites prior to field data collection. Landowner cooperation was also sought, as many potential RUA survey sites for each stream were accessible only via private property. These public meetings were used to solicit input from all interested parties within the study area.

Table 1.3 RUA introductory meetings with watershed stakeholders

Watersheds	Meeting Date	Meeting Location
Prairie Creek, Neches River Above Lake Palestine, Mud Creek, West Mud Creek	February 20, 2014	Tyler, Texas
Kickapoo Creek , Neches River Above Lake Palestine	February 24, 2014	Chandler, Texas
Mud Creek and West Mud Creek	February 25, 2014	Rusk, Texas

Progress update meetings were held to provide a summary of activities conducted to date on the RUAs and to discuss findings from the initial RUA field survey completed in the summer of 2014 (Table 1.4). The importance of interviews in providing feedback on past recreational use was emphasized by TIAER and the TSSWCB, and interview forms were made available at these meetings to watershed stakeholders.

Table 1.4 RUA summary meetings with watershed stakeholders

Watershed	Meeting Date	Meeting Location
Kickapoo Creek (0605A), Neches River Above Lake Palestine	August 25, 2014	Chandler, Texas
Mud Creek and West Mud Creek	September 15, 2014	Rusk, Texas
Prairie Creek, Neches River Above Lake Palestine, Mud Creek, West Mud Creek	September 16, 2014	Tyler, Texas

A final stakeholder meeting will occur in each watershed, during which the findings of field surveys, the historical review, and interviews will be presented. The next steps of the RUA will also be discussed at this meeting and feedback from stakeholders will be solicited. At the meeting, stakeholders will be informed of the availability of the draft RUA report for public review and comment. The draft report will be made available via the project website and TIAER will provide hard copies to individuals if desired.

Information on past meetings, including agendas, presentations, and other information can be found at the websites provided below:

[Kickapoo Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/kickapoo-creek.html)¹

[Neches River Above Lake Palestine Project Webpage](http://tiaer.tarleton.edu/ruaa/neches-river-above-lake-palestine.html)²

[Prairie Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/prairie-creek.html)³

[Mud Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/mud-creek1.html)⁴

[West Mud Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/west-mud-creek.html)⁵

¹ <http://tiaer.tarleton.edu/ruaa/kickapoo-creek.html>

² <http://tiaer.tarleton.edu/ruaa/neches-river-above-lake-palestine.html>

³ <http://tiaer.tarleton.edu/ruaa/prairie-creek.html>

⁴ <http://tiaer.tarleton.edu/ruaa/mud-creek1.html>

⁵ <http://tiaer.tarleton.edu/ruaa/west-mud-creek.html>

CHAPTER 2

STUDY METHODOLOGY

The process of developing a list of sites to be surveyed for the RUAA began with a reconnaissance of potential locations along the water body. A combination of Geographic Information System (GIS) data, review of historical information, and meetings and phone conversations with local entities and stakeholders were used in the final determination of sites included in the RUAA.

Watershed Reconnaissance and Site Selection Strategy

Reconnaissance of the watershed was conducted to collect background information before selecting appropriate sites for the RUAA. To the degree possible, site reconnaissance was coordinated with watershed stakeholders in an effort to increase local landowner interest in water quality issues. The March 2014 RUAA procedures (TCEQ, 2014) recommend selecting three sites per every five miles of stream. Based on this recommendation, the ideal number of sites was 25 for Kickapoo Creek in Henderson County, 20 for the Neches River Above Lake Palestine, 7 for Prairie Creek, 34 for Mud Creek, and 13 for West Mud Creek.

The following information was compiled using Geographic Information System (GIS) based tools prior to, during, and immediately following watershed reconnaissance:

- The location of areas along the water body that were accessible to the public and had the highest potential for recreational use, such as road crossings and parks;
- The location of permitted wastewater outfalls and other potential point sources;
- The hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations; and
- The location of city boundaries or other designated population areas.

The site selection process took into account locations that were accessible to the public, had the highest potential for recreational use, and had TCEQ monitoring stations where historical data may have been collected. The site selection process also considered parks and bridge crossings along the river, as well as access through private lands adjacent to the river.

Survey Methods

Field Survey Data Collection Activities

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2014), two separate field surveys occurred at each selected survey site during the warm season (air temperature greater than or equal to 70°F or 21°C) when human recreational activities were most likely to occur (May - September). Ideally, field surveys were to be conducted when stream flow conditions were normal. However, due to a significant amount of rainfall the areas experienced, particularly in the Mud Creek watershed, water levels were high. Most of the stream sites were wet through the

summer of 2014. Rainfall data 30 days prior to each survey were also documented to provide antecedent conditions.

Data collection activities at each RUAA site for both field surveys included the following:

- Measurement of average depth at thalweg (deepest depth),
- Measurement of depths, lengths, and widths of substantial pools,
- Documentation of observational/anecdotal data required on the RUAA field forms,
- Photographs of any signs of recreation and
- Photographs of site conditions including upstream, downstream, left bank, and right bank photos at the 0-m, 150-m, and 300-m transects.

Average Depth at Thalweg and Substantial Pool Depths

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2014). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was defined as a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of the RUAA survey (TCEQ, 2014).

As instructed in the RUAA procedures manual (TCEQ, 2014), a 300-m reach at each survey site was evaluated to determine average thalweg depth. Eleven transects at 30-m intervals were established in the 300-m stream reach bracketing each station. Each reach surveyed was oriented downstream to up, the 0-m transect was always set as the most downstream and the 300-m transect as the most upstream. All transect distances including thalweg depths and pool depths and lengths are presented in units of meters per the RUAA procedures (TCEQ, 2014).

Observational /Anecdotal Data

Anecdotal information was recorded on field data sheets during all surveys using the field data sheets from the TSSWCB-approved QAPP (TIAER, 2014).

Types of observational and anecdotal records included, but were not limited to, the following:

- Channel flow status as indicated by flow severity
- Stream type (e.g., ephemeral, intermittent, etc.)
- Streamflow
- General weather conditions (cloud cover/rain), including 30-day conditions and antecedent rainfall record
- Substrate type
- Stream accessibility
- Anecdotal information related to observed human contact activities

Photographs

TIAER staff created photographic records of each site during the site surveys. Photographs included an upstream view, left and right bank views, downstream view (as described in the Field Data Sheets), and any evidence of observed uses or indications of human use, hydrologic

modifications, etc. Photographs were intended to clearly depict the entire channel and were taken specifically at the 0-m, 150-m, and 300-m transects for the reach. Any items of interest, e.g., obstructions, were also photographed. Photographs were used to document evidence of recreational use (e.g., fishing tackle) and actual recreation. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition as part of the overall project, photographs were also taken to indicate potential bacteria sources to the water body. All photographs were labeled in a manner that indicated the photo's subject, site location, date, and orientation to the stream. Selected photos representative of each RUAA field site are included with the survey results for each water body in this report.

More information regarding the RUAA for each water body can be found on the project website

[Kickapoo Creek \(0605A\) Project Webpage](http://tiaer.tarleton.edu/ruaa/kickapoo-creek.html)⁶

[Neches River Above Lake Palestine Project Webpage](http://tiaer.tarleton.edu/ruaa/neches-river-above-lake-palestine.html)⁷

[Prairie Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/prairie-creek.html)⁸

[Mud Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/mud-creek1.html)⁹

[West Mud Creek Project Webpage](http://tiaer.tarleton.edu/ruaa/west-mud-creek.html)¹⁰

⁶ <http://tiaer.tarleton.edu/ruaa/kickapoo-creek.html>

⁷ <http://tiaer.tarleton.edu/ruaa/neches-river-above-lake-palestine.html>

⁸ <http://tiaer.tarleton.edu/ruaa/prairie-creek.html>

⁹ <http://tiaer.tarleton.edu/ruaa/mud-creek1.html>

¹⁰ <http://tiaer.tarleton.edu/ruaa/west-mud-creek.html>

CHAPTER 3

KICKAPOO CREEK IN HENDERSON COUNTY

(0605A)

Watershed Characteristics

The watershed of Kickapoo Creek in Henderson County (0605A) covers 178,000 acres and includes portions of the cities of Chandler (estimated population 2,805), Murchison (estimated population 600), Edom (estimated population 375), and Brownsboro (estimated population 1,050). Cream Level Creek, Slater Creek, and Murchison Creek are major tributaries to Kickapoo Creek (Figure 3.1). No parks either public or private were identified along Kickapoo Creek, although Callendar Lake, a private lake of about 365 acres, is formed along Slater Creek, which has housing developed around it. While surface water is the primary focus, the watershed overlays a portion of the Carrizo – Wilcox Aquifer (George, et al., 2011). The watershed area is largely within an area of rolling terrain with deep sandy soils (TSHA, 2010), although the terrain near the creek is often fairly flat leading to braiding of the creek as it meanders.

The headwaters of Kickapoo Creek in Henderson County lie within the Northern Post Oak Savanna ecoregion (33a) with the lower portion of the watershed within the Tertiary Uplands ecoregion (35a) (Griffith, et al., 2007). Average rainfall for the region is roughly 42 inches annually (Tyler Texas Weather, 2015). Mean minimum and maximum temperatures for the region range from 36 to 57°F in January and 73 to 94°F in July. The watershed is primarily rural with only 5 percent of the watershed comprised of developed land (Figure 3.2). The dominant land use is hay/pasture comprising 46 percent of the watershed area largely within the uplands. Riparian areas within the Kickapoo Creek watershed are predominately deciduous forest or woody wetlands transiting to evergreen forest only in the most eastern portion of the watershed. The native deciduous forest is composed mostly of post oak (*Quercis stellate*), blackjack oak (*Quercus marilandica*), and black hickory (*Carya texana*). Some coniferous trees occur, especially among the transitional boundary of Ecoregion 33a and Ecoregion 35a (Griffith et al., 2007). The soils of the watershed are generally well-drained loamy sands or sandy loams in the uplands and frequently flooded loams along the creeks and riparian areas (Stringer, 1998; Hatherly and Mays, 1979). While the riparian areas are largely wooded, frequent flooding and soil wetness severely limits commercial timber production in these areas.

Designated Uses, Impairments and Concerns

Kickapoo Creek in Henderson County is classified as perennial (TCEQ, 2013a) and has presumed uses of primary contact recreation, general use, and fish consumption with a limited aquatic life use. Kickapoo Creek in Henderson County was first listed impaired for bacteria on the 2000 Texas 303(d) list for the lower portion of the creek, while concerns are noted for bacteria in the upper portion of the creek (TCEQ, 2013). The confluence of Slater Creek, as shown in Figure 3.1, is used by TCEQ to partition Kickapoo Creek into its lower and upper assessment units (AUs). The lower portion of Kickapoo Creek is also listed as impaired for depressed dissolved oxygen. Parameters of concern include depressed dissolved oxygen and elevated ammonia and chlorophyll-a in the lower portion and elevated ammonia in the upper portion of Kickapoo Creek.

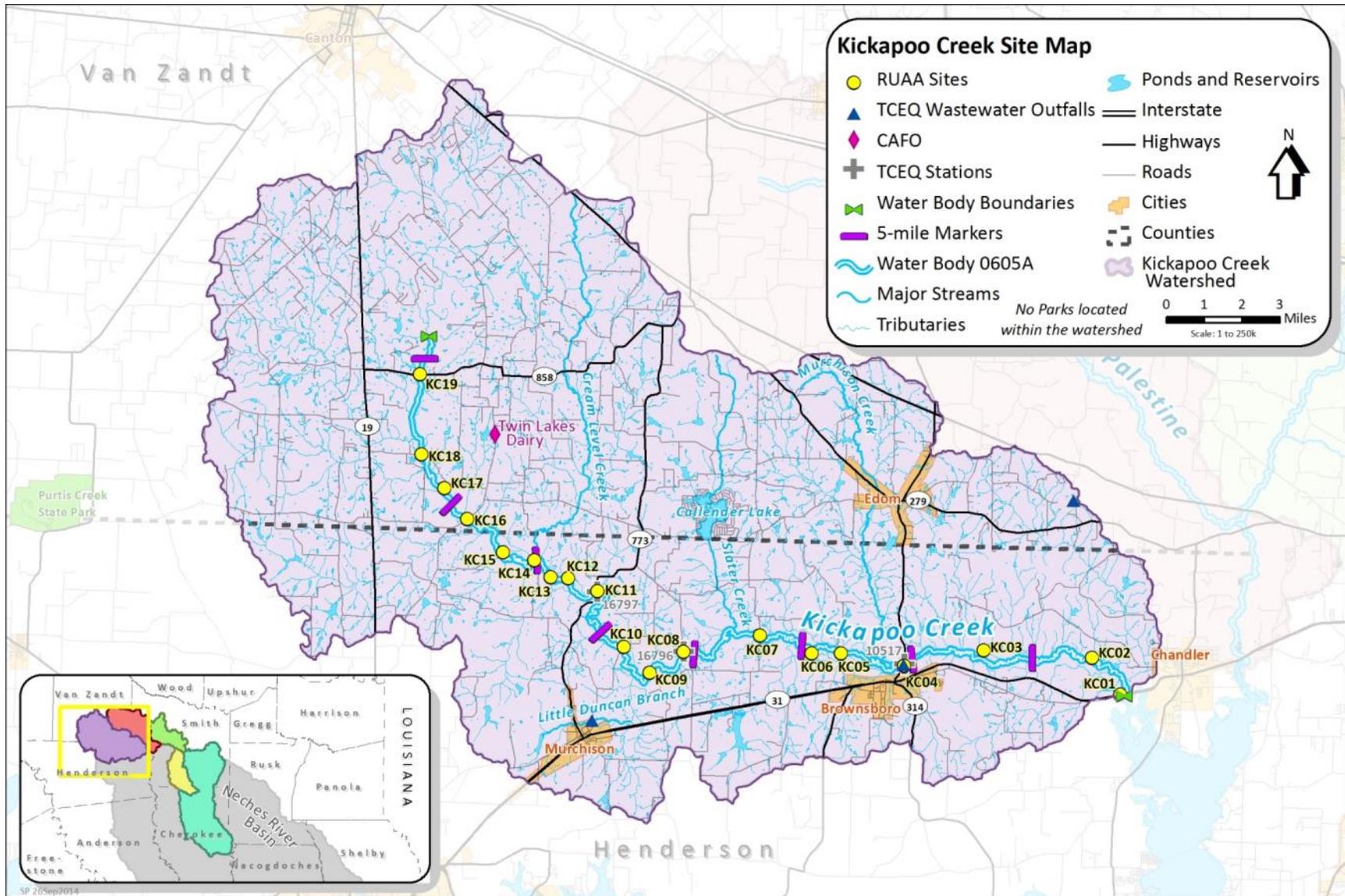


Figure 3.1 Overview of Kickapoo Creek in Henderson County watershed and RUA sites.

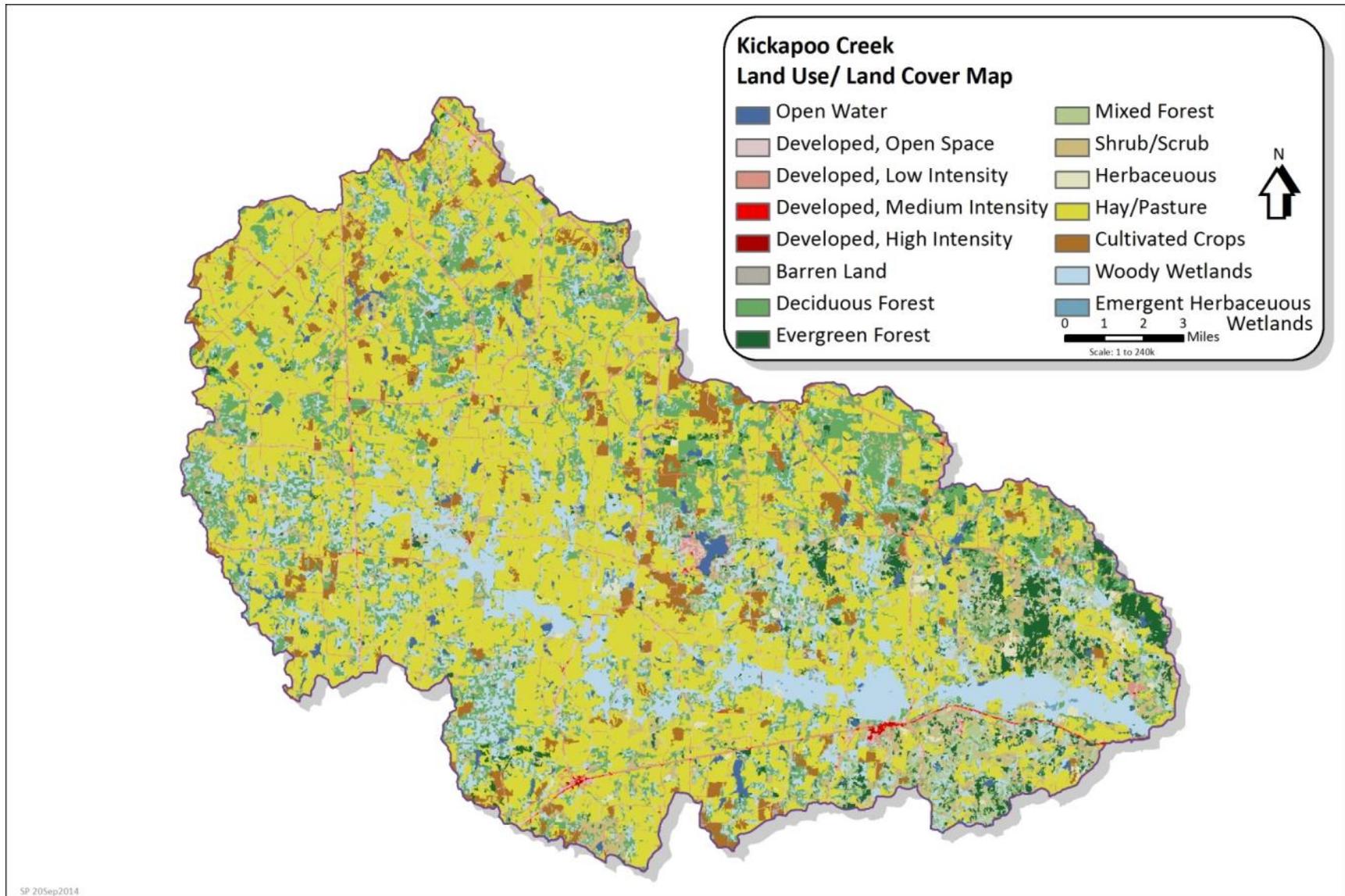


Figure 3.2 Land use/land cover for the Kickapoo Creek in Henderson County watershed. Source: 2011 National Land Cover Database (USGS, 2013).

Permitted Discharges

There are two municipal, permitted wastewater treatment facilities (WWTFs) within the Kickapoo Creek in Henderson County watershed, the City of Brownsboro WWTF (TX0062707) and the City of Murchison WWTF (TX0072087). The largest permitted discharge is the City of Brownsboro with a permitted average daily flow of 0.156 MGD. The City of Brownsboro WWTF is located in Brownsboro at the intersection of FM 314 and County Road 3300. It has one outfall that discharges into a drainage ditch to Kickapoo Creek. The City of Murchison WWTF (TX0072087) is located in Murchison Texas, northeast of the intersection of FM 773 and County Road 1616 on 10121 County Road 3807. Average daily discharge for the Murchison WWTF is not to exceed 0.08 MGD or an average of 167 gallons per minute (GPM) over a 2 hour peak. A third small WWTF (TX0133086), run by the RPM Water Supply Corporation (permitted average daily discharge of 0.01 MGD), does not discharge directly into Kickapoo Creek but to Battle Creek, which merges with Kickapoo Creek in a braided fashion as part of Kickapoo Cove of Lake Palestine. Depending on flow conditions and patterns, Battle Creek may be considered a tributary of Kickapoo Creek or a separate creek into Lake Palestine.

There is one concentrated animal feeding operation (CAFO) within the Kickapoo Creek watershed with a general permit. The Twin Lake Dairy (TXG920265) is located on the east side of FM 1861, about 1 mile south of its intersection with FM 858 in Van Zandt County. The Twin Lake Dairy is permitted for 3,599 total dairy cattle of which 2,880 are milking cows.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to water bodies and agricultural use of manure as fertilizer, can contribute bacteria to nearby waterbodies. To provide an estimate of livestock densities in the watershed, livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website from the 2012 survey (USDA, 2012). These statistics on a county level indicate large numbers of beef cattle in Henderson and Van Zandt Counties, and, thus, likely within the watershed area.

Table 3.1 Estimated livestock numbers within the Kickapoo Creek in Henderson County watershed based on statistics for Henderson and Van Zandt Counties adjusted for the percent of the county within the watershed. (Source USDA, 2012).

The Kickapoo Creek watershed comprises about 13% of Henderson County and 18% of Van Zandt County.

County	Year	Cattle & Calves (all beef)	All Goats	Mules, Burros, and Donkeys	Horses & ponies	Hogs
Henderson	2012	53,402	2,131	950	3,184	665
Van Zandt	2012	68,357	3,305	1,044	3,787	280
Kickapoo Creek Watershed Average	2012	19,269	874	312	1,096	136

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 5,700 households within the Kickapoo Creek watershed based on 2010 census population data, there are potentially about 3,330 dogs within the Kickapoo Creek watershed. Other domestic animals, such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife, such as deer, feral hogs, and birds. In 2013 statewide population estimated roughly 39 whitetail deer per 1,000 acres. This estimation suggests that the population for whitetail deer in the Post Oak Savannah region is roughly 400,000 deer, or 35 deer per 1,000 acres (Cain, 2014). Feral hogs are an invasive species commonly found throughout Texas. They have been known to travel in large groups along waterways and congregate near shallow depressions of water. Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (AgriLife, 2011).

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CNNs) from the Public Utility Commission of Texas was used. As not all cities with WWTFs have CNNs, the CNN layer was supplemented with a GIS layer representing municipal boundaries for those cities with WWTFs. Population data from the U.S. Census Bureau (USCB) were then overlaid masking out areas that should be serviced by WWTFs. Of the 5,700 households in the Kickapoo Creek watershed, 88.6% were indicated as outside of municipal areas serviced by WWTFs and, thus, likely on septic systems.

Historical Review

A review of historical information regarding recreational use of Kickapoo Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Chandler

[City of Chandler Homepage](#)¹¹

Only significant information found pertained to the history of the City of Chandler. Kickapoo Creek in Henderson County was briefly referenced in the historical description in establishing the city's boundaries. [Web link to Kickapoo Creek in Henderson County referenced in historical description of City of Chandler.](#)¹²

City of Brownsboro

[City of Brownsboro Homepage](#)¹³

Nothing of significance was found pertaining to the historical use of Kickapoo Creek in Henderson County.

Library Sources

Chandler Public Library

[City of Chandler Public Library Homepage](#)¹⁴

Phone: (903) 495-4122

Explored various links and online texts. Nothing pertaining to Kickapoo Creek in Henderson County was found.

Clint W. Murchison Memorial Library

[Clint W. Murchison Memorial Library Homepage](#)¹⁵

Phone: (903) 677-7295

Explored various links and online texts. Nothing pertaining to Kickapoo Creek in Henderson County was found.

Newspaper Sources

Time Record News

[Times Record News Homepage](#)¹⁶

Phone: (940) 767-8341

Explored various links and online texts. Nothing significant was found.

Internet Searches

The Handbook of Texas Online

[The Handbook of Texas Online Homepage](#)¹⁷

Searched the handbook by creek name. Nothing was found.

Texas Hometown Locator

[Texas Hometown Locator Homepage](#)¹⁸

A search of the site turned up a single photo of a kayaker in Kickapoo Creek in Henderson County. The photo was posted by author in 2010.

¹¹ <http://www.chandler.tx.com/>

¹² <http://www.chandler.tx.com/documentcenter/view/53>

¹³ <http://www.brownsboro.us/>

¹⁴ <http://www.chandler.tx.com/index.aspx?nid=101>

¹⁵ <http://www.hendersoncountylibrary.com/>

¹⁶ <http://www.timesrecordnews.com/>

¹⁷ <https://tshaonline.org/>

¹⁸ <http://texas.hometownlocator.com/photos/index,n,kickapoo%20creek,c,henderson,lat,32.2548735,lon,-95.4691231.cfm>

Survey Site Descriptions

Kickapoo Creek in Henderson County (0605A) is 41 river miles long indicating a goal of 25 sites (3 sites per 5 miles of river) for the RUAA survey (Figure 3.1). With the help of cooperating stakeholders, TIAER was able to establish a total of 19 sampling stations along Kickapoo Creek (Table 3.2). Although the optimum number of sampling stations was 25 following the RUAA guidelines, acceptance of using only 19 stations was sought and granted from TCEQ.

Of the 25 sites used for the RUAA field surveys, 10 were located at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. It should be noted that at these 10 publically accessible locations, there was actually very limited public access at several of the sites due to property fences. Of these 10 publically accessible sites, 3 were collocated with TCEQ sampling stations. The remaining nine privately controlled sites were selected to provide physical characterization of Kickapoo Creek in areas between public access points. Entrances to sites on private lands were limited by fences and locked gates and were often several meters to kilometers from the stream. The average distance between survey sites was 2.2 river miles and ranged from 0.63 to 5.0 miles. The largest gap of five river miles was between survey sites KC02 and KC03. There are no major or minor road crossings between KC02 and KC03 and attempts to contact landowners for private land access in this gap area were unsuccessful. RUAA surveys were performed July 25-26 and August 22, 2014 at these locations. A brief description of each site follows.

Table 3.2 Description and location of RUAA field survey sites for Kickapoo Creek, Water Body 0605A.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi) ¹	Distance from Confluence (mi) ¹	Access
	KC01	Kickapoo Creek crossing at SH31	32.300024	-95.507758	NA	0.06	Public
	KC02	Kickapoo Creek on private property approximately 720 meters south of Henderson CR3302 and 1.1 km west of Henderson CR3315	32.313740	-95.521041	2.10	2.16	Private
	KC03	Kickapoo Creek on private property approximately 1.8 km south of Henderson CR3302 and 5.8 km west of Henderson CR3315	32.315784	-95.570040	5.00	7.16	Private
10517	KC04	Kickapoo Creek crossing at FM314	32.309099	-95.605826	3.13	10.29	Public
	KC05	Kickapoo Creek crossing at Henderson CR3514	32.313294	-95.634427	2.60	12.89	Public
	KC06	Kickapoo Creek on private property approximately 1.3 km north of Henderson CR3516	32.312876	-95.647848	1.33	14.22	Private
	KC07	Kickapoo Creek crossing at Henderson CR3520	32.319250	-95.671307	2.82	17.04	Public*
16796	KC08	Kickapoo Creek crossing at FM1803	32.312309	-95.705716	3.31	20.35	Public*
	KC09	Kickapoo Creek on private property (Fund for Animals) approximately 1.5 km east of Henderson CR3806	32.303873	-95.720764	1.55	21.90	Private
	KC10	Kickapoo Creek crossing at Henderson CR3806	32.313565	-95.732693	2.08	23.98	Public
16797	KC11	Kickapoo Creek crossing at FM773	32.334668	-95.745165	3.24	27.22	Public
	KC12	Kickapoo Creek on private property approximately 1.2 km west of FM773	32.339385	-95.758632	1.22	28.44	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Access
	KC13	Kickapoo Creek on private property approximately 2.0 km west of FM773	32.339670	-95.766563	0.63	29.07	Private
	KC14	Kickapoo Creek on private property approximately 1.4 km south of Van Zandt CR4301	32.345898	-95.774142	1.12	30.19	Private
	KC15	Kickapoo Creek on private property approximately 1.4 km southwest of Van Zandt CR4301	32.348719	-95.788403	2.08	32.27	Private
	KC16	Kickapoo Creek crossing at FM1861	32.361167	-95.805017	2.05	34.32	Public*
	KC17	Kickapoo Creek on private property approximately 25 meters southwest of Deer Park Estates Road	32.372709	-95.815739	1.25	35.57	Private
	KC18	Kickapoo Creek crossing at Van Zandt CR4206	32.385408	-95.826422	1.56	37.13	Public*
	KC19	Creek crossing at FM858	32.416093	-95.828130	2.45	39.58	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site KC01 is located on Kickapoo Creek at the bridge crossing on State Highway 31, west of Chandler, Texas. Site KC01 was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC02 is located on Kickapoo Creek on private property approximately 720 meters south of Henderson County Road 3302 and 1.1 km west of Henderson County Road 3315, west of Chandler, Texas. Site KC02 was only accessible with landowner permission through fenced private property via a potentially locked gate with a cattle guard. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC03 is located on Kickapoo Creek on private property approximately 1.8 km south of Henderson County Road 3302 and 5.8 km west of Henderson County Road 3315, west of Chandler, Texas. Site KC03 was only accessible through fenced private property with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC04 (TCEQ Station 10517) is located on Kickapoo Creek at the bridge crossing on Farm-to-Market Road 314, north of Brownsboro, Texas. Site KC04 was only publicly accessible underneath the bridge with unfenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC05 is located on Kickapoo Creek at the bridge crossing on Henderson County Road 3514, northwest of Brownsboro, Texas. Site KC05 was only publicly accessible at the bridge with unfenced private property upstream and downstream of the crossing. The unfenced private property was posted no trespassing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC06 is located on Kickapoo Creek on private property approximately 1.3 km north of Henderson County Road 3516, northwest of Brownsboro, Texas. Site KC06 was only accessible, with landowner permission, through a locked gate on fenced private property. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC07 is located on Kickapoo Creek at the bridge crossing on Henderson County Road 3520, northwest of Brownsboro, Texas. Site KC07 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC08 (TCEQ Station 16796) is located on Kickapoo Creek at the bridge crossing on Farm-to-Market Road 1803, northeast of Murchison, Texas. Site KC08 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC09 is located on Kickapoo Creek on private property (Fund for Animals) approximately 1.5 km east of Henderson County Road 3806, northeast of Murchison, Texas. Site KC09 was only

accessible, with landowner permission, through fenced private property via a gravel road and locked gates. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC10 is located on Kickapoo Creek at the bridge crossing on Henderson County Road 3806, northeast of Murchison, Texas. Site KC10 was only publicly accessible at the bridge with private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC11 (TCEQ Station 16797) is located on Kickapoo Creek at the bridge crossing on Farm-to-Market Road 773, north of Murchison, Texas. Site KC11 was publicly accessible at the bridge with private property upstream and downstream of the crossing. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC12 is located on Kickapoo Creek on private property approximately 1.2 km west of Farm-to-Market 773, north of Murchison, Texas. Site KC12 was only accessible, with landowner permission, through fenced private property with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC13 is located on Kickapoo Creek on private property approximately 2.0 km west of Farm-to-Market 773, north of Murchison, Texas. Site KC13 was only accessible, with landowner permission, through fenced private property with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC14 is located on Kickapoo Creek on private property approximately 1.4 km south of Van Zandt County Road 4301, north of Murchison, Texas. Site KC14 was only accessible, with landowner permission, through fenced private property with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC15 is located on Kickapoo Creek on private property approximately 1.4 km southwest of Van Zandt County Road 4301, north of Murchison, Texas. Site KC15 was only accessible, with landowner permission, through fenced private property with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC16 is located on Kickapoo Creek at the bridge crossing on Farm-to-Market Road 1861, northwest of Murchison, Texas. Site KC16 was publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC17 is located on Kickapoo Creek on private property approximately 25 meters southwest of Deer Park Estates Road, northwest of Murchison, Texas. Site KC17 was only accessible through fenced private property with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0605A.

Site KC18 is located on Kickapoo Creek at the bridge crossing on Van Zandt County Road 4206, northwest of Murchison, Texas. Site KC18 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Site KC19 is located on Kickapoo at the bridge crossing on Farm-to-Market Road 858, northwest of Murchison, Texas. Site KC19 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of 0605A.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Water Body 0605A

The Kickapoo Creek RUAA surveys were conducted on July 25-26 and August 22, 2014 at all nineteen sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 3.3 and 3.4). In the 30 days prior to the first survey, 2.94 inches of precipitation fell, while 3.77 inches fell 30 days prior to the second survey. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both July and August 2014 (TWDB, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 3.5 describes the stream channel and corridor characteristics at each site.
- Table 3.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 3.7 and 3.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 3.9 and 3.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth was approximately 0.5 m during both surveys. Access to the stream was moderately easy to easy in most locations due to low banks with only some sites with difficult access. The dominant substrate was mud/clay, and the stream corridor was largely lined with trees except in a few locations where pastures abutted the stream. The maximum stream width encountered was over 100 m during both surveys, at Site KC01, which is the site nearest in proximity to Lake Palestine. Flow conditions were largely normal in July with only a few locations indicating low or no flow conditions. During the second survey in August, no to low flow conditions were common with only a few occurrences indicating normal flow conditions. The water surface typically had a surface scum and occasionally an oily sheen. The water encountered was brown in color. Tracks observed most often included cattle, raccoon, deer, and canine. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics, aluminum cans, and bottles. Kayaking was the only form of recreation directly observed during either of the two field surveys. The recreation observed involved two kayakers at Site KC01 during the first survey. These kayakers were carrying fishing equipment, but not actively observed to be fishing. Interviews obtained from the two kayakers indicated their primary interest was in fishing. Fishing equipment, such as bobbers, were observed at some sites as signs of potential recreational activity.

Table 3.3 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the first RUAA survey initiated on July 25, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC, 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
25-Jun-14	1.36	79	79
26-Jun-14	0.20	87	87
27-Jun-14	0.09	86	86
28-Jun-14	0.00	91	91
29-Jun-14	0.00	92	92
30-Jun-14	0.00	93	93
1-Jul-14	0.00	92	92
2-Jul-14	0.00	91	91
3-Jul-14	0.00	89	89
4-Jul-14	0.31	86	86
5-Jul-14	0.00	87	87
6-Jul-14	0.00	91	91
7-Jul-14	0.00	92	92
8-Jul-14	0.00	93	93
9-Jul-14	0.00	95	75
10-Jul-14	0.00	94	74
11-Jul-14	0.00	94	73
12-Jul-14	0.00	96	73
13-Jul-14	0.00	98	75
14-Jul-14	0.00	97	75
15-Jul-14	0.03	93	74
16-Jul-14	0.00	88	67
17-Jul-14	0.00	84	67
18-Jul-14	0.95	71	65
19-Jul-14	0.00	73	65
20-Jul-14	0.00	87	66
21-Jul-14	0.00	91	68
22-Jul-14	0.00	91	71
23-Jul-14	0.00	92	69
24-Jul-14	0.00	90	67
25-Jul-14	0.00	94	71
26-Jul-14	0.00	95	74

Table 3.4 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the second RUAA survey initiated on August 22, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC, 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
23-Jul-14	0.00	92	69
24-Jul-14	0.00	90	67
25-Jul-14	0.00	94	71
26-Jul-14	0.00	95	74
27-Jul-14	0.00	96	76
28-Jul-14	0.00	95	74
29-Jul-14	0.73	91	72
30-Jul-14	0.00	87	72
31-Jul-14	2.63	84	70
1-Aug-14	0.30	77	67
2-Aug-14	0.02	84	68
3-Aug-14	0.00	87	70
4-Aug-14	0.00	90	72
5-Aug-14	0.00	92	73
6-Aug-14	0.00	93	75
7-Aug-14	0.00	94	76
8-Aug-14	0.00	95	77
9-Aug-14	0.00	95	77
10-Aug-14	0.00	97	76
11-Aug-14	0.00	94	78
12-Aug-14	0.00	91	72
13-Aug-14	0.00	88	65
14-Aug-14	0.00	89	66
15-Aug-14	0.00	93	68
16-Aug-14	0.00	97	75
17-Aug-14	0.00	92	78
18-Aug-14	0.06	93	77
19-Aug-14	0.01	94	76
20-Aug-14	0.00	94	74
21-Aug-14	0.02	97	76
22-Aug-14	0.00	96	75

Table 3.5 Stream Channel and corridor appearance for each site sampled along Kickapoo Creek (0605A).

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
KC01	Natural	Mud/Clay	Forest	Large	No	Native
KC02	Natural	Sand	Forest	Large	No	Native
KC03	Natural	Mud/Clay	Forest	Large	No	Native pasture
KC04	Natural	Mud/Clay	Forest	Large	No	Native
KC05	Natural	Mud/Clay	Forest	Large	No	Native
KC06	Natural	Mud/Clay	Forest – Left Pasture - Right	Large	No	Pasture & Native
KC07	Natural	Silt	Forest	Large	No	Native
KC08	Natural	Mud/Clay	Forest Mowed at Bridge	Large	No	Native
KC09	Natural	Sand	Forest & Pasture	Large	No	Pasture & Native
KC10	Natural	Mud/Clay	Forest	Large	No	Native
KC11	Natural	Mud/Clay	Forest Mowed at Bridge	Large	No	Native
KC12	Natural	Mud/Clay	Forest Maintained pipeline	Large	No	Native
KC13	Natural	Mud/Clay	Forest – Left Pasture - Right	Large	No	Pasture & Native
KC14	Natural	Mud/Clay	Forest Maintained corridor	Large	No	Native

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
KC15	Natural	Mud/Clay	Forest – Left Pasture - Right	Large	No	Native pasture
KC16	Natural	Mud/Clay	Forest	Large	No	Native
KC17	Natural	Mud/Clay	Forest	Large	No	Native
KC18	Natural	Mud/Clay	Forest	Large	No	Native
KC19	Natural	Mud/Clay	Forest & Pasture	Large	No	Native pasture

Table 3.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Kickapoo Creek (0605A).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
KC01	300	11	0	>1.5	>1.5	Intermittent with Pools	Public	E
KC02	300	11	0	0.2	0.1	Intermittent with Pools	Private	E
KC03	300	11	0	0.3	0.3	Intermittent with Pools	Private	D
KC04	300	11	0	0.6	0.5	Intermittent with Pools	Public	E
KC05	300	11	0	0.8	0.7	Intermittent with Pools	Public	ME
KC06	300	11	0	0.3	0.1	Intermittent with Pools	Private	ME
KC07	300	11	0	0.3	0.3	Intermittent with Pools	Public*	MD
KC08	300	11	0	>1.5	>1.5	Intermittent with Pools	Public*	ME
KC09	300	11	0	0.4	0.2	Intermittent with Pools	Private	ME
KC10	300	11	0	0.6	0.4	Intermittent with Pools	Public	ME
KC11	300	11	0	0.3	0.2	Intermittent with Pools	Public	E
KC12	300	11	0	0.5	0.5	Intermittent with Pools	Private	ME
KC13	300	11	0	0.9	0.9	Intermittent with Pools	Private	ME

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
KC14	300	11	0	0.3	0.1	Intermittent with Pools	Private	MD
KC15	300	11	0	0.4	0.2	Intermittent with Pools	Private	MD
KC16	300	11	0	0.7	0.6	Intermittent with Pools	Public*	E
KC17	300	11	0	0.3	0.3	Intermittent with Pools	Public	D
KC18	300	11	0	0.2	0.1	Intermittent with Pools	Public*	D
KC19	300	11	0	0.2	0.1	Intermittent with Pools	Public*	ME

Table 3.7 Description of surveyed stream sites along Kickapoo Creek during first survey performed in July 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
KC01 ¹	~100	~30	~65	Normal
KC02	20	0.0	0.0	No Flow
KC03 ²	Unknown	Unknown	Unknown	Low
KC04	27	0.8	9.0	Low
KC05	25	4.0	10	Low
KC06	8.0	1.0	4.5	Low
KC07	17	0.0	6.5	No Flow
KC08	26	18	23	Normal
KC09	12	0.5	8.0	Normal
KC10	16	0.8	3.0	Normal
KC11	6.0	0.5	4.0	Normal
KC12	10	1.6	8.5	Normal
KC13	10	7.5	8.0	Normal
KC14	6.0	0.4	2.5	Low
KC15	12	0.5	3.5	Low
KC16	22	4.0	9.0	Normal
KC17	8	1.0	5.0	Normal
KC18	13	0.3	2.5	Normal
KC19	6.0	0.3	2.5	Normal

1. Abundant aquatic vegetation throughout the reach at Site KC01 made determining the location of the stream bank edges difficult, thus, only estimated values could be obtained.
2. Kickapoo Creek at Site KC03 did not have a well-defined stream channel at the time of the surveys, but rather had numerous small channels that were separated by dry land. The inability to accurately discern the true stream width led to the resulting “unknown” widths recorded.

Table 3.8 Description of surveyed stream sites along Kickapoo Creek during second survey performed in August 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
KC01 ¹	~100	~30	~65	Normal
KC02	16	0.0	0.0	No Flow
KC03 ²	Unknown	0.0	Unknown	No flow
KC04	26	0.7	4.5	Low
KC05	24	4.0	10	No Flow
KC06	6.5	0.0	2.5	No Flow
KC07	15	0.0	2.5	No Flow
KC08	26	18	22	Low
KC09	10	0.0	6.0	No Flow
KC10	15	0.0	2.8	No Flow
KC11	5.5	0.0	3.7	No Flow
KC12	10	1.5	8.0	Low
KC13	10	7.5	8.0	Low
KC14	1.5	0.0	0.0	No Flow
KC15	11	0.0	0.0	No Flow
KC16	15	3.5	5.0	Low
KC17	7.5	0.0	4.8	No Flow
KC18	13	0.0	2.3	No Flow
KC19	5.8	0.2	2.3	Low

1. Abundant aquatic vegetation throughout the reach at Site KC01 made determining the location of the stream bank edges difficult, thus, only estimated values could be obtained.
2. Kickapoo Creek at Site KC03 did not have a well-defined stream channel at the time of the surveys, but rather had numerous small channels that were separated by dry land. The inability to accurately discern the true stream width led to the resulting “unknown” widths recorded.

Table 3.9 Stream aesthetics along Kickapoo Creek during first survey performed in July 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
KC01	Ab	R	N	Brown	Fine sediment	Clear/Scum	N	N	N	Fecal/Nests	N	R	R
KC02	R	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	N	N
KC03	A	A	R	Brown	Fine sediment	Clear/Scum	N	SP	N	Tracks/Fecal	N	N	N
KC04	C	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	C
KC05	A	A	N	Brown	Fine sediment	Clear/Scum	N	N	N	Tracks/Fecal	N	R	R
KC06	R	R	R	Clear	Fine sediment	Scum	N	N	MP	Tracks/Fecal	N	N	N
KC07	R	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	C	R
KC08	A	A	N	Brown	Fine sediment	Clear	N	SP	N	Fecal/Nests	R	R	R
KC09	R	A	N	Brown	Fine sediment	Clear/Scum/Oil	N	N	LP	Tracks/Fecal	N	N	N
KC10	R	A	R	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	C	C	C
KC11	R	A	N	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	R	R	R
KC12	R	R	R	Brown	Fine sediment	Scum	N	SP	N	Tracks/Fecal	R	N	N
KC13	R	A	R	Brown	Fine sediment	Scum	SP	N	N	Tracks/Fecal	N	R	N
KC14	R	R	R	Brown	Fine sediment	Scum	N	N	SP/MP	Tracks/Fecal	N	N	R
KC15	R	R	R	Brown	Fine sediment	Scum	SP	N	SP/MP	Tracks/Fecal	N	R	N
KC16	C	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	C	R

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
KC17	R	R	R	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	N	N	N
KC18	C	A	R	Brown	Fine sediment	Clear/Scum/Oil	MP	N	N	Tracks/Fecal	C	C	N
KC19	C	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	R	N

Table 3.10 Stream aesthetics along Kickapoo Creek during second survey performed in August 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
KC01	Ab	R	N	Brown	Fine sediment	Clear/Scum	N	MP	N	Fecal	N	R	R
KC02	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
KC03	A	A	R	Brown	Fine sediment	Clear/Scum/Oil	N	SP	N	Tracks/Fecal	N	N	N
KC04	R	A	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	R
KC05	A	A	N	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	N	R	R
KC06	A	R	N	Brown	Fine sediment	Scum	N	N	MP	Tracks/Fecal	N	N	N
KC07	A	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	N
KC08	A	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks/Fecal	R	R	R
KC09	R	A	N	Brown	Fine sediment	Clear/Scum/Oil	N	N	LP	Tracks/Fecal	N	N	N
KC10	R	A	C	Brown	Fine sediment	Clear/Scum/Oil	MP	N	N	Tracks/Fecal	C	C	C
KC11	R	A	C	Brown	Fine Sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	R	R	R
KC12	A	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	N	N
KC13	A	A	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	N	N
KC14	A	A	N	Brown	Fine sediment	Scum	N	N	LP	Tracks/Fecal	N	R	N
KC15	A	A	N	Brown	Fine sediment	Scum	N	N	LP	Tracks/Fecal	N	N	N
KC16	C	C	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	C

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
KC17	R	R	R	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	N	N	N
KC18	C	A	R	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	C	C	N
KC19	C	A	R	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	C	R	N

Physical Description of KC01

Kickapoo Creek at Site KC01 was visited on July 25 and August 22, 2014. This site was located at the bridge crossing on State Highway 31, west of Chandler, Texas in Henderson County, and was publically accessible from the bridge crossing. The site is located in a forest dominated corridor (Table 3.5). At the site, access to the stream was easy from the northwest side of the bridge crossing. The easy access was due to the presence of a cleared dirt pathway that was large enough to accommodate a vehicle (Figure 3.3). Additionally, the pathway led to a small dirt boat ramp that was adequate for launching a small boat. Access elsewhere along the reach would have likely been difficult due to dense vegetation and fenced private property. Figures 3.4 and 3.5 depict the appearance of the site during each of the surveys.



Figure 3.3 Photograph of dirt path leading to a dirt boat ramp on Kickapoo Creek Site KC01 taken on July 25, 2014. TIAER vehicle in photograph.

Site KC01 was not wadeable as average thalweg depths were greater than 1.5 meters during both surveys. The relatively deep water necessitated the use of a small boat to conduct both surveys. Abundant aquatic vegetation throughout the reach made determining the location of the stream bank edges difficult. Stream widths were estimated and ranged from a minimum of 30 meters to a maximum of 100 meters (Tables 3.7 and 3.8).



Figure 3.4 Photograph of Kickapoo Creek Site KC01 taken on July 25, 2014. The upstream view of the 0-m transect.



Figure 3.5 Photograph of Kickapoo Creek Site KC01 taken on August 22, 2014. The upstream view of the 150-m transect.

There were no vertebrates or mammals observed during the first survey (Table 3.9). A moderate presence of water dependent birds was observed during the second survey with no other vertebrates observed (Table 3.10). No wildlife tracks were observed during either survey due to an inability to see most of the dry stream bank. Bird feces were found during both surveys. Aquatic vegetation was abundant during both surveys, and algae cover was rare. Trash observed was rare to non-existent. When encountered, trash consisted of plastic bottles. Two individuals in kayaks with fishing gear were observed traveling from downstream of the surveyed reach to the boat ramp during the first survey. No individuals were observed at or near the site during the second survey. Other evidence potential recreation included human footprints, foot paths, and fishing bait containers near the boat ramp. A public trash can filled with garbage was also present near the boat ramp.

Physical Description of KC02

Kickapoo Creek at site KC02 was visited on July 26 and August 29, 2014. This site was located west of Chandler, Texas in Henderson County. Site KC02 was accessible only through private lands that were fenced with a gate that could be locked. With landowner permission, TIAER personnel entered private property over a cattle guard and drove approximately one-half mile through the pasture and a second gate to reach the site. The corridor was forested along both banks (Table 3.5). At the site, access to the stream was easy via gentle sloping banks and little to no understory vegetation (Table 3.6). Figures 3.6 and 3.7 depict the site during each of the surveys.

Site KC02 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.10 m during the second survey (Table 3.6). During both surveys, most of the reach was dry with only two pools identified (during the first survey). Two pools were identified during the first survey and the dimensions of each are provided in Table 3.11. During the second survey, the two pools encountered during the first survey were less than 0.5 m deep and not considered significant pools for measurement. During both surveys, shallow water depths and sandy substrate made wading in the stream channel easy. Obstructions were encountered throughout the reach in the form of fallen timber, which would make navigating the stream in a boat or tube difficult. Stream widths varied from 0.0 to 20 m during the first survey and 0.0 to 16 m during the second survey (Tables 3.7 and 3.8).

Table 3.11 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC02.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	30	6.5	0.6
Pool 2	>60	20	0.8

There were no mammals or vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip were identified as cattle, deer, raccoon, feral hog, and canine. Bird, cattle, and horse feces were also found throughout the reach. Aquatic vegetation and algae were rare during the first survey and absent during the second survey. Water color was brown with a surface scum identified during the first survey, but clear during the second survey. No trash of any kind was observed along the banks or in the stream channel. The only evidence of potential

recreation was a hunting blind observed in a field adjacent to the stream and a hog trap found along the left bank, both of which were identified as belonging to the landowner's son.



