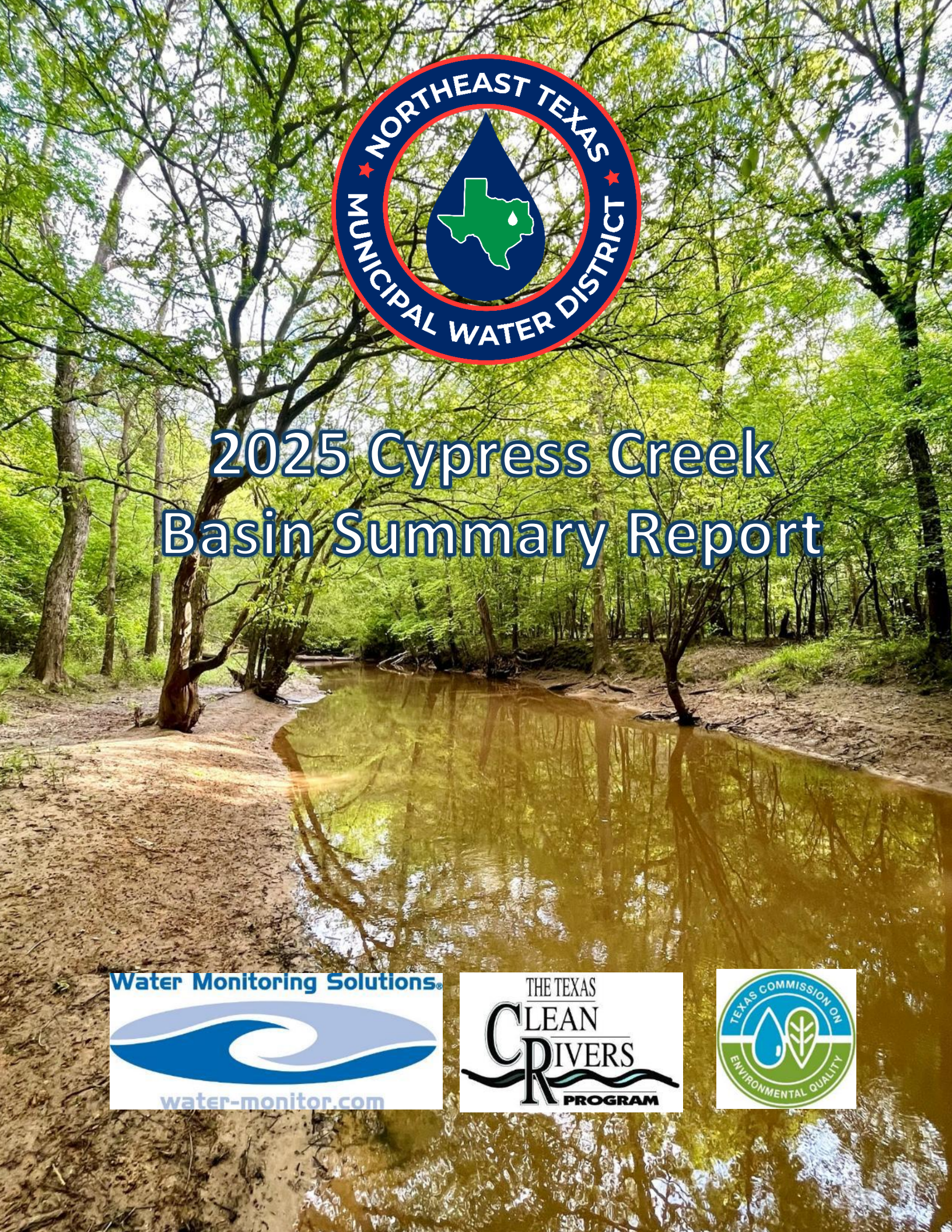

2025 Cypress Creek Basin Summary Report

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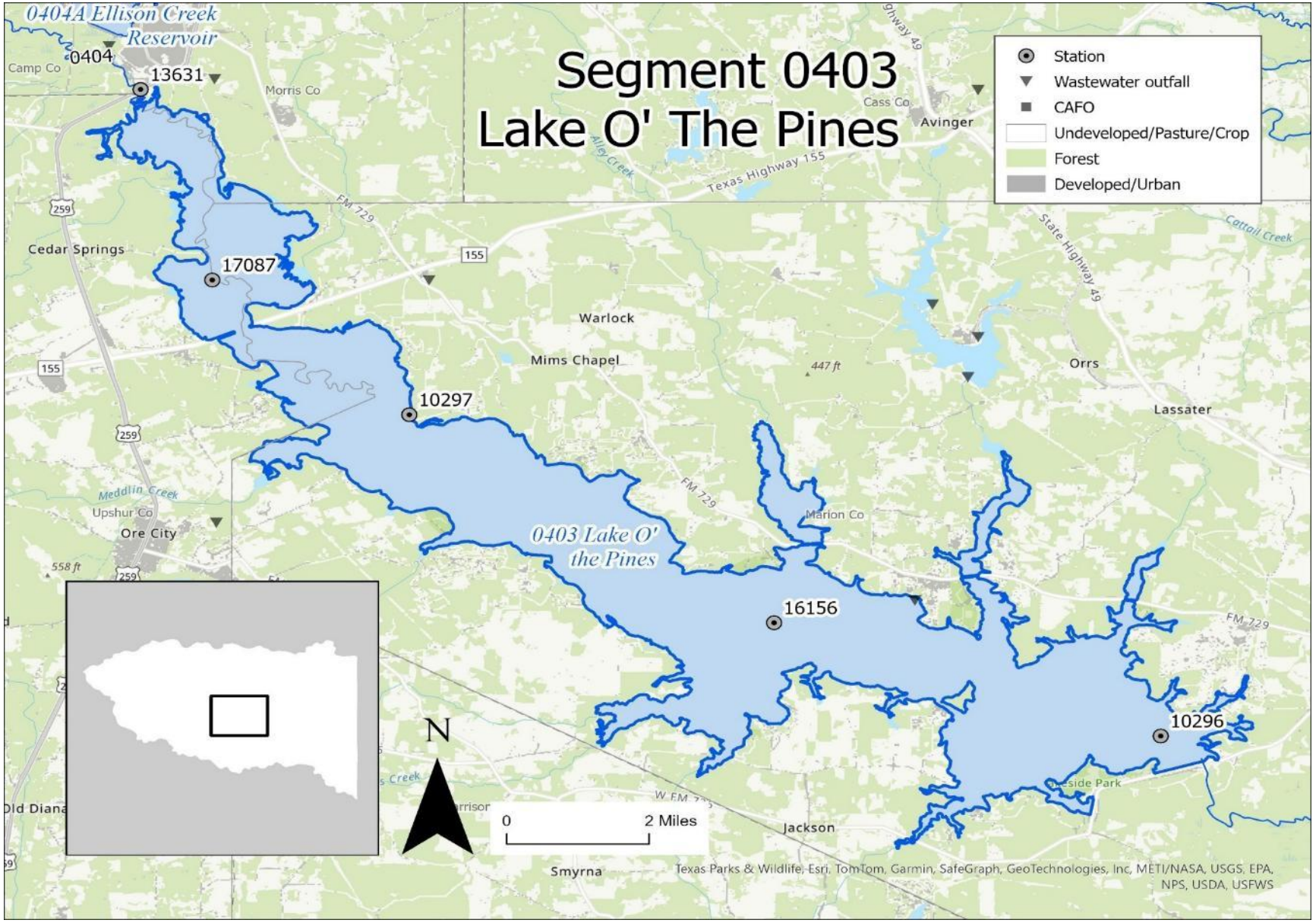

