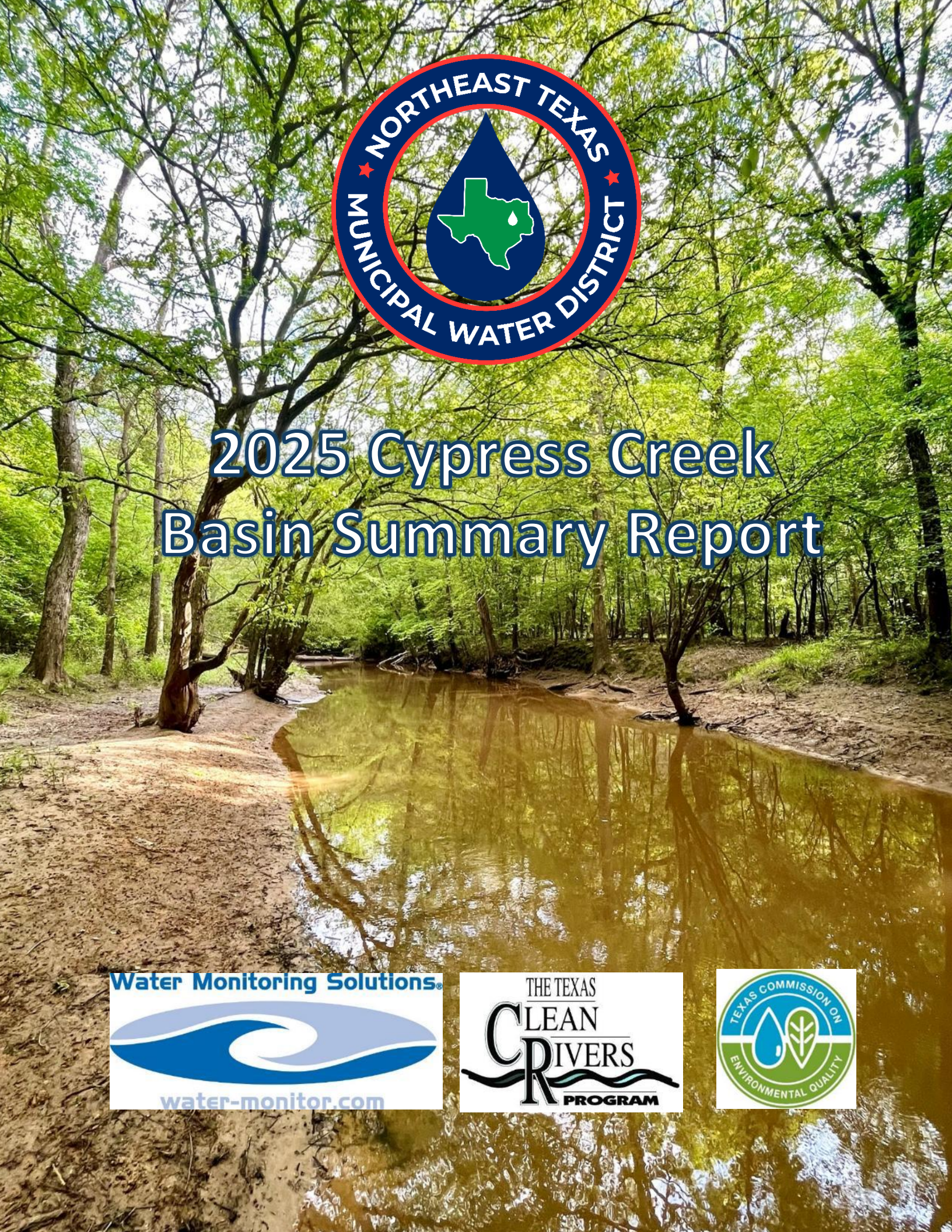

2025 Cypress Creek Basin Summary Report

Water Monitoring Solutions®
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THE TEXAS CLEAN RIVERS PROGRAM

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Foreword

The Clean Rivers Program (CRP) is a water quality monitoring, assessment, and public outreach program administered by the Texas Commission on Environmental Quality (TCEQ) and is funded by state collected fees. The Northeast Texas Municipal Water District (NETMWD) coordinates the CRP for the Cypress Creek Basin. As a participant in the Clean Rivers Program, NETMWD submits its basin highlights and basin summary reports to the TCEQ and CRP partners.

This report and others submitted throughout the State are used to develop and prioritize programs to protect the quality of healthy water bodies and improve the quality of impaired water bodies. Under the CRP, biologists and field staff collect water quality and biological samples, field parameters and measure flow at sites throughout the Cypress Creek Basin.

Monitoring and analysis are the basis for maintaining good water quality within the Cypress Creek Basin. Within a cooperative program directed by the NETMWD, these activities are an integral part of the State's Clean Rivers Program. Cypress Creek Basin CRP stakeholders include:

- Caddo Lake Institute
- U. S. Steel Tubular Products, Inc.
- Northeast Texas Community College
- Luminant
- Pilgrim's Pride Corporation
- AEP SWEPCO
- Titus Co. Fresh Water Supply District #1
- City of Marshall
- Texas Parks and Wildlife Department
- United States Geological Survey
- Franklin County Water District
- East Texas Baptist University

NETMWD contracts with Water Monitoring Solutions, Inc. (WMS) to fulfill the sampling, data analysis, and reporting requirements of the CRP.

cover photo: Station 15895 - Boggy Creek at SH 49

Get Involved!

Each spring, NETMWD provides a venue for local stakeholders to learn about water quality issues affecting their region and to provide input on projects in their communities. The Cypress Creek Steering Committee meetings allow stakeholders to have input on addressing water quality concerns and to prioritize water quality monitoring within the Cypress Creek Basin. NETMWD and its Clean Rivers Program partners continue to reach out to the public to educate and help resolve local water quality issues. Members of the public, water supply corporations, permitted dischargers, councils of government, and city and county officials are invited annually to become steering committee members.

A joint NETMWD and Sulphur River Basin CRP Steering Committee meeting was held in March 2025 at North Texas Community College and virtually via Zoom. Topics included information on the construction activities of Lake Ralph Hall, Aquatic Invasive Species, updates on the Total Phosphorus Load Agreement and NETMWD's On-site Septic Facility program, and discussions of the Sulphur River Basin Highlights Report and Cypress Creek Basin Summary Report.

NETMWD plans and coordinates monitoring efforts with other basin entities, the TCEQ monitoring staff, Texas Parks and Wildlife Department (TPWD), Caddo Lake Institute, and other interested participants annually within the Cypress Creek Basin. All entities collecting water quality data in the Cypress Creek Basin are encouraged to coordinate their efforts with the NETMWD and participate under the NETMWD Quality Assurance Project Plan.

Visit NETMWD to join the Clean Rivers Program Steering Committee or contact Robert Speight at 903-639-7538 or rspeight@netmwd.org.

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Abbreviations and Acronyms

24-Hour DO	Diel Dissolved Oxygen measurements
ALM	Aquatic Life Monitoring
ALU	Aquatic Life Use
AU	Assessment Unit
cfs	Cubic feet per second (measurement of stream flow)
CN	Concern for Non-attainment of water quality criterion
CS	Concern for Screening level
CRP	Clean Rivers Program
DO	Dissolved Oxygen; 24 HR DO
E. coli	*Escherichia coli* (bacteria)
FM	Farm-to-Market Road
FY	Fiscal Year
IR	Integrated Report
MGD	Million Gallons per Day
mg/L	milligrams per liter
MPN/100 mL	Most Probable Number per 100 milliliters (bacteria measurement units)
NETMWD	Northeast Texas Municipal Water District
NS	Non-support of water quality criterion
R5	TCEQ Region 5 (Tyler)
SH	State Highway
s.u.	standard units (measurement of pH)
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TKN	Total Kjeldahl Nitrogen (organic nitrogen analysis)
TMDL	Total Maximum Daily Load
TPLA	Total Phosphorus Load Agreement
TPWD	Texas Parks and Wildlife Department
USGS	United States Geological Survey
WMS	Water Monitoring Solutions, Inc.
WWTP	Wastewater Treatment Plant
§303(d) List	Impaired water bodies in Section §303(d) of the Federal Clean Water Act
µg/L	micrograms per liter

Executive Summary

The Texas Clean Rivers Program (CRP) is a statewide water quality monitoring and assessment program that provides funding and resources for regional watershed protection efforts. The program is administered by the Texas Commission on Environmental Quality (TCEQ) in partnership with river authorities and other regional governments with the goal of maintaining and improving water quality in each river basin in the state.

As the coordinating agency in the Cypress Creek basin, the Northeast Texas Municipal Water District (NETMWD) works with federal and state agencies, municipalities, water suppliers, and private companies to accomplish water quality monitoring and watershed protection objectives. Monitoring priorities are established through stakeholder input and coordination with other organizations working in the basin. Water quality sampling regimens are established though an annual Coordinated Monitoring Meeting with the objective of ensuring that resources and efforts are not duplicated or overlapped. Coordinating entities in attendance often include the TCEQ staff from the CRP, Surfaced Water Quality Monitoring, Standards, and Region 5 teams; Texas Parks and Wildlife Department (TPWD); U. S. Geological Survey (USGS); and Texas State Soil and Water Conservation Board.

During most years, a basin highlights report is authored, presented at stakeholder meetings, and posted to the NETMWD Clean Rivers Program website. The basin highlights report is typically non-technical and intended to provide a high-level overview of issues that may affect water quality in the basin. Every five to six years, a basin summary report is written. This technical report is used to provide an in-depth review of historical and recent data, and an analysis of water quality trends occurring throughout the watershed. The objectives of the basin summary report are to:

- Discuss water quality issues and their potential sources,
- Identify statistically significant water quality trends,
- Compare the current Texas Integrated Report with reported data, and
- Examine the effects of water quality impairments on the biotic community structures.

The Cypress Creek watershed encompasses approximately 6,000 square miles. Its major tributaries – Big Cypress Creek, Little Cypress Creek, James' Bayou, Harrison Bayou, and Black Cypress Bayou – drain into Caddo Lake on the Texas/Louisiana border. The watershed has a diverse ecology. The headwaters of Big Cypress Creek, above Lake Cypress Springs, is intermittent. Releases into Big Cypress Creek from Lake Bob Sandlin runs through flat to rolling terrain surfaced by sandy and clay loams that support water-tolerant hardwoods, conifers, and

grasses before entering Lake O' the Pines. Below Lake O' the Pines, Big Cypress Creek (Bayou) flows into Caddo Lake through bottomland thick with hardwood and cypress trees.

The watershed originates in the southern portions of Hopkins and Franklin Counties. Headwaters flow south eastwardly into Camp, Titus, Morris, Cass, Marion, and Harrison Counties. Reservoirs in the basin include Monticello Reservoir, Lake Cypress Springs, Lake Bob Sandlin, Lake Gilmer, Lake Daingerfield, Ellison Creek Reservoir, Lake O' the Pines, and Caddo Lake. The major tributaries of Caddo Lake include Big Cypress Creek, Little Cypress Creek (Bayou), Black Cypress Bayou, James Bayou, and Harrison Bayou.

The 2024 Texas Integrated Report (2024 IR) assessed data collected between December 1, 2015 and November 30, 2022. The methods used for water quality assessments are developed through the Guidance Advisory Work Group meetings. The TCEQ assessed 38 water bodies in the Cypress Creek Basin in the 2024 IR. No new impairments were added to the *2024 Texas §303(d) List* while four were removed including a high pH impairment in the Panther Arm of Lake Cypress Springs and dissolved oxygen in Little Cypress Bayou and Black Cypress Bayou. Due to the acceptance of the Recreational Use Attainability Assessment, the *Escherichia coli* (*E. coli*) impairment was removed from South Lilly Creek.

The 2024 §303(d) List identified 21 water bodies located in nine classified and twelve unclassified segments that did not meet the water quality criteria. High levels of bacteria and low concentrations of dissolved oxygen were the most common impairments in the basin. Impairments due to contaminants in fish tissue, leading to fish consumption advisories, were found in five segments while high pH impairments were shown for two reservoir segments. Segment 0408 – Lake Bob Sandlin was the only segment in the Cypress Creek Basin with no impairments or concerns.

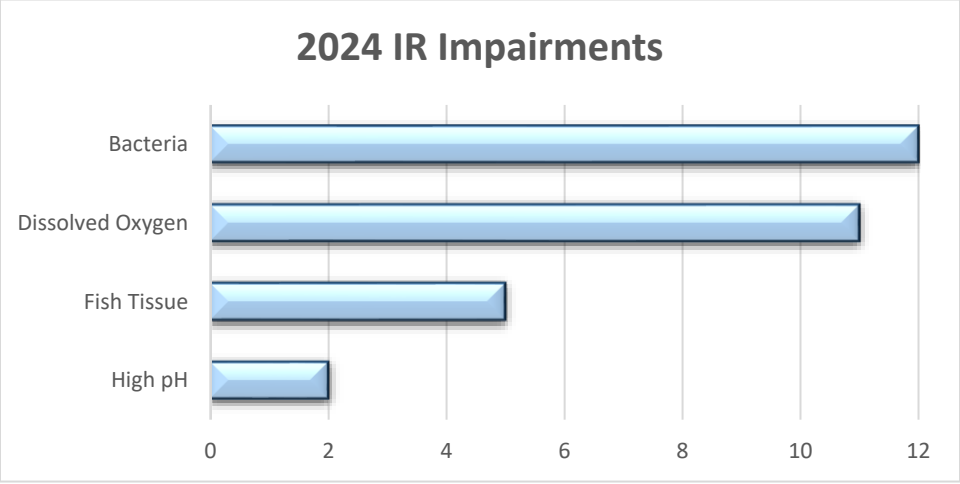

Figure 1: Number of impairments by segment from the 2024 IR

Low dissolved oxygen impairments were found in most segments except for Lake Bob Sandlin and Big Cypress Creek below Lake Bob Sandlin. In the stream segments, low dissolved oxygen readings were quite often associated with low flow, especially in the intermittent streams of Black Bayou, James Bayou, and Segment 0410A of Black Cypress Creek. The pervasive drought most likely exacerbated the low dissolved oxygen conditions leading to these impairments.

The arms of Caddo Lake are shallow, swamp-like, and from May to October, much of the water surface is often covered by invasive aquatic vegetation preventing sunlight from entering the water column. Low dissolved oxygen readings have been common in these areas, especially for samples collected during the warm weather months of May through October. A review of all historical data showed that out of almost 1,000 surface readings collected in the upper assessment units, over 92 percent of the low dissolved oxygen values were recorded during the warm weather months. In contrast, only two readings out of 384 measurements had dissolved oxygen values less than 3 milligrams per liter (mg/L) at the “Midlake” station 10283. This station rarely has any aquatic vegetation present. These results suggest that the low dissolved oxygen impairments in the upper portion of Caddo Lake were due to surface coverage by invasive aquatic vegetation.

Elevated bacteria levels appear to be a significant threat to the water quality of the Cypress Creek Basin. Impairments and concerns for *E. coli* were shown in many stream segments. *E. coli* listings included Big Cypress Creek and its tributaries, Tankersley Creek and Hart Creek; Little Cypress Creek and its tributary, Lilly Creek; Black Cypress Creek; Black Bayou; and James Bayou. Potential sources of bacteria include livestock, pets, wildlife, and improperly treated human waste, such malfunctioning on-site septic systems. Since much of the basin is relatively unpopulated and is heavily forested, wildlife likely account for much of the bacteria contributions in the basin. Evidence of feral hogs including wallows, rooting, and tracks are frequently observed during sampling events.

A Comprehensive Recreational Use Attainability Analysis (RUAA) was conducted in Big Cypress Creek, Tankersley Creek, and Hart Creek in 2009 through 2011 to address the bacteria impairments. The comprehensive RUAA found no evidence of primary contact recreation occurring within the study area, and the TCEQ is considering the appropriate designation. Similarly, an RUAA was conducted South Lilly Creek in 2016. The results from this study also indicated that the stream was not being used for primary contact recreation. Other RUAAs conducted in the basin have found similar results. Due to the rural population and abundance of

nearby public reservoirs, RUAA studies should be conducted in all stream segments to address all *E. coli* impairments.

Eutrophication is the most significant threat to the water quality of the reservoirs in the Cypress Creek Basin. The 2024 IR classified Lake Cypress Springs and Lake O' the Pines as eutrophic. The effects of eutrophication diminish the aesthetics of the reservoir, reduce its biological diversity, and increase the cost of drinking water treatment. Excess nutrients found in tributaries of these reservoirs have exacerbated this issue. Efforts to reduce nutrient loadings through the implementation of best management practices, such as those used in the Lake O' the Pines Total Maximum Daily Load, should be considered across the entire Cypress Creek Basin.

Releases from Lake Bob Sandlin play an important role in the water quality of Big Cypress Creek and Lake O' the Pines. In addition to providing stream flow in Big Cypress Creek, the high-quality water from Lake Bob Sandlin helps to offset the nutrient-laden discharges from the eight wastewater treatments plants in the Lake O' the Pines watershed. There are no instream flow requirements in Big Cypress Creek, so water is only released by the Titus County Freshwater Supply District #1 to maintain the freeboard of the Fort Sherman Dam. On average, a little over 97,000 acre-feet of water are released each year. For the first time since 2014, no water was released from the reservoir in 2022. Between February and July 2023, over 84,000 acre-feet were released and almost forty percent of those releases were in the months of June and July. In fact, this was the most water released during those months in at least fifteen years.

The impacts on water quality during extended periods without releases from Lake Bob Sandlin are evident in Big Cypress Creek. During low flow periods, nutrients tend to remain elevated in the stream, which in turn increases chlorophyll *a* concentrations in the lower reaches of the stream and supports excess primary productivity in Lake O' the Pines. The 2024 IR showed concerns for nitrate in both assessment units of Segment 0404 – Big Cypress Creek below Lake Bob Sandlin along with a concern for chlorophyll *a* in the lower reach of the stream. The elevated nitrate results in the upper assessment unit appear to be influenced by the treated effluent discharged from the City of Mount Pleasant and Pilgrim's Pride wastewater treatment plants. Nitrate and total phosphorus concentrations were highest during periods of low flow indicating contributions from point sources. Station 10310, located downstream from the confluence with Tankersley Creek, had much higher concentrations of nitrate than at station 10308 at SH 11 or at station 13631 at US 259. Tankersley Creek (station 10261) had the greatest concentration of nitrate while Hart Creek (station 10266) contributed nitrate but at a much lower concentration.

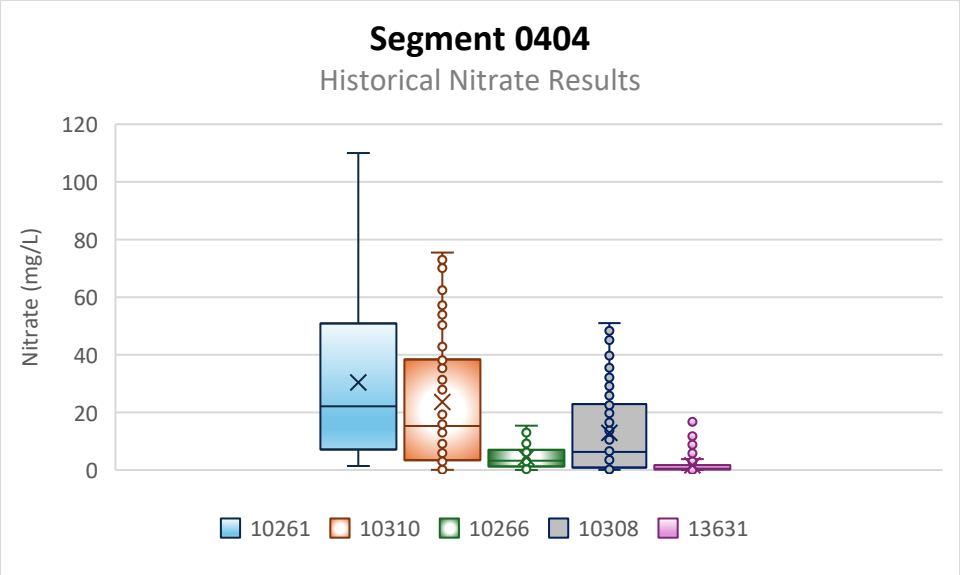

Figure 2: Segment 0404 historical nitrate results

The results suggest that the Pilgrim's Pride discharge is the primary contributor of nitrate to the watershed. The highest concentrations of nitrate were found at flows less than 15 cubic feet per second as shown in the following chart which incorporates all historical data collected at stations in Tankersley Creek (station 10261) and in the upper assessment unit of Big Cypress Creek.

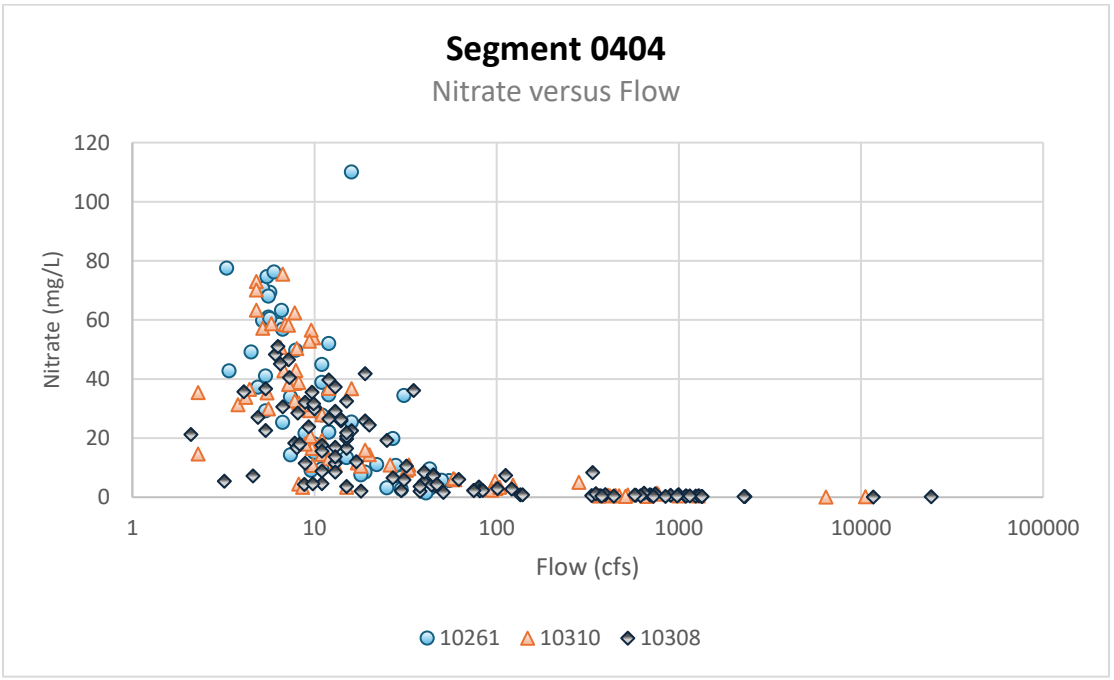

Figure 3: Segment 0404 nitrate versus flow

Despite meeting its phosphorus permit limit, the primary contributor of total phosphorus in the watershed appeared to be from the Pilgrim's Pride wastewater treatment plant. The highest concentrations in Big Cypress Creek were also found at flows less than 15 cubic feet per second.

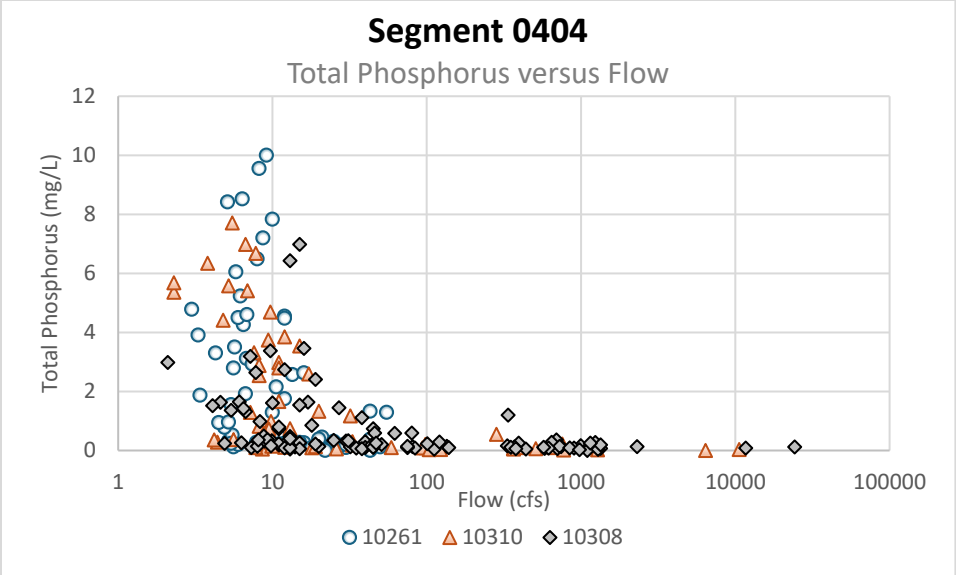

Figure 4: Segment 0404 total phosphorus versus flow

The excess nutrients coupled with low flows contributed to algal productivity in the lower portion of Big Cypress Creek. A comparison of historical results showed that chlorophyll *a* was highest at station 13631 located at the headwaters of Lake O' the Pines.

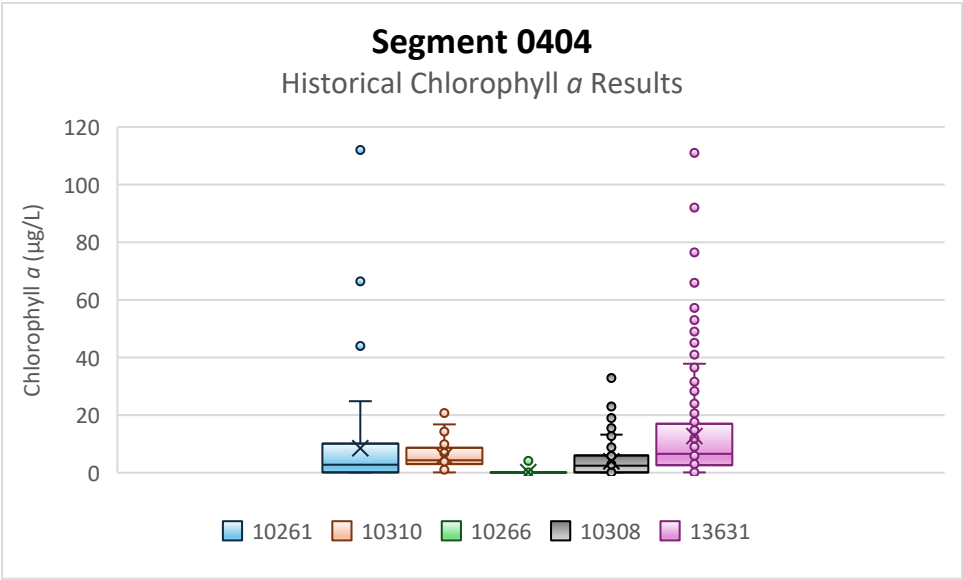

Figure 5: Segment 0404 historical chlorophyll a results

These excess nutrients have supported high concentrations of chlorophyll *a* in Lake O' the Pines, which in turn have contributed to the high pH impairments. Chlorophyll *a* was increasing at a statistically significant rate at stations 10296 (dam) and 10297 (NETMWD intake) over the past decade. Although not at a statistically significant rate, chlorophyll *a* concentrations were increasing at the other stations in the reservoir.

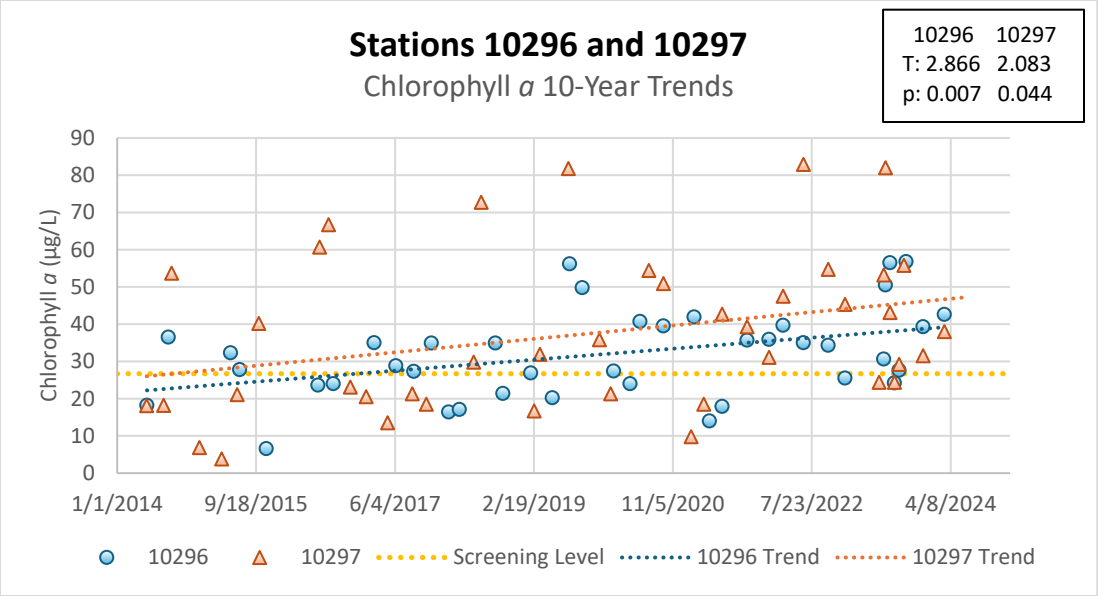

Figure 6: Increasing chlorophyll a trends at stations 10296 and 10297 in Lake O' the Pines

As a result of higher algal productivity, statistically significant decreasing transparency trends were found at all stations in Lake O' the Pines. The decreasing trend was found for both 10- and 20-year datasets at station 10296 while decreasing 10-year trends were found at all stations.

