

Recreational Use Attainability Analysis for Lilly Creek (0409A) in the Cypress Creek River Basin

By Leah Taylor
Texas Institute for Applied Environmental Research
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Chapter 1. Introduction

Problem Statement

Lilly Creek (0409A) is an unclassified water body identified for assessment purposes by the Texas Commission on Environmental Quality (TCEQ). Lilly Creek is approximately 20 river miles long and is comprised of one assessment unit (AU). The 2018 Texas Integrated Report of Surface Water Quality (TCEQ, 2018a) defines Lilly Creek (0409A) as being located from the confluence with Little Cypress Creek to the Camp County line near Lawton in Upshur County (Figure 1.1). Lilly Creek is listed as impaired for bacteria on the 2018 Texas 303(d) list for bacteria. AU01 was first listed in 2016 and has continued to be listed as impaired for bacteria on the 2018 Texas 303(d) list. There are no additional impairments or concerns for Lilly Creek. The Texas Integrated Report of Surface Water Quality (TCEQ, 2018a) includes the Texas 303(d) list of impaired water bodies and is available online dating back to 1992.

Lilly Creek (0409A) has a presumed use of primary contact recreation based on the Texas Surface Water Quality Standards (TSWQS) (TCEQ, 2010). Prior to June 2010 only two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the 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. On February 12, 2014, TCEQ adopted a fourth designation of contact recreation, primary contact 2. 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 water bodies 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 use category for recreation should be considered.

Use attainability analyses (UAAs) are studies to evaluate the designated or presumed uses of a water body. In order to identify and assign attainable uses and criteria to individual water bodies, 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, the findings of which are presented within this report for Lilly Creek (0409A).

Objectives

The objective of this report is to present the findings of a Comprehensive RUAA for Lilly Creek following TCEQ March 2014 Procedures for a Comprehensive RUAA and a Basic RUAA Survey (TCEQ, 2014b). 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. All components of this RUAA were performed by 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 TCEQ approved Quality Assurance Plan (QAP; TIAER, 2020).

Stakeholder and Agency Involvement

TCEQ and its collaborating entities maintain an inclusive public participation process. From the inception of this project, the project team sought to ensure that stakeholders were informed and involved. TIAER provided coordination for public participation for this project.

Input from TCEQ regional staff, United States Geological Survey regional staff, Texas Parks and Wildlife Department (TPWD) regional staff, and other local agencies was solicited as well as input from watershed stakeholders on the need for the RUAA (see Contact Information Form available on the project website noted below).

Meetings with state agencies, river authority representatives, local officials, and stakeholders were held to give an overview of water quality issues within Lilly Creek watershed and to obtain comments on proposed survey sites prior to field data collection. Meetings targeted local and state agencies as well as stakeholders in an effort to inform them of the assessment of water quality within Lilly Creek and the need for an RUAA.

A public meeting focusing specifically on the RUAA was held at the Hansen-Sewell Center located in Pittsburg, Texas on February 17, 2020. At this meeting input was sought on the proposed sampling sites for the Lilly Creek RUAA. Attendees provided information regarding activities that typically occur within the watershed and offered assistance in accessing the stream via privately owned property.

A final public meeting occurred on January 20, 2022 virtually on Zoom to inform stakeholders of the findings of both field surveys. The next steps of the RUAA were discussed at this meeting and feedback from stakeholders was solicited. At the meeting, stakeholders were informed that the draft RUAA report was open for public review and comment. No comments were received during the meeting nor during the 30 day review period.

Watershed stakeholders were invited to attend public meetings through mailed invitations, public announcements (TCEQ website), and individual phone calls. Information on past meetings for this RUAA, presentations, and other information, can

be found on the project's website:

www.tceq.texas.gov/waterquality/standards/ruaas/cypress-creek-basin-ruaa-part3

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 each water body. A combination of Geographic Information System (GIS) data, review of historical information, and meetings, phone conversations with local entities and stakeholders were used to determine sites included in the RUAA field surveys.

Watershed Reconnaissance and Site Selection Strategy

Reconnaissance of each watershed was conducted to collect background information before selecting appropriate sites for each 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) recommends selecting three sites per every five miles of stream. Based on this recommendation, the preferred number of sites for Lilly Creek was 12.

The following information was compiled using GIS based tools prior to, during, and immediately following the watershed reconnaissance:

- 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.
- Location of permitted wastewater outfalls and other potential point sources.
- Hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations.
- Location of city boundaries or other designated population areas.

The site selection process considered locations that were accessible to the public, had the highest potential for recreational use, and that were established 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 degrees Fahrenheit or 21 degrees Celsius) when human recreational activities were most likely to occur (May - September). Ideally, field surveys were to be conducted when stream flow conditions were normal. 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 data sheets.
- Photographs of any signs of recreation.
- 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 site was evaluated to determine average thalweg depth. Eleven transects at 30-m intervals were established along the reach. Transects were labeled upstream to downstream with the 300-m transect at the most upstream point of the survey and the 0-m transect being the most downstream. Thalweg was measured at each of the eleven transects. Where significant pools were encountered along the 300-m reach, depths, widths and lengths were measured and recorded. Depths, lengths and widths are presented in meters as 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 TCEQ-approved QAP (TIAER, 2020).

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.).
- Riparian zone characteristics (forest, pasture, eroded banks, etc.).
- Stream accessibility.
- Substrate type.
- Anecdotal information related to observed human contact activities.

Photographs

TIAER staff created photographic records of each site during the site surveys. Photographs were intended to clearly depict the characteristics of the channel and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were taken specifically at the 0-m, 150-m, and 300-m transects (as described in the Field Data Sheets). 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 taken to indicate potential bacteria sources to the water body. All photographs were labeled in a manner that indicated the date, site location, orientation to the stream, and photo's subject. Selected photos representative of each RUAA field site are included with the survey results for each water body in this report.

Chapter 3. Study Area

Description of Lilly Creek

Lilly Creek is primarily located in Upshur and Camp Counties with a portion of the stream extending into Wood County in the eastern portion of Texas. Water body 0409A is within the Cypress Creek River Basin. The large sized watershed is approximately 77,321 acres (roughly 120.82 square miles) with a population of 3,316 (USCB, 2010). The watershed does not include parks and its nearest city is Pittsburg (population 4,523) (USCB, 2010).

Climatic Conditions

Annual precipitation for the Lilly Creek watershed was based on data obtained from the National Oceanic and Atmospheric Administration's website (NOAA, 2015) for Gilmer, Texas (Station USC00413546). It is important to note that this station is not within the Lilly Creek watershed boundaries. However, it is the nearest station with climate data available for both precipitation and temperature. Normal precipitation (1981-2010) for Station USC00413546 averages 46.84 inches per year with a peak rainfall typically occurring in the months of May and October (Figure 3.1).