Figure 58: Map of stations in Segment 0403 – Lake O' the Pines

Segment 0403 - Lake O' the Pines

The Lake O' the Pines watershed encompasses approximately 885 square miles. The lower portion of the watershed lies within the Pineywoods Ecoregion and is composed of hardwood and pine forests. The upper portion, near Lake Bob Sandlin, is in the Post Oak Savanah Ecoregion which is comprised of patches of oak woodlands interspersed with grasslands. The watershed is rural. Land is predominantly used for agriculture, including silviculture, poultry, and livestock.

Lake O' the Pines covers about 18,700 surface acres and has a storage capacity of 254,000 acre-feet. Releases from the two gates in the control structure vary from a minimum of 5 cfs to a maximum of 3,000 cfs. Lake O' the Pines provides water for eight cities and towns, numerous rural water districts, a steel manufacturer, and electricity generators. In addition to recreation and tourism, the reservoir is an important resource to the timber industry as well as to agricultural enterprises such as poultry, dairy, and cattle operations.

The reservoir was created for flood control after the historic flooding of the City of Jefferson in 1945. The reservoir was authorized by the U.S. Congress through the Flood Control Act of 1946. Construction of the Ferrell's Bridge Dam on Big Cypress Bayou was completed in 1959. Despite historic rainfall in 2015 and in early 2016, Lake O' the Pines performed its primary function and prevented the City of Jefferson from flooding. Through controlled water releases, over one million acre-feet of water was discharged between January and August 2016 which was enough water to fill Caddo Lake nearly seven times.

Segment 0403 is divided into four assessment units including the area near the dam, the lower middle assessment unit near Alley Creek, the upper middle assessment unit below SH 155, and the upper assessment unit above SH 155.

Segment 0403 Assessment Units		
Assessment Unit	**Description**	**Station**
0403_01	Lower 5,000 acres near dam	10296
0403_02	Lower Middle 5,000 acres	16156
0403_03	Upper Middle 5,000 acres below SH 155	10297
0403_04	Upper 3,700 acres above SH 155	17087

Table 16: Stations and assessment unit descriptions in Segment 0403

The TCEQ Region 5 samples quarterly in each assessment unit for field and laboratory parameters and bacteria. Station 10296 has been sampled the longest with the first results reported in October 1973. Monitoring began at station 16156 in October 1998 while station 10297 had data available since February 1997. The first results reported at station 17087 were in October 2000.

2025 Monitoring Schedule						
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**
0403_01	10296	R5	LAKE O THE PINES NEAR DAM	4	4	4
0403_02	16156	R5	LAKE O THE PINES MID LAKE	4	4	4
0403_03	10297	R5	LAKE O THE PINES NETMWD INTAKE	4	4	4
0403_04	17087	R5	LAKE O THE PINES N OF SH 155	4	4	4

Table 17: FY 2025 Monitoring Schedule for Segment 0403

The 2024 §303(d) List identified Lake O' the Pines as impaired for high pH in all but the upper assessment unit. This impairment was first shown on the 2016 §303(d) List. The 2024 IR included an impairment for 24-Hour DO Minimum in the upper assessment unit. The impairment was a carry-forward from previous assessments since no diel studies have been performed in this assessment unit since 2002. It should be noted that none of the five diels conducted between May and August 2023 as part of a special study fell below the 24-Hour DO Average and Minimum criteria while none of the 26 dissolved oxygen measurements reviewed in the 2024 IR fell below the 3 mg/L dissolved oxygen grab minimum criterion.

2024 Texas Integrated Report				
Parameter	**0403_01**	**0403_02**	**0403_03**	**0403_04**
pH	NS	NS	NS	
24 HR DO Minimum				NS

Table 18: Segment 0403 impairments and concerns in the 2024 IR

The high pH impairment was due to pH samples exceeding the 8.5 s.u. high pH criterion during the assessment period. For station 10296, almost eighteen percent of the pH readings were high, while 25 percent of the measurements at station 16156 and about 31 percent at station 10297 exceeded the 8.5 s.u. criterion. The mean of the exceedances was about the same in all three assessment units at 8.9 s.u. Three out of 26 pH measurements were elevated at station 17087 with a mean exceedance of 8.97 s.u. This assessment unit was not impaired for high pH in the 2024 IR.

A review of all historical pH readings in SWQMIS showed that, on average, a little over ten percent of pH measurements reported in Lake O' the Pines exceeded the high pH criterion. Elevated pH measurements exceeding the 8.5 s.u. criterion were most frequently collected in the middle assessment units while the upper assessment unit had the fewest high values and the lowest assessment unit had the lowest percentage of high readings. The highest pH reading reported in each assessment unit was the same at 9.3 s.u.