Figure 3.6 Photograph of Kickapoo Creek Site KC02 taken on July 26, 2014. The downstream view of the 300-m transect.



Figure 3.7 Photograph of Kickapoo Creek Site KC02 taken on August 22, 2014. The upstream view of the 150-m transect.

Physical Description of KC03

Kickapoo Creek at Site KC03 was visited on July 26 and August 22, 2014. This site was located west of Chandler, Texas in Henderson County, and was accessible only through private lands that were fenced. With landowner permission, TIAER personnel entered private property and drove approximately 0.9 miles on a pasture road and then walked an additional 0.35 miles along an ATV path to reach the site. The stream corridor was forested (Table 3.5), and access to the stream was difficult due to dense vegetation and muddy stream banks as shown in Figures 3.8 and 3.9 during each survey.



Figure 3.8 Photograph of typical obstructions encountered on Kickapoo Creek Site KC03 taken on July 26, 2014, the upstream view of the 300-m transect.

Site KC03 was wadeable for the entire 300-m reach length. Average thalweg was 0.30 m during both surveys (Table 3.6). During both surveys, TIAER personnel encountered downed timber and log jams throughout the reach that made wading difficult (e.g., Figure 3.8). Kickapoo Creek at this location did not have a well-defined stream channel at the time of the surveys, but rather had numerous small channels that were separated by dry land. The inability to accurately discern the true stream width led to the resulting “unknown” widths recorded in Tables 3.7 and 3.8.



Figure 3.9 Photograph of Kickapoo Creek Site KC03 taken on August 22, 2014, the upstream view of the 0-m transect.

A slight presence of water dependent birds was observed during both surveys with no other vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during the first survey consisted of raccoon, armadillo, canine, and deer. Tracks observed during the second survey consisted of feral hog, deer, and raccoon. Bird feces were also found throughout the reach. The presence of aquatic vegetation and algae cover was rare during both surveys. The water color during both surveys was brown with a surface scum and slight odor. No trash was observed during either survey. The only evidence of potential recreation within the reach was a barbeque grill located at the 300-m transect and the ATV trail leading to the site.

Physical Description of KC04

Kickapoo Creek at Site KC04 was visited on July 26 and August 22, 2014. This site was located north of Brownsboro, Texas in Henderson County, and was publicly accessible at the bridge crossing of FM 314. Private property upstream and downstream of this bridge crossing was unfenced. With landowner permission, TIAER personnel parked underneath the bridge and walked along an ATV path to reach the stream. The stream corridor was forested on both sides (Table 3.5), and access to the stream was easy due to gently sloping banks with little to no understory vegetation (Table 3.6). The general appearance of the creek at this location is shown in Figures 3.10 and 3.11.



Figure 3.10 Photograph of Kickapoo Creek Site KC04 taken on July 26, 2014, the upstream view of the 150-m transect.



Figure 3.11 Photograph of Kickapoo Creek Site KC04 taken on August 22, 2014, the downstream view of the 300-m transect.

Site KC04 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.6 m during the first survey to 0.5 m during the second survey (Table 3.6). During both surveys, the fallen timber in the stream channel and mud/clay substrate made wading in the stream channel very difficult. Widths of the stream ranged from 27 m to 0.8 m during the first survey and 26 to 0.7 m during the second survey (Tables 3.7 and 3.8). Log jams and obstacles were encountered during both surveys, which would obstruct navigating the creek in a boat.

There were no mammals or vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of raccoon, feral hog, deer, and canine. Bird feces were found throughout the reach. Aquatic vegetation was common during the first survey and rare during the second. Algae was absent during both surveys. The water color was brown with surface scum during both surveys. Trash was rarely observed within the stream channel but was common along the stream banks. Observed trash consisted of plastic cups, sacks and bottles with tires and barrels also found within the reach. Evidence of potential recreation was found in the form of fishing tackle observed throughout the reach as well as foot paths and an ATV trail underneath the bridge and along the left bank of the stream.

Physical Description of KC05

Kickapoo Creek at Site KC05 was visited on July 26 and August 22, 2014. This site was located northwest of Brownsboro, Texas in Henderson County. It was publicly accessible at the bridge and the private property upstream and downstream of the bridge crossing was unfenced (landowner permission was granted for TIAER field crew to access the stream). The stream corridor was forested on both sides (Table 3.5), and access to the stream was moderately easy (Table 3.6). The general appearance of the site during each survey is shown in Figures 3.12 and 3.13).

Site KC05 was wadeable for the entire 300-m reach length with the exception of an area near the bridge crossing that had depths > 1.5 m. Average thalweg ranged from 0.80 m during the first survey to 0.70 m during the second survey (Table 3.6). During both surveys, muddy stream bottoms and occasional instream obstructions made wading in the stream channel challenging. The typical width of the stream during both surveys was approximately 10 m (Tables 3.7 and 3.8).

There were no mammals or other vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during the first survey consisted of raccoon and feral hog. Tracks observed during the second survey consisted of feral hog, raccoon, and canine. Bird feces were found throughout the reach. Aquatic vegetation and algae cover were absent, and the water color was brown with a surface scum observed during both surveys. Trash was rarely observed and when encountered, consisted of typical plastic cups and bottles. The only evidence of potential recreation at the site consisted of ATV tracks located along the west side of the bridge crossing that were oriented parallel to the county road. The ATV tracks were on a steep bank near the bridge but did not appear to travel up or down stream of the bridge crossing.



Figure 3.12 Photograph of Kickapoo Creek Site KC05 taken on July 26, 2014, the downstream view of the 0-m transect.



Figure 3.13 Photograph of Kickapoo Creek Site KC05 taken on August 22, 2014, the upstream view of the 150-m transect.

Physical Description of KC06

Kickapoo Creek at Site KC06 was visited on July 26 and August 22, 2014. This site was located northwest of Brownsboro, Texas in Henderson County, and was accessible only through private lands that were fenced and had two locked entrances. With landowner permission, TIAER personnel entered private property through the first entrance and drove one-quarter mile to a second locked gate. Once through the second gate, TIAER personnel drove approximately three-quarter mile through pasture land to reach the site. The stream corridor had primarily forest on the left bank of the reach and pasture on the right bank of the reach (Table 3.5). At the site, access to the stream was moderately easy (Table 3.6), although at other locations along the reach, access to the stream was more challenging due to steep banks and dense vegetation. Figures 3.14 and 3.15 depict the general appearance of the site during each of the surveys.

Site KC06 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.3 m during the first survey to 0.1 m during the second survey when portions of the stream were dry (Table 3.6). During both surveys, the mud/clay substrate and numerous timber obstacles and obstructions made traversing the stream channel challenging and sometimes treacherous. Widths of the stream ranged from 8.0 m to 1.0 m during the first survey and 6.5 m to 0.0 m during the second survey (Tables 3.7 and 3.8). Two fence obstructions were observed within the survey reach. One fence went across the stream near the 270-m transect and the other was parallel in the stream near the 180-m transect.



Figure 3.14 Photograph of Kickapoo Creek Site KC06 taken on July 26, 2014, the downstream view of the 0-m transect.



Figure 3.15 Photograph of Kickapoo Creek Site KC06 taken on August 22, 2014, the downstream view of the 150-m transect.

There was a moderate presence of cattle during the first and second surveys, but no other mammals or vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of cattle, deer, feral hog, raccoon, and canine. Cattle and bird feces were also found throughout the reach during both surveys. Aquatic vegetation was rare during the first survey and absent during the second survey. Algae cover was rare during both surveys. The water color varied from clear during the first survey to brown during the second survey. The water surface had scum observed during both surveys with a noticeable odor during the first survey. Trash was not observed in the channel or along the banks of the stream during either survey. No evidence of recreational activity was found within the reach.

Physical Description of KC07

Kickapoo Creek at Site KC07 was visited on July 26 and August 22, 2014. This site was located northwest of Brownsboro, Texas at the crossing of Henderson County Road 3520. Site KC07 was only publicly accessible at the bridge crossing as private property fencing occurred upstream and downstream of the bridge crossing. With landowner permission, TIAER personnel entered private property through the fence and conducted the 300 m survey downstream of the bridge crossing. The stream corridor is forested for the entire length of the reach (Table 3.5). Access to the creek was moderately difficult due to thick vegetation and steep banks at the bridge crossing (Table 3.6). Away from the bridge crossing, access to the stream was easier with more gently sloping banks, but these locations were on private property, which would limit access to these locations. The general appearance of the creek at Site KC07 is depicted in Figures 3.16 and 3.17.



Figure 3.16 Photograph of Kickapoo Creek Site KC07 taken on July 26, 2014, the downstream view of the 0-m transect.



Figure 3.17 Photograph of Kickapoo Creek Site KC07 taken on August 22, 2014, the downstream view of the 150-m transect.

Site KC07 was wadeable for the entire 300-m reach length. Average thalweg was 0.3 m during both surveys (Table 3.6), and shallow water depths with the silt substrate made wading in the stream channel easy. Parts of the stream were dry during both surveys. Widths of the stream ranged from a minimum of 0.0 m during both surveys to a maximum of 17 m during the first survey (Tables 3.7 and 3.8). One pool was identified at the bridge crossing and went upstream beyond the survey reach. The pool was identified during each survey. The dimensions for the first survey are provided in Table 3.12 with dimensions for the second survey in Table 3.13. There were several tree obstructions and some overhanging trees during both surveys that made traversing the streambed sometimes challenging (Figure 3.18).

Table 3.12 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC07.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	>50	17	1.3

Table 3.13 Pool dimensions observed during the second survey along Kickapoo Creek at Site KC07.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	>30	15	1.25



Figure 3.18 Photograph of typical obstructions at Kickapoo Creek Site KC07 taken on July 26, 2014.

No mammals or vertebrates were encountered during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of canine, deer, raccoon, and feral hog. Bird feces were also found throughout the reach during both surveys. Aquatic vegetation was rare to absent between the first and second survey, respectively. Algae was absent to rare from the first survey to the second survey. The water color was brown during both surveys with surface scum. There was a rare occurrence of odor during the first survey. Trash observed consisted of typical plastics, bottles, cans, a kiddie pool, buckets, and pieces of broken glass. No evidence of recreation was found within the reach.

Physical Description of KC08

Kickapoo Creek at Site KC08 was visited on July 26 and August 22, 2014. This site was located northeast of Murchison, Texas in Henderson County, and was only publicly accessible at the FM 1803 bridge crossing. There was a narrow dirt path along the road right-a-way that went to the creek, but private property fencing otherwise limited access to the creek at this location. To access the site, TIAER personnel drove along this dirt path on the northwest side of the bridge and parked under the bridge. The site is located in a forest dominated corridor (Table 3.5). At the site, access to the stream was moderately easy (Table 3.6). At other locations throughout the reach, access to the stream would be more challenging due to steep banks, tree obstructions, and dense vegetation. Figures 3.19 and 3.20 depict the appearance of the site during each of the surveys.

Site KC08 was not wadeable for the entire 300-m reach length. To traverse the reach TIAER personnel launched a small boat via a makeshift dirt boat ramp that was located at the northeast side of the bridge crossing (Figure 3.21). Average thalweg was greater than 1.5 m during both surveys (Table 3.6). During each survey, numerous log jams and other woody debris were encountered within the reach. A log jam at the 0-m transect was significant enough to restrict travelling any further downstream. Stream widths ranged from 18 m to 26 m during both surveys (Tables 3.7 and 3.8).



Figure 3.19 Photograph of dirt boat ramp on Kickapoo Creek KC08 taken on July 26, 2014.



Figure 3.20 Photograph of Kickapoo Creek Site KC08 taken on July 26, 2014, the downstream view of the 0-m transect.



Figure 3.21 Photograph of Kickapoo Creek Site KC08 taken on August 22, 2014, the upstream view of the 150-m transect.

A water dependent bird was observed during the first survey (Table 3.9). During the second survey a slight presence of cattle was observed (Table 3.10). No other mammals or other vertebrates were observed during either survey. Cattle tracks were observed during both surveys. Bird tracks were observed during the first survey, but no other tracks observed during either survey. Bird nests were observed along with bird feces during both surveys. No aquatic vegetation or algae cover was observed during either survey. The water color was brown with no surface scum or foam. Trash was rarely observed and when encountered, consisted of typical plastics and aluminum cans. Evidence of recreational activity consisted of ATV tracks that were underneath the bridge crossing, a chair situated on the right bank near the 270-m transect, and a makeshift boat ramp located near the bridge crossing. Additionally, during the second survey two individuals were observed fishing under the bridge. These two individuals were interviewed.

Physical Description of KC09

Kickapoo Creek at Site KC09 was visited on July 26 and August 22, 2014. This site was located northeast of Murchison, Texas in Henderson County, and was accessible only through private lands that were fenced and required permission to enter the property. The owners of this property run an animal rescue facility and numerous types of animals ranging from primates to cattle may be cared for on this property at various times. This ranch is not regularly open to the public, but about twice a year is open for public tours. With permission, TIAER personnel drove approximately 1.1 miles through the ranch to access the stream site. While traveling through the private property TIAER personnel had to cross three gates, two of which were locked.

The stream corridor had forest and pasture on both sides (Table 3.5). Access to the stream was moderately easy due to the presence of a low water crossing at the 300-m transect (Table 3.6). The general appearance of Kickapoo Creek at KC09 is shown in Figures 3.22 and 3.23.

Site KC09 was wadeable for the entire 300-m reach length. Average thalweg was 0.40 m during the first survey when water was flowing and 0.20 m during the second survey when the stream was pooled and not flowing (Table 3.6). During both surveys, shallow water depths made wading relatively easy. Widths of the stream ranged from a maximum of 12 m during the first survey to a minimum of 0 m during the second survey (Tables 3.7 and 3.8). A few small log obstructions were encountered during both surveys.



Figure 3.22 Photograph of Kickapoo Creek Site KC09 taken on July 26, 2014 the downstream view of the 300-m transect.



Figure 3.23 Photograph of Kickapoo Creek Site KC09 taken on August 22, 2014, the downstream view of the 0-m transect.

During the first survey numerous donkeys were observed at the low water crossing near the 300-m transect. During the second survey, numerous donkeys and horses were observed at this same low water crossing. No other mammals or other vertebrates were observed within the survey reach during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of horse and donkey. Equine feces were found near the 300-m transect, and bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare and algae cover was absent during both surveys, and water color was brown with an oily surface scum. Trash was absent and no evidence of recreational activity was observed during either survey.

Physical Description of KC10

Kickapoo Creek at Site KC10 was visited on July 26 and August 22, 2014. This site was located northeast of Murchison, Texas in Henderson County. Site KC10 was publicly accessible only at the Henderson County Road 3806 bridge crossing with private property upstream and downstream of the crossing (landowner permission was granted for TIAER field crew to access the stream). Forest vegetation was prominent along the stream corridor (Table 3.5). Access to the stream was moderately easy at the bridge crossing. At other locations throughout the reach, access to the stream would be more challenging due to steep banks and dense vegetation. The general appearance of the creek along site KC10 is shown in Figures 3.24 and 3.25.



Figure 3.24 Photograph of Kickapoo Creek Site KC10 taken on July 26, 2014, the downstream view of the 300-m transect.



Figure 3.25 Photograph of Kickapoo Creek Site KC10 taken on August 22, 2014, the upstream view of the 0-m transect.

Site KC10 was wadeable for most of the 300-m reach length. Average thalweg ranged from 0.60 m during the first survey to 0.40 m during the second survey (Table 3.6). During both surveys, wading in the stream channel was challenging at times due to the mud substrate and occasional areas of deep water. In addition, log obstructions and overhanging trees encountered during both surveys sometimes made traversing the streambed difficult. Stream widths ranged from a maximum of 8.0 m during the first survey, when the creek was flowing, to a minimum of 0 m during the second survey, when the creek was pooled (Tables 3.7 and 3.8). Two substantial pools were identified within the survey reach. The dimensions of each during the first survey are provided in Tables 3.14 and 3.15.

Table 3.14 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC10.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	10	5.5	1.1
Pool 2	25	16	>1.5

Table 3.15 Pool dimensions observed during the second survey along Kickapoo Creek at Site KC10.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	10	5	1.0
Pool 2	25	15	>1.5

During the first survey there were no mammals or other vertebrates observed (Table 3.9). During the second survey, a moderate presence of venomous water snakes (*Agkistrodon piscivorus*) was observed (Table 3.10). No other vertebrates were observed during the second survey. Tracks observed during each trip consisted of deer, raccoon, and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare and algae cover was absent during both surveys, and the water color was brown with an oily surface scum. Trash was common throughout the reach both instream and along the banks. The bridge crossing appeared to be a frequently visited dump site (Figure 3.26). Trash consisted of numerous types of items including televisions, typical plastic bottles, metal, trash bags filled with garbage, and furniture. No evidence of human recreational activity was observed within the reach.



Figure 3.26 Photograph of full garbage bags located at the bridge crossing at Kickapoo Creek Site KC10 taken on July 26, 2014.

Physical Description of KC11

Kickapoo Creek at site KC11 was visited on July 26 and August 22, 2014. This site was located north of Murchison, Texas in Henderson County, and was publicly accessible only at the Farm-to-Market Road 773 bridge crossing with private property upstream and downstream of the crossing. Forests are prominent along the stream corridor, however the area immediately at the bridge crossing was mowed (Table 3.5 and Figure 3.27). The mowed area at the bridge crossing had gently sloping banks, providing easy access to the stream (Table 3.6). The more general appearance of the creek depicting the forested corridor is shown in Figures 3.28 and 3.29.

Site KC11 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.30 m during the first survey to 0.20 m during the second survey (Table 3.6). During both surveys, wading in the stream channel was moderately easy due to shallow water depths. Widths of the stream ranged from a maximum of 6.0 m during the first survey to a minimum of 0.0 m during the second survey (Tables 3.7 and 3.8). During the first survey a pool was identified (dimensions recorded in Table 3.16). This pool was not present during the second survey. Log obstructions and other instream woody debris were encountered during both surveys, which made traversing the streambed challenging at times.

Table 3.16 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC11.

	Length (meters)	Width (meters)	Depth (meters)

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	29	6	0.82



Figure 3.27 Photograph of mowed area at the FM 773 Bridge crossing on Kickapoo Creek Site KC11 taken on July 26, 2014. TIAER vehicle in photograph.



Figure 3.28 Photograph of Kickapoo Creek Site KC11 taken on July 26, 2014, the upstream view of the 0-m transect.



Figure 3.29 Photograph of Kickapoo Creek Site KC11 taken on August 22, 2014, the downstream view of the 300-m transect.

There were no mammals or other vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during the first survey consisted of raccoon and deer. Tracks observed during the second survey consisted of raccoon, deer, canine, and feral swine. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare and algae cover was absent during both surveys. Water color was brown with an oily surface scum. Trash was rarely observed and when encountered, consisted of typical plastics, aluminum cans, and bottles. The ATV tracks that led from under the bridge were the only evidence of potential recreational activity at this location. There was also an ATV trail observed on private land along the left bank in the forested area downstream of the bridge, which led to a deer blind.

Physical Description of KC12

Kickapoo Creek at site KC12 was visited on July 26 and August 22, 2014. This site was located north of Murchison, Texas in Henderson County, and was accessible only through private lands that were fenced with a locked gate. With landowner permission, TIAER personnel entered private property and drove approximately 0.9 mile down a pasture road to reach the site. The site starts at a private bridge crossing along a pipeline right-of-way (Figure 3.30). Forest lines the stream corridor, except for about a 50 meter stretch that is within the maintained for the pipeline right-of way (Table 3.5). Access to the stream was moderately easy (Table 3.6), and Figures 3.31 and 3.32 show the general appearance of the site during each survey.



Figure 3.30 Photograph of the private bridge crossing at Kickapoo Creek Site KC12 taken on July 26, 2014.



Figure 3.31 Photograph of Kickapoo Creek Site KC12 taken on July 26, 2014, the upstream view of the 150-m transect.



Figure 3.32 Photograph of Kickapoo Creek Site KC12 taken on August 22, 2014, the downstream view of the 300-m transect.

Site KC12 was wadeable for the entire 300-m reach length. Average thalweg was 0.5 m during both surveys (Table 3.6). Although the water depths were relatively shallow, the mud/clay substrate made wading in the stream channel challenging for most of the reach. Stream widths ranged from a maximum of 10 m during both surveys to a minimum of 1.5 m during the second survey (Tables 3.7 and 3.8). Log obstructions were encountered during both surveys as well as a small beaver dam.

There was a slight presence of water dependent birds during the first survey with no other animals or vertebrates encountered during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of feral hog, deer, raccoon, and beaver, and bird feces were found throughout the reach. Additionally, there was a strong swine odor at the 0-m transect during the second survey. Aquatic vegetation and algae were rarely observed during the first survey and absent during the second survey. The water color was brown with a surface scum and occasional odor. Some lumber was observed within the creek, but no other trash of any kind was observed during either survey. Other than a couple of hunting blinds located along the pipeline right-of-way, no other evidence of human recreational activity was encountered during the either survey.

Physical Description of KC13

Kickapoo Creek at site KC13 was visited on July 26 and August 22, 2014. This site was located north of Murchison, Texas in Henderson County, and is owned by the same landowner as Site KC012. The site was accessible only through private lands that were fenced with a locked gate. With landowner permission, TIAER personnel entered private property and drove approximately one-half mile through a pasture to reach the site. The left-bank is forested, while the right-bank is primarily pasture (Table 3.5). Access to the stream was moderately easy, although a barbed wire fence had to be crossed to reach the creek (Table 3.6). The general appearance of the creek is shown in Figures 3.33 and 3.34.



Figure 3.33 Photograph of Kickapoo Creek Site KC13 taken on July 26, 2014, the upstream view of the 0-m transect. TIAER personnel in photograph.

Site KC13 was wadeable for the entire 300-m reach length. Average thalweg was 0.9 m during both surveys (Table 3.6). During both surveys, the mud/clay substrate and multiple tree obstructions made wading the stream channel challenging for most of the reach. Stream widths ranged from a maximum of 10 m to a minimum of 7.5 m (Tables 3.7 and 3.8).

There was a slight presence of snakes during the first survey with no other vertebrates encountered during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of raccoon, deer, hog, and bird with bird feces encountered throughout the reach. Aquatic vegetation was rare during the first survey and absent during the second survey, while algae was absent during both surveys. A surface scum was observed on the brown water with odor detected during both surveys. Trash in the form of rolled up barbed wire was encountered during the first survey with no other forms of trash observed during either survey. No signs of recreation were observed within the creek, although a manmade duck pond was located in a coastal field near KC13, which is used by the landowner during duck season.



Figure 3.34 Photograph of Kickapoo Creek Site KC13 taken on August 22, 2014, the downstream view of the 300-m transect.

Physical Description of KC14

Kickapoo Creek at site KC14 was visited on July 26 and August 22, 2014. This site was located north of Murchison, Texas in Henderson County, and was accessible only through private lands that were fenced with a locked gate. With landowner permission, TIAER personnel entered private property and drove approximately 1.8 miles through the pasture to reach the site. Forest dominated the stream corridor, except a maintained right-of-way located near the 300-m transect (Table 3.5). Access to the stream was moderately easy with low banks and shallow water depths, although traversing through the forest to reach the site was challenging (Table 3.6). Figures 3.35 and 3.36 depict the appearance of the site during each of the surveys.

Site KC14 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.3 m during the first survey to 0.1 m during the second survey, when most of the reach was dry and only a few pockets of water were encountered (Table 3.6). During both surveys, the shallow to nonexistent water depths made wading in the stream channel relatively easy until obstructions were encountered. Stream widths ranged from a maximum of 6.0 m during the first survey to a minimum of 0.0 m during the second survey, when most of the stream was dry (Tables 3.7 and 3.8). Obstructions encountered during both surveys included several log jams and a concrete low water crossing found between the 150-m and 200-m transects.



Figure 3.35 Photograph of Kickapoo Creek Site KC14 taken on July 26, 2014, the upstream view of the 0-m transect.



Figure 3.36 Photograph of Kickapoo Creek Site KC14 taken on August 22, 2014, the downstream view of the 150-m transect.

There was a slight presence of deer during the first survey and cattle were observed during both surveys (Tables 3.9 and 3.10). No other mammals or other vertebrates were observed during either survey. Tracks observed during each trip consisted of cattle, deer, feral hog, and raccoon. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rare during the first survey and absent during the second survey due to the lack of water. Water color was brown with a surface scum during both surveys, and a slight odor was detected during the first survey. Garbage encountered during both surveys was rare and consisted of a few plastics and some square tubing in the channel and along the banks. No other trash of any kind was observed within the reach during either survey. The only evidence of recreational activity found during the either survey were deer blinds located in the pastures around the river.

Physical Description of KC15

Kickapoo Creek at site KC15 was visited on July 26 and August 22, 2014. This site was located north of Murchison, Texas in Henderson County, and was owned by the same landowner as site KC014. Site KC15 was accessible only through private lands that were fenced with a locked gate. With landowner permission, TIAER personnel entered private property and drove approximately 1.2 miles through a pasture to reach the site. Forest dominated the corridor along the left bank and pasture along the right bank (Table 3.5). Access to the stream was moderately difficult due to dense vegetation and a barbed wire fence that had to be crossed to reach the site (Table 3.6). The appearance of the creek during each survey is shown in Figures 3.37 and 3.38.



Figure 3.37 Photograph of Kickapoo Creek Site KC15 taken on July 26, 2014, the upstream view of the 0-m transect.



Figure 3.38 Photograph of Kickapoo Creek Site KC15 taken on August 22, 2014, the downstream view of the 150-m transect.

Site KC15 was wadeable for the entire 300-m reach length. A beaver dam located near the 240-m transect created an impoundment leading to shallower running water below the dam (Figure 3.39). Average thalweg ranged from 0.4 m during the first survey to 0.2 m during the second survey (Table 3.6). Depths within the dam impoundment were about 1.0 meter, while depths below the dam were typically less than 0.5 meter during both surveys. Stream widths ranged from a maximum of 12 m during the first survey to a minimum of 0.0 m during the second survey, during which the stream was not flowing (Tables 3.7 and 3.8). Wading the stream was relatively easy as the water was shallow, but several log jams were encountered that were challenging to circumvent.

During the first survey, there was a slight presence of snakes and deer and a moderate presence of cattle with no other mammals or other vertebrates observed (Table 3.9). There was a large presence of cattle observed during the second survey, but no other animals (Table 3.10). Tracks observed during each trip consisted of beaver, deer, feral hog, raccoon, and canine. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were both rarely observed during the first survey and absent during the second survey. Water color was brown with a surface scum and a slight odor was detected, but only during the first survey. Trash was rare and only observed during the first survey. The trash observed consisted of a 5-gallon bucket, glass bottles, and typical plastics. Hunting blinds located in the pastures alongside the stream were the only signs of human recreational activity observed during either survey.



Figure 3.39 Photograph of Kickapoo Creek Site KC15 taken on July 26, 2014, the beaver dam near the 240-m transect.

Physical Description of KC16

Kickapoo Creek at Site KC16 was visited on July 26 and August 22, 2014. This site was located northwest of Murchison, Texas in Van Zandt County, and was only publicly accessible at the FM 1861 bridge crossing. Although the site is publicly accessible, property fences upstream and downstream of the crossing limit public accessibility to the areas immediately surrounding the bridge. TIAER personnel entered the stream underneath the bridge to access the site. The site is located in a forest dominated corridor (Table 3.5). Access to the stream at the bridge crossing was easy as this area is mowed and has gently sloping banks (Table 3.6). The general appearance of the creek at Site KC16 is shown in Figures 3.40 and 3.41.

Site KC16 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.7 m during the first survey to 0.6 m during the second survey (Table 3.6). During both surveys, the mud/clay substrate and brown murky water made wading in the stream challenging. Widths of the stream ranged from a maximum of 22 m during the first survey to a minimum of 3.5 m during the second survey (Tables 3.7 and 3.8). Most of the reach was considered a large pool (dimensions are recorded in Table 3.17 for the first survey and 3.18 for the second survey). Several tree obstructions were encountered throughout the reach as well as a water-gap fence located at the 300-m transect (Figure 3.42).

Table 3.17 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC16.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	180	22	1

Table 3.18 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC16.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	>40	14.5	1.1

**Figure 3.40 Photograph of Kickapoo Creek Site KC16 taken on July 26, 2014, the upstream view of the 150-m transect.**



Figure 3.41 Photograph of Kickapoo Creek Site KC16 taken on August 22, 2014, the upstream view of the 0-m transect.



Figure 3.42 Photograph of Kickapoo Creek Site KC16 taken on July 26, 2014, the water gap at the 300-m transect.

No mammals or other vertebrates were observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of raccoon, deer, feral hog, and bird with bird feces throughout the reach. Aquatic vegetation was common during both surveys, while algae was absent during the first survey and common during the second survey. Water color was brown with a surface scum and a slight odor, which was detected only during the first survey. The observation of trash was rare to common during both surveys and consisted of a few tires, bottles, cans and typical plastics. The only sign of recreational activity observed was a fishing bobber (Figure 3.43).



Figure 3.43 Photograph of Kickapoo Creek Site KC16 taken on August 22, 2014 showing a fishing bobber observed in the stream.

Physical Description of KC17

Kickapoo Creek at site KC17 was visited on July 26 and August 22, 2014. This site was located northwest of Murchison, Texas in Van Zandt County, and was accessible only through private land that required landowner permission to access. With landowner permission, TIAER personnel walked approximately 120 m south of the landowner's residence through a partially mowed corridor to reach the site. The site is located in forest dominated corridor (Table 3.5). Access to the stream was difficult due to steep banks and dense vegetation (Table 3.6). The general appearance of the reach is shown in Figures 3.44 and 3.45. The steep bands are evident in Figure 3.44.

Site KC17 was wadeable for the entire 300-m reach length. Average thalweg was 0.30 m during both surveys (Table 3.6). During both surveys, the muddy substrate and log jams made wading in the stream channel challenging. Widths of the stream ranged from a maximum of 8.0 m during the first survey to a minimum of 0.0 m during the second survey, when the stream was pooled (Tables

3.7 and 3.8). One pool was identified and was encountered during both surveys. The dimensions recorded during the first survey are provided in Table 3.19 and Table 3.20 for the second survey.

Table 3.19 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC17.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	30	8	0.65

Table 3.20 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC17.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	30	7.5	0.6



Figure 3.44 Photograph of Kickapoo Creek Site KC17 taken on July 26, 2014, the upstream view of the 0-m transect.



Figure 3.45 Photograph of Kickapoo Creek Site KC17 taken on August 22, 2014, the upstream view of the 150-m transect.

There were no mammals or other vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of deer, raccoon, canine, and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rarely observed during either survey, and the water color was brown with an oily surface scum. No trash was observed nor was any evidence of human recreational activity during either survey.

Physical Description of KC18

Kickapoo Creek at Site KC18 was visited on July 26 and August 22, 2014. This site was located northwest of Murchison, Texas in Van Zandt County. Site KC18, was publicly accessible only at the Van Zandt County Road 4206 bridge crossing due to fenced private property upstream and downstream of the crossing. TIAER personnel accessed the site on the downstream side of the bridge crossing and waded downstream. A water gap positioned on the upstream side of the bridge blocked upstream access (Figure 3.46). The site is located in a forest dominated corridor (Table 3.5). Access to the stream was difficult due to no parking areas, fenced private property, and steep banks lined with poison ivy. Figures 3.47 and 3.48 depict the general appearance of the site during each survey.



Figure 3.46 Photograph of water gap on upstream side of the bridge crossing at Kickapoo Creek Site KC18 taken on July 26, 2014.

Site KC18 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.1 m during the second survey when the stream was pooled (Table 3.6). During both surveys, numerous log jams were encountered that made wading the stream channel difficult (Figure 3.49). Stream widths ranged from a maximum of 13 m during the first survey to a minimum of 0.0 m during the second survey, when the stream was pooled (Tables 3.7 and 3.8).



Figure 3.47 Photograph of Kickapoo Creek Site KC18 taken on July 26, 2014, the downstream view of the 150-m transect.



Figure 3.48 Photograph of Kickapoo Creek Site KC18 taken on August 22, 2014, the downstream view of the 300-m transect.



Figure 3.49 Photograph of large log obstruction on Kickapoo Creek at Site KC18 taken on July 26, 2014.

There was a moderate presence of venomous water snakes (*Agkistrodon piscivorus*) during the first survey (Table 3.9). There were no other vertebrates observed during either survey (Tables 3.9 and 3.10). Tracks observed during each trip consisted of deer, raccoon, and feral hog. A feral swine wallow was also observed during both surveys near the 30-m transect. Bird feces were observed throughout the reach during both surveys. Aquatic vegetation was common, while algal cover was absent. The water color was brown with an oily surface scum. Garbage along the banks and instream was commonly observed during both surveys and consisted of typical plastic bottles, cans, Styrofoam, tires, a toilet lid, and plastic bags. No evidence of human recreational activity was observed during either survey.

Physical Description of KC19

Kickapoo Creek at Site KC19 was visited on July 26 and August 22, 2014. This site was located northwest of Murchison, Texas in Van Zandt County, and was publically accessible only at bridge crossing of FM Road 858. Forest and pasture were noted along both sides of the stream corridor (Table 3.5). Access to the stream was moderately easy due to gently sloping banks at the bridge crossing. Access at other locations along the reach would be difficult due to dense vegetation (Table 3.6). The general appearance of the reach at Site KC19 is shown in Figures 3.50 and 3.51.



Figure 3.50 Photograph of Kickapoo Creek Site KC19 taken on July 26, 2014, the downstream view of the 0-m transect.



Figure 3.51 Photograph of Kickapoo Creek Site KC19 taken on August 22, 2014, the downstream view of the 150-m transect.

Site KC19 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.10 m during the second survey, when the stream was nearly pooled (Table 3.6). One pool was identified and was encountered during both surveys. The dimensions recorded during the first survey are provided in Table 3.21 and Table 3.22 for the second survey. During both surveys, the shallow water depths resulted in relatively easy wading; however occasional log jams and other instream woody debris posed an occasional challenge. Stream widths ranged from a maximum of 6.0 m during the first survey to a minimum of 0.20 m during the second survey (Tables 3.7 and 3.8).

Table 3.21 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC19.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	9.5	2.5	0.5

Table 3.22 Pool dimensions observed during the first survey along Kickapoo Creek at Site KC19.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	9.3	2.5	0.45

There was no observance of any mammals or other vertebrates during either of the surveys (Tables 3.9 and 3.10). Wildlife tracks observed during both surveys consisted of raccoon, deer, and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was common and algae cover was absent during both surveys. Water color was brown and during the first survey no surface scum was present; however during the second survey an oily surface scum was visible throughout the reach. Trash was commonly observed and consisted of tires, scrap metal, typical plastic bottles, and aluminum cans. Human footprints were observed under the bridge and serve as the only sign of potential human recreation occurring at the site.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited sites during times of days and on days when recreational activities were apt to be observed. Eleven of the 19 sites were at public road crossings; however, private property boundaries generally limited public access to small areas around and underneath bridge crossings. The remaining eight sites were located on private property, and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations.

Recreation was directly observed by TIAER staff on two instances, once during each survey. During the first survey, two kayakers were observed with fishing equipment at Site KC01. When interviewed, they indicated that they were using the boat launch at the site and traveling downstream to fish closer to the reservoir, outside of the survey reach. During the second survey,

two people were observed fishing underneath the bridge crossing at Site KC08. These two people were also interviewed.

Evidence of potential recreation was encountered at 13 of the 19 sites as follows:

- Site KC01 – A small, dirt boat ramp, a public trash can, fishing tackle, and several foot paths were observed during the RUAA field surveys. The site is located near the confluence of Kickapoo Creek and Lake Palestine. During the scouting for potential RUAA survey sites in the spring of 2014, several vehicles, some with boat trailers, were observed at this location.
- Site KC02 – One hunting blind was observed in a field adjacent to the stream. Additionally, a feral hog trap was found in the wooded area along the stream corridor. According to the landowner, both the blind and trap belonged to her son, who is an avid deer and hog hunter.
- KC03 - A barbeque grill was found along the bank that had been left there by the landowner. There was also an ATV trail leading to the stream site, which was used by the landowner.
- KC04 – An ATV trail and footpaths along the banks were observed. Parking was available underneath the bridge crossing and appeared to have been used fairly regularly. Fishing tackle was found at various locations throughout the survey reach.
- Site KC05 – ATV tracks were found along a steep bank by the bridge. The ATV tracks were apparent only near the bridge and did not travel upstream or downstream of the crossing.
- Site KC08 – ATV tracks underneath the bridge crossing along a dirt path, a chair situated on the right bank near the 270-m transect, and dirt boat ramp located near the bridge crossing were observed.
- KC11 – ATV tracks were observed underneath the bridge crossing. There was also a private ATV trail along the left bank of the stream in the forested area downstream of the bridge which led to the area of an observed deer blind. The ATV trail was located on private property and not believed to be for public use.
- KC12 – Deer blinds were observed along the cleared right-of-way near the creek.
- KC13 – A manmade duck pond was located in the coastal field near Site KC13. During site reconnaissance, the duck pond contained water; however, during the field surveys, the pond was dry. According to the landowner, the pond is used by his family and it generally contains water only during duck season.
- KC14 and KC15 – Hunting blinds were observed in some of the pastures along the creek.
- KC16 – A fishing bobber was observed.

- KC19 – Footprints were observed underneath the bridge crossing.

Sites KC10 and KC18 appeared to be dump sites. Both locations contained large amounts of household trash including a toilet lid, tires, a recliner, televisions, children's toys, vegetables, and bags of garbage. Although trash is not necessarily a sign of recreational activity, the abundance of trash indicates that people routinely visit Sites KC10 and KC18.

Activities Interviewed

A total of 28 interviews were collected from landowners along Kickapoo Creek as well as others with interest in the watershed area. The interviews indicated that fishing and hunting as the principal recreational activities occurring throughout the creek, while swimming, wading, and boating were noted at only a few locations (Table 3.23).

Swimming and wading was noted at Site KC03. Three interviews were collected from Site KC03. These were from a landowner, landowner's son and landowner's granddaughter. All three interviews indicated they had personally recreated in Kickapoo Creek in the following forms: swimming, adult wading, children wading, and fishing. In the interviews the landowner noted that he does not hunt. The landowner holds family outings at the creek and even has left a barbecue grill along the bank for cookouts. Additionally, they indicated that they ride their ATVs on the property, sometimes traveling alongside and through the creek.

At Site KC04, the landowner indicated that he used to swim, wade, and fish as a little boy in the creek, no longer did because he was too old and there was too much debris in the creek. Because this activity was reported to have occurred prior to 1970 (the timeframe for the RUAA assessment is for activity after November 28, 1975), it was not reported in Table 3.23. The landowner further indicated that he had observed and heard of fishing at KC04 and KC01.

Swimming and wading were also noted at Site KC11 in an interview with the wife of the landowner. She indicated that her adult son one time about three years ago had gone swimming, wading, hunting, and fishing with friends in the creek. Although this site was located at a publicly accessible location, the son's recreation occurred downstream of the road crossing on private property. The interviewee stated that she had observed and heard of fishing at the publicly accessible bridge crossing.

Hunting was an activity identified as a personal use occurring on private property at nine survey sites (see Table 3.23), and in one instance at an unknown location within the watershed. Hunting was observed by one interviewee at an unknown location within the watershed and heard of occurring by interviewees at three locations within the watershed (Site KC01 and two unknown locations). Deer and hog hunting were the most popular forms of hunting. A father and son who owned property for Sites KC12 and KC13 also included duck hunting in their interview. They had constructed their own private duck pond that could be filled and drained of water depending on the time of year.

Kayaking and/or boating were identified by two interviewees as a form of recreation on Kickapoo Creek. Kayaking was specifically noted by both at Site KC01, and one of the interviewees noted

checking out some other locations along the creek. The kayaking by both interviewees was related to accessing the creek for fishing.

Fishing was the main form of recreation identified within the study area. Fishing was noted at several locations, but Site KC01 was the predominant location at which fishing occurred (Table 3.23). This is likely due to the close proximity of Site KC01 to Lake Palestine and the public boat ramp at this location.

Although fishing occurs throughout the year, it primarily occurs during early spring when the white bass (*Morone chrysops*) are running, according to the interviewees. They stated that cars are lined up along State Highway 31 at the bridge crossing, some with boats and some without boats, all fishing in Kickapoo Creek. During scouting for sites in the spring of 2014, TIAER employees personally observed many fishermen at Site KC01, a few who were fishing from their boats.

Table 3.23 Summary of recreational activities noted in interviews for Kickapoo Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. An * and numbers in parentheses indicate recreation reported from an interview for another site.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
KC01	3 ^a				0,0,1	3,2,2 (1*,13*,11*)	2,2,2
KC02	2 ^b				2,0,0		
KC03	3 ^b	3,0,0	3,0,0	3,0,0	2,0,0	3,0,0	
KC04	1 ^b					1,1,1	
KC05	0						
KC06	1 ^b						
KC07	1					0,1,0	
KC08	1 ^b					1,0,0	
KC09	3 ^c						
KC10	1 ^b				1,0,0		
KC11	2 ^c	1,0,0	1,0,0		1,0,0	1,1,1	
KC12	2 ^d				2,0,0		
KC13					(2*,0,0)		
KC14	2 ^e				1,0,0		
KC15					(1*,0,0)		
KC16	1					0,1,0	
KC17	1				1,0,0		
KC18	0						
KC19							
General AU	4				1,1,2	1,1,2	(1*,0,0)
Totals	28	4,0,0	4,0,0	3,0,0	11,1,3 (3*,0,0)	10,7,6 (1*,13*,11*)	2,2,2 (1*,0,0)

a. One interviewee also noted kayaking at locations general to Kickapoo Creek.

- b. Interviewee(s) also provided information pertaining to site KC01.
- c. One of the interviewees provided information pertaining to site KC01.
- d. Interviewees also provided information pertaining to site KC01 and KC13
- e. Interviewees also provided information pertaining to site KC15

Interviewees stated that hunting occurs during the appropriate seasons. Deer and duck season occur during the fall and early winter. Hogs were hunted whenever the opportunity arose, according to the persons interviewed.

The remaining interviewees all stated to have not personally used, seen others use or heard of others using the stream for any form of recreation.

Summary

RUAAs were conducted at nineteen sites along Kickapoo Creek (AU-0605A) on the days of July 25-26, 2014 and August 22, 2014. Temperatures were above 21°C (70°F) during the 30 days prior to each survey. Stream flow was considered normal at most sites during the July survey with low to no flow conditions generally encountered during the August survey. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions during both July and August 2014 (TWDB, 2014).

Recreational activities were observed at one site during each survey. During the first survey, two kayakers were observed with fishing equipment at Site KC001. During the second survey, two individuals were observed fishing underneath the bridge at Site KC08. Other than the public boat ramp at Site KC01 and improvised dirt boat ramp at KC08, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation during either survey.

The interviews indicated fishing and hunting as the principal recreational activities occurring throughout the creek, while swimming, wading, and boating were noted at only a few locations. The primary site noted for recreational activities was Site KC01 for fishing. Site KC01 has a public boat ramp and is in close proximity to Lake Palestine. Public access to the stream at more upstream locations is limited to the right-of-ways immediately surrounding bridge crossings or areas immediately up and down stream of culvert crossings, typically ranging from 10 to 30 meters.

Recreational activities observed and reported in interviews are summarized in Figure 3.52. Overall RUAAs findings are summarized in the form below.

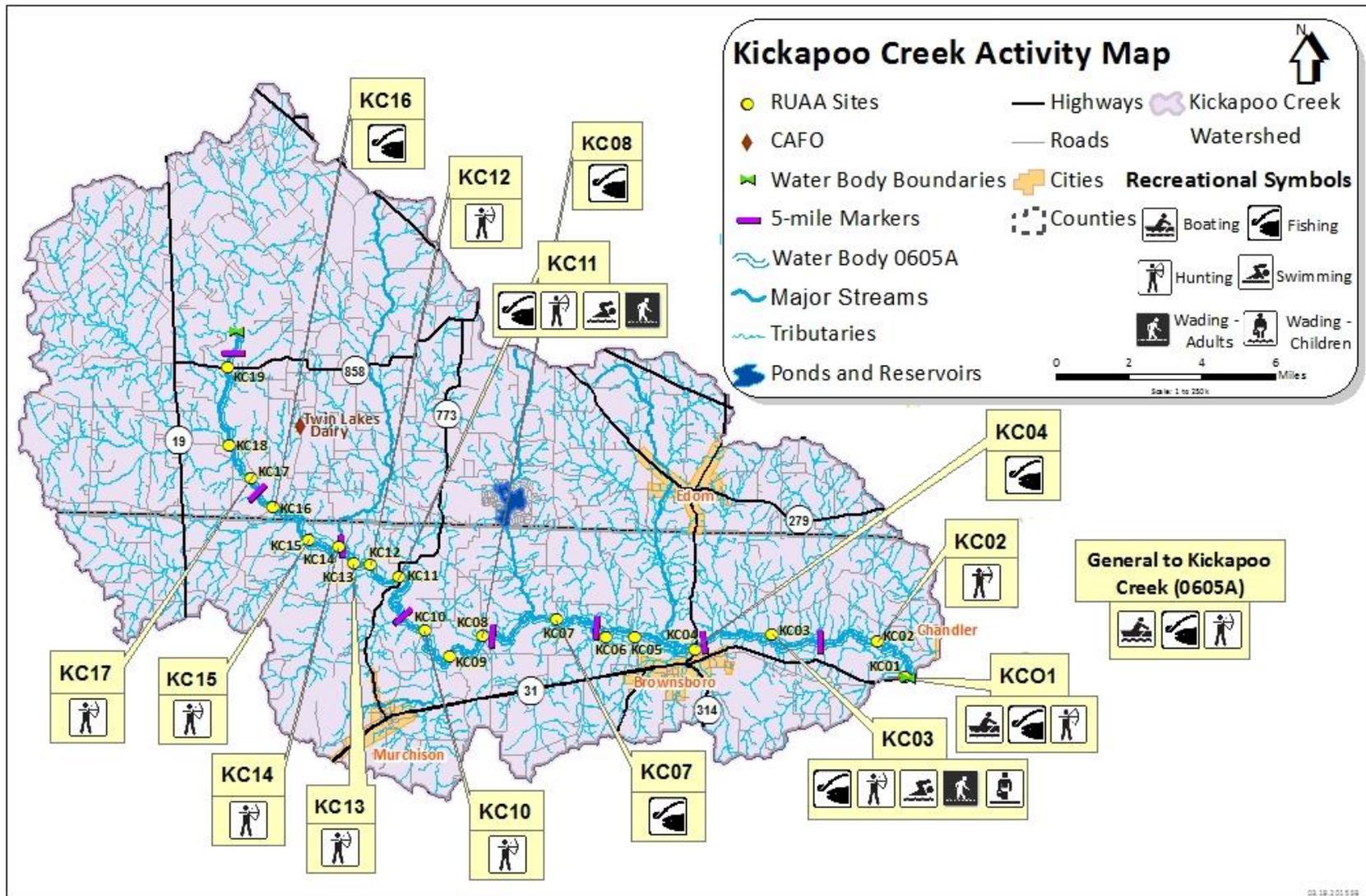


Figure 3.52 Summary of observed and interviewed human activities on Kickapoo Creek. Fishing and kayaking were the only recreational activities observed during field surveys or site visits.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Kickapoo Creek

Segment No. of Nearest Downstream Segment No.: Segment 0605A

Classified?:No

County: Van Zandt and Henderson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

b. Do secondary contact recreation 1 activities occur on the water body?

frequently seldom not observed or reported unknown

c. Do secondary contact recreation 2 activities occur on the water body?

frequently seldom not observed or reported unknown

d. Do noncontact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.5 meters

b. Are there substantial pools deeper than 1 meter? Yes No

c. What is the general level of public access?

easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

Mild-Extreme Drought

Incipient dry spell

Near Normal

Incipient wet spell

Mild-Extreme Wet

CHAPTER 4

THE NECHES RIVER ABOVE LAKE PALESTINE

(0606)

Watershed Characteristics

The watershed of the Neches River Above Lake Palestine (Segment 0606) covers 90,100 acres, excluding the watershed area of Prairie Creek (0606A), which covers about 57,300 acres and is described in Chapter 5. Prairie Creek is a major tributary to the Neches River Above Lake Palestine with its confluence occurring with the Neches River between Texas State Highway 64 and FM 279. The Neches River Above Lake Palestine encompasses the City of Van (estimated population 2,805) and small portions of the City of Chandler (estimated population 2,650) (Figure 4.1). In association with the City of Chandler, Segment 0606 flows through the River Park off State Highway 31. The River Park is located on the banks of the Neches River and provides a boat ramp for fishermen, a nature walk, and picnic areas. A historical marker commemorating the Battle of the Neches is also located along Segment 0606 near Site NR08 (see Figure 4.1). While surface water is the primary focus, this portion of the Neches River watershed overlays the Carrizo – Wilcox Aquifer (George, et al., 2011). The watershed area has rolling terrain with deep sandy loam soils in the uplands (TSHA, 2013b), while the bottom lands are fairly flat with loamy soils that are frequently flooded and often strongly acidic (Stringer, 1998).