Average maximum temperatures for Station USC00413546 rise above 70°F beginning in April and ending in October (Figure 3.1). March through October are the months known as generally suitable for assessing recreational use, but only if temperatures reach above 70°F (TCEQ, 2014b).

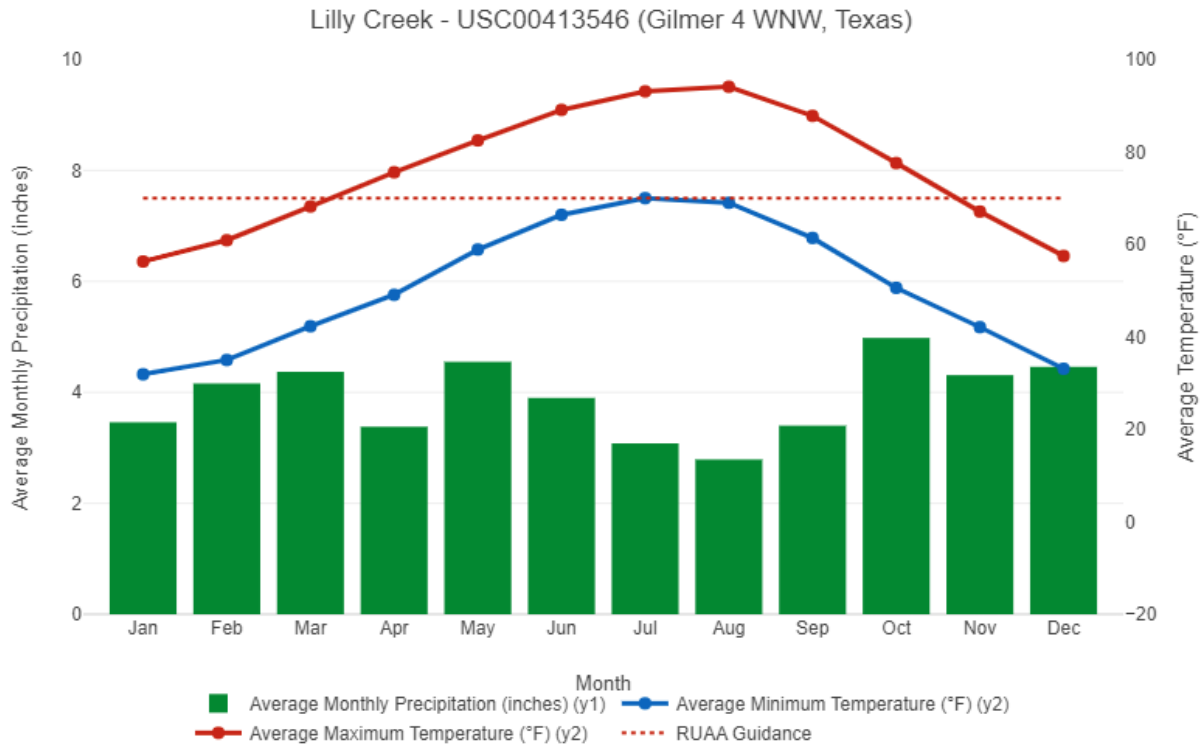


Figure 3.1 Monthly average precipitation for Gilmer, Texas

Source: NOAA (2015) based on data for 1974-2015.

Land Use and Land Cover

The Lilly Creek watershed lies within the Piney Woods ecoregion as defined in the publication Ecoregions of Texas (Griffith et al., 2007). The dominant land cover within the Lilly Creek watershed is Pasture/Hay at 36.79% and is present throughout the watershed (Table 3.1 and Figure 3.2). Mixed Forest is the secondary land cover encompassing 26.36% of the Lilly Creek watershed.

Table 3.1 Land use/land cover classes within the Lilly Creek watershed

Source: 2011 National Land Cover Database (USGS, 2016).

Class	Area (acres)	Percent (%)
Pasture/Hay	28,456	36.79%
Mixed Forest	20,386	26.36%
Woody Wetlands	9,236	11.94%
Deciduous Forest	6,374	8.24%
Evergreen Forest	3,481	4.50%
Grassland/Herbaceous	2,457	3.18%

Class	Area (acres)	Percent (%)
Developed, Low Intensity	1,848	2.39%
Developed, Open Space	1,680	2.17%
Shrub/Scrub	1,458	1.89%
Emergent Herbaceous Wetlands	1,008	1.30%
Open Water	721	0.93%
Developed, Medium Intensity	164	0.21%
Barren Land (Rock/Sand/Clay)	41	0.05%
Developed High Intensity	26	0.03%
Cultivated Crops	3	0.00%
TOTAL	77,341	100%

The land use/land cover for the watershed area was obtained from the National Land Cover Database (NLCD) maintained by the U.S. Geological Survey (USGS, 2016). The land use/land cover categories within the watershed are described as follows from the NLCD legend:

- Pasture/Hay - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- Mixed Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
- Woody Wetlands - areas of forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
- Evergreen Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
- Grassland/Herbaceous - Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

- Developed, Low Intensity - Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
- Developed, Open Space - Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- Open Water - Areas of open water, generally with less than 25% cover of vegetation or soil.
- Developed, Medium Intensity - Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
- Barren Land (Rock/Sand/Clay) - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
- Developed High Intensity - Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
- Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.