Lake O' the Pines Historical pH					
Station	**10296**	**16156**	**10297**	**17087**	**Total**
n	204	125	132	97	558
High	13	22	16	8	59
Percent High	6.4%	17.6%	12.1%	8.2%	10.6%
# High pH since 2014	9	12	13	7	41
Cool months	1	1	1	1	4
Maximum pH	9.3	9.3	9.3	9.3	

Table 19: Historical pH readings in Lake O' the Pines

The *2019 Cypress Creek Basin Summary Report* revealed that high pH readings had been rare in Lake O' the Pines prior to 2010. Historically, only one pH value was reported above the 8.5 s.u criterion from 1973 through 2009 at station 10296. The first high pH value reported for the entire reservoir was at station 10296 in September 1998. Station 16156 first had elevated pH readings in July 2002 while August 2008 and September 2012 were the first high pH values reported for stations 10297 and 17087, respectively.

High pH measurements have become more regularly reported over the past decade across all stations. A review of the historical data showed that at least half of all elevated pH measurements were obtained between August 2014 through June 2024. The data review also revealed that out of 59 high pH values reported in Lake O' the Pines, all but four of those readings were collected during the warm weather months of May through October.

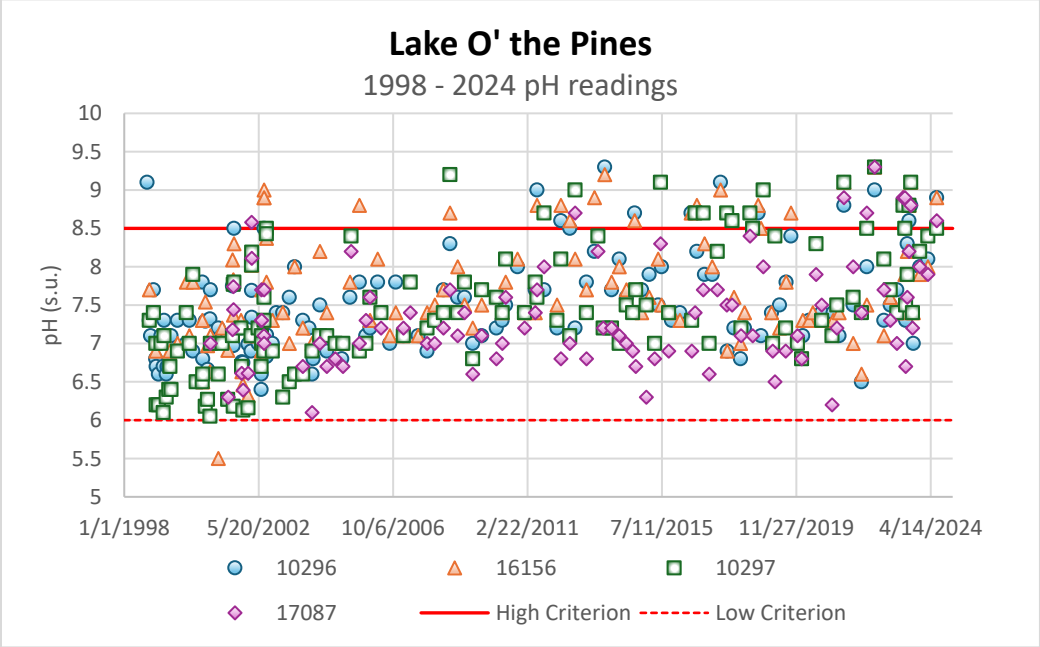

Figure 59: pH measurements by station in Lake O' the Pines, 1998 - 2024

Figure 60: Station 10297, NETMWD intake (left) and station 17087, above SH 155 (right)

Due to the high pH 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. As detailed in the Segment 0405 discusssion, algae and other primary producers can consume the available carbon dioxide 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 was assumed in Lake O' the Pines since all of the grab samples used in the assessment were generally collected between 10 AM and 2 PM, the peak hours of primary productivity.

The report demonstrated that all but two high pH measurements collected since 2010 corresponded with super-saturated dissolved oxygen. A strong statistical correlation between all pH and dissolved oxygen percent saturation was identified. However, since no diel monitoring had been conducted in the reservoir since 2002, there were no data to support the pH cycling assertion.

The CRP has funded three special studies in Lake O' the Pines to explore possible links between primary productivity and high pH. A Continuous Water Quality Monitoring Special Study, conducted from November 2019 through August 2021, incorporated two continuous water quality monitoring stations in the upper assessment units of the reservoir. Although located in a transition zone, the US 259 station was used to represent AU 0403_04 while the NETMWD intake

station 10297 represented AU 0403_03. A Diel Special Study conducted from June to August 2020 and from May to August 2021 incorporated targeted diel monitoring in the lower assessement units. Data collected near the City of Longview intake represented AU 0403_02 and the Dam station represented AU 0403_01. A complete discussion of these studies is available in the *2022 Cypress Creek Basin Highlights Report*.

The continuous monitoring sondes revealed that pH did not exceed the 8.5 s.u. criterion very often. At the US 259 station, pH was reported above 8.5 s.u. in less than 0.11 percent of the measurements whereas the NETMWD intake was above the criterion in 1.22 percent of the readings. Most high pH values measured by the continuous water quality monitors were recorded in the warm weather months. The warm weather months also exhibited the greatest diel range between minimum and maximum pH. The highest monthly pH range at the US 259 station was 2.4 s.u. while it was 3.1 s.u. at the NETMWD intake. These pH ranges occurred in June and July 2020 at both stations.

For the Diel Special Study, high pH was most often obtained at the City of Longview intake (AU 0403_02), exceeding the criterion in over 36 percent of all samples collected while pH at the Dam was high in approximately 31 percent of the readings. The greatest percentage of high pH values were collected during the July 26, 2021 deployments where the City of Longview intake and Dam stations exceeded the criterion in over 94 percent and 85 percent of the readings, respectively. The only deployment where none of the pH values exceeded the criteria at either station was the August 25, 2020 study.

The studies indicated that there is a close relationship between dissolved oxygen percent saturation and pH throughout the reservoir. Most high pH results were collected during super-saturated dissolved oxygen conditions. Further, dissolved oxygen percent saturation and pH correlated well at both continuous monitoring stations as well as at both diel stations. A comparison of the data collected at the NETMWD intake continuous monitor with the diel data from the City of Longview intake and Dam stations revealed that dissolved oxygen percent saturation and pH were almost perfectly correlated with the mean coefficients ranging from 0.93 at the NETMWD intake to 0.95 at Dam station and 0.96 at the Longview intake.