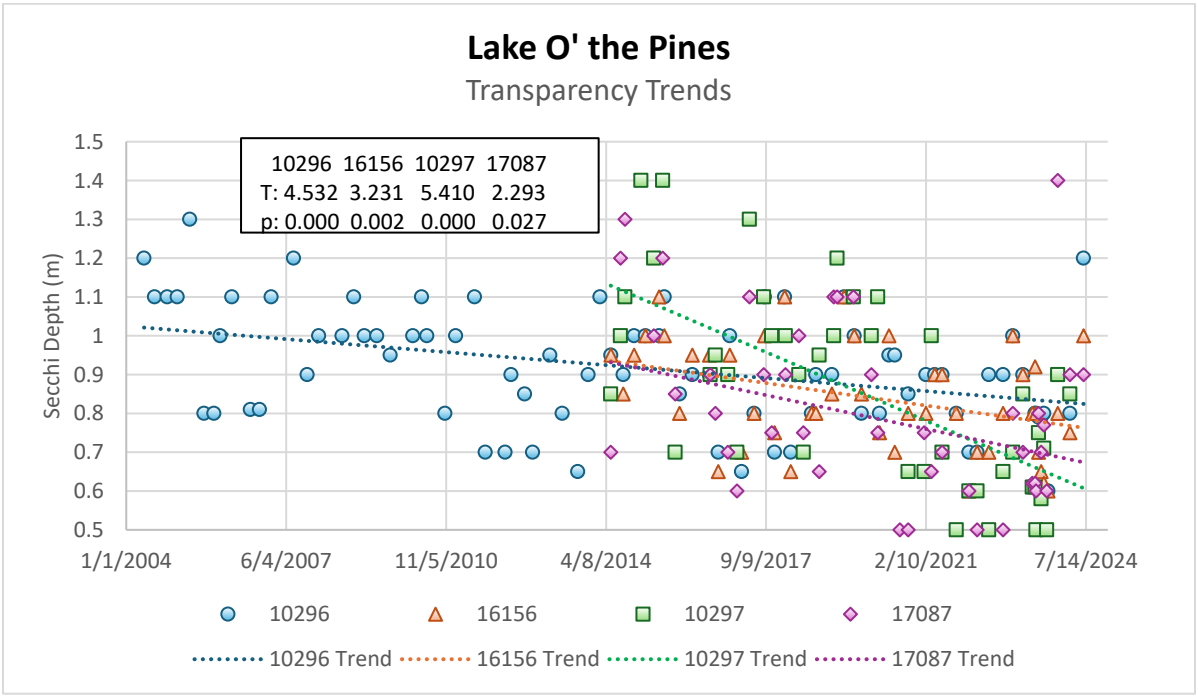

Figure 7: Decreasing transparency trends in Lake O' the Pines

Both Lake Cypress Springs and Lake O' the Pines have high pH impairments. The results of special studies performed in both reservoirs in 2023 suggested that the high pH impairments were due to primary productivity. Although elevated chlorophyll *a* and high pH were poorly correlated,

excessive algal production could not be discounted as the basis for increasing pH in these water bodies. Grab samples are collected at 0.3-meter below the water surface, and the diurnal movement of phytoplankton vertically within the water column is well-documented. As a result, algal populations may have been above or below the 0.3-meter depth at the time of sampling. Since most samples were collected during peak productivity, the percent saturation of dissolved oxygen provided a reasonable surrogate parameter for chlorophyll *a*. In nearly all cases where a high pH was measured, dissolved oxygen was also reported above 100% saturation. Additionally, most high pH readings were obtained during the warm weather months when primary productivity is highest.

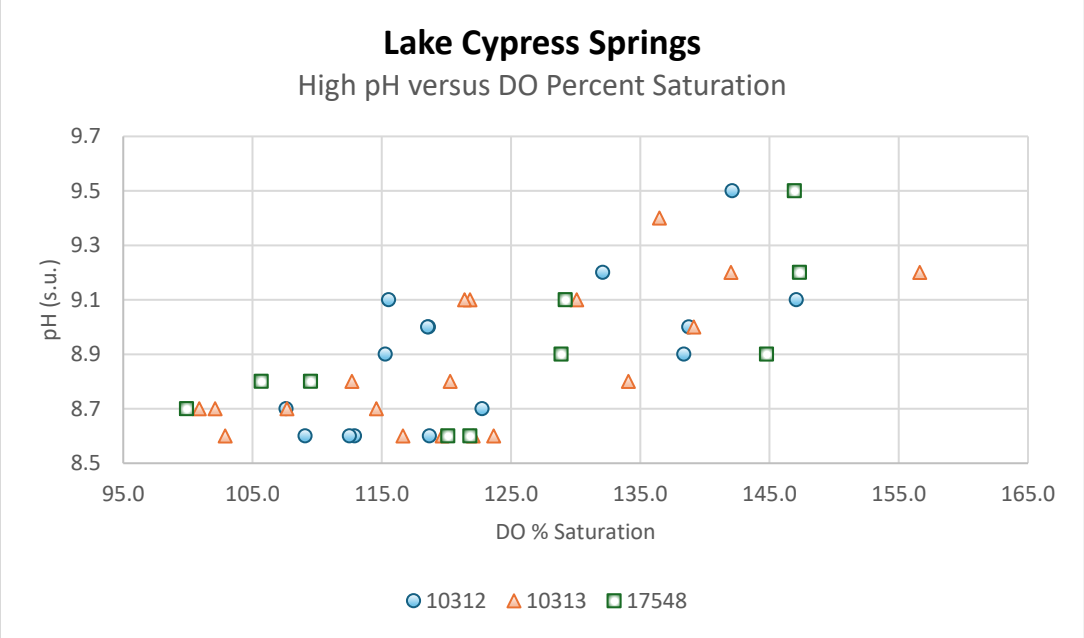

Figure 8: High pH readings versus DO percent saturation in Lake Cypress Springs

Alkalinity is a measure of the water's ability to neutralize acids and thus maintain a fairly stable pH level. Alkalinity enters the water column through the weathering of rocks and minerals during runoff events. Three increasing alkalinity trends were first identified in the *2019 Cypress Creek Basin Summary Report* while seven increasing trends were found in this report. These trends included the analysis of historical data, the past twenty years, and the past decade.

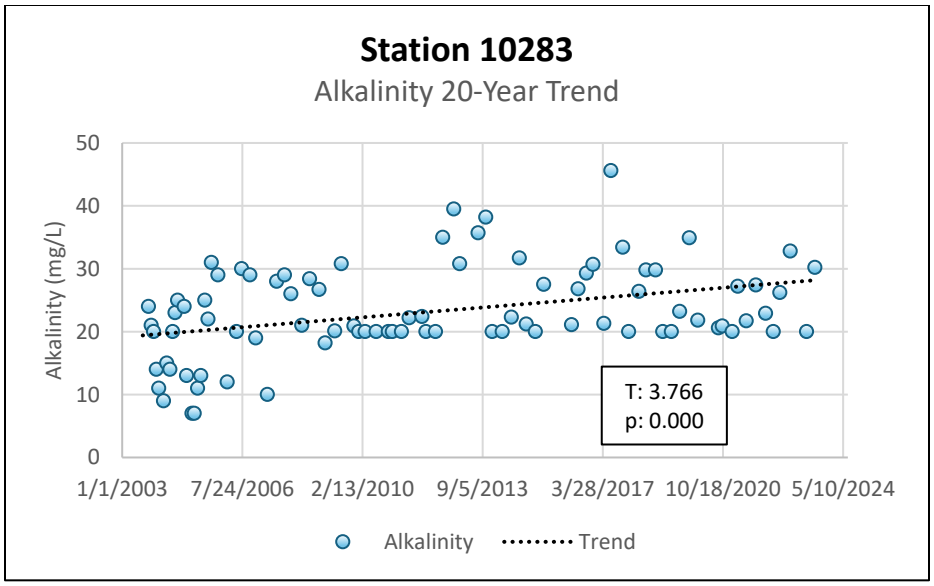

Figure 9: Increasing 20-year alkalinity trend at station 10283 in Caddo Lake

In recent years, researchers have found that alkalinity is increasing across much of the eastern United States and have linked this increase to the implementation of scrubbers and other technology in smokestacks to reduce acid rain as required by the 1990 Clean Air Act. Increasing alkalinity is most pronounced in water bodies which tend naturally to have low alkalinity such as those of East Texas.

Along with alkalinity, increasing pH trends have been identified around the basin. Since alkalinity is a measure of the water's ability to neutralize acids and bases to maintain a stable pH level, increasing pH trends are not surprising especially in water bodies which tend to have naturally have low pH and alkalinity. It should be noted that the elevated pH values and impairments in Lake Cypress Springs and Lake O' the Pines (as detailed previously) may have been impacted by higher alkalinity concentrations; however, these impairments appear to be mostly due to excessive primary productivity.

For the water bodies in the eastern portion of the basin that have consumption advisories due to mercury in fish tissue, the increasing pH trends may be encouraging. For mercury to bioaccumulate in organisms, it must first become methylated. The process of mercury methylation generally occurs in the sediments of waters with pH below 7.3 standard units (Kelly, Rudd, Holoka, 2003). In other words, the increasing pH and alkalinity trends may indicate the reduction of the availability of mercury to bioaccumulate in organisms. Fish tissue analysis should be considered to determine whether these consumption advisories need to remain in place.

Despite the water quality impairments found around the basin, its streams support abundant and diverse biota. These streams are home to two turtle species (alligator snapping turtle,

western chicken turtle) and one crayfish species (Kisatchie painted crayfish) that are being considered for listing as threatened and endangered by the U.S. Fish and Wildlife Service.

Since 2001, 101 bioassessments have been conducted across the basin including 32 monitoring events completed between 2020 and 2024. Over 5,000 fish were collected representing 55 species during these recent bioassessments. In almost all cases, the fish populations scored in the high Aquatic Life Use category regardless of the stream classification of perennial or intermittent with perennial pools. Darters are an important indicator of stream health since they tend to be sensitive to water quality conditions. From these recent studies, 251 individuals from ten darter species were identified. Two species rarely found were collected in Big Cypress Creek including the redspot darter and the blindside darter. The blindside darter is listed by the TPWD as a species of greatest conservation need.

Recommendations:

Areas of future study that should be considered are:

- Diel monitoring in the upper assessment unit of Lake O' the Pines to address the dissolved oxygen impairment. Diel dissolved oxygen met the criteria during all five studies conducted in the summer of 2023.
- Recreational Use Attainability Analysis should be performed in all streams to determine whether the streams are being used for primary contact recreation.
- Continue biological monitoring studies to evaluate the biotic integrity of stream segments within the basin.

In addition, NETMWD should encourage:

- the Department of State Health Services to perform fish tissue studies to determine if the consumption advisories should be removed or remain in place, and
- the TCEQ to incrementally raise the CRP budget to offset higher costs to maintain the current number of monitoring stations.

Introduction

The Texas Clean Rivers Program (CRP) is a statewide water quality monitoring and assessment program that provides funding and resources for regional watershed protection efforts. The program is administered by the Texas Commission on Environmental Quality (TCEQ) in partnership with river authorities and other regional governments with the goal of maintaining and improving water quality in each river basin in the state.

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Overview of the Cypress Creek Basin

The Cypress Creek watershed encompasses approximately 6,000 square miles. Its major tributaries – Big Cypress Creek, Little Cypress Creek, James' Bayou, Harrison Bayou, and Black Cypress Bayou – drain into Caddo Lake on the Texas/Louisiana border. The watershed has a diverse ecology. The headwaters of Big Cypress Creek, above Lake Cypress Springs, is

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The watershed originates in the southern portions of Hopkins and Franklin Counties. Headwaters flow south eastwardly into Camp, Titus, Morris, Cass, Marion, and Harrison Counties. Reservoirs in the basin include Monticello Reservoir, Lake Cypress Springs, Lake Bob Sandlin, Lake Gilmer, Lake Daingerfield, Ellison Creek Reservoir, Lake O' the Pines, and Caddo Lake. The major tributaries of Caddo Lake include Big Cypress Creek, Little Cypress Creek (Bayou), Black Cypress Bayou, James Bayou, and Harrison Bayou. The basin experienced a pervasive drought that began around 1999 and extended through 2014. During this period, the drought was punctuated with large rainfall events. In 2011 and 2012, the drought reached comparable levels with the drought of record from the 1950s. This drought was followed by near-historic flooding in 2015 and 2016 which ended the drought.

Rainfall records at the Fort Sherman Dam (Lake Bob Sandlin), located in the upper portion of the basin, have been maintained since its completion in 1978. Over the past forty-six years, annual precipitation has averaged around 51.5 inches. However, from 1979 to 1999, the average was 53.7 inches per year, as compared to 49.6 inches from 2000 through 2024. During the 1999 - 2014 drought, an annual average of 48 inches of rain was recorded. At slightly over 25 inches of precipitation, 2005 was the driest year on record and was also the first year that no water had been released from Lake Bob Sandlin since its completion. In 2024, the area received above average rainfall of 59.4 inches with April being the wettest month at 12.04 inches of precipitation.

Much of the basin experienced some level of drought in 2022 through 2024, especially throughout the summer and fall of these years. Figure 9 presents the U.S. Drought Monitor data for the basin since 2000. The drought monitor is updated weekly and reports the percent of the area in the five stages of drought: D0 – abnormally dry; D1 – moderate drought; D2 – severe drought; D3 – extreme drought; and D4 – exceptional drought.

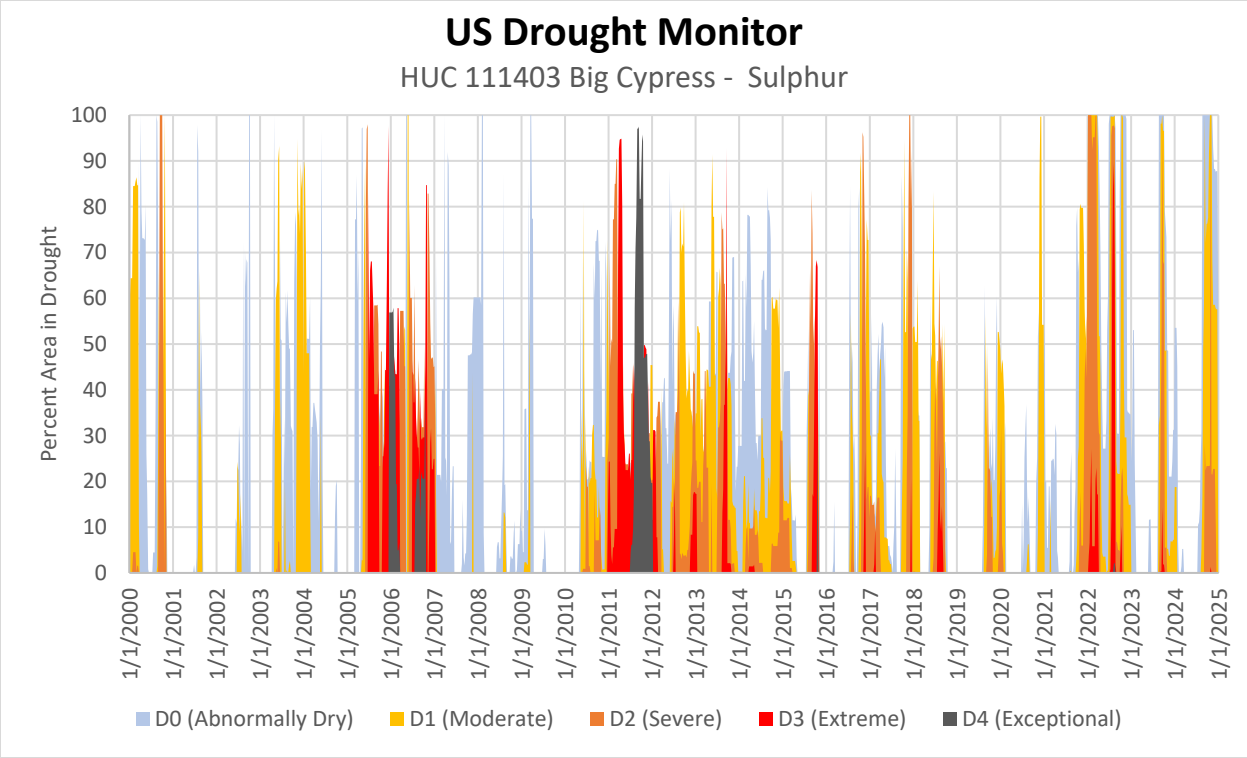

Figure 10: U.S. Drought Monitor, 2000 - 2024

Releases from Lake Bob Sandlin play an important role in the water quality of Big Cypress Creek and Lake O' the Pines. There are no instream flow requirements in Big Cypress Creek, so water is only released by the Titus County Freshwater Supply District #1 to maintain the freeboard of the Fort Sherman Dam. In addition to providing stream flow in Big Cypress Creek, the high-quality water from Lake Bob Sandlin helps to offset the nutrient-laden discharges from wastewater treatments plants in the Lake O' the Pines watershed. When there are no releases from the reservoir, Big Cypress Creek becomes effluent-dominated. This is evident in the water quality data as detailed in the Segment 0404 – Big Cypress Creek below Lake Bob Sandlin discussion.

In 2024, 197,000 acre-feet of water was released from the reservoir. On average, about 99,000 acre-feet is released each year. From 2005 to 2007 and from 2011 through 2014, no water was released from the reservoir. The greatest amount released was 280,000 acre-feet in 2015 followed by 269,000 acre-feet in 2019. Despite no water being released in 2022, the average released from 2015 through 2024 was 157,000 acre-feet. On average, the majority (79%) of the water released each year occurs between February and June with over half (55%) of those releases in the months of March, April, and May.

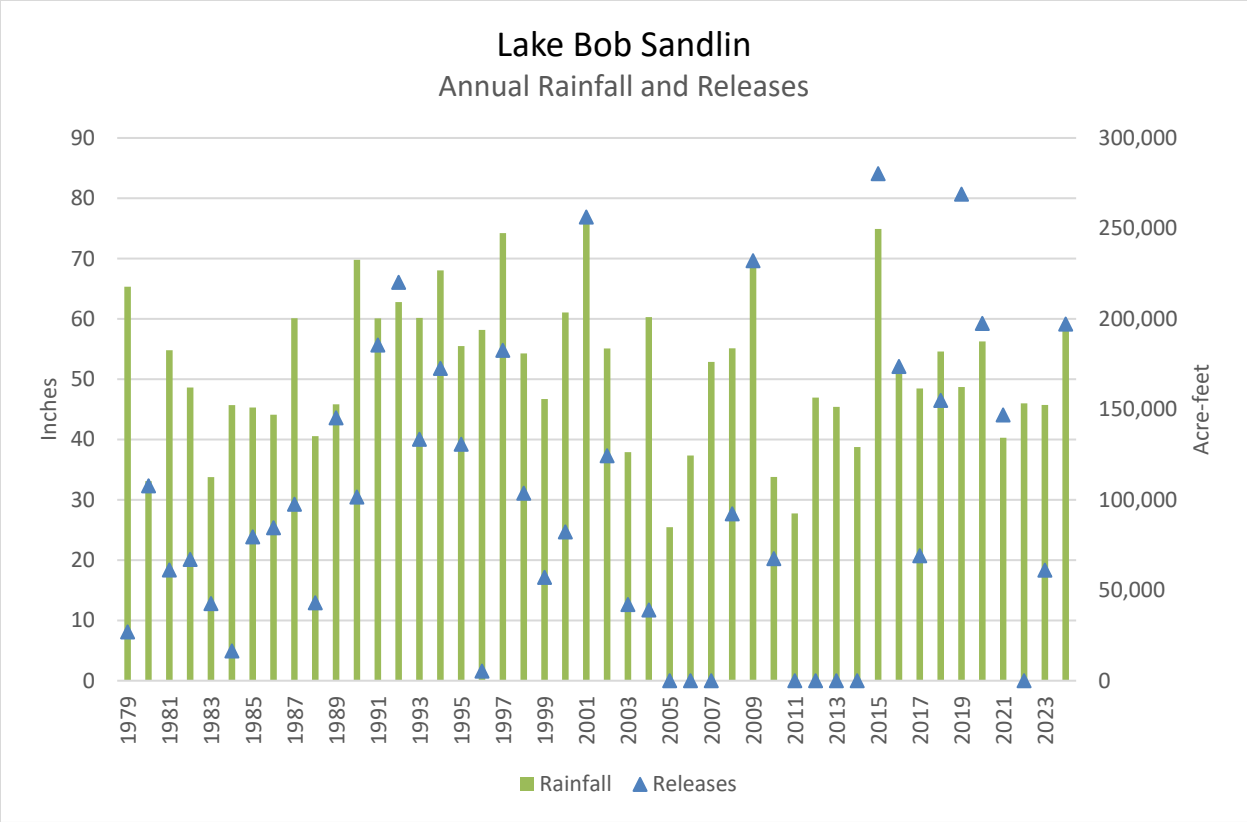

Figure 11: Annual rainfall and releases form Lake Bob Sandlin, 1979 - 2024

The *2025 Cypress Creek Basin Summary Report* discusses water quality trends and conditions across the basin. The report includes four discussion topics:

- Watershed Summaries
- Trend Analysis
- Species of Concern
- Aquatic Life Monitoring Studies

The Watershed Summaries section of this report details the *2024 Texas Integrated Report* (IR) which is an assessment of water quality of the watersheds in the Cypress Creek Basin. Included in this section are analyses of trends. Trend analysis was performed on data obtained over the past decade, last twenty years, and all data (historical). The Species of Concern section discusses potentially threatened or endangered species in the basin. A discussion of the Aquatic Life Monitoring studies section details bioassessments performed by NETMWD and WMS over the past five years.

Water Quality Monitoring and Assessment

The 2024 Texas Integrated Report (2024 IR) assessed data collected between **December 1, 2015 and November 30, 2022**. The methods used for water quality assessments are developed through the Guidance Advisory Work Group meetings.

The Integrated Reports are based on designated uses and assessment units. **Designated uses** for water bodies include Aquatic Life Use, Recreation Use, General Use, and Domestic Water Supply Use. Support for each of these designated uses is based on attainment of water quality criteria for various parameters. These criteria may be either standards or screening levels. Standards are defined in the Texas Surface Water Quality Standards (TSWQS) and are "narrative and numerical criteria deemed necessary to protect" the designated uses of water bodies. Screening levels are criteria that have been developed for parameters which do not have water quality standards.

Each river basin in the state is broken into **segments** which are major water bodies such as reservoirs, rivers, and tributaries. These segments can be either classified or unclassified. **Classified segments** are water bodies that are defined in Appendix A of the TSWQS; **unclassified segments** are water bodies that are not defined in Appendix A. All unclassified water bodies are identified by the segment number of the water body into which they flow followed by a letter suffix. **Assessment units** (AU) are hydrologically distinct sub-sections of classified and unclassified water bodies. They represent discrete areas of the segment such as the arms of a reservoir or portions of a stream between tributary confluences. If there are multiple monitoring stations within an assessment unit, data from these stations are grouped together for assessment purposes. Some segments may only have a single assessment unit while others may consist of several assessment units.

When assessment units are discussed in this report, they are designated by the letters "**AU**" followed by the segment number and assessment unit number. For example, Lake O' the Pines is segment number 0403. The lowest assessment unit, the lower 5,000 acres near the dam, is numbered 01. When discussing the water quality of this assessment unit, the discussion will include "AU 0403_01" to identify the segment and assessment unit. The headwater of Lake O' the Pines in the upper 3,700 acres is assessment unit 04; discussions about the upmost portion of the reservoir are identified as "AU 0403_04."

Data collected through CRP has many uses, including the development of the surface water quality standards, determining if water bodies meet those standards, and the development of wastewater permit limits. This report references the 2024 IR which compares all available quality assured data to the TSWQS or to screening levels when no standards have been established. The Integrated Report defines the status of each water body as one of the following:

Meets or Supports — Sufficient data are available to assess. The water body meets all applicable surface water quality standards and fully supports its designated uses. These water bodies are labeled in tables as "FS" for fully supporting the criteria. When the water body meets its screening level for a parameter, the label of "NC" is assigned meaning there is "No Concern" for that constituent.

Concern — **a)** A concern for not meeting water quality criterion based upon adequate data, **b)** Sufficient data are not available to perform a full assessment and the limited data indicate surface water quality standards are not being met, or **c)** Surface water quality standards have not yet been established. If water quality data indicate a concern, resources are allocated to collect more data and verify the concern. These water bodies are labeled in tables as "CN" or "CS". The "**CN**" label indicates that there is a concern for not meeting the water quality standard for that parameter while "**CS**" indicates a concern for not meeting TCEQ screening levels.

Impaired — Sufficient data are available and show that the water body does not meet surface water quality criteria. If monitoring data indicate that a water body does not support one or more of its designated uses, then it is said to be impaired. Details of the impairment are published in the Texas Integrated Report and §303(d) List. Impaired water bodies are shown as "**NS**" for not supporting its designated uses.

LEVELS OF SUPPORT	
Designated Use Criteria	**Screening Level**
FS Fully Supporting	NC No Concern
CN Use Concern	CS Screening Level Concern
NS Non-support	

Table 1: Designated uses levels of support

These standards define an antidegradation policy of the Clean Water Act to protect existing uses and water quality of less impacted water bodies. Some water quality standards are applied generally across the state while other criteria are site-specific. Site-specific criteria may be revised when new data become available. Initially, site-specific standards were set for individual water bodies in the state using limited data to establish uses and criteria. Many of the subsequent changes in water quality standards have involved revisions to the initial standards based upon additional data and evaluations. As new data were collected, a subsequent evaluation found that a revised criterion was appropriate.

Clean Rivers Program partners collect monitoring data following a TCEQ-approved Quality Assurance Project Plan. This plan references procedures and methods for sample collection and handling. All CRP partners follow these methods of data collection and quality assurance protocols. The resulting data are submitted to the TCEQ for inclusion in the state water quality database, the Surface Water Quality Monitoring Information Systems. After a thorough review and approval by TCEQ, these data are made available for public access via the NETMWD and TCEQ websites. These data are used by the TCEQ to assess the water quality of the basin.

Physical and chemical measurements of water quality are typically made at each station. Common parameters include dissolved oxygen (DO), pH, suspended sediments, nutrients, bacteria, and stream flow or lake level. Biological assessments include the collection of fish, aquatic invertebrates, and habitat assessments to quantify the overall health of streams. Water quality monitoring is often described in general terms of field parameters, conventional laboratory parameters, diel studies (data collected over a twenty-four-hour period [*i.e*. 24-Hour DO]), stream flow, and biological monitoring.

The Integrated Report is updated every two years, and the period of record for the 2024 IR included samples collected between **December 1, 2015 and November 30, 2022**. The TCEQ assessed 38 water bodies in the Cypress Creek Basin in the 2024 IR. No new impairments were added to the *2024 Texas §303(d) List* while four were removed as shown in the table below.

Assessment Unit	Description	Parameter	Reason
0405_02	Lake Cypress Springs	High pH	New Data
0409_01	Little Cypress Bayou	DO	Listing Incorrect
0409B_01	South Lilly Creek	*E. coli*	Standards Change
0410_02	Black Cypress Bayou	DO	Listing Incorrect

Table 2: Water bodies removed from the 2024 Texas §303(d) List

The 2024 §303(d) List identified 21 water bodies located in nine classified and twelve unclassified segments that did not meet the water quality criteria. High levels of bacteria and low concentrations of dissolved oxygen were the most common impairments in the basin. Impairments due to contaminants in fish tissue, leading to fish consumption advisories, were found in five segments while high pH impairments were shown for two reservoir segments.

The following table is a list of all impairments by segment in the Cypress Creek Basin. The water quality impairments and concerns shown in the 2024 IR are discussed in detail in the Watershed Summaries section of the report. Note in the following table, there is an impairment denoted with an asterisk for low dissolved oxygen in the upper assessment unit of Segment 0403 - Lake

O’ the Pines; however, it is not included on the 303(d) List since the impairment is addressed through the Total Maximum Daily Load Implementation. This impairment is detailed in the Lake O’ the Pines discussion.

2024 Texas §303(d) List		
Segment ID	**Description**	**Parameter**
0401	Caddo Lake	Mercury in fish tissue
		DO
0401A	Harrison Bayou	DO, *E. coli*
0402	Big Cypress Creek below Lake O' the Pines	Mercury in fish tissue
		DO
0403	Lake O' the Pines	High pH, DO*
0404	Big Cypress Creek below Lake Bob Sandlin	*E. coli*
0404A	Ellison Creek Reservoir	Sediment Toxicity
		Dioxin in fish tissue
		PCBs in fish tissue
0404B	Tankersley Creek	*E. coli*
0404C	Hart Creek	*E. coli*
0404E	Dry Creek	*E. coli*
0404F	Sparks Branch	*E. coli*
0404J	Prairie Creek	DO
0404N	Lake Daingerfield	Mercury in fish tissue
0405	Lake Cypress Springs	High pH
		Nutrient Reservoir Criteria
0405A	Big Cypress Creek	DO, *E. coli*
0406	Black Bayou	DO, *E. coli*
0407	James' Bayou	DO, *E. coli*
0409	Little Cypress Bayou	DO, *E. coli*
0409A	Lilly Creek	*E. coli*
0409B	South Lilly Creek	DO
0410	Black Cypress Bayou	Mercury in fish tissue
		Copper, Lead in water
		DO
0410A	Black Cypress Creek	*E. coli*

Table 3: 2024 Texas §303(d) List for the Cypress Creek Basin

The following discussion provides definitions of the common field and conventional laboratory parameters detailed in this report.

FIELD PARAMETERS

Field parameters include those obtained using a water quality sonde such as temperature, dissolved oxygen, pH, and specific conductance (also referred to as temperature-compensated conductivity). Other field parameters include Secchi transparency, stream flow, air temperature, and general observations.

Temperature – Water temperature affects the oxygen content of the water, with warmer water unable to hold as much oxygen. When the water temperature is too cold, cold-blooded organisms such as fish and invertebrates may either die or become weaker and more susceptible to other stresses, such as disease or parasites. In addition to weather conditions, colder water can be caused by reservoir releases while higher water temperatures can be the result of removing trees from the riparian zone, soil erosion, or the use of water to cool equipment in manufacturing or power generation processes.

Dissolved Oxygen (DO) – The concentration of dissolved oxygen is a characteristic of water that correlates with the occurrence and diversity of aquatic life. A water body that can support diverse, abundant aquatic life is a good indication of water quality since all aerobic aquatic organisms require oxygen to live. Modifications to the riparian zone, decreases in stream flow, increases in water temperature, increases in organic matter, bacteria, and over abundant algae may lead to lower DO concentrations in water.

Specific Conductance – Conductivity is a measure of the water body's ability to conduct electricity and indicates the approximate levels of dissolved salts, such as chloride, sulfate, and sodium in the stream. Elevated concentrations of dissolved salts can impact the water as a drinking water source and as suitable aquatic habitat.

pH – pH is a measure of the acidity or basicity of a solution. The pH scale is a logarithmic (base 10) scale. A change of one pH unit means that the water has become ten times more acidic or basic. Most aquatic life is adapted to live within a relatively narrow pH range, but tolerant species can adjust to varying pH ranges. However, pH levels below 4 (acidity of orange juice) or above 12 (basicity of ammonia) are lethal to most fish species and invertebrates. Industrial and wastewater discharge, runoff from quarry operations, and accidental spills are examples of factors that can change the pH composition of a water body. For many water bodies in East Texas, the pH tends to be naturally low (acidic) due to soil composition and tannins contained in plant life, especially in the bark of shrubs and trees.

Transparency – Transparency is measured using a Secchi disk and is a measure of the depth to which light is transmitted through the water column and thus the depth at which algae and aquatic plants can grow. Transparency is an important secondary parameter for assessing eutrophication, a natural aging process in lakes and reservoirs, and perturbation of water quality through soil erosion. Transparency can be reduced by the overabundance of algal populations and by sediments through runoff events.