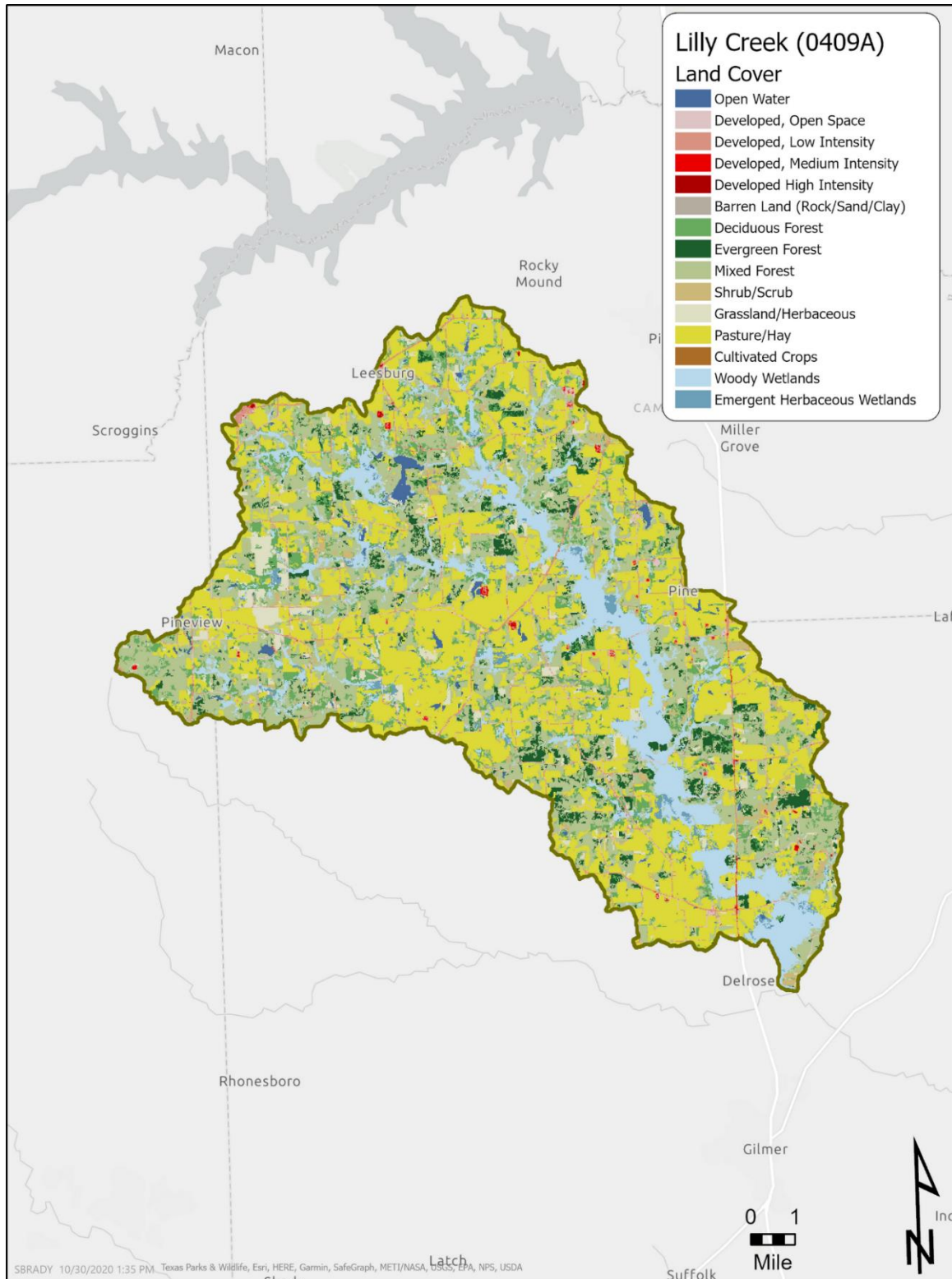


Figure 3.2 Land use and land cover of the Lilly Creek watershed

Source: 2016 National Land Cover Database (USGS, 2016).

Regulated Sources

Potential sources of fecal pollution, as measured by indicator bacteria *Escherichia coli* (*E. coli*), can be divided into two primary categories: regulated and unregulated. Pollution sources that are regulated have permits issued by TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) and/or by the United States Environmental Protection Agency (USEPA) under the National Pollutant Discharge Elimination System (NPDES) and are generally point sources. Examples of regulated sources include domestic and industrial wastewater treatment facilities (WWTFs); stormwater from industries, construction, and municipal separate storm sewer systems (MS4s) of cities; and concentrated animal feeding operations (CAFOs). These various regulated sources are required to have either an individual permit that is specific for each facility or a general permit for operation.

Wastewater Discharge Facilities

There are two municipal wastewater treatment facilities (WWTF) within the Lilly Creek watershed. Neither WWTF discharges directly into Lilly Creek. One WWTF is associated with Luminant Mining Company LLC (WQ0004681000) for discharges to Outfalls 001 and 00R to Lamar Branch, then to North Lilly Creek, then to Lilly Creek. The second WWTF is associated with the Union Hill ISD in Upshur County (WQ0013885001). This WWRF does not discharge to Lilly Creek at all.

Regulated Stormwater

The TPDES and the NPDES Municipal Separate Storm Sewer (MS4) Phase I and II rules require municipalities and certain other entities in urban areas to obtain permits for their stormwater systems. Phase I permits are individual permits for large and medium sized communities with populations exceeding 100,000, whereas Phase II permits are for smaller communities that are located within an “Urbanized Area”. An “Urbanized Area” is defined by the U.S. Census Bureau as an area with populations greater than 50,000 and with an overall population density of at least 1,000 people per square mile. Because there are no cities within the watershed that meet this requirement, there are no entities required to obtain a stormwater permit.

Concentrated Animal Feeding Operations

There are no concentrated animal feeding operations (CAFOs) within the watershed.

Potential Unregulated Sources

Unregulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple diffuse locations and is usually carried to surface waters by rainfall runoff, and the sources are not regulated by permit under the TPDES and NPDES. Potential unregulated sources include wildlife (mammals and birds), large exotics, unmanaged feral animals (e.g., feral hogs), on-site sewage facilities (OSSFs), pets, and livestock.

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 *E. coli* to nearby water bodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2017). While these are county level statistics and thus only a very rough estimate of livestock in the watershed (Table 3.2), these statistics indicate that chickens, cattle and calves, and horses and donkeys are the most common livestock found within the watershed.

Table 3.2 Estimated livestock numbers within the Lilly Creek watershed based on statistics for Upshur, Camp, and Wood Counties and adjusted for the percent of each county represented by the watershed

Source: USDA, 2012

The Lilly Creek watershed comprises about 49.1% in Upshur County, 47.6% in Camp County, and 3.3% in Wood County.

County	Chickens	Cattle & Calves (all beef)	Horses & Donkeys	Goats	Hogs & Pigs	Sheep
Camp	2,432,811	41,236	877	202	1,814	238
Upshur	763,943	100,998	2,605	1,800	846	412
Wood	4,804,532	89,056	2,809	1,568	548	1,858
Proportional Average for the Lilly Creek Watershed	418,946	12,167	331	188	168	131

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (USEPA, 2009). A rough estimate of the dog and cat population can be computed assuming there are 0.614 dogs and 0.457 cats per household (AVMA, 2018). According to the 2010 census there are 1,657 households within the Lilly Creek watershed which indicates that there are potentially 923 dogs and 687 cats residing within the watershed.

Wildlife

E. coli bacteria are common inhabitants of the intestines of all warm-blooded animals, including wildlife such as mammals and birds. Wildlife are naturally attracted to riparian corridors of streams and rivers. With direct access to the stream channel, the deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where it may be washed into nearby streams by rainfall runoff.

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, 911 address points outside of city boundaries and outside of any area municipal utility districts were used. Results were unclear as to how many households in the watershed are outside municipal areas and on septic systems.

Historical Information on Recreational Use

A review of historical information was performed regarding recreational water uses for Lilly Creek. 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, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review and searches.