The CRP also funded a special study during the summer of 2023 that included the laboratory analysis of nutrients and chlorophyll *a* in addition to field parameter profile measurements and diel studies. The special study is discussed in the *2024 Cypress Creek Basin Highlights Report*. Monitoring was conducted five times between May and August 2023 in each of the four assessment units. As with the Lake Cypress Springs 5n Impairment Study, sondes were deployed from buoys at each station for 24 hours. Field observations were recorded along with transparency measurements.

The results of this study corroborated the findings from the other two special studies and supported the assertions discussed in the *2019 Cypress Creek Basin Summary Report*. The study revealed that the median pH of in the mixed surface layer and diel measurements were often over the 8.5 s.u. high pH criterion. In all cases of a high pH value, dissolved oxygen was reported to be over one hundred percent saturation.

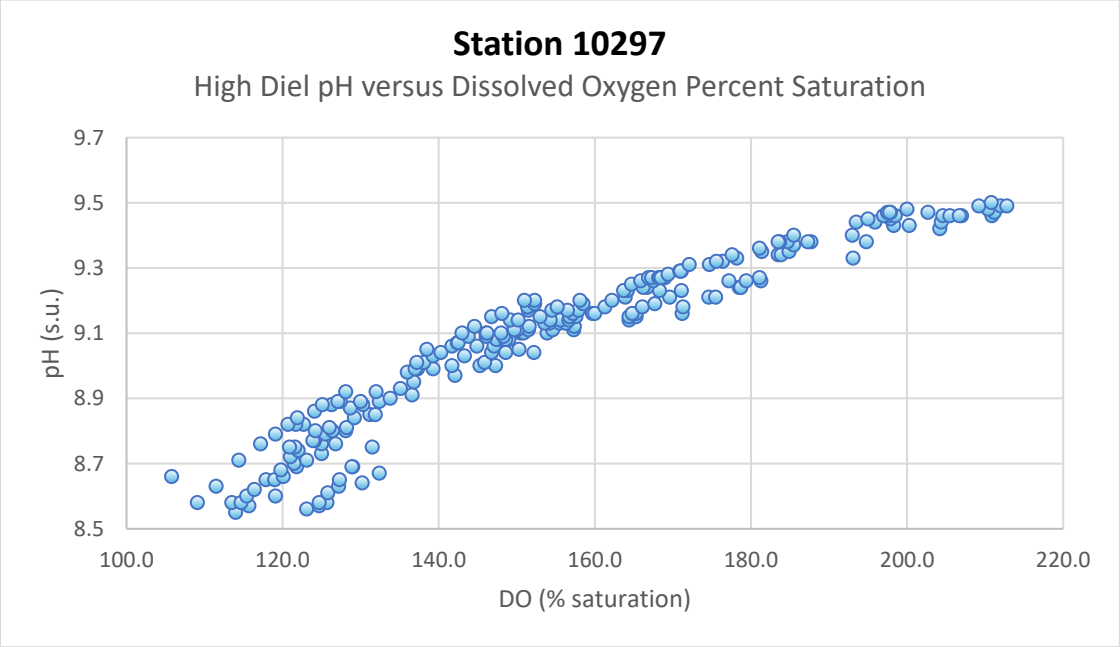

Figure 61: High diel pH versus DO percent saturation at station 10297, May through August 2023

The mean grab dissolved oxygen percent saturation in the mixed surface layer was over one hundred percent for all readings while none of the diel dissolved oxygen readings fell below the 24-Hour DO Minimum criterion. The low dissolved oxygen impairment in the upper assessment unit should be reevaluated since no diel studies had been conducted in this assessment unit in over two decades.

Laboratory analysis revealed that nutrient concentrations were low throughout the reservoir with many of the ammonia, nitrite, and nitrate results reported below the limit of quantitation. Total phosphorus was very low with averages ranging from 0.05 to 0.07 mg/L. However, the average chlorophyll *a* value for all samples combined was 32.0 µg/L suggesting that available nutrients were readily being converted into algal biomass.

The study concluded that the super-saturated DO and elevated pH readings were likely the result of primary productivity. Primary productivity from algae was likely responsible for the high pH readings, and the study results supported the assumption that the high pH impairment in Lake O' the Pines was a result of eutrophication.

A review of all high pH readings reported in Lake O' the Pines was compared with the dissolved oxygen percent saturation. In all but two cases of high pH, dissolved oxygen percent saturation was one hundred percent or higher. The highest pH values corresponded to dissolved oxygen with values greater than 145 percent saturation. These results corroborate the findings of the three special studies.