The watershed of the Neches River Above Lake Palestine falls largely within the Tertiary Uplands ecoregion (35a) with a small portion of its headwaters within the Northern Post Oak Savanna (33a) (Griffith, et al., 2007). Much of the native wooded plain has been converted to pasture with almost 40 percent of the land area existing as hay/pasture (Figure 4.2). Deciduous forest and woody wetlands dominate the area adjacent to the river. Less than 10 percent of the watershed reflects developed land with most of the developed area around the City of Van and the City of Chandler (Figure 4.2). The mean minimum and maximum temperatures for the region range from 36 and 57°F in January and 73 to 94°F in July. Average rainfall for the area is 42 inches annually (Tyler Texas Weather, 2015).

Designated Uses, Impairments, and Concerns

The Neches River Above Lake Palestine (Segment 0606) is classified as perennial (TCEQ, 2013a) and has designated uses of primary contact recreation, general use, and fish consumption with an intermediate aquatic life use. Based on the confluence of Prairie Creek, Segment 0606 is divided into two assessment units (TCEQ, 2013b). Only the lower AU (0606_01), extending from the northeast arm of Lake Palestine to the confluence with Prairie Creek, is listed as impaired for bacteria with an initial listing in 2008 (TCEQ, 2013). Additional concerns for AU0606_01 include nitrate, orthophosphorus, and total phosphorus (TCEQ 2013b). The upper AU (0606_02) extends upstream from the confluence with Prairie Creek to Rhines Lake Dam. Impairments for depressed dissolved oxygen and low pH are noted along the upper portion of the Neches River (AU 0606_02).

Permitted Discharges

With regard to permitted discharges within the watershed of Segment 0606, these also include all permitted discharges within the Prairie Creek watershed (see Chapter 5). The Prairie Creek watershed contains three WWTF discharges with a total permitted average daily discharge of 13.08 MGD. Prairie Creek also has several permitted stormwater outfalls associated with Delek Refining. The largest discharger to Prairie Creek is the City of Tyler Westside WWTF with a permitted discharge of 13 MDG. Besides these outfalls in the Prairie Creek watershed, there are five permitted WWTFs within the watershed of the Neches River Above Lake Palestine, none of which directly discharge to Segment 0606. Of the five permitted discharges, the largest discharge is associated with the City of Van (TX0054071) with a permitted flow of 0.60 MGD. South of Van, the Ben Wheeler Water Supply Corporation has three WWTFs (TX0065650, TX0070548, and TX0118591) averaging a combined discharge of 0.02 MGD, and the Free State Sewer Service and Water Supply Corporation (TX0133931) had a small facility with a permitted discharge of 0.10 MGD.

There are currently no permitted concentrated animal feeding operations within the watershed of Segment 0606.

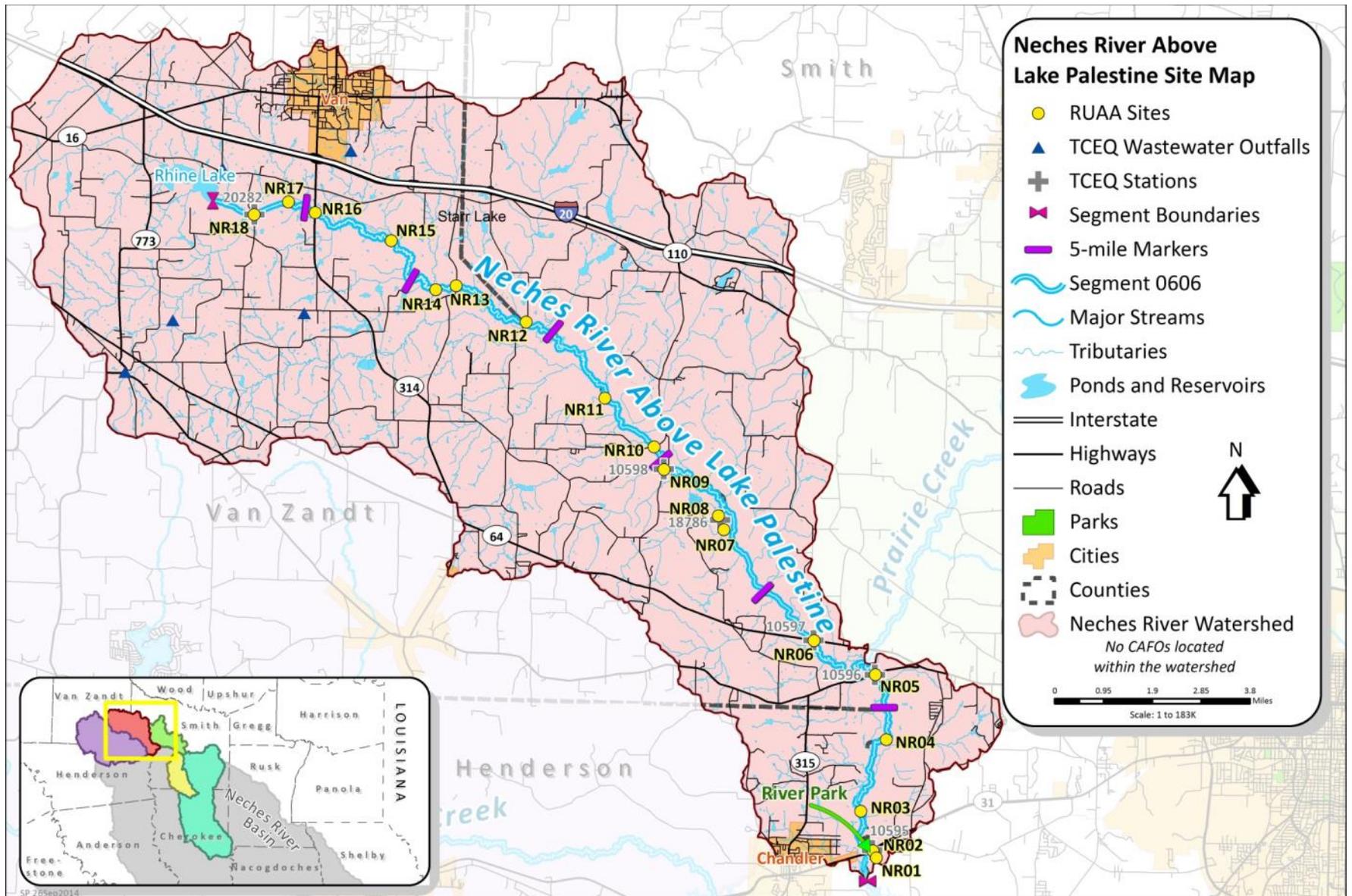


Figure 4.1 Overview of the Neches River Above Lake Palestine watershed and RUAA sites.

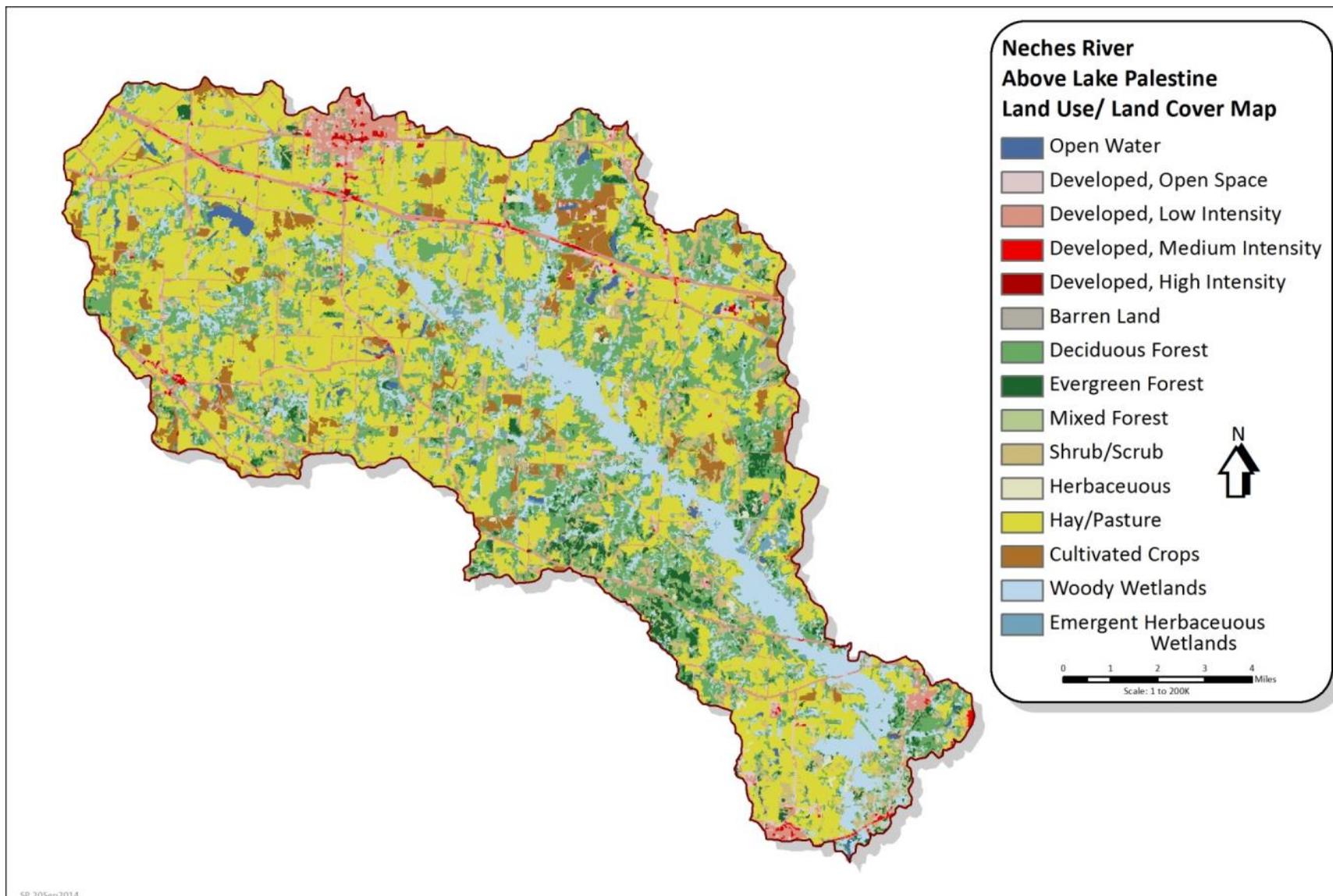


Figure 4.2 Land use/land cover for the Neches River Above Lake Palestine watershed. Source: 2011 National Land Cover Database (USGS, 2013).

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute bacteria to nearby waterbodies. To provide an estimate of livestock densities in the watershed, county level livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website from the 2012 survey (USDA, 2012). The Neches River Above Lake Palestine lies within Van Zandt, Smith, and Henderson Counties (Figure 4.1), and these county level data were weighted by watershed area within each county to estimate livestock within the watershed. These statistics indicate large numbers of beef cattle in Van Zandt, Smith, and Henderson counties, and, thus, likely within the watershed (Table 4.1).

Table 4.1 Estimated livestock numbers within the Neches River Above Lake Palestine watershed based on statistics for Van Zandt, Smith, and Henderson Counties adjusted for the percent of the county within the watershed. (Source: USDA, 2012).

The Neches River (Segment 0606) watershed comprises about 10% of Van Zandt County, 5% of Smith County, and 1% of Henderson County.

County	Year	Cattle & Calves (all beef)	All Goats	Mules, Burros, and Donkeys	Horses & ponies	Hogs
Van Zandt	2012	68,357	3,305	1,044	3,787	280
Smith	2012	42,885	3,561	1,127	4,342	401
Henderson	2012	53,402	2,131	950	3,184	665
Neches River Above Lake Palestine Watershed Average	2012	9,474	525	168	619	53

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 4,275 households within the Segment 0606 watershed (based on 2010 census population data) there are potentially about 2,500 dogs within the Neches River Above Lake Palestine watershed. Other domestic animals, such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife, such as deer, feral hogs, and birds. In 2013 statewide population estimated roughly 39 whitetail deer per 1,000 acres. This estimation suggests that the population for whitetail deer in the Post Oak Savannah region is roughly 400,000 deer, or 35 deer per 1,000 acres (Cain, 2014). Feral hogs are an invasive species commonly found throughout Texas. They have been known to travel in large groups along waterways and

congregate near shallow depressions of water. Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (AgriLife, 2011).

Failing On-Site Sewage Facilities

Failing On-Site Sewage Facilities Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CNNs) from the Public Utility Commission of Texas was used. As not all cities with WWTFs have CNNs, the CNN layer was supplemented with a GIS layer representing municipal boundaries for those cities with WWTFs. Population data from the U.S. Census Bureau (USCB) were then overlaid masking out areas that should be serviced by WWTFs. The 2010 U.S. Census Bureau (USCB) data indicated that of the 4, 275 households in the Segment 0606 watershed, about 65% are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of the Neches River (Segment 0606) was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Van

[City of Van Homepage](#)¹⁹

Nothing significant was found pertaining to the historical recreational use of the Neches River within Segment 0606.

City of Chandler

[City of Chandler Homepage](#)²⁰

Website search found previous “Neches River Clean-Up” and “Neches River Sweep” events held on April 22, 2012 and April 27, 2013 respectively. Both events were asking for volunteers to help pick up trash and debris in River Park, located in Chandler, and the portion of the Neches River that runs through the park. No pictures of recreational use in the Neches River were found on website.

Library Source

Chandler Public Library

900 E. State Hwy 31

Chandler, TX 75758

Phone Number: (903) 849-4122

Website: [City of Chandler Public Library Homepage](#)²¹

No significant information was found regarding recreational use of the Neches River..

Newspaper Sources

The Tyler Morning Telegraph

[The Tyler Morning Telegraph Homepage](#)²²

Phone: (903) 592-3818

No significant information was found regarding recreational use of the Neches River.

Van Zandt News

[Van Zandt News Homepage](#)²³

Phone: (903) 567-4000

No significant information was found regarding recreational use of the Neches River.

Internet Searches

The Handbook of Texas Online

[The Handbook of Texas Online Homepage](#)²⁴

Search of the handbook by river name was conducted. No significant information was found regarding the recreational use of the Neches River.

¹⁹ <http://vantx.com/>

²⁰ <http://www.chandlertx.com/>

²¹ <http://www.chandlertx.com/index.aspx?NID=101>

²² <http://www.tylerpaper.com/>

²³ <http://vanzandtnews.com/>

²⁴ <https://tshaonline.org/>

Survey Site Descriptions

The Neches River Above Lake Palestine is 33 miles long and therefore indicated a goal of 20 sites (3 site per 5 miles of river for the RUAA survey (Figure 4.1). With the help of cooperating stakeholders, TIAER was able to establish a total of 18 survey sites along Segment 0606 (Table 4.2). Although the optimum number of sampling stations would have been 20 following the RUAA guidelines, acceptance of using only 18 sites was sought and granted from TCEQ. Although 18 sites were initially established, when making arrangements to conduct the first survey, landowners for Site NR04 decided not to allow access to the stream through their property, so no field surveys were conducted at this location. Also, at Site NR15 only the first survey was conducted and not the second as the landowner was unavailable to escort TIAER personnel on his property and would not allow access without his presence.

Of the remaining 17 sites, 9 were located at public road crossings that did not require permission for access to the river, but did require landowner cooperation to conduct the full 300 meter assessment. It should be noted that at these nine publically accessible locations, there was actually very limited public access at some of the nine sites due to private property fences or boundaries. Of these nine publically accessible sites, five were collocated with TCEQ sampling stations. The remaining eight sites were associated with private property and were selected to provide physical characterization of Neches River Above Lake Palestine in areas between public access points. Of note, Site NF01, while off of private land was accessible by boat with public boat ramps both up and downstream of this location. Site NF08 also had limited public accessibility in that a historical marker resides on this property and access to the marker is open to the public. Entrances to sites on private lands were limited by fences and locked gates and were often several meters to kilometers from the stream. The average distance between survey sites was 1.80 river miles and ranged from 0.20 to 3.61 miles. The largest gap of 3.61 river miles was between NR11 and NR12. There are no major or minor road crossings between NR11 and NR12 and attempts to contact landowners for private land access in this gap area were unsuccessful. RUAA surveys were performed July 24-25 and August 22-23, 2014 at these locations. A brief description of each site follows.

Table 4.2 Description and location of RUAA field survey sites for Neches River Above Lake Palestine, Segment 0606.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi) ¹	Distance from Confluence (mi) ¹	Access
	NR01	Neches River on private property approximately 250 meters south of SH31	32.313151	-95.451144	0.0	0.76	Public ²
10595	NR02	Neches River at intersection with SH31	32.315093	-95.452393	0.20	0.96	Public
	NR03	Neches River on private property approximately 1.4 km north of SH 31	32.326158	-95.456693	1.09	2.05	Private
	NR04	Neches River on private property approximately 3.6 km north of SH 31 and 2.5 km west of SH 49	32.348680	-95.456751	2.34	4.39	Private
10596	NR05	Neches River at intersection with FM 279	32.364788	-95.452936	1.43	5.82	Public*
10597	NR06	Neches River at intersection with SH 64	32.374025	-95.473591	2.44	8.26	Public*
	NR07	Neches River on private property approximately 1.4 km east of Van Zandt CR 4923 and 3 km north of SH 64	32.404723	-95.504434	3.31	11.57	Private
	NR08	Neches River on private property approximately 1.2 km east of Van Zandt CR 4923 and 3.4 km north of SH 64	32.408613	-95.506397	0.29	11.86	Private with limited public access ³
10598	NR09	Neches River at intersection with Van Zandt CR4915; Smith CR420	32.421333	-95.524882	2.85	14.71	Public*
	NR10	Neches River at intersection with Van Zandt CR4931; Smith CR421	32.427673	-95.528349	0.84	15.55	Public*
	NR11	Private Property approximately 1.3 km west of Smith CR 420	32.441093	-95.545139	1.69	17.24	Private
	NR12	Neches River at intersection with Van Zandt CR4908; Smith CR426; Willow Branch Rd	32.462036	-95.572039	3.61	20.85	Public*
	NR13	Neches River at intersection with Van Zandt CR4912	32.471813	-95.595652	2.45	23.30	Public*

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Access
	NR14	Neches River on private property approximately 340 meters north of Van Zandt County Road 4912	32.470571	-95.602380	0.56	23.86	Private
	NR15	Neches River on private property approximately 1.4 km south of Van Zandt CR 1995 and 2.2 km east of FM 314	32.484084	-95.617644	3.02	26.88	Private
	NR16	Neches River at intersection with FM 314	32.491473	-95.643209	2.82	29.70	Public*
	NR17	Neches River on private property approximately 610 meters east of Van Zandt CR 4511 south of FM 1995 and 850 meters west of FM 314	32.494288	-95.652186	0.89	30.59	Private
20282	NR18	Neches River at intersection with Van Zandt CR4511	32.490439	-95.663521	0.77	31.36	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

²Site NR01 was off private property but was publically accessible via a boat using public boat ramps either downstream or upstream.

³Site NR08 was on tribal land on which is located a historical marker. There is public access allowed to the historical marker, but not necessary to the river at this location.

Site NR01 is located on Neches River Above Lake Palestine on private property approximately 250 meters south of State Highway 31, east of Chandler, Texas. Site NR01 was accessible through locked and fenced private property with landowner permission. The site is also publicly accessible by launching a small boat upstream at the public boat ramp located within the River Park of Chandler, TX associated with Site NR02. Additionally access to this site could potentially be obtained by navigating a boat from Lake Palestine. The site was selected because of landowner cooperation, public availability and the site provided opportunity for characterization of Segment 0606.

Site NR02 (TCEQ Station 10595) is located on Neches River Above Lake Palestine at the bridge crossing on State Highway 31, east of Chandler, Texas. Site NR02 was publicly accessible at the bridge crossing and City of Chandler River Park with unfenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR03 is located on Neches River Above Lake Palestine on private property approximately 1.4 km north of State Highway 31, northeast of Chandler, Texas. Site NR03 was only accessible through fenced private property via two cattle guards and one locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR04 is located on Neches River Above Lake Palestine on private property approximately 3.6 km north of State Highway 31 and 2.5 km west of State Highway 49, northeast of Chandler, Texas. Site NR04 was only accessible through fenced private property via a potentially locked gate. When making arrangements to conduct the first survey, landowners of this location decided to deny access to the stream through their property. No surveys were conducted at this location.

Site NR05 (TCEQ Station 10596) is located on Neches River Above Lake Palestine at the bridge crossing on Farm-to-Market Road 279, north of Chandler, Texas. Site NR05 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR06 (TCEQ Station 10597) is located on Neches River Above Lake Palestine at the bridge crossing on State Highway 64, north of Chandler, Texas. Site NR06 was only publicly accessible at the bridge with fenced private property upstream of the crossing and unfenced private property downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR07 is located on Neches River Above Lake Palestine on private property approximately 1.4 km east of Van Zandt County Road 4923 and 3 km north of State Highway 64, north of Chandler, Texas. Site NR07 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR08 is located on Neches River Above Lake Palestine on private property approximately 1.2 km east of Van Zandt County Road 4923 and 3.4 km north of State Highway 64, north of Chandler, Texas. Site NR08 was located on tribal land on which also resides a historical landmark that is public accessibility. Access to the stream may be gained by walking through the maintained areas near the historical landmark and then traversing through the vegetated and forested non-maintained areas to reach the stream. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR09 (TCEQ Station 10598) is located on Neches River Above Lake Palestine at the culvert crossing on Van Zandt County Road 4915(Smith County Road 420), north of Chandler, Texas. Site NR09 is only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR10 is located on Neches River Above Lake Palestine at the culvert crossing on Van Zandt County Road 4931(Smith County Road 421), north of Chandler, Texas. Site NR10 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR11 is located on Neches River Above Lake Palestine on private property approximately 1.3 km west of Smith County Road 420, southeast of Van, Texas. Site NR11 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR12 is located on Neches River Above Lake Palestine at the culvert crossing on Van Zandt County Road 4908 (Smith County Road 426; Willow Branch Rd), southeast of Van, Texas. Site NR12 was only publicly accessible at the culvert crossing with posted, fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR13 is located on Neches River Above Lake Palestine at the culvert crossing on Van Zandt County Road 4912, southeast of Van, Texas. Site NR13 was only publicly accessible at the culvert with fenced private property upstream and downstream of the crossing. The site was selected because of landowner cooperation, public accessibility and the site provided opportunity for characterization of Segment 0606.

Site NR14 is located on Neches River Above Lake Palestine on private property approximately 340 meters north of Van Zandt County Road 4912, southeast of Van, Texas. Site NR14 was only accessible, with landowner permission, through fenced private property. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR15 is located on Neches River Above Lake Palestine on private property approximately 1.4 km south of Van Zandt County Road 1995 and 2.2 km east of Farm-to-Market Road 314, southeast of Van, Texas. Site NR15 was only accessible through fenced private property with

permission and an escort from the landowner, which was sought and granted to TIAER field staff for the first survey. At the time of the second survey, the landowner was unavailable to escort TIAER personnel onto his property and would not allow access without an escort. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR16 is located on Neches River Above Lake Palestine at the bridge crossing on Farm-to-Market Road 314, south of Van, Texas. Site NR16 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR17 is located on Neches River Above Lake Palestine on private property approximately 610 meters east of Van Zandt County Road 4511 and 850 meters west of Farm-to-Market Road 314, south of Van, Texas. Site NR17 was only accessible through fenced private property via a locked gate with landowner permission or by access at the upstream bridge crossing at Van Zandt County Road 4511. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Segment 0606.

Site NR18 (TCEQ Station 20282) is located on Neches River Above Lake Palestine at the bridge crossing on Van Zandt County Road 4511, southwest of Van, Texas. Site NR18 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of Segment 0606.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Segment 0606

The Neches River RUAA surveys were conducted on July 24-25, 2014 and August 22-23, 2014 at seventeen of the eighteen selected sites. Seventeen sites were surveyed instead of eighteen due to the landowner of Site NR04 deciding to deny access to their property. Also, the second survey for Site NR15 was not conducted, because the landowner was unavailable to escort the field crew and would not allow access without his presence. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 4.3 and 4.4). In the 30 days prior to the first survey, 3.60 inches of precipitation fell, while 4.00 inches fell 30 days prior to the second survey. A weather station located in Tyler, TX was the source of the precipitation and air temperature records. The weather station had recorded 0.62 inches of rainfall on the first day of the first survey; however no evidence of precipitation was observed within the Neches River watershed. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions during both surveys in July and August 2014 (TWDB, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 4.5 describes the stream channel and corridor characteristics at each site.

- Table 4.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 4.7 and 4.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 4.9 and 4.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Thalweg depth ranged from 0.0 m to >1.5m during both surveys. Access to the stream down the bank was moderately easy to moderately difficult in most locations and was largely dependent on the density of vegetation along the stream corridor. The dominant substrate was mud/clay and the stream corridor was largely within forested areas. The maximum typical average stream width encountered during both surveys was 15 m. Flow conditions encountered during both surveys ranged from normal to no flow, although more no flow and low flow conditions were observed during the second survey in August than during the first in July. Water surface scum was often observed at various sites during both surveys. Tracks observed most often included raccoon, deer, canine, feral hog, and cattle. Trash was rarely observed at most survey sites, but when observed, consisted of typical plastics, bottles, and aluminum cans. Recreation was directly observed by TIAER staff only during the second survey, when three individuals were observed fishing from the bank at Site NR02. Signs of recreation in the form of discarded fishing tackle and bait containers also indicated fishing occurred at various locations throughout the reach.

Table 4.3 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the first RUAA survey initiated on July 24, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
24-Jun-14	1.43	89	89
25-Jun-14	0.08	79	79
26-Jun-14	0.00	87	87
27-Jun-14	0.67	86	86
28-Jun-14	0.02	91	91
29-Jun-14	0.00	92	92
30-Jun-14	0.00	93	93
1-Jul-14	0.00	92	92
2-Jul-14	0.00	91	91
3-Jul-14	0.31	89	89
4-Jul-14	0.00	86	86
5-Jul-14	0.00	87	87
6-Jul-14	0.00	91	91
7-Jul-14	0.00	92	92
8-Jul-14	0.00	93	93
9-Jul-14	0.00	95	75
10-Jul-14	0.00	94	74
11-Jul-14	0.00	94	73
12-Jul-14	0.00	96	73
13-Jul-14	0.00	98	75
14-Jul-14	0.00	97	75
15-Jul-14	0.44	93	74
16-Jul-14	0.00	88	67
17-Jul-14	0.50	84	67
18-Jul-14	0.13	71	65
19-Jul-14	0.02	73	65
20-Jul-14	0.00	87	66
21-Jul-14	0.00	91	68
22-Jul-14	0.00	91	71
23-Jul-14	0.00	92	69
24-Jul-14	0.62	90	67
25-Jul-14	0.00	94	71

Table 4.4 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the second RUAA survey initiated on August 22, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
24-Jul-14	0.62	90	67
25-Jul-14	0.00	94	71
26-Jul-14	0.00	95	74
27-Jul-14	0.00	96	76
28-Jul-14	0.43	95	74
29-Jul-14	0.00	91	72
30-Jul-14	0.00	87	72
31-Jul-14	2.80	84	70
1-Aug-14	0.04	77	67
2-Aug-14	0.06	84	68
3-Aug-14	0.02	87	70
4-Aug-14	0.00	90	72
5-Aug-14	0.00	92	73
6-Aug-14	0.00	93	75
7-Aug-14	0.00	94	76
8-Aug-14	0.00	95	77
9-Aug-14	0.00	95	77
10-Aug-14	0.00	97	76
11-Aug-14	0.00	94	78
12-Aug-14	0.00	91	72
13-Aug-14	0.00	88	65
14-Aug-14	0.00	89	66
15-Aug-14	0.00	93	68
16-Aug-14	0.00	97	75
17-Aug-14	0.00	92	78
18-Aug-14	0.03	93	77
19-Aug-14	0.00	94	76
20-Aug-14	0.00	94	74
21-Aug-14	0.00	97	76
22-Aug-14	0.00	96	75
23-Aug-14	0.00	95	74

Table 4.5 Stream Channel and corridor appearance for each site sampled along Neches River Above Lake Palestine Segment 0606.

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
NR01	Natural	Mud/Clay	Forest	Large	No	Native
NR02	Natural	Mud/Clay	Forest Mowed at Bridge	Large	Yes	Native
NR03	Natural	Mud/Clay	Forest – Left Pasture - Right	Large	No	Native & Pasture
NR04	NA ¹	NA	NA	NA	NA	NA
NR05	Natural	Mud/Clay	Shrubs - Left Forest - Right	Large	No	Native
NR06	Natural	Mud/Clay	Forest Mowed at Bridge	Large	No	Native
NR07	Natural	Mud/Clay	Herbaceous Marsh	Large	No	Native
NR08	Natural	Mud/Clay	Herbaceous Marsh	Large	No	Native
NR09	Natural	Mud/Clay	Forest	Large	No	Native
NR10	Natural	Mud/Clay	Forest	Large	No	Native
NR11	Natural	Mud/Clay	Pasture - Left Forest - Right	Large	No	Native & Pasture
NR12	Natural	Mud/Clay	Shrub - Left Forest - Right	Large	No	Native
NR13	Natural	Mud/Clay	Forest	Large	No	Native

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
NR14	Natural	Mud/Clay	Forest	Large	No	Native
NR15	Natural	Mud/Clay	Forest	Large	No	Native
NR16	Natural	Mud/Clay	Pasture	Large	No	Native pasture
NR17	Natural	Mud/Clay	Forest	Large	No	Native
NR18	Natural	Mud/Clay	Forest	Large	No	Native

1. NA indicates not applicable as field surveys were not conducted at Site NR04 due to lack of access.

Table 4.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Neches River Above Lake Palestine (0606).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult. NA indicates not applicable as field surveys were not conducted due to lack of access at Site NR04 for both surveys and NR15 for the second survey.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
NR01	300	11	0	>1.5	>1.5	Perennial	Public	ME
NR02	300	11	1	>1.5	>1.5	Perennial	Public	ME
NR03	300	11	0	1.1	1.0	Perennial	Private	MD
NR04	NA	NA	NA	NA	NA	NA	NA	NA
NR05	300	11	0	1.0	0.7	Perennial	Public*	MD
NR06	300	11	0	0.9	0.9	Perennial	Public*	ME
NR07	300	11	0	1.1	1.1	Perennial	Private	MD
NR08	300	11	0	>1.5	>1.5	Perennial	Private with limited public access	D
NR09	300	11	0	0.7	0.7	Perennial	Public*	MD
NR10	300	11	0	0.8	0.7	Perennial	Public*	MD
NR11	300	11	0	0.8	0.8	Perennial	Private	E
NR12	300	11	0	0.5	0.5	Perennial	Public*	ME
NR13	300	11	0	0.6	0.7	Perennial	Public*	MD
NR14	300	11	0	0.7	0.7	Perennial	Private	E

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
NR15	300	11	0	>0.4	NA	Perennial	Private	ME
NR16	300	11	0	0.0	0.0	Perennial	Public*	ME
NR17	300	11	0	0.2	0.0	Perennial	Private	MD
NR18	300	11	0	0.4	0.2	Perennial	Public*	ME

Table 4.7 Description of surveyed stream sites along Neches River Above Lake Palestine during first survey performed in July 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
NR01	65	10	15	Normal
NR02	36	11	12	Normal
NR03	20	12	14	Normal
NR04	NA ¹	NA	NA	NA
NR05	22	5.7	11	Normal
NR06	15	7.0	10	Normal
NR07	8.5	4.5	5.0	Low
NR08	20	7.0	13	Low
NR09	8.0	5.5	7.0	Low
NR10	7.5	3.5	5.5	Low
NR11	15	5.0	9.0	Low
NR12	9.0	1.5	6.0	Low
NR13	10	4.5	6.0	Normal
NR14	8.5	4.5	5.5	Normal
NR15	12	1.5	7.5	Low
NR16	2.5	0.0	0.0	No Flow
NR17	6.0	0.4	4.5	Low
NR18	7.0	0.4	5.0	Low

1. NA indicates not applicable as field surveys were not conducted at Site NR04 due to lack of access.

Table 4.8 Description of surveyed stream sites along Neches River Above Lake Palestine during second survey performed in August 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
NR01	65	9.5	15	Normal
NR02	37	11	12	Normal
NR03	20	12	14	Normal
NR04	NA ¹	NA	NA	NA
NR05	22	5.7	11	Normal
NR06	15	7.0	10	Normal
NR07	8.5	4.5	5.0	Low
NR08	20	7.0	13	Low
NR09	9.0	5.8	7.0	Low
NR10	7.8	3.4	5.5	Low
NR11	16	4.5	9.0	Low
NR12	8.5	1.4	6.0	Low
NR13	10	4.0	6.0	Normal
NR14	8.5	4.5	5.5	Normal
NR15	NA	NA	NA	NA
NR16	1.5	0.0	0.0	No Flow
NR17	3.0	0.0	0.0	No Flow
NR18	7.0	0.0	2.5	No Flow

1. NA indicates not applicable as field surveys were not conducted at Site NR04 and Site NR15 due to lack of access.

Table 4.9 Stream aesthetics along Neches River Above Lake Palestine during first survey performed in July 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as field surveys were not conducted at Site NR04 due to lack of access.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
NR01	C	R	N	Brown	Fine sediment	Clear	N	SP	N	Fecal/Nests	N	N	C
NR02	C	R	N	Brown	Fine sediment	Clear	N	N	N	Fecal/Nests	N	N	C
NR03	R	A	N	Brown	Fine sediment	Clear	N	SP	N	Tracks/Fecal	N	R	N
NR04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NR05	R	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
NR06	R	A	N	Brown	Fine sediment	Clear/Scum/Oil	N	N	N	Tracks/Fecal	R	R	R
NR07	Ab	R	N	Brown	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	N	N
NR08	Ab	R	N	Brown	Fine sediment	Clear/Scum	N	N	SP	Fecal	N	N	N
NR09	R	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	C
NR10	R	R	C	Brown	Fine sediment	Scum	N	N	SP	Tracks/Fecal	N	R	N
NR11	Ab	R	C	Brown	Fine sediment	Scum	N	SP	MP	Tracks/Fecal	N	N	N
NR12	C	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	R
NR13	R	A	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	R	N
NR14	A	A	C	Brown	Fine sediment	Scum	SP	N	SP	Tracks/Fecal	N	R	N
NR15	R	A	R	Brown	Fine sediment	Scum	SP	N	SP/MP	Tracks/Fecal	N	R	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
NR16	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
NR17	A	A	N	Brown	Fine sediment	Scum	N	SP	SP	Tracks/Fecal	R	R	N
NR18	R	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	C	R	N

Table 4.10 Stream aesthetics along Neches River Above Lake Palestine during second survey performed in August 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as field surveys were not conducted at Site NR04 or NR15 due to lack of access.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
NR01	C	R	N	Brown	Fine sediment	Clear/Scum	N	SP	N	Fecal/Nests	N	N	C
NR02	C	R	N	Brown	Fine sediment	Clear	N	N	N	Fecal	N	N	C
NR03	A	A	N	Green	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
NR04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NR05	A	A	N	Green	Fine sediment	Scum	N	N	SP	Tracks/Fecal	N	R	C
NR06	R	R	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal/Nests	R	R	R
NR07	Ab	R	R	Brown	Fine sediment	Clear	N	SP	MP	Tracks/Fecal	N	N	N
NR08	Ab	R	C	Brown	Fine sediment	Scum	N	SP	N	Fecal	N	N	N
NR09	R	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	R
NR10	R	R	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	N
NR11	Ab	R	C	Brown	Fine sediment	Scum	N	MP	MP	Tracks/Fecal	N	N	N
NR12	C	A	R	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	R
NR13	R	R	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	R	N
NR14	R	R	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	R	N
NR15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
NR16	A	A	N	Brown	Fine sediment	Clear	N	N	MP	Tracks/Fecal	R	R	N
NR17	A	A	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	R	R	N
NR18	R	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	C	R	N

Physical Description of NR01

Neches River at Site NR01 was visited on July 25 and August 22, 2014. This site was located approximately 250 meters south of State Highway 31, east of Chandler, Texas on the border between Smith and Henderson Counties. Three methods of accessing this site were available. One option required driving approximately 0.40 miles and walking approximately 0.30 miles through private lands that were locked and fenced. A second option allowed for utilizing a publicly accessible boat ramp at the City of Chandler River Park near the State Highway 31 bridge crossing and boating downstream approximately 0.20 miles to the site. The third option for accessing this site was to launch a boat on Lake Palestine and travel up the Neches River to the site. TIAER personnel accessed the site during both surveys by utilizing the upstream public boat ramp at the City of Chandler River Park. The location of the boat ramp also provided paved parking locations on both sides of State Highway 31 along with covered picnic areas associated with the River Park (Figure 4.3). Forest dominated the stream corridor (Table 4.5), and access to the stream was moderately easy, due to the well maintained boat ramp and ample parking space (Table 4.6). The general appearance of the site during each survey is shown in Figures 4.4 and 4.5.



Figure 4.3 Photograph of public boat ramp near Highway 31 bridge crossing.



Figure 4.4 Photograph of Neches River Site NR01 taken on July 25, 2014. The downstream view of the 300-m transect.



Figure 4.5 Photograph of Neches River Site NR01 taken on August 22, 2014. The downstream view of the 0-m transect.

Site NR01 was not wadeable as water depths were often > 1.5 m throughout the 300-m reach. Stream widths ranged from 10 m to 65 m during the first survey and 9.5 to 65 m during the second survey (Tables 4.7 and 4.8). Water depths and stream widths were adequate for navigating the reach via a boat with submerged woody debris only occasionally posing a slight challenge to traversing the reach.

A slight presence of water dependent birds was observed during both surveys (Tables 4.9 and 4.10). There were no other mammals or vertebrates observed during either survey. Bird feces and bird nests were also found throughout the reach. Aquatic vegetation was common during both surveys, while algae were rarely observed. Trash commonly observed along the banks and consisted of typical plastics, cans, and discarded fishing tackle and bait containers. No recreational activities were observed within the reach during either survey; however the abundance of fishing evidence indicates that fishing likely occurs within the reach on a relatively regular basis. While scouting the watershed for potential sites in the spring of 2015, TIAER personnel observed several people fishing along the banks at this location.

Physical Description of NR02

Neches River at Site NR02 was visited on July 25 and August 22, 2014. This site was located at the bridge crossing on State Highway 31, east of Chandler, Texas, on the border between Smith and Henderson Counties. Site NR02 was publicly accessible at the bridge crossing with unfenced private property upstream and downstream of the crossing. A concrete public boat ramp was available at this location along with ample parking spaces on both sides of the highway. Additionally, a covered picnic/rest area was located near the boat ramp along with a concrete walking path that passed under the highway bridge crossing. TIAER personnel accessed the reach by deploying a small boat via the public boat ramp during both surveys. The area immediately at the bridge crossing was mowed, while the remainder of the stream corridor was forested. Access to the stream was easy near the bridge crossing due to the availability of a boat ramp and the concrete walking path; however access was moderately easy elsewhere due to moderately dense vegetation and slightly steep banks (Table 4.6). The general appearance of the reach at NR02 is shown in Figures 4.6 and 4.7.

Site NR02 was not wadeable for the entire 300-m reach length as the average thalweg was >1.5 m during both surveys (Table 4.6). During both surveys, adequate water depth allowed for relatively easy navigation of the reach using a small boat. A significant log jam located just upstream of the 300-m transect was observed during both surveys, which would impede travel upstream beyond the surveyed reach. Stream widths varied from 11 to 36 m during the first survey and 11 to 37 m during the second survey (Tables 4.7 and 4.8).



Figure 4.6 Photograph of Neches River Site NR02 taken on July 25, 2014. The downstream view of the 300-m transect.



Figure 4.7 Photograph of Neches River Site NR02 taken on August 22, 2014. The downstream view of the 0-m transect.

No mammals or other vertebrates were observed during either survey (Tables 4.9 and 4.10). No wildlife tracks observed during either survey, but bird feces were found throughout the reach. Aquatic vegetation was common during both surveys and algae cover was rare. The water color was brown during both surveys with no surface scum or foam. Garbage on the stream bank was common during both surveys and consisted of typical plastics, bottles, fishing bait containers, and other fishing related containers. During the first survey three individuals were observed fishing from the bank near the 150-m transect. As TIAER personnel were in a boat, there was not a reasonable way to interview the three fishermen without disrupting their fishing. After conducting the survey, an attempt was made to walk over to where the fishermen had been to request an interview, however by that time the fishermen had left the location. No recreational activities were observed during the second survey. During both surveys there were signs of potential recreational activity consisting of discarded fishing bait containers and other fishing related trash.

Physical Description of NR03

Neches River at Site NR03 was visited on July 25 and August 22, 2014. This site was located northeast of Chandler, Texas, on the border between Smith and Henderson Counties. Site NR03 was only accessible through private lands that were fenced with cattle guards and a locked gate. With landowner permission, TIAER personnel entered private property through a locked gate and over two cattle guards and drove approximately 0.8 miles on a gravel then pasture road to reach the site. The right-bank of the stream corridor was primarily pasture and the left-bank primarily forest (Table 4.5). Steep banks throughout the reach made access to the stream moderately difficult (Table 4.6). The general appearance of the reach is shown in Figures 4.8 and 4.9.



Figure 4.8 Photograph of Neches River Site NR03 taken on July 25, 2014, the downstream view of the 300-m transect.



Figure 4.9 Photograph of Neches River Site NR03 taken on August 22, 2014, the downstream view of the 0-m transect.

Although water depths at site NR03 were too deep for wading, there were portions of the 300-m reach that were wadeable. The average thalweg depth ranged from 1.1 m during the first survey to 1.0 m during the second survey (Table 4.6). During the first survey a small boat was used to navigate the reach; however numerous log jams and other instream woody obstructions made navigation challenging. During the second survey, TIAER personnel navigated the reach by wading close to the bank in order to avoid water depths too great to wade. Stream widths ranged from maximum of 20 m a minimum of 12 m during both surveys (Tables 4.7 and 4.8).

A slight presence of water dependent birds was observed during the first survey with no other vertebrates observed during either survey (Tables 4.9 and 4.10). Tracks observed during the first survey included deer, canine, raccoon, and cattle. Tracks observed during the second survey consisted of water dependent bird and raccoon. Cattle and bird feces were found throughout the reach. Aquatic vegetation was rare during the first survey and absent during the second survey. Algae cover was absent during both surveys. The water color was brown during the first survey and green during the second survey with no surface scum or foam observed during either survey. Trash was rarely observed in the stream channel during the first survey and consisted of typical plastics. No trash was observed during the second survey. The only sign observed of potential recreation along the reach was a fishing bobber near the 120-m transect.

Physical Description of NR04

Neches River at Site NR04 was located approximately 3.6 miles north of State Highway 31, northeast of Chandler, Texas along the border between Smith and Henderson Counties. The site

was accessible only through private lands that were fenced with a potentially locked gate. While scouting the watershed for potential sites, TIAER personnel met with the landowners who initially gave permission to use their private property as a RUAA field survey site. When contacting landowners before conducting the first survey, the landowners stated that they had changed their minds and did not want to participate with the project. No surveys were conducted at this site, however the landowners did provide an interview.

Physical Description of NR05

Neches River at Site NR05 was visited on July 25 and August 22, 2014. This site was located north of Chandler, Texas on the border between Smith and Van Zandt Counties. Site NR05 was publicly accessible only at the bridge crossing of State Highway 64. Private property was fenced upstream of the crossing and unfenced downstream of the crossing. With landowner permission, TIAER personnel parked in a private property entrance and entered the stream underneath the bridge. Shrubs dominated stream corridor along the left bank and forest along the right bank (Table 4.5). Access to the stream was moderately difficult due to steep muddy banks (Table 4.6). The general appearance of the river at this location is shown in Figures 4.10 and 4.11.

Site NR05 was wadeable for the entire 300-m reach length. Average thalweg ranged from 1.0 m during the first survey to 0.7 m during the second survey (Table 4.6). During both surveys, the mud/clay substrate and timber obstacles made wading in the stream channel challenging. One of the log obstructions encountered is shown in Figure 4.12. Stream widths ranged from a maximum of 22 m to a minimum of 5.7 m (Tables 4.7 and 4.8).

There was a slight presence of deer encountered during the first survey with no other animals observed during either survey (Tables 4.9 and 4.10). Tracks observed during each trip were identified as cattle, deer, and raccoon. Cattle and bird feces were also found throughout the reach. Aquatic vegetation and algae were rare during the first survey and absent during the second survey. The water color was brown during the first survey with no surface scum or foam. During the second survey, water color was green with a surface scum. Trash was rarely observed within the stream channel, although a few wooden boards and a lawnmower were identified. Trash along the banks was rare to common and consisted of typical plastic cups, cans and bottles with a couch, tires, lawn chair and mattress observed underneath the bridge and one couch along the bank, downstream of the bridge crossing. Evidence of recreation observed within the reach consisted of fishing tackle and one bandana found along the bank.



Figure 4.10 Photograph of Neches River Site NR05 taken on July 25, 2014, the downstream view of the 150-m transect.



Figure 4.11 Photograph of Neches River Site NR05 taken on August 22, 2014, the downstream view of the 300-m transect.



Figure 4.12 Photograph of Neches River Site NR05 taken on July 25, 2014, showing a typical timber obstruction.

Physical Description of NR06

Neches River at Site NR06 was visited on July 25 and August 23, 2014. This site was located at the bridge crossing State Highway 60 north of Chandler, Texas along the border between Smith and Van Zandt Counties. The site was publicly accessible only at the bridge, although private property was unfenced upstream and downstream of the road crossing. Forest dominated the stream corridor, although the area immediately at the bridge was mowed and maintained (Table 4.5). Access to the stream was moderately easy (Table 4.6) at the bridge crossing; however access at other locations throughout the reach were more challenging due to dense vegetation. Figures 4.13 and 4.14 depict the general appearance of the site during each survey.

Site NR06 was wadeable for most of the entire 300-m reach length. Average thalweg was 0.9 m during both surveys (Table 4.6). Log jams, overhanging tree branches, and other instream woody debris was encountered that made wading challenging and provided less than ideal conditions for boating. Stream widths ranged from 7.0 m to 15 m during both surveys (Tables 4.7 and 4.8). Because no water movement was observed during either survey, TIAER staff considered the entire length of the reach to be one large pool with a maximum width of 15 m, a maximum depth greater than 1.5 m, and a length greater than 300 m during both surveys.



Figure 4.13 Photograph of Neches River Site NR06 taken on July 25, 2014, the upstream view of the 150-m transect.



Figure 4.14 Photograph of Neches River Site NR06 taken on August 23, 2014, the upstream view of the 0-m transect.

No mammals or other vertebrates were observed during either survey. Tracks observed during the first survey consisted of canine, deer, and raccoon and during the second survey feral hog and canine (Tables 4.9 and 4.10). Bird nests were observed during the second survey, while bird feces were commonly seen throughout the reach during both surveys. Aquatic vegetation was rare during both surveys, while algae was absent during the first survey and rare during the second survey. The water color was brown with a surface scum during each survey. Trash was rarely observed and when encountered, consisted of typical plastics, aluminum cans, garbage bags, tires, and Styrofoam. No signs of recreational activity were found within the reach.

Physical Description of NR07

Neches River at Site NR07 was visited on July 25 and August 23, 2014. This site was located north of Chandler, Texas on the border between Smith and Van Zandt Counties. This site was accessible only through private lands that were fenced. The entrance was a private road with a cattle guard and a gate that could be locked. With landowner permission, TIAER personnel entered private property and drove approximately 0.7 miles through a coastal pasture to reach a heavily wooded area. TIAER personnel then walked an additional 0.30 miles through the wooded area to Site NR07. The stream corridor was considered an herbaceous marsh for the entire length of the reach (Table 4.5). Access to the stream was moderately difficult (Table 4.6) due to the densely vegetated nature of the stream corridor (Figure 4.15). The general appearance of the stream during the surveys is shown in Figures 4.16 and 4.17.