Government Sources

City of Pittsburg

[City of Pittsburg Homepage¹](#)

Search retrieved no results.

Camp County

[Camp County Homepage²](#)

Search retrieved no results.

Upshur County

[Upshur County Homepage³](#)

Search retrieved no results.

Wood County

[Wood County Homepage⁴](#)

Search retrieved no results

Library Sources

City of Pittsburg Public Library

[City of Pittsburg Public Library Homepage⁵](#)

Phone: (903) 593-856-3302

Searched online catalog. Search retrieved no results.

Newspaper Sources

Pittsburg Morning Telegraph

¹ www.pittsburgtexas.com/

² www.co.camp.tx.us/

³ www.countyofupshur.com/

⁴ www.mywoodcounty.com/

⁵ www.pittsburglibrary.org/

[Pittsburg Gazette](#)⁶

Phone: (940) 856-6629

Explored various links and online texts. Search retrieved no results.

Internet Searches

Google

[Google.com – Search for Lilly Creek](#)⁷

Searched Google by creek name. Search retrieved no results of recreational contact.

The Handbook of Texas Online

[The Handbook of Texas Online - Search for Lilly Creek](#)⁸

Searched the handbook by creek name. Search retrieved no results of recreational contact.

⁶ www.campcountynow.com/

⁷ www.google.com/search?q=black+fork+creek&rlz=1C1CHBD_enUS865US865&oq=black+fork+creek&aqs=chrome..69i64j69i59l2j69i58j69i60l4.4879j0j4&sourceid=chrome&ie=UTF-8

⁸ www.tshaonline.org/handbook/entries/lilly-creek

Chapter 4. Lilly Creek (0409A)

Survey Site Descriptions

Lilly Creek is 20 river miles long indicating a goal of 12 sites (3 sites per 5 miles of river) for the RUAA survey. With the help of cooperating stakeholders, TIAER was able to establish a total of 6 survey sites along Lilly Creek (Figure 4.1 and Table 4.1). Of all six sites, only one was located on private property. Landowner permission to access Site LC01 was granted during a public stakeholder meeting. The other five sites were located at public road crossings.

For the five, publicly accessible sites, there was no fencing upstream or downstream of the crossings. Access to the stream between road crossings was moderately difficult due to steep banks and dense vegetation. The average distance between survey sites was 3.55 river miles with the largest gap being 5.71 river miles between Sites LC03 and LC04. Sites LC02, LC03, LC04, and LC05 are co-located with TCEQ sampling stations. RUAA surveys were performed June 22, 2021 and August 24, 2021 at all locations. Landowner permission was not required to access sites at any location. A brief description of each site follows.

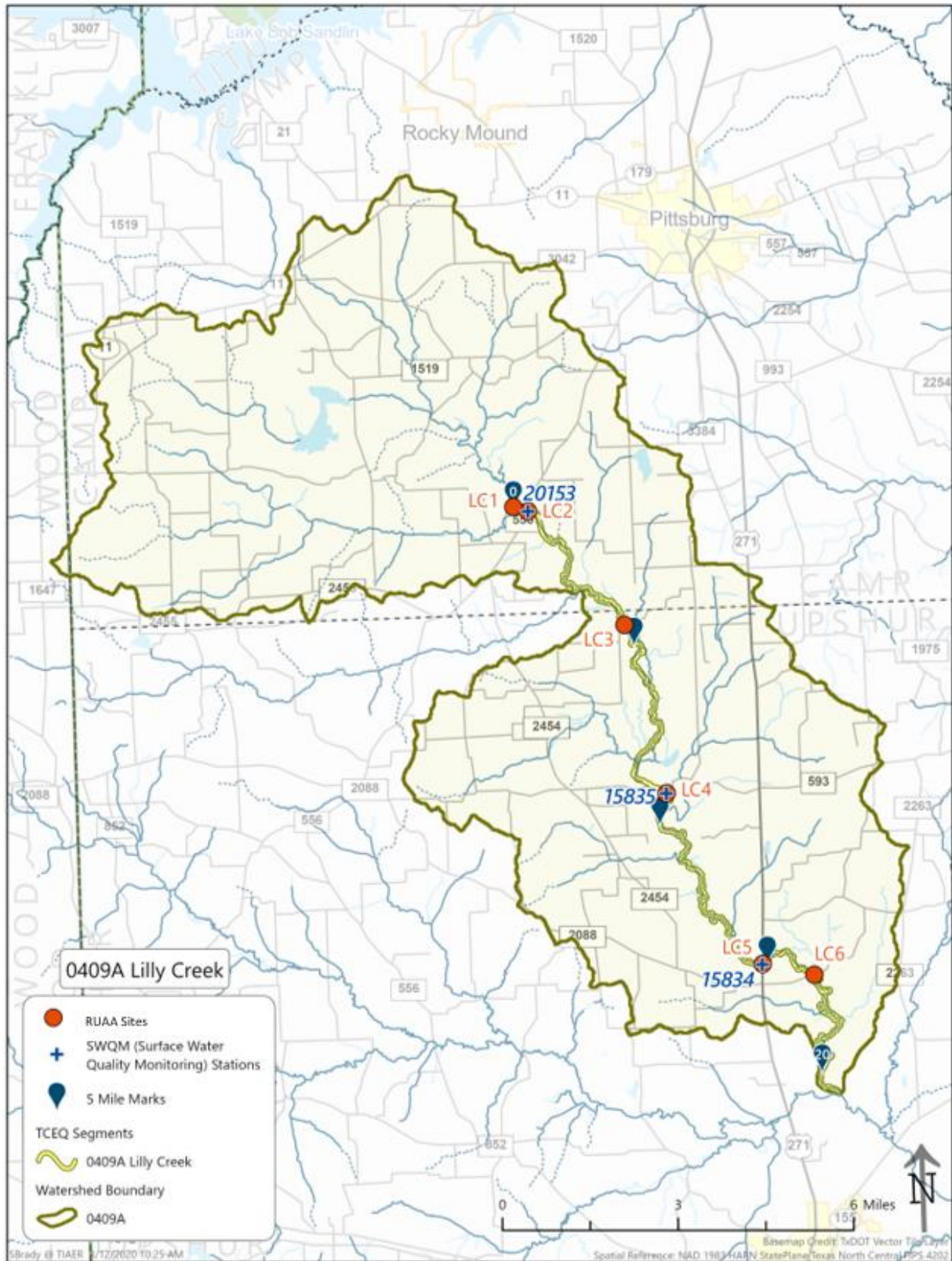


Figure 4.1 Watershed of Lilly Creek (0409A)

Table 4.1 Description and location of RUAA field survey sites for Lilly Creek, Water Body 0409A

Site ID	TCEQ ID	Site Description	Latitude	Longitude	Access
LC01		Lilly Creek on private property northwest of FM 556	32.92924	-95.02125	Private
LC02	20153	Lilly Creek at FM 556	32.92801	-95.01697	Public
LC03	15833	Lilly Creek at Turtle Road	32.8991	-94.98976	Public
LC04	15835	Lilly Creek at Mule Deer Road	32.85705	-94.97903	Public
LC05	15834	Lilly Creek at HWY 271	32.81399	-94.95252	Public
LC06		Lilly Creek at Bluebonnet Road	32.81088	-94.93747	Public

Site LC01 is the most downstream site located on Lilly Creek. This site is located on private property and required landowner permission to access.