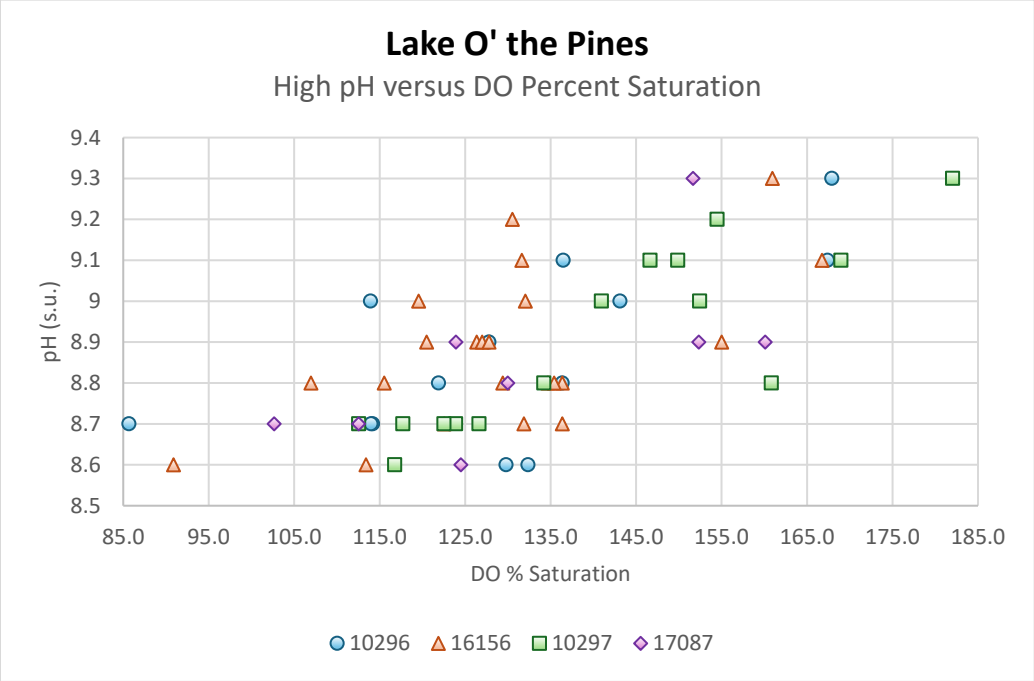

Figure 62: High pH versus DO percent saturation by station in Lake O' the Pines

Although the Lake O' the Pines TMDL was designed to address low dissolved oxygen in the reservoir, there are no concerns or impairments for dissolved oxygen grab readings in the 2024 IR. All 106 dissolved oxygen grab samples assessed met the 3 mg/L dissolved oxygen grab minimum criterion while five readings fell below the 5 mg/L grab screening level. In addition, none of the 577 historical dissolved oxygen measurements shown in SWQMIS were reported below the grab minimum criterion, while only sixteen readings fell below the screening level. It should be noted that the upper assessment unit is impaired for low 24-Hour DO Minimum.

The 2024 IR defined Lake O' the Pines as an eutrophic reservoir and ranked it in the top sixteen percent out of 141 Texas resevoirs for elevated chlorophyll *a*. Although chlorophyll *a* was not shown as concern in the 2024 IR, data collected during the assessment period revealed many elevated results. Over sixty percent of all samples collected in the lower three assessment units exceeded the 26.7 µg/L screening level. The mean of the exceedances ranged from 36.7 µg/L at station 10296 to 52.19 µg/L at station 10297. For the headwaters station 17087, about 58 percent of the chlorophyll *a* samples were elevated. This assessment unit had the highest concentrations with a mean of the exceedances more than twice the screening level at 54.75 µg/L.

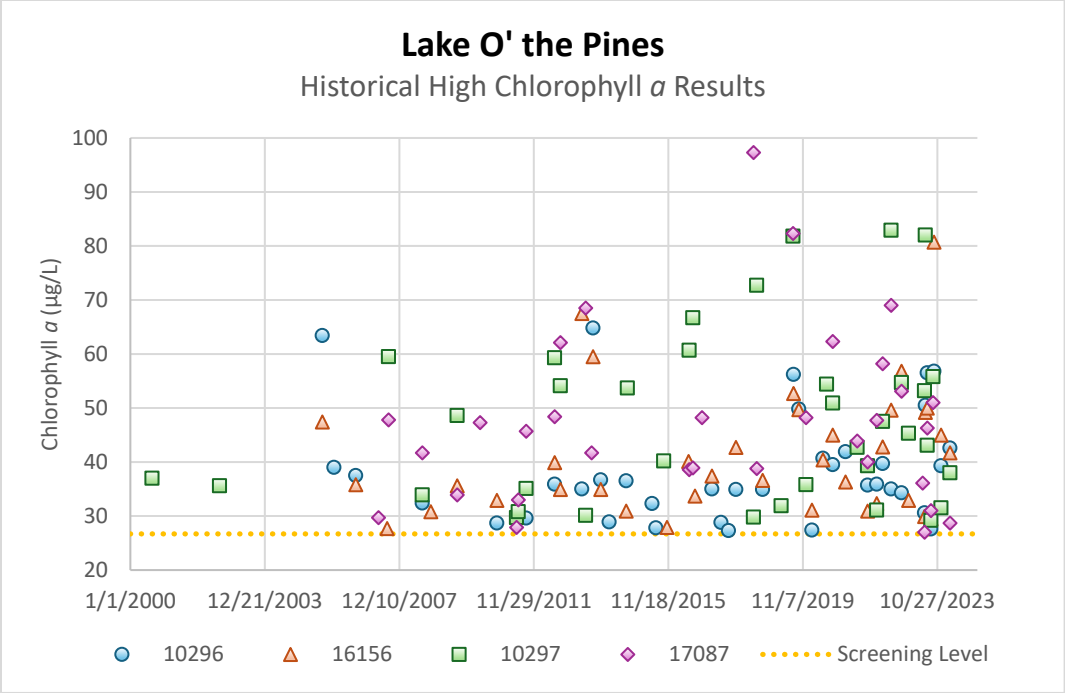

Figure 63: High chlorophyll a results by station in Lake O' the Pines

As found with pH, elevated chlorophyll *a* concentrations have become more common over the past decade. The number of high sample results were similar across all assessment units. Out of 143 values exceeding the 26.7 µg/L screening level reported in SWQMIS, over two-thirds were collected after July 2014. Unlike the findings in Lake Cypress Springs, over sixty percent of the elevated chlorophyll *a* samples were collected during the warm weather months.

Lake O' the Pines Historical Chlorophyll *a*				
Station	**10296**	**16156**	**10297**	**17087**
n	180	109	108	64
# High	38	37	36	32
Percent High	21.1%	33.9%	33.3%	50.0%
Cool months	11	12	7	7
# High since 2014	26	26	25	20
Maximum result (µg/L)	64.8	80.7	82.9	97.3

Table 20: Historical chlorophyll a results by station in Lake O' the Pines

A single-factor Analysis of Variance was conducted on all chlorophyll *a* samples across Lake O' the Pines, and statistically significant differences were identified between the stations with a p-value of 7.018e-06. After removing station 10296 from the analysis, the difference was no longer statistically significant. These results suggest that chlorophyll *a* values were significantly lower at station 10296 than at the other stations.