Stream Flow – Flow is an important parameter affecting water quality. Low flow conditions, common in the dry summer months, create critical conditions for aquatic organisms. At low flows, the stream has a lower assimilative capacity for waste inputs from point and non-point sources. Streams have critical low flows calculated by TCEQ. When stream flows drop below these (known as 7Q2) calculations, some water quality standards do not apply. For example, low DO is often a result of low flows. Because of this, flow is often evaluated in conjunction with DO by the assessors to determine if an assessment unit meets its Aquatic Life Use designation.

Figure 12: Sample bottles and instruments used to measure field parameters

CONVENTIONAL LABORATORY PARAMETERS

Laboratory analysis of "conventional" parameters generally includes solids, salts, nutrients, and bacteria. Conventional parameters analyzed by a laboratory include:

Solids: Total Suspended Solids and Total Dissolved Solids – High solids may affect the aesthetic quality of the water, interfere with washing clothes, and corrode plumbing fixtures. High total

dissolved solids in the environment can also affect the permeability of ions in aquatic organisms. Mineral springs, carbonate deposits, salt deposits, and sea water intrusion are sources for naturally occurring high concentration of solids levels. Other sources can be attributed to oil and gas exploration, drinking water treatment chemicals, storm water and agricultural runoff, and point/non-point wastewater discharges. Elevated levels of dissolved solids such as chloride and sulfate can cause water to be unusable, or simply too costly to treat for drinking water uses. Changes in dissolved solids concentrations also affect the quality of habitat for aquatic life.

Total Hardness – Hardness is a composite measure of ions in water and is primarily composed of calcium and magnesium. The hardness of the water is critical due to its effect on the toxicity of certain metals. Higher hardness concentrations in the receiving stream can result in reduced toxicity of heavy metals.

Chloride – Chloride is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can disrupt osmotic pressure, water balance, and acid/base balances in aquatic organisms which can adversely affect survival, growth, and/or reproduction. Natural weathering and leaching of sedimentary rocks, soils, and salt deposits can release chloride into the environment. Other sources can be attributed to oil and gas exploration and storage, wastewater discharges, landfill run off, and saltwater intrusion.

Sulfate – Effects of high sulfate levels in the environment have not been fully documented; however, sulfate contamination may contribute to the decline of native plants by altering chemical conditions in the sediment. Due to abundance of elemental and organic sulfur and sulfide mineral, soluble sulfate occurs in almost all natural waters. Other sources are the burning of sulfur-containing fossil fuels, steel mills, wastewater treatment plant discharges, and fertilizers.

***Escherichia coli (E. coli)* –** Occurring naturally in the digestive system of warm-blooded animals, *E. coli* bacteria are commonly found in surface water. Although not all sub-species of *E. coli* bacteria are harmful to human beings, their presence is an indication of recent fecal matter contamination, and that other pathogens dangerous to human beings may be present. Bacteria are measured to determine the relative risk of human contact with pathogens through swimming or other contact recreation activities. Sources may include inadequately treated sewage; waste from livestock, pets, waterfowl, and wildlife; or malfunctioning/failing septic systems.

Chlorophyll *a* – High levels of chlorophyll *a* can indicate algal blooms, decrease water clarity, and cause swings in pH and dissolved oxygen concentrations due to photosynthesis and respiration processes. An increase in nutrients can lead to excessive algal production. Chlorophyll *a* concentrations are used as an indication of eutrophication in lakes and reservoirs.

Total Kjeldahl Nitrogen – Total Kjeldahl nitrogen is a measure of organic nitrogen, a compound derived from all life forms including plants, animals, and wastes. The process of mineralization is the conversion of organic nitrogen (measured by total Kjeldahl nitrogen analysis) into inorganic nitrogen. Nitrate is the form of inorganic nitrogen that is biologically available for uptake by plants and algae.

Nutrients (Ammonia, Nitrate, Phosphorus) – Nutrients are essential for life. However, elevated nutrients can cause excessive growth in aquatic vegetation and may lead to algal blooms. Bloom conditions may cause wide variations in pH and dissolved oxygen within a water body. Common sources of nutrient pollution are treated effluent, malfunctioning septic systems, and agricultural runoff. Soil erosion and runoff from farms, lawns, and gardens can add nutrients to the water. Some nutrient loading may also occur naturally through biotic decomposition. When plants and algae die in aquatic systems, bacteria use oxygen to decompose these materials, thereby reducing the amount of dissolved oxygen in the water column which may lead to fish kills and decreased species diversity.

Elevated amounts of nitrogen in the environment can adversely affect fish and invertebrate reproductive capacity and reduce the growth of young. High levels of nitrite can produce nitrite toxicity, or “brown blood disease.” Excess nitrate can contribute to Blue Baby Syndrome in humans, a disease which reduces the ability of blood to transport oxygen throughout the body.

Ammonia is excreted by animals and is produced during the decomposition of organic matter. Municipal and industrial wastewater treatment plant discharge is another common source of ammonia.

Phosphorus is one of the most abundant elements on the planet; however, most natural phosphate compounds are very insoluble and not biologically available for plant uptake. Most water bodies are phosphorus-limited, meaning that algal production is limited by the amount of soluble phosphorus in the water column. Common contributors of soluble phosphorus are non-point sources such as human and animal waste as well as commercial fertilizers. Commercial fertilizers are a more soluble form that can readily be used by plants, but this property also makes the phosphorus more susceptible to runoff.

Total Alkalinity - Total Alkalinity is referred to as “alkalinity” throughout this report. Alkalinity is the measure of the water’s ability to neutralize acids to maintain a stable pH level. Alkalinity is introduced to the water column through the weathering of rocks and minerals.

Organics - Toxic substances from pesticides and industrial chemicals pose the same concerns as metals. PCBs (polychlorinated biphenyls), for example, are industrial chemicals that are toxic

and probably carcinogenic. Despite being banned in the United States in 1977, PCBs remain in the environment, and they accumulate in fish and human tissues when consumed.

Metals – High concentrations of metals such as cadmium, mercury, and lead pose a threat to drinking water supplies and human health. Eating fish contaminated with metals can cause these toxic substances to accumulate in human tissue and organs, posing a long-term significant health threat. Bioaccumulation of mercury in the edible tissue of many fish species to the point of becoming a human health concern has prompted the Texas Department of State Health Services to issue fish consumption advisories around the basin. Mercury in edible tissue has been identified in fish tissue in water bodies throughout East Texas.

FISCAL YEAR (FY) 2025

Water quality monitoring and reporting is the heart of the CRP program. NETMWD/WMS and the TCEQ Region 5 – Tyler routinely collect water quality data. In 2025, monitoring is conducted at 44 stations located in all ten classified segments and in fourteen unclassified water bodies within the Cypress Creek Basin.

The NETMWD/WMS is scheduled to sample fifteen stations quarterly for field and laboratory parameters and at three stations for field parameters and flow only. Diel, or 24-Hour DO monitoring, is scheduled at two stream stations while Aquatic Life Monitoring is being conducted at one station. The TCEQ collects field and laboratory samples quarterly at 23 stations. For a full list of stations monitored by NETMWD/WMS and TCEQ Region 5, visit the Coordinated Monitoring Schedule.

The following pages include a map of all CRP stations sampled by NETMWD/WMS. The FY 2025 monitoring table shows the Collecting Entity (CE) as WMS or R5 for the TCEQ Region 5 stations. The monitoring type (MT) is identified as routine (RT) and/or biased to season (BS).

2025 CYPRESS CREEK BASIN MONITORING SCHEDULE										
STATION DESCRIPTION	**STATION**	**SEGMENT**	**CE**	**MT**	**Field**	**Lab**	**Bacteria**	**Flow**	**24 HR DO**	**ALM**
CADDO LAKE IN GOOSE PRAIRIE	10288	0401	WMS	RT	4	4	4			
CADDO LAKE MID LAKE	10283	0401	WMS	RT	4	4	4			
CADDO LAKE TURTLE SHELL	15249	0401	WMS	RT	4	4	4			
HARRISON BAYOU AT FM 134 / HARRISON BAYOU AT AVENUE Q	15508 / 22543	0401A	WMS	RT	4	4	4	4		
KITCHEN CREEK AT CR 3416	14998	0401B	WMS	RT	4			4		
BIG CYPRESS BAYOU AT US 59	15511	0402	R5	RT	4	4	4	4		
BIG CYPRESS BAYOU AT BACKWATER JACKS	22422	0402	WMS	BS	4			4	4	
BIG CYPRESS CREEK AT SH 43	10295	0402	WMS	RT	4	4	4	4		
HUGHES CREEK AT CR 2985	22321	0402B	WMS	RT	4			4		
KELLEY CREEK AT FM 250	16934	0402E	WMS	RT	4			4		
LAKE O THE PINES ABOVE SH 155	17087	0403	R5	RT	4	4	4			
LAKE O THE PINES AT NETMWD INTAKE	10297	0403	R5	RT	4	4	4			
LAKE O THE PINES NEAR DAM	10296	0403	R5	RT	4	4	4			
LAKE O THE PINES MID LAKE	16156	0403	R5	RT	4	4	4			
BIG CYPRESS AT SH 11	10308	0404	R5	RT	4	4	4	4		
BIG CYPRESS CREEK NEAR WALKERS CREEK	22423	0404	WMS	BS	2			2	2	2
BIG CYPRESS CREEK AT US 259	13631	0404	R5	RT	4	4	4			
BIG CYPRESS CREEK AT US 271	10310	0404	WMS	RT	4	4	4	4		
BIG CYPRESS CREEK NEAR GREASY CREEK	16458	0404	WMS	RT	4	4	4	4		
TANKERSLEY CREEK AT FM 3417	10261	0404B	WMS	RT	4	4	4	4		
HART CREEK AT CR 4550	10266	0404C	WMS	RT	4	4	4	4		
DRY CREEK AT FM 557	10275	0404E	WMS	RT	2	2	2	2		

2025 CYPRESS CREEK BASIN MONITORING SCHEDULE										
STATION DESCRIPTION	**STATION**	**SEGMENT**	**CE**	**MT**	**Field**	**Lab**	**Bacteria**	**Flow**	**24 HR DO**	**ALM**
SPARKS BRANCH AT CR 4220	10276	0404F	WMS	RT	2	2	2	2		
LAKE DAINGERFIELD AT HEADWATERS	17337	0404N	R5	RT	4	4	4			
LAKE CYPRESS SPRINGS NORTH OF FM 115	10313	0405	R5	RT	4	4	4			
LAKE CYPRESS SPRINGS NEAR DAM	10312	0405	R5	RT	4	4	4			
BIG CYPRESS CREEK AT CR SW 3170	22151	0405A	WMS	RT	4	4	4	4		
BLACK BAYOU AT CR 4659	10314	0406	R5	RT	4	4	4	4	1	
BLACK BAYOU AT SH 43	10318	0406	R5	RT	4	4	4	4		
JAMES BAYOU AT CR 1775	10321	0407	WMS	BS	4			4	4	
JIMS BAYOU AT SH 43	14976	0407	WMS	RT	4	4	4	4		
LAKE BOB SANDLIN AT FM 21	16158	0408	R5	RT	4	4	4			
LAKE BOB SANDLIN AT MID DAM	10329	0408	R5	RT	4	4	4			
LITTLE CYPRESS BAYOU AT SH 154	22455	0409	R5	RT	4	4	4			
LITTLE CYPRESS BAYOU AT US 271	16017	0409	R5	RT	4	4	4	4		
LITTLE CYPRESS BAYOU AT US 259	16861	0409	R5	RT	4	4	4	4		
LITTLE CYPRESS CREEK AT FM 134	10331	0409	R5	RT	4	4	4			
LILLY CREEK AT FM 556	20153	0409A	WMS	RT	4	4	4	4		
SOUTH LILLY CREEK AT FM 2454	17954	0409B	WMS	RT	4	4	4	4		
LAKE GILMER AT MID DAM	17478	0409D	R5	RT	4	4	4			
LAKE GILMER AT FM 852	18825	0409D	R5	RT	4	4	4			
BLACK CYPRESS BAYOU AT SH 11	10247	0410	R5	RT	4	4	4	4		
BLACK CYPRESS CREEK AT SH 49	10243	0410	R5	RT	4	4	4	4		
BLACK CYPRESS CREEK AT CR 2924	21729	0410A	R5	RT	4	4	4	4		

Table 4: FY 2025 NETMWD/WMS and TCEQ Region 5 coordinated monitoring schedule in the Cypress Creek Basin

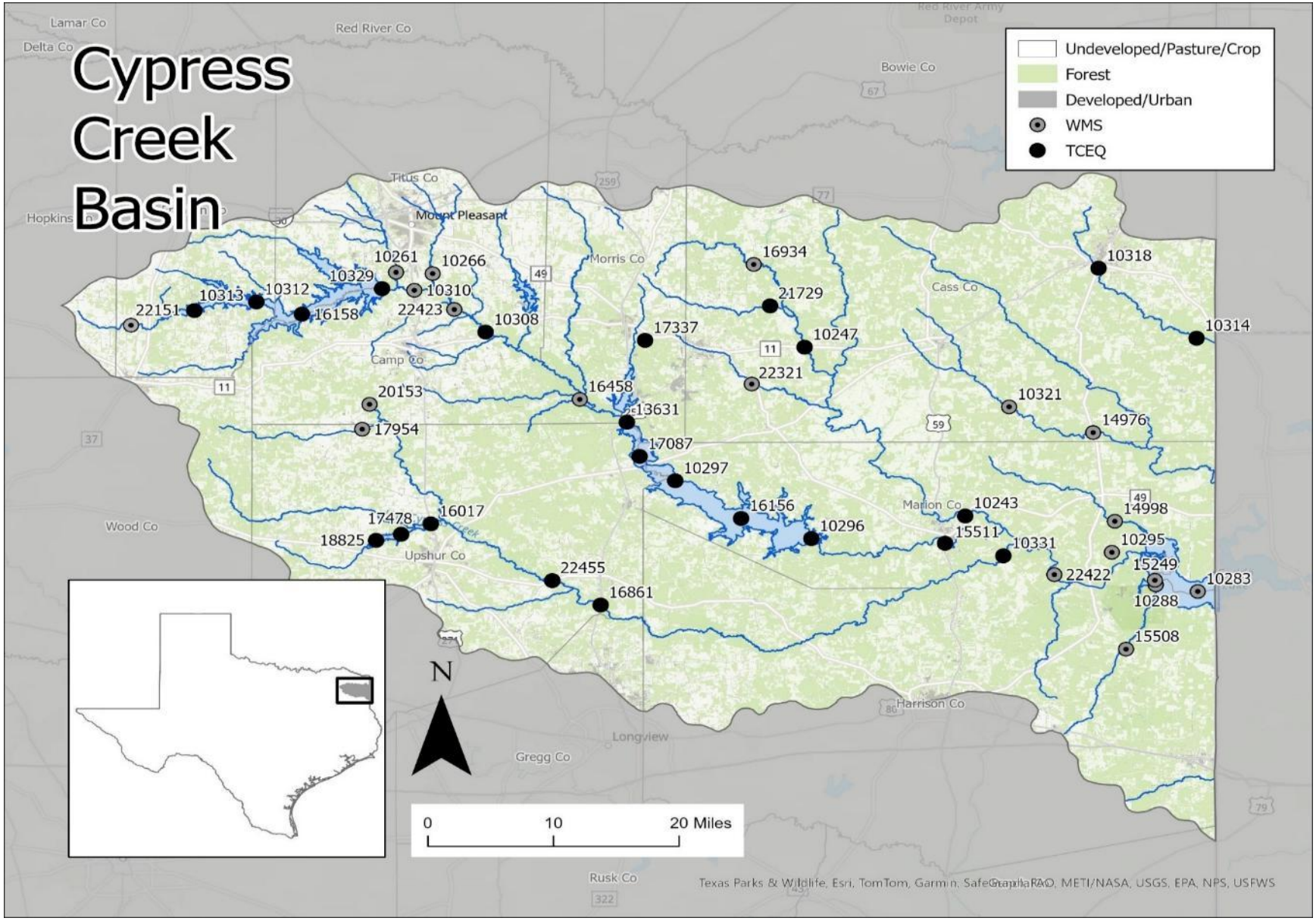

Figure 13: Map of the FY 2025 NETMWD/WMS and TCEQ Region 5 monitoring stations in the Cypress Creek Basin

Data Preparation and Trend Analysis

All data used for trend analyses were obtained from the TCEQ Surface Water Quality Monitoring Information System (SWQMIS). The period of analysis used for this report is from the beginning of the historical data set to **November 30, 2024**. Trends were performed on all available (historical) data, past twenty years, and the past ten years. These data were processed to obtain data sets that were suitable for trend analyses. In almost all cases, trend analyses were based on individual station data rather than by grouping data by assessment unit. This method was chosen because there may be localized conditions which affect water quality between stations that could be missed if trends were analyzed on the assessment unit scale.

Data reported below the laboratory limit of quantitation are generally problematic when determining usefulness in data analysis. A data point that is reported as "less than" a reporting limit is an unknown value that may be anything from zero to the concentration at the laboratory limit. Therefore, it is not acceptable to censor the value to zero as this falsely biases the data set down. It is not acceptable to delete the data point as that removes the record of sampling. Reporting limits can change over time since they tend to decrease as technology improves. Simply removing the less than symbol may introduce false decreasing trends for data sets that have many non-detectable results.

For the purposes of this report, all values reported below the limit of quantitation were censored to one-half of the lowest reporting limit in the data set for each parameter. Although this method may introduce false trends if the non-detectable data are concentrated near the beginning or end of the data set, it prevents influencing trends if the samples reported below the limit of quantitation are spread throughout the data set. Additionally, false trends are visually obvious when viewing graphed data as the censored data appears as a fixed minimum concentration in the data set.

Results that were reported as "greater than" a given value are less problematic. Typically, there are far fewer of these data points and represent parameters such as Days Since Precipitation Event and *E. coli*. There are no standards or screening levels for Days Since Precipitation Event, but this parameter is useful for determining reasons for elevated concentrations of parameters that occur soon after precipitation. *E. coli* often has a maximum test result of 2,400 Most Probable Number per 100 milliliters (MPN/100 mL) for undiluted samples, which is much greater than the 126 MPN/100 mL criterion. For these reasons, if a data point was reported with a greater than symbol, the symbol was simply removed for the analysis.

Flow severity data were also edited. Data for this parameter are reported as a single digit number that represents a broad range of flows. Due to the addition of flow categories over time, the existing values do not represent a linear increase in flow ranges: 1=no flow, 2=low flow, 3=normal

flow, 4=flood, 5=high flow, 6=dry. These values were recategorized as follows to be meaningful for trend analysis: 1=dry, 2=no flow, 3=low flow, 4=normal flow, 5=high flow, 6=flood. Stations for which depth profiles were collected were summarized as appropriate. The lower boundary of the mixed surface layer is the depth where the temperature difference is greater than 0.5 degrees Celsius from the surface sample. Results for each parameter within the mixed surface layer were averaged together with the exception of pH which was taken as the median.

Data processing was conducted to meet TCEQ guidelines for trend analyses. The criteria for trend analysis included:

- At least ten years of regular sampling,
- No large data gaps,
- At least twenty results, and
- Less than fifty percent censored values due to non-detectable results.

The remaining data were then passed to the trend analysis step. As discussed in the Watershed Summaries, many stations did not meet these criteria.

Trend Analysis

Trend analyses were conducted for water temperature, Secchi transparency, DO, specific conductance, pH, alkalinity, total suspended solids, total dissolved solids, ammonia, total Kjeldahl nitrogen (TKN), nitrate, total phosphorus, total organic carbon, hardness, chloride, sulfate, chlorophyll *a*, *E. coli* and stream flow. It should be noted that *E. coli* and stream flow values were log-transformed prior to the analysis.

Most water quality data are inherently non-normal while most statistics are based on the assumption of normality. This can make the results of statistical analyses performed on water quality data less reliable. To increase the reliability of trend analyses in this report, only trends identified for data sets that fell within predefined boundaries of adequate normality were considered significant. Normality can be determined by the skewness and kurtosis of the data set.

Skewness refers to the length of one tail compared to the other on a distribution plot. In a normally distributed data set, the skewness is zero. This indicates that the length of the tails on either side of the peak are equal. If skewness is less than zero, the data are skewed to the left indicating that the left tail is longer compared to the right tail. If skewness is greater than zero, the data is skewed to the right indicating that the right tail is longer than the left tail. To extend these findings to a population, a test statistic must be calculated. Skewness divided by the

standard error of skewness is a common test statistic. If the test statistic for the sample set is greater than two or less than negative 2, then it can be inferred that the population is likely to be skewed in the same direction as the sample set. The test statistic is represented by the letter "T" on all graphs and by "T-stat" on all tables in this report.

Kurtosis is a measure of peakedness of a data set. The standard kurtosis calculation for a normally distributed data set results in a value of three. Excess kurtosis simply subtracts a value of three from the standard calculation, resulting in a value of zero. This is a matter of convention and ease of comprehension. For this report, excess kurtosis is used. If excess kurtosis is positive, the peak is taller and narrower with longer tails indicating that there are more values around the mean than a normal distribution. If excess kurtosis is negative, the peak is shorter and flatter with shorter tails indicating that there are more values at the extremes than a normal distribution. Similar to skewness, a test statistic is calculated by dividing excess kurtosis by the standard error of excess kurtosis. If the test statistic is greater than three or less than negative three, then it can be inferred that the population is peaked in a manner similar to the sample set.

Significance of a trend is based on the R^2, p-value, and test statistic. The R^2 value is used as a measure of how well the predicted line, or the regression line, fits the observed data. R^2 values range from zero to one with one being a perfect fit. R^2 values greater than or equal to 0.1 were considered to be a good fit; meaning that 10 percent of the difference between the observed and predicted values is explained by the independent variable. Although this may not seem like a good fit, as stated previously, most water quality data are not normally distributed, yet most statistics are based on normality. An R^2 value of 0.1 was selected because it is more inclusive.

The null hypothesis for temporal trend analysis is that there is no correlation between time and measured values; in other words, there is no significant trend. The p-value is the probability of a null hypothesis being true or a measure of confidence that a data set can be used to make predictions and that the observed values are not random. For trend analyses in this report, a significance level of 0.1 was used to determine statistical significance. If the p-value is less than 0.1, the trend is significant, and the observed values are not random. The p-value is represented by the letter "p" on all graphs in this report.

The test statistic is the probability that a correlation (or slope) is due to chance. If the regression line falls entirely within two standard errors away from the slope, then the test statistic value is close to zero and the correlation is due to chance and therefore not significant. If the regression line crosses over the lines two standards error away from the slope, then the test statistic is greater than the absolute value of two and the correlation is not due to chance and is significant. If the data set passed the R^2, p-value, and t-statistic tests, then the trend was considered significant.

In total, data from 44 stations met the criteria for trend analysis. Of those stations analyzed, 56 statistically significant trends were identified from 25 stations. Six trends were observed using all available (historical) data, while eighteen were discovered over the past twenty years, and 32 trends were found over the past decade. Note that three trends were identified for both the ten- and twenty-year analyses. In those cases, the twenty-year trend data are presented in this report.

The historical trends were for alkalinity, dissolved oxygen, salts, and transparency. Out of eighteen trends using data from the past two decades, thirteen were decreasing trends for salts. These decreasing trends appear to be the result of concentration by the pervasive drought from 1999 to 2014 followed by dilution from the elevated stream flows beginning in 2015.

Over the past decade, the most identified trends were for decreasing transparency and nutrients. The decreasing trends for transparency in streams were likely caused by elevated sediment loads from the frequent and large runoff events during this period while the decreasing trends in reservoirs may be an indication of eutrophication caused by excessive algal populations.

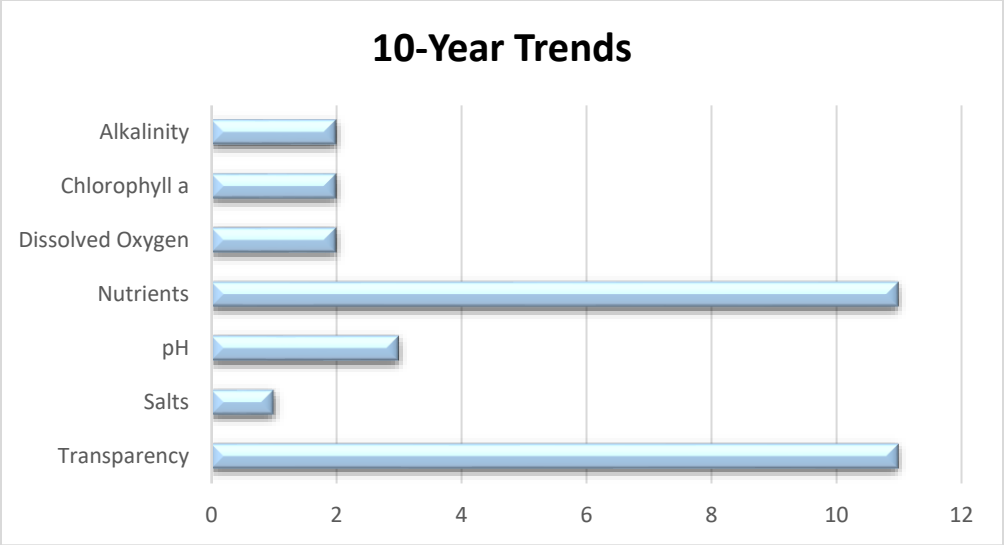

Figure 14: 10-Year trends in the Cypress Creek Basin

The decreasing trends for nutrients were possibly due to dilution from above normal rainfall. Counted in the nutrients trends were seven organic nitrogen trends measured by total Kjeldahl nitrogen analysis. Organic nitrogen goes through the process of mineralization which converts organic nitrogen into inorganic nitrogen including ammonia and nitrate, the molecule that is used by plants and phytoplankton. Similarly, decreasing TKN trends were found across the Sulphur River Basin in the *2024 Sulphur River Basin Summary Report*. The decreasing trends were surmised to be the result of concentration during the pervasive drought followed by dilution through elevated flows beginning in 2015.

An interesting finding was increasing trends for alkalinity. Alkalinity is a measure of the water's ability to neutralize acids and bases and thus maintain a fairly stable pH level. Increasing alkalinity trends were first identified in the *2019 Cypress Creek Basin Summary Report*. This analysis was based upon sample data collected from 1997 to 2018. In the 2019 report, three trends were found in Segment 0402 – Big Cypress Creek below Lake O' the Pines, Segment 0405 – Lake Cypress Springs, and Segment 0408 – Lake Bob Sandlin. The increasing trends could not be explained at the time of writing because alkalinity enters the water column through the weathering of rocks and minerals during runoff events. Considering that much of the period of analysis encompassed a historical drought, increasing trends could not be explained by this process.

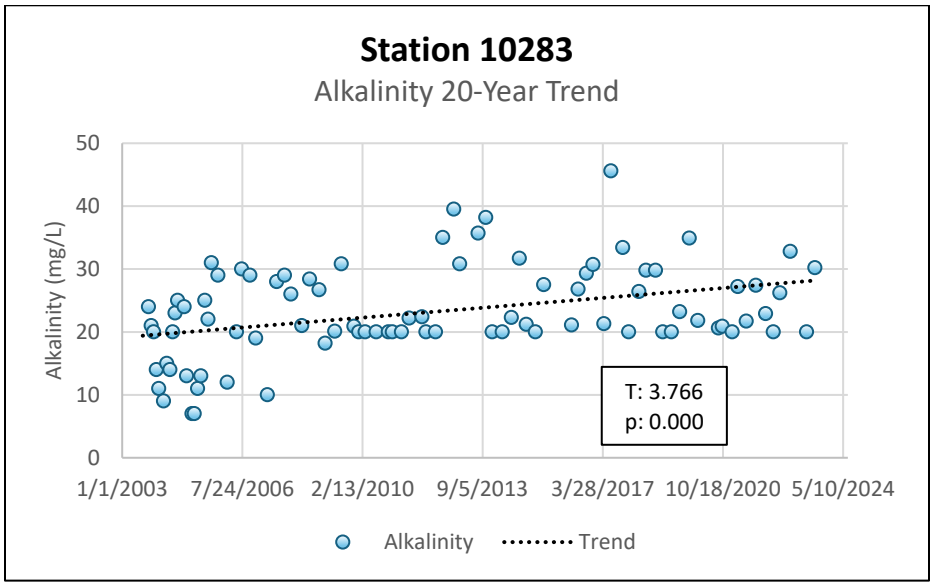

Figure 15: Increasing 20-year alkalinity trend at station 10283 in Caddo Lake

In the current analysis, seven increasing alkalinity trends were observed. Two of those trends were found using historical data while three incorporated data collected over the past twenty years. Both historical trends were for Lake Bob Sandlin while the twenty-year trends were observed in Segment 0403 - Lake O' the Pines, Segment 0402 – Big Cypress Creek below Lake O' the Pines, and in Segment 0401 – Caddo Lake. The ten-year trends were identified in Segment 0404B – Tankersley Creek and Segment 0404C – Hart Creek.

In recent years, researchers have found that alkalinity is increasing across much of the eastern United States and have linked this increase to the reduction of acid rain due to the use of scrubbers and other technologies in smokestacks as required by the 1990 Clean Air Act (Kaushal, *et al*., 2013; Stets, *et al*., 2014). Increasing alkalinity is most pronounced in water bodies which tend naturally to have low alkalinity such as those of East Texas.

Along with alkalinity, increasing pH trends were identified around the basin in the 2009, 2014, 2019, and in the current basin summary report. Since alkalinity is a measure of the water's ability

to neutralize acids to maintain a stable pH level, increasing pH trends are not surprising especially in water bodies which tend to have naturally have low pH and alkalinity such as those in East Texas. It should be noted that the elevated pH values and impairments in Lake Cypress Springs and Lake O' the Pines may have been impacted by higher alkalinity concentrations; however, the impairments appear to be mostly due to excessive primary productivity.

For the water bodies in the eastern portion of the basin that have consumption advisories due to mercury in fish tissue, the increasing pH trends may be encouraging. For mercury to bioaccumulate in organisms, it must first become methylated. The process of mercury methylation generally occurs in the sediments of waters with pH below 7.3 standard units (s.u.) (Kelly, Rudd, Holoka, 2003). One study determined that the pH appeared to affect a facilitated mechanism by which mercury is taken up by the cells. Lowering the pH of mercury solutions mixed together with natural dissolved organic carbon, or with whole lake water, also increased bacterial uptake of mercury (Kelly, Rudd, Holoka, 2003). In other words, the increasing pH and alkalinity trends may indicate the reduction of the availability of mercury to bioaccumulate in organisms. Fish tissue analysis should be considered to determine whether these consumption advisories need to remain in place.