Site LC02 is located on Lilly Creek about 3.99 miles from site LC01. This site is publicly accessible via the road crossing on FM 556 in Camp County and is co-located with TCEQ sampling station 20153. Due to very dense vegetation and steep banks, access into the stream was moderately difficult. Landowner permission to access the stream from the road crossing was not required to complete the surveys.

Site LC03 is located on Lilly Creek about 4.87 miles from site LC02. This site was publicly accessible via the road crossing on Turtle Road in Upshur County. Site LC03 is co-located with TCEQ sampling station 15833. Access to the stream was moderately easy. Landowner permission to access the stream from the road crossing was not required to complete the surveys.

Site LC04 is located on Lilly Creek Creek about 5.71 miles from site LC03. This site is co-located with TCEQ sampling station 15835 and was publicly accessible via the road crossing on Mule Deer Road in Upshur County. Access to the stream was ranged from moderately easy and difficult throughout the reach. Landowner permission to access the stream from the road crossing was not required to complete the surveys.

Site LC05 is located on Lilly Creek about 1.360 miles from site LC04. This site was publicly accessible via the road crossing on HWY 271 in Upshur County. Site LC05 is co-located with TCEQ sampling station 15834. Access to the stream was moderately difficult due to steep banks and thick vegetation. Landowner permission to access the stream from the road crossing was not required to complete the surveys.

Site LC06 is located on Lilly Creek about 4.38 miles from site LC05. This site was publicly accessible via the road crossing at Bluebonnet Road in Upshur County. Access

to the stream was ranged from moderately easy and difficult throughout the reach. Landowner permission to access the stream from the road crossing was not required to complete the surveys.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Lilly Creek 0409A

The Lilly Creek RUAA surveys were conducted on June 22 and August 24, 2021 at all six sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior to 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 4.2 and 4.3). In the 30 days prior to the first survey, 3.33 inches of precipitation fell, while 3.02 inches fell 30 days prior to the second survey. These rainfall events did not cause a hindrance to accessing the stream. The Palmer Drought Severity Index (PDSI) indicated moderately moist (index value: +2.00 to +2.99) conditions for East Texas during June and very moist conditions (+3.00 to +3.99) for August (TWDB, 2020).

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

- Table 4.4 describes the stream channel and corridor characteristics at each site.
- Table 4.5 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 4.6 and 4.7 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 4.8 and 4.9 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. Five of the six sites were at public road crossings with one site being on private property. Overall thalweg depth averaged 0.59 m for the first survey and 0.34 m for the second survey. Access to the stream was moderately easy or moderately difficult at all six sites due to gentle, but densely vegetated banks. The dominant substrate was mud and clay. The majority of the stream corridor was forest and shrub several areas lined with pasture. The maximum stream width encountered was 16.3 m at Site LC02 during the first survey. Typical stream widths were widest at the upper portion of Site LC02 (8 m) with a narrow width of 0 m at LC01 and LC02. Flow conditions appeared normal at all sites during the first survey and low or showed no flow at all sites during the second survey. The water was brown in color at all sites during both surveys. The water surface was clear at all sites during the first survey, but had scum apparent at Sites LC03, LC04, and LC05 during the second survey. Evidence of wildlife was rarely observed at sites, most commonly in the form of raccoon and hog tracks. Trash was rarely observed at most survey sites

and when observed was typically plastics, aluminum cans, and bottles. No evidence of recreation was observed at any of the six survey sites.

Table 4.2 Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the first RUAA survey initiated on June 22, 2021

Survey dates are bolded and highlighted in gray. Weather Data from Weather Underground; East Texas Regional Airport Station in Longview, Texas. (Weather Underground, 2020)

Date	Daily Precipitation (in)	High Temperature (°F)	Low Temperature (°F)
May 21	0.27	77	69
May 22	0.31	75	68
May 23	0	81	67
May 24	0.01	80	69
May 25	0.03	82	67
May 26	0.11	85	67
May 27	0	88	71
May 28	0	80	64
May 29	0	81	68
May 30	0	76	57
May 31	0	83	61
June 1	0	80	67
June 2	0	79	62
June 3	0	80	64
June 4	0	77	67
June 5	0.12	84	68
June 6	1.50	85	68
June 7	0.35	84	69
June 8	0.18	84	70
June 9	0.17	92	75
June 10	0	90	74
June 11	0	90	77
June 12	0	82	74
June 13	0	95	72
June 14	0.28	94	72
June 15	0	93	74
June 16	0	95	71
June 17	0	91	75
June 18	0	89	70
June 19	0	93	68
June 20	0	92	75
June 21	0	93	74
June 22	0	83	70

Table 4.3 Rainfall records with maximum and minimum temperature for Pittsburg, Texas 30 days prior to the first RUA survey initiated on August 24, 2021

Survey dates are bolded and highlighted in gray. Weather Data from Weather Underground; East Texas Regional Airport Station in Longview, Texas. (Weather Underground, 2020)

Date	Daily Precipitation (in)	High Temperature (°F)	Low Temperature (°F)
July 24	0.04	91	75
July 25	0	92	74
July 26	0	93	73
July 27	0	93	76
July 28	0	93	77
July 29	0	95	76
July 30	0	95	76
July 31	0	94	76
August 1	0	95	77
August 2	0.15	81	73
August 3	0.16	87	73
August 4	0	88	70
August 5	0	87	67
August 6	0	90	70
August 7	0	91	71
August 8	0.12	93	75
August 9	0	93	75
August 10	0	94	76
August 11	0	93	75
August 12	0	94	74
August 13	0	94	73
August 14	0	93	73
August 15	0	90	72
August 16	0	90	71
August 17	0	90	73
August 18	1.08	89	72
August 19	1.19	88	76
August 20	0.28	93	75
August 21	0	92	72
August 22	0	93	75
August 23	0	93	74
August 24	0	94	73

Table 4.4 Stream channel and corridor appearance for each site sampled along Lilly Creek (0409A)