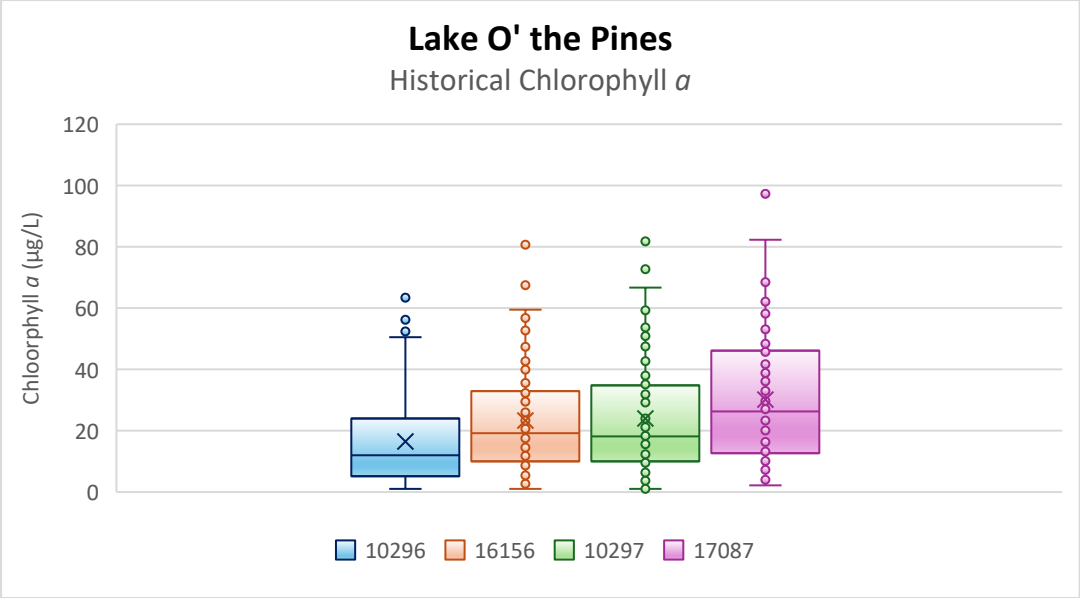

Figure 64: Historical chlorophyll a values by station in Lake O' the Pines

As found in the Lake Cypress Springs discussion, pH and chlorophyll *a* did not correlate strongly with coefficients ranging from -0.06 at station 17087 to 0.39 at station 10296. The correlations between dissolved oxygen and chlorophyll *a* was much lower with -0.10 at station 17087 to 0.16 at station 10297. However, as found in the *2019 Cypress Creek Basin Summary Report* and the special studies, pH and dissolved oxygen correlated strongly in the middle and upper assessment units with a mean coefficient of 0.72. The correlation near the dam was moderate at 0.53. Except for station 16156, the other assessment units did not correlate well between transparency and chlorophyll *a*. For station 16156, the correlation coefficient was -0.62. The inverse relationship indicates that as chlorophyll *a* increases, transparency decreases.

Lake O' the Pines Correlations				
Parameters	**10296**	**16156**	**10297**	**17087**
pH to DO percent saturation	0.53	0.70	0.73	0.72
Chlorophyll *a* to pH	0.39	0.36	0.25	-0.06
Chlorophyll *a* to DO percent saturation	0.10	0.13	0.16	-0.10
Chlorophyll *a* to Transparency	0.20	-0.62	-0.23	0.02

Table 21: Correlations between pH, DO percent saturation, chlorophyll a, and transparency by station in Lake O' the Pines

Transparency has been decreasing across the reservoir over the past decade while chlorophyll *a* has been increasing in two assessment units. Although the only station that correlated well between chlorophyll *a* and transparency was station 16156, water clarity has been decreasing at all stations at statistically significant rates. Unsurprisingly, transparency was lowest at the headwaters and greatest near the dam. Average transparency increased as the water moved

from the headwaters to the dam assessment units. A single-factor Analysis of Variance was conducted on all Secchi measurements across Lake O' the Pines, and statistically significant differences were identified between the stations with a p-value of 2.63e-05. However, after removing station 17087, the difference was no longer significantly different. These results suggest that the transparency was significantly lower at station 17087 than at the other stations.

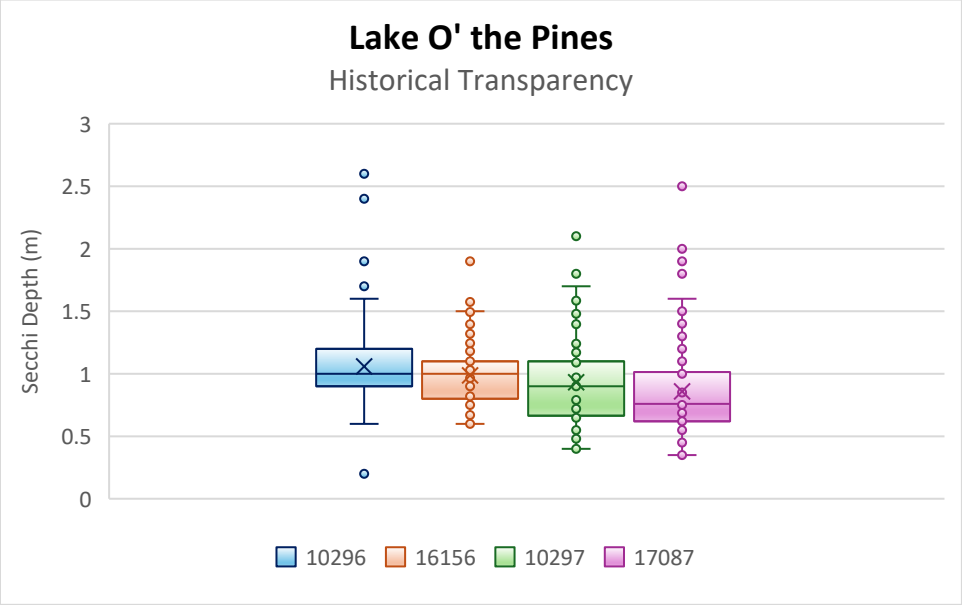

Figure 65: Historical transparency measurements by station in Lake O' the Pines

As found in the special study in 2023, nutrients tended to be very low in Lake O' the Pines. Out of the 103 total phosphorus samples assessed in the 2024 IR, none of them exceeded the 0.2 mg/L screening level while only four nitrate results were reported over the 0.37 mg/L screening level. Three of those elevated values were collected at station 17087 near the headwaters and the fourth was obtained at station 10297. Almost ten percent of the ammonia samples surpassed the 0.11 mg/L screening level. Out of the nine high values, seven were collected at station 10296 while one each was collected at stations 16156 and 10297. For station 10296, 28 percent out of 25 values were elevated with a mean of the exceedances at 0.22 mg/L. The highest single sample result was from station 16156 at 0.39 mg/L. These results suggest that Lake O' the Pines may be phosphorus limited.