These trends are discussed in detail by water body in the Watershed Summaries section of the report. The Watershed Summaries begin with Segment 0405 – Lake Cypress Springs at the western end of the basin and are generally discussed in the order that water flows to the south and east. Please see the Appendices for a complete list of statistically significant trends along with the number of observations, test statistic, p-value, skewness, and kurtosis values.

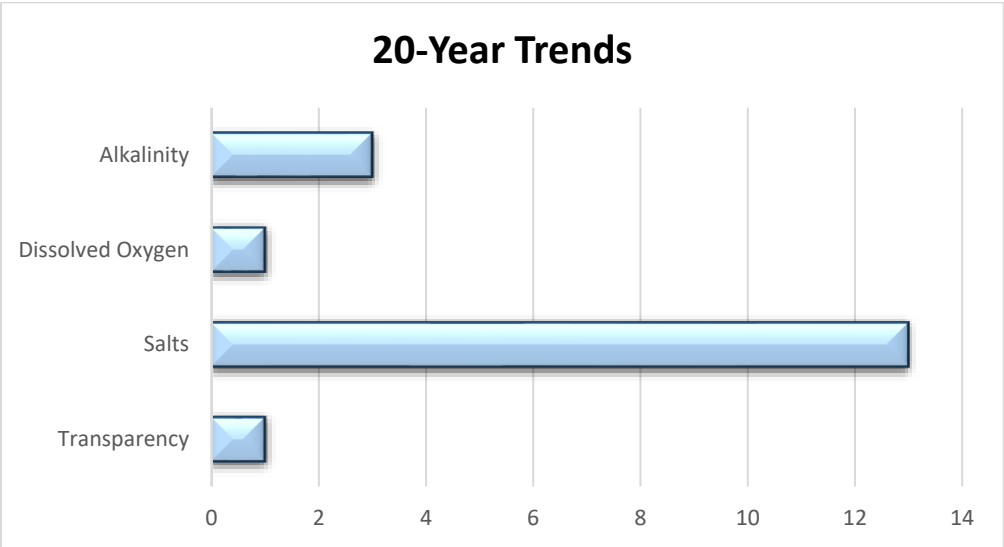

Figure 16: 20-Year trends in the Cypress Creek Basin

Watershed Summaries

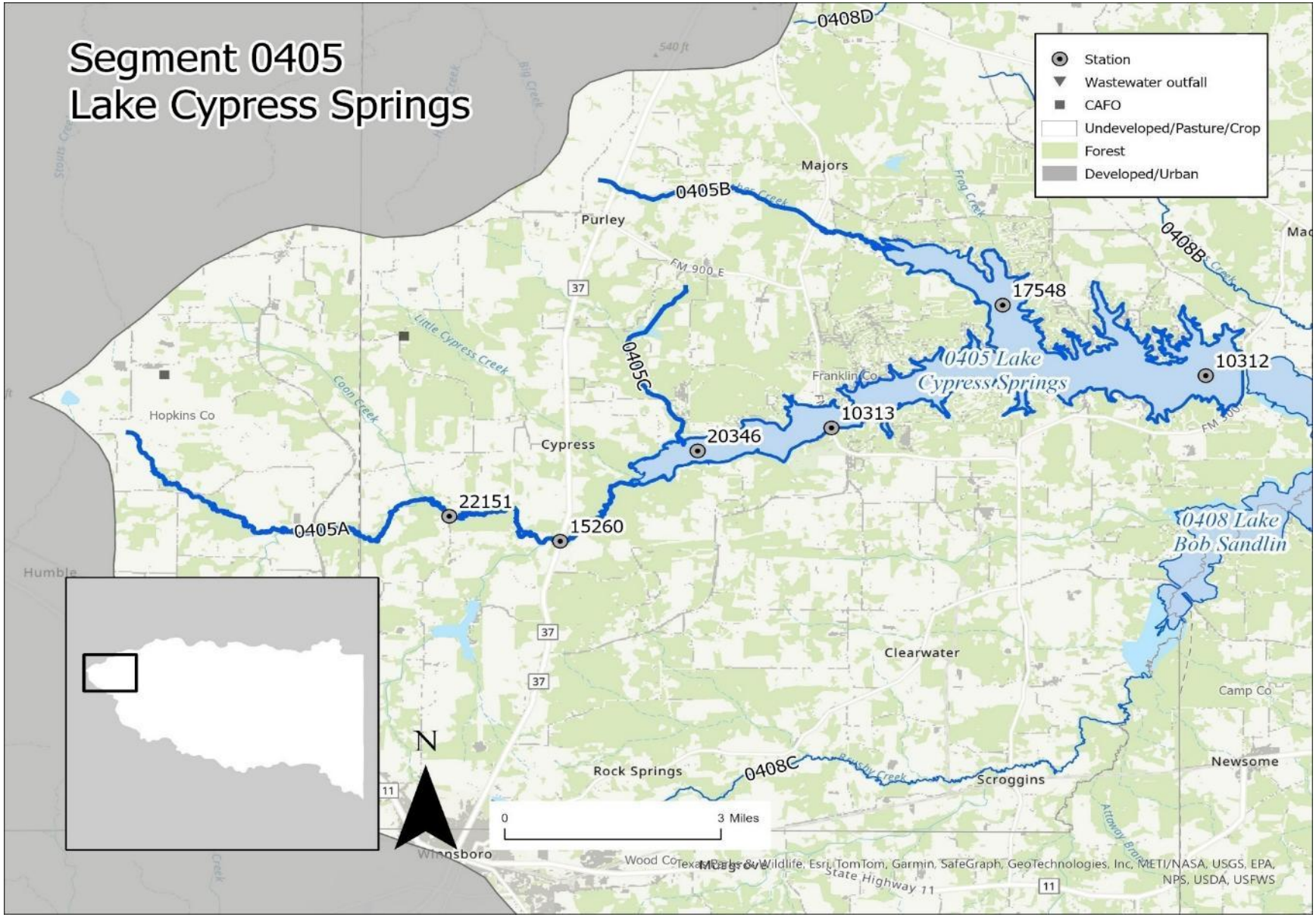

Figure 17: Map of stations in Segment 0405 – Lake Cypress Springs

Lake Cypress Springs Watershed

Lake Cypress Springs is located approximately eight miles south of Mount Vernon in Franklin County, Texas. The mostly rural watershed of Lake Cypress Springs is approximately 75 square miles and is located in the Pineywoods ecoregion while its western tributaries extend into the Post Oak Savannah ecoregion. Much of the watershed immediately surrounding the lake is forested, although the western portion includes unimproved and improved pastures used for poultry, cattle, and hay production. All residential waste is treated using on-site septic systems.

The reservoir impounds the upper reach of Big Cypress Creek and has been voted by D Magazine as "the most beautiful lake in Texas" and as one of "our favorite lakes just a short drive from Dallas." The watershed is primarily rural though many new luxury homes have been constructed around the lake over the past decade.

Authorization for constructing the dam and impounding up to 72,800 acre-feet of water was granted on November 10, 1966. Construction commenced in July 1968 and was completed in February 1971. The Texas Parks and Wildlife Department (TPWD) reports that the watershed area is approximately 75 square miles and has a shoreline length of 43 miles. The shoreline is highly developed with over 800 docks and boat houses.

In 2025, Lake Cypress Springs is monitored quarterly by the TCEQ Region 5 at station 10312 near the dam and at station 10313 near Farm to Market Road (FM) 115. WMS is scheduled to collect field and laboratory parameters, bacteria, and flow at station 22151 in Big Cypress Creek.

2025 Monitoring Schedule							
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**
0405_01	10312	R5	LAKE CYPRESS SPRINGS NEAR DAM	4	4	4	
0405_02	10313	R5	LAKE CYPRESS SPRINGS AT FM 115	4	4	4	
0405A	22151	WMS	BIG CYPRESS CREEK AT CR SW 3170	4	4	4	4

Table 5: FY 2025 Monitoring Schedule for Segment 0405

Tributary streams to Lake Cypress Springs are Big Cypress Creek (Segment 0405A), Panther Creek (Segment 0405B), and Blair Creek (Segment 0405C). The reservoir is impaired for Nutrient Reservoir Criteria throughout, along with high pH in Assessment Units 0405_01 and 0405_03. Segment 0405A is impaired for 24-Hour DO Average and *E. coli*. The 2024 IR showed concerns for chlorophyll *a* in Big Cypress Creek (Segment 0405A) and for habitat in Panther Creek (Segment 0405B). Blair Creek (Segment 0405C) was only sampled four times in FY 2004 and was not assessed in the 2024 IR.

2024 Texas Integrated Report					
Parameter	**0405_01**	**0405_02**	**0405_03**	**0405A**	**0405B**
pH	NS		NS		
Nutrient Reservoir Criteria	NS	NS	NS		
24 HR DO Average				NS	
E. coli				NS	
Chlorophyll *a*				CS	
Habitat					CS

Table 6: Segment 0405 impairments and concerns in the 2024 IR

Unclassified Segment 0405B – Panther Creek

Panther Creek rises near Purley in Franklin County. The stream, which is intermittent in its upper reaches, originally ran southeast for 6.5 miles to its confluence with Big Cypress Creek prior to the construction of Lake Cypress Springs in 1970. The 2024 IR showed a concern for impaired habitat from bioassessments performed in June and August 2002. No sampling has been conducted in this stream since then, and none is currently scheduled.

Unclassified Segment 0405A – Big Cypress Creek

Big Cypress Creek originates in Hopkins County near the Franklin County line and flows southeast into Lake Cypress Springs. The current assesment is based upon data collected at station 15260, located on State Highway (SH) 37 between Mount Vernon and Winnsboro, and from station 22151, located upstream on County Road (CR) SW 3170. The stream is classified as intermittent with perennial pools and has an aquatic life use designation of limited. Sampling in Segment 0405A of Big Cypress Creek was first performed at station 15260 in October 1997.

Located on the west side of Lake Cypress Springs, Big Cypress Creek is a primary source of water for the reservoir. Segment 0405A of Big Cypress Creek originates in western Hopkins County and flows through rural areas with limited residential development. Land use is largely agricultural and includes dairy, cattle, and poultry production. Much of the pastureland is improved for grazing and hay production. The use of poultry litter and commercial fertilizers to improve coastal Bermuda hay yields is common throughout this watershed. All residential waste in the watershed is treated by on-site septic systems.

Due to the typically low flow conditions at station 15260, low dissolved oxygen values were often obtained. Stream flow of under one cubic feet per second (cfs) had been reported for over one-third of the site visits, and less than two cfs were measured at nearly half. Discussions about the

representativeness of station 15260 were held at coordinated monitoring meetings and after reviewing historical data, the Coordinated Monitoring Committee agreed to move sampling upstream to station 22151 since it had more representative conditions.

Figure 18: Station 22151 - Big Cypress Creek at CR 3170

Diel monitoring at station 22151 at CR 3170 was conducted to address the dissolved oxygen impairment. Twenty-two diels were performed between May 2019 and July 2024. Out of those events, three failed to meet the 24-Hour DO Average criterion of 3 milligrams per liter (mg/L) while two did not meet the 2 mg/L 24-Hour DO Minimum criterion. The flow ranged from no flow to 0.07 cfs during those low dissolved oxygen diels which occurred in October 2019, 2021, and 2022. Based upon these diel studies, the stream will meet its dissolved oxygen criteria whenever flow is at least 0.1 cfs. It should be noted that only one dissolved oxygen grab out of fifteen fell below the minimum grab criterion during the 2024 assessment period. This lone low dissolved oxygen reading was recorded in October 2021.

Segment 0405A was also included on the 2024 Texas §303(d) List for bacteria. The impairment carried forward from past assessments since no bacteria samples were assessed in the 2024 IR. WMS began sampling for field and laboratory parameters, bacteria, and flow to address this impairment in October 2024. The *E. coli* result from the first event was 38.9 MPN/100 mL.

The 2024 IR also included a concern for screening level for chlorophyll *a*. The concern carried forward from past assessments since no chlorophyll *a* results were assessed in the 2024 IR. In October 2024, WMS began sampling for field and laboratory parameters, bacteria, and flow to address this concern. The first sample result was 4.43 micrograms per liter (µg/L).

Figure 19: Station 10313 – Midlake (left); station 17548 – Panther Arm (right) in Lake Cypress Springs

Segment 0405 - Lake Cypress Springs

Lake Cypress Springs is owned and operated by the Franklin County Water District (FCWD) for the purposes of municipal water supply and public recreation. The FCWD maintains several boat ramps as well as six parks, campgrounds and RV parks. Walleye Park is the largest park and has a number of tent camping areas, RV pads with water and electrical hookups, a pavilion, restrooms with showers, a dump station, and a boat ramp.

The Franklin County Dam, an earth-fill embankment dam, is 5,230 feet long with a top crest elevation of 395 feet. The uncontrolled emergency spillway is excavated on natural ground to the north side of the dam and has a crest elevation of 385 feet. The service spillway is located near the south end of the main embankment, and water is discharged through an uncontrolled rectangular drop inlet measuring 23 feet by 23 feet. Water is only released when the lake level exceeds the normal conservation pool elevation of 378.0 feet. The fixed structure has no valves

or gates to adjust the rate of releases from Lake Cypress Springs. As a result, flooding in the watershed in December 2015 caused damage to homes and property along the shoreline. Water released from the reservoir flows directly into Lake Bob Sandlin.

Lake Cypress Springs serves as a drinking water supply for approximately 21,000 residents located in the cities of Mount Vernon and Winnsboro, and for residents in the unincorporated areas of Franklin County, and portions of Hopkins, Wood, and Titus counties. According to the Texas Water Development Board Water Use Survey, slightly more than 2,500 acre-feet of water was withdrawn from the reservoir for drinking water production in 2021. The amount of water withdrawn in 2021 represents less than four percent of its total storage capacity.

The reservoir is divided into three assessment units (AU) with AU 0405_01 being the lower portion of the reservoir near the dam; AU 0405_02, the upper 2,600 acres; and AU 0405_03, Panther Arm. The lower assessment unit is represented by station 10312 near the dam while the upper unit is sampled at station 10313 near FM 115 and at station 17548 for the Panther Arm. A limited amount of sampling was performed at station 20346, located in the transitional zone near the headwaters where Segment 0405A - Big Cypress Creek enters the reservoir. Station 10313 was first sampled in 1972 while sampling at station 10312 commenced in 1980 and at station 17548 in 2002.

The TCEQ Region 5 office samples Lake Cypress Springs on a quarterly basis for field and laboratory parameters and for bacteria. The 2024 IR classified Lake Cypress Springs as eutrophic and ranked it in the top twenty percent of reservoirs statewide for chlorophyll *a* despite having relatively low phosphorus concentrations. The mean chlorophyll *a* concentration during the 2024 assessment period was 28.33 µg/L while the mean transparency was 1.06 meters. The reservoir was first impaired for high pH in the 2012 §303(d) List and for excessive algal growth in 2016. The 2022 IR included the new 5n impairment for excessive algal growth along with the high pH impairments in all assessment units; however, the high pH impairment in AU 0405_02 was removed from the 2024 IR because the measurements met the pH criteria during the assessment period.

Texas controls nutrient loadings to water bodies through its Surface Water Quality Standards, watershed rules, and antidegradation considerations in permitting actions using both narrative and numerical nutrient criteria. Until the *2016 Texas Integrated Report of Surface Water Quality*, TCEQ assessed nutrients in surface waters based solely on narrative criteria. The TCEQ began developing numerical nutrient criteria to include in the Surface Water Quality Standards in the early 2000s, establishing its first nutrient criteria development plan in 2001. TCEQ has updated that plan several times, most recently in 2014, in coordination with EPA, an advisory workgroup, and through other public meetings and forums.

In 2010, TCEQ adopted reservoir-specific numerical nutrient (chlorophyll *a*) criteria for 75 reservoirs into Section 307.10 (Appendix F) of the 2010 Texas Surface Water Quality Standards. These criteria were intended to maintain existing water quality and to protect the long-term existing conditions in these reservoirs. The objectives of the numeric and narrative criteria are to preclude excessive growth of aquatic vegetation and are also intended to protect multiple uses such as primary, secondary, and noncontact recreation, aquatic life, and public water supplies. In July 2013, EPA approved the adopted criteria for 39 of the 75 reservoirs, whose criteria were first used for assessment purposes in 2016.

Lake Cypress Springs is the only reservoir in the Cypress Creek Basin with EPA-approved numerical nutrient criteria. Unlike other reservoirs in the basin, Lake Cypress Springs has reservoir-specific numerical criteria assigned for chlorophyll *a*, and narrative thresholds for total nitrogen, total phosphorus, and transparency. The chlorophyll *a* criterion was based upon ambient data collected between July 1990 and October 2008. Using several factors to evaluate the water quality in Lake Cypress Springs, the EPA agreed that the chlorophyll *a* criterion of 17.54 µg/L is protective of the water quality conditions in the reservoir. It should be noted that the assessment of the reservoir is based only upon the results collected at station 10312, located near the dam, and is assessed using the following values:

- Chlorophyll *a* 17.54 µg/L
- Total Nitrogen 0.8 mg/L
- Total Phosphorus 0.03 mg/L
- Secchi 1.19 m

As part of the *2022 Texas Integrated Report of Surface Water Quality*, the TCEQ revised their assessment methodology for the 39 reservoirs with EPA-approved chlorophyll *a* criteria. The new methodology stated, "all reservoirs exceeding their numeric chlorophyll *a* criterion would be impaired and identified as not supporting." Additionally, a new sub-category "5n" was created for reservoirs that did not meet their applicable chlorophyll *a* criterion, but an additional study is needed to verify that the exceedance is associated with causal nutrient parameters or impacts to response variables.

Due to exceedances in its chlorophyll *a*, total nitrogen, total phosphorus, and Secchi transparency values as part of the 2022 IR, Lake Cypress Springs was one of the first reservoirs in Texas to fall into the new 5n impairment category. As a result, the TCEQ funded the very first 5n impairment study in the state of Texas. The 5n impairment study is discussed in detail in the *2024 Cypress Creek Basin Highlights Report*. The project included monthly sampling from September 2022 through August 2023 in each of the three assessment units plus a station located in the western end of the reservoir in AU 0405_02. Although the West End station (20346) was in a transition

zone and is not representative of the assessment unit, this area was widely believed to receive much of the nutrient loading to the reservoir through contributions from Big Cypress Creek.

The 5n impairment study sampling included the collection of field and laboratory parameters. Field parameters consisted of depth profiles for dissolved oxygen, pH, conductivity, and temperature along with observations of transparency, lake and weather conditions, and water color. Laboratory samples were analyzed for the nitrogen suite (ammonia, nitrite, nitrate, total Kjeldahl nitrogen), total phosphorus, total alkalinity, sulfate, chloride, pheophytin *a*, and chlorophyll *a*. Total nitrogen was calculated by adding the results of nitrite, nitrate, and total Kjeldahl nitrogen. Depth profiles and field observations were recorded at the time of laboratory sample collection. Monthly diel monitoring was conducted in each assessment unit for dissolved oxygen, pH, conductivity, and temperature every fifteen minutes for a period of twenty-four hours.

The results of the study found that nitrate and total nitrogen were relatively abundant at the Dam station (10312), but this station had the lowest mean concentrations of total phosphorus and chlorophyll *a*. This station also had the highest transparency of all stations. The Panther Arm station 17548 had similar results to those found at the Dam station.

Laboratory analyses supported the assumption that Segment 0405A of Big Cypress Creek is a significant contributor of nutrient loading into Lake Cypress Springs. The West End station 20346 had the highest total nitrogen, total phosphorus, and lowest transparency of the four stations. These elevated nutrients likely lead to increased primary production at station 10313 which had the highest chlorophyll *a* concentration in a single sample and as an average of all samples. Total Kjeldahl nitrogen, total phosphorus, and Secchi transparency were statistically different at the West End station than the other stations. These results suggest that Big Cypress Creek was the primary contributor of nutrients into Lake Cypress Springs.

Lake Cypress Springs is impaired for high pH in the Panther Arm and lower assessment units. Sixteen percent of the average mixed surface layer pH measurements in the 2024 IR exceeded the 8.5 s.u. high pH criterion at all stations combined in Lake Cypress Springs. A review of all historical data in the TCEQ Surface Water Quality Monitoring Information System database (SWQMIS) revealed that about fifteen percent of all pH readings were elevated across the reservoir with the highest pH value of 9.5 s.u. reported at station 10312 and at station 17548 in August 2013. For station 10313, the maximum value of 9.4 s.u. was collected in May 2010. An interesting discovery was that the vast majority of high pH readings occurred during the warm weather months of May through October. No high pH values were measured during the cool weather months of November through April at station 17548 while only one was reported for station 10312. Station 10313 had the most high pH values in the cool weather months at six.

Lake Cypress Springs Historical pH				
Station	**10312**	**10313**	**17548**	**Total**
n	112	112	68	292
High	15	19	10	44
% High	13.4%	17.0%	14.7%	15.1%
Cool weather	1	6	0	7
Maximum pH	9.5	9.4	9.5	

Table 7: Historical pH values by station in Lake Cypress Springs

A statistically significant increasing pH trend was identified at station 10313 in the *2009 Cypress Creek Basin Summary Report*. The trend analysis was performed on data collected between January 1972 and August 2007. The increasing pH trend did not continue into the 2014, 2019, or the current analysis. However, high pH readings have become more frequent since 2009. Prior to August 2009, no high pH results had been reported at stations 10312 or 17548. The first elevated pH measurement reported at station 10313 was from June 2001.

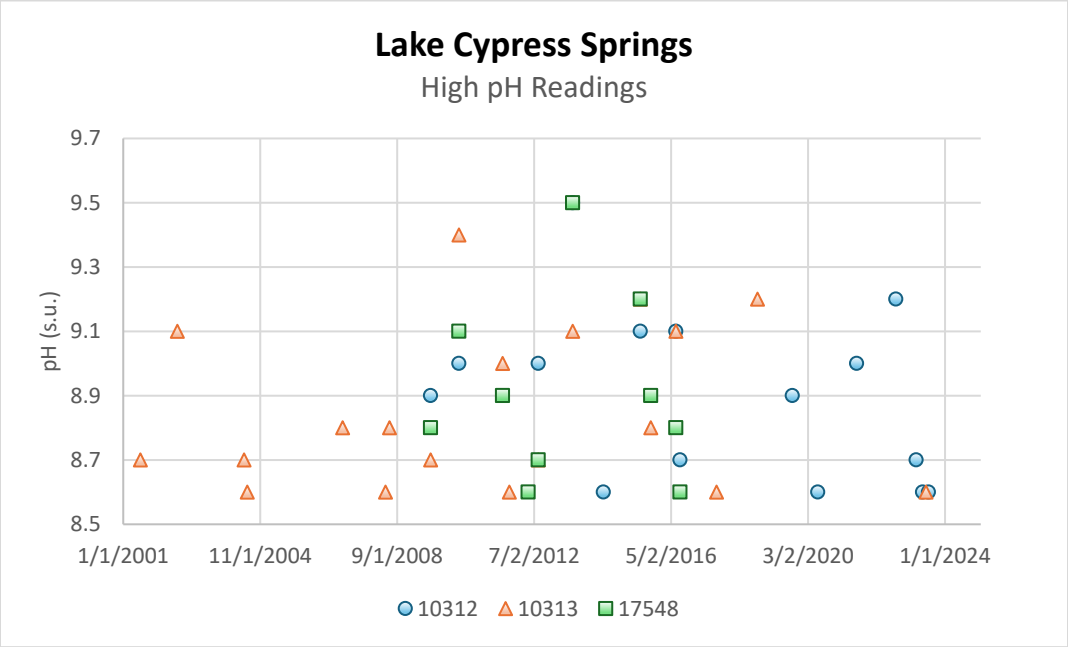

Figure 20: High pH readings by station since 2000 in Lake Cypress Springs

Due to the excessive algal growth impairment shown in the 2016 IR, data analysis discussed in the *2019 Cypress Creek Basin Summary Report* explored the possible relationship between high pH and primary productivity. In eutrophic reservoirs, algae and other primary producers can consume the available carbon dioxide (CO_2) during the process of photosynthesis. Once the available carbon dioxide is exhausted, a CO_2 molecule will be broken away from carbonic acid, thereby increasing the pH in the water column. During nighttime when photosynthesis does not occur, CO_2 released through respiration will bond with hydrogen to form carbonic acid, thereby

decreasing pH. This pH cycling phenomenon can be assumed in Lake Cypress Springs since all of the grab samples used in the assessment were collected between 10 AM and 2 PM, the peak hours of primary productivity.

Although dissolved oxygen concentration (mg/L) is used for assessment purposes, dissolved oxygen percent saturation is a useful indication of primary productivity. Dissolved oxygen concentration is a calculated parameter based upon the percent saturation of oxygen, temperature, and salinity. Contributors of oxygen into the water column, such as phytoplankton and aquatic plants, can raise the amount of oxygen above saturation during photosynthesis. Super-saturated dissolved oxygen conditions can be alarming since large diel changes in dissolved oxygen can stress the organisms living in the water body. During peak hours of photosynthesis, dissolved oxygen may become super-saturated to levels high enough to cause fish kills. Oxygen is consumed by aerobic organisms through respiration which can cause dissolved oxygen to fall. If the primary contributor of oxygen is from phytoplankton, then these organisms, along with bacteria, can cause oxygen to rapidly decline during nighttime respiration leading to a fish kill.

A review of all high pH readings was compared with the dissolved oxygen percent saturation. In all but one case of high pH, dissolved oxygen percent saturation was one hundred percent or greater. A review of all historical data showed that dissolved oxygen grab samples and pH correlated with a coefficient of 0.62. The highest correlation was at station 10312 at 0.67.

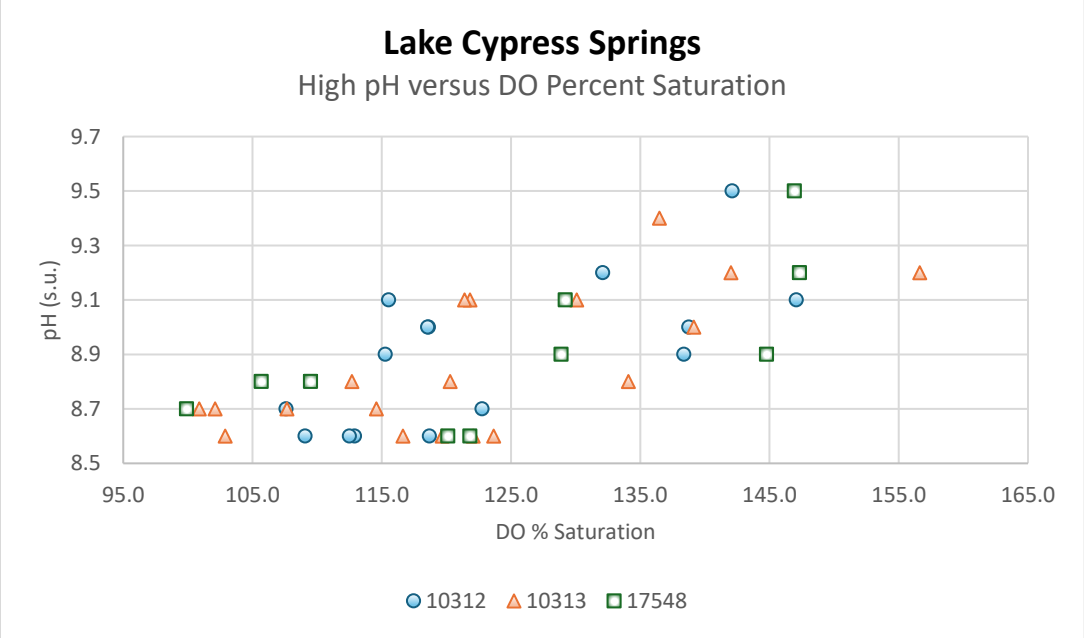

Figure 21: High pH readings versus DO percent saturation in Lake Cypress Springs

It should be noted that without diel data, pH cycling cannot be demonstrated. The pH cycle is especially pronounced in waters with low alkalinity, such as those found in Lake Cypress Springs.

Monthly diel sampling was included in the 5n impairment study at stations 10312, 10313, and 17548. High pH during diel measurements were most often observed at station 10313 with 483 out of 1,152 readings (41.9 percent) exceeding the 8.5 s.u. pH criterion. At least one elevated pH value was recorded in nine out of twelve months at this station. Most of the high pH readings were observed in the warm weather months while no high pH values were recorded at any station in November and December 2022.

Dissolved oxygen and pH often exhibited the same diel cycle during the 5n impairment study. Dissolved oxygen percent saturation and pH strongly correlated with an average coefficient of 0.93. Station 10313 had the highest correlation coefficient between dissolved oxygen percent saturation and pH at 0.97. Station 10313 had a perfect correlation coefficient of 1.00 in the months of September and October 2022 and in January 2023. During the study, dissolved oxygen percent saturation often exceeded one hundred percent with super-saturated readings as high as 158 percent.

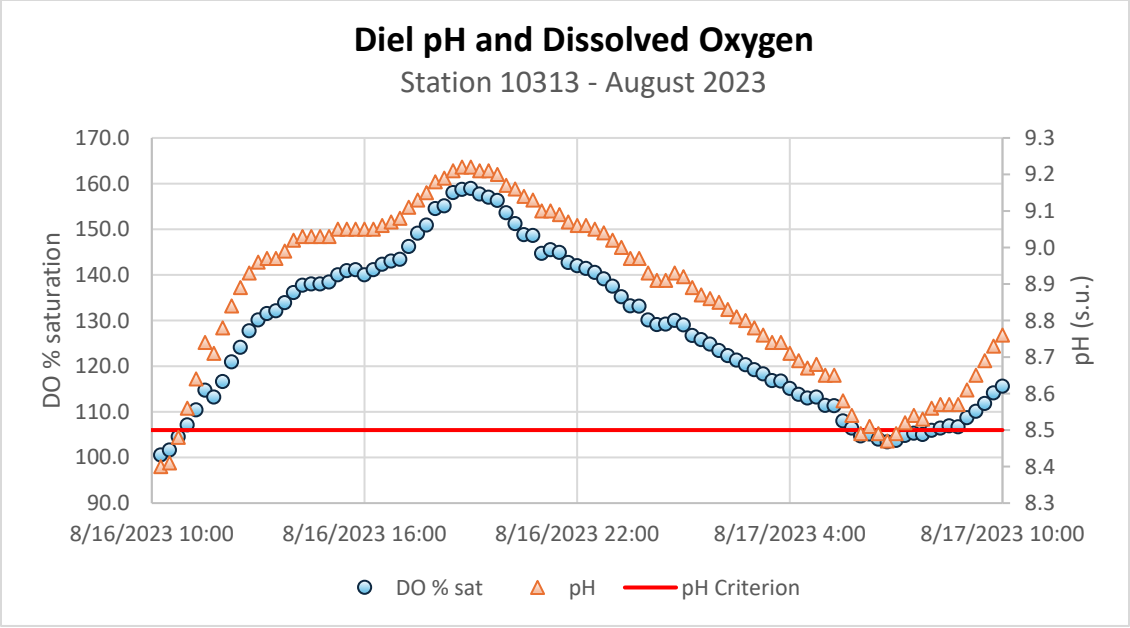

Figure 22: Diel pH and DO percent saturation at station 10313 in August 2023

The results of the 5n impairment study indicated that the high pH impairment was due to excessive amounts of algae in the reservoir. A review of all historical chlorophyll *a* data, a measure of algae, showed that chlorophyll *a* is generally trending higher across the reservoir, although not at a statistically significant rate. The highest values were obtained from station 10313 along with the most results exceeding the 17.54 µg/L criterion at seventy percent of all samples. Half of the samples collected at station 10212 were elevated while 65 percent were high at station 17548. However, unlike pH, the elevated chlorophyll *a* results were not

predominately collected in the warm weather months. About half of all elevated results were obtained in the cool weather months.