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
LC01	Natural	Mud/Clay	Forest/Shrub	Small	No	Forest/Shrub
LC02	Natural	Mud/Clay	Forest/Shrub	Small	No	Forest/Shrub
LC03	Natural	Mud/Clay/Gravel	Forest/Shrub	Small	No	Forest/Shrub
LC04	Natural	Mud/Clay	Forest/Shrub	Small	No	Forest/Shrub
LC05	Natural	Mud/Clay	Forest/Shrub	Small	No	Forest/Shrub
LC06	Natural	Mud/Clay	Forest/Shrub	Small	No	Forest/Shrub

Table 4.5 Thalweg depth, stream flow type, and site accessibility during the two surveys of Lilly Creek (0409A)

Stream flow type represents observed stream characteristics on the date of the survey. Under general access, * indicates that the site was publicly 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 Survey 1	Stream Flow Type Survey 2	General Access	Bank Access
LC01	300	11	0	0.33	0	Intermittent with Pools	Intermittent with Pools	Public	ME
LC02	300	11	0	0.50	0.15	Intermittent with Pools	Intermittent with Pools	Public	MD
LC03	300	11	0	0.57	0.32	Intermittent with Pools	Intermittent with Pools	Public	ME
LC04	300	11	0	0.69	0.56	Intermittent with Pools	Intermittent with Pools	Public	ME/MD
LC05	300	11	0	0.78	0.63	Intermittent with Pools	Intermittent with Pools	Public	MD
LC06	300	11	0	0.64	0.36	Intermittent with Pools	Intermittent with Pools	Public	ME/MD

Table 4.6 Description of surveyed stream sites along Lilly Creek during the first survey performed on June 22, 2021

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
LC01	7.3	1.4	3.5	Normal
LC02	16.3	0.93	5	Normal
LC03	8.1	6.3	7	Normal
LC04	11	3.7	7	Normal
LC05	8	2.7	6	Normal
LC06	6.5	2.5	4	Normal

Table 4.7 Description of surveyed stream sites along Lilly Creek during the second survey performed on August 24, 2021

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
LC01	0	0	0	No Flow
LC02	14.3	0	0 for lower; 8 for upper	No Flow
LC03	7.6	0.70	5.5	Low
LC04	10.3	1.7	6.5	Low
LC05	7.5	1.8	5	Low
LC06	5.5	1.7	3.5	Low

Table 4.8 Stream aesthetics along Lilly Creek during the first survey performed June 22, 2021

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
LC01	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	N	N	N
LC02	R	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	N	N	N
LC03	A	A	R	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	N	R	R
LC04	R	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	C	N	R
LC05	A	A	N	Brown	Fine Sediment	Clear	SP	N	N	Tracks/Fecal Droppings	N	N	R
LC06	A	A	N	Brown	Fine Sediment	Clear	SP	N	N	Tracks/Fecal Droppings	R	R	R

Table 4.9 Stream aesthetics along Lilly Creek during the second survey performed August 24, 2021

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 because conditions were dry.

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
LC01	A	A	N	N/A	Fine Sediment	N/A	SP	N	N	Tracks/Fecal Droppings	N	N	N
LC02	R	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	R	N	N
LC03	A	A	N	Brown	Fine Sediment	Scum	SP	N	N	Tracks/Fecal Droppings	N	R	R
LC04	R	A	N	Brown	Fine Sediment	Clear/Scum	N	N	N	Tracks/Fecal Droppings	C	N	R
LC05	A	A	N	Brown	Fine Sediment	Clear/Scum	N	N	N	Tracks/Fecal Droppings	N	N	R
LC06	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal Droppings	N	R	R

Physical Description of LC01

Lilly Creek site LC01 was visited on June 22 and August 24, 2021. This site was located on private property in Camp County. Landowner permission was required and granted to access the stream at this site.

The creek at this site passes through a forest riparian zone that led directly up to the creek. Banks, while not steep, were slippery and had large, above ground tree roots. The general appearance of the creek at this location is shown in Figures 4.2 and 4.3.



Figure 4.2 Photograph of Lilly Creek Site LC01 taken on June 22, 2021

The downstream view of the 150-m transect

Site LC01 was wadeable with average thalweg of 0.33 m during the first survey. Site LC01 was dry at the time of the second survey. Figure 4.2 illustrates the typical observed width of the creek at this site, approximately 3.5 m. Widths ranged from 0 m to 7.3 m during the two surveys (Tables 4.6 and 4.7).

The stream flow type was observed as intermittent with perennial pools at the time of the first survey (Table 4.5). Aquatic vegetation and algae cover was absent at this site for each survey. The deepest thalweg depth measured during the first survey at the 300-m transect was .50 m and the shallowest was 0.09 m at the 120-m transect during the first survey. No pools were observed during either survey at this site.



Figure 4.3 Photograph of Lilly Creek Site LC01 taken on August 24, 2021

The upstream view of the 300-m transect

No water dependent birds were observed during either survey (Tables 4.8 and 4.9), however, one snake was spotted during the first survey. Raccoon, deer, hog, dog, and cat tracks were noted during both surveys. Aquatic vegetation and algae cover were absent during both surveys. Large and small garbage and bank garbage were all absent during both surveys.

Physical Description of LC02

Lilly Creek at Site LC02 was visited on June 22 and August 24, 2021. This site was located at the FM 556 bridge crossing in Camp County at TCEQ sampling station 20153. Access to this site was moderately difficult because the banks were steep with thick vegetation leading down to the water. The stream was only publicly accessible at the bridge crossing.

The riparian zone at Site LC02 was forest with thick vegetation and shrub dominated corridor on both the right and left banks (Table 4.4). Banks were vegetated with larger trees and a larger shaded understory (Figures 4.4 and 4.5) throughout this site. The stream was wadeable during both surveys with average thalweg depths ranging from 0.0 m to 0.50 m. The stream at this site had no flow from the 0-m transect to the 180-m transect. The stream was designated as intermittent with perennial pools during both surveys (Table 4.5). Channel widths ranged from 16.3 m to 0 m throughout the reach during both surveys with a typical observed width of 5 m (Tables 4.6 and 4.7).



Figure 4.4 Photograph of Lilly Creek Site LC02 taken on June 22, 2021
Photograph shows the upstream view of the 0-m transect.



Figure 4.5 Photograph of Lilly Creek at Site LC02 taken on August 24, 2021
Photograph at the 150-m transect facing downstream.

No water dependent birds were observed at this site during either survey (Tables 4.8 and 4.9). Bird droppings were observed in addition to raccoon, hog, and deer tracks. No evidence of wildlife was observed in either survey. Aquatic vegetation was rare and algae was absent during both surveys. No odor was detected, water color was brown, and the surface clear during each survey. Tires were observed in the channel during the second survey, but no other garbage was observed during either survey.