Figure 4.15 Photograph of heavily vegetated area leading to Neches River Site NR07 taken on August 23, 2014.



Figure 4.16 Photograph of Neches River Site NR07 taken on July 25, 2014, the upstream view of the 0-m transect.



Figure 4.17 Photograph of Neches River Site NR07 taken on August 23, 2014, the downstream view of the 300-m transect.

Site NR07 was wadeable for most of the 300-m reach length, although a few locations had water depths greater than 1.5 m. Average thalweg was 1.1 m during both surveys (Table 4.6). During both surveys, instream obstructions and overhanging vegetation made wading the stream channel challenging. Stream widths ranged from a minimum of 4.5 to a maximum of 8.5 m (Tables 4.7 and 4.8). Due to a lack of water movement, TIAER personnel considered the entire length of the reach one large pool with a maximum width of 8.5 m and a maximum depth greater than 1.5 m during both surveys.

During the first survey, there was a moderate presence of cattle within the coastal pasture area with no other mammals or other vertebrates encountered (Table 4.9). During the second survey, there was a slight presence of water dependent birds in addition to the moderate presence of cattle (Table 4.10). Tracks observed during each trip consisted of cattle, deer, raccoon, bird, and feral hog. Cattle and bird feces were also found throughout the reach during both surveys. Aquatic vegetation was abundant and algae cover was rare during both surveys. The water color was brown during both surveys with no surface scum or foam. No trash of any type was seen during either survey. No evidence of human recreation was observed within the reach.

Physical Description of NR08

Neches River at Site NR08 was visited on July 25 and August 23, 2014. This site was located north of Chandler, Texas on the border between Smith and Van Zandt Counties. Site NR08 was publicly accessible via tribal land maintained by The American Indian Cultural Society. The property is the site of the Battle of the Neches and contains a memorial to Cherokee Chief Bowles along with benches (Figure 4.18). A gravel parking area and trash receptacles were available near the memorial. TIAER personnel accessed the site by parking in the gravel parking area and walking approximately 0.15 miles on a mowed trail and then an additional 0.25 miles through a heavily vegetated forest area. The stream corridor was classified as an herbaceous marsh with some trees along each stream bank (Table 4.5). Access to the stream was difficult (Table 4.6) due to the dense vegetation and marsh conditions (Figure 4.19). The general appearance of the stream at Site NR08 is further depicted in Figures 4.20 and 4.21.

Site NR08 was not wadeable, because average thalweg depths that were greater than 1.5 m during both surveys (Table 4.6). During both surveys, the marsh conditions and heavily vegetated banks made traversing along the banks of the stream reach very challenging. Stream widths ranged from a maximum of 20 m to a minimum of 7.0 m during both surveys (Tables 4.7 and 4.8). Due to a lack of observed water movement, the entire survey reach was considered a pool with a maximum width of 20 m and a maximum depth greater than 1.5 m during both surveys.



Figure 4.18 Photograph of memorial located at Neches River Site NR08 taken on July 25, 2014.



Figure 4.19 Photograph of dense vegetation that must be traversed in order to reach Neches River Site NR08 taken on August 23, 2014.

Feral hog's were heard by TIAER field personnel during the first survey; no mammals or other vertebrates were observed (Table 4.9). The dense vegetation covering the ground made it impossible to observe any animal tracks. During the second survey there was a slight presence of water dependent birds observed (Table 4.10). Aquatic vegetation was abundant while algae cover was rare during both surveys. The water color was brown and clear during the first survey, but had surface scum during the second survey. No trash was observed during either survey. The only evidence of human recreational activity consisted of a duck decoy found along the stream bank and a shotgun shell hull.



Figure 4.20 Photograph of Neches River Site NR08 taken on July 25, 2014 showing the upstream view of the 0-m transect.



Figure 4.21 Photograph of Neches River Site NR08 taken on August 22, 2014 showing the downstream view of the 300-m transect.

Physical Description of NR09

Neches River at Site NR09 was visited on July 24 and August 23, 2014. This site was located at the culvert crossing on Van Zandt County Road 4915 (Smith County Road 420), north of Chandler, Texas at the border between Smith and Van Zandt Counties. The site was only publicly accessible at the culvert with fenced private property upstream and downstream of the crossing. TIAER personnel parked on the side of the county road and accessed the stream by down the culvert embankment. The site is located in a forest dominated corridor (Table 4.5). At the site, access to the stream was moderately difficult due to steep banks and dense vegetation. The general appearance of the stream is shown in Figures 4.22 and 4.23.

Site NR09 was wadeable for the entire 300-m reach length, although the mud/clay channel bottom and numerous log obstructions/obstacles made wading in the stream challenging. Average thalweg was 0.70 m during both surveys (Table 4.6). Stream widths ranged from 5.5 m to 8.0 m during the first survey and 5.8 m to 9.0 m during the second survey (Tables 4.7 and 4.8).

No mammals or other vertebrates were observed during either survey, although feral hog and raccoon tracks were observed (Tables 4.9 and 4.10). Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae cover was rarely observed. Water color was brown with a surface scum during both surveys. Trash in the stream channel was rare and consisted of typical plastics, cans, and bottles. Trash along the stream bank was more common, particularly at the culvert crossing and consisted of typical plastics, cans, bottles, one couch, a kiddie pool, and scrap metal. No signs of recreational activity were observed.



Figure 4.22 Photograph of Neches River Site NR09 taken on July 24, 2014, the upstream view of the 150-m transect.



Figure 4.23 Photograph of Neches River Site NR09 taken on August 23, 2014, the downstream view of the 300-m transect.

Physical Description of NR10

Neches River at Site NR10 was visited on July 24 and August 23, 2014. This site was located north of Chandler, Texas on the border between Smith and Van Zandt Counties. The site was only publicly accessible at the culvert crossing on Van Zandt County Road 4931 (Smith County Road 421) and had fenced private property upstream and downstream of the culvert. With landowner permission, TIAER personnel entered the stream at the culvert and conducted the survey upstream. Forest bordered the corridor (Table 4.5). Access to the stream was moderately difficult due to dense vegetation and steep banks (Table 4.6). The general stream appearance is shown in Figures 4.24 and 4.25.



Figure 4.24 Photograph of Neches River Site NR10 taken on July 24, 2014, the upstream view of the 0-m transect.



Figure 4.25 Photograph of Neches River Site NR10 taken on August 23, 2014, the upstream view of the 150-m transect.

Site NR10 was wadeable for the entire 300-m reach length, although the mud/clay substrate and numerous submerged tree obstacles made wading in the stream channel difficult. Average thalweg ranged from 0.8 m during the first survey to 0.7 m during the second survey (Table 4.6). Stream widths ranged from a maximum of 7.8 m to a minimum of 3.4 m, both encountered during the second survey (Tables 4.7 and 4.8). As depicted in Figure 4.25, log obstructions and overhanging trees were encountered during both surveys.

A river otter was observed during the first survey, but no other mammals or vertebrates during either survey (Tables 4.9 and 4.10). Tracks observed during each trip consisted of deer, raccoon, and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rarely observed. Water color was brown with a surface scum and commonly had an odor. Trash was rarely observed, but when encountered, consisted of typical plastics and an occasional tire, primarily at the culvert crossing. A fishing bobber found dangling in an overhanging branch was the only sign of recreational activity observed within the reach (Figure 4.26).

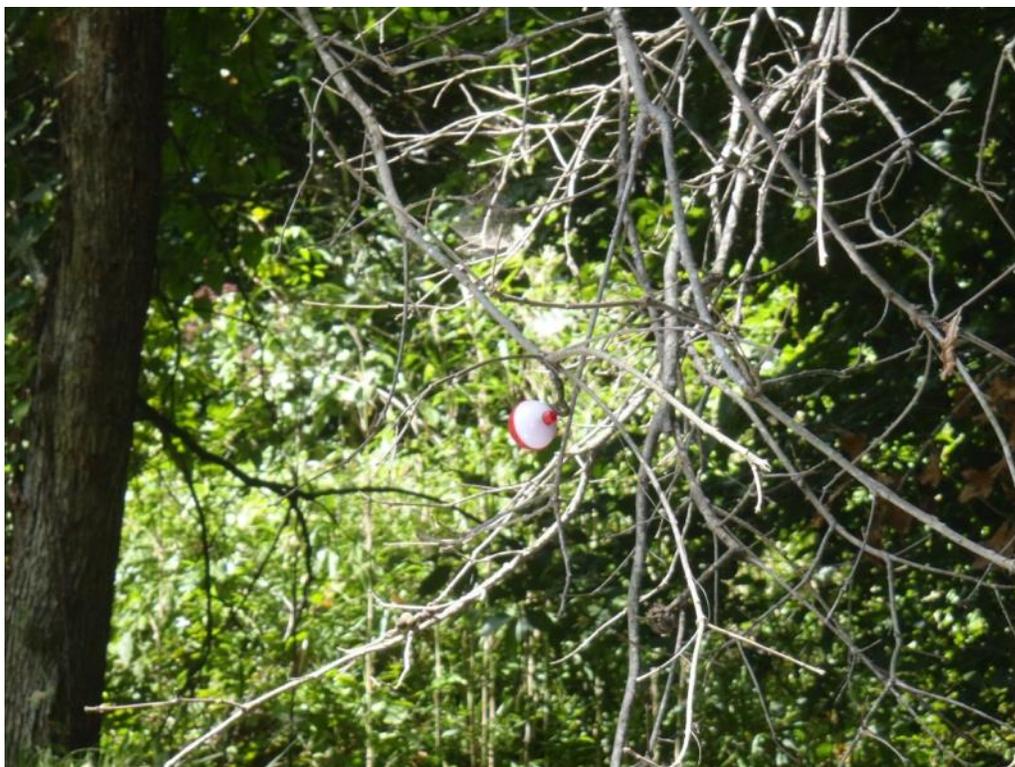


Figure 4.26 Photograph of Neches River Site NR10 taken on August 23, 2014 depicting the fishing bobber in an overhanging branch.

Physical Description of NR11

Neches River at Site NR11 was visited on May 27 and July 29, 2014. This site was located southeast of Van, Texas on the border between Smith and Van Zandt Counties. The site was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard with a locked gate and drove approximately 0.6 mile through a pasture to reach the site. The site is located in a pasture dominated corridor along the left bank and a forest dominated corridor along the right bank (Table 4.5). The landowner stated that generally during the summer months, he uses his tractor and shredder to keep the stream channel mowed and maintained. He further stated that this year was significantly wetter than recent past years, and he was unable to mow the stream before our arrival. At the site, access to the stream was easy despite dense vegetation (Table 4.6). Figures 4.27 and 4.28 depict the appearance of the site during each of the surveys.



Figure 4.27 Photograph of Neches River Site NR11 taken on July 24, 2014, the upstream view of the 300-m transect.

Site NR11 was wadeable for the entire 300-m reach length, although the mud/clay substrate combined with dense vegetation, particularly in the lower two-thirds of the reach, made wading difficult. Average thalweg was 0.8 m during both surveys (Table 4.6). Stream widths ranged from a maximum of 16 m to a minimum of 4.5 m, both encountered during the second survey (Tables 4.7 and 4.8). Due to a lack of flow, TIAER field personnel identified the entire reach as one large pool. During the first survey the pool had a maximum depth of 1.0 m, a maximum width of 16 m, and a length greater than 300 m. and during the second survey the pool had a maximum depth of 1.1 m a width of 15 m. and a length greater than 300 m. Extremely dense aquatic vegetation was the only obstruction encountered during both surveys.



Figure 4.28 Photograph of Neches River Creek Site NR11 taken on August 23, 2014, the upstream view of the 0-m transect.

There was a slight to moderate presence of water dependent birds and a moderate presence of cattle encountered during both surveys (Tables 4.9 and 4.10). No other mammals or vertebrates were observed during either survey, although tracks consisted of cattle, feral hog, deer, raccoon, and bird. Cattle and bird feces were also found throughout the reach during both surveys. Aquatic vegetation was abundant, while algae was rarely observed during either survey. The water was brown with a surface scum and commonly noticed odor. Trash was not observed within the stream channel or along the banks during either survey. No evidence of recreational activity was found.

Physical Description of NR12

Neches River at Site NR12 was visited on July 25 and August 23, 2014. This site was located southeast of Van, Texas on the border between Smith and Van Zandt Counties. This site was only publicly accessible at the area around the culvert road crossing on Van Zandt County Road 420 (Smith County Road 426). Properties upstream and downstream of the crossing were only partially fenced, but one no trespassing sign was observed and several trees were marked with purple paint indicating private property. With landowner permission, TIAER personnel entered stream at the culvert crossing and conducted the survey upstream of the crossing. Shrubs lined the left bank and forest the right bank of the stream corridor (Table 4.5). Access to the stream was moderately easy (Table 4.6), and Figures 4.29 and 4.30 depict the general appearance of the site during each survey.



Figure 4.29 Photograph of Neches River Site NR12 taken on July 25, 2014, the upstream view of the 150-m transect.



Figure 4.30 Photograph of Neches River Site NR12 taken on August 23, 2014, the downstream view of the 300-m transect.

Site NR12 was wadeable for the entire 300-m reach length, although the dense vegetation and primarily mud/clay substrate made wading challenging, despite relatively shallow water depths. Average thalweg depth was 0.5 m for each survey (Table 4.6). Stream widths ranged from a maximum of 9.0 m during the first survey to a minimum of 1.4 m during the second survey (Tables 4.7 and 4.8). Several log obstructions were encountered as were overhanging branches and dense vegetation, which could impede potential recreation (Figure 4.31).

There were no mammals or vertebrates encountered during either survey (Tables 4.9 and 4.10). Tracks observed during each trip consisted of deer, raccoon, and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was common while algae was absent. The water color was brown with a surface scum and a slight odor. Trash was rarely observed and was primarily observed at the culvert road crossing. The trash observed consisted of a television, tires, bottles, and typical plastics. No evidence of recreational activity was encountered during the either survey, except a duck decoy that was observed in some vegetation along the stream bank. This duck decoy appeared to have washed in from an unknown upstream location.



Figure 4.31 Photograph of Neches River Site NR12 taken on July 25, 2014 depicting a typical obstruction encountered during the field surveys.

Physical Description of NR13

Neches River at Site NR13 was visited on July 25 and August 23, 2014. This site was located at the culvert crossing on Van Zandt County Road 4912, southeast of Van, Texas in Van Zandt County. The site was only publicly accessible at the culvert with fenced private property upstream and downstream of the crossing. At the culvert crossing, dense vegetation (Figure 4.32) created

more challenging access to the stream than what was available on the private property just upstream of the crossing. With landowner permission, TIAER personnel entered private property and drove approximately 0.30 miles down a mowed road and then walked an additional 100 m to reach the downstream portion of the 300-m reach. Forest was noted on both sides of the stream corridor (Table 4.5). Access to the stream was moderately difficult due to steep banks and dense vegetation (Table 4.6). The general appearance of the stream is shown in Figures 4.33 and 4.34.



Figure 4.32 Photograph of dense vegetation at the Neches River culvert crossing on Van Zandt County Road 4912 taken on August 23, 2014.



Figure 4.33 Photograph of Neches River Site NR13 taken on July 25, 2014, the upstream view of the 300-m transect.



Figure 4.34 Photograph of Neches River Site NR13 taken on August 23, 2014, the downstream view of the 0-m transect.

Site NR13 was wadeable for the entire 300-m reach length, although numerous instream obstructions encountered made wading difficult. Average thalweg ranged from 0.60 m during the first survey to 0.70 m during the second survey (Table 4.6). Stream widths ranged from 4.5 m to 10 m during the first survey to 4.0 m to 10 m during the second survey (Tables 4.7 and 4.8). Two pools of similar dimensions were identified during both surveys. During both surveys the pools had maximum widths of approximately 9 m, lengths of approximately 40 m, and maximum depths of approximately 1.5 m.

There were no mammals or other vertebrates observed during either survey (Tables 4.9 and 4.10). Tracks observed consisted of feral hog, deer, and raccoon. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare, while algae cover was absent during the first survey. During the second survey, aquatic vegetation and algae cover were both rare. Water color was brown with a surface scum and odor during both surveys. Small garbage was rarely observed in the channel and consisted of typical plastics, aluminum cans, and bottles. No evidence of recreational activity was observed during the either survey.

Physical Description of NR14

Neches River at Site NR14 was visited on July 25 and August 23, 2014. This site was located on private property southeast of Van, Texas in Van Zandt County, and was only accessible, with landowner permission, through fenced private property. With landowner permission, TIAER personnel entered private property and drove approximately 0.30 miles on a mowed dirt road to reach the site. The most upstream portion of the site reach was located at a privately owned and maintained low-water crossing. Forest occurred along both sides of the stream corridor (Table 4.5). Access to the stream was easy at the low water crossing (Table 4.6). Figures 4.35 and 4.36 depict the general appearance of the site during each survey.

Site NR14 was wadeable for the entire 300-m reach length, although numerous instream woody obstructions made wading challenging. Average thalweg was 0.70 m during both surveys (Table 4.6). Stream widths ranged from a maximum of 8.5 m to a minimum of 4.5 m during both surveys (Tables 4.7 and 4.8). Four pools were identified during each survey and the dimensions of each are provided in Table 4.11.



Figure 4.35 Photograph of Neches River Site NR14 taken on July 25, 2014, the upstream view of the 0-m transect.



Figure 4.36 Photograph of Neches River Site NR14 taken on August 23, 2014, the upstream view of the 150-m transect.

Table 4.11 Pool dimensions observed during both surveys along Neches River Above Lake Palestine at Site NR14.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	20	6.0	>1.5
Pool 2	30	7.0	>1.5
Pool 3	45	8.0	>1.5
Pool 4	42	8.5	>1.5

During the first survey, a water snake and a deer were observed, but no other mammals or other vertebrates observed during either survey (Tables 4.9 and 4.10). Tracks observed consisted of raccoon, deer, and feral hog, and bird feces were found throughout the reach. Aquatic vegetation and algae cover were absent during the first survey and rarely observed during the second survey. Water color was brown with a surface scum and odor during both surveys. Small instream garbage was rarely observed and consisted of typical plastics, bottles, and cans. No evidence of recreational activity was found during the either survey.

Physical Description of NR15

Neches River at Site NR15 was first visited on July 25, 2014. This site, located southeast of Van, Texas in Van Zandt County, was accessible only through private land that was fenced with a potentially locked gate. With the landowner serving as an escort, TIAER personnel entered private property and drove approximately 0.7 mile through a pasture and parked the vehicle. TIAER personnel and the landowner then crossed a fence and walked approximately 0.5 mile through a forested pasture to reach the site. Forest lined the stream corridor on both sides (Table 4.5). Access to the stream was moderately easy at the culvert crossing off a private road on the property (Table 4.6). Access to the stream at other locations within the reach was more difficult due to steep banks and dense vegetation. The general appearance of the stream during the surveys is depicted in Figures 4.37 and 4.38. During the second survey on August 23, 2014, the landowner was unavailable to accompany TIAER field staff to the site and did not grant permission for personnel to travel to the site without an escort.



Figure 4.37 Photograph of Neches River Site NR15 taken on July 25, 2014, the downstream view of the 150-m transect.



Figure 4.38 Photograph of Neches River Site NR15 taken on July 25, 2014, the upstream view of the 0-m transect.

Site NR15 was wadeable for the entire 300-m reach length. Although the average thalweg was 0.4 m during the first survey (Table 4.6), the mud/clay substrate and multiple tree obstructions encountered made wading in the stream channel precarious. Stream widths ranged from a maximum of 12 m to a minimum of 1.5 m (Tables 4.7 and 4.8). Although the landowner was not available during the second survey, he stated that conditions of the stream were very similar to what was encountered and recorded during the first survey.

There was a slight presence of snakes and deer with a large presence of cattle during the survey (Table 4.9). No other mammals or vertebrates were observed. Tracks observed consisted of cattle, deer, canine, feral hog and raccoon. Bird, swine, and cattle feces were found throughout the reach. Aquatic vegetation and water odor were rare, while algae was absent during the survey. Water color was brown with a surface scum. Trash was rarely observed and consisted of typical plastics, bottles, and cans. There was no evidence of human recreational activity found during the survey.

Physical Description of NR16

Neches River at Site NR16 was visited on July 25 and August 23, 2014. This site was located at the bridge crossing on Farm-to-Market Road 314, south of Van, Texas in Van Zandt County. The site was only publicly accessible at the bridge crossing as there was fenced private property upstream and downstream of the crossing. With landowner permission, TIAER personnel entered private property over the downstream fence to gain stream access at the site. Native pasture lined the stream corridor (Table 4.5). Access to the stream was moderately easy with moderately steep banks and some areas of dense vegetation (Table 4.6). The general appearance of the stream at this site is shown in Figures 4.39 and 4.40.

Site NR16 was wadeable for the entire 300-m reach length. The stream channel was mostly dry during both surveys with only a few puddles observed resulting in an average thalweg of 0.0 m for both surveys (Table 4.6). The lack of water made traversing the stream channel easy for most of the reach; however a few log obstructions within the channel did pose a challenge. Stream widths ranged from 0.0 m to 2.5 m during the first survey and 0.0 m to 1.5 m during the second survey (Tables 4.7 and 4.8).



Figure 4.39 Photograph of Neches River Site NR16 taken on July 25, 2014, the downstream view of the 300-m transect.



Figure 4.40 Photograph of Neches River Site NR16 taken on August 23, 2014, the downstream view of the 150-m transect.

A moderate presence of cattle was observed during the second survey with no other mammals or other vertebrates observed during either survey (Tables 4.9 and 4.10). Tracks observed during the first survey consisted of cattle and raccoon. During the second survey cattle, raccoon, and canine tracks were observed. Bird and cattle feces were found throughout the reach during both surveys. A cattle trail crossing the stream channel was also observed. One primitive bridge crossing (hydrologic modification) was also observed between the 240-m and 270-m transects as depicted in Figure 4.41. Aquatic vegetation and algae cover were absent during both surveys due to a lack of water. When encountered, water color was brown with no surface scum. Trash was observed near the road crossing and consisted of tires and typical plastics. There was no evidence of human recreational activity found by TIAER personnel.



Figure 4.41 Photograph of Neches River Site NR16 taken on July 25, 2014 showing the primitive bridge (hydrologic modification).

Physical Description of NR17

Neches River at Site NR17 was visited on July 25 and August 23, 2014. This site was located on private property south of Van, Texas in Van Zandt County. The site was accessible through fenced private property via a locked gate with landowner permission or by access at the upstream bridge crossing on Van Zandt County Road 4511. A survey site (Site NR18) had been established on the Neches River Crossing at Van Zandt County Road 4511, so for convenience, TIAER personnel accessed Site NR17 by walking from the County Road 4511 bridge crossing approximately 0.38 miles along the streambank on a mowed clearing. Forest dominated the stream corridor (Table 4.5), and access to the stream was moderately difficult due to steep banks (Table 4.6). The general appearance of the stream is shown in Figures 4.42 and 4.43.

Site NR17 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.0 m during the second survey when the stream was mainly dry (Table 4.6). During both surveys, shallow to non-existent water depths made wading in the stream channel moderately easy with the exception of areas containing log jams and other woody debris. Stream widths ranged from a maximum of 6.0 m during the first survey to a minimum of 0.0 m during the second survey when very little water was present (Tables 4.7 and 4.8).



Figure 4.42 Photograph of Neches River Site NR17 taken on July 25, 2014, the downstream view of the 150-m transect.



Figure 4.43 Photograph of Neches River Site NR17 taken on August 23, 2014, the upstream view of the 0-m transect.

There was a slight presence of cattle and water dependent birds observed during the first survey with no other animals observed (Table 4.9). During the second survey no mammals or vertebrates were observed (Table 4.10). Tracks observed during each trip consisted of deer, feral hog, and raccoon. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were absent during both surveys. When present, water color was brown with a surface scum. Trash, which was rarely encountered, consisted of tires, bottles, and one ice chest. No evidence of human recreational activity was observed.

Physical Description of NR18

Neches River at Site NR18 was visited on July 25 and August 23, 2014. This site was located at the bridge crossing on Van Zandt County Road 4511, southwest of Van, Texas in Van Zandt County. The site was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. TIAER personnel accessed the site by walking under the county road bridge. The site is located in a forest dominated corridor (Table 4.5). At the bridge crossing, access to the stream was moderately easy with some patches of dense vegetation. Access at other locations along the reach would prove more difficult due to steep banks and dense vegetation. The general appearance of the stream at this site is shown in Figures 4.44 and 4.45.



Figure 4.44 Photograph of Neches River Site NR18 taken on July 25, 2014, the upstream view of the 0-m transect.



Figure 4.45 Photograph of Neches River Site NR18 taken on August 23, 2014, the downstream view of the 150-m transect. TIAER personnel in photograph.

Site NR18 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.40 m during the first survey to 0.2 m during the second survey when the stream was not flowing (Table 4.6). During both surveys, the shallow to non-existent water depths made wading in the stream channel easy with the exception of areas that contained log jams and other woody debris. Stream widths ranged from a maximum of 7.0 m during both surveys to a minimum of 0.0 m during the second survey when the stream was pooled (Tables 4.7 and 4.8).

There was no observance of any mammals or other vertebrates during either of the surveys (Tables 4.9 and 4.10). Tracks observed during each trip consisted of raccoon, feral hog, and deer. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rarely observed within the reach. Water color was brown with a surface scum during both surveys. Large sized garbage was common at the bridge and consisted of tires, television, toilet, carpet, and a five gallon drum. Small garbage was rarely observed and consisted of typical plastics, cans and bottles. No evidence of human recreational activity was observed during either survey.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. Eleven of the 17 surveyed sites were at locations that provided some public access; however, private property boundaries generally limited public access to small areas around and underneath the bridge or culvert crossings. The remaining six sites were located on private property, and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations. Of note, Site NR04 was excluded from the site count, because the landowners rescinded their permission to enter their property at this site prior to the first survey.

Recreation was directly observed by TIAER staff only during the second survey when three individuals were observed fishing from the bank at Site NR02. Prior to the field surveys on February 21, 2014, TIAER personnel observed about 20 individuals fishing from the bank at Site NR02. No other recreational activities were observed by TIAER employees at any of the sites.

Evidence of potential recreation was encountered at 6 of the 17 survey sites as follows:

- Sites NR01 and NR02 – Discarded fishing bait containers and other fishing related trash were observed along the banks of sites NR01 and NR02.
- Site NR03 – A bobber was observed near the 120-m transect.
- Site NR05 – A fishing bobber and fishing line was found within the surveyed reach.
- Site NR10 – A fishing bobber and fishing line was found within the surveyed reach.
- At Site NR12, a duck decoy was found within the surveyed reach. It is unknown if the duck decoy was used at this site or if the decoy had floated downstream from another location.

Activities Interviewed

A total of 36 interviews were conducted with landowners or others with an interest in the Neches River Above Lake Palestine (Segment 0606). Fishing, boating, and hunting were the main activities noted as occurring along this portion of the Neches River, although swimming had been observed by one interviewee and wading by children by two interviewees (Table 4.12).

The landowner of Site NR01 and an adjacent landowner indicated that they did fish at the site and had observed and heard of others fishing and boating at the site. The landowner indicated that he had observed individuals trespassing on his property numerous times in order to fish at Site NR01. Both indicated they had observed and heard of people fishing and boating at Site NR02.

In an interview sent to TIAER via email, a local resident indicated that he had fished and boated along a reach that begins three miles upstream of Highway 31 to one mile downstream of Highway 31, which encompasses the surveyed reach of Sites NR01 and NR02. As a public boat ramp is at Site NR02, it was assumed that the interviewee accessed the river from this location and his responses are summarized in Table 4.12, noting Site NR02 as the primary site for this interview. The local resident indicated that he typically recreated within this reach three times a month from January through March for the last seven years during the white bass spawning season. The local resident also stated that he had observed other individuals fishing, kayaking, boating, canoeing, and children wading. In Table 4.12, children wading is noted only with Site NR02 because wading at Site NR01 seemed unlikely due to the limited access and deep thalweg depths measured during the field surveys. The local resident stated that most of the observed recreation occurred from November through May when more fish are present within this reach of the Neches River. The interviewee noted that he had heard of kayaking, boating, and fishing within the area of Sites NR01 and NR02 from November through May.

At Site NR02, 16 individuals were approached for interviews, one who declined due to a language barrier. An interview associated with Mud Creek also indicated fishing at Site NR02 and is included in the summary for this site in Table 4.12, so along with the interview noted in the paragraph above, there were 17 interviews conducted representing information for Site NR02. The majority of the interviews at Site NR02 were conducted in February 2014, when the white bass spawning run was beginning to occur which in turn attracted numerous fisherman to the site. The majority of these interviews indicated only fishing and boating as types of recreation occurring at this location. In addition to the interviewee noted in the previous paragraph who noted that he had observed children wading, one other interviewee had observed children wading and swimming and heard of swimming at NR02. The only other form of recreation noted had been hunting by a separate interviewee.

The landowner of Site NR03 indicated that her family hunted on their property. The landowner stated that she had observed and heard of people trespassing on her property to fish at Site NR03.

The landowner of Site NR04 stated that no recreation occurs in the stream on her property. She stated that access to the Neches River through her property would be difficult.

The landowner of Site NR05 stated that he and his family do not recreate in the stream on their property. He stated that he had occasionally observed individuals trespassing on his property in order to fish on the Neches River.

The landowner of Site NR07 stated that no recreation occurs in the stream on his property. He stated that dense vegetation made accessing and even finding the stream difficult. The difficult access to NR07 was confirmed by TIAER personnel during the two survey events.

A local resident who owns a business directly adjacent to Site NR08 stated that he does not recreate in the stream. He had heard of people hunting in the stream within the reach of NR08 and that on more than one occasion these individuals had required rescuing because they had gotten lost in the dense vegetation. He stated that he did not recommend that anyone access the stream in the vicinity of NR08 due to the dangerous conditions posed by the thick vegetation.

The landowner of Site NR11 stated that no recreation occurs in the stream on his property. He stated that the stream channel is typically dry on his property in the summer.

The landowner of Site NR14 stated that he fished during the spring months on his property and at other locations along the Neches River. He had also observed or heard of others fishing on his property. A local resident that leases the land near Site NR14 stated that he hunts on the property and had not observed or heard of others recreating in the stream.

The landowner of Site NR15 stated that he hunts and occasionally uses a boat on the stream both on his property and downstream of his property. He stated he had not observed or heard of others recreating in the stream.

The landowner of Site NR16, an individual that leases the property, and a local resident indicated that no recreation occurs in the stream at this location. The individual that leases the property stated that the stream is typically dry within the surveyed reach.

The landowner of Site NR17 stated that no recreation occurs in the stream on their property. He stated that he had never attempted to access the stream from his property due to dense vegetation.

Two individuals in vehicles stopped at Site NR18 during the stream surveys and were interviewed. One individual stated that he does not recreate in the stream and has not observed or seen anyone else recreating in the stream. The reason given for the lack of recreation at the site was due to an absence of fish in the stream. The other individual indicated that he fished at the site throughout the year and at other road crossing and had observed and heard of others fishing at the site and other road crossings throughout the year.

Besides the one individual interviewed at Site NR18, two other individuals noted that they hunt and fish at multiple locations along the Neches River Above Lake Palestine. One stated that he had also observed hunting, but did not indicate a location. The other noted observing and hearing of fishing on private property and at road crossings year-round when adequate water is present.

Table 4.12 Summary of recreational activities noted in interviews for Neches River Above Lake Palestine.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. An * and numbers in parentheses indicate recreation reported from an interview for another site.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
NR01 ^a	2					2,2,2 (1*,1*,1*)	0,2,2 (1*,1*,1*)
NR02 ^b	17	0,1,1		0,2,0	0,1,1	15,16,15 (0,2*,2*)	1,11,11 (0,2*,2*)
NR03	1				1,0,0	0,1,1	
NR04	1						
NR05	1					0,1,0	
NR06							
NR07	1						
NR08	1				0,0,1		
NR09							
NR10							
NR11	1						
NR12							
NR13							
NR14	2				1,0,0	1,1,1	
NR15	1				1,0,0		1,0,0
NR16	3						
NR17	1						
NR18	2					1,1,1	
General AU	2				1,1,0	2,1,1 (1*1*1*)	
Totals	36	0,1,1		0,2,0 (0,1*,0)	4,2,2	21,23,21 (2*,4*,4*)	2,13,13 (1*,3*,3*)

- a. Both interviewees at Site NR01 indicated observing and hearing of individuals fishing and boating at Site NR02.
- b. One interviewee for Site NR02 indicated personally boating and fishing downstream of this location in an area that would encompass Site NR01. He also noted observing and hearing of others doing the same.
- c. One interviewee at Site NF18 indicated that he fished and had observed and heard of others fishing at road crossings throughout the Neches River Above Lake Palestine.

Summary

RUAA surveys were conducted at seventeen of the eighteen sites along the Neches River (AU-0606) on the days of July 24-25, 2014 and August 22-23, 2014. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions during both surveys in July and August 2014 (TWDB, 2014).

During the first survey, three individuals were observed by TIAER field staff fishing from the stream bank at Site NR02. In February 2014 when scouting for survey sites, multiple individuals were observed by TIAER field staff fishing from the stream bank at Site NR02. There were no other recreational activities observed by TIAER field staff. Interviews revealed that fishing and hunting have occurred at various sites throughout the reach. Boating was associated with only the two most downstream sites, NR01 and NR02. Interviews also revealed that swimming and children wading in the Neches River has occurred at Site NR02. Anecdotal evidence through field staff observations and information gathered from interviews indicate that the majority of recreational activities along Segment 0606 occur in the vicinity of Site NR02. This is likely due to the availability of a maintained public boat ramp and ample parking spaces, in addition to having perennial streamflow conditions. A maintained public boat ramp, ample parking spaces, a concrete walking path, and covered picnic area were located at Site NR02. Based on interviews and observations during the field surveys, Site NR02 appears to be popular fishing sites. While fishing likely occurs throughout the year at these sites the frequency and number of individuals is probably greatest during late February through March when white bass (*Morone chrysops*) are migrating up the river from Lake Palestine to spawn. With the exception of Site NR02, areas of the stream open to the public are typically limited to the right-of-ways immediately underneath bridge crossings or areas immediately up and down stream of culvert crossings. Recreational activities reported by interviewees are summarized in Figure 4.46. Overall RUAA findings are summarized in the form below.

The mostly rural nature of the area surrounding the Neches River is an impediment to recreation. Ten of the eighteen surveyed sites were considered publicly accessible; however the access was typically limited to the area immediately under a bridge crossing. In most cases, due to vegetation and property fences, access could only be gained directly from the bridge into the stream. The remaining eight sites were only legally accessible through private property with landowner permission.

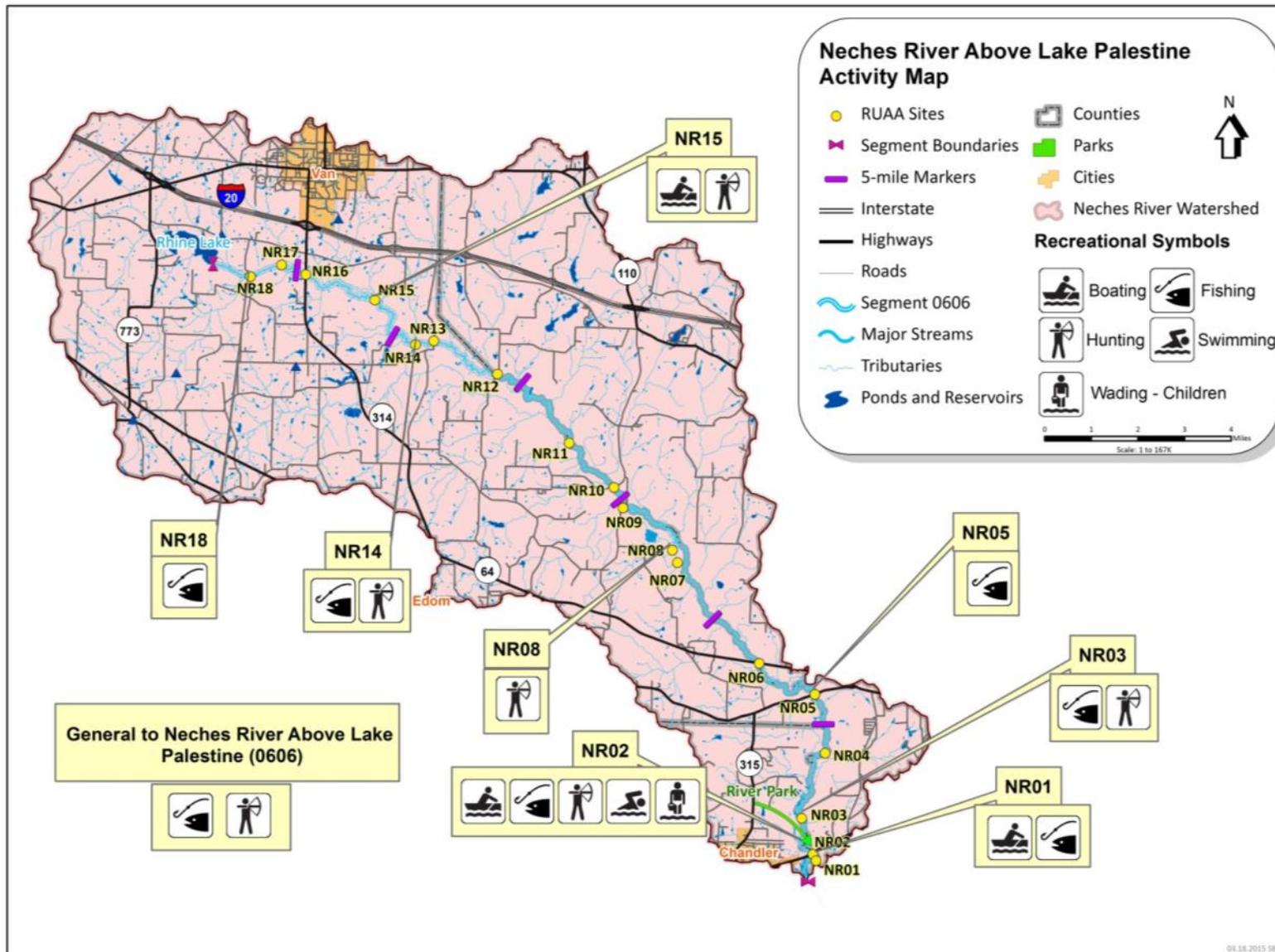


Figure 4.46 Summary of observed and interviewed human activities on Neches River above Lake Palestine.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Neches River

Segment No. of Nearest Downstream Segment No.: Segment 0606

Classified? :No

County: Smith, Van Zandt, and Henderson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

b. Do secondary contact recreation 1 activities occur on the water body?

frequently seldom not observed or reported unknown

c. Do secondary contact recreation 2 activities occur on the water body?

frequently seldom not observed or reported unknown

d. Do noncontact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

2. Physical Characteristics of Water body

a. What is the average thalweg depth? 0.79 meters

b. Are there substantial pools deeper than 1 meter? Yes No

c. What is the general level of public access?

easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

Mild-Extreme Drought

Incipient dry spell

Near Normal

Incipient wet spell

Mild-Extreme Wet

CHAPTER 5

PRAIRIE CREEK

(0606A)

Watershed Characteristics

The watershed of Prairie Creek (0606A) located within Smith County covers 57,300 acres and includes significant portions of the cities of Tyler (estimated population 100,223), Hideaway (estimated population 3,185), and Lindale (estimated population 5,323) (Figure 5.1). Prairie Creek is nearly 12 miles long and flows southwest from its headwaters near Lindale, Texas until it merges with the Neches River (Segment 0606) just south of State Highway 64. Black Fork Creek (0606D), which is about 14 miles long, is a major tributary of Prairie Creek that flows northwest through Tyler and then westward until reaching its confluence with Prairie Creek. While surface water is the primary focus of this study, the watershed overlays the Carizzo-Wilcox Aquifer (George et al., 2011). The terrain of the watershed varies from flat to rolling hills and dominant soil types include brown, loamy, fine sand (TSHA, 2010b). The bottom lands are fairly flat with loamy soils that are frequently flooded and often strongly acidic (Hatherly, 1993).

The Prairie Creek watershed lies within the Post Oak Savannah ecoregion (35a) (Griffith et al., 2007). Average annual rainfall in the Prairie Creek region is 42 inches annually (Tyler Texas Weather, 2015). Mean minimum and maximum temperatures for the region range from 36 to 57°F in January and 73 to 94°F in July. The dominant land use categories within the Prairie Creek watershed reflect a developed landscape around the cities of Tyler and Lindale, woody wetlands around Prairie Creek, and hay/pasture dissected by woodland in much of the remaining areas (Figure 5.2). While its headwaters are in the City of Lindale, Prairie Creek largely flows through rural areas and has no parks located along its mainstem.

Designated Uses, Impairments, and Concerns

Prairie Creek (0606A) is an unclassified perennial freshwater stream (TCEQ, 2013a) and has designated uses of contact recreation, fish consumption, and high aquatic life use. Prairie Creek has three AUs. The first AU, 0606A_01, extends from the confluence with Neches River in Smith County upstream to the confluence with Black Forest Creek where the second AU, 0606A_02, begins and extends from the confluence with Black Forest Creek to the confluence with Caney Creek. The final AU, 0606A_03, extends from the confluence with Caney Creek upstream to confluence with unnamed tributary approximately 0.4 miles downstream of the US 69 bridge crossing. Of these three AUs, only AU 0606A_01 and 0606A_03 are listed as impaired for bacteria. Both AU 0606A_01 and AU 0606_03 were first listed as impaired on the 2002 Texas 303(d) list and remain listed in the 2012 Texas Integrated Report for bacteria. A concern for ammonia is also noted for Prairie Creek in AU 060A_03.

Permitted Discharges

Prairie Creek watershed has three permitted WWTFs and several permitted outfalls for stormwater discharge associated with the Delek Refining (TX001449), located within Tyler, Texas. The City of Tyler Westside WWTF (TX0134287) is the largest discharger with a permitted flow of 13

MGD. The Spring Lake Mobile Home Park WWTF (TX0134287) is the smallest of the three WWTFs located in the Prairie Creek watershed with an allowable average daily flow of 0.0075 MGD. The City of Lindale WWTF (TX0105066) holds a permitted average daily flow of 0.072 MGD. Because Prairie Creek is a tributary of the Neches River Above Lake Palestine (Segment 0606), loadings arising from permitted discharges along Prairie Creek ultimately enter Segment 0606.

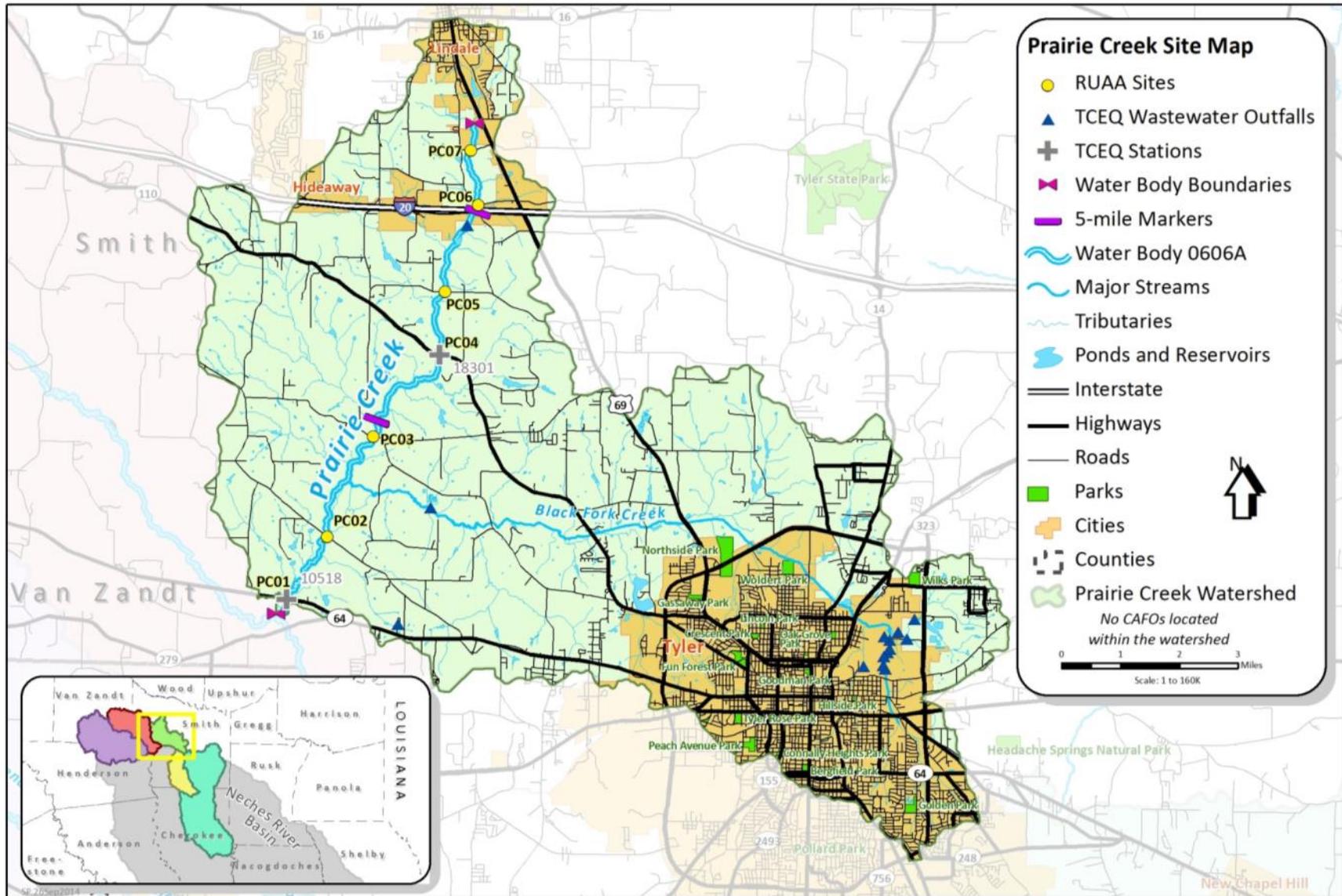


Figure 5.1 Overview of Prairie Creek watershed and RUAA sites for water body 0606A.

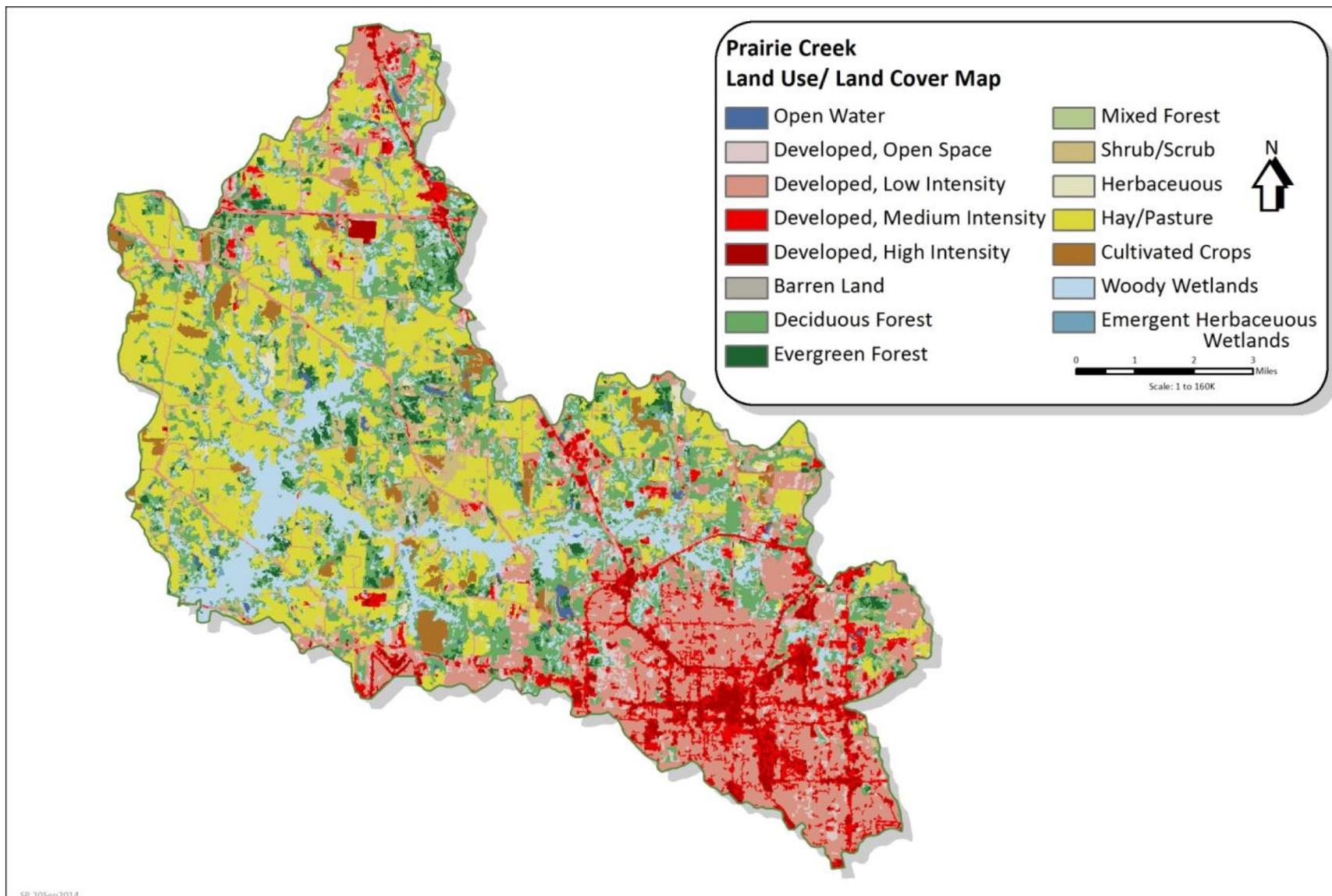


Figure 5.2 Land use/land cover for the Prairie Creek watershed. Source: 2011 National Land Cover Database (USGS, 2013).