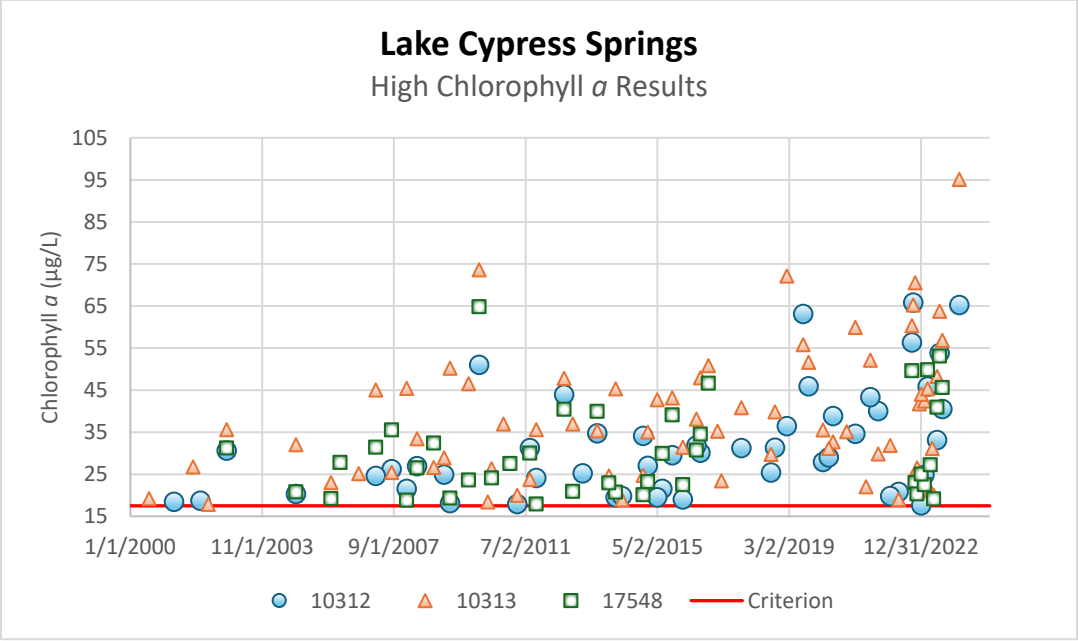

Figure 23: High chlorophyll a results by station in Lake Cypress Springs

A single-factor Analysis of Variance was conducted on all chlorophyll *a* samples across Lake Cypress Springs, and statistically significant differences were identified between the stations with a p-value of 0.000. After removing station 10313 from the analysis, the difference was no longer statistically significant. These results suggest that chlorophyll *a* values at station 10313 were significantly higher than in the Panther Arm or near the dam. These results were similar to the findings in the 5n impairment study.

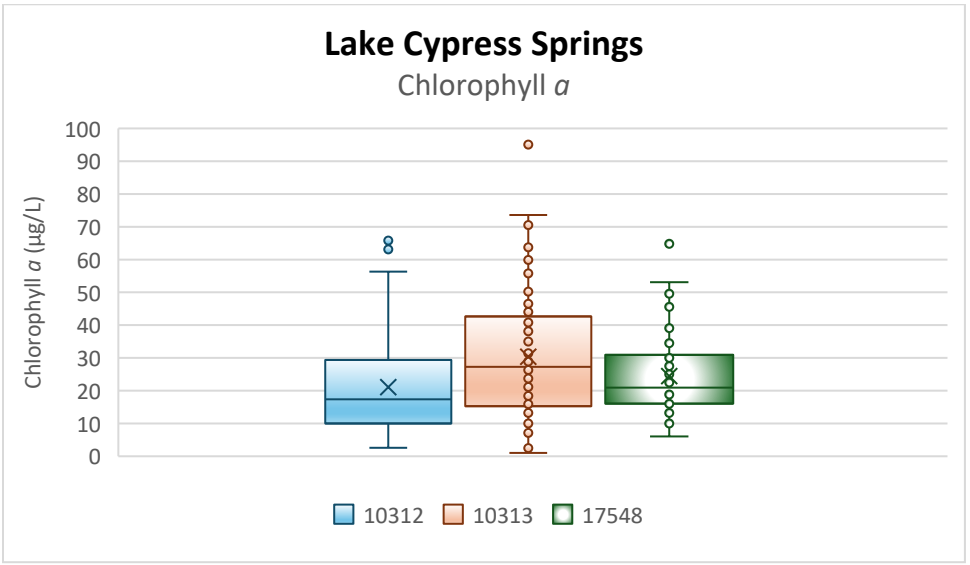

Figure 24: Historical chlorophyll a values by station in Lake Cypress Springs

The historic chlorophyll *a* values did not correlate well with pH with an average coefficient of 0.23. The correlation was highest at station 10312 at 0.40 and lowest at station 10313 with 0.11. The chlorophyll *a* results did not correlate well with dissolved oxygen percent saturation with coefficients ranging from 0.10 at station 10313 to 0.34 at station 10312. Although the correlation coefficients were low, these results did not necessarily negate the cause of high pH was due to eutrophication. By following the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1*, all surface water grab samples in reservoirs are collected at 0.3 meter below the surface. Although most other parameters are subject to the law of diffusion, moving from high concentration to low concentration, phytoplankton are motile organisms. The movement of phytoplankton vertically through the water column to a depth that is most suitable for photosynthesis and reproduction is well documented in the literature. That depth may be well above or below 0.3 meter at the time of sampling which may explain the lack of strong correlations between chlorophyll *a* and pH or dissolved oxygen percent saturation.

Lake Cypress Springs Correlations			
Correlation	**10312**	**10313**	**17548**
pH to DO percent saturation	0.67	0.56	0.62
Chlorophyll *a* to pH	0.40	0.11	0.20
Chlorophyll *a* to DO percent saturation	0.34	0.10	0.15
Chlorophyll *a* to Transparency	-0.54	-0.53	-0.12

Table 8: Correlations between DO percent saturation, pH, chlorophyll a, and transparency by station

Transparency is an indication of water clarity and is measured using a Secchi disk. Secchi depth provides an estimate of the amount of light penetrance in the water column. The greater the Secchi depth, the greater the depth that light can penetrate. The transparency of water is affected by the amount of solids (measured by turbidity) and other constituents present in the water column. While turbidity is one component of transparency, algal biomass is another. In other words, a water body with low turbidity may not necessarily mean that it has high transparency.

Transparency in Lake Cypress Springs is relatively low. The historical average Secchi depth at station 10312 was 1.13 meters. This falls short of the narrative threshold of 1.19 meters. The mean transparency at station 10313 was 0.82 meter and 1.09 meters at station 17548. Secchi transparency and chlorophyll *a* had an inverse correlation at stations 10312 and 10313 with coefficients of -0.54 and -0.53, respectively. These results suggest that as chlorophyll *a* increases, transparency decreases.

A single-factor Analysis of Variance was conducted on all Secchi measurements across Lake Cypress Springs, and statistically significant differences were identified between the stations with a p-value of 5.69e-06. After removing station 10313 from the analysis, the difference was no longer statistically significant. These results suggest that transparency at station 10313 was significantly less than in the Panther Arm or near the dam. These results were similar to the findings detailed in the 5n impairment study.

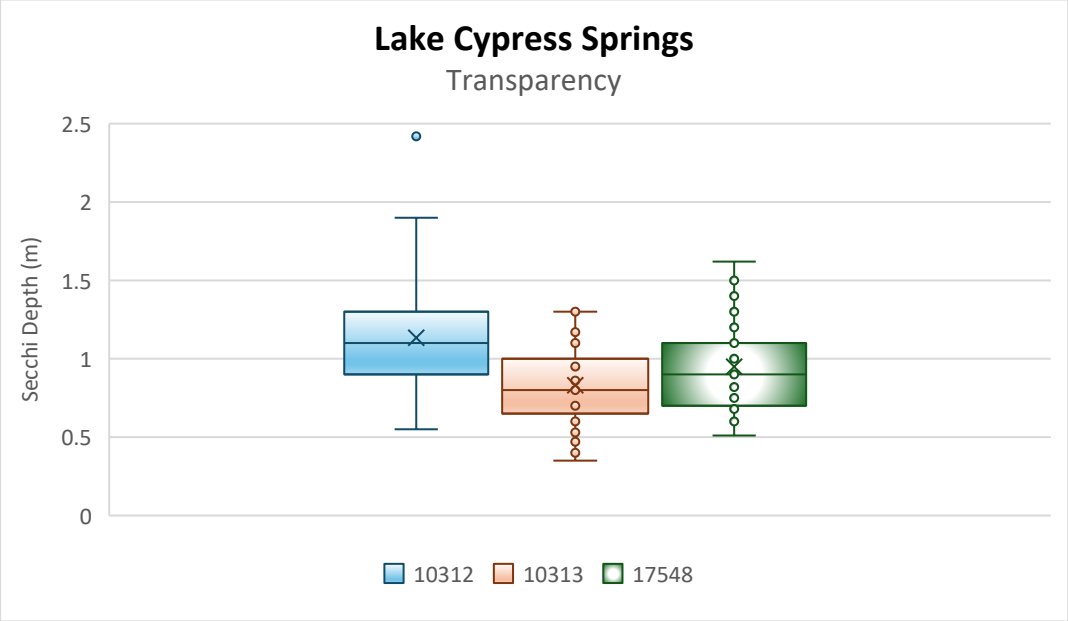

Figure 25: Historical transparency readings by station in Lake Cypress Springs

TRENDS

Trend analysis was conducted on all data collected at stations 10312, 10313, and 17548. Three trends were identified at station 10313 while no trends were observed at the other stations. Two of the trends were for decreasing chloride and sulfate over the past twenty years. Both chloride and sulfate are salts, and the decreasing trends were likely the result of concentration by the pervasive drought from around 1999 to 2014 followed by dilution from the near historic flooding in 2015 and 2016 and above average rainfall amounts experienced through mid-2022. Specific conductance is a measure of the salt content in waters. During the drought periods, these salts concentrate in the water column and then become diluted by flooding and regular runoff events. The impact of the drought on these parameters was exemplified by the increasing trends for specific conductance that were identified at stations 10312 and 10313 in the 2009, 2014, and 2019 basin summary reports.

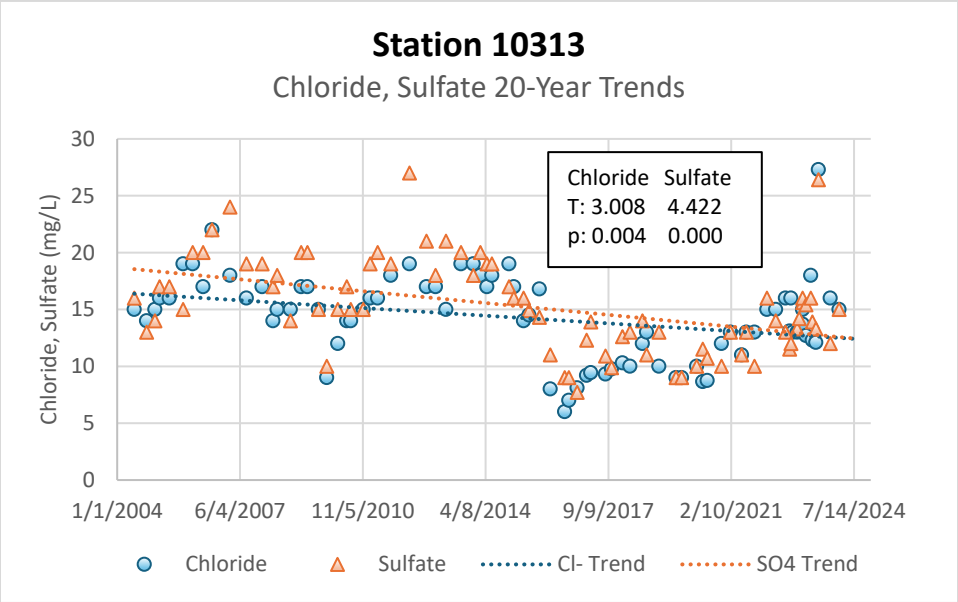

Figure 26: Decreasing 20-Year chloride and sulfate trends at station 10313

A decreasing trend for transparency using historical data was discovered at station 10313. This trend was possibly affected by algal productivity. This station had the highest concentrations of chlorophyll *a* along with the most samples reported above the criterion in the reservoir. The 5n impairment study demonstrated that the excess nutrients at station 20346 near the headwaters resulted in elevated chlorophyll *a* concentrations at station 10313. The historical sampling results supported this finding.

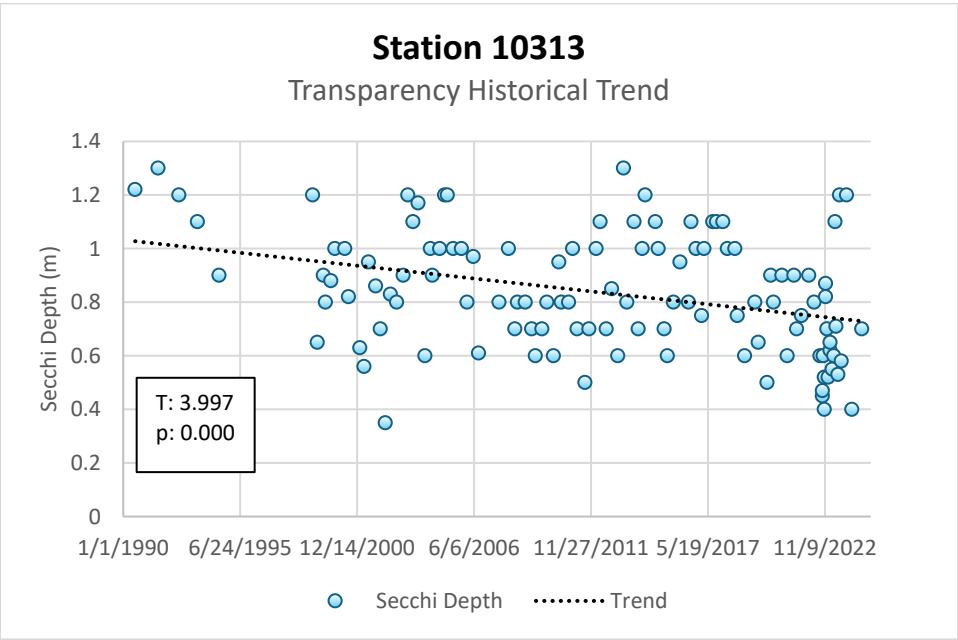

Figure 27: Decreasing historical transparency trend at station 10313

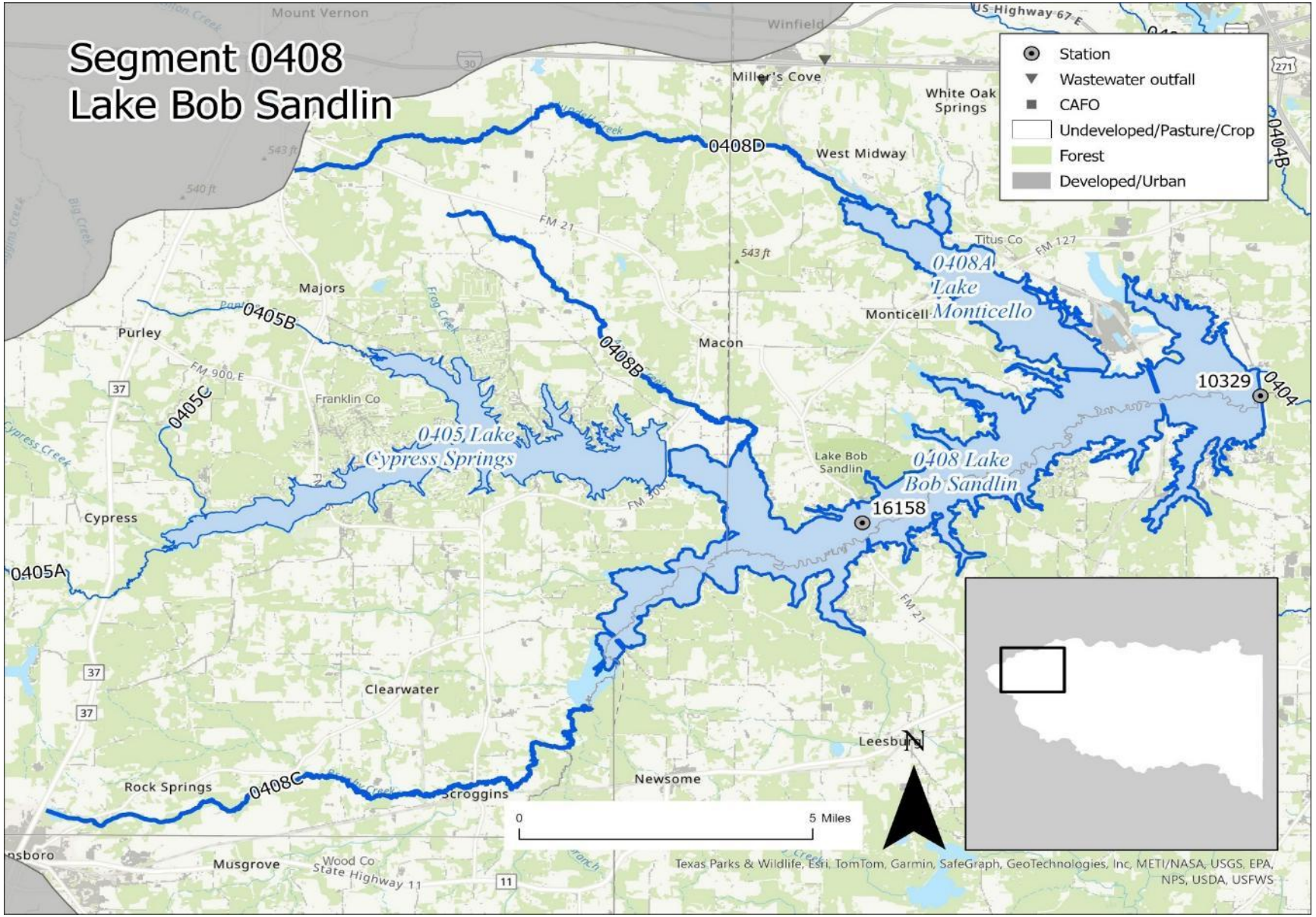

Figure 28: Map of stations in Segment 0408 – Lake Bob Sandlin

Segment 0408 – Lake Bob Sandlin

Lake Bob Sandlin is located immediately below Lake Cypress Springs and Lake Monticello, located in the upper reaches of the reservoir. Completed in 1977, the Fort Sherman Dam impounds over 8,800 surface acres with a storage capacity of 203,148 acre-feet of water. The reservoir serves as a municipal and industrial water supply and is managed by the Titus County Freshwater Supply District #1. Sandlin is a popular recreational and fishing lake and many new homes have been constructed along the shoreline over the past few years.

Water released from the Fort Sherman Dam enters Segment 0404 - Big Cypress Creek. These releases play a vital role in the water quality of Big Cypress Creek and Lake O' the Pines. Since there are no in-stream flow requirements, water is only released from the reservoir to maintain freeboard. Due to the pervasive drought from 1999 through 2014, no water was released during seven of those fifteen years causing Big Cypress Creek to become dominated by effluent flows.

Due to flooding, a record amount of water was released from the Fort Sherman Dam in 2015 at more than 280,000 acre-feet. An additional 150,000 acre-feet was released by the end of April 2016. This amount of water could fill Lake Bob Sandlin more than twice. Over 1.5 million acre-feet were released in the decade of 2015 and 2024, which represents over one-third of all water discharged from Lake Bob Sandlin since its completion in 1979. However, drought conditions from the summer of 2021 through 2022 resulted in no water being released between July 2021 and January 2023.

Lake Bob Sandlin is divided into three assessment units, but was only assessed in the upper and lower units of the reservoir. The lower assessment unit, AU 0408_01, is the lower 2,500 acres near the dam and has historically included three stations: 10329 near mid-dam; 17059 on the north side of the dam near the City of Mt. Pleasant intake; and 17060 on the south side of the dam near the City of Pitssburg intake. There were no stations sampled or assessed in the middle portion of the lake while AU 0408_03, the upper 3,000 acres, was monitored at station 16158 near the FM 21 bridge.

Segment 0408 Assessment Units		
Assessment Unit	**Description**	**Station(s)**
0408_01	Lower 2,500 acres near dam	10329; 17059; 17060
0408_02	Middle 3,000 acres	No stations
0408_03	Upper 3,000 acres	16158
0408C	Brushy Creek	No stations

Table 9: Stations and assessment unit descriptions in Segment 0408

Figure 29: Lake Bob Sandlin at Titus County Freshwater Supply District Boat Ramp 1 near the Fort Sherman Dam

The TCEQ Region 5 currently samples quarterly for field, laboratory, and bacteria at station 10329 at mid-dam and at station 16158 near FM 21. They began sampling at station 10329 in October 1981 but discontinued the station in 2000. From October 2000 to March 2017, the TCEQ sampled at the two intake stations in AU 0408_01, located near the north and south ends of the dam. In July 2017, they moved all sampling in the assessment unit to station 10329. It should be noted that sample results from all three stations were used in the assessment of AU 0408_01 in the 2024 IR and for statistical analyses. For the upper assessment unit, monitoring has been conducted at station 16158 since November 1998.

2025 Monitoring Schedule						
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**
0408_01	10329	R5	LAKE BOB SANDLIN AT MID DAM	4	4	4
0408_03	16158	R5	LAKE BOB SANDLIN AT FM 21	4	4	4

Table 10: FY 2025 Monitoring Schedule for Segment 0408

There were no impairments or concerns for Lake Bob Sandlin shown in the 2024 IR in any assessment unit. Unlike Lake Cypress Springs, chlorophyll *a* concentrations were typically low throughout the assessment period. In AU 0408_01, only one out of 31 samples was reported above the 26.7 µg/L screening level at 50.1 µg/L. This value was obtained in July 2019 at station

10329. All samples collected in 2023 through February 2024 were less than the screening level except for a 27 µg/L result in July 2023.

For AU 0408_03 in the 2024 IR, two of the 25 samples collected at station 16158 were elevated with a mean of 31.85 µg/L. These high values were from July 2019 and October 2022. It should be noted that samples from July and November 2023 and February 2024 were also elevated at 30.4, 30.4, and 34.5 µg/L, respectively. These results were collected after the end of the 2024 assessment period but should be included in the 2026 IR.

Historically, nutrient concentrations have been very low at all stations in AU 0408_01. In a review of all 162 total phosphorus samples collected in the assessment unit, 120 were reported below the limit of quantitation. Similarly, almost 81 percent of all ammonia results and over half of the nitrite plus nitrate samples fell below this limit. Nutrients were also low in the upper assessment unit with over 96 percent of the 62 total phosphorus, 83 out of 93 ammonia samples, and sixty percent of the nitrite plus nitrate concentrations falling below the limit of quantitation.

For the 2024 assessment period, none of the ammonia, nitrate, or total phosphorus concentrations exceeded their screening levels in AU 0408_03. In the lower assessment unit, one ammonia and five nitrate results were reported above their screening levels, while all total phosphorus values were below the 0.2 mg/L screening level. The elevated ammonia sample was 0.27 mg/L, more than double the 0.11 mg/L screening level. A result of 0.25 mg/L was collected in November 2023 that will be included in the 2026 assessment. Five out of 33 nitrate samples assessed were over the 0.37 mg/L screening level with a mean of the exceedances of 0.42 mg/L. In February 2023, a sample result of 0.46 mg/L was recorded.

Unlike Lake Cypress Springs, pH fell within the criteria in both assessment units. None of the pH measurements were reported outside of the criteria in AU 0408_01 while a single reading of 9.1 s.u. was reported in July 2017 for AU 0408_03. As of July 2024, no other high pH values were reported. It should also be noted that all dissolved measurements met both the grab sample criterion and screening level.

TRENDS

Several trends were identified in Lake Bob Sandlin. Sample results from stations 10329 and 17059 were combined and are shown as AU 0408_01 in the following graphs. Data from these stations were combined because both stations are located within the same assessment unit and to extend the period of trend analysis.

In the *2019 Cypress Creek Basin Summary Report*, an increasing alkalinity trend was identified at station 16158 which continued into this analysis. Increasing trends for alkalinity were discovered in both the upper and lower assessment units using all results reported since 2000. Interestingly, the T-statistics and p-values results were identical for both units. These increasing alkalinity trends are of interest as they may indicate improvements in water quality as discussed in the Trend Analysis section of the report.

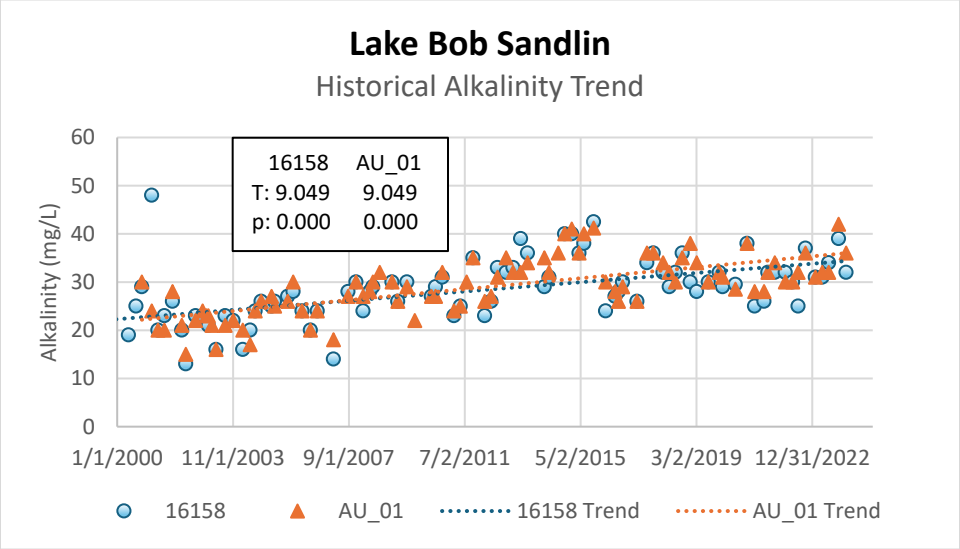

Figure 30: Decreasing historical alkalinity trend in Assessment Unit 0408_01 and at station 16158

Decreasing trends for sulfate and chloride were found in both assessment units over the past twenty years along with a decreasing trend for specific conductance in lower assessment unit. Both sulfate and chloride are salts, and specific conductance is a measure of salts in the water column. These decreasing trends appear to be heavily influenced by the extended drought period of 1999 through 2014 which concentrated these salts in the reservoir. The near historic flooding in 2015 and 2016, which ended the pervasive drought, diluted salt concentrations and resulted in these decreasing trends. In contrast, specific conductance and salts were found to be increasing at statistically significant rates in the 2014 and 2019 analyses.

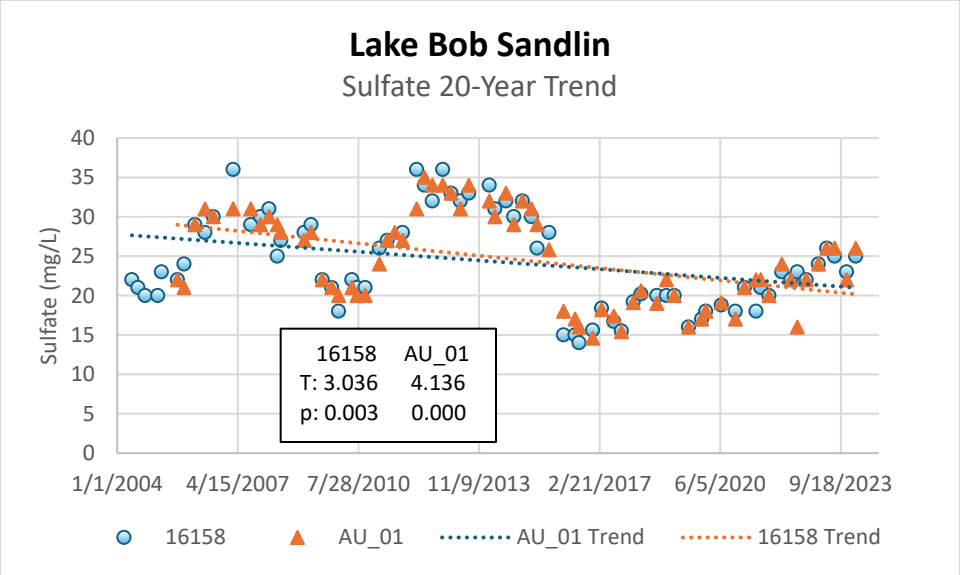

Figure 31: Decreasing 20-Year sulfate trend in Assessment Unit 0408_01 and at station 16158

A decreasing trend for total Kjeldahl nitrogen over the past decade was found in both assessment units. The declining trend was possibly due to heavy rainfall and flooding in 2015 and 2016, thereby diluting organic nitrogen concentrations in the reservoir. The T-statistics and p-values were also identical at both stations.