Physical Description of LC03

Lilly Creek at Site LC03 was visited on June 22 and August 24, 2021. This site was accessed via a bridge crossing at Turtle Road in Upshur County and is co-located with TCEQ sampling station 15833. Access to the stream passed the road crossing was by private property only. The riparian area was forest with thick vegetation on both the right and left banks (Table 4.4). Access to the stream was moderately easy due to banks not being too steep. Public access obstacles include private property past the road crossing and the dense forest riparian zones.

Site LC03 was wadeable during both surveys with average thalweg depths ranging from 0.32 m to 0.57 m (Table 4.5). The stream flow type was characterized as intermittent with perennial pools for this reach. Average stream width was 7 m during the first survey and 5.5 m during the second survey, with maximum and minimum stream widths of 8.5 m and 7.6 m, respectively by survey (Tables 4.6 and 4.7).

The stream banks were densely vegetated (as seen in Figure 4.6) at LC03. Channel obstructions at this site included submerged log jams and tree branches. Additionally, there was a strong odor at this site during the first survey. Aquatic vegetation and algae cover were absent during each survey. The water was brown or tan in color with scum observed during the second survey only.



Figure 4.6 Photograph of Lilly Creek Site LC03 taken on June 22, 2021, the upstream view of the 150-m transect

The only evidence of wildlife observed were deer, hog, and raccoon tracks during both surveys. A small wheel and hubcap were observed during the first survey. No other large garbage was encountered, but some small garbage, in the channel and along the banks was observed in the form of plastic bottles observed during both surveys (Tables 4.8 and 4.9). No evidence of human recreation was observed at this site.

Physical Description of LC04

Lilly Creek site LC04 was visited on June 22 and August 24, 2021. This site was located at the Mule Deer Road and stream crossing in Upshur County. This site is co-located with TCEQ sampling station 15835 and was publicly accessible via the bridge crossing only.

Access to the stream at this site was moderately easy at the road crossing, but because moderately difficult past the road crossing access. The riparian area was forest with thick vegetation and slippery slopes on both the right and left banks (Table 4.4). Banks were steep, slippery, and overgrown with vegetation (Figures 4.7 and 4.8).



Figure 4.7 Photograph of Lilly Creek Site LC04 taken on June 22, 2021

The upstream view of the 150-m transect.

Site LC04 was wadeable with average thalweg ranging from 0.56 m to 0.69 m between surveys. The typical observed width of the creek at this site was approximately 7 m. Widths ranged from 1.7 m to 11 m during each survey (Tables 4.6 and 4.7).

The stream flow type was observed as intermittent with perennial pools at the time of both surveys (Table 4.5). Aquatic vegetation was rarely observed during both surveys, while algae cover was absent during both surveys. No pools were observed during either survey at this site.



Figure 4.8 Photograph of Lilly Creek Site LC04 taken on August 24, 2021

The downstream view of the 0-m transect.

No water dependent birds or reptiles were observed during either survey (Tables 4.8 and 4.9). Tracks and fecal droppings from hogs, deer, and raccoons were noted throughout the survey reach. Typical household garbage (plastics, glass, cans) was observed in the stream and on the bank during each survey. However, large garbage such as tires, were common throughout the stream at this site.

Physical Description of LC05

Lilly Creek at Site LC05 was visited on June 22 and August 24, 2021. This site was located at the HWY 271 bridge crossing in Upshur County. This site is shared with TCEQ sampling station 15834. Access to this site was moderately difficult due to steep, slippery banks with thick tree vegetation leading down to the water. The stream was only publicly accessible at the bridge crossing.

The riparian zone at Site LC05 was forest with thick vegetation along both banks (Table 4.4). The stream was wadeable during both surveys with an average thalweg depths of 0.78 m to 0.63 m between the first and second surveys respectively. The stream is observed as intermittent with perennial pools (Table 4.5). Channel widths ranged from 1.8 m to 8 m throughout the reach during both surveys with a typical observed width of 5 m during the first survey and 6 m during the second survey (Tables 4.6 and 4.7). Figure 4.9 depicts the typical channel width during each survey.



Figure 4.9 Photograph of pool at Lilly Creek Site LC05 taken on June 22, 2021
Photograph shows the upstream view of the 300-m transect.



Figure 4.10 Photograph of Heron Tracks spotted on the banks of Lilly Creek on June 22, 2021

Heron tracks were observed at this site during the first survey (Figure 4.10 and Tables 4.8 and 4.9). Bird droppings were observed in addition to raccoon and hog tracks. Aquatic vegetation was rare during the first survey and absent during the second. Algae cover was absent during both surveys. No odor was detected, water color was brown, and the surface was clear during each survey.

Physical Description of LC06

Lilly Creek at Site LC06 was visited on June 22 and August 24, 2021. This site was accessed via a bridge crossing Bluebonnet Road in Upshur County. Access to the stream past the road crossing was by private property only. The riparian area at this site was crowded with thick vegetation and slippery slopes along both the right and left banks (Table 4.4). There was one, open fishing spot at this site.

Site LC06 was wadeable with thalwegs ranging from 0.39 m to 1.1 m during the first survey (Table 4.5) and 0.2 m to 0.55 m during the second. The average thalweg was 0.64 m and 0.36 m during the first and second surveys, respectively. The stream flow type was characterized as intermittent with perennial pools for this reach. The average stream widths for each survey was 4 m during the first survey and 3.5 m during the second survey (Tables 4.6 and 4.7).

The stream banks were densely vegetated (as seen in Figure 4.11) at BF06. The stream channel was populated with downed logs and twig debris during both surveys (Figure 4.12). Aquatic vegetation and algae cover was absent during both surveys. The water was brown in color with a clear surface during both surveys.



Figure 4.11 Photograph of Lilly Creek at Site LC06 taken on June 22, 2021, the upstream view of the 0-m transect



Figure 4.12 Photograph of Logjam in Lilly Creek at Site LC06 taken on August 24, 2021

The only evidence of wildlife observed were raccoon and dog tracks during both surveys. Large garbage was rarely encountered during the first survey and other small channel and bank garbage (plastic bottles, cans) observed during both surveys (Tables 4.8 and 4.9).

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited sites during times of day and on days when recreational activities were most likely to be observed. Five of the six sites were at public road crossings; however, private property boundaries limited public access to a small area around and underneath all bridge crossings. One site was on private property. No form of recreation was directly observed by TIAER staff during either of the two surveys.

Activities Interviewed

A total of four interviews were collected from landowners along Lilly Creek.

All four interviewees stated they had personally used, seen others use, and heard of others using the stream for fishing. One interview indicated he had heard of swimming back in the early 1990s but believed it to be a rumor. Multiple interviews noted that they see people fishing in Lilly Creek throughout the year multiple times a year. One interview indicated they used the stream for hunting hogs, deer, and ducks in season. Another interview stated the interviewee rents a hunting lease around Site LC06 and uses the stream for hunting (Table 4.10).