There are no permitted concentrated animal feeding operations (CAFOs) in the Prairie Creek watershed.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. To provide an estimate of livestock densities in the watershed, livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2012). These statistics on a county level indicated a large numbers of beef cattle within Smith County, and, thus, likely within the watershed (Table 5.1).

Table 5.1 Estimated livestock numbers within the Prairie Creek watershed based on statistics for Smith County adjusted for the percent of the county within the watershed. (Source USDA, 2012).

The Prairie Creek watershed comprises about 9% of Smith County.

County	Year	Cattle & Calves (all beef)	All Goats	Mules, Burros, and Donkeys	Horses & ponies	Hogs
Smith	2012	42,885	3,561	1,127	4,342	401
Prairie Creek Watershed Average	2012	4,044	336	106	409	38

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 21,660 households within the Prairie Creek watershed based on 2010 census population data, there are potentially about 12,650 dogs within the Prairie Creek watershed. Other domestic animals such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife such as deer, feral hogs, and birds. In 2013 statewide population estimated roughly 39 whitetail deer per 1,000 acres. This estimation suggests that the population for whitetail deer in the Post Oak Savannah region is roughly 400,000 deer, or 35 deer per 1,000 acres (Cain, 2014). Feral hogs are an invasive species commonly found throughout Texas. They have been known to travel in large groups along waterways and congregate near shallow depressions of water. Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (AgriLife, 2011).

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CNNs) from the Public Utility Commission of Texas was used. As not all cities with WWTFs have CNNs, the CNN layer was supplemented with a GIS layer representing municipal boundaries for those cities with WWTFs. Population data from the U.S. Census Bureau (USCB) were then overlaid masking out areas that should be serviced by WWTFs. The 2010 U.S. Census Bureau (USCB) data indicated that of the 21,660 households in the Prairie Creek watershed, about 22% are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of Prairie Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Tyler

[City of Tyler Homepage](#)²⁵

Nothing significant was found pertaining to the historical recreational use of Prairie Creek.

City of Lindale

[City of Lindale Homepage](#)²⁶

Nothing significant to the historical recreational use of Prairie Creek was found.

Library Sources

Tyler Public Library

201 S. College Ave.

Tyler, TX 75702

Phone Number: (903) 593-7323

Website: [Tyler Public Library Homepage](#)²⁷

No significant information was found regarding recreational use of Prairie Creek.

Lindale Library

200 East Hubbard Street
Lindale, TX 75771
Phone Number: (903) 882-1900
Website: [Lindale Library Homepage](#)²⁸

No significant information was found regarding recreational use of Prairie Creek.

Newspaper Sources

The Tyler Morning Telegraph
[Tyler Morning Telegraph Homepage](#)²⁹

Phone: (903) 592-3818

No significant information was found regarding recreational use of Prairie Creek.

Lindale News & Times
[Lindale News & Times Homepage](#)³⁰

Phone: (903) 882-8880

No significant information was found regarding recreational use of Prairie Creek.

Internet Searches

The Handbook of Texas Online
[The Handbook of Texas Online Homepage](#)³¹

Search of the handbook by river name was conducted. No significant information was found regarding the recreational use of Prairie Creek.

²⁵ <http://www.cityoftyler.org/>

²⁶ <http://www.lindaletx.gov/>

²⁷ <http://library.cityoftyler.org/>

²⁸ <http://www.lindalelibrary.org/>

²⁹ <http://www.tylerpaper.com/>

³⁰ [http://www.lindaleneews-times.com./](http://www.lindaleneews-times.com/)

³¹ <https://tshaonline.org/>

Survey Site Descriptions

With the help of cooperating stakeholders, TIAER was able to establish seven sites along the 12 mile long stretch of water body 0606A (Figure 5.1 and Table 5.2). The optimum number of survey sites following the RUAA guidelines from TCEQ was seven or three per each five miles of stream, so this goal was met. All seven sites were at public road crossings that did not require private landowner permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. Public accessibility at five of the seven sites was very limited due to private property fences. Four of the seven sites were located at TCEQ sampling stations. The average distance between survey sites was 1.80 river miles and ranged from 1.11 to 2.42 miles. The largest gap of 2.42 river miles was between PC02 and PC03. RUAA surveys were performed in June and August of 2014 at these locations. A brief description of each site follows.

Table 5.2 Description and location of RUAA field survey sites for Prairie Creek, Water Body 0606A.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Access
10518	PC01	Prairie Creek at intersection with SH 64	32.371761	-95.453573	0.0	0.46	Public
10519	PC02	Prairie Creek at intersection with FM 724	32.387410	-95.442177	1.78	2.24	Public
10520	PC03	Prairie Creek at intersection with Old New Harmony Rd	32.412369	-95.429435	2.42	4.66	Public*
18301	PC04	Prairie Creek at intersection with SH110	32.432981	-95.410707	1.72	6.38	Public*
	PC05	Prairie Creek at intersection with CR 471	32.448349	-95.409622	1.91	8.29	Public*
	PC06	Prairie Creek at intersection with CR 472	32.469911	-95.400456	1.86	10.15	Public*
	PC07	Prairie Creek at intersection with CR 474	32.483380	-95.402960	1.11	11.26	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site PC01 (TCEQ Station 10518) is located on Prairie Creek at the bridge crossing on State Highway 64, west of Tyler, Texas. Site PC01 was publicly accessible at the bridge crossing with private property upstream and downstream of the highway right-of-way. However, the properties are not fenced allowing easy access. The site was selected because of potential public access and the site provided opportunity for characterization of 0606A.

Site PC02 (TCEQ Station 10519) is located on Prairie Creek at the bridge crossing on Farm to Market Road 724, west of Tyler, Texas. Site PC02 was publicly accessible at the bridge crossing with unfenced private property located upstream and downstream of the road right-of-way. The site was selected because of potential public access and the site provided opportunity for characterization of 0606A.

Site PC03 (TCEQ Station 10520) is located on Prairie Creek at the bridge crossing on Old Harmony Road, northwest of Tyler, Texas. Site PC03 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0606A. The site also served as a publicly accessible site.

Site PC04 (TCEQ Station 18301) is located on Prairie Creek at the bridge crossing on State Highway 110, northwest of Tyler, Texas. Site PC04 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. The site was selected because of public accessibility, landowner cooperation and the site provided opportunity for characterization of 0606A.

Site PC05 is located on Prairie Creek at the bridge crossing on County Road 471, south of Lindale, Texas. Site PC04 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. The site was selected because of public accessibility, landowner cooperation and the site provided opportunity for characterization of 0606A.

Site PC06 is located on Prairie Creek at the bridge crossing on County Road 472, south of Lindale, Texas. Site PC06 was only publicly accessible at the bridge crossing right-of-way on County Road 472 and also the Interstate Highway 20 right-of way. Private properties upstream and downstream of the CR 472 crossing were fenced. The site was selected because of landowner cooperation and the site provided opportunity for characterization of 0606A. The site also served as a publicly accessible site.

Site PC07 is located on Prairie Creek at the crossing on County Road 474, south of Lindale, Texas. Site PC07 was publicly accessible upstream of the crossing, but fenced private property was located south of the crossing. Although landowner permission was sought and granted for the downstream property, the survey was conducted upstream of the crossing due to the public accessibility along an easement bordering the west side of the stream. The site was selected because of public accessibility and the site provided opportunity for characterization of 0606A.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Water Body 0606A

The Prairie Creek RUAA surveys were conducted on June 3, 2014 and August 8, 2014 at all seven sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 5.3 and 5.4). According to a weather gauge located in Tyler, TX, in the 30 days prior to the first survey, 4.52 inches of precipitation fell, while 5.06 inches fell 30 days prior to the second survey. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both July and August 2014 (TWDB, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 5.5 describes the stream channel and corridor characteristics at each site.
- Table 5.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 5.7 and 5.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 5.9 and 5.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall average thalweg depth ranged from 0.3 m to 1.2 m during both surveys. Access to the stream down the bank was moderately easy to easy in most locations due to low banks and grassy vegetation. Only one site (PC03) was characterized as having difficult access and was due to dense vegetation along the stream banks and instream. The dominant substrate was sand at the two most upstream and the most downstream site and mud and clay at the remaining four sites. The stream corridor was largely lined with forest, except PC06, at which contained some shrubs, and PC07, at which one bank was mowed. The maximum stream width encountered was 36 m during both surveys. Flow conditions were characterized as low in June and normal in August. The water surface was generally clear in color. Tracks observed most often included cattle, raccoon, deer, feral hog, and canine. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics and aluminum cans found on the banks. Recreation was only directly observed during the first survey and consisted of one individual fishing from the bank at site PC02. Evidence of potential recreation associated with fishing was noted at sites PC01, PC02, and PC03.

Table 5.3 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the first RUAA survey initiated on June 3, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
5-May-14	0	86	59
6-May-14	0	85	62
7-May-14	0	83	64
8-May-14	0.13	80	69
9-May-14	1.20	85	63
10-May-14	0.16	85	65
11-May-14	0	89	71
12-May-14	0	86	74
13-May-14	1.54	75	55
14-May-14	0.24	69	52
15-May-14	0	79	44
16-May-14	0	83	52
17-May-14	0	83	56
18-May-14	0	84	60
19-May-14	0	84	63
20-May-14	0	87	69
21-May-14	0	88	68
22-May-14	0	84	68
23-May-14	0	83	66
24-May-14	0	84	69
25-May-14	0	87	68
26-May-14	0	82	70
27-May-14	0.40	77	66
28-May-14	0.05	82	66
29-May-14	0.33	86	63
30-May-14	0	84	68
31-May-14	0.46	85	70
1-Jun-14	0	88	69
2-Jun-14	0	88	73
3-Jun-14	0	89	71

Table 5.4 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the second RUAA survey initiated on August 8, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
9-Jul-14	0	95	75
10-Jul-14	0	94	74
11-Jul-14	0	94	73
12-Jul-14	0	96	73
13-Jul-14	0	98	75
14-Jul-14	0	97	75
15-Jul-14	0.44	93	74
16-Jul-14	0	88	67
17-Jul-14	0.50	84	67
18-Jul-14	0.13	71	65
19-Jul-14	0.02	73	65
20-Jul-14	0	87	66
21-Jul-14	0	91	68
22-Jul-14	0	91	71
23-Jul-14	0	92	69
24-Jul-14	0.62	90	67
25-Jul-14	0	94	71
26-Jul-14	0	95	74
27-Jul-14	0	96	76
28-Jul-14	0.43	95	74
29-Jul-14	0	91	72
30-Jul-14	0	87	72
31-Jul-14	2.80	84	70
1-Aug-14	0.04	77	67
2-Aug-14	0.06	84	68
3-Aug-14	0.02	87	70
4-Aug-14	0	90	72
5-Aug-14	0	92	73
6-Aug-14	0	93	75
7-Aug-14	0	94	76
8-Aug-14	0	95	77

Table 5.5 Stream Channel and corridor appearance for each site sampled along Prairie Creek Water Body 0606A.

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
PC01	Natural	Sand	Forest	Large	No	Native
PC02	Natural	Mud/Clay	Forest	Large	No	Native
PC03	Natural	Mud/Clay	Forest	Large	No	Native
PC04	Natural	Mud/Clay	Forest	Large	No	Native
PC05	Natural	Mud/Clay	Pasture	Large	No	Native pasture
PC06	Natural	Sand	Forest - Upper ½ Shrub - Lower ½	Large	No	Native
PC07	Natural	Sand	Forest - Left Mowed - Right	Large	No	School, Native and Pasture

Table 5.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Prairie Creek (0606A).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
PC01	300	11	0	1.0	1.0	Perennial	Public	E
PC02	300	11	0	1.0	1.2	Perennial	Public	ME
PC03	300	11	0	1.2	1.1	Perennial	Public*	D
PC04	300	11	0	0.3	0.3	Perennial	Public*	ME
PC05	300	11	0	0.7	0.7	Perennial	Public*	ME
PC06	300	11	0	0.3	0.3	Perennial	Public*	ME
PC07	300	11	0	0.3	0.4	Perennial	Public*	E

Table 5.7 Description of surveyed stream sites along Prairie Creek during first survey performed in June 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
PC01	20	6.5	7.5	Low
PC02	36	7.0	8.0	Low
PC03	12	4.0	5.0	Low
PC04	3.0	2.3	2.7	Low
PC05	30	1.0	3.0	Low
PC06	3.5	1.3	2.5	Low
PC07	5.5	0.9	2.5	Low

Table 5.8 Description of surveyed stream sites along Prairie Creek during second survey performed in August 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
PC01	19	6.0	8.0	Normal
PC02	36	6.5	8.0	Normal
PC03	12	3.0	5.0	Normal
PC04	5.0	1.5	3.0	Normal
PC05	33	2.0	4.0	Normal
PC06	3.5	1.5	2.5	Normal
PC07	4.0	1.5	3.0	Normal

Table 5.9 Stream aesthetics along Prairie Creek during first survey performed in June 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PC01	A	A	C	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	C
PC02	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	C
PC03	A	A	N	Brown	None	Scum	N	N	SP	Tracks/Fecal	N	R	N
PC04	R	A	N	Clear	None	Clear	N	N	N	Tracks/Fecal/Nests	R	R	R
PC05	Ab	A	N	Brown	None	Clear	N	N	MP	Tracks/Fecal	N	N	R
PC06	C	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
PC07	R	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N

Table 5.10 Stream aesthetics along Prairie Creek during second survey performed in August 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PC01	A	A	C	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal/Nests	N	N	R
PC02	A	A	C	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	C
PC03	A	A	N	Brown	Fine sediment	Scum	N	N	SP	Tracks/Fecal	N	R	N
PC04	R	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal/Nests	R	R	R
PC05	Ab	A	N	Brown	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	N	R
PC06	R	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
PC07	R	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R

Physical Description of PC01

Prairie Creek at Site PC01 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing of State Highway 64 approximately 9 miles west of Tyler, Texas in Smith County. Site PC01 is publicly accessible at the bridge crossing. A dirt trail is located on the south side of the bridge crossing, which made access to the stream easy (Table 5.6). TIAER personnel were able to drive directly to the stream and launch a small boat. The corridor on either side of the stream was forested at this site (Table 5.5), as shown in Figures 5.3 and 5.4 showing the general appearance of the site during each survey.

Site PC01 was wadeable for nearly the entire 300-m reach length; however, deep water was encountered in a few locations that necessitated use of the small boat to traverse. Throughout the reach, numerous log obstructions were encountered. Substrate was typically sand. During both surveys the average thalweg was 1.0 meter. Stream widths ranged from 6.5 m to 20 m during the first survey and 6.0 m to 19 m during the second survey (Tables 5.7 and 5.8).



Figure 5.3 Photograph of Prairie Creek Site PC01 taken on June 3, 2014. The downstream view of the 0-m transect.



Figure 5.4 Photograph of Prairie Creek Site PC01 taken on August 8, 2014. The downstream view of the 150-m transect. TIAER personnel in photograph.

There were no vertebrates or mammals observed during either survey (Tables 5.9 and 5.10). Tracks observed during each trip consisted of canine, raccoon, and bird. Bird feces were also found throughout the reach. Aquatic vegetation and algae cover were absent both of the surveys. No trash was observed within the channel, but trash along the bank was commonly observed during the first survey and rarely observed during the second survey. When encountered, the trash consisted of typical plastic cups and bottles. While no one was observed recreating at the site, evidence of recreation consisted of a fishing trotline, ATV tracks, human footprints, and a footpath.

Physical Description of PC02

Prairie Creek at Site PC02 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing of Farm to Market 724 approximately 9 miles west of Tyler, Texas in Smith County. Site PC02 is publicly accessible at the bridge crossing, and a trail large enough for a vehicle to drive down was located along the northwest side of the bridge. TIAER used this trail to access the creek and deployed a small boat for use during the surveys. The stream corridor was dominated by forest on both sides (Table 5.5). Access to the stream was moderately easy (Table 5.6) rather than easy due to slightly steep banks and relatively deep water at the stream edge. There were banks throughout the reach that were steep and more treacherous. The general appearance of the creek is shown in Figures 5.5 and 5.6.



Figure 5.5 Photograph of Prairie Creek Site PC02 taken on June 3, 2014. The upstream view of the 300-m transect.



Figure 5.6 Photograph of Prairie Creek Site PC02 taken on August 8, 2014. The upstream view of the 0-m transect.

Site PC02 was wadeable for most of the entire 300-m reach length; however, deeper holes encountered were traversed using the small boat. Average thalweg was from 1.0 m during the first survey to 1.2 m during the second survey (Table 5.6). During both surveys, the entire 300-m reach was traversed by some field crew using a small boat; however numerous log obstructions were encountered that made boating slightly difficult. Stream widths varied from about 7 m to 36 m during the two surveys (Tables 5.7 and 5.8).

No mammals or other vertebrates were observed during either survey (Tables 5.9 and 5.10). Tracks observed during the first survey consisted of raccoon and bird. Tracks during the second survey consisted of raccoon, bird, and cattle. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algal cover were absent during both surveys, and water color was brown. Small garbage in the stream channel was rare and bank garbage was common. When encountered, trash consisted of typical plastic cups and bottles along with discarded fishing paraphernalia. Evidence of recreation consisted of the vehicle trail along the edge of the bridge along with foot paths and discarded fishing tackle. During the first survey, two individuals were observed at the site. One individual was fishing and the other individual arrived at the site due to curiosity as to what TIAER personnel were doing. Both individuals agreed to interviews. No people were observed at the site during the second survey.

Physical Description of PC03

Prairie Creek at Site PC03 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing on Old Harmony Road, 9 miles northwest of Tyler, Texas. Site PC03 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. The stream corridor was forested (Table 5.5), and dense vegetation and steep banks under the bridge and throughout the reach made access difficult (Table 5.6). To access the stream, TIAER personnel lowered a small boat by rope from the bridge down to the stream. Figures 5.7 and 5.8 depict the general appearance of the site during each survey.

Site PC03 was wadeable for the entire 300-m reach length. Average thalweg ranged from 1.2 m during the first survey to 1.1 m during the second survey (Table 5.6). During both surveys, numerous log obstructions were encountered that made boating difficult. When necessary TIAER personnel had to exit the small boat in order to navigate through obstructions. Widths of the stream ranged from maximum of 12 m during both surveys to a minimum of 3.0 m during the second survey (Tables 5.7 and 5.8).



Figure 5.7 Photograph of Prairie Creek Site PC03 taken on June 3, 2014, the upstream view of the 300-m transect.



Figure 5.8 Photograph of Prairie Creek Site PC03 taken on August 8, 2014, the downstream view of the 0-m transect.

There was a slight presence of mammals observed consisting of a horse and a dog during the first survey and one horse during the second survey (Tables 5.9 and 5.10). Tracks observed during each trip consisted of raccoon and bird. Bird feces were also found throughout the reach. Aquatic vegetation and algae cover were absent during both surveys. The water color was brown with no surface scum or foam. Trash observed in the stream channel was rare and consisted of typical plastic cups and bottles. No garbage was observed along the stream banks. Evidence of recreation observed consisted of a chair located near the 60-m transect on fenced private property with a forked stick fishing rod holder situated nearby (Figure 5.9). A fishing bobber near this same location was observed in a tree. No individuals were observed recreating in or near the stream at the time of either survey.



Figure 5.9 Photograph of Prairie Creek Site PC03 taken on June 3, 2014, showing a chair and fishing rod holders located near the 60 m transect.

Physical Description of PC04

Prairie Creek at Site PC04 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing on State Highway 110, northwest of Tyler, Texas. Site PC04 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. The stream corridor was forested along this reach (Table 5.5), and access to the stream was moderately easy at the bridge crossing; however, access would have been difficult elsewhere along the reach due to steep banks and dense vegetation. The general appearance of the stream at PC04 is shown in Figures 5.10 and 5.11.



Figure 5.10 Photograph of Prairie Creek Site PC04 taken on June 3, 2014, the upstream view of the 300-m transect.



Figure 5.11 Photograph of Prairie Creek Site PC04 taken on August 8, 2014, the upstream view of the 0-m transect.

Site PC04 was wadeable for the entire 300-m reach length. Average thalweg was 0.3 m during both surveys (Table 5.6). Log obstructions and overhanging vegetation made traversing the reach upstream of the SH 110 bridge challenging. Wading was easier downstream of the bridge. Stream widths ranged from 2.3 m to 3.0 m during the first survey and 1.5 m to 5 m during the second survey (Tables 5.7 and 5.8).

There were no mammals or other vertebrates observed within the reach during either survey (Tables 5.9 and 5.10). Tracks observed during the first survey consisted of raccoon and feral hog. Tracks observed during the second survey consisted of raccoon, and bird feces were found throughout the reach. Aquatic vegetation was rare during both surveys, while algae cover was absent. The water color during the first survey was clear with no surface scum or foam. Water color during the second survey was brown with no surface scum or foam. Trash was rarely observed and when encountered, consisted of typical plastic cups and bottles along with a microwave oven. A decommissioned bridge crossing was located near the 0-m transect south of the SH 110 bridge crossing. No individuals were observed at this site nor evidence of human recreational activities.

Physical Description of PC05

Prairie Creek at Site PC05 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing on Smith County Road 471, south of Lindale, Texas. Site PC04 was only publicly accessible at the bridge crossing with fenced private property located upstream and downstream of the road right-of-way. With landowner permission, TIAER personnel entered private property on the upstream side of the bridge crossing. Pastures were located on either side of the creek (Table 5.5), making access to the stream moderately easy (Table 5.6). Figures 5.12 and 5.13 depict the appearance of the site during each survey.

Site PC05 was wadeable for the entire 300-m reach length; however, dense tall aquatic vegetation made traversing the reach very difficult (Figure 5.12). Average thalweg was 0.7 m during both surveys (Table 5.6). Stream widths ranged from 1.0 m to 30 m during the first survey and from 2.0 m to 33 m during the second survey (Tables 5.7 and 5.8).

There was a moderate presence of cattle during both surveys (Tables 5.9 and 5.10). The only tracks observed during each trip consisted of cattle. Cattle and bird feces were also found throughout the reach. Aquatic vegetation was abundant during both surveys, while algae was absent. The water color was brown with no surface scum or foam during both surveys. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastic cups, bottles, and a tire. No evidence of recreation was observed within the reach.



Figure 5.12 Photograph of Prairie Creek Site PC05 taken on June 3, 2014, the downstream view of the 150-m transect.



Figure 5.13 Photograph of Prairie Creek Site PC05 taken on August 8, 2014, the downstream view of the 300-m transect.

Physical Description of PC06

Prairie Creek at Site PC06 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing on Smith County Road 472, south of Lindale, Texas. Site PC06 was publicly accessible at the bridge crossing on County Road 472 and also at a bridge crossing associated with Interstate Highway 20, which was located within the surveyed reach. Private properties upstream and downstream of the county road crossing were fenced. The upstream portion of the site was located in a forest dominated corridor and the downstream portion was largely in a shrub dominated corridor (Table 5.5). Access to the stream was moderately easy at the county road crossing and at the Interstate Highway crossing (Table 5.6). Access at other locations upstream and directly downstream of the county road crossing would be challenging due to steep banks and dense vegetation. The general appearance of the stream is shown in Figures 5.14 and 5.15.

Site PC06 was wadeable for the entire 300-m reach length with an average thalweg of 0.3 m during both surveys (Table 5.6). During both surveys, the shallow water depths with the sandy substrate made wading in the stream channel easy; however, occasional log jams, overhanging tree branches, and a utility pipe crossing temporarily impeded travel. Stream widths ranged from 1.3 m to 3.5 m during the first survey to 1.5 m to 3.5 m during the second survey (Tables 5.7 and 5.8). During the first survey a pool was identified (dimensions recorded in Table 5.11). This pool was not present during the second survey.

Table 5.11 Pool dimensions observed during the first survey along Kickapoo Creek at Site PC06.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1	12	3.5	1.2



Figure 5.14 Photograph of Prairie Creek Site PC06 taken on June 3, 2014, the upstream view of the 300-m transect.



Figure 5.15 Photograph of Prairie Creek Site PC06 taken on August 8, 2014, the downstream view of the 0-m transect.

No mammals or other vertebrates were observed during either survey (Tables 5.9 and 5.10). Tracks observed during the first survey consisted of deer, raccoon, and feral hog. During the second trip, the only tracks observed were feral hog. Bird feces were also found throughout the reach during both surveys. Aquatic vegetation was common during the first survey and rare during the second survey, while algae was absent during both surveys. The water color was clear with no surface scum or foam during both surveys. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics and aluminum cans. A plastic tub was encountered at the 300 m transect. Large trash also consisted of a discarded mattress observed in the creek under the county road bridge and a television set under the Interstate Highway 20 Bridge. No evidence of recreational activity was found within the reach.

Physical Description of PC07

Prairie Creek at Site PC07 was visited on June 3 and August 8, 2014. This site is located at the bridge crossing on Smith County Road 474, south of Lindale, Texas. Site PC07 was publicly accessible upstream of the crossing, but fenced private property was located south of the crossing. Although landowner permission was sought and granted for the downstream property, the survey was conducted upstream of the crossing because a utility easement bordered the west side of the stream making the stream more readily accessible. The Lindale Junior High School is located approximately 0.2 miles northwest of the bridge crossing. The stream corridor was forested along the left bank and mowed along the right bank (Figure 5.16). Access to the stream was easy along the right bank. The general appearance of the site is shown in Figures 5.17 and 5.18.



Figure 5.16 Photograph of mowed corridor along the right bank of Prairie Creek Site PC07 taken on August 8, 2014. TIAER vehicle in photograph.



Figure 5.17 Photograph of Prairie Creek Site PC07 taken on June 3, 2014, the downstream view of the 150-m transect.

Site PC07 was wadeable for the entire 300-m reach length. Average thalweg depth ranged from 0.30 m during the first survey to 0.40 m during the second survey (Table 5.6). During both surveys, the shallow water depths and sandy substrate made wading in the stream channel easy. When encountered, log obstructions were generally small and easy to navigate around. Widths of the stream ranged from 0.9 m to 5.5 m during the first survey to 1.5 m to 4.0 m during the second survey (Tables 5.7 and 5.8).

There were no mammals or other vertebrates encountered during either survey (Tables 5.9 and 5.10). Tracks observed during the first survey consisted of deer, raccoon, canine, and human. Tracks observed during the second survey consisted of raccoon, canine, opossum, and human. Bird feces were found throughout the reach. Aquatic vegetation was rare during both surveys and algae was absent. The water color was clear during both surveys with no surface scum or foam. Garbage was rare and when encountered consisted of typical plastics, bottles, cans, tires, and a water hose. Evidence of human presence consisted of human footprints along the mowed right-of-way. No recreation was observed along the reach.



Figure 5.18 Photograph of Prairie Creek Site PC07 taken on June 3, 2014, the downstream view of the 300-m transect. TIAER personnel in photograph.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. All of the selected sites were at locations that provided public access due to public road crossing. However, property fences limited access to small areas between the road and the fence at most sites. Site PC07 was a notable exception at which a utility easement provided easy access to the creek.

The only recreation observed was one individual fishing at Site PC02 during the first survey. Evidence of potential recreation was encountered at the three most downstream sites as follows:

- Site PC01 – A vehicle trail and foot path was apparent by the bridge crossing. An abandoned trotline attached to a tree limb in the stream channel was observed.
- Site PC02 – A vehicle trail and foot paths near the bride crossing as well as discarded fishing worm containers and fishing bobbers were observed.
- Site PC03 – A chair with fishing rod holders situated nearby were observed on private property within the survey reach, and a fishing bobber was observed hanging in a tree.

Activities Interviewed

A total of twelve interviews were conducted, which included landowners along Prairie Creek as well as others with interest in the watershed. The only instances of recreation along Prairie Creek noted from the interviews occurred at Sites PC02 and PC03 (Table 5.11). Personal use of fishing occurred at Sites PC02 and PC03, while swimming had been observed at PC02.

An individual that was fishing at the time of the first survey at site PC02 stated that he had fished at this site about one or two times each month during the last year. The same individual said he had observed another individual swimming at the site one time in the last year and that he had heard of other people fishing at site PC02 on a weekly basis. A local landowner near site PC02 was also interviewed and stated that site PC02 was a popular fishing location during the weekends.

Four local landowners near site PC03 were interviewed and all four stated that they had and currently fish at the site. All four landowner indicated that fishing occurred at site PC03 throughout the year, and each landowner had observed others fishing at the site.

The landowner of Site PC05 indicated that he did not recreate in the stream and that he had not seen individuals recreating in the stream. The reason given for the lack of recreation was the dense aquatic vegetation and lack of sufficient water depth at this location. Two local residents that live near PC05 also stated that they do not recreate in the stream and have not seen or heard of anyone recreating in the stream. Fenced private property and dense vegetation at this location were the primary reasons given for the lack of recreation by the two local residents.

The landowner of Site PC06 stated that he did not recreate in the stream and that he had not seen or heard of anyone recreating in the stream. The primary reason given for the lack of recreation at Site PC06 was that it was difficult to access the stream and the water depth was insufficient for most recreational purposes. A local resident who had stopped by Site PC06 during the second survey stated that he did not recreate in the stream and that he had not observed or heard of anyone recreating in the stream. The individual stated that at the Site PC06 location there was an abundance of poisonous snakes.

A landowner near the site PC07 location stated that he had not recreated in the stream and had not seen or heard of anyone recreating in the stream. The primary reason for no recreational activity in the stream given was insufficient water depth.

Table 5.11 Summary of recreational activities noted in interviews for Prairie Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
PC01	0						
PC02	2	0,1,0	0,0,0	0,0,0	0,0,0	1,1,1	0,0,0
PC03	4	0,0,0	0,0,0	0,0,0	0,0,0	4,4,2	0,0,0
PC04	0						

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
PC05	3	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PC06	2	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PC07	1	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Totals	12	0,1,0	0,0,0	0,0,0	0,0,0	5,5,3	0,0,0

Summary

RUAA surveys were conducted at seven sites along Prairie Creek (0606A) on the days of June 3, 2014 and August 8, 2014. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions during both surveys (TWDB, 2014). During the two surveys, TIAER field staff observed only one individual fishing and this was at Site PC02 at the FM 724 bridge crossing. Interviews for Prairie Creek revealed that swimming had occurred at least one time in the last year at Site PC02. Additionally interviews indicated that fishing occurs at Sites PC02 and PC03. Site PC03 is located at the bridge crossing of Old Harmony Road. Areas of the stream open to the public are limited to the right-of-ways immediately underneath bridge crossings at all sites except PC07, which has a maintained utility right-of-way along the right bank. Recreational activities observed and reported by interviewees are summarized in Figure 5.19. Overall RUAA findings are summarized in the form below.

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds, or sports fields, were encountered that would promote recreation. The rural nature of the area surrounding most of Prairie Creek is an impediment to recreation. At the public road crossings, access is typically limited to the area immediately underneath the bridge. In most cases, due to dense vegetation and property fences, access could only be gained directly from the bridge into the stream. Access to most of the stream can only be gained by permission of the landowner. Water depths at the upper four sites (PC07-PC04) were likely insufficient for most forms of recreation with the exception of wading.

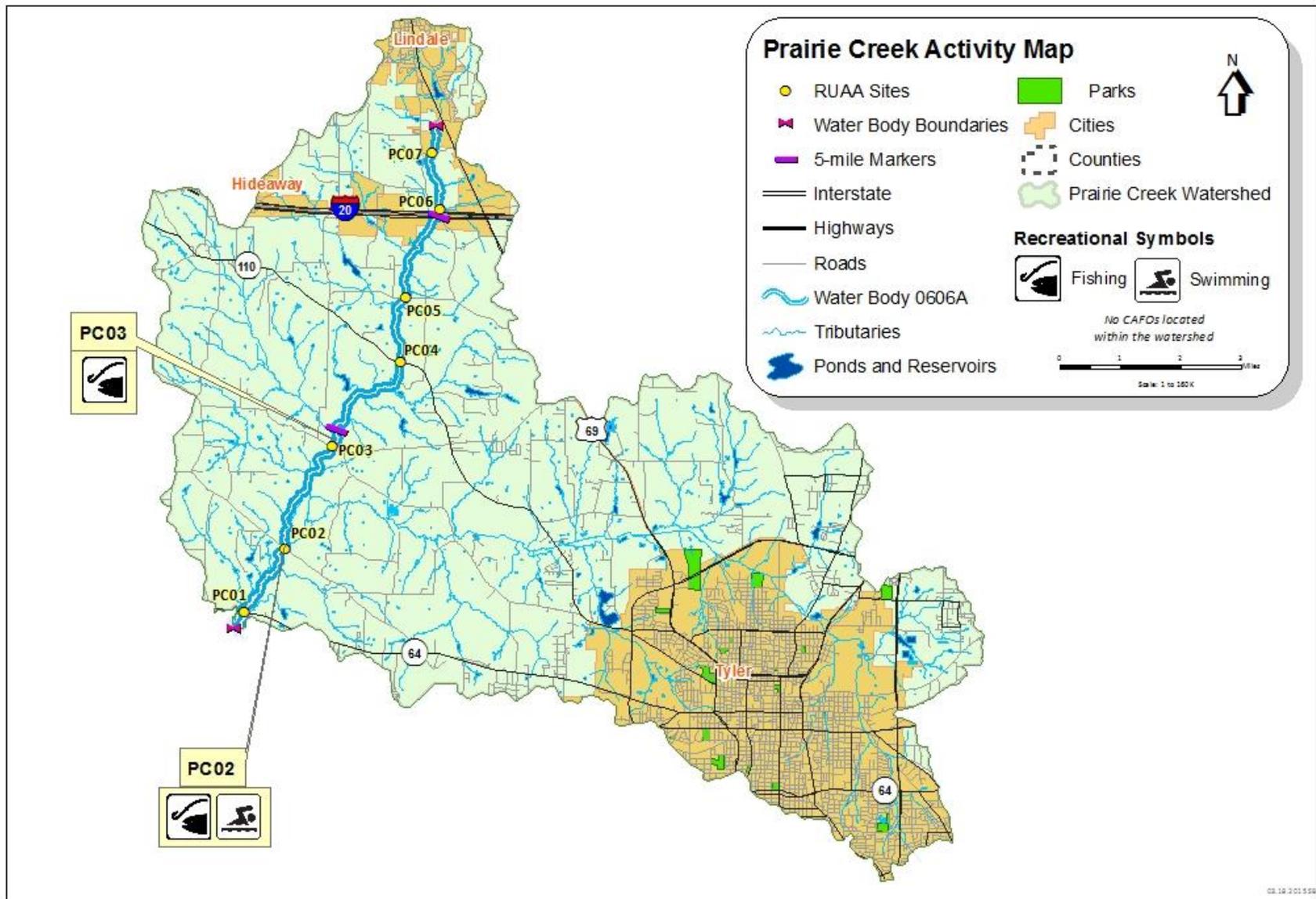


Figure 5.19 Summary of observed and interviewed human activities on Prairie Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Prairie Creek

Segment No. of Nearest Downstream Segment No.: Segment 0606

Classified?:No

County: Smith

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

b. Do secondary contact recreation 1 activities occur on the water body?

frequently seldom not observed or reported unknown

c. Do secondary contact recreation 2 activities occur on the water body?

frequently seldom not observed or reported unknown

d. Do noncontact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.70 meters

b. Are there substantial pools deeper than 1 meter? Yes No

c. What is the general level of public access?

easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

Mild-Extreme Drought

Incipient dry spell

Near Normal

Incipient wet spell

Mild-Extreme Wet

CHAPTER 6

MUD CREEK

(0611C)

Watershed Characteristics

The Mud Creek watershed covers 357,000 acres including 59,400 acres associated with West Mud Creek (0611D, presented in Chapter 7). Excluding the watershed area of West Mud Creek, Mud Creek includes portions of the cities of Tyler, New Chapel Hill, Whitehouse, Arp, Troup, Jacksonville, New Summerfield, Gallatin, and Reklaw (Figure 6.1). The largest being the City of Tyler with an estimated population of 100,223 and the smallest being the City of Reklaw with an estimated population of 382. Within the Mud Creek watershed are Lake Tyler and Lake Tyler East and major tributaries to Mud Creek include West Mud Creek, Kicakpoo Creek in Smith County, and Keys Creek. While the focus is on surface water, the watershed overlays the Carizzo-Wilcox Aquifer (George et al., 2011). The terrain varies from flat to rolling hills and primarily sandy loam soils (TSHA, 2013c). Along Mud Creek the floodplain is nearly level allowing the stream to meander. Frequent flooding limits timber production within the riparian area, but can provide excellent wildlife habitat (Hatherly, 1993). The uplands are rolling hills suitable primarily for pasture and woodland with some commercial pine and crop production (Hatherly, 1993; Mowery, 1959).

The Mud Creek watershed lies within the Tertiary Uplands ecoregion (35a) (Griffith et al., 2007). Average annual rainfall ranges from 42 inches in Jacksonville (U.S. Climate Data, 2015) to 46 inches in Tyler annually (Tyler Texas Weather, 2015). Mean minimum and maximum temperatures for the region range from 36 to 57°F in January and 73 to 94°F for July. Only about 10 percent of the watershed is developed with the cities of Tyler, Whitehouse, and Jacksonville representing the densest developed areas (Figure 6.2). Woody wetlands surround Mud Creek, while hay and pasture interspersed with deciduous and evergreen forest cover the majority of the watershed. No public parks are located along Mud Creek, however, there is a private park; the Mud Creek Off-Road Park located off CR 4209 east of Jacksonville, Texas (see Figure 6.1). The Mud Creek Off-Road Park covers about 4,100 acres and is an ATV only park, which hosts several events each year that bring hundreds of people to the area. This ATV park includes trails that cross Mud Creek, but these all appeared to have bridges to keep vehicles from driving directly in the creek.

Designated Uses, Impairments, and Concerns

Mud Creek (0611C) is an unclassified perennial stream (TCEQ, 2013) and has presumed uses of primary contact recreation, fish consumption, and high aquatic life use. Mud Creek is divided into two AUs with the dividing point being 1.4 miles south of US Highway 79. Only the lower AU (0611C_01) of Mud Creek is listed as impaired for bacteria and was first listed in 2010. Concerns along the lower portion of Mud Creek (AU0611C_01) include depressed dissolved oxygen and ammonia. Noted concerns along the upper portion of Mud Creek (AU0611C_02) are bacteria and ammonia.

Permitted Discharges

There are nine WWTFs within the Mud Creek watershed, three of which are located within the West Mud Creek watershed (see Chapter 7). The three WWTFs located in the West Mud Creek watershed have a cumulative discharge of 9.56 MGD. Besides the WWTFs within the West Mud Creek watershed, there are six additional WWTFs within the Mud Creek watershed, none of which directly discharge to Mud Creek (0661C). The largest permitted outfall is The City of Jacksonville Double Creek WWTF (TX0100587) with an allowable permitted discharge of 2.9 MGD. The City of Jacksonville Canada Street (TX0024392) and The City of Whitehouse Blackhawk Creek (TX0072770) have the second largest permitted discharge both being 1.5 MGD. The City of New Summerfield WWTF (TX0107875) has the lowest allowable discharge of 0.06 MGD. The remaining two permitted outfalls within the Mud Creek watershed are for the City of Troup (TX0033529) and the City of Arp (TX0054194) have a cumulative discharge of 0.52 MGD.

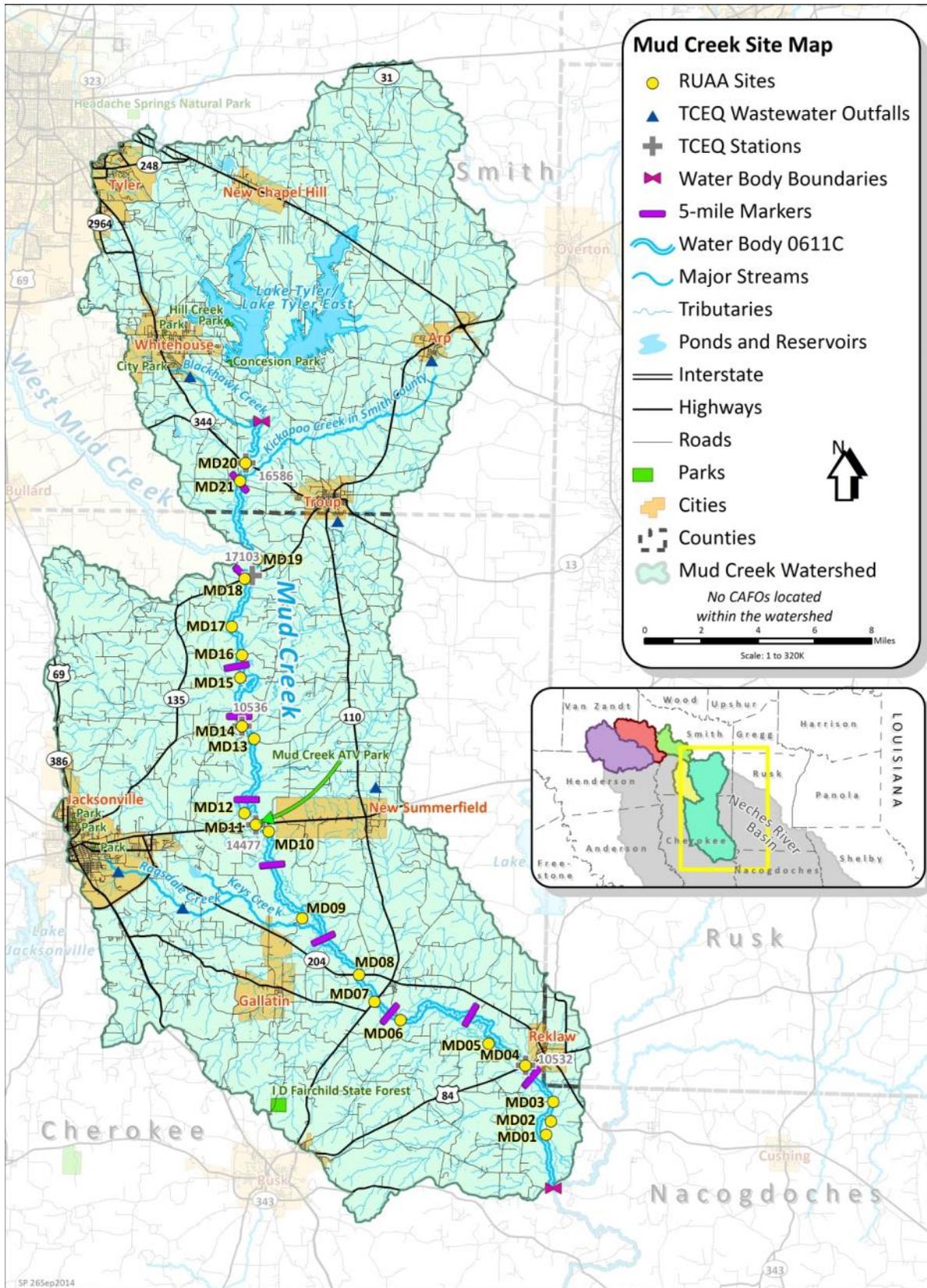


Figure 6.1 Overview of Mud Creek watershed and RUAA sites for water body 0611C.

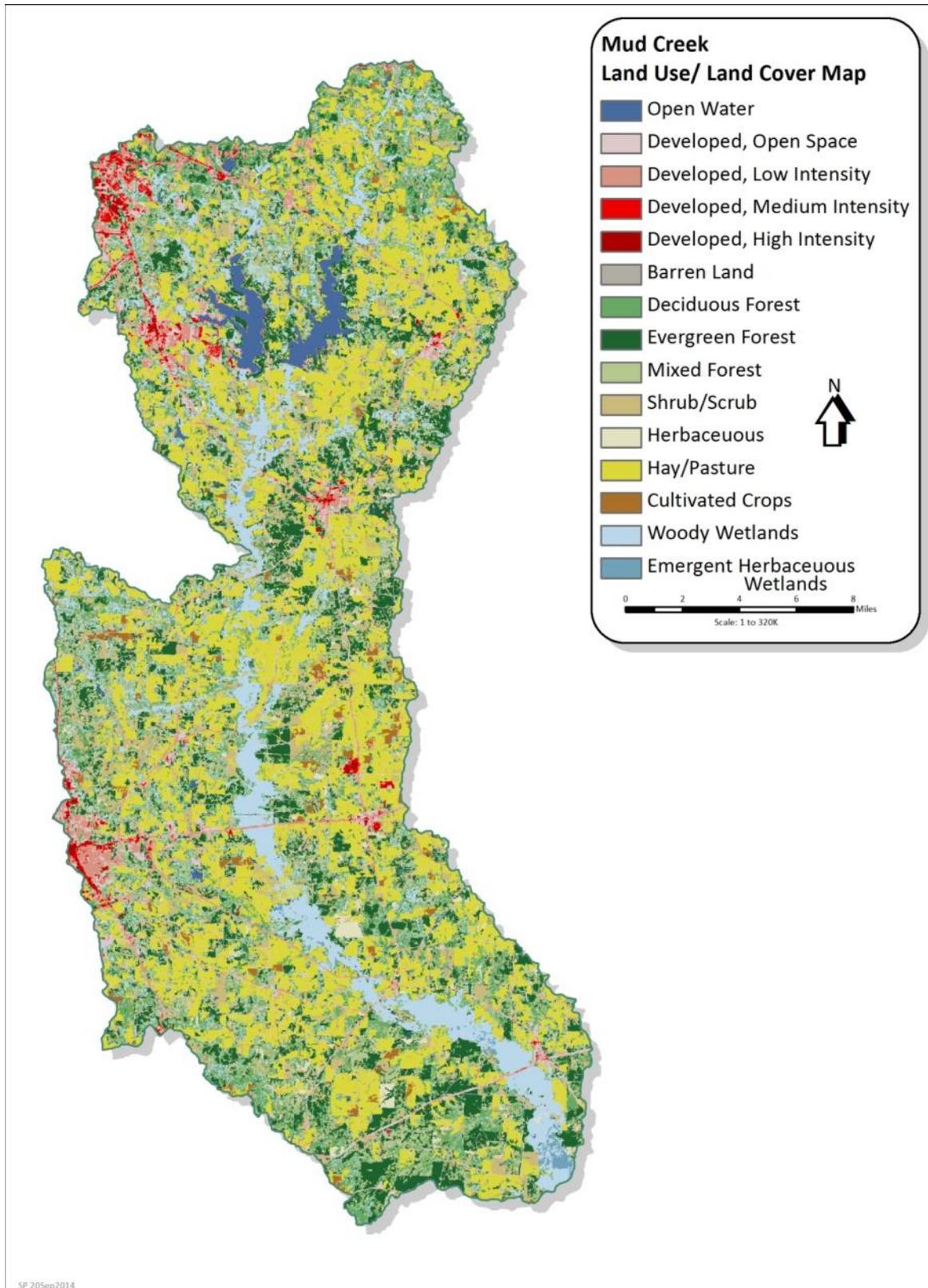


Figure 6.2 Land use/land cover for the Mud Creek watershed. Source: 2011 National Land Cover Database (USGS, 2013).