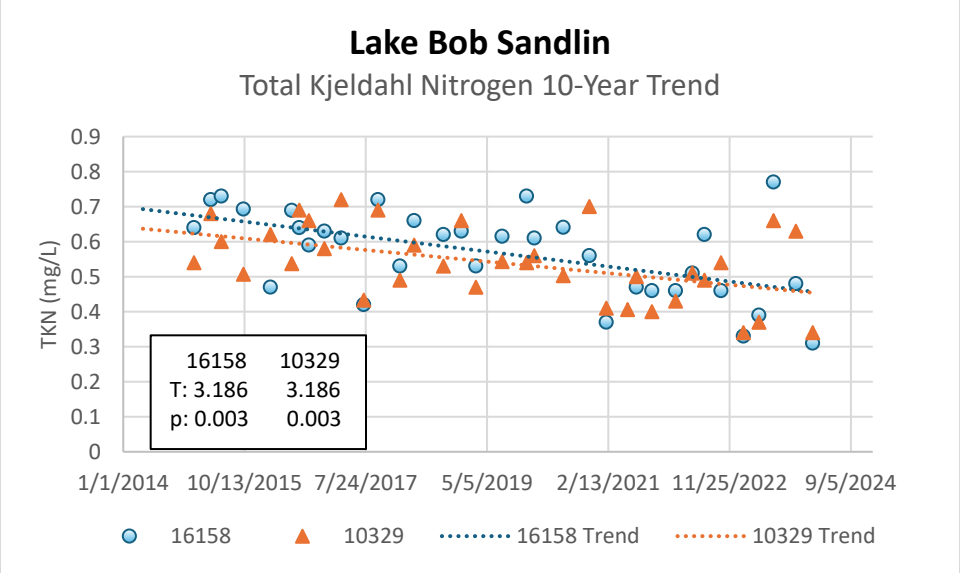

Figure 32: Decreasing 10-year sulfate trend at stations 10329 and 16158

Transparency has decreased at a statistically significant rate across Lake Bob Sandlin. There are a couple of possible causes for these trends. One explanation is that the reduction in transparency may be due to more solids entering the reservoir due to flooding over the past decade. Total suspended solids values were inversely correlated to Secchi depth for data

collected over the past decade with coefficients of -0.27 at station 10329 and -0.38 at station 16158.

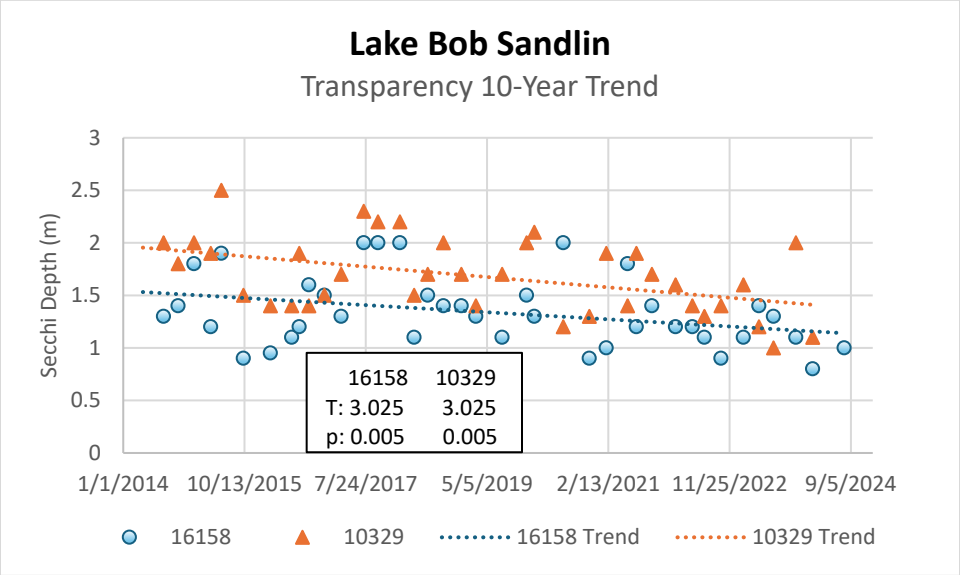

Figure 33: Decreasing 10-year transparency trend at stations 10329 and 16158

Another possible explanation is that phytoplankton populations were increasing which reduces water clarity. Secchi and chlorophyll *a* had inverse correlations with coefficients of -0.39 at station 10329 and -0.50 at station 16158. The effects from a combination of runoff and phytoplankton are most likely the best explanation for the decreasing trend. A review of chlorophyll *a* samples collected in both assessment units shows that the parameter has generally been increasing over the past decade, although not at a statistically significant rate. These increases may be due to algae from Lake Cypress Springs washing into Lake Bob Sandlin and/or due to the natural aging cycle of the reservoir. These decreasing transparency trends should continue to be monitored since they may be indicative of eutrophication and degradation of water quality.

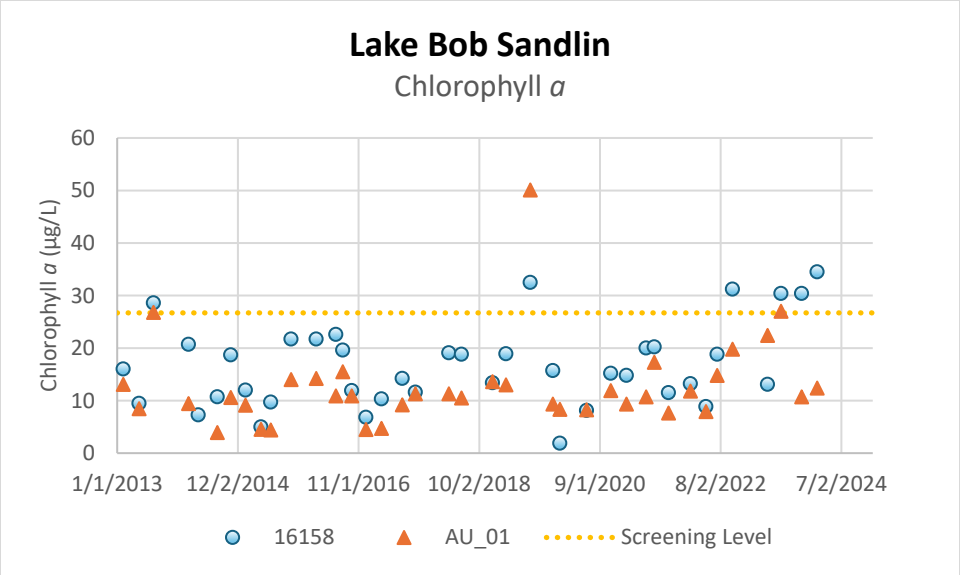

Figure 34: Chlorophyll a values in Assessment Unit 0408_01 and at station 16158

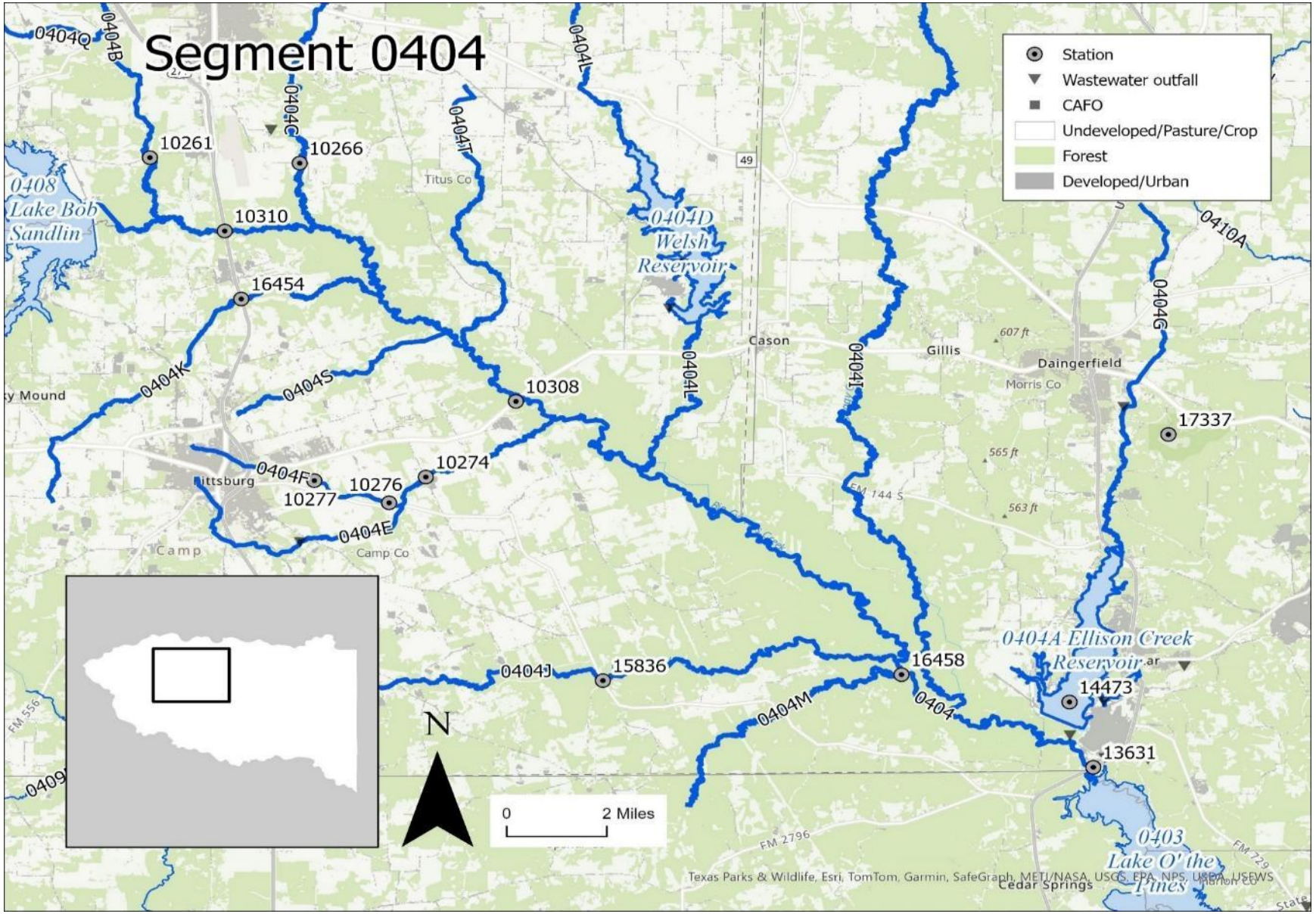

Figure 35: Map of stations in Segment 0404 – Big Cypress Creek below Lake Bob Sandlin

Segment 0404 – Big Cypress Creek below Lake Bob Sandlin

Segment 0404 is the most urban-influenced segment in the Cypress Creek basin. Population centers include Mount Pleasant, Pittsburg, and Daingerfield. The segment begins at the release from Fort Sherman Dam on Lake Bob Sandlin and continues 61 kilometers to the headwaters of Lake O' the Pines. Stream flow in this reach of Big Cypress Creek is highly influenced by releases from Lake Bob Sandlin and by treated effluent discharged into tributary streams. During periods of low flow and drought, stream flow is almost entirely composed of treated effluent discharged from wastewater plants in Mount Pleasant, Pittsburg, Daingerfield, Lone Star, and Omaha. The two largest plants are the City of Mount Pleasant and Pilgrim's Pride.

Big Cypress Creek is divided into two assessment units. The upper assessment unit, 0404_02, extends 37.2 kilometers downstream from Lake Bob Sandlin to NHD RC 11140305002717. The lower assessment unit, AU 0404_01, is the 24 kilometer reach downstream to the headwaters of Lake O' the Pines. Segment 0404 is comprised of several tributary streams and two reservoirs. The unclassified water bodies include:

0404A – Ellison Creek Reservoir
0404B – Tankersley Creek
0404C – Hart Creek
0404E – Dry Creek
0404F – Sparks Branch
0404I – Boggy Creek
0404J – Prairie Creek
0404K – Walkers Creek
0404L – Swauano Creek
0404M – Greasy Creek
0404N - Lake Daingerfield
0404O – Dragoo Creek
0404S – Unnamed Tributary
0404T – Prairie Branch
0404U – Evans Creek
0404V – Hays Creek

Monitoring in 2025 is conducted quarterly in Big Cypress Creek at four stations by TCEQ Region 5 and WMS. The upper assessment unit is sampled by Region 5 at station 10308 at SH 11 and by WMS at station 10310 at US 271. The lower assessment unit is monitored at station 13631 at US 259 by TCEQ and at station 16458 below the confluence with Greasy Creek by WMS. A bioassessment is planned in Big Cypress Creek at station 22423 located downstream of the confluence with Walkers Creek in the critical period of 2025. Three Aquatic Life Monitoring (ALM) events were completed at this station by WMS between October 2023 and October 2024.

Region 5 also collects samples in Lake Daingerfield quarterly for field and laboratory parameters and bacteria. WMS monitors Hart and Tankersley creeks quarterly and is scheduled to collect samples in Sparks Branch and Dry Creek in the third and fourth quarters of FY 2025 for field and laboratory parameters, bacteria, and flow.

2025 Monitoring Schedule								
Segment/ AU	Station	CE	Description	Field	Lab	Bacteria	Flow	ALM
0404_01	13631	R5	BIG CYPRESS CREEK AT US 259	4	4	4		
0404_01	16458	WMS	BIG CYPRESS CREEK NEAR GREASY CREEK	4	4	4	4	
0404_02	10308	R5	BIG CYPRESS CR BRIDGE ON SH 11	4	4	4	4	
0404_02	22423	WMS	BIG CYPRESS CREEK BELOW WALKERS CREEK	2			2	2
0404_02	10310	WMS	BIG CYPRESS CREEK AT US 271	4	4	4	4	
0404B	10261	WMS	TANKERSLEY CREEK AT FM 3417	4	4	4	4	
0404C	10266	WMS	HART CREEK AT CR 4550	4	4	4	4	
0404E	10275	WMS	DRY CREEK AT FM 557	2	2	2	2	
0404F	10276	WMS	SPARKS BRANCH AT CR 4220	2	2	2	2	
0404N	17337	R5	LAKE DAINGERFIELD AT HEADWATERS	4	4	4		

Table 11: FY 2025 Monitoring Schedule for Segment 0404

The following discussion focuses on the four primary tributaries to Big Cypress Creek followed by a discussion of Big Cypress Creek. The smaller tributary streams and both reservoirs are detailed afterwards. Except for the lower assessment unit of Big Cypress Creek, all water bodies shown in the following table were impaired for *E. coli*. All water bodies in the following discussion had concerns for nitrate in the 2024 IR, while the lower assessment unit of Big Cypress Creek also included a concern for chlorophyll *a*. Both Tankersley and Hart creeks had concerns for habitat and benthic macroinvertebrate communities.

2024 Texas Integrated Report						
Parameter	0404_01	0404_02	0404B	0404C	0404E	0404F
E. coli		NS	NS	NS	NS	NS
Nitrate	CS	CS	CS	CS	CS	CS
Chlorophyll *a*	CS					
Benthic			CN	CN		
Habitat			CS	CS		

Table 12: Segment 0404 impairments and concerns in the 2024 IR, part 1

Unclassified Segment 0404B – Tankersley Creek

Tankersley Creek arises in Titus County northwest of the city of Mount Pleasant. The stream flows in a southeasterly direction for approximately 3.2 kilometers before it enters Tankersley Lake. Downstream of the impoundment, the stream flows at the Titus-Camp County line. After being released from Tankersley Lake, located immediately north of I-30, the stream flows about thirteen kilometers to its confluence with Big Cypress Creek through a mainly rural watershed. The basin includes a mostly forested corridor with a watershed that primarily consists of unimproved and improved pastures that are used for hay and livestock production.

Tankersley Creek is the receiving water for the Pilgrim's Pride wastewater treatment plant, located on FM 127, west of Mount Pleasant. The plant has a permitted discharge of 3.5 million gallons per day.

Most monitoring in Tankersley Creek has taken place at station 10261 located at FM 3417 with the first data reported from 1983. The station was somewhat regularly sampled from 1987 through 2003. In 2013, quarterly sampling resumed at station 10261 and continues through 2025. A limited number of samples were collected at station 10264 at FM 899 and at station 10263 at FM 127 below the Pilgrim's Pride treatment plant outfall. A few samples were collected at stations immediately above and below Tankersley Lake.

Tankersley Creek was first listed as impaired for bacteria in 2000. The impairment continued into the 2024 IR with a geometric mean of 278.1 MPN/100 mL, more than double the criterion of 126 MPN/100 mL. Due to the impairment, a bacteria study, *The Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)*, was funded by the Texas State Soil and Water Conservation Board. The study was conducted from 2009 through 2011 and included a Comprehensive Recreation Use Attainability Analysis. The purpose of the study was to determine if primary contact recreation was the appropriate use designation of the stream.

The TCEQ recommended that the contact recreation use on Big Cypress Creek Below Lake Bob Sandlin, Tankersley Creek, and Hart Creek be revised to secondary contact recreation 1. This recommended use was included in the 2018 Texas Surface Water Quality Standards but has yet to be approved by the Environmental Protection Agency. Should the criterion be changed to secondary contact recreation 1, the stream will meet its recreational use designation.

Prior to the Pilgrim's Pride wastewater treatment plant upgrades, total phosphorus results regularly exceeded the 0.69 mg/L screening level with an average concentration of 3.37 mg/L, or about five times the screening level. Since the plant upgrades were completed in the spring of 2015, the mean value was 0.54 mg/L. As a result, the concern for the total phosphorus screening

level that had been shown in previous assessments was removed from the 2022 IR. For the 2024 IR, thirteen out of sixty total phosphorus samples were elevated with a 1.62 mg/L average of exceedances. Three samples collected after the end of the 2024 assessment period were elevated with concentrations of 4.48, 1.81, and 1.35 mg/L. These elevated results will be included in the assessment for the 2026 IR.

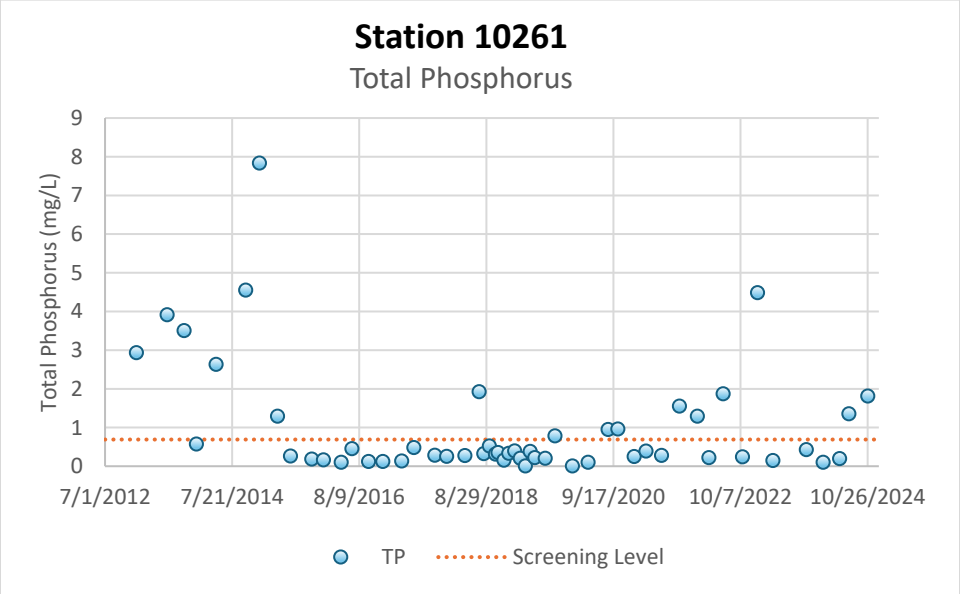

Figure 36: Total phosphorus values at station 10261 in Tankersley Creek

Total phosphorus had a weak inverse correlation to flow with a coefficient of -0.32. This correlation suggests that as flow decreases, the total phosphorus concentration increases. This relationship indicates that the primary contributor of phosphorus is from point source rather than non-point sources such as runoff from fertilized hay meadows.

A concern for nitrate was shown in the 2024 IR. Almost three-fourths of the 58 nitrate samples assessed exceeded the 1.95 mg/L screening level with a mean exceedance of 29.13 mg/L. The highest concentration of 110 mg/L was collected in July 2015. Since then, the highest concentration was 76.2 mg/L from August 2019. All but one of the eight samples collected after the 2024 assessment period exceeded the screening level indicating that the concern will continue into the 2026 IR. Nitrate inversely correlated to flow with a coefficient of -0.58. Most high concentrations were obtained at lower flows suggesting that effluent was the primary source of nitrate in the stream.

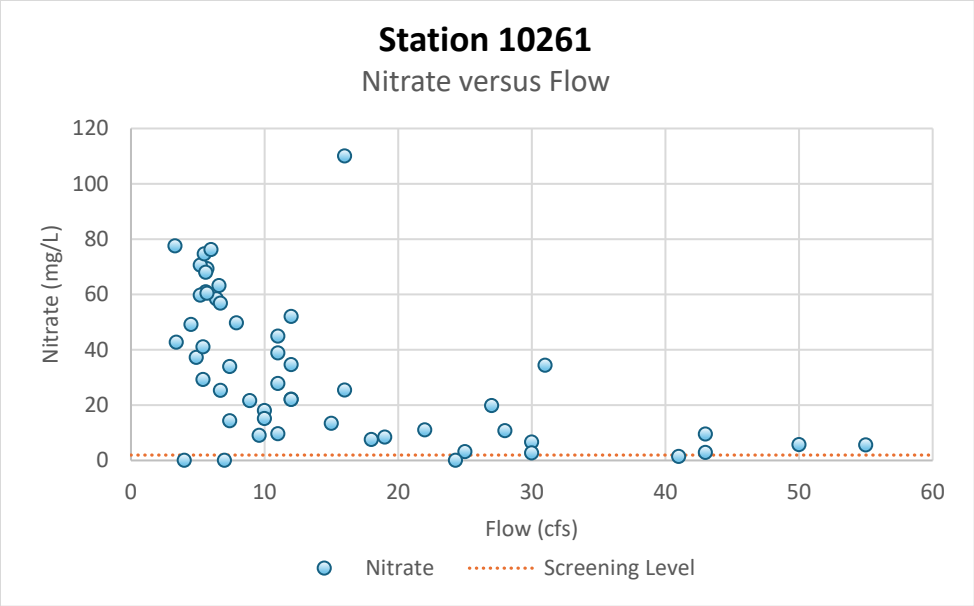

Figure 37: Nitrate readings versus flow at station 10261 in Tankersley Creek

Almost all ammonia results met the 0.33 mg/L screening level for the assessment period. Four of the sixty samples assessed exceeded the screening level with a mean of exceedances at 2.8 mg/L. A high concentration of 8.75 mg/L was collected on June 12, 2019 at station 10263, located about 200 meters downstream of the Pilgrim's Pride outfall. Ammonia was 0.99 mg/L at station 10261 on that date. Field notes stated that fish were active at both stations that day and did not appear to be affected by the toxic concentrations of ammonia. Another extremely high result with a concentration of 6.13 mg/L was reported in July 2024 along with a value of 0.951 mg/L in October 2024.

Station 10263 was monitored monthly as part of a special study funded by CRP. Due to high total phosphorus, nitrate, and sulfate results, special studies of these parameters were funded by CRP in 2018 and 2019. Monthly samples for sulfate, ammonia, nitrite, nitrate, total Kjeldahl nitrogen, and total phosphorus were collected at three stations in Tankersley Creek to identify potential sources. The nitrate special study monitoring began in July 2018 and was completed in June 2019. The sulfate special study began in November 2019 and continued through October 2020. The results of both studies showed that the Pilgrim's Pride plant was the primary contributor of these constituents; however, it should be noted that none of the sample results exceeded the plant's permit limits. Results of both studies were detailed in the *2021 Cypress Creek Basin Highlights Report*.

The 2022 IR showed a concern for chlorophyll *a* with six out of twenty samples exceeding the 14.1 µg/L screening level. The concern did not continue into the 2024 IR with six out of 22 chlorophyll *a* results exceeding the screening level with a mean exceedance of 18.95 µg/L. Half of the high results were obtained in 2016, and none have been elevated since April 2020.

Big Cypress Creek was first listed as impaired for sulfate in 2014. The source of the elevated sulfate concentrations was suspected to be from the Pilgrim's Pride treatment plant since the chemical used in the process to sequester phosphorus contained sulfur. For the data collected between November 2012 and July 2015 at station 10261, sulfate averaged 197.5 mg/L or almost double the 100 mg/L criterion of Big Cypress Creek, the receiving water body. The highest concentration reported was 508 mg/L. After the plant upgrades were completed, sulfate samples have had a mean of 81 mg/L with a maximum value of 167 mg/L. However, of the thirteen samples collected from June 2021 through October 2024, eight exceeded the 100 mg/L criterion of the receiving water body with a mean of 128.6 mg/L. Sulfate sampling should be continued at this station.

Figure 38: Station 10261 - Tankersley Creek

A concern for dissolved oxygen grab screening level was new in the 2022 IR. Eight out of 62 grab samples fell below the 5 mg/L screening level with a mean of 4.01 mg/L. The concern did not continue into the 2024 IR, though. During the 2024 assessment period, six out of seventy readings fell below the 5 mg/L screening level while two were below the 3 mg/L grab minimum criterion.

Concerns for impaired habitat and benthic communities were included in the 2024 IR. Aquatic Life Monitoring (ALM) was conducted in Tankersley Creek in 2020 and 2021. Although habitat scored in the intermediate range at 18.3 and the criterion is 14, the concern continued into the current assessment. The mean of the four benthic samples was intermediate with an average score of 26.1. The criterion is 30 which led to the concern. Despite the habitat and benthos scoring in the intermediate range, the fish scored in the high category with a mean value of 48.7, well above its criterion of 42. A detailed summary of all four monitoring events was discussed in the *2022 Cypress Creek Basin Highlights Report* and included in the Biological Discussions section of this report.

TRENDS

Trend analysis was conducted on all data collected since November 2012. Two increasing trends were discovered for pH and alkalinity. Although the increasing pH trend is statistically significant, the readings were well within the pH criteria for Segment 0404. Most readings reported fell between 7.2 and 7.8 s.u.

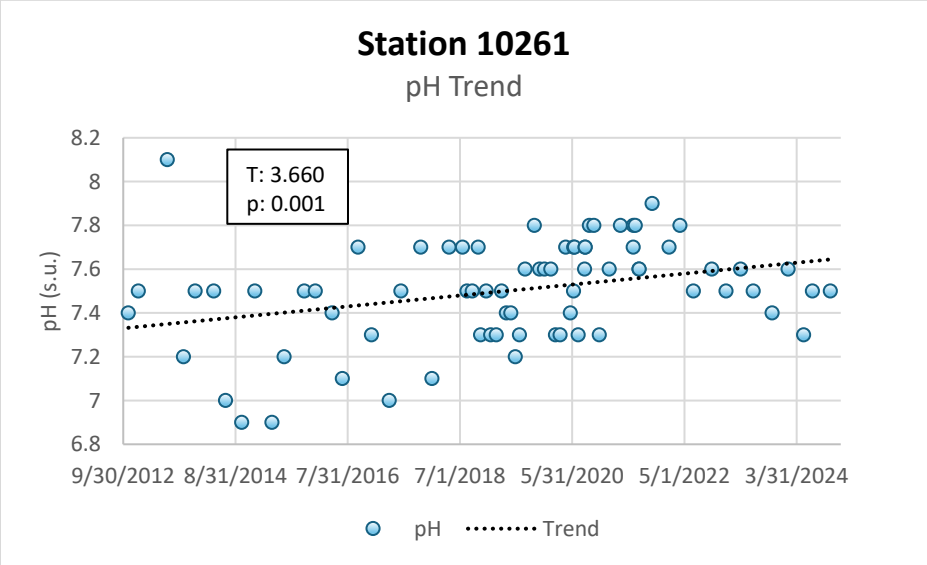

Figure 39: Increasing pH trend at station 10261 in Tankersley Creek

Alkalinity enters the waterway through the erosion of rocks, minerals, and soils. Given that near historic flooding and above normal rainfall that has been received in the region over the past decade, the increasing trend is possibly a result of these runoff events, or it may be reflective of increasing alkalinity trends found across the basin. Please see the alkalinity discussion in the Trend Analysis section of the report.

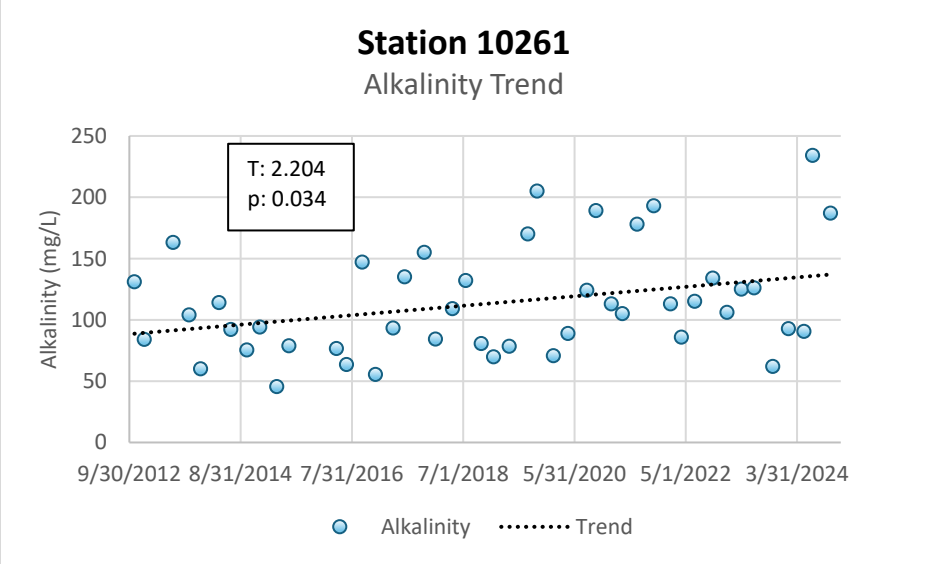

Figure 40: Increasing alkalinity trend at station 10261 in Tankersley Creek

Figure 41: Station 10266 - Hart Creek

Unclassified Segment 0404C – Hart Creek

Hart Creek, an unclassified water body, rises 7.2 kilometers north of Mount Pleasant and runs southeast for nineteen kilometers to its confluence with Big Cypress Creek. The stream originates about five kilometers north of I-30 and flows through a mostly rural watershed. Much of the drainage basin includes a forested corridor along with unimproved and improved pastures that are often used for hay and livestock production. Hart Creek receives surface drainage from two small tributaries to the east of Mount Pleasant - Hayes Creek and Evans Creek. The City of Mount Pleasant wastewater treatment plant outfall is located on Hart Creek approximately 2 kilometers upstream of station 10266, located on County Road 4550.

Most samples in Hart Creek have been collected at station 10266 with the first data reported in 1997. The station was somewhat regularly sampled from 1997 to 2003. Quarterly monitoring for field and laboratory parameters, bacteria, and flow resumed in November 2012 and continues through 2025. A limited number of samples were collected at station 10271 at CR 28, station 10272 at SH 49, and at station 10273 at US 67. Most of the samples collected at these stations were part of a bacteria study and a nutrient special study.

It should be noted that the TCEQ has required the City of Mount Pleasant to move their outfall to discharge directly into Big Cypress Creek instead of using Hart Creek as means of conveyance. Construction of the new discharge pipeline is expected to be completed in 2026. Moving the outfall was possibly required due to an increase in the permitted discharge from 3 to 5 million gallons per day.