TRENDS

Several trends were identified in Lake O' the Pines for both ten- and 20-year periods. Some positive trends (as indicated by green arrows ↑↓) were identified including an increasing trend for alkalinity and decreasing trends for salts and organic carbon and nitrogen. Negative trends (indicated by red arrows ↑↓) were for chlorophyll *a*, pH, and transparency. The increasing trend for dissolved oxygen was considered neutral as it may be a positive finding that demonstrated the effectiveness of the TMDL, or it may be a negative finding serving as an indication of excessive primary production. Additional data are needed to make this determination.

Lake O' the Pines Trends								
	20-Year Trends				10-Year Trends			
	10296	16156	10297	17087	10296	16156	10297	17087
Alkalinity			↑					
Chlorophyll *a*					↑		↑	
Dissolved Oxygen								↑
pH								↑
Specific Conductance		↓						
Sulfate	↓	↓						
Total Kjeldahl Nitrogen						↓		
Total Organic Carbon					↓	↓		
Transparency	↓				↓	↓	↓	↓

Table 22: 10- and 20-Year trends by parameter in Lake O' the Pines

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 trends at station 10296 near the dam while decreasing 10-year trends were found at all stations. These 10-year decreasing transparency trends were coupled with increasing trends for chlorophyll *a* at stations 10296 and 10297 which further demonstrates the relationship between transparency and chlorophyll *a*. However, the near historical flooding and frequent runoff events over the past decade likely contributed to these declining trends, as well.

Decreasing transparency trends were also found in the 2014 and 2019 basin summary reports. Trends from both reports analyzed data from the previous twenty years. In the 2014 report, Secchi depth was significantly decreasing in the headwaters assessment unit at station 17087, while it was decreasing at a statistically significant rate at station 10296 in the 2019 report.

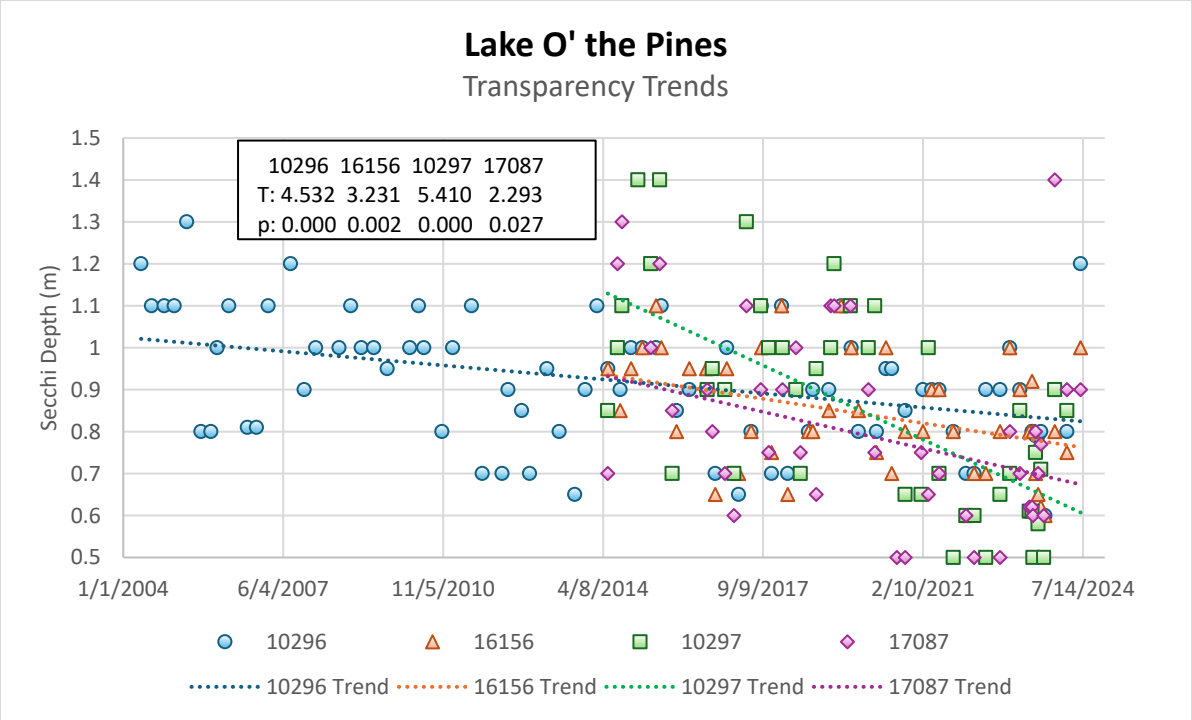

Figure 66: Decreasing transparency trends by station in Lake O' the Pines

Chlorophyll *a* was increasing at a statistically significant rate at stations 10296 and 10297 over the past decade. Increasing trends were also found at station 10296 in the 2009 and 2014 basin summary reports and at station 16156 in the 2009 report.