There are no permitted concentrated animal feeding operations (CAFOs) in the Mud Creek watershed.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. To provide an estimate of livestock densities in the watershed, livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2012). The Mud Creek watershed lies within Smith and Cherokee Counties (Figure 6.1). For estimating livestock numbers, county estimates for Smith and Cherokee Counties were used (Table 6.1), and these county level data were weighted by watershed area within each county to estimate livestock within the watershed. These statistics indicated large numbers of beef cattle in both counties, and, thus, likely within the watershed.

Table 6.1 Estimated livestock numbers within the Mud Creek watershed based on statistics for Smith and Cherokee Counties adjusted for the percent of the county within the watershed. (Source: USDA, 2012).

The Mud Creek watershed covers 30% of Smith County and 16% of Cherokee County.

County	Year	Cattle & Calves (all beef)	All Goats	All Sheep	Horses & ponies	Hogs
Smith	2012	42,885	3,561	1,127	4,342	401
Cherokee	2012	47,174	1,488	426	2,346	162
Mud Creek Watershed Average	2012	13,843	838	259	1,090	94

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 21,600 households within the Mud Creek watershed based on 2010 census population data there are potentially about 12,614 dogs within the Mud Creek watershed. Other domestic animals, such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife such as deer, feral hogs, and birds. In 2013 statewide population estimated roughly 39 whitetail deer per 1,000 acres. This estimation suggests that the population for whitetail deer in the Post Oak Savannah region is roughly 400,000 deer, or 35 deer per 1,000 acres (Cain, 2014). Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (AgriLife, 2011).

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CNNs) from the Public Utility Commission of Texas was used. As not all cities with WWTFs have CNNs, the CNN layer was supplemented with a GIS layer representing municipal boundaries for those cities with WWTFs. Population data from the U.S. Census Bureau (USCB) were then overlaid masking out areas that should be serviced by WWTFs. The 2010 U.S. Census Bureau (USCB) data indicated that of the 21,600 households in the Mud Creek watershed, about 47% are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of Mud Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Whitehouse

[City of Whitehouse Homepage](#)³²

Nothing significant was found pertaining to the historical recreational use of Mud Creek.

City of Troup

[City of Troup Homepage](#)³³

Nothing significant was found pertaining to the historical recreational use of Mud Creek.

City of Gallatin

[City of Gallatin Homepage](#)³⁴

Nothing significant was found pertaining to the historical recreational use of Mud Creek.

Library Sources

Whitehouse Community Library

107 Bascom Rd.

Whitehouse, TX 75791

Phone Number: (903) 839-2949

Website: [Whitehouse Community Library Homepage](#)³⁵

No significant information was found regarding recreational use of Mud Creek.

Cameron-J. Jarvis Troup Municipal Library

102 S. Georgia St.

Troup, TX 75789

Phone: (903) 842-3101

Website: [Cameron-J. Jarvis Troup Municipal Library Homepage](#)³⁶

No significant information was found regarding recreational use of Mud Creek.

Newspaper Source

Tri County Leader

[Tri County Leader Newspaper Homepage](#)³⁷

Phone: (903) 839-2353

No significant information was found regarding recreational use of Mud Creek.

Internet Searches

The Handbook of Texas Online

[The Handbook of Texas Online Homepage](#)³⁸

Search of the handbook by river name was conducted. No significant information was found regarding the recreational use of Mud Creek.

³² <http://www.whitehousetx.org/index.php>

³³ <http://www.trouptexas.org/newsite/content/troup>

³⁴ <http://www.cherokeecountytexas.us/Gallatin/Gallatin.htm>

³⁵ <http://www.whitehousecommunitylibrary.com/>

³⁶ <http://www.trouplibrary.org/newsite/>

³⁷ <http://www.tricountyleader.com/>

³⁸ <https://tshaonline.org/>

Survey Site Descriptions

With the help of cooperating stakeholders, TIAER was able to establish 21 survey sites along the almost 54 mile long water body of Mud Creek, 0611C (Figure 6.1 and Table 6.2). Although the optimum number of sampling stations would have been 32, following the RUAA guidelines, acceptance of using only 21 stations was sought and granted from TCEQ. Eleven sites were chosen at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. The remaining ten privately controlled sites were selected to provide physical characterization of Mud Creek in areas between public access points. Entrances to sites on private lands were generally limited by fences and locked gates and were often several meters to kilometers from the stream.

The average distance between survey sites was 2.45 river miles and ranged from 7.23 to 0.50 miles. The largest gap of 7.23 miles was between survey sites MD05 and MD06 (Table 6.2). Seven of the 21 sites were collocated with TCEQ sampling stations. At these sites, RUAA surveys were performed on July 27-28 and August 23-24, 2014. A brief description of each site follows.

Table 6.2 Description and location of RUAA field survey sites for Mud Creek, water body 0611C.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Access
	MD01	Mud Creek on private property approximately 4.3 km south of Highway 84	31.820916	-94.982989	0.0	2.16	Private
	MD02	Mud Creek on private property approximately 3.7 km south of Highway 84	31.827724	-94.980324	0.50	2.66	Private
	MD03	Mud Creek on private property approximately 2.5 km south of Highway 84	31.837863	-94.979123	1.07	3.73	Private
10532	MD04	Mud Creek crossing SH 84	31.856100	-94.996248	1.90	5.63	Public*
	MD05	Mud Creek on private property approximately 2.2 km north of Highway 84	31.866965	-95.018537	1.64	7.27	Private
	MD06	Mud Creek crossing CR 1301	31.878245	-95.071563	7.23	14.50	Public
	MD07	Mud Creek crossing FM 110	31.887333	-95.087438	1.49	15.99	Public*
	MD08	Mud Creek crossing SH 204	31.900987	-95.097038	1.56	17.55	Public
	MD09	Mud Creek on private property approximately 1.9 km north of Highway 204	31.929423	-95.131729	3.44	20.99	Private
	MD10	Mud Creek on private property approximately 450 meters south of Highway 79	31.973525	-95.152809	5.87	26.86	Private
14477	MD11	Mud Creek crossing SH 79	31.976895	-95.160566	0.81	27.67	Public*
	MD12	Mud Creek along the powerline right of way on private property approximately 760 meters North of SH 79	31.982668	-95.167659	0.63	28.30	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Access
10535	MD13	Mud Creek crossing CR 4223	32.020911	-95.162730	5.31	33.61	Public
10536	MD14	Mud Creek crossing FM 2064	32.027296	-95.170207	0.77	34.38	Public
	MD15	Mud Creek on private property approximately 1.3 km south of Cherokee County Road 4905	32.052076	-95.171736	5.01	39.39	Private
	MD16	Mud Creek crossing CR 4905	32.063672	-95.170959	1.24	40.63	Public*
	MD17	Mud Creek on private property approximately 3.2 km East of SH 135	32.078190	-95.177492	1.83	42.46	Private
17103	MD18	Mud Creek crossing SH 135	32.102921	-95.170332	2.38	44.84	Public*
	MD19	Mud Creek on private property approximately 1.0 km North of SH 135	32.113126	-95.163117	1.20	46.04	Private
10537	MD20	Mud Creek crossing CR 2138	32.152908	-95.174308	4.03	50.07	Public*
16586	MD21	Mud Creek crossing SH 110	32.162091	-95.171159	1.05	51.12	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site MD01 is located on Mud Creek on private property approximately 4.3 km south of State Highway 84, south of Reklaw, Texas. Site MD01 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD02 is located on Mud Creek on private property approximately 3.7 km south of State Highway 84, south of Reklaw, Texas. Site MD01 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD03 is located on Mud Creek on private property approximately 2.5 km south of State Highway 84, south of Reklaw, Texas. Site MD01 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD04 (TCEQ Station 10532) is located on Mud Creek at the bridge crossing on State Highway 84, west of Reklaw, Texas. Site MD04 was only publicly accessible at the bridge. The lands upstream and downstream of the bridge were private property with no fences, but there was a cable gate across a trail going downstream with a sign stating no trespassing and no dumping. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611C.

Site MD05 is located on Mud Creek on private property approximately 2.2 km north of State Highway 84, west of Reklaw, Texas. Site MD05 was only accessible, with landowner permission, through fenced private property via a cattle guard with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C. Of note, while TIAER had landowner permission to access site MD05, access to the stream was impeded during both surveys due to flood damage to a cattle guard across a private road on the property. No measurements or stream photographs were collected at MD05 during either survey.

Site MD06 is located on Mud Creek at the bridge crossing on Cherokee County Road 1301, west of Reklaw, Texas. Site MD06 was only publicly accessible at the bridge with private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611C.

Site MD07 is located on Mud Creek at the bridge crossing on Farm-to-Market Road 110, west of Reklaw, Texas. Site MD07 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611C.

Site MD08 is located on Mud Creek at the bridge crossing on State Highway 204, east of Gallatin and west of unincorporated community of Ponta, Texas. Site MD08 is publicly accessible at the area immediately underneath the bridge crossing. The site provided opportunity for characterization of water body 0611C.

Site MD09 is located on Mud Creek on private property approximately 1.9 km north of State Highway 204, north of Gallatin, Texas. Site MD09 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD10 is located on Mud Creek on private property associated with the Mud Creek ATV Park about 450 meters south of State Highway 79, east of Jacksonville, Texas. While the Mud Creek ATV Park has its general access off of CR 4209, Site MD10 was accessed with landowner permission through a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD11 (TCEQ Station 14477) is located on Mud Creek at the bridge crossing on State Highway 79, east of Jacksonville, Texas. Site MD11 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. Upstream private property is part of the Mud Creek ATV Park. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD12 is located on Mud Creek along a power line right of way on private property approximately 760 meters north of State Highway 79, east of Jacksonville, Texas. While the Mud Creek ATV Park has its general access off of CR 4209, Site MD12 was accessed with landowner permission through a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD13 (TCEQ station 10535) is located on Mud Creek at the bridge crossing on Cherokee County Road 4223, northeast of Jacksonville, Texas. Site MD13 is publicly accessible at the area immediately underneath the bridge crossing. The site provided opportunity for characterization of water body 0611C.

Site MD14 (TCEQ station 10536) is located on Mud Creek at the bridge crossing on Farm-to-Market Road 2064, northeast of Jacksonville, Texas. Site MD14 is publicly accessible at the area immediately underneath the bridge crossing. The site provided opportunity for characterization of water body 0611C.

Site MD15 is located on Mud Creek on private property approximately 1.3 km south of Cherokee County Road 4905, northeast of Jacksonville, Texas. Site MD15 was only accessible through fenced private property with permission from the landowner, which was sought and granted to TIAER field staff. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD16 is located on Mud Creek at the bridge crossing on Cherokee County Road 4905, northeast of Jacksonville, Texas. Although the site is listed as having public access, property fences up to the edge of the road only allow very limited public access to the stream. The site provided opportunity for characterization of water body 0611C.

Site MD17 is located on Mud Creek on private property approximately 3.2 km east of State Highway 135, southwest of Troup, Texas. Site MD17 was only accessible through fenced private

property with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD18 (TCEQ Station 17103) is located on Mud Creek at the bridge crossing State Highway 135, southwest of Troup, Texas. Site MD18 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611C.

Site MD19 is located on Mud Creek on private property approximately 1.0 km north of State Highway 135, southwest of Troup, Texas. Site MD19 was only accessible through fenced private property via a potentially locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611C.

Site MD20 (TCEQ Station 10537) is located on Mud Creek at the bridge crossing Smith County Road 2138, west of Troup, Texas. Site MD14 is publicly accessible at the area immediately underneath the bridge crossing, but has private property fencing and a sign limiting parking within 10 ft of the paved road limiting access. The site provided opportunity for characterization of water body 0611C.

Site MD21 (TCEQ Station 16586) is located on Mud Creek at the bridge crossing on State Highway 110, northwest of Troup, Texas. Site MD21 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611C.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Water body 0611C

The Mud Creek RUAA surveys were conducted on July 27-28, 2014 at 20 of the 21 sites and August 23-24, 2014 at 19 of the 21 sites. Surveys were not conducted at Site MD05 as a cattle guard across a private road to the creek had been washed out during spring rains and the road was blocked prohibiting access. At Site MD21, only a limited second survey between the 0 and 30-m transect was conducted due to safety concerns related to the large amount of fallen debris within the creek channel. The appearance at MD21 during the second visit was considered similar to the first visit. The surveys were performed on weekdays and weekends at opportune times to observe recreational activities. Daily high air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 6.3 and 6.4). In the 30 days prior to the first survey, 3.14 inches of precipitation was recorded in Tyler, TX and 2.87 inches was recorded in Jacksonville, TX (Table 6.3). In the 30 days prior to the second survey 3.38 inches of precipitation was recorded in Tyler, TX and 4.96 inches was recorded in Jacksonville, TX (Table 6.4). Temperatures during the first surveys in July were very similar to temperatures encountered during the second surveys in August 2014 (Tables 6.3 and 6.4). The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both July and August 2014 (TWDB, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 6.5 describes the stream channel and corridor characteristics at each site.
- Table 6.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 6.7 and 6.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 6.9 and 6.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth ranged from 0.70 m to >1.5 m during both surveys. Access to the stream was moderately difficult to difficult in most locations due to steep banks and abundant vegetation. The dominant substrate was mud and clay and the stream corridor was largely lined with large trees and brush. During both surveys the maximum stream width encountered was 50 m, and stream flow conditions were characterized as normal. The water surface was brown in color at all sites except the most upstream site (MD21), which had a green water color. Tracks observed most often included raccoon, feral hog, and deer. Trash was observed at most survey sites and when observed was predominantly typical plastics and aluminum cans. During the first survey, two people were observed fishing near Site MD08 along Mud Creek, but directly within the surveyed reach. One of the individuals was interviewed, but the other individual was no longer at this location when reached by the field crew. No other recreation was directly observed during either field survey, but signs of potential recreation were observed throughout, largely in the form of fishing tackle and fishing related trash (e.g., empty worm boxes).

Table 6.3 Rainfall records with maximum and minimum temperature for Tyler and Jacksonville, TX 30 days prior to the first RUA survey initiated on July 27, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014). Note: N/A indicates daily records were unavailable.

Date	Tyler, TX			Jacksonville, TX		
	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)
27-Jun-14	0.67	86	71	0.03	85	71
28-Jun-14	0.02	91	74	0.20	86	72
29-Jun-14	0.00	92	78	0.25	87	72
30-Jun-14	0.00	93	76	N/A	N/A	N/A
1-Jul-14	0.00	92	73	0.00	90	72
2-Jul-14	0.00	91	75	0.00	90	72
3-Jul-14	0.31	89	71	0.00	91	72
4-Jul-14	0.00	86	71	0.00	91	68
5-Jul-14	0.00	87	67	0.00	86	66
6-Jul-14	0.00	91	69	0.00	91	66
7-Jul-14	0.00	92	73	0.00	91	66
8-Jul-14	0.00	93	74	0.00	91	73
9-Jul-14	0.00	95	75	0.00	91	74
10-Jul-14	0.00	94	74	0.00	92	74
11-Jul-14	0.00	94	73	0.00	92	74
12-Jul-14	0.00	96	73	0.00	92	71
13-Jul-14	0.00	98	75	0.00	94	75
14-Jul-14	0.00	97	75	0.00	96	74
15-Jul-14	0.44	93	74	0.00	96	75
16-Jul-14	0.00	88	67	0.01	89	67
17-Jul-14	0.50	84	67	0.00	89	68
18-Jul-14	0.13	71	65	2.02	73	67
19-Jul-14	0.02	73	65	0.04	72	65
20-Jul-14	0.00	87	66	0.00	73	65
21-Jul-14	0.00	91	68	0.00	87	65
22-Jul-14	0.00	91	71	0.00	91	65
23-Jul-14	0.00	92	69	0.00	91	69
24-Jul-14	0.62	90	67	0.31	N/A	N/A
25-Jul-14	0.00	94	71	0.00	89	66
26-Jul-14	0.00	95	74	0.00	90	66
27-Jul-14	0.00	96	76	0.00	92	76

Date	Tyler, TX			Jacksonville, TX		
	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)
28-Jul-14	0.43	95	74	0.00	93	76

Table 6.4 Rainfall records with maximum and minimum temperature for Tyler and Jacksonville, TX 30 days prior to the first RUA survey initiated on August 23, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014). Note: N/A indicates unavailable daily record.

Date	Tyler, TX			Jacksonville, TX		
	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)
23-Jul-14	0.00	92	69	0.00	91	69
24-Jul-14	0.62	90	67	0.31		
25-Jul-14	0.00	94	71	0.00	89	66
26-Jul-14	0.00	95	74	0.00	90	66
27-Jul-14	0.00	96	76	0.00	92	76
28-Jul-14	0.43	95	74	0.00	93	76
29-Jul-14	0.00	91	72	0.10	92	70
30-Jul-14	0.00	87	72	N/A	N/A	N/A
31-Jul-14	2.80	84	70	0.16	93	69
1-Aug-14	0.04	78	67	4.20	78	67
2-Aug-14	0.06	74	68	0.05	73	67
3-Aug-14	0.02	84	70	0.00	82	67
4-Aug-14	0.00	87	72	0.00	87	67
5-Aug-14	0.00	90	73	N/A	N/A	N/A
6-Aug-14	0.00	92	75	0.00	91	71
7-Aug-14	0.00	93	76	0.02	91	71
8-Aug-14	0.00	94	77	0.00	90	77
9-Aug-14	0.00	95	77	0.00	94	71
10-Aug-14	0.00	95	76	0.00	94	75
11-Aug-14	0.00	94	78	0.00	94	74
12-Aug-14	0.00	94	72	0.00	95	71
13-Aug-14	0.00	88	65	0.00	94	63
14-Aug-14	0.00	88	66	0.00	87	68
15-Aug-14	0.00	89	69	0.00	95	63
16-Aug-14	0.00	93	75	0.00	91	67
17-Aug-14	0.00	97	78	0.00	94	78
18-Aug-14	0.03	93	77	0.00	95	68
19-Aug-14	0.00	93	76	0.00	91	75
20-Aug-14	0.00	94	74	0.00	93	72
21-Aug-14	0.00	94	76	0.43	93	75

Date	Tyler, TX			Jacksonville, TX		
	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)	Precipitation (in)	Max. Temp. (°F)	Min. Temp. (°F)
22-Aug-14	0.00	96	75	0.00	94	74
23-Aug-14	0.00	96	74	0.00	94	74
24-Aug-14	0.00	95	75	0.00	93	74

Table 6.5 Stream Channel and corridor appearance for each site sampled along Mud Creek water body 0611C.

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
MD01	Natural	Mud/Clay	Forest	Large	No	Native
MD02	Natural	Mud/Clay	Forest	Large	No	Native
MD03	Natural	Mud/Clay	Forest	Large	No	Native
MD04	Natural	Mud/Clay	Forest	Large	NO	Native
MD05	NA ¹	NA	NA	NA	NA	NA
MD06	Natural	Mud/Clay	Forest	Large	No	Native
MD07	Natural	Mud/Clay	Forest	Large	No	Native
MD08	Natural	Mud/Clay	Forest	Large	No	Native
MD09	Natural	Mud/Clay	Forest/Pasture	Large	No	Native
MD10	Natural	Mud/Clay	Forest	Large	No	Native
MD11	Natural	Mud/Clay	Forest	Large	No	Native
MD12	Natural	Mud/Clay	Forest	Large	No	Native
MD13	Natural	Mud/Clay/Silt	Forest	Large	No	Native
MD14	Natural	Mud/Clay/Silt	Forest	Large	No	Native

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
MD15	Natural	Mud/Clay	Forest/Pasture	Large	No	Native
MD16	Natural	Mud/Clay/Silt	Forest	Large	No	Native
MD17	Natural	Mud/Clay	Pasture	Large	No	Native
MD18	Natural	Mud/Clay	Forest	Large	No	Native
MD19	Natural	Mud/Clay/Silt	Forest	Large	No	Native
MD20	Natural	Mud/Clay	Forest	Large	No	Native
MD21	Natural	Mud/Clay	Forest	Large	No	Native

2. NA indicates not applicable as field surveys were not conducted at Site MD05 due to lack of access.

Table 6.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Mud Creek (0611C).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing or gates associated with private property. Under average thalweg depth for Trips 1 and 2, ** indicates that some depths were greater than 1.5 m, however, 1.5 m was used to calculate the average thalweg per TCEQ RUAA Procedures for a Comprehensive RUAA and Basin RUAA Survey (May 2014). For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult. NA indicates not applicable as field surveys were not conducted due to lack of access or safety concerns at Site MD05 for both surveys and Site MD21 for the second survey.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
MD01	300	11	0	1.2**	1.2**	Perennial	Private	MD
MD02	300	11	0	1.2**	1.2**	Perennial	Private	MD
MD03	300	11	0	1.4**	1.4**	Perennial	Private	E
MD04	300	11	0	0.9**	0.9**	Perennial	Public*	E
MD05	NA	NA	NA	NA	NA	Perennial	Private	NA
MD06	300	11	0	>1.5	>1.5	Perennial	Public	ME
MD07	300	11	0	1.4**	1.4**	Perennial	Public*	D
MD08	300	11	0	0.8	0.8	Perennial	Public	D
MD09	300	11	0	>1.5	>1.5	Perennial	Private	E
MD10	300	11	0	0.8	0.7	Perennial	Private	MD
MD11	300	11	0	0.9	0.8	Perennial	Public*	ME
MD12	300	11	0	0.7	0.7	Perennial	Private	E
MD13	300	11	0	1.4**	1.4**	Perennial	Public	MD
MD14	300	11	0	0.9	0.9	Perennial	Public	MD

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
MD15	300	11	0	1.3**	1.2**	Perennial	Private	D
MD16	300	11	0	1.0	1.0	Perennial	Public*	D
MD17	300	11	0	1.1**	1.1**	Perennial	Private	MD
MD18	300	11	0	0.9	0.8	Perennial	Public*	ME
MD19	300	11	0	0.7	0.8	Perennial	Private	MD
MD20	300	11	0	>1.5	>1.5	Perennial	Public*	MD
MD21	300	11 ¹	0	0.8	NA	Perennial	Public*	MD

1. During the second survey, only the 0 transect was completed due to safety concerns.

Table 6.7 Description of surveyed stream sites along Mud Creek during first survey performed in July 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
MD01	50	10	12	Normal
MD02	50	10	12	Normal
MD03	39	11	15	Normal
MD04	18	6.5	9.0	Normal
MD05	NA ¹	NA	NA	NA
MD06	25	20	24	Normal
MD07	19	7.0	12	Normal
MD08	20	9.0	10	Normal
MD09	28	16	18	Normal
MD10	9.0	7.0	8.0	Normal
MD11	9.0	7.0	8.0	Normal
MD12	22	3.5	7.0	Normal
MD13	17	9.0	13	Normal
MD14	12	6.0	10	Normal
MD15	18	9.0	11	Normal
MD16	10	8.0	9.0	Normal
MD17	15	8.0	10	Normal
MD18	17	8.0	9.5	Normal
MD19	9.0	6.0	7.0	Normal
MD20	15	7.0	9.0	Normal
MD21	19	6.0	8.0	Normal

2. NA indicates not applicable as field surveys were not conducted at Site MD05 due to lack of access.

Table 6.8 Description of surveyed stream sites along Mud Creek during second survey performed in August 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
MD01	50	9.0	13	Normal
MD02	50	9.0	12	Normal
MD03	39	11	15	Normal
MD04	18	6.5	9.0	Normal
MD05	NA ¹	NA	NA	NA
MD06	25	20	24	Normal
MD07	19	7.0	12	Normal
MD08	20	8.0	10	Normal
MD09	26	14	16	Normal
MD10	9.0	7.5	8.0	Normal
MD11	9.0	7.0	8.0	Normal
MD12	22	3.5	7.0	Normal
MD13	17	9.0	14	Normal
MD14	12	6.0	10	Normal
MD15	18	9.0	11	Normal
MD16	10	8.0	9.0	Normal
MD17	15	8.0	10	Normal
MD18	17	8.0	9.5	Normal
MD19	9.0	6.0	7.0	Normal
MD20	15	7.0	9.0	Normal
MD21	NA	NA	NA	Normal

1. NA indicates not applicable as field surveys were not conducted at Site MD05 due to lack of access and at MD21 due to safety concerns.

Table 6.9 Stream aesthetics along Mud Creek during first survey performed in July 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as field surveys were not conducted at Site MD05 due to lack of access.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
MD01	R	A	N	Brown	Fine sediment	Clear	SP	MP	N	Tracks/Fecal	N	R	N
MD02	R	A	N	Brown	Fine sediment	Clear	SP	MP	N	Tracks/Fecal	N	N	N
MD03	A	A	R	Brown	Fine sediment	Clear/Scum	N	N	LP	Tracks/Fecal	N	N	N
MD04	R	R	C	Brown	Fine sediment	Scum	SP	N	N	Tracks/Fecal	N	R	C
MD05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MD06	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
MD07	R	A	R	Brown	Fine sediment	Clear	SP	N	N	Tracks/Fecal	R	R	R
MD08	R	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	R
MD09	C	R	N	Brown	Fine sediment	Clear	N	N	N	Fecal	N	N	N
MD10	R	A	N	Brown	Fine sediment	Clear	SP	N	N	Tracks/Fecal	N	R	N
MD11	R	R	R	Brown	Fine sediment	Clear	N	SP	N	Tracks/Fecal	N	R	C
MD12	R	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	C	R
MD13	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD14	A	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD15	A	R	N	Brown	Fine sediment	Scum	N	N	SP	Tracks/Fecal	N	R	R

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
MD16	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD17	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
MD18	R	R	N	Brown	Fine sediment	Clear	SP	SP	N	Tracks/Fecal	R	R	R
MD19	R	A	R	Brown	Fine sediment	Clear/Foam	N	N	N	Tracks/Fecal	N	N	N
MD20	A	A	R	Brown	Fine sediment	Scum/Foam	N	N	N	Tracks/Fecal	N	R	R
MD21	C	C	R	Green	Fine sediment	Scum	N	SP	N	Tracks/Fecal	N	R	R

Table 6.10 Stream aesthetics along Mud Creek during second survey performed in August 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence. NA indicates not applicable as field surveys were not conducted at Site MD05 due to lack of access.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
MD01	R	A	R	Brown	Fine sediment	Clear	N	SP	N	Tracks/Fecal	N	R	N
MD02	R	A	R	Brown	Fine sediment	Clear	N	SP	N	Tracks/Fecal	N	N	N
MD03	R	A	C	Brown	Fine sediment	Clear/Scum	N	N	N	Tracks/Fecal	N	N	N
MD04	R	R	C	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	R	C
MD05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MD06	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
MD07	R	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
MD08	R	A	C	Brown	Fine sediment	Clear/Scum	N	N	N	Tracks/Fecal	N	N	R
MD09	C	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
MD10	R	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
MD11	R	R	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	C
MD12	R	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	C	R
MD13	A	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD14	A	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD15	A	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks/Fecal	N	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
MD16	A	A	C	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	C	C
MD17	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
MD18	R	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	C	R	R
MD19	R	A	R	Brown	Fine sediment	Clear/Scum	N	N	N	Tracks/Fecal	N	N	N
MD20	A	C	R	Brown	Fine sediment	Scum/Foam	M	MP	N	Tracks/Fecal	N	R	R
MD21 ¹	C	C	R	Green	Fine sediment	Scum	N	N	N	N	N	R	R

1. Survey at MD21 limited to first 30 meters.

Physical Description of MD01

Mud Creek at Site MD01 was visited on July 27 and August 24, 2014. This site, located south of Reklaw, Texas in Cherokee County, was accessible only through private property that was fenced with a locked gate. After entering the private property, TIAER personnel drove approximately 1.7 miles down a pasture road to reach the stream and then waded an additional 0.4 miles to reach site MD01. The site is located in a forest dominated corridor (Table 6.5). At the site, access to the stream was moderately difficult due to abundant vegetation (Table 6.6). At the 0-m transect, a small privately owned bridge was located across the stream (Figure 6.3). Large tupelo trees were common within and adjacent to the stream channel, and thick canopy cover persisted throughout the reach. Figures 6.3 and 6.4 depict the appearance of the site during each survey.



Figure 6.3 Photograph of Mud Creek Site MD01 taken on July 27, 2014. The downstream view of a bridge located at the 0-m transect.



Figure 6.4 Photograph of Mud Creek Site MD01 taken on August, 24, 2014. The upstream view of the 150-m transect.

Site MD01 was wadeable for about half of the 300-m reach. During both surveys, there were many instances in which TIAER field crew were required to walk along the bank due to stream depths greater than 1.5-m. Wading in the stream channel was very difficult due to a number of instream obstructions in the form of logs and other woody debris. During both surveys, the average thalweg was greater than 1.2 m. Stream widths ranged from 10 m to 50 m during the first survey and 9.0 m to 50 m during the second survey (Tables 6.7 and 6.8).

There was a slight presence of reptiles observed during the first survey and a moderate presence of water dependent birds observed during both surveys (Tables 6.9 and 6.10). Tracks observed during each trip consisted of raccoon, feral hog, and deer. Bird feces were noted throughout the reach. Aquatic vegetation was rare and algae was absent during both of the surveys. Trash observed was rare to non-existent. When encountered, the trash consisted of typical plastic cups and bottles. Additionally, several jug line fishing lines were observed throughout the reach as debris rather than being set for fishing. A boat located on the bank near the 30-m transect was the only evidence of human presence or recreation observed within the reach (Figure 6.5).



Figure 6.5 Photograph of Mud Creek Site MD01 taken on August, 24, 2014. A small boat located on the left bank near the 30-m transect.

Physical Description of MD02

Mud Creek at Site MD02 was visited on July 27 and August 24, 2014. This site was located on the same tract of privately owned property as site MD01, south of Reklaw, Texas in Cherokee County and likewise was accessible only through private property that was fenced with a locked gate. After entering the private property, TIAER personnel drove approximately 1.7 miles down a pasture road to reach the stream site. The site is located in a forest dominated corridor (Table 6.5). At the site, access to the stream was moderately difficult due to abundant vegetation (Table 6.6). Similar to the riparian area of MD01, large tupelo trees were common within and adjacent to the stream channel and thick canopy cover persisted throughout the reach. Figures 6.6 and 6.7 depict the appearance of the site during each survey.

During both surveys there were multiple instances in which water depths were greater than 1.5m, which required circumventing the stream channel by walking along the stream bank in order to traverse the entire 300-m reach. Within the stream channel wading was difficult due to an abundance of logs and other woody debris. During both surveys, the average thalweg was estimated to have been greater than 1.2 m. Stream widths ranged from 10 m to 50 m during the first survey and 9.0 m to 50 m during the second survey (Tables 6.7 and 6.8).



Figure 6.6 Photograph of Mud Creek Site MD02 taken on July 27, 2014. The upstream view of the 150-m transect.



Figure 6.7 Photograph of Mud Creek Site MD02 taken on August 24, 2014. The upstream view of the 300-m transect.

There was a slight presence of reptiles observed during the first survey and a moderate presence of water dependent birds (Table 6.9). During the second survey a slight presence of water dependent birds was observed (Table 6.10). Tracks observed during each trip consisted of cattle, raccoon, feral hog, and deer. Bird feces were also found throughout the reach. Aquatic vegetation was rare and algae was absent during both of the surveys. No garbage was observed either instream or along the bank.

Physical Description of MD03

Mud Creek at Site MD03 was visited on July 27 and August 24, 2014. This site was located on the same tract of privately owned property as sites MD01 and MD02, south of Reklaw, Texas in Cherokee County and likewise was accessible only through private property that was fenced with a locked gate. After entering the private property, TIAER personnel drove approximately 1.2 miles down a pasture road to reach a forested area adjacent to the stream site. Once at the forested area, TIAER personnel then walked approximately 350 yards through the forest to reach the site. Figures 6.8 and 6.9 depict the appearance of the site during each of survey.



Figure 6.8 Photograph of Mud Creek Site MD03 taken on July 26, 2014, the upstream view of the 300-m transect. Note fishing jug lines in background.



Figure 6.9 Photograph of Mud Creek Site MD03 taken on August 24, 2014, the right bank view at the 150-m transect.

Site MD03 was not wadeable for majority of the 300-m reach length due to relatively deep water coupled with fine sediment deposits and abundant instream woody debris. During both surveys average thalweg depth was greater than 1.4 m and stream width ranged from 11 m to 39 m (Table 6.6).

There was a large presence of mammals (feral hog) observed during the first survey (Table 6.9). A slight presence of water dependent birds were observed during the second survey (Table 6.10). Tracks observed during first survey consisted of raccoon, feral hog, and feline. Tracks observed during the second survey included feral hog and raccoon. Bird feces were also found throughout the reach. Aquatic vegetation and algae was absent during the first survey. During the second survey aquatic vegetation was recorded as being rare. No garbage was observed during either survey. Fishing jug lines were observed near the 300-m transect and served as the only evidence of human presence or recreation observed within the reach (Figure 6.8).

Physical Description of MD04

Mud Creek at Site MD04 was visited on July 27 and August 24, 2014. This site (TCEQ station 10532), located west of Reklaw, Texas in Cherokee County, was accessible to the public in the area of the bridge crossing State Highway 84. The lands upstream and downstream of the bridge were private property with no fences, but there was a cable gate across a trail going downstream with a no trespassing and no dumping sign (Figure 6.10). TIAER field personnel drove down a well-traveled road alongside the highway and reached the stream in an area void of vegetation. There were also paths underneath the bridge that looked like they had possibly been used for

launching small boats. This site appeared to be a popular area for people to congregate. The site is located in a forest dominated corridor (Table 6.5). At the site, access to the stream was easy at various areas underneath the bridge as shown in Table 6.6. Figures 6.11 and 6.12 depict the appearance of the site during each survey.



Figure 6.10 Photograph of Mud Creek Site MD04 taken on July 27, 2014, showing the no trespassing and no dumping sign.



Figure 6.11 Photograph of Mud Creek Site MD04 taken on July 27, 2014, the downstream view of the 300-m transect.



Figure 6.12 Photograph of Mud Creek Site MD04 taken on August 24, 2014, depicting an area suspected of promoting recreational activities.

Site MD04 was wadeable for the entire 300-m reach length. Average thalweg was greater than 0.9 m during both surveys due to some areas where depths exceeded 1.5 meters (Table 6.6). During both surveys, water depths, wood obstacles, and the mud/clay substrate made wading in the stream channel very challenging. Widths of the stream ranged from 6.5 m to 18 m during both surveys (Tables 6.7 and 6.8). No log jams were encountered during the either survey, but tree obstacles and overhanging trees were encountered during both surveys that posed as obstructions.

There was a slight presence of snakes during the first survey with no other vertebrates or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during each trip consisted of raccoon, heron, beaver, and human. Bird feces were found throughout the reach. Aquatic vegetation and algae were rare, while water odor was common during both surveys. The water color during the both surveys was brown with a surface scum. Small trash was rarely observed in the stream channel throughout the reach and when encountered, consisted of typical plastic cups and bottles. Bank garbage within the reach was common, especially in the area around the bridge consisting of typical plastics and fishing garbage.

Evidence of potential recreation was found around the bridge area in the form of fishing drop lines, bobbers, a hook, and footprints. Additionally, during the second survey, a pile of trash was observed underneath the bridge, which someone had attempted to burn (Figure 6.13). It appeared that people often congregate at this site based on the road leading from the highway to the stream, the types of trash observed that would be associated with fishing, and the footpaths noted in areas around the bridge.



Figure 6.13 Photograph of Mud Creek Site MD04 taken on August 24, 2014, showing the attempted burning of trash underneath the bridge.

Physical Description of MD05

Mud Creek at Site MD05 was visited on July 27 and August 24, 2014. This site, located west of Reklaw, Texas in Cherokee County, was accessible only through private lands that were fenced with a cattle guard and locked gate. With landowner permission, TIAER personnel attempted to enter private property during both surveys. However, during the first survey, a cattle guard leading to the property gate had been washed out and not repaired. During the second survey, two piles of dirt had been dumped in front of the unrepaired cattle guard impeding traffic to reach the private property gate. Figures 6.14 and 6.15 depict the conditions. TIAER personnel were still approximately one-third mile from the locked gate when the impediment was encountered. No measurements or stream photographs were collected at the site for either survey.



Figure 6.14 Photograph of Mud Creek Site MD05 taken on July 27, 2014, showing the damaged cattle guard.



Figure 6.15 Photograph of Mud Creek Site MD05 taken on August 24, 2014, depicting the two dirt piles in front of the cattle guard.

Physical Description of MD06

Mud Creek at Site MD06 was visited on July 27 and August 24, 2014. This site, located west of Reklaw, Texas in Cherokee County, was publicly accessible at the bridge crossing on County Road 1301. There was a well-traveled road/path located along the east bank on the south side of the bridge crossing with a primitive boat ramp near the bridge (Figure 6.16). The site is located in a forest dominated corridor (Table 6.5). Access to the stream was moderately easy near the bridge crossing (Table 6.6). At other locations throughout the reach, access to the stream was more challenging due to steep banks and dense vegetation. Figures 6.17 and 6.18 depict the appearance of the site during each survey.

Site MD06 was non-wadeable for the entire 300-m reach length as average thalweg depths were greater than 1.5 m during both surveys (Table 6.6). These deep water depths made wading in the stream channel impossible. TIAER field personnel walked along the banks and attempted to wade into the stream at each transect with no success. Stream widths ranged from 20 m to 25 m during the both surveys (Tables 6.7 and 6.8). There were tree obstacles and some overhanging trees during both surveys, which would make navigating the stream by boat challenging.



Figure 6.16 Photograph of Mud Creek Site MD06 taken on July 27, 2014 showing the primitive boat ramp.



Figure 6.17 Photograph of Mud Creek Site MD06 taken on July 27, 2014, the downstream view of the 0-m transect.



Figure 6.18 Photograph of Mud Creek Site MD06 taken on July 27, 2014, the upstream view of the 150-m transect.

No mammals or vertebrates were observed during either survey (Table 6.9 and 6.10). Tracks observed during each trip consisted of canine, raccoon, and vehicle. Bird feces were also found throughout the reach during both surveys. Aquatic vegetation and algae were rare during both surveys. The water color was brown during both surveys with no surface scum, foam or odor present. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics aluminum cans with fishing trash around the area of the bridge. Evidence of recreational activity occurred in the form of fishing tackle in the stream and fishing trash, worm containers, and lure packages found in the area near the boat ramp. The site appears to be a popular fishing location based on the well-traveled vehicle path, boat ramp, and assorted trash.



Figure 6.19 Photograph of Mud Creek Site MD06 taken on July 27, 2014 showing the vehicle path along the south bank, east of the bridge crossing. TIAER vehicle is shown in the photograph.

Physical Description of MD07

Mud Creek at Site MD07 was visited on July 27 and August 24, 2014. This site, located west of Reklaw, Texas in Cherokee County, was publicly accessible at the bridge crossing on Farm-to-Market Road 110 with fenced private property fences upstream and downstream of the bridge. The area publicly available is limited to underneath the bridge and approximately 10.0 meters upstream and downstream of the bridge. The rest of the survey reach is located on private property, which required landowner permission to perform the complete survey. The site is located in a forest dominated stream corridor (Table 6.5). Access to the stream was difficult due to steep banks and dense stands of vegetation and trees (Table 6.6). Figures 6.20 and 6.21 depict the appearance of the site during each survey.



Figure 6.20 Photograph of Mud Creek Site MD07 taken on July 27, 2014, the downstream view of the 150-m transect.



Figure 6.21 Photograph of Mud Creek Site MD07 taken on August 24, 2014, the upstream view of the 0-m transect.

Site MD07 was non-wadeable for the entire 300-m reach length with only two transects having a thalweg less than 1.5 meters. Average thalweg was greater than 1.4 meters for both surveys (Table 6.6). Deep water depths and tree obstacles made wading in the stream channel very difficult. TIAER field personnel had to traverse much of the reach along the thickly vegetated banks of the stream, retrieving depth measurements at each 30-m transect. Stream widths ranged from 7.0 m to 19 m (Tables 6.7 and 6.8). Obstructions encountered included trees in the creek (one with a snake) and overhanging branches (Figure 6.22).



Figure 6.22 Photograph of typical obstructions at Mud Creek Site MD07 taken on July 27, 2014. This one also contained a snake.

During the first survey, there was a slight presence of snakes with no other vertebrates or mammals encountered during either survey (Tables 6.9 and 6.10). Feral hog tracks and bird feces were observed throughout the reach during each trip. No other tracks or feces were identified. Aquatic vegetation was rare, while algae was absent during both surveys. The water color was brown during both surveys with no surface scum or foam and a rare occurrence of odor. Trash was rarely observed and consisted of typical plastic cups, bottles, and sacks. A half, submerged boat was found located just downstream of the bridge crossing and was considered debris and listed with the garbage on the field data sheet. The only other evidence of human presence was one rubber boot found underneath the bridge. Tractor tracks were observed underneath the bridge, but are believed to belong to highway department mowing crews.

Physical Description of MD08

Mud Creek at Site MD08 was visited on July 27 and August 24, 2014. This site is located at the bridge crossing State Highway 204, east of Gallatin and west of unincorporated community of

Ponta, Texas. The site is located in a forest dominated corridor. Access to the stream was difficult due to a lack of safe parking areas, steep banks, and dense vegetation. Figures 6.23 and 6.24 depict the appearance of the site during each survey.

Site MD08 was wadeable for the entire 300-m reach. Average thalweg remained consistent between the two surveys averaging 0.8 m. Likewise stream widths ranged from 9.0 m to 20 m during the first survey and 10 m to 20 m during the second survey. While wadeable, log obstructions and other woody debris coupled with the mud substrate made traversing the streambed challenging.

No vertebrates or mammals were observed during either survey (Table 6.9 and 6.10). Tracks observed during the first survey consisted of raccoon, canine, armadillo, feral hog, and deer. Tracks observed during the second survey consisted of raccoon and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare during both surveys, and algae cover was absent. The water color was brown with no surface scum or foam. Trash was rarely observed and when encountered, consisted of small typical plastics along the banks. Evidence of human recreational activity observed included footprints under the bridge crossing, an abandoned backpack under the bridge, and various forms of discarded fishing tackle (Figure 6.25).



Figure 6.23 Photograph of Mud Creek Site MD08 taken on July 27, 2014, the downstream view of a log jam near the 240-m transect.



Figure 6.24 Photograph of Mud Creek Site MD08 taken on August 24, 2014, the upstream view of the 150-m transect.



Figure 6.25 Photograph of Mud Creek Site MD08 taken on August 24, 2014, abandoned backpack located under the State Highway 204 Bridge.

Physical Description of MD09

Mud Creek at Site MD09 was visited on July 27 and August 24, 2014. This site was located 1.2 miles north of Highway 204, north of Gallatin, Texas. Site MD09 was only accessible through fenced private property via a locked gate with landowner permission. With landowner permission, TIAER personnel drove approximately 1.6 miles through the fenced private property to reach the site and used a small boat to traverse the reach. A camper trailer and small cabin was located at the site along with a privately owned walkway bridge that crossed the stream (Figure 6.26). Figures 6.27 and 6.28 depict the appearance of the site during each survey.



Figure 6.26 Photograph of Mud Creek Site MD09 taken on July 27, 2014 showing a portion of a privately owned bridge and access area.

Site MD09 was not wadeable due to depths greater than 1.5 m throughout the entire 300-m reach length (Table 6.6). Occasional submerged logs and overhanging vegetation were encountered while traversing the reach via a small boat. Stream widths ranged from a minimum of 14 m during the second survey to a maximum of 28 m during the first survey (Tables 6.7 and 6.8).

No vertebrates or mammals were observed during either survey (Tables 6.9 and 6.10). Tracks were also not observed during each trip, likely due to concealment by vegetative cover. Bird feces were found along the reach during both surveys. Aquatic vegetation was common, while algae was rare during the first survey and absent during the second. Water color was brown during the first survey and reddish-brown during the second. Surface scum and foam were absent during both surveys. No trash was observed within or adjacent to the 300-m reach. Evidence of human activity included the camper trailer and small cabin located adjacent to the stream site belonging to the landowner. No other evidence of human activity was observed throughout the rest of the reach.



Figure 6.27 Photograph of Mud Creek Site MD09 taken on July 27, 2014, the downstream view of the 150-m transect.



Figure 6.28 Photograph of Mud Creek Site MD09 taken on August 24, 2014, the downstream view of the 0-m transect.

Physical Description of MD10

Mud Creek at site MD10 was visited on July 27 and August 24, 2014. This site, located east of Jacksonville, Texas in Cherokee County, was accessible only through private lands that were fenced with a locked gate. This property is home to an all-terrain vehicle (ATV) park with many trails throughout the property. With landowner permission, TIAER personnel entered private property and drove approximately 0.5 mile on an ATV trail to reach the site. The site is located in a forest dominated corridor (Table 6.5). At the site, access to the stream was moderately difficult due to dense vegetation and steep, easily erodible banks (Table 6.6). Figures 6.29 and 6.30 depict the appearance of the site during each survey.



Figure 6.29 Photograph of Mud Creek Site MD10 taken on July 27, 2014, the upstream view of the 0-m transect.



Figure 6.30 Photograph of Mud Creek Site MD10 taken on August 24, 2014, the upstream view of the 150-m transect.

Site MD10 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.8 m during the first survey to 0.7 m during the second survey (Table 6.6). During both surveys, the thick mud substrate and log obstructions made wading in the stream challenging. Stream widths ranged from 7.0 to 9.0 m (Tables 6.7 and 6.8). Logs, downed trees, and overhanging branches were obstacles encountered during both surveys.

There was a slight presence of snakes during the first survey with no other vertebrates or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during each trip consisted of deer, feral hog, raccoon, and heron. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare while algae was absent during both surveys. Water color was brown with no surface scum or odor. Trash was rarely observed and when encountered, consisted of typical plastics. Other than the ATV trails near the creek, no evidence of human recreational activity was observed within the reach.

Physical Description of MD11

Mud Creek at site MD11 was visited on July 27 and August 24, 2014. This site (TCEQ Station 14477), located east of Jacksonville, Texas in Cherokee County, was publicly accessible at the bridge crossing State Highway 79. Upstream and downstream of the bridge was fenced private property belonging to the Mud Creek ATV Park. With landowner permission, TIAER personnel drove along the highway right-of-way and parked at the bridge to reach the site. The site is located in a forest dominated corridor (Table 6.5). Access to the stream was moderately easy due to steep,

easily erodible banks (Table 6.6). Figures 6.31 and 6.32 depict the appearance of the site during each survey.



Figure 6.31 Photograph of Mud Creek Site MD11 taken on July 27, 2014, the upstream view of the 0-m transect.

Site MD11 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.9 m during the first survey to 0.8 m during the second survey (Table 6.6). While wadeable, submerged trees and the thick mud/clay substrate made wading in the stream channel difficult. Stream widths from 7.0 to 9.0 m (Tables 6.7 and 6.8). Additional obstructions included logs and overhanging trees and branches.



Figure 6.32 Photograph of Mud Creek Site MD11 taken on August 27, 2014, the upstream view of the 300-m transect.

There was a slight presence water dependent birds observed during the first survey with no other mammals or vertebrates during either survey (Tables 6.9 and 6.10). Aquatic vegetation and algae were both rare during each survey with a rare occurrence of odor. Water color was brown with no surface scum or foam encountered. Tracks observed during each trip consisted of feral hogs and raccoon. Bird feces were found throughout the reach during both surveys. The only evidence of human activity were ATV tracks and trails found throughout the reach, including a bridge crossing the stream at the 180-m transect. ATV riders were also observed and heard in the area, but not seen recreating in the stream. Human footprints, believed to be associated with ATV riders in the park, were observed underneath the bridge at the 0-m transect.

Physical Description of MD12

Mud Creek at site MD12 was visited on July 27 and August 24, 2014. This site, located east of Jacksonville, Texas in Cherokee County, was accessible only through private lands, belonging to the Mud Creek ATV Park. With landowner permission, TIAER personnel entered private property through a locked gate and drove approximately one mile down a caliche road, which was a power line right-of-way, to reach the site. The site was located in a forest dominated corridor with ATV trails throughout the area (Table 6.5). Access to the stream was easy (Table 6.6). Figures 6.33 and 6.34 depict the appearance of the site during each survey.



Figure 6.33 Photograph of Mud Creek Site MD12 taken on July 27, 2014, the downstream view of the 150-m transect.



Figure 6.34 Photograph of Mud Creek Site MD12 taken on August 24, 2014, the downstream view of the 300-m transect.

Site MD12 was wadeable for the entire 300-m reach length. Average thalweg for both surveys was 0.7 m (Table 6.6). While wadeable, the thick mud/clay substrate made wading in the stream channel difficult for most of the reach. Stream widths ranged from 3.5 to 22 m (Tables 6.7 and 6.8). The portion of the stream above the power line right-of-way was deeper and significantly wider than the stream below the power line right-of-way. Log obstructions, submerged trees, and overhanging branches were encountered as obstacles during both surveys. Since this property is located on an ATV park, there were ATV trails throughout the reach.