Hart Creek was first included on the §303(d) List for bacteria in 2006. For the 2024 IR, the geometric mean was 362.9 MPN/100 mL, almost three times the criterion of 126 MPN/100 mL. All but one sample collected since the 2024 assessment were above the criterion so the impairment will likely continue. The most likely sources of bacteria were from wildlife and livestock. The stream was part of a bacteria study, *The Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)* and included a Comprehensive Recreation Use Attainability Analysis which was conducted from 2009 through 2011. The study indicated that people were not using the stream for primary contact recreation. As for Tankersley Creek, the TCEQ recommended that the contact recreation use be changed to secondary contact recreation 1. This recommended use was included in the 2018 Texas Surface Water Quality Standards but has yet to be approved by the Environmental Protection Agency.

The 2024 IR showed a concern for nitrate. Over forty percent of the results in the assessment period exceeded the 1.95 mg/L screening level with the highest result of 10.9 mg/L collected in October 2017 and August 2018. The mean nitrate concentration for samples that exceeded the

screening level was 5.67 mg/L. The concern will likely continue into the 2026 IR since four of the seven samples collected after the end of the 2024 assessment period were elevated with a mean concentration of 4.95 mg/L.

Nitrate was inversely correlated to stream flow with a coefficient of -0.56. The inverse correlation suggests that as stream flow decreases, the concentration of nitrate increases. A comparison of nitrate and flow data showed that nitrate concentrations were highest at flows under 5 cfs.

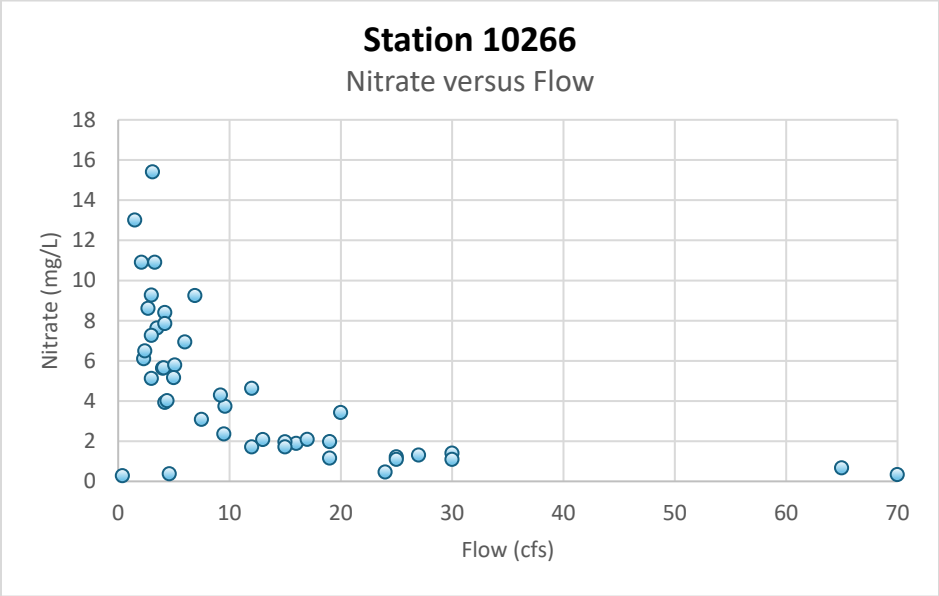

Figure 42: Nitrate results versus flow at station 10266 in Hart Creek

Due to high nitrate concentrations, Hart Creek was included as part of the nitrate special study along with Tankersley Creek. Monthly samples for ammonia, nitrite, nitrate, total Kjeldahl nitrogen, and total phosphorus were collected at two stations in Hart Creek in 2018 and 2019 to identify potential sources. Monitoring was conducted at station 10272 (SH 49) and at station 10266 (CR 4550). The results of the study were detailed in the *2021 Cypress Creek Basin Highlights Report*. Like the findings for Tankersley Creek, the primary source of nitrate in Hart Creek was treated effluent from the City of Mount Pleasant treatment plant. The plant, however, was not contributing excessive amounts of ammonia or total phosphorus. Unlike Tankersley Creek, all total phosphorus samples were reported below the 0.69 mg/L screening level with a mean of 0.21 mg/L.

These findings were consistent with those shown in the 2024 IR. None of the forty-five samples assessed for ammonia and total phosphorus exceeded the screening criteria of 0.33 mg/L and 0.69 mg/L, respectively. None of the 22 chlorophyll *a* samples exceeded the 14.1 µg/L screening level during the assessment period. Similarly, none of the ammonia, total phosphorus, or chlorophyll *a* samples collected after the 2024 assessment period were elevated.

Out of 51 dissolved oxygen grab samples, two measurements were below the 5 mg/L grab screening level with a mean of 4.35 mg/L. None of the grab samples fell below the 3 mg/L criterion while none of the diel results for 24 HR DO Average or Minimum were reported below the criteria.

Four biological monitoring events were conducted by WMS and NETMWD staff in Hart Creek in 2022 and in 2023. For the 2024 IR, only the 2022 data were evaluated. The benthic macroinvertebrate samples had an average score of 24.5, falling below the criterion of 30 which led to the concern in the 2024 IR. The two habitat scores had a mean of 13.5, slightly below the screening level of 14. Meanwhile, the fish community scored in the High range with an average of 49.8, well over the 42 criterion. Combining the scores for all four events, benthos fell into the Intermediate category with an average of 23.3 using regional metrics and 27 using state-wide metrics. The habitat barely fell into the Limited category with a mean of 13.6. The screening level of 14 is the lower limit for the Intermediate category. As for the fish analysis, all four events scored in the High to Exceptional range with a mean of 50. It should be noted that six Kisatchie painted crayfish were collected in Hart Creek in August 2022. These monitoring events were detailed in the *2024 Cypress Creek Basin Highlights Report* and included in the Biological Discussions section of this report.

TRENDS

Trend analysis was conducted on all data collected after regular sampling resumed in November 2012. An increasing trend for total alkalinity and a decreasing trend for transparency were identified in Hart Creek. Alkalinity enters the waterway through the erosion of rocks, minerals, and soils. Given that near historic flooding and above normal rainfall that has been received in the region over the past decade, the increasing trend is possibly a result of these runoff events, or it may be reflective of increasing alkalinity trends found across the basin. Please see the alkalinity discussion in the Trend Analysis section of this report.

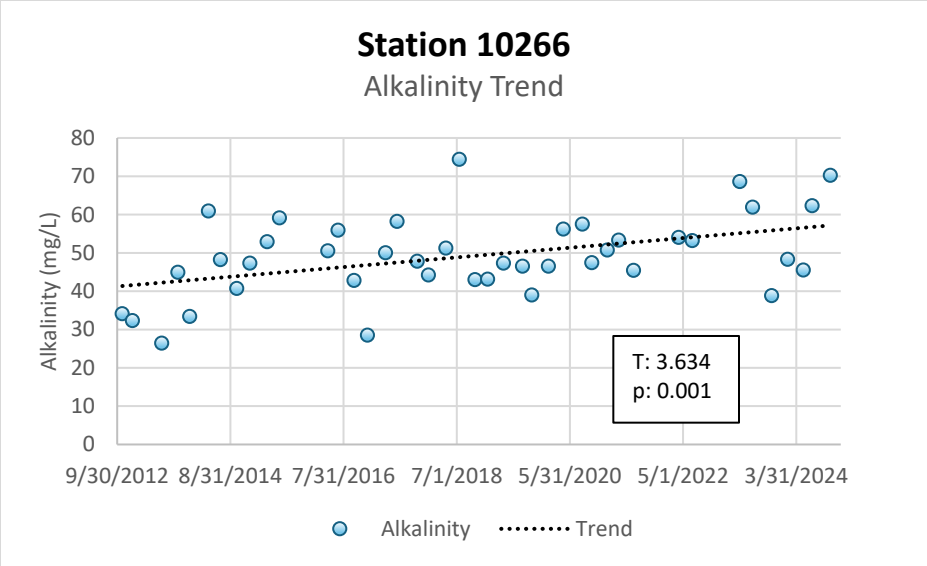

Figure 43: Increasing alkalinity trend at station 10266 in Hart Creek

The decreasing transparency trend was likely due to the runoff events over the past decade coupled with the replacement of the bridge at this station. Bridge construction took place in late 2021 through mid-2022. During this period, the banks were denuded for a distance above and below the bridge while the stream bed was cleared of refuse and some of the bottom sediments. The unstable bed and banks coupled with regular, large runoff events likely contributed to reduced Secchi depths encountered at the station over the past few years.

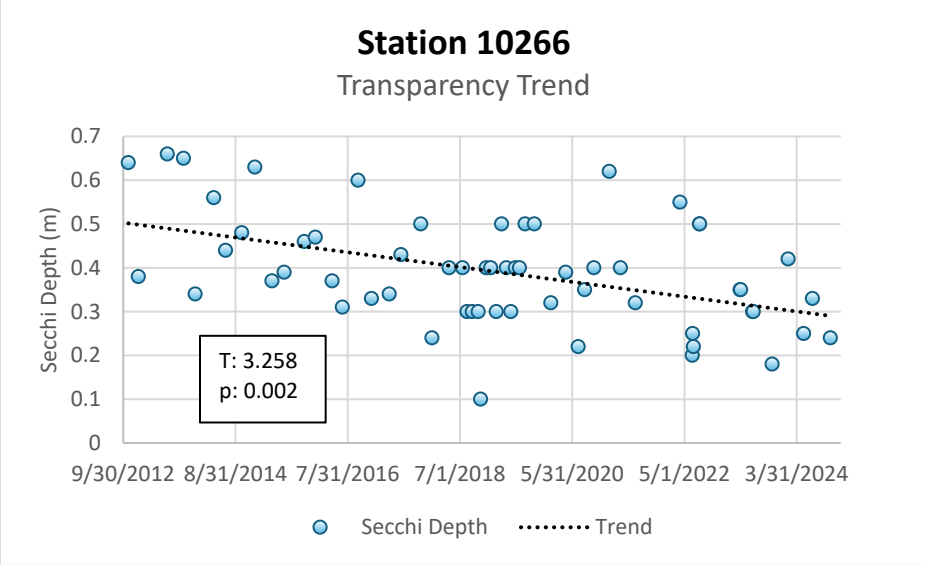

Figure 44: Decreasing transparency trend at station 10266 in Hart Creek

Unclassified Segment 0404E – Dry Creek

The headwaters of Dry Creek are located south of Pittsburg and generally flow eastwardly to its confluence with Big Cypress Creek in northeast Camp County. The upper reaches of the stream flow through Pittsburg before turning east and flowing through forests and pastures including a few residences in the area. The stream serves as a receiving water for the City of Pittsburg Dry Creek wastewater treatment plant which is permitted to discharge up to 0.2 million gallons per day.

Most data for Dry Creek were collected at station 10274 at McMinn Road, located downstream of the confluence with Sparks Branch. A few samples were from station 10275 at FM 557, which is immediately prior to the confluence with Sparks Branch. Monitoring at station 10275 was performed in 2004 and 2005 while station 10274 was sampled in 2000 through 2002 and from June 2015 through March 2020. No monitoring has been performed in Dry Creek since 2020. WMS is scheduled to sample at station 10275 in the spring and summer of 2025 for field and laboratory parameters, bacteria, and flow.

Dry Creek is impaired for *E. coli* and has a concern for nitrate in the 2024 IR. The stream was first included on the §303(d) List in 2020. WMS collected fifteen bacteria samples and TCEQ Region 5 collected 23. For the 2024 IR, 34 *E. coli* samples were assessed which had a geometric mean of 522.12 MPN/100 mL, over four times the 126 MPN/100 mL criterion. The riparian zone of the property immediately upstream and downstream of the bridge crossing is improved pasture and is used for grazing cattle and hay production. Cattle were noted to be in the stream during several monitoring events and were a likely source of bacteria. Wildlife was another probable source; however, since residential development is sparse in this portion of the stream, contributions from failing septic systems were not as likely as wildlife and livestock. A Recreational Use Attainability Analysis should be considered to address the *E. coli* impairment.

Six of the eleven nitrate samples assessed exceeded the 1.95 mg/L screening level with a mean exceedance of 7.74 mg/L. Sources of nitrate include treated effluent, runoff from commercial fertilizers and poultry operations, along with deposition from wildlife and livestock. Nitrate had a strong inverse correlation to flow with a coefficient of -0.73. Since nitrate was highest at lower flows, this relationship suggests that the primary source of nitrate was treated effluent.

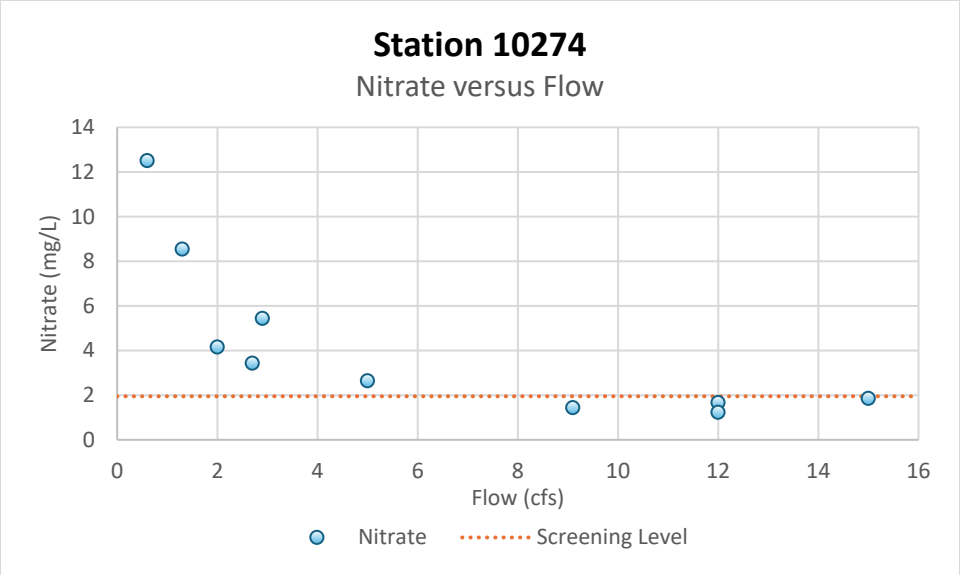

Figure 45: Nitrate results versus flow at station 10274 in Dry Creek

It should be noted that none of the total phosphorus or chlorophyll *a* results exceeded the screening levels while one ammonia sample was reported above the 0.33 mg/L screening level at 0.67 mg/L. All dissolved oxygen grab readings were above the 3 mg/L criterion while one fell below the 4 mg/L screening level with a measurement of 3.2 mg/L.

Trend analysis was not performed for Dry Creek since the data did not meet the criteria for analysis.

Unclassified Segment 0404F – Sparks Branch

Sparks Branch originates in Pittsburg and flows through an urbanized watershed until crossing SH 11. After SH 11, the stream flows along a forested corridor bounded by improved pastures used for grazing and hay production along with limited residential development. The stream is a tributary of Dry Creek and is a receiving water for the City of Pittsburg Sparks Branch wastewater treatment plant which has a permitted discharge of 2 million gallons per day. Recently, Pilgrim's Pride has discussed the possibility of significantly expanding production at their Pittsburg facility. If this occurs, it will require the expansion of the Sparks Branch wastewater treatment plant or construction of new plant at the Pilgrim's Pride facility.

Monitoring has taken place in Sparks Branch at station 10276, located at CR 4220. The stream was sampled once in 1983 and ten times by WMS in April 2016 through August 2018. TCEQ Region 5 collected *E. coli* samples monthly from April 2018 through March 2020. No sampling has been conducted in this stream since 2020, but WMS is scheduled to sample at station 10276 in the spring and summer of 2025 for field and laboratory parameters, bacteria, and flow.

Sparks Branch was listed as impaired for bacteria in 2022 and continued into the 2024 IR. The bacteria results were very high with a geometric mean of 613.25 MPN/100 mL, or almost five times the 126 MPN/mL criterion. Sources of bacteria include wildlife, livestock, and malfunctioning septic systems. A Recreational Use Attainability Analysis should be considered to address the impairment for bacteria.

A concern for nitrate was shown in the 2024 IR. Six out of the ten nitrate samples assessed were above the 1.95 mg/L screening level with a mean exceedance of 10.39 mg/L. Sources of nitrate include treated effluent, runoff from commercial fertilizers, deposition from wildlife and livestock, and malfunctioning septic systems. Nitrate had a strong inverse correlation to flow with a coefficient of -0.72. Since nitrate was highest at lower flows, this relationship suggests that the primary source of nitrate was treated effluent.

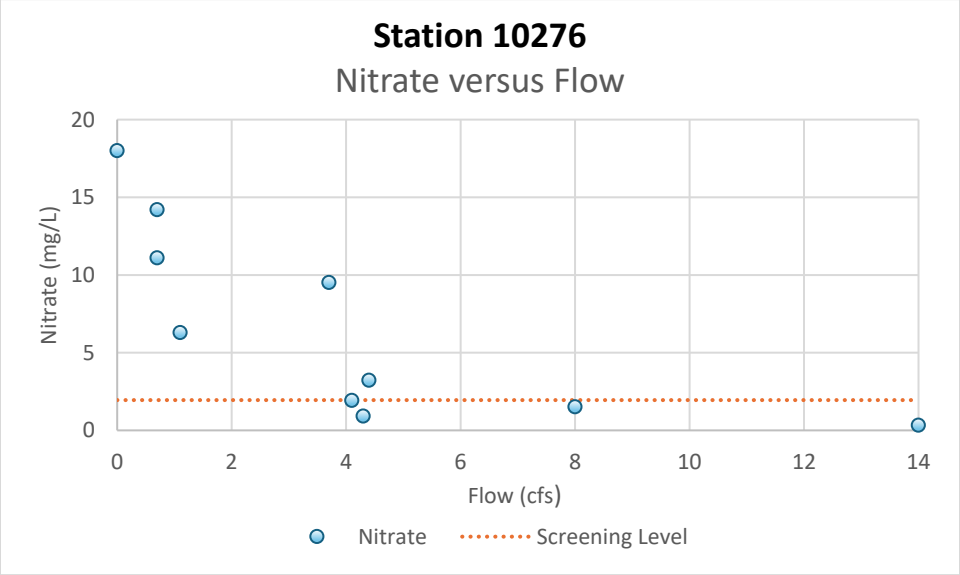

Figure 46: Nitrate results versus flow at station 10276 in Sparks Branch

None of the ammonia samples were elevated while one total phosphorus sample exceeded its 0.69 mg/L screening level with a concentration of 1.13 mg/L. Two of the chlorophyll *a* samples were elevated with a mean of 33.15 µg/L, well above the 14.1 µg/L screening level. None of the nine dissolved oxygen grab samples fell below the criterion or screening level.

Trend analysis was not performed for Sparks Branch since the data did not meet the criteria for analysis.

Segment 0404 – Big Cypress Creek

Monitoring was first conducted at station 10308, located at SH 11, in September 1968 and has been regularly sampled since then. Station 13631 at US 259 has been routinely sampled since October 1979. Station 10310 at US 271 was first sampled in May 2007, but regular sampling began in 2010. Some monitoring had been performed at station 16458 in the early 2000s but was discontinued due to no longer having access to the property. Monitoring resumed at station 16458 in October 2019 after the new owner granted access to the property.

Figure 47: Big Cypress Creek station 16458 at Couch Mountain (left) and station 13631 at US 259 (right)

The upper assessment unit of Segment 0404 was impaired for bacteria and was first included on the §303(d) List in 2002. The geometric mean of the *E. coli* samples collected during the assessment period was 225.96 MPN/100 mL exceeding the 126 MPN/100 mL geometric mean criterion. The lower assessment unit met its recreational use designation with a geometric mean of 68.95 MPN/100 mL based upon the results of 37 samples. The lower assessment unit includes station 13631 located at the headwaters of Lake O' the Pines in a transitional location. When Lake O' the Pines is full, this station appears and functions as a lentic station but becomes lotic during periods of drought and low flow. The *E. coli* values at station 13631 were lower than in the upper assessment unit, most likely due to the low flow conditions.

Due to the impairment, a bacteria study, *The Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)*, was funded by the Texas State Soil and Water Conservation Board. The study was conducted from

2009 through 2011 and included a Comprehensive Recreation Use Attainability Analysis. The purpose of the study was to determine if primary contact recreation was the appropriate use designation of the stream. The TCEQ recommended that the contact recreation use on Big Cypress Creek Below Lake Bob Sandlin be revised to secondary contact recreation 1. This recommended use was included in the 2018 Texas Surface Water Quality Standards but has yet to be approved by the Environmental Protection Agency. Should the recreational use designation be changed to secondary contact recreation 1, the stream will meet the bacteria criterion.

The 2024 IR showed concerns for nitrate in both assessment units of Segment 0404 and for chlorophyll *a* in the lower reach of the stream. In AU 0404_02, over three-fourths of the 62 nitrate samples assessed far exceeded the 1.95 mg/L screening level. The mean of the exceedances was 17.8 mg/L. Nitrate concentrations were lower in AU 0404_01 with about forty percent of samples exceeding the screening level with a mean of the exceedances at 7.6 mg/L.

The nitrate results in the upper assessment unit appear to be influenced by the treated effluent discharged into Tankersley Creek and Hart Creek from the Pilgrim's Pride and City of Mount Pleasant wastewater treatment plants, which then flow into Big Cypress Creek. Nitrate concentrations were highest during periods of low flow indicating contributions from point sources. Station 10310, located downstream from the confluence with Tankersley Creek, had much higher concentrations of nitrate than at station 10308 at SH 11 or at station 13631 at US 259. Tankersley Creek (station 10261) had the greatest concentration of nitrate while Hart Creek (station 10266) contributed nitrate but at a much lower concentration.

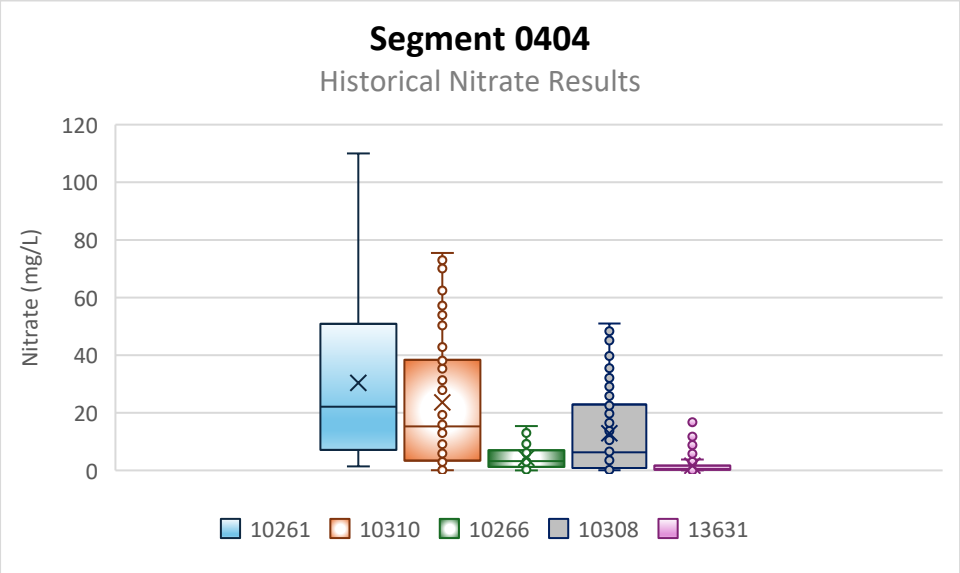

Figure 48: Historical nitrate values by station in Segment 0404

These results suggest that the Pilgrim's Pride discharge is the primary contributor of nitrate to the watershed. Nitrate at station 10308 and 13631 did not correlate with flow while station

10310 had a weak inverse correlation with a coefficient of -0.26. The highest concentrations of nitrate were found at flows less than 15 cfs as shown in the following chart which incorporates all historical data at both stations in AU 0404_02 and from station 10261 in Tankersley Creek.

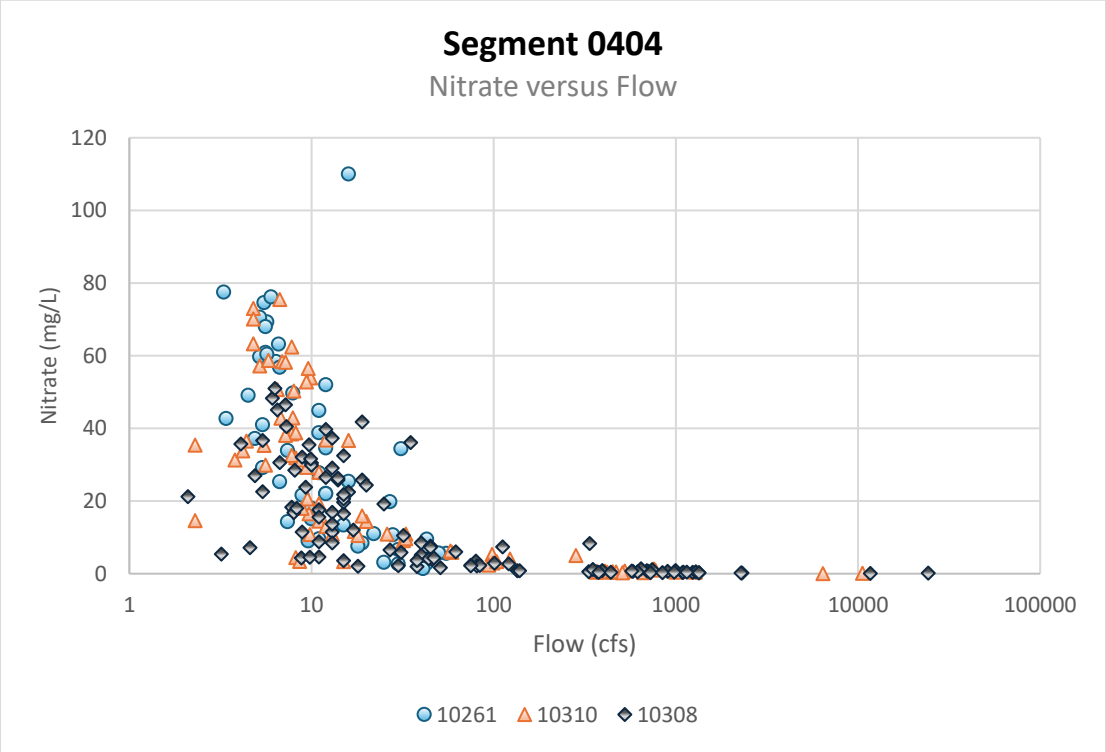

Figure 49: Nitrate readings versus flow by station in Segment 0404

For the most part, total phosphorus results were lower than the screening level in both assessment units in the 2024 IR. None of the 61 total phosphorus samples exceeded the 0.69 mg/L screening level in the AU 0404_01, while six were elevated in the upper assessment unit with a mean exceedance of 0.84 mg/L. Total phosphorus at stations 10308 and 13631 did not correlate with flow while station 10310 had a weak inverse correlation to flow with a coefficient of -0.18. A comparison of the historical total phosphorus values in Big Cypress Creek, Tankersley Creek (station 10261), and Hart Creek (station 10266) are shown in the following graph.

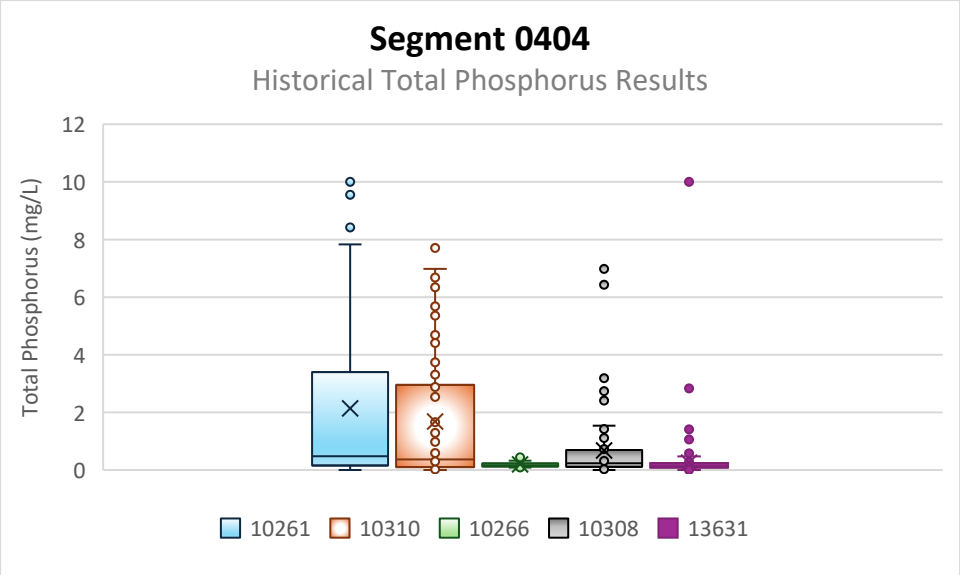

Figure 50: Total phosphorus results by station in Segment 0404

As found with nitrate, the primary contributor of total phosphorus in the watershed appeared to be from the Pilgrim's Pride wastewater treatment plant. The highest concentrations were also found at flows less than 15 cfs. The following chart is based upon all historical data obtained from both stations in AU 0404_02 and from station 10261 in Tankersley Creek.

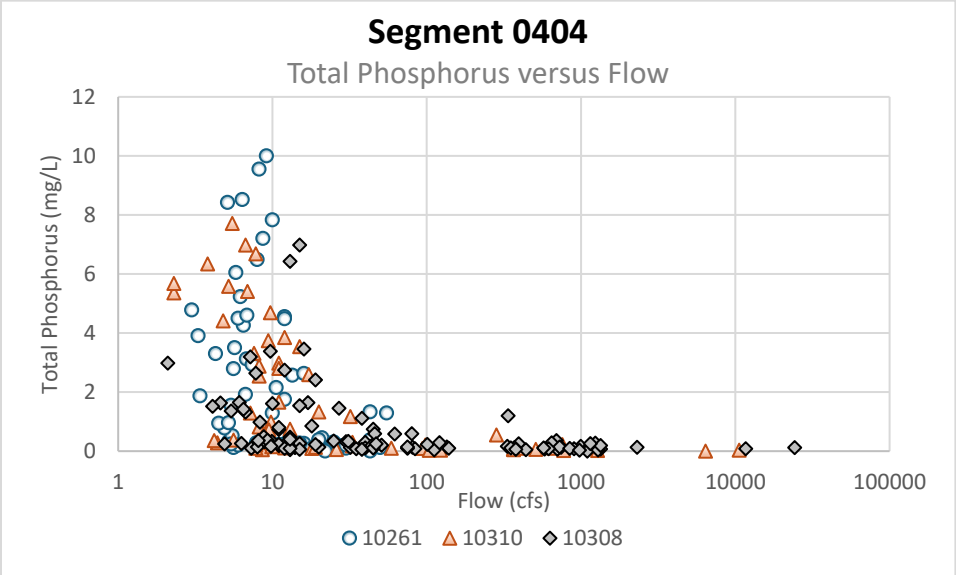

Figure 51: Total phosphorus versus flow by station in Segment 0404

Slightly more than one quarter of the chlorophyll *a* results in AU 0404_01 exceeded the screening level. The mean of the exceedances of those fifteen samples was 39.89 µg/L, or almost triple the 14.1 µg/L screening level. In the upper assessment unit, only two of the sixty samples assessed were elevated with a mean of 17.5 µg/L. A comparison of historical results showed that chlorophyll *a* was highest at station 13631 located at the headwaters of Lake O' the Pines in a

transitional location. As previously mentioned, when Lake O' the Pines is full, this station appears and functions as a lentic station but becomes lotic during periods of drought and low flow. Station 13631 had an inverse correlation to flow with a coefficient of -0.36. A correlation was not found between chlorophyll *a* and flow at stations 10310 and 10308.