Activities listed in Table 4.10 indicate the number of times personal use, observed use, and/or heard of use was documented from interviews for a given location or in general along the assessment unit. Blank cells in Table 4.10 indicate no interviewed feedback for that location.

Table 4.10 Summary of recreational activities noted in interviews for Lilly Creek

Site Name	Number of Interviews	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat, Canoe, Kayak
LC01							
LC02							
LC03	2	0,0,0	0,0,0	0,0,0	0,0,0	2,2,2	0,0,0
LC04							
LC05							
LC06	1	0,0,0	0,0,0	0,0,0	1,0,1	1,1,1	0,0,0
General AU	1	0,0,0	0,0,0	0,0,0	1,1,1	1,1,1	0,0,0
Totals	4	0,0,0	0,0,0	0,0,0	2,1,2	4,4,4	0,0,0

Summary

RUAA surveys were conducted at six sites along Lilly Creek on June 22, 2021 and August 24, 2021. Temperatures were above 21°C (70°F) during the 30 days prior to each survey (Tables 4.2 and 4.3). Water existed and flowed all six sites on Lilly Creek during the first survey, but lacked flow in two of the six sites during the second survey. Stream flow was considered normal during the first survey but was either low or lacking flow during the second survey based on information provided by local

residents. The Palmer Drought Severity Index (PDSI) indicated moderately moist conditions in June 2021 and very moist conditions in August 2021 (TWDB, 2020).

No recreational activities were observed by TIAER field staff during either survey. Roughly 60% of the watershed through which Lilly Creek falls into two types of land use. Pasture/hay land accounts for the majority at roughly 37%, while mixed forest represents 26%. Steep and slippery banks and overgrown banks with thick vegetation were present at all six sites indicating hazardous locations for recreation.

Interviews indicated four occurrences of recreational activity, hunting and fishing, within the stream. Public access to the stream is limited at all six sites primarily to the right-of-ways immediately surrounding bridge crossings or areas immediately up and down stream of culvert crossings.

Recreational activities observed and reported in interviews are summarized in Figure 4.13. Overall RUAA findings are summarized in the form below.

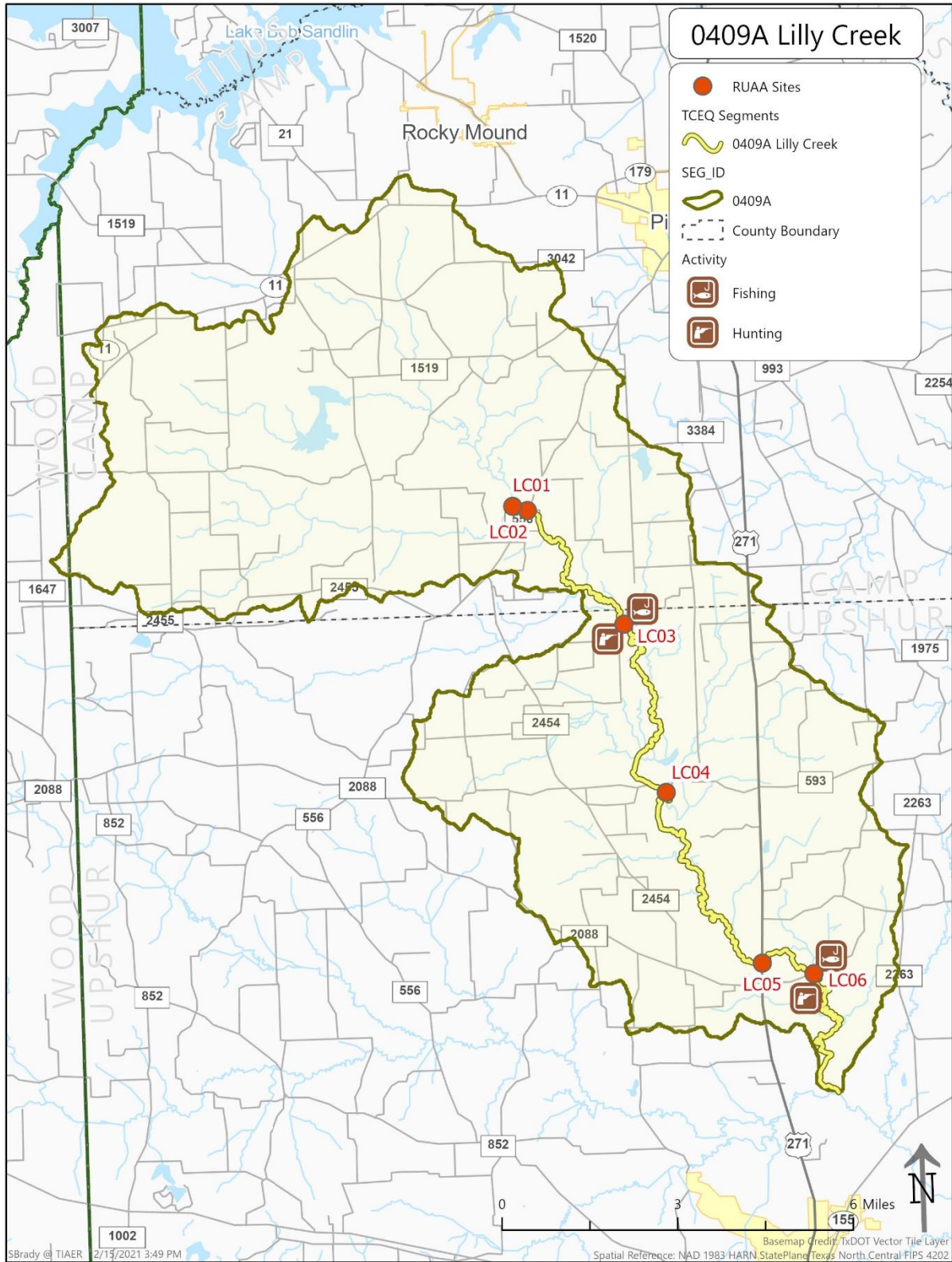


Figure 4.13 Summary of observed and interviewed human activities on Lilly Creek

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: Lilly Creek
Segment No. of Nearest Downstream Segment No.: 0409A
Classified?: No
County: Camp and Upshur Counties

1. Observations on Use

- a. Do primary contact recreation activities occur on the water body?
 frequently seldom not observed or reported unknown
- b. Do primary contact recreation 2 activities occur on the water body?
 frequently seldom not observed or reported unknown
- c. Do secondary contact recreation 1 activities occur on the water body?
 frequently seldom not observed or reported unknown
- d. Do secondary contact recreation 2 activities occur on the water body?
 frequently seldom not observed or reported unknown
- e. 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? 0.73 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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