No mammals or vertebrates were encountered during either survey (Tables 6.9 and 6.10). Tracks observed during each trip consisted of deer, feral hog, and canine. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rare both surveys. Water color was brown during both surveys with no surface scum or foam. Trash was commonly observed within the stream channel and rarely observed along the banks. Trash consisted of typical plastics and a few tires. The only evidence of human activity was the ATV trails and tracks observed in the area. ATV riders were also observed and heard in the area, but none were observed in the stream.

Physical Description of MD13

Mud Creek at Site MD13 was visited on July 27 and August 24, 2014. Site MD13 (TCEQ station 10535) is located on Mud Creek at the bridge crossing Cherokee County Road 4223, northeast of Jacksonville, Texas. Site MD13 is publicly accessible at the area immediately underneath the bridge crossing. The site is located in a forest dominated corridor (Table 6.5). Access to the stream was moderately difficult due to steep banks, vegetation, and large tree obstructions (Table 6.6). Figures 6.35 and 6.36 depict the appearance of the site during each survey.



Figure 6.35 Photograph of Mud Creek Site MD13 taken on July 27, 2014, view near the 300 m transect from the left bank.



Figure 6.36 Photograph of Mud Creek Site MD13 taken on August 24, 2014, the downstream view of the 0-m transect.

Site MD13 was not wadeable except for the area immediately under the bridge crossing. Average thalweg was greater than 1.4 m during both surveys (Table 6.6). The steep banks and numerous instream obstructions (e.g., log jams) negated use of a boat, therefore, most of the reach was surveyed via the stream bank. Stream widths from 9.0 m to 17 m (Tables 6.7 and 6.8).

There were no reptiles, water dependent birds, or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during the first survey consisted of deer and raccoon. Tracks observed during the second survey consisted of feral hog, deer, raccoon, and alligator (Figure 6.37). Water color was brown with a clear surface and aquatic vegetation and algae cover was absent during both surveys. Trash was common both instream and along the bank and included tires, typical plastics, cans, and scrap metal. Remnants of a camp fire near the bridge crossing and graffiti on the bridge railing were the only evidence of human activity observed during the either survey.



Figure 6.37 Photograph of alligator track near the 30-m transect at Mud Creek Site MD13 taken on August 24, 2014.

Physical Description of MD14

Mud Creek at site MD14 was visited on July 27 and August 24, 2014. Site MD14 (TCEQ station 10536) is located on Mud Creek at the bridge crossing Farm to Market Road 2064, northeast of Jacksonville, Texas. Site MD14 is publicly accessible at the area immediately underneath the bridge crossing. The site is located in a forest dominated corridor (Table 6.5). Access to the stream was moderately difficult due to steep banks, vegetation, no parking area, and large tree obstructions (Table 6.6). Figures 6.38 and 6.39 depict the appearance of the site during each survey.

Site MD14 was wadeable for the entire 300-m reach. Average thalweg was 0.9 m during both surveys (Table 6.6). The steep banks and numerous instream obstructions made wading difficult. Stream widths ranged from 6.0 m to 12 m during both surveys (Tables 6.7 and 6.8).

There were no reptiles, water dependent birds or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during the first survey consisted of deer, armadillo, and raccoon. Tracks observed during the second survey consisted of feral hog, deer, raccoon, and canine. Water color was brown with a clear surface. Aquatic vegetation and algae cover was absent during the first survey. During the second survey algae cover was rare and aquatic vegetation was still absent. Trash was common both instream and along the bank which included furniture, typical plastics, cans and scrap metal. A fishing bobber was the only evidence of potential recreation observed, and it appeared as if it had washed in from upstream.



Figure 6.38 Photograph of Mud Creek Site MD14 taken on July 27, 2014, view near the 90 m transect showing a large log obstruction and a discarded mattress.



Figure 6.39 Photograph of Mud Creek Site MD14 taken on August 24, 2014, the downstream view of the 150-m transect.

Physical Description of MD15

Mud Creek at Site MD15 was visited on July 27 and August 24, 2014. This site, located northeast of Jacksonville, Texas in Cherokee County, was accessible only through private land that was fenced with a locked gate. With landowner permission, TIAER personnel entered private property through the gate and drove approximately 1.5 mile along a pasture and gravel oil field road to reach the site. The site is located in a forest and pasture dominated corridor (Table 6.5). At the site, access to the stream was difficult due to steep banks (Table 6.6). Figures 6.40 and 6.41 depict the appearance of the site during each survey.



Figure 6.40 Photograph of Mud Creek Site MD15 taken on July 27, 2014, the downstream view of the 300-m transect.



Figure 6.41 Photograph of Mud Creek Site MD15 taken on August 24, 2014, the upstream view of the 0-m transect.

Site MD15 was unwadeable for most of the 300-m reach length. Average thalweg was greater than 1.3 m during the first survey and greater than 1.2 m during the second survey (Table 6.6). Stream widths ranged 9.0 to 18 m with a typical width of 9.0 m (Tables 6.7 and 6.8). Tree obstructions were encountered during both surveys.

During the first survey, there was a slight presence of cattle with no other mammals or vertebrates observed (Table 6.9). There was no observance of any animals during the second survey (Table 6.10). Tracks observed during each trip consisted of cattle, deer, and canine. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was absent and algae was rare during both surveys. Water color was brown during both surveys with surface scum encountered during both surveys. Trash, which was rarely observed and only during the first survey, consisted of typical plastics, bottles, and aluminum cans. Evidence of human recreational activity was found in the form of a milk jug trotline (Figure 6.42) and a boat located just out of the survey reach.



Figure 6.42 Photograph of Mud Creek Site MD15 taken on July 27, 2014, the milk jug trotline.

Physical Description of MD16

Mud Creek at Site MD16 was visited on July 27 and August 24, 2014. Site MD16 is located on Mud Creek at the bridge crossing Cherokee County Road 4905, northeast of Jacksonville, Texas. Although the site is listed as having public access, property fences (posted no trespassing) up to the edge of the road only allow very limited public access to the stream. Access to the stream was difficult due to steep banks (Table 6.6). TIAER personnel could only access the stream channel by climbing down a wooden bank stabilization structure located on the southwest side of the bridge

crossing (Figure 6.43). The site is located in a forest dominated corridor (Table 6.5). Figures 6.40 and 6.41 depict the appearance of the site during each survey.

Site MD16 was wadeable for most of the entire 300-m reach with only a few locations in which water depth was too great to wade. Average thalweg was 1.0 m and stream width ranged from 8.0 m to 10 m during both surveys (Tables 6.6 – 6.8). Although wadeable based on depth, numerous instream obstructions made wading in the channel difficult.

There were no reptiles, water dependent birds or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during both surveys consisted of raccoon and canine. Water color was brown with a clear surface. Aquatic vegetation and algae cover was absent during both surveys. Trash was common both instream and along the bank and consisted of furniture, typical plastics, tires, scrap metal, and buckets. Two travel trailers located near the southeast side of the bridge crossing and a fishing bobber were the only evidence of human recreational activity observed at the site during either survey.



Figure 6.43 Photograph of Mud Creek Site MD16 taken on July 26, 2014 showing difficult access to the stream. TIAER personnel in the photograph.



Figure 6.44 Photograph of Mud Creek Site MD16 taken on July 26, 2014, the upstream view of the 300-m transect.

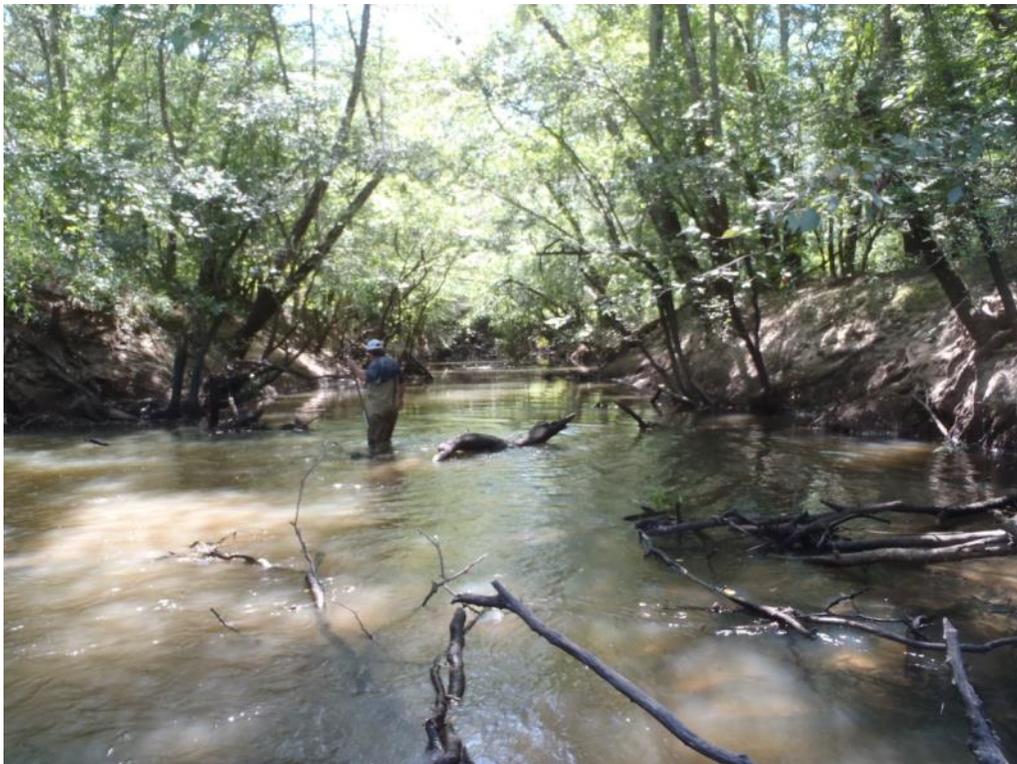


Figure 6.45 Photograph of Mud Creek Site MD16 taken on August 24, 2014, the downstream view of the 150-m transect. TIAER personnel in the photograph.

Physical Description of MD17

Mud Creek at Site MD17 was visited on July 27 and August 24, 2014. This site, located southwest of Troup, Texas in Cherokee County, was accessible only through private land that was fenced and required landowner permission to access. With landowner permission, TIAER personnel drove approximately 0.6 mile through a coastal field to reach the site. The site is located in a pasture dominated corridor with trees along the stream bank (Table 6.5). At the site, access to the stream was moderately difficult due to tall steep banks throughout most of the reach (Table 6.6). TIAER field personnel were very selective on choosing an entry point to the stream. Figures 6.46 and 6.47 depict the appearance of the site during each survey.

Site MD17 was wadeable for most of the entire 300-m reach length. There were a few transects where depths were much greater than 1.5 m and field personnel had to traverse the very edges of the channel. Average thalweg was greater than 1.1 m during both surveys (Table 6.6). Stream widths ranged from 8.0 to 15 m (Tables 6.7 and 6.8). Obstructions encountered were primarily fallen and submerged trees. One pool was encountered with a length of 110 m, width of 13 m, and a maximum depth greater than 1.5 m.



Figure 6.46 Photograph of Mud Creek Site MD17 taken on July 27, 2014, the downstream view of the 150-m transect.



Figure 6.47 Photograph of Mud Creek Site MD17 taken on August 24, 2014, the upstream view of the 0-m transect.

No mammals or vertebrates were encountered during either survey (Tables 6.9 and 6.10). Tracks observed during each trip consisted of feral hog and deer. Bird and canine feces were found within the reach during both surveys. Aquatic vegetation and algae were both absent with no odor during each survey. Water color was clear with no surface scum or foam during the surveys. Trash rarely observed consisted of typical plastics, aluminum cans, and one large piece of metal believed to be an old refrigerator. No evidence of human recreational activity was observed.

Physical Description of MD18

Mud Creek at Site MD18 was visited on July 28 and August 23, 2014. This site, located southwest of Troup, Texas in Cherokee County, was only publicly accessible at the bridge crossing at State Highway 135, with fenced private property upstream and downstream of the crossing. The site is located in a forest dominated corridor with a power line right of way just downstream of the bridge (Table 6.5). Access to the stream was moderately easy depending on the entry point to the stream. Some of the banks were low, while others were of moderate height with dense vegetation along the banks (Table 6.6). Figures 6.48 and 6.49 depict the appearance of the site during each survey.



Figure 6.48 Photograph of Mud Creek Site MD18 taken on July 28, 2014, the downstream view of the 0-m transect.



Figure 6.49 Photograph of Mud Creek Site MD18 taken on August 23, 2014, the downstream view of the 300-m transect.

Site MD18 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.9 m during the first survey to 0.8 m during the second survey (Table 6.6). Stream widths ranged 8.0 to 17 m (Tables 6.7 and 6.8). Log jams and fallen tree obstacles were encountered as obstructions throughout the reach.

There was a slight presence of snakes and water dependent birds observed during the first survey with no other mammals or vertebrates during either survey (Tables 6.9 and 6.10). Tracks observed during each trip consisted of feral hog and deer. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were rare during both surveys. Water color was brown during the first survey and clear during the second survey with no surface scum or foam. Trash observed during the surveys was common to rare consisting of tires, pieces of metal, typical plastics, cups, cans, and bottles. Evidence of human recreational activity was observed during both surveys in the form of fishing tackle and fishing pole prop sticks as shown in Figure 6.50.



Figure 6.50 Photograph of Mud Creek Site MD18 taken on July 28, 2014 showing the fishing pole prop observed on private property, downstream of the bridge.

Physical Description of MD19

Mud Creek at Site MD19 was visited on July 28 and August 23, 2014. Site MD19 is located on Mud Creek on private property approximately 1.0 km north of State Highway 135, southwest of Troup, Texas. Site MD19 was only accessible through fenced private property via a potentially locked gate with landowner permission. With landowner permission, TIAER personnel drove approximately 1.1 miles through the fenced private property to reach the site. Access to the stream was moderately difficult due to steep banks and dense vegetation. The site is located in a forest

dominated corridor (Table 6.5). Figures 6.51 and 6.52 depict the appearance of the site during each survey.

Site MD19 was wadeable for the entire 300-m reach, however wading was challenging due to numerous instream obstructions. Average thalweg was 0.7 m during the first survey and 0.8 m during the second survey. Stream widths ranged from 6.0 m to 9.0 m (Tables 6.6 – 6.8).

There were no reptiles, water dependent birds or mammals observed during either survey (Tables 6.9 and 6.10). Tracks observed during first survey consisted of river otter, beaver, deer, feral hog, raccoon, and bird. Tracks observed during the second survey consisted of feral hog, deer, raccoon, bird, and beaver. Water color was brown with a clear surface. Aquatic vegetation was rare and algae cover was absent during both surveys. Trash was not observed throughout the 300-m reach. A privately owned bridge located at the 150-m transect was the only evidence of human activity observed at the site during either survey (Figure 6.53).



Figure 6.51 Photograph of Mud Creek Site MD19 taken on July 28, 2014, the downstream view of the 300-m transect. TIAER personnel in the photograph.



Figure 6.52 Photograph of Mud Creek Site MD19 taken on August 23, 2014, the upstream view of the 0-m transect. TIAER personnel in the photograph.



Figure 6.53 Photograph of Mud Creek Site MD19 taken on August 23, 2014 view of the privately owned bridge crossing the stream at the 150-m transect.

Physical Description of MD20

Mud Creek at Site MD20 was visited on July 28 and August 23, 2014. Site MD20 (TCEQ Station 10537) is located on Mud Creek at the bridge crossing Smith County Road 2138, west-northwest of Troup, Texas. Site MD14 is publicly accessible at the area immediately underneath the bridge crossing. A sign located near the bridge stated that no parking was allowed within 10 feet of the paved road (Figure 6.54). The distance from privately fenced property to the paved road was typically less than 10 feet, so parking was unavailable near this site. Access to the stream was moderately difficult due to steep banks and dense vegetation. The site is located in a forest dominated corridor (Table 6.5). Figures 6.55 and 6.56 depict the appearance of the site during each survey.



Figure 6.54 Photograph of Mud Creek Site MD20 taken on July 28, 2014 view of a sign prohibiting parking near the bridge crossing. TIAER vehicle in the photograph.

Site MD19 was not wadeable for the entire 300-m reach for two reasons. The first was due to water depths that were typically over 1.5 m, and the second was thick deposits of fine sediment that caused TIAER personnel to sink well over knee deep in mud. Because of these two factors, the majority of the surveys at this site were conducted from the stream banks. Average thalweg was greater than 1.5 m, and stream widths ranged from 7.0 m to 15 m (Tables 6.6 – 6.8).

There were no reptiles, water dependent birds or mammals observed during first survey and a moderate presence of water dependent birds was observed during the second survey (Table 6.9 and 6.10). Tracks observed during both surveys consisted of raccoon and feral hog. Water color was brown with a clear surface. Aquatic vegetation and algae cover was absent during the first survey,

and algae cover was common during the second survey. Trash was observed near the bridge crossing and consisted of typical plastics and cans. A drop-line with attached hook was found secured to railing on top of the bridge during the first survey and had been removed by the time the second survey occurred. The drop-line was the only evidence of human activity observed at the site (Figure 6.57).



Figure 6.55 Photograph of Mud Creek Site MD20 taken on July 28, 2014, the downstream view of the 0-m transect.



Figure 6.56 Photograph of Mud Creek Site MD20 taken on July 28, 2014, the downstream view of the 150-m transect.



Figure 6.57 Photograph of Mud Creek Site MD20 taken on July 28, 2014, downstream view from the 0 m transect showing a fishing drop-line attached to the top of the bridge.

Physical Description of MD21

Mud Creek at Site MD21 was visited on July 28 and August 23, 2014. This site (TCEQ Station 16586), located northwest of Troup, Texas in Smith County, was publicly accessible at the bridge crossing on State Highway 110 with fenced private property upstream and downstream of the crossing. TIAER personnel parked on the highway right of way and entered the stream underneath the bridge crossing. The site is located in a forest dominated corridor (Table 6.5). Access to the stream was moderately difficult due to the densely vegetated stream banks (Table 6.6). Figures 6.58 and 6.59 depict the appearance of the site during each survey.



Figure 6.58 Photograph of Mud Creek Site MD21 taken on July 28, 2014, the downstream view of the 300-m transect.



Figure 6.59 Photograph of Mud Creek Site MD21 taken on August 23, 2014, the upstream view of the 0-m transect.

Site MD21 was wadeable for the entire 300-m reach length. Average thalweg was 0.8 m during both surveys (Table 6.6). During the first survey, the mud/clay substrate and submerged woody debris made wading in the stream channel very hazardous. Stream widths ranged 6.0 to 19 m (Tables 6.7 and 6.8). Obstructions were encountered throughout the reach in the form of fallen logs. During the second survey, only two depth measurements were collected at 0 and 30 m. These were compared against the first survey and appeared to be similar. Since the depths were fairly similar and the conditions did not look different, it was determined that due to safety concerns, a complete 300-m survey would not be performed. Pictures were collected at the 0 transect to show the conditions of the creek during the second survey.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 6.9 and 6.10, respectively. There was a slight presence of water dependent birds encountered during the first survey with no other mammals or vertebrates observed during either survey (Tables 6.9 and 6.10). Tracks found during both surveys were identified as deer and feral hog. Bird feces were found throughout the reach during both surveys. Aquatic vegetation and algae were common during the both surveys. Water color was green during both surveys with a surface scum observed. Trash was rarely observed and consisted of typical plastics, cups and bottles. There was no evidence of human recreational activity.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. Eleven sites were at road crossings; however, property fences limited access to small areas between the road and the fence. Private fences at some locations went right up to the bridge at the road crossing to a distance of about 20 meters up and downstream of the bridge crossings. The remaining 10 sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations.

Two people were observed fishing near Site MD08 during the first survey, but no other recreational activity was directly observed by TIAER employees at any of the sites during the two field surveys. Evidence of possible recreation encountered was as follows:

- MD01 – A boat was observed near the 30-m transect. The boat was upside down on the bank just upstream of a man-made bridge crossing the stream at the 0-m transect. Additionally, several jug line fishing lines were observed throughout the reach as debris rather than being set for fishing.
- MD03 – Several fishing jug lines were observed near the 300-m transect. The landowner for this site, and Site MD02, stated that he fished on his property frequently, but recently has noticed little to no fish in the area.
- MD04 – There were well traveled trails along the southeast and northeast sides of State Highway 84 leading to the stream at the bridge crossing and human footprints along the banks directly underneath the bridge. There was a large area that lacked vegetation near

the bridge, which had a large amount of fishing trash (bobbers, a hook and fishing drop lines). During the second survey, a pile of trash was also observed which had been burned and was not observed during the first survey. Based on these findings, this site is believed to be a popular fishing location, despite the no trespassing sign found attached to a tree in the area.

- MD05 – No formal surveys were conducted at site MD05 as the private road through the property was closed when RUAA surveys were conducted. However, when scouting this site in the spring of 2014, TIAER personnel did observe a small motorized boat on the bank. The timber company representative who granted access to this location stated he did not know the origin of the boat. The site is located near a crude cabin owned by a local hunt club. Attempts to make contact with club representatives were unsuccessful.
- MD06 – Similar to Site MD04, this site appeared to be a popular location for stream recreation, presumably fishing. A well-traveled vehicle path was observed along the south bank of the stream below the bridge crossing. A crude boat launch was also identified just below the bridge crossing. Fishing tackle and fishing trash (worm containers and hook wrappers) were also found along the southeastern bank of the stream. During the scouting of this site in the spring of 2014, TIAER personnel did observe the remnants of a small campfire, still smoldering, on the bank in the area just below the location of the 0-m transect.
- MD07 – A half-submerged boat was observed just below the 0-m transect. To TIAER field personnel, it appeared that this boat had washed in from upstream of this site and was listed with the garbage observed.
- MD08 – Besides the two people observed fishing near the site during the first survey, a backpack was found underneath the bridge crossing on State Highway 204. Footpaths and footprints were also observed near the bridge crossing as well as fishing tackle and trash.
- MD10, MD11, and MD12 – These sites were located on property owned by the Mud Creek ATV Park and ATV tracks and trails were observed throughout alongside the creek. No other signs of stream recreation were observed at these sites. ATV riders were observed at a distance during the first survey. They were riding the trails throughout the property and alongside the creek. At no point during the surveys did field personnel observe the ATVs in the stream. Places where ATV trails crossed the creek were observed to have bridges, so ATVs would not travel in the creek.
- MD13 – Graffiti was observed on the bridge railing, and an old campfire was observed underneath the bridge.
- MD14 – A fishing bobber was observed, although it appeared as if it had washed in from upstream.
- MD15 – A boat was observed just outside of the survey reach, which appeared to have been there for many years. Additionally, a milk jug drop line or trot line was observed along the bank, although it appeared to field personnel to have washed in from upstream.

- MD16 – An old fishing bobber was observed, but is believed to have washed in from upstream. Two travel trailers, presumed to be used as a deer camp, were observed on the left bank between the 300-m and 150-m transects.
- MD18 – A fishing bobber was found in an overhanging tree that looked like it had washed in from downstream. Fishing pole prop sticks were also found downstream of the bridge crossing, near the 0-m transect on private property.
- MD20 – Fishing drop lines were found secured to the concrete bridge railing.

Activities Interviewed

Fourteen interviews were conducted with creek-side landowners and other people with interest in Mud Creek. An additional 15th interview was collected, but it referenced portions of Mud Creek north of the designated water body (0611C) and is, thus, not included in the summary of activities interviewed (Table 6.11). As shown in Table 6.11, most instances of recreation noted as occurring along Mud Creek were identified as fishing. Spring and summer were identified as the most common periods that fishing occurred at any of the sites. The only other recreation noted was adult wading, hunting, and mudding.

The landowner of Sites MD01, MD02, and MD03 identified hunting, fishing and wading at Sites MD02 and MD03 as the only forms of recreation occurring on his property. The landowner stated that fishing on his property was considerably less frequent in recent years due to an abrupt decline in fish populations. Additionally the landowner stated that he had heard of fishing occurring at Sites MD04 and MD08.

An individual was encountered near Site MD08 and indicated that he did fish at the site and had observed others fishing at MD08. A local resident also stated that he had observed and heard of fishing at Site MD08.

The landowner of Site MD09 stated that fishing did occur on his property. The landowner also had observed and heard of fishing at Site MD08.

Two interviewees stated that they had observed “mudding” with ATV’s in the creek at Site MD11. Occurrences of mudding ranged from twice to several times a year. Of note, there are “mudding” events that occur at the Mud Creek ATV Park, but these do not occur in the creek itself. Another stakeholder stated to have seen fishing occurring at Site MD11. Additionally, hunting and fishing were identified as being heard of within the watershed, but exact locations were not known.

The remaining interviewees all stated to have not personally used, seen others use, or heard of others using the stream for any form of recreation. When asked why the stream was not used for recreational purposes the answers consisted of the following: lack of access, because much of the stream is located within private property, snaky, and difficult access due to the steep banks and dense vegetation commonly encountered throughout Mud Creek. Also it was stated that more attractive options than Mud Creek were available at area lakes that allow for more public access and better opportunities for recreational activities.

Table 6.11 Summary of recreational activities noted in interviews for Mud Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. An * and numbers in parentheses indicate recreation reported from an interview for another site.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak	Mudding
MD01								
MD02	1 ^a		1,0,0		1,0,0	1,0,0		
MD03	0					(1*,0,0)		
MD04	0					(0,1*,1*)		
MD05	1							
MD06	0							
MD07	0							
MD08	2					1,2,2 (0,1*,1*)		
MD09	1 ^b					1,0,0		
MD10	2 ^c							
MD11	3 ^d					0,1,0		0,2,0
MD12	0							
MD13	0							
MD14	0							
MD15	0							
MD16	0							
MD17	1							
MD18	1							
MD19	2							
MD20	0							
MD21	0							
General AU	0				(0,0,1*)	(0,0,1*)		
Totals	14		1,0,0		1,0,0 (0,0,1*)	3,3,2 (1*,2*,3*)		0,2,0

- Interviewee personally fishes at Sites MD02 and MD03, but also has heard about fishing at Sites MD04 and MD08. This individual owns land associated with Sites MD01, MD02, and MD03, but fishes only in relation to Sites MD02 and MD03.
- Interviewee also noted witnessing fishing at Sites MD04 and MD08.
- One of the interviewees for Site MD10, also noted knowledge of Sites MD11 and MD12 and indicated that no recreation occurred in the creek at these locations.
- Two interviewees at Site MD11 indicated “mudding” with ATVs as a type of recreation that they have observed in this area. One of the interviewees at Site MD11 indicated he had heard of hunting and fishing occurring along the creek, but noted location as unknown.

Summary

RUAA surveys were conducted at 20 sites along Mud Creek (0611C) on the days of July 27-28, 2014 and August 23-24, 2014. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both July and August 2014 (TWDB, 2014). During the two surveys, the only recreational activity observed were two gentlemen fishing at a bridge crossing near site MD08 during the first survey. Interviews revealed that fishing has occurred at various sites throughout the reach. Recreational activities observed and reported by interviewees are summarized in Figure 6.60. Overall RUAA findings are summarized in the form below.

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation. The mostly rural nature of the area surrounding Mud Creek is an impediment to recreation. Except for eleven sites located at road crossings, all access to Mud Creek is through private property that is generally fenced, gated, and locked. At the public road crossings, access is typically limited to the area immediately underneath the bridge. In most cases, due to vegetation and property fences, access could only be gained directly from the bridge into the stream. Access to most of the stream can only be gained by permission of the landowner. Even then dense vegetation and steep banks typically make accessing the stream difficult. Abundant instream obstructions found in Mud Creek likely limit recreational activities such as boating, swimming, and wading.

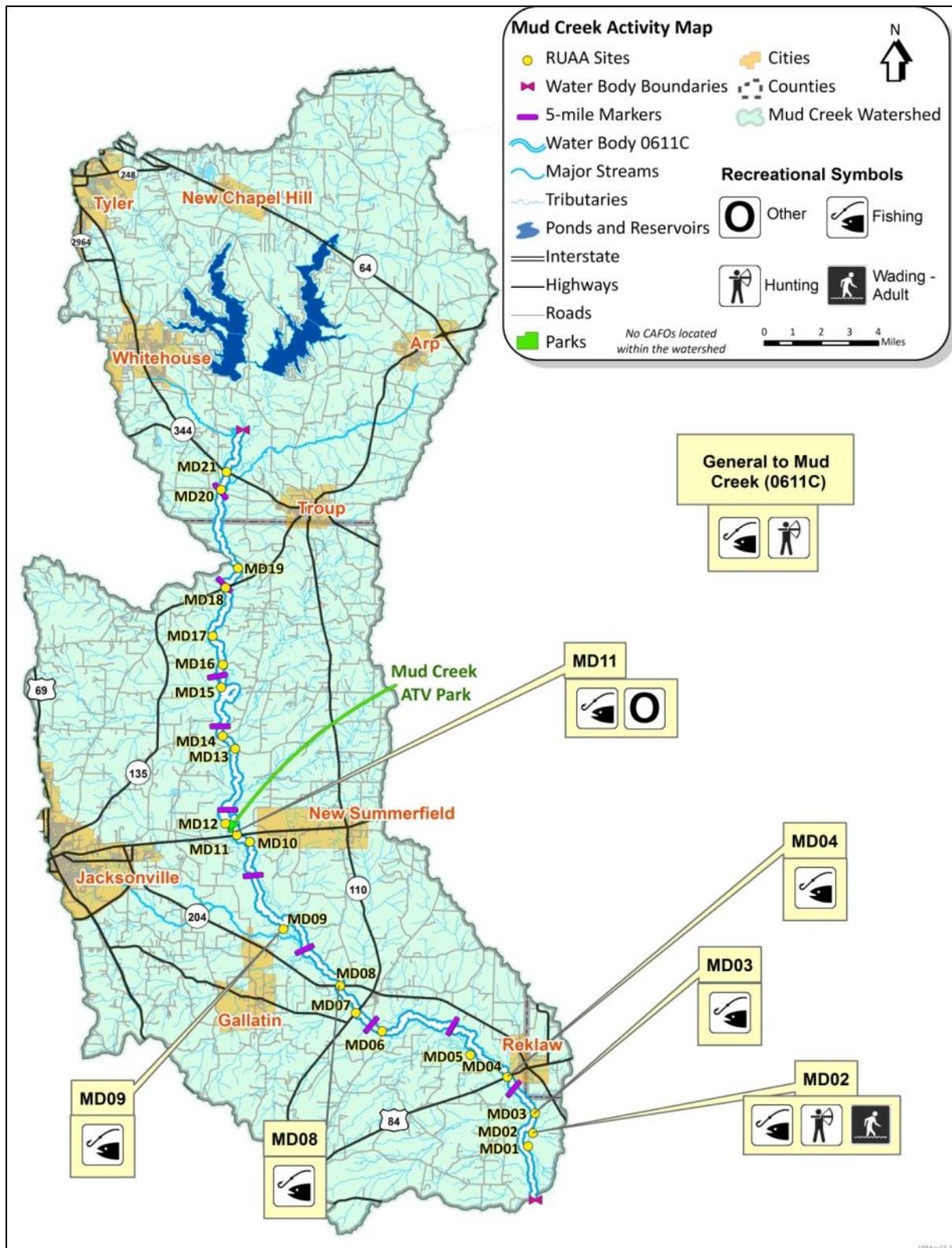


Figure 6.60 Summary of observed and interviewed recreational activities on Mud Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Mud Creek

Segment No. of Nearest Downstream Segment No.: Water body 0611C

Classified?:No

County: Smith and Cherokee

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

b. Do secondary contact recreation 1 activities occur on the water body?

frequently seldom not observed or reported unknown

c. Do secondary contact recreation 2 activities occur on the water body?

frequently seldom not observed or reported unknown

d. Do noncontact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

2. Physical Characteristics of Water body

a. What is the average thalweg depth? 1.1 meters

b. Are there substantial pools deeper than 1 meter? Yes No

c. What is the general level of public access?

easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

Mild-Extreme Drought

Incipient dry spell

Near Normal

Incipient wet spell

Mild-Extreme Wet

CHAPTER 7

WEST MUD CREEK

(0611D)

Watershed Characteristics

The West Mud Creek watershed (water body 0611D) covers 59,200 acres and includes portions of the cities of Tyler (estimated population 100,223) and Bullard (estimated population 2,599) (Figure 7.1). West Mud Creek is approximately 23 miles long and flows from its headwaters in Smith County within the City of Tyler to its confluence with Mud Creek (water body 0611C) in Cherokee County. Henshaw Creek (water body 0611F) in Smith County is a major tributary of West Mud Creek. While the focus is on surface water, the watershed overlays the Carizzo-Wilcox Aquifer (George et al., 2011). The terrain varies from flat to rolling hills and dominant soil types consist of sandy loams (TSHA, 2013). The nearly flat flood plain of West Mud Creek allows the stream to meander and soils along the creek are often strongly acidic (Hatherly, 1993). Frequent flooding within the riparian area supports a hardwood forest, which is good wildlife habitat but poorly suited for commercial timber production. The uplands are generally considered suitable for pasture or woodland and support some commercial pine production (Hatherly, 1993).

The West Mud Creek watershed lies within the Tertiary Uplands ecoregion (35a) (Griffith et al., 2007). Average annual rainfall for the region is 42 inches annually (Tyler Texas Weather, 2015). Mean minimum and maximum temperatures for the region range from 36 to 57°F in January and 73 to 94°F in July. Developed land as represented by the City of Tyler, and to a lesser degree the City of Bullard, comprises almost 32 percent of the watershed area (Figure 7.2). Hay/pasture intermingled with woodland represents most of the remaining watershed area with woody wetlands surrounding the area nearest to West Mud Creek.

While there are parks within the City of Tyler to the northeast of water body 0611D, only one small park, Faulkner Park, is located directly along West Mud Creek (Figure 7.1). Faulkner Park is located off Cumberland Road in Tyler, Texas. The park has picnic areas, baseball/softball fields, tennis courts, a children's playground, a fishing pond and a nature trail. The western edge of the park abuts West Mud Creek, but the creek is not readily accessible due to dense trees and brush.

Designated Uses, Impairments, and Concerns

West Mud Creek (0611D) is an unclassified perennial stream (TCEQ, 2013a) and has designated uses of primary contact recreation, fish consumption, and a limited aquatic life use. West Mud Creek is split into two AUs based on the confluence of an unnamed tributary located about 250 ft north of the Southside WWTF within the City of Tyler. Both AUs are listed as being impaired due to bacteria and were first listed in 2010 (TCEQ, 2013). Concerns for ammonia and nitrate are noted for AU 0611D_01, the more downstream AU, and for ammonia in AU 0611D_02, the more upstream AU.

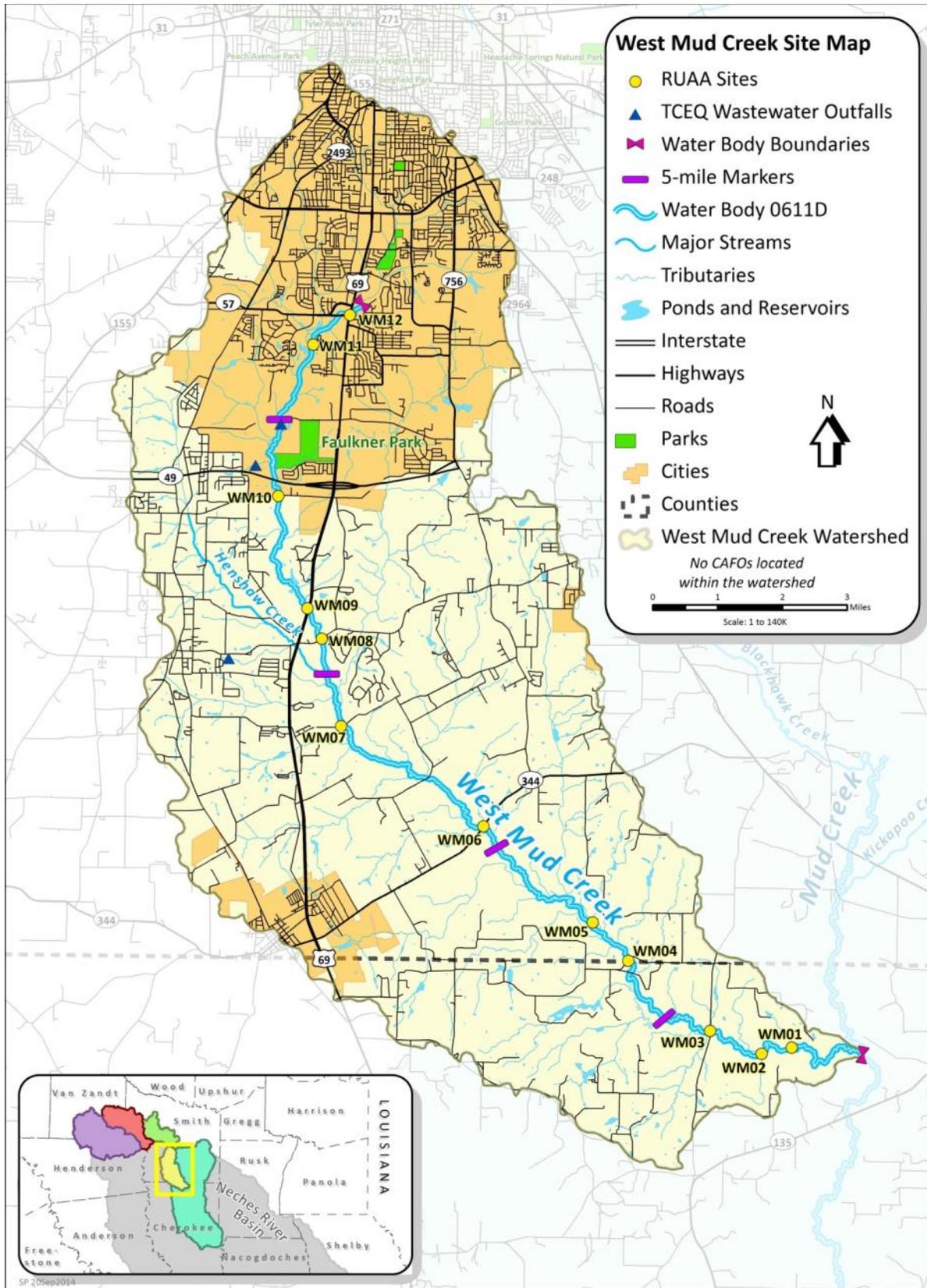


Figure 7.1 Overview of West Mud watershed and RUA sites for water body 0611D.

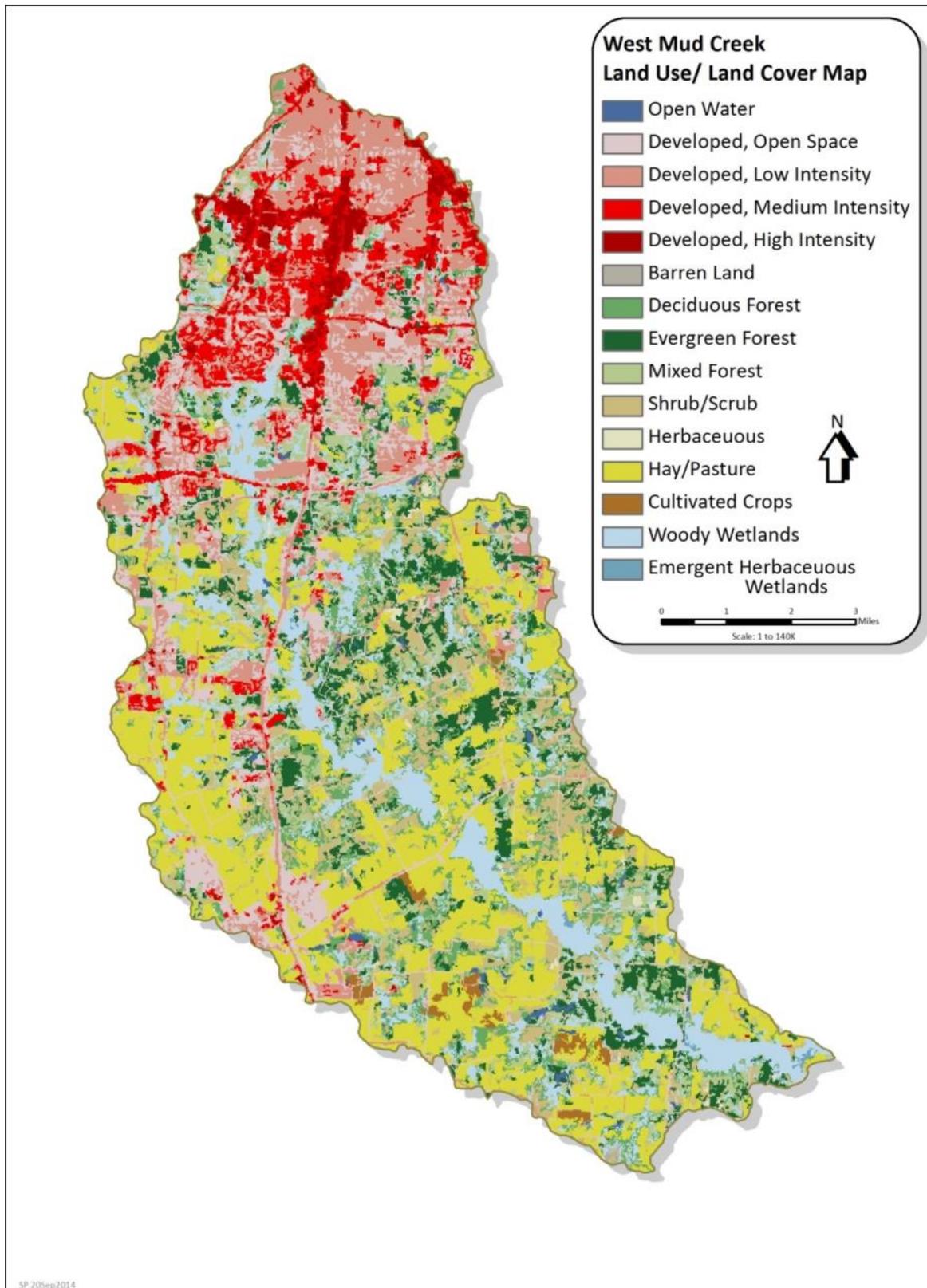


Figure 7.2 Land use/land cover for the West Mud Creek watershed. Source: 2011 National Land Cover Database (USGS, 2013).

Permitted Discharges

The West Mud Creek watershed contains three permitted WWTF discharges. The largest permitted discharge, and the only one flowing directly into West Mud Creek, is the City of Tyler Southside WWTF (TX0047988) with a permitted average daily flow of 9.0 MGD. The Woodmark Utilities WWTF (TX0098795) and Tall Timbers Utility Company, Inc. WWTF (TX0101010) have permitted average daily flows of 0.25 and 0.312 MGD, respectively. The combined daily discharge for all three municipal facilities is 9.56 MGD.

There are no permitted concentrated animal feeding operations (CAFOs) in the West Mud Creek watershed.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. To provide an estimate of livestock densities in the watershed, livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2012). The West Mud Creek watershed is within Smith and Cherokee Counties (Figure 7.1). For estimating livestock numbers, county estimates for Smith and Cherokee Counties were used (Table 7.1). These county level data were weighted by watershed area within each county to estimate livestock within the watershed. These statistics indicated large numbers of beef cattle in both counties, and, thus, likely within the watershed.

Table 7.1 Estimated livestock numbers within the West Mud Creek watershed based on statistics for Smith and Cherokee Counties adjusted for the percent of the county within the watershed. (Source USDA, 2012).

The West Mud Creek watershed comprises about 8% of Smith County and 1% of Cherokee county. (Source: USDA, 2012).

County	Year	Cattle & Calves (all beef)	All Goats	Mules, Burros, and Donkeys	Horses & ponies	Hogs
Smith	2012	42,885	3,561	1,127	4,342	401
Cherokee	2012	47,174	1,488	426	2,346	162
West Mud Creek Watershed Average	2012	13,843	838	259	1,090	94

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 26,600 households within the West Mud Creek watershed based on 2010 census population data there are potentially about 15,534 dogs within the West Mud Creek watershed. Other domestic animals, such as outdoor cats, can also contribute

to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife such as deer, feral hogs, and birds. In 2013 statewide population estimated roughly 39 whitetail deer per 1,000 acres. This estimation suggests that the population for whitetail deer in the Post Oak Savannah region is roughly 400,000 deer, or 35 deer per 1,000 acres (Cain, 2014). Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (AgriLife, 2011).

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. To estimate the number of potential OSSFs in the watershed, a GIS layer associated with the sewer Certificates of Convenience and Necessity (CNNs) from the Public Utility Commission of Texas was used. As not all cities with WWTFs have CNNs, the CNN layer was supplemented with a GIS layer representing municipal boundaries for those cities with WWTFs. Population data from the U.S. Census Bureau (USCB) were then overlaid masking out areas that should be serviced by WWTFs. The 2010 U.S. Census Bureau (USCB) data indicated that of the 26,600 households in the West Mud Creek watershed, about 7.6% are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of West Mud Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Tyler

[City of Tyler Homepage](#)³⁹

Nothing significant was found pertaining to the historical recreational use of West Mud Creek.

City of Bullard

[City of Bullard Homepage](#)⁴⁰

Nothing significant was found pertaining to the historical recreational use of West Mud Creek.

Library Sources

Tyler Public Library

201 S. College Ave.

Tyler, TX 75702

Phone Number: (903) 593-7323

Website: [Tyler Public Library Homepage](#)⁴¹

No significant information was found regarding recreational use of West Mud Creek.

Bullard Community Library

211 West Main Street

Bullard, TX 75757

Phone: (903) 894-6125

Website: [Bullard Community Library Homepage](#)⁴²

No significant information was found regarding recreational use of West Mud Creek.

Newspaper Source

The Tyler Morning Telegraph

[The Tyler Morning Telegraph Homepage](#)⁴³

Phone: (903) 592-3818

No significant information was found regarding recreational use of West Mud Creek.

Bullard Banner News

[Bullard Banner News Homepage](#)⁴⁴

Phone: (903) 894-9306

No significant information was found regarding recreational use of West Mud Creek

Internet Searches

The Handbook of Texas Online

[The Handbook of Texas Homepage](#)⁴⁵

Search of the handbook by river name was conducted. No significant information was found regarding the recreational use of West Mud Creek.

³⁹ <http://www.cityoftyler.org/>

⁴⁰ <https://www.bullardtexas.net/>

⁴¹ <http://library.cityoftyler.org/>

⁴² <http://www.bullardlibrary.org/>

⁴³ <http://www.tylerpaper.com/>

⁴⁴ <http://www.bullardnews.com/>

⁴⁵ <https://tshaonline.org/>

Survey Site Descriptions

With the help of cooperating stakeholders, TIAER was able to establish a total of 12 sampling stations along the 23 river miles of West Mud Creek, 0611D (Figure 7.1, Table 7.2). Although the optimum number of sampling stations would have been 14, following the RUAA guidelines, acceptance of using only 12 stations was sought and granted from TCEQ. Of the 12 stations, 8 were publically accessible via road crossings and the remaining 4 were accessible via private property (Table 7.2). Of the eight publically accessible sites, five were at recognized TCEQ sampling stations.

The average distance between survey sites is 1.83 river miles and ranges from 0.62 to 3.55 miles. The largest gap between survey sites is 3.55 river miles between Sites WM06 and WM07. While CR 113 crosses almost midway between Sites WM06 and WM07, it was not used as an RUAA survey site as there was no safe way to access West Mud Creek from this road crossing. RUAA surveys were performed on June 3-5 and August 8-10, 2014. A brief description of each site follows.