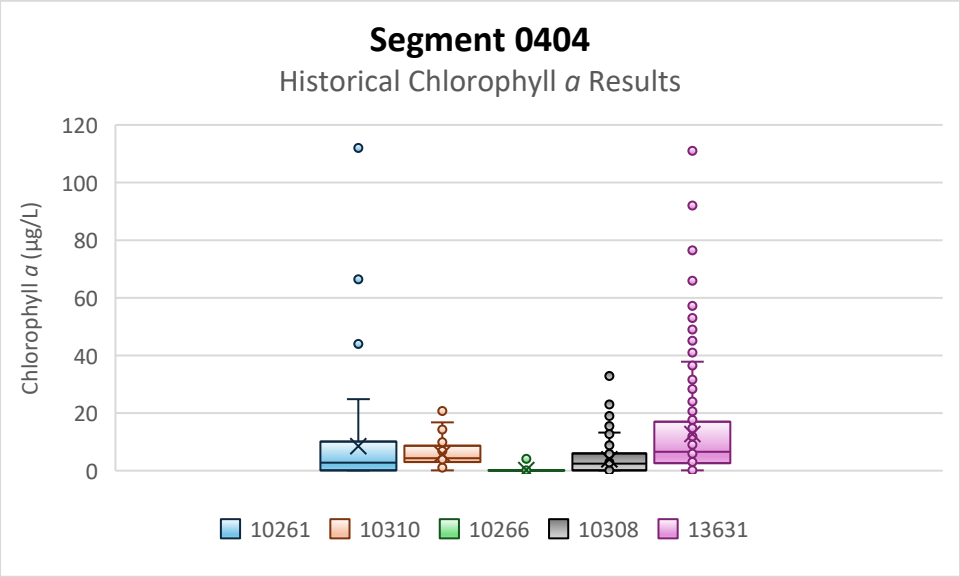

Figure 52: Historical chlorophyll a values by station in Segment 0404

None of the 110 ammonia samples collected in Big Cypress Creek that were assessed in the 2024 IR were reported above the 0.33 mg/L screening level. Although a few high ammonia samples were reported in Tankersley Creek, the concentration became diluted after entering Big Cypress Creek. Ammonia results from station 10310 had a weak inverse correlation to flow with a coefficient of -0.26. No correlations were found between ammonia and flow at stations 10308 and 13631.

For AU 0404_01, three out of 63 dissolved oxygen grabs fell below the 3 mg/L criterion while five measurements fell below the 4 mg/L dissolved oxygen grab screening level. All dissolved oxygen readings met the grab screening level and criterion in the upper assessment unit. Despite the elevated nutrient and chlorophyll *a* concentrations, they did not appear to negatively impact dissolved oxygen concentrations in the stream.

Bioassessments have been conducted at two stations in Big Cypress Creek since 2023. The results of the Aquatic Life Monitoring events at station 16548 and at station 22423 are discussed in the Biological Discussions section of the report.

TRENDS

Trend analysis was conducted on all data collected at stations 10310, 10308, and 13631 in Big Cypress Creek. Decreasing trends from the past decade for total Kjeldahl nitrogen were discovered at stations 10308 and 13631. The decreasing TKN trends appear to be a result of the drought and flood periods experienced over the last ten years. Sample values were generally higher near the end of the drought period and declined most likely due to dilution from flooding and elevated flows beginning around 2015.

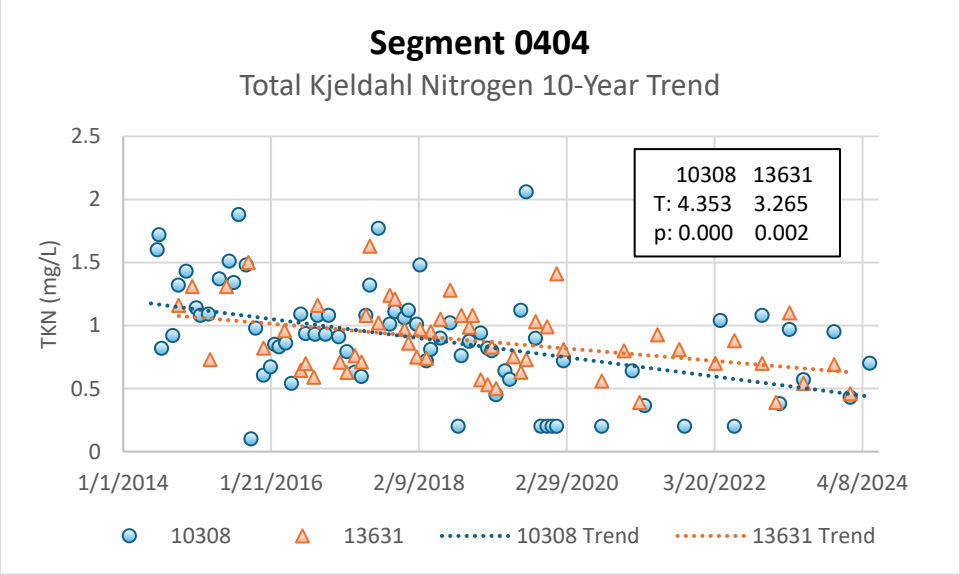

Figure 53: Decreasing 10-Year Total Kjeldahl Nitrogen trends at stations 10318 and 13631

Increasing trends for salts and nutrients were observed at stations 10308 and 13631 in the 2009 and 2014 basin summary reports; however, no trends were identified in Segment 0404 in the 2019 analysis. Those increasing trends were likely due to concentration during the pervasive drought.

The next portion of the Segment 0404 discussion includes details about four intermittent streams and two reservoirs. The following table shows impairments and concerns for those water bodies from the 2024 IR. Except for Segment 0404N (Lake Daingerfield), no monitoring is scheduled in these unclassified water bodies in 2025.

2024 Texas Integrated Report						
Parameter	**0404A**	**0404I**	**0404J**	**0404K**	**0404M**	**0404N**
24 HR DO Average			NS			
24 HR DO Minimum			NS			
E. coli				CN		
Sediment Toxicity	NS					
Toxins in Tissue	NS					NS
Metals in Sediment	CS					

Table 13: Segment 0404 impairments and concerns in the 2024 IR, part 2

Figure 54: Sunset over Lake Lone Star Park

Unclassified Segment 0404A – Ellison Creek Reservoir

Ellison Creek Reservoir (sometimes called Lake Lone Star) is located due west of Lone Star in southern Morris County. The drainage area of the Ellison Creek watershed is thirty-seven square miles, and the reservoir has a surface area of approximately 1,516 acres. The reservoir originally provided process water and cooling water for U. S. Steel Company and the Southwest Gas and Electric Company Power Plant. Water discharged from Ellison Creek Reservoir flows into Big Cypress Creek immediately above station 13631 at US 259 near the headwaters of Lake O' the Pines.

Sampling in Ellison Creek Reservoir has been conducted one to four times per year by TCEQ Region 5 since 1995 at station 14473 near the dam. The reservoir was included on the 2024 §303(d) List for PCBs and dioxin in fish tissue, and for sediment toxicity. The 2024 IR showed concerns for screening levels for cadmium, iron, lead, manganese, nickel, and zinc in sediment. Sediment samples were last collected in the reservoir in June 2005 and those samples greatly exceeded their respective screening limits. Although sediment samples are needed to address these concerns and impairment, no sampling is currently scheduled.

Seventeen to twenty dissolved metals samples were assessed in the 2024 IR. None of the dissolved metals results were reported above the acute or chronic toxicity criteria. The TCEQ Region 5 has sampled dissolved metals in water and field parameters at least annually since 1995 but discontinued monitoring Ellison Creek Reservoir after February 2023. The dissolved metals included analysis for arsenic, cadmium, chromium, iron, lead, nickel, manganese, silver and zinc. Depending upon the parameter, between 59 and 73 results were reported in SWQMIS. All of the cadmium, chromium, and silver samples were reported below the limit of quantitation while over ninety percent of the arsenic, lead, nickel, selenium, and zinc concentrations were below those limits. Almost all of the manganese results were above the limit of quantitation but below the acute and chronic criteria. These results suggest that the metals of concern were contained within the sediments but were not mixing within the water column.

Ellison Creek Reservoir is impaired for dioxin and polychlorinated biphenyls in fish tissue. The polychlorinated biphenyls impairment was first listed in 2006 while the dioxin impairment was shown on the 2016 §303(d) List. In December 1995, the Texas Department of State Health Services issued ADV-29, a consumption advisory due to high levels of polychlorinated biphenyls in fish tissue. In September 2016, the Department of State Health Services issued ADV-58 which added dioxin in fish tissue to the advisory.

The 2024 IR assessed the reservoir for dissolved oxygen grab samples. None of the 23 readings were reported below the 3 mg/L criterion or 5 mg/L screening level. None of the 67 readings

reported since 1995 has fallen below the minimum criterion while one measurement of 4.3 mg/L was recorded under the 5 mg/L screening level.

TRENDS

Trend analysis was conducted on all data reported for station 14473. Three trends were identified including an increasing trend for dissolved oxygen, a decreasing trend for specific conductance, and a decreasing trend for transparency. The transparency trend was for data collected over the past decade and most likely due to the pervasive drought at the beginning of the period followed by the near historic flooding and frequent runoff events beginning around 2015.

The increasing trend for dissolved oxygen was based upon all 67 readings reported since 1995. This increasing trend was also found in the *2019 Cypress Creek Basin Summary Report*. While the increasing trend is usually a positive finding, in this case, it should be investigated further. Many of the dissolved oxygen readings were well above saturation levels. Super-saturated dissolved oxygen grab readings were caused by excessive phytoplankton productivity in Lake Cypress Springs and Lake O' the Pines. This trend may be an indicative of eutrophication in the reservoir.

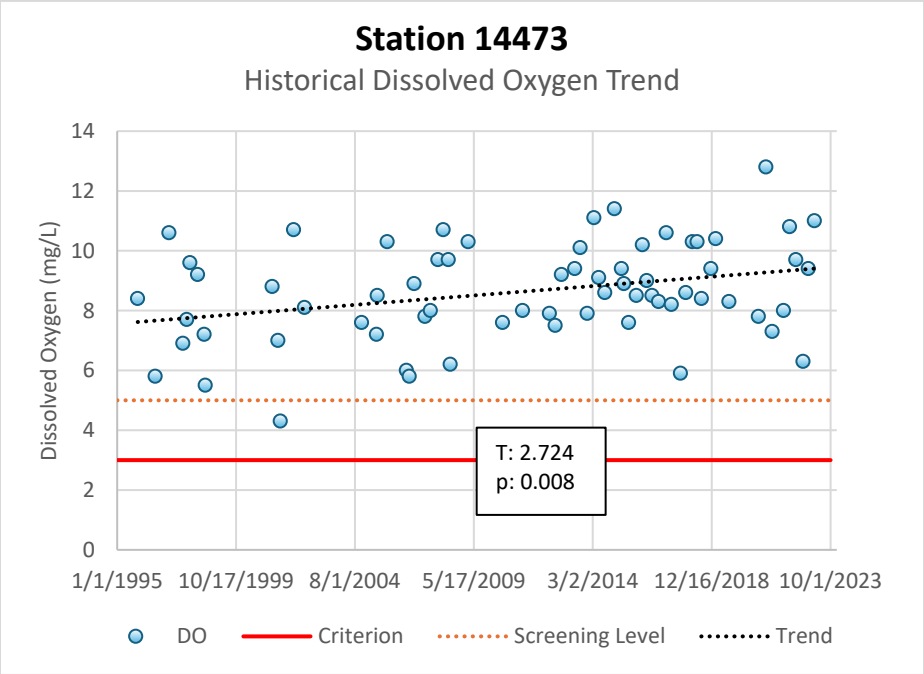

Figure 55: Increasing historical dissolved oxygen trend at station 14473

A decreasing trend for specific conductance was identified using all data collected over the past twenty years. As with the decreasing transparency trend, this trend was likely due to the pervasive drought at the beginning of the period with peak measurements in 2006 and 2011 followed by flooding and frequent runoff events beginning around 2015.

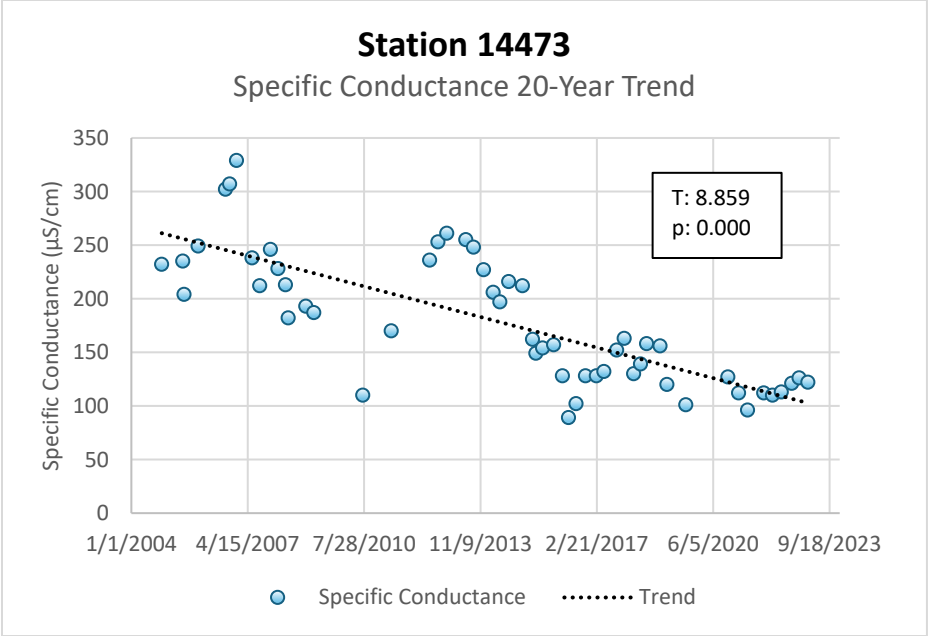

Figure 56: Decreasing 20-Year specific conductance trend at station 14473

Unclassified Segment 0404I – Boggy Creek

Boggy Creek is an intermittent stream that flows through Morris County. The stream originates south of Omaha and continues approximately 33 kilometers to its confluence with Big Cypress Creek about two kilometers downstream of station 16458. Boggy Creek was sampled for field laboratory parameters at station 15894 at FM 144 monthly from November 1999 through June 2001 and two bioassessments were conducted in August 2000 and June 2001. No sampling has been performed at this station since.

In 2022 and 2023, four bioassessments were completed in Boggy Creek at station 15895 at FM 49. The stream was stagnant and pooled during the August and October 2022 events while the stream had flow during both 2023 collections. It should be noted that only the 2022 data were included in the 2024 IR which showed no impairments or concerns for the segment. However, all three dissolved oxygen grabs fell below the 2 mg/L criterion and 3 mg/L screening level with a mean of the low readings at 1.1 mg/L. In addition, the lone diel fell below both the 24-Hour DO Average and Minimum criteria with a 0.3 mg/L average and 0.1 mg/L minimum. These low dissolved oxygen values were likely due to the stream having no flow as the dissolved oxygen grab readings along with both 24-Hour DO Average and Minimum values were above the criteria during both events in 2023.

Since Boggy Creek has an intermittent with perennial pool flow status, it has an aquatic life designation of limited. These low dissolved oxygen readings in 2022 had little impact on the biota

in the stream. For both 2022 events evaluated in the 2024 IR, the benthic macroinvertebrate samples had an average score of 25, above the criterion of 11 while the two habitat scores had a mean of 14, the same value as the screening level. Meanwhile, the fish community scored in the High range with an average of 48.72, well over the criterion of 11. Combining the scores for all events, benthos fell into the Intermediate category with an average of 20.3 using regional metrics and 23 using state-wide metrics. The habitat barely fell into the Intermediate category with a mean of 15.5. As for the fish analysis, all four events averaged in the High range with a mean of 44.3. More details about these monitoring events are provided in the *2024 Cypress Creek Basin Highlights Report* and in the Biological Discussions section of this report.

Trend analysis was not performed for Boggy Creek since the data did not meet the criteria for analysis.

Unclassified Segment 0404J – Prairie Creek

Prairie Creek is an intermittent stream with perennial pools that originates south of Pittsburg and flows eastwardly for approximately 27 kilometers to its confluence with Big Cypress Creek. Its confluence with Big Cypress Creek is located about 0.6 kilometer upstream of station 16458. Prairie Creek is classified as having a flow type of intermittent with perennial pools and an aquatic life designation of limited. The Lake O' the Pines Implementation Plan workgroup identified diel dissolved oxygen monitoring as a priority for this watershed to evaluate potential impacts of loadings into the reservoir.

The stream was impaired for 24-Hour DO Average and Minimum in the 2024 IR and was first included on the §303(d) List in 2020. In December 2016, diel sampling commenced at station 15386 at FM 557 to address the dissolved oxygen concern that had been carried forward from previous assessments. In the 2024 IR, five of the 24 diels assessed fell below the 3 mg/L DO Average criterion with a mean exceedance of 1.14 mg/L. Six of out of 24 diels failed to meet the DO Minimum criterion of 2 mg/L with an average exceedance of 0.42 mg/L. Five more diels were recorded after the end of the 2024 assessment period. One diel DO Minimum and two diel DO Averages failed to meet the criteria.

For all but one of the diels that did not meet the criteria, either a flow measurement of 0 cfs or a flow status of no flow was reported. Diels correlated to flow with a coefficient of 0.54 for diel DO Average and 0.57 for DO Minimum.

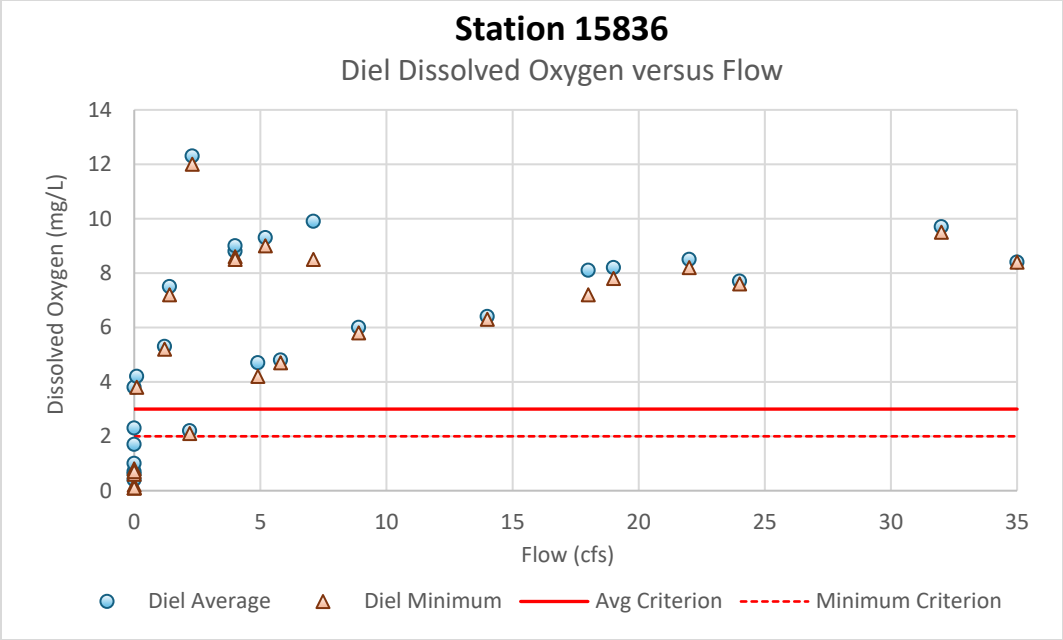

Figure 57: Diel dissolved oxygen readings versus flow at station 15836 in Prairie Creek

In 2022 and 2023, four bioassessments were completed in Boggy Creek at station 15836. Due to the channel being completely dry in the summer of 2022, a critical period monitoring event could not be completed. A non-critical period bioassessment was performed in October 2022 after rains in late September and early October allowed the stream to reconnect to Big Cypress Creek. This lone event was assessed in the 2024 IR.

Based upon the bioassessments results, the low diel dissolved oxygen minimally affected the biota of the stream. For all four bioassessments conducted from 2022 through 2023, the benthic macroinvertebrate samples had an average score of 21 using the regionalized metrics and 27.7 using state-wide metrics, both well-above the criterion of 11. The habitat scores had a mean of 17.1 exceeding the screening level of 14. The fish community scored in the High category with an average of 49. More details about these bioassessments are discussed in the *2024 Cypress Creek Basin Highlights Report* and in the Biological Discussions section of this report.

Trend analysis was not performed for Prairie Creek since the data did not meet the criteria for analysis.

Unclassified Segment 0404K – Walkers Creek

Walkers Creek arises in Camp County west of Pittsburg and generally flows to the northeast about fourteen kilometers to its confluence with Big Cypress Creek. The stream is classified as having a flow type of intermittent and an aquatic life designation of minimal. The stream often goes dry including in the late summer and fall of 2023.

All samples have been collected at station 16454 at US 271. Samples for laboratory parameters were collected from 2000 to 2002 while seventeen diels were performed from 2008 to 2012. Walkers Creek was included in *The Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)*, which was funded by the Texas State Soil and Water Conservation Board from 2009 to 2011. The concern for *E. coli* was a result of the study and has been carried over from previous assessments. No other monitoring has been conducted in Walkers Creek. Bacteria sampling will be needed to address the concern.

Trend analysis was not performed for Walkers Creek since the data did not meet the criteria for analysis.

Unclassified Segment 0404M – Greasy Creek

Greasy Creek is an intermittent stream that originates near the community of Lafayette in Camp County and flows to the northeast for about ten kilometers to its confluence with Big Cypress Creek. The confluence is about thirty meters upstream of station 16458 on Big Cypress Creek. The stream has been monitored at station 16016 at FM 557 with the first data reported in 1998. The site was sampled for laboratory parameters eight times between 2000 and 2002. No other monitoring was conducted in the stream until bioassessments were performed in 2022 and 2003. There were no impairments or concerns shown for Boggy Creek in the 2024 IR.

The stream was stagnant and pooled during the August and October 2022 bioassessments while the stream had flow during both 2023 collections. It should be noted that only the 2022 data were included in the 2024 IR which showed no impairments or concerns. However, two of the three dissolved oxygen grabs fell below the 2 mg/L criterion and 3 mg/L screening level with a mean of the low readings at 0.5 mg/L. These low dissolved oxygen values were likely due to the stream being pooled with no flow. Both 2023 dissolved oxygen grab readings met the criterion along with the 24-Hour DO Average and Minimum values in June 2023. The August 2023 diel failed to meet the criteria with a 24-Hour DO Average of 2 mg/L and Minimum at 1.5 mg/L. For the August event, the stream flow was quite low at 0.6 cfs.

Boggy Creek has an aquatic life designation of limited. The low dissolved oxygen readings appeared to have little impact on the biota in the stream. The benthic macroinvertebrate samples had an average score of 22 using regionalized metrics and 26 with statewide metrics, both well above the criterion of 11 and placing it in the Intermediate category. Habitat scored in the Limited category with a mean of 13.6, slightly under the screening level of 14. The fish community scored in the High range with an average of 44, well over the criterion of 11. More details about these monitoring events are provided in the *2024 Cypress Creek Basin Highlights Report* and in the Biological Discussions section of this report.

Trend analysis was not performed for Greasy Creek since the data did not meet the criteria for analysis.

Unclassified Segment 0404N – Lake Daingerfield

Lake Daingerfield is an eighty-acre reservoir which was completed in 1935 as a Civilian Conservation Corps project. Water released from Lake Daingerfield flows into Brutons Creek and then into Ellison Creek Reservoir. First included on the §303(d) List in 2002, the impairment has continued for mercury in fish tissue. In December 2001, the Department of State Health Services issued ADV-22, a fish consumption advisory. Lake Daingerfield also has a concern for mercury in fish tissue.

Located in Daingerfield State Park, Lake Daingerfield is monitored quarterly by TCEQ Region 5 at station 17337 near its headwaters. The reservoir was first sampled in 2000 and resumed in November 2016 for field and laboratory parameters and bacteria. The water quality of the reservoir is generally good with none of the 22 ammonia, nitrate, or chlorophyll *a* samples exceeding their screening levels during the assessment period. One total phosphorus value of 0.42 mg/L was reported over the 0.2 mg/L screening level. Out of 28 total phosphorus samples reported through May 2024, only five were reported above the 0.02 mg/L limit of quantitation. Similarly, only seven ammonia samples and five nitrate results were above the limit of quantitation while the mean of 25 chlorophyll *a* concentrations was 3.5 µg/L.

Trend analysis was not performed in Lake Daingerfield because the data did not meet the criteria for analysis.

- Unclassified Segment 0404O – Dragoo Creek
- Unclassified Segment 0404S – Unnamed Tributary of Big Cypress Creek
- Unclassified Segment 0404T – Prairie Branch
- Unclassified Segment 0404U – Evans Creek
- Unclassified Segment 0404V – Hayes Creek

These unclassified water bodies are intermittent streams and are tributaries to Tankersley, Hart, and Big Cypress Creeks. These streams were sampled as part of *The Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)*. No samples have been collected in these streams since the study was completed in August 2011. The 2024 IR showed concerns for *E. coli* and dissolved oxygen grab samples as a carry-forward from previous assessments. No monitoring is scheduled in these water bodies in 2025.

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Parameter	**0404O**	**0404S**	**0404T**	**0404U**	**0404V**
Dissolved Oxygen Grab		CS	CS, CN		CS
E. coli	CN	CN	CN	CN	CN

Table 14: Segment 0404 impairments and concerns in the 2024 IR, part 3

Lake O' the Pines Total Maximum Daily Load Implementation

There are eight permitted wastewater treatment plants in the Lake O' the Pines watershed. The two largest plants are the City of Mount Pleasant and Pilgrim's Pride, permitted at about three million gallons per day each. Both plants are located near the City of Mount Pleasant. Pilgrim's Pride discharges into Segment 0404B – Tankersley Creek and the City of Mount Pleasant discharges into Segment 0404C – Hart Creek. The City of Pittsburg operates two plants with one on Segment 0404E - Dry Creek and another on Segment 0404F - Sparks Branch. The remaining plants in the Lake O' the Pines watershed include the cities of Daingerfield, Lone Star, Omaha, and Ore City.

Excessive nutrient inputs into the reservoir from both point and non-point sources have long been a concern for Lake O' the Pines stakeholders. In 2000, the TCEQ found that dissolved oxygen levels in Lake O' the Pines were less than optimal for supporting fish and other aquatic species. Although the amount of dissolved oxygen in water fluctuates naturally, anthropogenic sources can cause unusually or chronically low dissolved oxygen levels. A Total Maximum Daily Load

(TMDL) was implemented to reduce oxygen-demanding substances to improve water quality conditions for aquatic life. The study determined that a 56 percent reduction in phosphorus entering the reservoir was needed to improve dissolved oxygen concentrations in the reservoir. In 2013 and 2014, stakeholders reviewed the 2008 TMDL Implementation Plan and revised the Implementation Plan to continue their efforts in improving its water quality.

Through the revised TMDL Implementation Plan, a group permit for phosphorus was issued to all wastewater treatment plants located in the Lake O' the Pines watershed. This permit, known as the Total Phosphorus Load Agreement (TPLA), is an agreement between NETMWD and entities operating permitted wastewater treatment plants in the Lake O' the Pines watershed. The TPLA was the first of its kind in the State of Texas.

In 2012, Pilgrim's Pride agreed to take on the full phosphorus reduction required to meet the TMDL. The TMDL program worked with the TCEQ Water Quality Division through the Water Quality Management Plan update process to develop permit limits and other permit language for all eight permittees. Although the total allocation of phosphorus from the point sources combined has remained the same, the individual allocations were different than shown in the original TMDL Implementation Plan. This change is reflected in the current versions of their permits.

Note that only Pilgrim's Pride Wastewater Treatment Plant (WWTP) has a phosphorus permit limit. The TPLA permitted the Pilgrim's Pride WWTP an annual discharge limit of 20,000 kilograms (kg) of phosphorus. In 2014, the plant discharged more than double that amount at 45,813 kilograms. That year, a multi-million-dollar upgrade to the Pilgrim's Pride WWTP was initiated which was completed in April 2015. In 2023, the WWTP released a total of about 4,270 kilograms of phosphorus, or about one-fifth of its permitted allocation.

The other seven municipal permittees are all required to sample and report their phosphorus discharges. Their allocated amounts are noted in the "Other Requirements" section of their permits, with wording stating that their permits can be amended to include those numbers as permit limits if the group fails to meet the phosphorus goal of the TPLA.

In 2023, about one-fourth of the permitted phosphorus allocation was discharged into the watersheds of Lake O' the Pines. Except for the City of Daingerfield, all other plants were well within their allocations. The City of Daingerfield exceeded its 500-kilogram allocation by 281 kilograms or almost sixty percent above its allocation. Pilgrim's Pride discharged 4,270 kilograms of phosphorus, or less than one-fourth of its 20,000-kilogram allocation. The amount of phosphorus discharged in 2023 by permittee is shown in the following table. Pilgrim's Pride is denoted with an asterisk (*) in the table since it is the only plant with a phosphorus permit limit.

Permitted Discharger	Permitted Discharge (MGD)	Phosphorus Allocation (kg)	2023 Phosphorus Discharge (kg)	Difference (kg)
Daingerfield	0.70	500	781	**281**
Lone Star	0.44	500	424	**-76**
Mt. Pleasant	2.91	2,300	431	**-1,869**
Omaha	0.20	300	140	**-160**
Ore City	0.22	1,000	379	**-621**
Pilgrim's Pride *	3.50	20,000	4,270	**-15,730**
Pittsburg/Dry Creek	0.20	600	45	**-555**
Pittsburg/Sparks Branch	2.00	1,800	458	**-1,342**
Total	**10.17**	**27,000**	**6,928**	**-20,072**

Table 15: TPLA phosphorus discharges in 2023 (in kilograms of phosphorus)

Stakeholders also specified voluntary actions aimed at reducing non-point source contributions into Lake O' the Pines, such as stormwater runoff, were necessary to achieve the goals of the TMDL. Technical and financial programs were created for agricultural producers and local/county programs were created to address on-site sewage facilities, marine sanitation, and education.