Table 7.2 Description and location of RUAA field survey sites for West Mud Creek, water body 0611D.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi) ¹	Distance from Confluence (mi) ¹	Access
	WM01	West Mud Creek on private property approximately 2.1 km north of SH 135 and 2.1 km east of Cherokee CR3052	32.117973	-95.185575	0.0	1.96	Private
	WM02	West Mud Creek on private property approximately 2.3 km north of SH135 and 1.5 km east of Cherokee CR3052	32.116472	-95.193437	0.78	2.74	Private
10538	WM03	West Mud Creek crossing at FM 3052	32.121359	-95.207115	1.16	3.9	Public*
	WM04	West Mud Creek crossing at County Line Road on Cherokee/Smith County Line	32.136688	-95.229016	2.50	6.4	Public*
	WM05	West Mud Creek on private property approximately 2.2 km west of Smith CR 2181	32.145149	-95.2386	0.98	7.38	Private
10539	WM06	West Mud Creek crossing at FM 344 5.8 KM northeast of Bullard	32.166134	-95.267905	3.1	10.48	Public*
	WM07	West Mud Creek crossing at Smith CR 129	32.187911	-95.305965	3.55	14.03	Public
10540	WM08	West Mud Creek crossing FM 346 4.2 miles south of Tyler	32.207414	-95.311517	1.56	15.59	Public
18302	WM09	West Mud Creek crossing US 69 4 miles south of Tyler	32.214147	-95.31548	0.62	16.21	Public
10541	WM10	West Mud Creek crossing at FM 2813 south of Tyler	32.239186	-95.323814	2.21	18.42	Public*
	WM11	West Mud Creek on private property in Tyler approximately 740 km south of West Grande Blvd	32.273255	-95.315474	2.98	21.4	Private
	WM12	West Mud Creek at intersection of SH69 and Grande Blvd in Tyler	32.28005	-95.305941	0.7	22.1	Public

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site WM01 is located on West Mud Creek on private property approximately 2.1 km north of State Highway 135 and 2.1 km east of Cherokee County Road 3052, southwest of Troup, Texas. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611D.

Site WM02 is located on West Mud Creek on private property approximately 2.3 km north of State Highway 135 and 1.5 km east of Cherokee County Road 3052, southwest of Troup, Texas. Site WM02 was only accessible with landowner permission through fenced private property via a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611D.

Site WM03 (TCEQ Station 10538) is located on West Mud Creek at the bridge crossing Farm-to-Market Road 3052, southwest of Troup, Texas. Site WM03 was only publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility; landowner cooperation and the site provided opportunity for characterization of water body 0611D.

Site WM04 is located on West Mud Creek at the bridge crossing at County Line Road on Cherokee/Smith County Line, west of Troup, Texas. Site WM04 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM05 is located on West Mud Creek approximately 2.1 miles west of Farm-to-Market Road 2177, west of Troup, Texas. Site WM05 was only accessible, with landowner permission, through fenced private property with potentially locked gates. The site was selected because of landowner cooperation and the site provided opportunity for characterization of water body 0611D.

Site WM06 (TCEQ Station 10539) is located on West Mud Creek at the bridge crossing at Farm-to-Market Road 344, northeast of Bullard, Texas. Site WM06 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM07 is located on West Mud Creek at the bridge crossing at Smith County Road 129, north of Bullard, Texas. Site WM07 was only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM08 (TCEQ 10540) is located on West Mud Creek at the bridge crossing at Farm-to-Market Road 346, south of Tyler, Texas. Site WM08 was only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM09 (TCEQ Station 18302) is located on West Mud Creek at the bridge crossing State Highway 69, south of Tyler, Texas. Site WM09 is only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM10 (TCEQ Station 10541) is located on West Mud Creek at the bridge crossing at Farm-to-Market Road 2813, south of Tyler, Texas. Site WM10 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site was selected because of public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM11 is located on West Mud Creek on private property south of West Grande Boulevard in Tyler, Texas. Site WM11 was only accessible through private property belonging to a local country club with permission. The site was selected because of potential public accessibility, landowner cooperation, and the site provided opportunity for characterization of water body 0611D.

Site WM12 is located on West Mud Creek at the intersection of West Grande Boulevard and State Highway 69 in Tyler, Texas. Site WM12 was publicly accessible for the entire length of the survey reach. The site was selected because of public accessibility and the site provided opportunity for characterization of water body 0611D.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Water Body 0611D

The West Mud Creek RUAA surveys were conducted on June 3-5 and August 8-10, 2014 at all twelve sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 7.3 and 7.4). In the 30 days prior to the first survey, 4.52 inches of precipitation fell, while 5.06 inches fell 30 days prior to the second survey. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both July and August 2014 (TWDB, 2014).

A summary of the RUAA field survey results is presented in the following tables:

- Table 7.5 describes the stream channel and corridor characteristics at each site.
- Table 7.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 7.7 and 7.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 7.9 and 7.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall average thalweg depth ranged from 0.1 m to greater than 1.5 m during both surveys. Access to the stream down the bank was moderately easy at most locations. The dominant substrate was clay, and the stream corridor was largely within a forest dominated corridor with the exception of one site located within an urban environment. The maximum stream width encountered was 19 m. Flow conditions were characterized as being normal at nearly all locations during both surveys. The water surface was generally brown in color at 8 of the 12 sites during the first survey with the remaining sites having a clear water color. During the second survey one half of the sites displayed brown water color, while the other half was clear. Tracks observed most often included cattle, raccoon, deer, feral hog, and canine. Trash was rarely observed at most survey sites and when observed was predominantly typical plastics and aluminum cans. No recreation was directly observed during either of the field surveys and signs of potential recreation were observed at only a couple of sites in the form of fishing equipment

Table 7.3 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the first RUAA survey initiated on June 3, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
5-May-14	0	86	59
6-May-14	0	85	62
7-May-14	0	83	64
8-May-14	0.13	80	69
9-May-14	1.20	85	63
10-May-14	0.16	85	65
11-May-14	0	89	71
12-May-14	0	86	74
13-May-14	1.54	75	55
14-May-14	0.24	69	52
15-May-14	0	79	44
16-May-14	0	83	52
17-May-14	0	83	56
18-May-14	0	84	60
19-May-14	0	84	63
20-May-14	0	87	69
21-May-14	0	88	68
22-May-14	0	84	68
23-May-14	0	83	66
24-May-14	0	84	69
25-May-14	0	87	68
26-May-14	0	82	70
27-May-14	0.40	77	66
28-May-14	0.05	82	66
29-May-14	0.33	86	63
30-May-14	0	84	68
31-May-14	0.46	85	70
1-Jun-14	0	88	69
2-Jun-14	0	88	73
3-Jun-14	0	89	71
4-June-14	0	90	73
5-June-14	0	89	72

Table 7.4 Rainfall records with maximum and minimum temperature for Tyler, Texas 30 days prior to the second RUAA survey initiated on August 8, 2014.

Survey dates are highlighted in gray. Weather Data from National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC 2014).

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
9-Jul-14	0	95	75
10-Jul-14	0	94	74
11-Jul-14	0	94	73
12-Jul-14	0	96	73
13-Jul-14	0	98	75
14-Jul-14	0	97	75
15-Jul-14	0.44	93	74
16-Jul-14	0	88	67
17-Jul-14	0.50	84	67
18-Jul-14	0.13	71	65
19-Jul-14	0.02	73	65
20-Jul-14	0	87	66
21-Jul-14	0	91	68
22-Jul-14	0	91	71
23-Jul-14	0	92	69
24-Jul-14	0.62	90	67
25-Jul-14	0	94	71
26-Jul-14	0	95	74
27-Jul-14	0	96	76
28-Jul-14	0.43	95	74
29-Jul-14	0	91	72
30-Jul-14	0	87	72
31-Jul-14	2.80	84	70
1-Aug-14	0.04	77	67
2-Aug-14	0.06	84	68
3-Aug-14	0.02	87	70
4-Aug-14	0	90	72
5-Aug-14	0	92	73
6-Aug-14	0	93	75
7-Aug-14	0	94	76
8-Aug-14	0	95	77
9-Aug-14	0	95	77
10-Aug-14	0	97	76

Table 7.5 Stream Channel and corridor appearance for each site sampled along West Mud Creek water body 0611D.

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
WM01	Natural	Mud/Clay	Forest	Large	No	Native
WM02	Natural	Mud/Clay	Forest	Large	No	Native
WM03	Natural	Mud/Clay	Forest	Large	No	Native
WM04	Natural	Mud/Clay	Forest	Large	No	Native
WM05	Natural	Mud/Clay	Pasture - Left Shrub - Right	Large	No	Native & Improved Pasture
WM06	Natural	Mud/Clay	Forest/Shrub - Left Pasture - Right	Large	No	Native & Improved Pasture
WM07	Natural	Mud/Clay	Forest	Large	No	Native
WM08	Natural	Mud/Clay	Forest	Large	No	Native
WM09	Natural	Mud/Clay	Forest	Large	No	Native
WM10	Natural	Mud/Clay	Forest - Left Pasture - Right	Large	No	Native & Pasture
WM11	Natural	Gravel	Forest/Shrub - Left Mowed - Right	Large	No	Golf Course & Residential
WM12	Urban	Concrete	Urban business	Small	No	Business and residential

Table 7.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of West Mud Creek (0611D).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
WM01	300	11	0	0.7	0.6	Perennial	Private	ME
WM02	300	11	0	0.6	0.5	Perennial	Private	MD
WM03	300	11	0	0.9	0.9	Perennial	Public	ME
WM04	300	11	0	0.8	0.7	Perennial	Public	ME
WM05	300	11	0	>1.5	>1.5	Perennial	Private	E
WM06	300	11	0	0.7	0.6	Perennial	Public	ME
WM07	300	11	0	0.8	0.7	Perennial	Public	ME
WM08	300	11	0	0.8	0.9	Perennial	Public	MD
WM09	300	11	0	0.9	1.2	Perennial	Public	ME
WM10	300	11	0	0.8	0.6	Perennial	Public	MD
WM11	300	11	0	0.5	0.5	Perennial	Public	ME
WM12	300	11	0	0.1	0.1	Perennial	Public	E

Table 7.7 Description of surveyed stream sites along West Mud Creek during first survey performed in June 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
WM01	11	7.5	8.0	Normal
WM02	4.7	3.2	4.0	Normal
WM03	17	10	12	Normal
WM04	12	9.0	10	Normal
WM05	19	7.5	13	Normal
WM06	7.5	5.0	5.5	Normal
WM07	13	4.0	8.0	Normal
WM08	6.5	4.0	6.0	Normal
WM09	15	7.0	8.0	Normal
WM10	12	3.0	5.0	Normal
WM11	6.5	1.0	3.5	Low
WM12	15	3.5	3.5	Normal

Table 7.8 Description of surveyed stream sites along West Mud Creek during second survey performed in July 2014.

Site Number	Maximum Width (m)	Minimum Width (m)	Average Width (m)	Observed Flow
WM01	11	6.0	7.0	Normal
WM02	6.5	4.5	5.0	Normal
WM03	18	10	12	Normal
WM04	12	9.0	10	Normal
WM05	19	8.0	14	Normal
WM06	8.0	4.0	5.0	Normal
WM07	13	4.0	8.5	Normal
WM08	7.5	4.0	6.0	Normal
WM09	8.0	5.5	6.5	Normal
WM10	13	2.5	5.0	Normal
WM11	7.0	1.0	3.0	Normal
WM12	15	3.5	3.5	Normal

Table 7.9 Stream aesthetics along West Mud Creek during first survey performed in June 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WM01	A	A	N	Brown	Fine sediment	Clear	SP	SP	MP	Tracks/Fecal	N	R	R
WM02	A	A	N	Brown	None	Clear	SP	N	N	Tracks/Fecal	N	N	N
WM03	A	A	N	Brown	None	Clear	N	N	N	Tracks/Fecal	N	N	R
WM04	A	A	R	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
WM05	A	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
WM06	A	R	N	Clear	None	Clear	N	N	N	Tracks/Fecal	R	N	R
WM07	A	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	C
WM08	A	A	N	Brown	Fine sediment	Clear	SP	N	N	Tracks/Fecal	R	Ab	R
WM09	R	A	N	Brown	None	Clear	SP	N	N	Tracks/Fecal	R	R	R
WM10	R	A	N	Clear	None	Clear	MP	N	N	Tracks/Fecal	R	R	R
WM11	A	R	N	Clear	None	Clear	N	N	SP	Tracks/Fecal	R	C	R
WM12	A	Ab	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	R	R

Table 7.10 Stream aesthetics along West Mud Creek during second survey performed in August 2014.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
WM01	R	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	R	N
WM02	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
WM03	A	A	N	Brown	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	N	C
WM04	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
WM05	A	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
WM06	A	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	N	R
WM07	R	R	N	Clear	Fine sediment	Clear	N	SP	SP	Tracks/Fecal	R	R	R
WM08	R	R	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	C	R
WM09	A	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
WM10	A	A	C	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	C	C
WM11	A	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	C	C
WM12	A	C	N	Clear	None	Clear	N	N	N	Tracks/Fecal	N	R	N

Physical Description of WM01

West Mud Creek at Site WM01 was visited on June 4 and August 9, 2014. This site is located in Cherokee County approximately 4 miles west of Troup, Texas. Access to the creek was obtained via an ATV trail that started near a gas well location and terminated at West Mud Creek (Figure 7.3). The ATV trail passed through what was presumed private property; however, no postings or fences were observed in the area. TIAER personnel walked down the heavily wooded ATV trail approximately 0.2 miles to reach the site. The site is located in a forest dominated corridor (Table 7.5). Access to the creek was moderately easy at an abandoned low water crossing; however, access at other areas of the reach would have been much more challenging due to densely wooded vegetation (Table 7.6). Depending on the location within the reach, banks were gently sloping to moderately steep. Figures 7.4 and 7.5 depict the appearance of the site during each survey.



Figure 7.3 Photograph of ATV trail leading to West Mud Creek Site WM01 taken on June 4, 2014.

Site WM01 was wadeable for the entire 300-m reach length. The average thalweg was 0.7 m during the first survey and 0.6 m during the second survey. Stream widths ranged from 7.5 m to 11 m during the first survey and 6.0 m to 11 m during the second survey (Tables 7.7 and 7.8). Numerous instream obstructions were encountered that made wading challenging which included submerged logs and two beaver dams.



Figure 7.4 Photograph of West Mud Creek Site WM01 taken on June 4, 2014. The downstream view of the 150-m transect.



Figure 7.5 Photograph of West Mud Creek Site WM01 taken on August 9, 2014. The upstream view of the 300-m transect.

A slight presence of reptiles and water dependent birds and a moderate presence of mammals were observed during the first survey (Table 7.9). Reptiles and mammals observed during the first survey consisted of a non-poisonous snake and a few deer. A slight presence of mammals was observed during the second survey and consisted of a beaver (Table 7.10). Tracks observed during the first survey consisted of deer, raccoon, and beaver. Tracks observed during the second survey consisted of feral hog, raccoon, and beaver. Various types of feces were also found throughout the reach. Aquatic vegetation was absent during the first survey and rare during the second survey, while algae was absent during both surveys. Trash observed was rare to non-existent. When encountered, the trash consisted of typical plastic cups and bottles. The only evidence of human presence observed near the reach was the ATV trail and ATV tracks leading to the site.

Physical Description of WM02

West Mud Creek at Site WM02 was visited on June 3 and August 9, 2014. This site is located in Cherokee County approximately 4.5 miles southwest of Troup, Texas. The site was accessible only through private lands that were fenced with a potentially locked gate. With landowner permission, TIAER personnel entered private property and drove approximately 0.5 miles on a heavily vegetated road to reach the site. The site is located in a forest dominated corridor (Table 7.5). At the site, access to the stream was moderately difficult (Table 7.6), due to relatively steep banks and dense vegetation. Figures 7.6 and 7.7 depict the appearance of the site during each survey.



Figure 7.6 Photograph of West Mud Creek Site WM02 taken on June 3, 2014. The upstream view of the 0-m transect.

Site WM02 was wadeable for the entire 300-m reach length. Average thalweg was from 0.6 m during the first survey to 0.5 m during the second survey (Table 7.6). During both surveys, numerous log obstructions and other instream woody debris made wading challenging. Relatively shallow water depths and instream obstructions would make boating difficult. Stream widths varied from 3.2 to 4.7 m during the first survey and 4.5 to 6.0 m during the second survey (Tables 7.7 and 7.8).



Figure 7.7 Photograph of West Mud Creek Site WM02 taken on August 9, 2014. The downstream view of the 150-m transect. TIAER personnel in photograph.

There was a slight presence of reptiles observed during the first survey (Table 7.9). No other mammals or other vertebrates were observed during either survey (Tables 7.9 and 7.10). Tracks observed during the first survey consisted of raccoon and feral hog. During the second survey, raccoon, feral hog, and river otter tracks (Figure 7.8) were observed. Bird feces were also found throughout the reach. Aquatic vegetation and algae cover were absent during both surveys. The water color was brown with no surface scum or foam during both surveys. Trash was not encountered during the first survey and was rare during the second survey. When encountered, the trash consisted of a few aluminum cans. No evidence of human presence or recreation was found during either survey.



Figure 7.8 Photograph of a river otter track observed within the survey reach of West Mud Creek Site WM02 taken on August 9, 2014.

Physical Description of WM03

West Mud Creek at Site WM03 was visited on June 4 and August 8, 2014. This site was located 5 miles west of Troup, Texas in Cherokee County at the Farm-to-Market Road 3052 bridge crossing. The site was publicly accessible at the bridge with fenced private property upstream and downstream of the crossing. The site is located in a forest dominated corridor (Table 7.5). At the site, a cleared and slightly steep location near the bridge allowed access to the stream via small boat moderately easy (Figure 7.9). Figures 7.10 and 7.11 depict the appearance of the site during each survey.

Site WM03 was wadeable for most of the entire 300-m reach length. A small boat was used to navigate areas that were not wadeable. Average thalweg was 0.9 m during both surveys (Table 7.6). During both surveys, log obstructions were encountered at various locations throughout the reach which made navigation by boat challenging. Widths of the stream ranged from 10.0 m to 17.0 m during the first survey and 10.0 m to 18.0 m during the second survey (Tables 7.7 and 7.8).



Figure 7.9 Photograph of West Mud Creek Site WM03 taken on June 4, 2014, showing stream access location near the bridge crossing. TIAER boat and personnel in photograph.



Figure 7.10 Photograph of West Mud Creek Site WM03 taken on June 4, 2014, the

downstream view of the 150-m transect.



Figure 7.11 Photograph of West Mud Creek Site WM03 taken on August 8, 2014, the upstream view of the 300-m transect.

There were no mammals or vertebrates observed during first survey (Table 7.9). A slight presence of mammals and reptiles was observed during the second trip due to the observation of a river otter consuming a snake (Table 7.10). Tracks observed during the first survey consisted of canine. Tracks observed during the second survey consisted of raccoon and canine. Bird feces were also found throughout the reach. Aquatic vegetation and algae cover was absent during both surveys. The water color was brown with no surface scum or foam during both surveys. Trash observed was rare consisted of typical plastic cups and bottles with occasional fishing tackle containers and shotgun shells. Evidence of human presence found within the reach was a fishing bobber hung in a tree, a human foot path, spent shotgun shells, and a vehicle trail on the southeast side of the Farm-to-Market road. No recreational activities were observed during either survey.

Physical Description of WM04

West Mud Creek at Site WM04 was visited on June 4 and August 9, 2014. This site is located on West Mud Creek at the bridge crossing at County Line Road on Cherokee/Smith County Line, west of Troup, Texas. Site WM04 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The site is located in a forest dominated corridor (Table 7.5). At the site, access to the stream was moderately easy near the bridge crossing. Steep and somewhat slick banks at other locations throughout the reach would make access to the stream difficult. Figures 7.12 and 7.13 depict the appearance of the site during each survey.



Figure 7.12 Photograph of West Mud Creek Site WM04 taken on June 4, 2014, the downstream view of the 150-m transect.

Site WM04 was wadeable for most of the entire 300-m reach length during both surveys. At a few locations along the reach water depths were too great to wade so TIAER personnel were required to either walk on the bank or as close to the bank in order to complete the 300-m reach. Average thalweg ranged from 0.8 m during the first survey to 0.7 m during the second survey (Table 7.6). During both surveys, rip rap composed of large boulders near the bridge crossing made wading challenging. A few log jams and other instream woody debris were also encountered along the surveyed reach. Stream widths ranged from 9.0 m to 12 m during both surveys (Tables 7.7 and 7.8).

No mammals or other vertebrates were observed during either survey (Tables 7.9 and 7.10). Tracks observed during each trip consisted of cattle, deer, and horse. Cattle and bird feces were found throughout the reach. Aquatic vegetation and algae cover was absent during both surveys. A slight odor of chlorine was detected during the first survey but was not present during the second survey. The water color during both surveys was brown with no surface scum or foam. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastic cups and bottles along with one washing machine and a vehicle tail gate. The only evidence of human presence was a fishing bobber hung in a tree near the bridge crossing (300-m transect). No other evidence of human presence was found within the reach.



Figure 7.13 Photograph of West Mud Creek Site WM04 taken on August 9, 2014, the upstream view of the 300-m transect.

Physical Description of WM05

West Mud Creek at Site WM05 was visited on June 4 and August 9, 2014. This site was located west of Troup, Texas approximately 2.1 miles west of Farm-to-Market Road 2177. The site was only accessible, with landowner permission, through fenced private property with potentially locked gates. With landowner permission, TIAER personnel walked approximately 0.4 miles through a mowed path to reach the site. Access to the stream was easy due to gently sloping banks and relatively short grass dominated vegetation along the surveyed reach. A privately owned and maintained bridge at the 150-m transect also provided easy access to either side of the stream (Figure 7.14). The site is located in shrub dominated corridor that had been mowed/maintained (Table 7.5). Figures 7.15 and 7.16 depict the appearance of the site during each survey.



Figure 7.14 Photograph of privately owned bridge at West Mud Creek Site WM05 taken on August 9, 2014.

Average thalweg depths during the time of both surveys was greater than 1.5 m resulting in Site WM05 being non-wadeable (Table 7.6). Stream widths ranged from 7.5 m to 19 m during the first survey and 8.0 m to 19 m during the second survey (Tables 7.7 and 7.8).

The landowner's dogs and one deer were observed near the site during the first survey (Table 7.9). There were no other mammals or vertebrates observed during either survey (Table 7.10). Tracks observed during each trip consisted of deer, raccoon and feral hog. Feral hog, deer and bird feces were also found throughout the reach. Aquatic vegetation and algae cover were absent during both surveys. The water color was brown during both surveys with no surface scum or foam. No trash was observed throughout the reach. No evidence of recreation was observed within the reach.



Figure 7.15 Photograph of West Mud Creek Site WM05 taken on June 4, 2014, the downstream view of the 300-m transect. TIAER personnel in photograph.



Figure 7.16 Photograph of West Mud Creek Site WM05 taken on August 9, 2014, the downstream view of the 150-m transect.

Physical Description of WM06

West Mud Creek at Site WM06 was visited on June 4 and August 9, 2014. This site was located at the bridge crossing at Farm-to-Market Road 344, northeast of Bullard, Texas. The site was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The left bank at the site was dominated by a forest and shrub corridor, while the right bank was within a pasture dominated corridor (Table 7.5). A vehicle trail on the east side of the bridge crossing in addition to only slightly steep banks under the bridge allowed for moderately easy access to the stream (Table 7.6). At other locations throughout the reach, access to the stream was more challenging due to steep banks and dense vegetation. Figures 7.17 and 7.18 depict the appearance of the site during each survey.

Site WM06 was wadeable for the entire 300-m reach length. Average thalweg during the first survey was 0.7 m and during the second survey was 0.6 m (Table 7.6). During both surveys, occasional log jams and other woody debris was encountered that made wading challenging; however, wading was relatively easy within areas that were free of obstructions. Stream widths ranged from 5.0 m to 7.5 m during the first survey and 4.0 m to 8.0 m during the second survey (Tables 7.7 and 7.8).

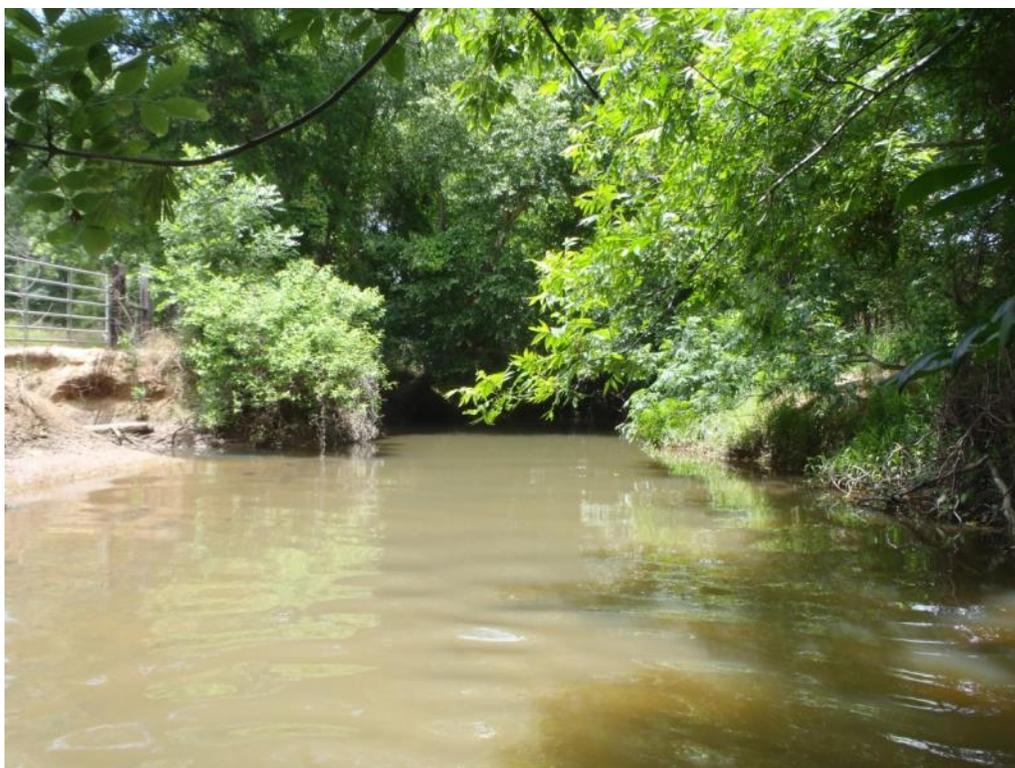


Figure 7.17 Photograph of West Mud Creek Site WM06 taken on June 4, 2014, the upstream view of the 300-m transect.



Figure 7.18 Photograph of West Mud Creek Site WM06 taken on August 9, 2014, the downstream view of the 150-m transect.

No mammals or other vertebrates were observed during either survey (Tables 7.9 and 7.10). Tracks observed during the first survey consisted of raccoon, feral hog, and cattle. During the second survey tracks observed consisted of raccoon. Bird feces were also found throughout the reach during both surveys. Aquatic vegetation was absent during both surveys while algae cover was rare. The water color was clear with no surface scum or foam during both surveys. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics and aluminum cans along with a tire and occasional sections of PVC pipe. Evidence of recreational activity was found near the bridge crossing and consisted of fishing pole holders crafted from sticks, a discarded jacket, and a cleared slick area leading from the bank to the stream that may have been a boat launch location (Figure 7.19). No other evidence of recreational activity was found within the reach.



Figure 7.19 Photograph of potential boat launch location near the FM 344 bridge crossing on West Mud Creek Site WM06 taken on June 4, 2014. TIAER vehicle in photograph.

Physical Description of WM07

West Mud Creek at site WM07 was visited on June 4 and August 9, 2014. This site is located at the bridge crossing at Smith County Road 129, north of Bullard, Texas. Site WM07 was only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site is located in a forest dominated corridor (Table 7.5). At the bridge crossing, access to the stream was moderately easy (Table 7.6); however access would have been more challenging elsewhere along the surveyed reach due to dense woody vegetation and steep banks. Figures 7.19 and 7.20 depict the appearance of the site during each survey.

Site WM07 was wadeable for much of 300-m reach length, although water that was too deep for wading was encountered at a few locations along the reach. The average thalweg was 0.8 m and 0.7 m during the first and second survey, respectively (Table 7.6). During both surveys numerous log jams and other woody obstructions were encountered along the reach that made wading and traversing the reach difficult. Stream widths ranged from 4.0 to 13 m (Table 7.7 and 7.8).



Figure 7.20 Photograph of West Mud Creek Site WM07 taken on June 4, 2014, the upstream view of the 300-m transect.



Figure 7.21 Photograph of West Mud Creek Site WM07 taken on August 9, 2014, the upstream view of the 0-m transect.

During the first survey, there were no mammals or other vertebrates encountered (Table 7.9). During the second survey, there was a slight presence of water dependent birds and mammals with no other vertebrates or mammals observed (Table 7.10). Tracks observed during the first survey consisted of bird, feral hog, horse, and raccoon. During the second survey tracks observed consisted of bird, raccoon, deer, and feral hog. Bird feces were also found throughout the reach during both surveys. Aquatic vegetation was absent to rare between the first and second survey, respectively. Algae were rare during both surveys. The water color was brown during the first survey and clear during the second survey with no surface scum or foam during either survey. Trash in the stream channel was rare and trash on the stream banks near the bridge was common. When encountered, trash consisted of typical plastics, bottles, cans, tires, pipes, and a wooden box. The only evidence of human recreational activity was a fishing bobber hung in brush near the 90-m transect. Based on the difficult access to the location in which the fishing bobber was found, it is likely to have originated at some other upstream location. No other evidence of human presence was found within the reach.

Physical Description of WM08

West Mud Creek at Site WM08 was visited on June 4 and August 10, 2014. This site is located at the bridge crossing on Farm-to-Market Road 346, south of Tyler, Texas. Site WM08 was only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site is located in a forest dominated corridor (Table 7.5). At the bridge crossing, access to the stream was moderately difficult (Table 7.6) due to tall dense vegetation and steep banks. Figures 7.21 and 7.22 depict the appearance of the site during each survey.

Site WM08 was wadeable for most of the entire 300-m reach, although water depth was too great for wading in a few locations. Average thalweg was 0.8 m and 0.9 m (Table 7.6) during the first and second surveys, respectively. During both surveys, beaver dams, logs jams, and instream rip rap made wading and traversing the reach difficult. Stream widths ranged from 4.0 m to 6.5 m during the first survey and 4.0 m to 7.5 m during the second survey (Tables 7.7 and 7.8).

A slight presence of snakes was observed during the first survey (Table 7.9). No other mammals or other vertebrates were observed during either survey (Table 7.10). Tracks observed during the first survey consisted of feral hog, raccoon, canine, and deer. Tracks observed during the second survey consisted of deer and raccoon. Aquatic vegetation and algae cover were absent during the first survey and rare during the second survey. The water color was brown with no surface scum or foam during both surveys. Trash observed in the stream channel was abundant to common during the surveys and consisted of typical plastics, bottles and cans. No evidence of human recreational activity was observed within the reach.



Figure 7.22 Photograph of West Mud Creek Site WM08 taken on August 10, 2014, the upstream view of the 150-m transect.



Figure 7.23 Photograph of West Mud Creek Site WM08 taken on June 4, 2014, the upstream view of the 300-m transect.

Physical Description of WM09

West Mud Creek at Site WM09 was visited on June 4 and August 10, 2014. This site was located at the bridge crossing State Highway 69, south of Tyler, Texas. The site was only publicly accessible at the bridge crossing with private property upstream and downstream of the crossing. The site is located in a forest dominated corridor (Table 7.5). At the site, access to the stream was moderately easy within the area under and directly adjacent to the bridge (Table 7.6). Access to the stream from other locations within the reach would have been difficult due to steep banks and dense vegetation. Figures 7.21 and 7.22 depict the appearance of the site during each survey.

During the first survey, Site WM09 was wadeable for the entire 300-m reach length. During the second survey, water depth had increased compared to depths encountered during the first survey and caused portions of the reach to be non-wadeable. The reason is unknown as to why such a pronounced increase in water depth between the two surveys occurred at this site and not at other sites surveyed along West Mud Creek. A possible explanation could be a beaver dam or other type of instream obstruction may have been formed downstream of the surveyed reach between the time of the first and second surveys. Average thalweg was 0.9 m during the first survey and 1.2 m during the second survey (Table 7.6). During both surveys, instream obstructions and steep banks made traversing the reach moderately difficult. Widths of the stream ranged from 7.0 m to 15 m during the first survey, and 5.5 m to 8.0 m during the second survey (Tables 7.7 and 7.8). One beaver dam was observed near the 150-m transect.

One snake was observed during the first survey with no other sighting of vertebrates or mammals during either survey (Tables 7.9 and 7.10). Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare during the first survey and absent during the second survey. Algae cover was absent during both surveys. Water color was brown during the first survey and clear during the second with no surface scum or foam present during either survey. Trash was rarely observed instream or along the banks, and when encountered, consisted of typical plastics and aluminum cans. No evidence of human activity was observed throughout the reach.



Figure 7.24 Photograph of West Mud Creek Site WM09 taken on June 4, 2014, the upstream view of the 0-m transect.



Figure 7.25 Photograph of West Mud Creek Site WM09 taken on August 10, 2014, the downstream view of the 150-m transect. TIAER personnel in photograph.

Physical Description of WM10

West Mud Creek at Site WM10 was visited on June 4 and August 10, 2014. This site is located at the bridge crossing on Farm-to-Market Road 2813, south of Tyler, Texas. Site WM10 was only publicly accessible at the bridge crossing with fenced private property upstream and downstream of the crossing. The left bank at this site is located in forest dominated corridor while the right bank is located in a pasture dominated corridor (Table 7.5). Access to the stream was moderately difficult due to dense vegetation and steep banks (Table 7.6). Figures 7.22 and 7.23 depict the appearance of the site during each survey.



Figure 7.26 Photograph of West Mud Creek Site WM10 taken on June 4, 2014, the downstream view of the 300-m transect.

Site WM10 was wadeable for the entire 300-m reach length. Average thalweg was 0.8 m during the first survey and 0.6 m during the second survey (Table 7.6). During the first survey a large debris dam composed of logs and other woody debris was located near the 180-m transect (Figure 7.24). The debris dam was substantial enough to cause water depths on the upstream side of the dam to be at least 0.2 m deeper than what was measured on the downstream side. During the second survey the debris dam was no longer present. During the first survey, wading was moderately difficult due to the deeper water on the upstream side of the debris dam. Wading was also challenging due to occasional log jams and other instream debris. Stream widths during the first survey ranged from 3.0 m to 12 m and from 2.5 m to 13 m during the second survey (Tables 7.7 and 7.8).



Figure 7.27 Photograph of West Mud Creek Site WM10 taken on August 10, 2014, the downstream view of the 150-m transect.



Figure 7.28 Photograph of debris dam near 180-m transect on West Mud Creek Site WM10 taken on June 4, 2014.

There was a moderate presence of snakes during the first survey with no other animals or vertebrates observed during either survey (Tables 7.9 and 7.10). Tracks observed during the first survey consisted of feral hog, deer, and raccoon. During the second survey tracks observed consisted of deer, raccoon, and bird. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was rare during the first survey and absent during the second survey. Algae cover was absent during both surveys. Water color was clear with no surface scum or foam during both surveys. Trash was rarely observed throughout the reach during the first survey, and when encountered, consisted of typical plastics with some tires and scrap metal. During the second survey trash was common and consisted of the same types of garbage as was found during the first survey. No evidence of human recreational activity was observed within the reach.

Physical Description of WM11

West Mud Creek at Site WM11 was visited on June 5 and August 10, 2014. This site is located on private property owned by the Holly Tree Country Club in Tyler, Texas. With permission from the Country Club management, TIAER personnel accessed the stream by traveling approximately 0.30 miles down concrete golf paths. The left bank of the site is located in a shrub and forest dominated corridor while the right bank is dominated by a mowed golf course (Table 7.5). Access to the stream was moderately easy due to the mowed/maintained nature of the right bank. Steep banks throughout the reach however did pose some challenges to accessing the stream (Table 7.6). Figures 7.25 and 7.26 depict the appearance of the site during each survey.



Figure 7.29 Photograph of West Mud Creek Site WM11 taken on June 5, 2014, the downstream view of the 300-m transect.

Site WM11 was wadeable for the entire 300-m reach length. Average thalweg was 0.5 m during both surveys (Table 7.6). The shallow water depths and compacted clay substrate made wading in the stream channel easy. Stream widths ranged from 1.0 m to 6.5 m during the first survey and 1.0 m to 7.0 m during the second survey (Tables 7.7 and 7.8).



Figure 7.30 Photograph of West Mud Creek Site WM11 taken on August 10, 2014, the downstream view of the 0-m transect.

There was a slight presence of wildlife, two squirrels, with no other animals or vertebrates during the first survey (Table 7.9). During the second survey, there were no animals observed at the site (Table 7.10). Tracks observed during each trip consisted of bird, squirrel and raccoon. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was absent during both surveys, while algae was rare during the first survey and absent during the second survey. Water color was clear during both surveys with no surface scum or foam observed during either survey. Trash was commonly observed throughout the reach and when encountered, consisted of typical plastics, aluminum cans, and bottles. A deflated inner tube was observed during the first survey, and likely originated upstream of the survey reach. No other evidence of recreational activity was observed during either survey.

Physical Description of WM12

West Mud Creek at Site WM12 was visited on June 4 and August 10, 2014. This site is located at the intersection of West Grande Boulevard and State Highway 69 in Tyler, Texas. The site is located in an urban area surrounded by paved roads and concrete, making it publically accessible all along the 300-m reach (Table 7.5). The stream channel and banks were concrete and likely serve as a stormwater conveyance for the City of Tyler. Access to the stream was easy via a

concrete stairway with hand rails that led to a pedestrian tunnel that passed under State Highway 69 (Table 7.6 and Figure 7.27). Figures 7.28 and 7.29 depict the appearance of the site during each survey.



Figure 7.31 Photograph of stairs leading to a pedestrian walkway at West Mud Creek Site WM12 taken on August 10, 2014. TIAER personnel in the photograph.

Shallow water depths within the concrete lined channel made wading in the stream channel easy at Site WM12 for the entire 300-m reach. Average thalweg was 0.1 m during both surveys (Table 7.6). Stream widths ranged from 3.5 to 15 m (Tables 7.7 and 7.8).

One squirrel was observed during the first survey with no other animals or vertebrates encountered during either survey (Tables 7.9 and 7.10). Tracks observed during the first survey consisted of bird and raccoon. Tracks observed during the second survey consisted of human, canine, raccoon, and bird. Bird feces were found throughout the reach during both surveys. Aquatic vegetation was absent during both surveys, while algae was abundant during the first survey and common during the second survey. Water color was clear during both surveys with no surface scum or foam. Trash was rarely observed within the reach and when encountered consisted of typical plastics, cans, and bottles. Evidence of human activity at the site was observed during the second survey and consisted of human footprints and bicycle tracks within dry portions of the stream channel. No other evidence of human activity and no individuals were observed during either survey.



Figure 7.32 Photograph of West Mud Creek Site WM12 taken on June 4, 2014, the downstream view of the 300-m transect. TIAER personnel in photograph.



Figure 7.33 Photograph of West Mud Creek Site WM12 taken on August 10, 2014, the downstream view of the 0-m transect.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited sites during times of days and on days when recreational activities were apt to be observed. Eight of the 12 selected sites were at locations that provided some, albeit limited, public access. All publicly accessible sites were located at public road crossings; however, property fences often limited access to small areas between the road and the fence. Site WM12 was an exception in that it was publically accessible along the full reach as it was located in an urban area surrounding the creek with paved roads. The remaining four sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations.

No recreational activities were directly observed by TIAER employees at any of the sites during the field surveys. Evidence of possible recreation was encountered at seven sites along West Mud Creek (0611D) as follows:

- WM01 – ATV tracks were observed along a trail leading to the creek. There were no ATV tracks observed within the stream channel.
- WM03 – A fishing bobber was observed hanging from a tree branch. There was also a foot path leading to the stream and spent shotgun shells and discarded fishing tackle packages were found along the bank. A vehicle trail was located on the southeast side of the bridge crossing that allowed for parking relatively close to the stream.
- WM04 – A fishing bobber was observed hanging from a tree branch near the bridge crossing.
- WM06 – Fishing rod holders crafted from tree limbs were found along with a discarded jacket near the bridge crossing. Additionally a cleared slick area leading from the bank to the stream was observed that potentially could be used as a boat launch.
- WM07 – A fishing bobber was observed hung in brush. Based on the difficult access to the location where the fishing bobber was found, it likely washed in from somewhere upstream.
- WM11 – A deflated inner tube was found at site WM11. The lack of public access as Site WM11 makes it likely that the inner tube originated from somewhere upstream.
- WM12 – Human footprints and bicycle tire tracks were observed within dry portions of the streambed near the pedestrian tunnel at this site.

Activities Interviewed

A total of 13 interviews were conducted with landowners along West Mud Creek as well as others with interest in the West Mud Creek watershed. Recreational activities identified from these interviews are summarized in Table 7.11.

Two individuals that live in close proximity to site WM01 stated that they did not recreate in the stream and did not know of anyone ever recreating in the stream. One of the individuals stated that she had rode on horseback down to the site but never recreated in the water. The other individual stated that she had walked down to the stream but never had entered the stream or recreated near the stream.

The landowner of Site WM02 stated that hunting occurs on his property near the stream. The hunting typically occurs in the fall and winter months. The landowner stated that he and his family do not recreate in the stream and have not seen or heard of anyone recreating within the stream.

The landowner of Site WM04 reported that he personally recreated and had observed others recreating in the stream. The types of recreation that occurred were hunting, swimming, fishing, and boating. Hunting happened primarily during the fall and winter months. Fishing and boating occurred throughout the year. Swimming occurred primarily during spring and summer months in a swimming hole located on the water body but not within the 300 m survey reach.

The landowner of Site WM05 stated that fishing, swimming, boating, and wading by children and adults occurred on his property. The landowner reported that he had personally recreated, seen others, and heard of others doing these same activities. All activities reported typically happened during the summer months about twice a month.

Two landowners of Site WM10 stated that no recreation occurs in the stream on their property. A landowner in general conversation indicated that the site was not suitable for recreation due to an abundance of instream logs and other woody debris within the stream channel.

Four employees of the country club where Site WM11 was located were interviewed. Three of the employees indicated that they had not personally used the stream for recreation and had not seen or heard of anyone recreating in the stream. One employee stated that he had fished in the stream multiple times during the summer months, but had not seen or heard of anyone else doing so.

An employee of a local business near Site WM12 was interviewed along with a local resident. The employee of the local business stated that he had not recreated in the stream and had not observed or heard of anyone recreating within the stream. The local resident stated that she and a group of friends had rode inner tubes down the concrete stream channel shortly after a rainfall event. She stated that this happened only one time and that she had not observed or heard of anyone else recreating in the stream.

Table 7.11 Summary of recreational activities noted in interviews for West Mud Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location.

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak, Tube
WM01	2						
WM02	1				1,0,0		
WM03	0						
WM04	1	1,1,0			1,1,0	1,1,0	1,1,0
WM05	1	1,1,1	1,1,1	1,1,1		1,1,1	1,1,1
WM06	0						
WM07	0						
WM08	0						
WM09	0						
WM10	2						
WM11	4					1,0,0	
WM12	2						1,0,0
General AU							
Totals	13	2,2,1	1,1,1	1,1,1	2,1,0	3,2,1	3,2,1

Summary

RUAA surveys were conducted at 12 sites along West Mud Creek (0611D) on the days of June 3-5, 2014 and August 8-10, 2014. The Palmer Drought Severity Index (PDSI) represented slightly wet conditions for East Texas during both surveys (TWDB, 2014). During the two surveys, there were no recreational activities directly observed by TIAER field staff. Interviews revealed that swimming, adult wading, children wading, hunting and/or fishing has occurred at a few sites throughout the reach, although not frequently. Areas of the stream open to the public are limited to the right-of-ways immediately underneath bridge crossings or areas immediately up and down stream of culvert crossings, typically ranging from 5 to 20 meters. Recreational activities reported by interviewees are summarized in Figure 7.85. Overall RUAA findings are summarized in the form below.

Characteristics encountered that would promote recreation via public access to West Mud Creek were encountered at a few sites. At Site WM03, there were footpaths leading to the stream, a vehicle trail along the southeast side of the bridge crossing, and an area suitable for launching a small boat. At Site WM07, there was an area suitable for parking a vehicle near the bridge crossing. Site WM08 was located in close proximity to a residential area. Site WM11 was adjacent to a privately owned golf course along the right bank and a residential area along the left bank. Site WM12 was located in close proximity to a residential area with a stairway leading to a pedestrian tunnel under the road near the creek.

The rural nature of the majority of the area surrounding West Mud Creek is an impediment to recreation. Although eight of the sites are considered publicly accessible, access was typically limited to the area immediately underneath the bridge. All other areas along West Mud Creek are accessible only by landowner permission.

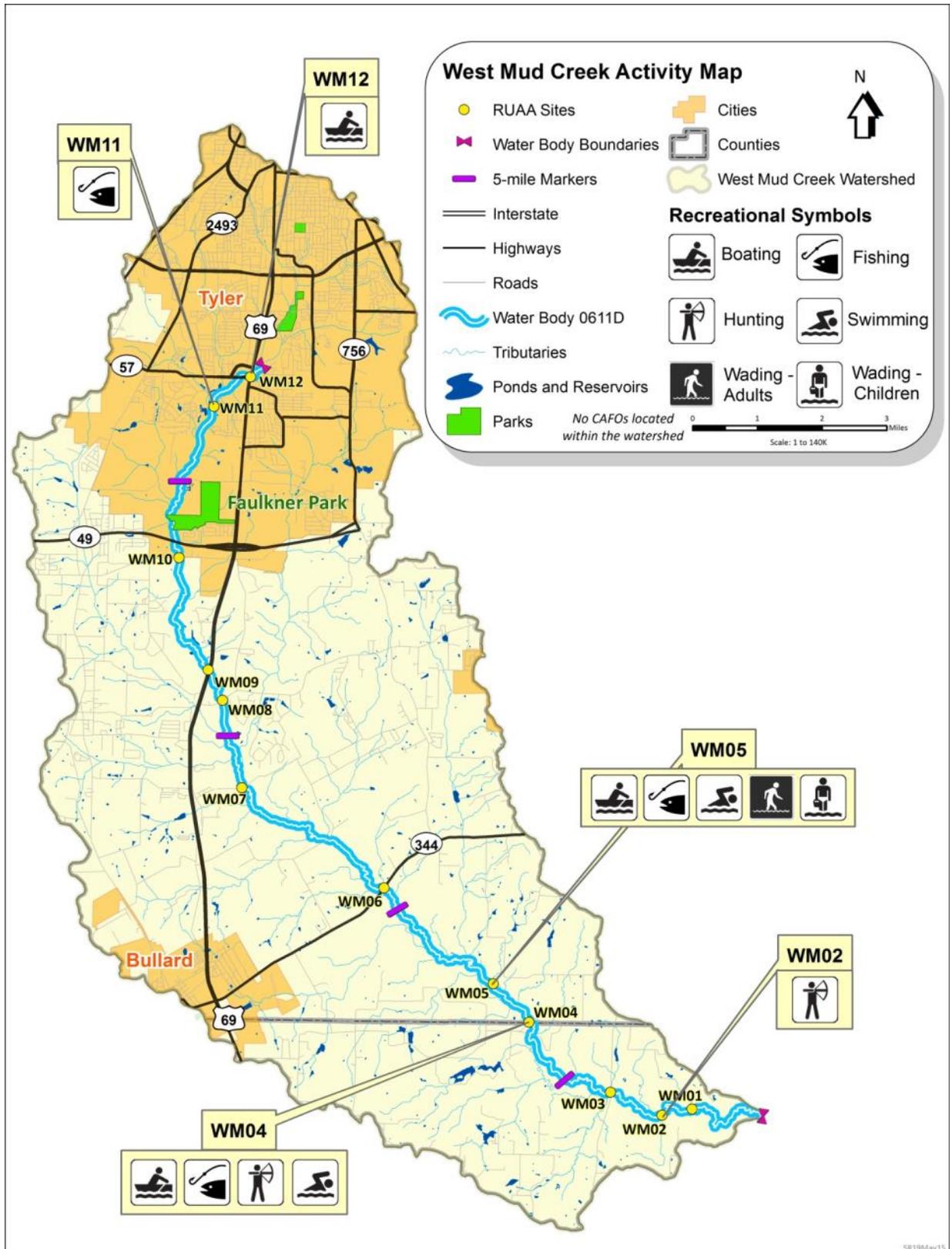


Figure 7.34 Summary of observed and interviewed human activities on West Mud Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: West Mud Creek
Segment No. of Nearest Downstream Segment No.: Segment 0611D
Classified?:No
County: Smith and Cherokee

1. Observations on Use

- a. Do primary contact recreation activities occur on the water body?
 frequently seldom not observed or reported unknown
- b. Do secondary contact recreation 1 activities occur on the water body?
 frequently seldom not observed or reported unknown
- c. Do secondary contact recreation 2 activities occur on the water body?
 frequently seldom not observed or reported unknown
- d. Do noncontact recreation activities occur on the water body?
 frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body

- a. What is the average thalweg depth? 0.8 meters
- b. Are there substantial pools deeper than 1 meter? Yes No
- c. What is the general level of public access?
 easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

- Mild-Extreme Drought
 Incipient dry spell
 Near Normal
 Incipient wet spell
 Mild-Extreme Wet

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