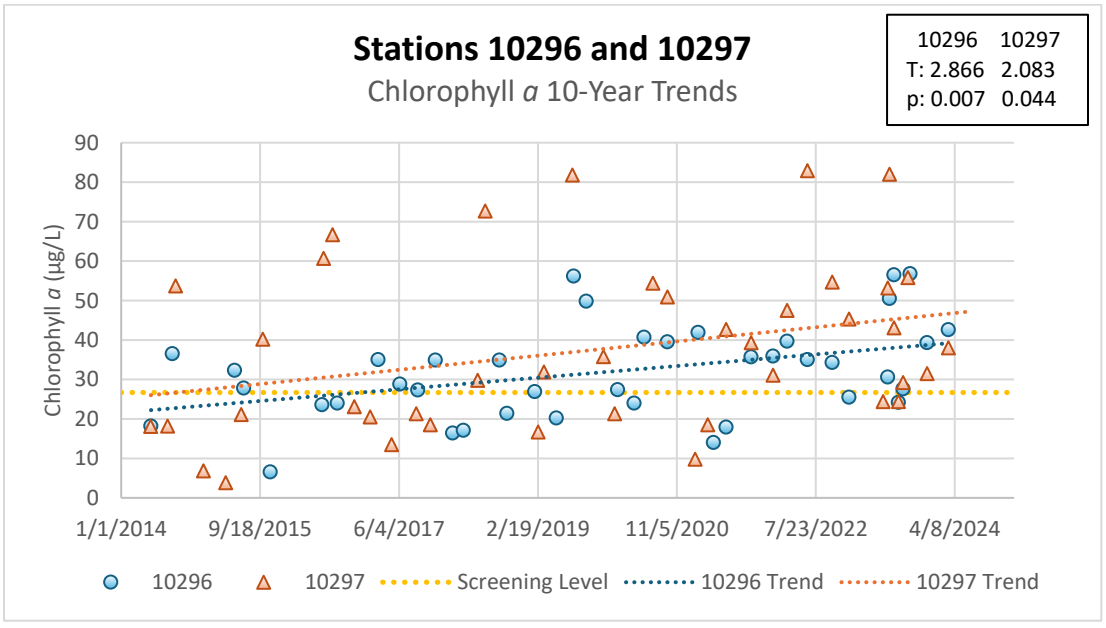

Figure 67: Increasing 10-Year chlorophyll a trends at stations 10296 and 10297

Alkalinity has been increasing at a statistically significant rate at the NETMWD intake station 10297 over the past twenty years. Increasing trends were found above Lake O' the Pines in Lake Cypress Springs and Lake Bob Sandlin in the *2019 Cypress Creek Basin Summary Report*.

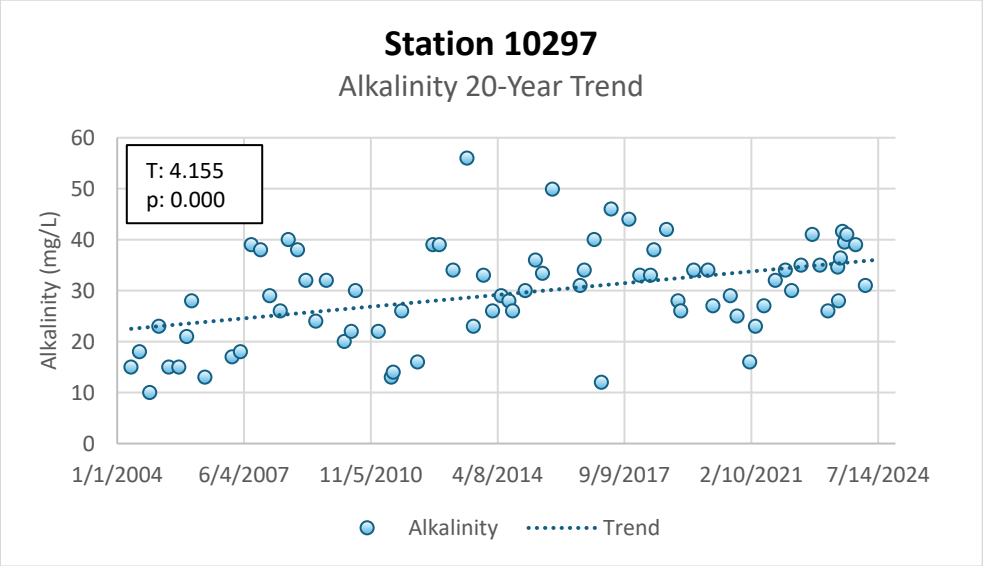

Figure 68: Increasing 20-Year alkalinity trend at station 10297

Although not at a statistically significant rate, chlorophyll *a* concentrations have been increasing at the other stations in the reservoir. This increase was most likely contributed to the increasing dissolved oxygen and pH trends over the past decade in the upper assessment unit.

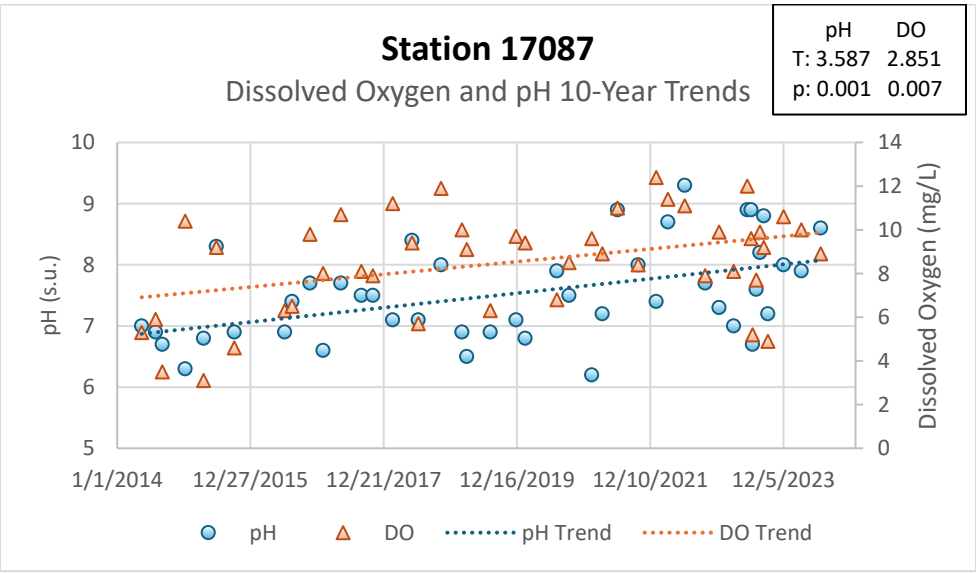

Figure 69: Increasing 10-Year dissolved oxygen and pH trends at station 17087

Other trends occurring in the reservoir include decreasing trends for sulfate during the past twenty years at stations 10296 and 16156 while specific conductance was also decreasing at station 16156. These decreasing trends appear to be due to the historical drought-flood cycle

experienced during this period. Salts became concentrated during the pervasive drought and then diluted during the flooding and runoff periods beginning in 2015. Similarly, flooding and many large runoff events over the past ten years have likely contributed to the decreasing total organic carbon trends at stations 10296 and 16156 along with the decreasing trend for total Kjeldahl nitrogen at station 16156.

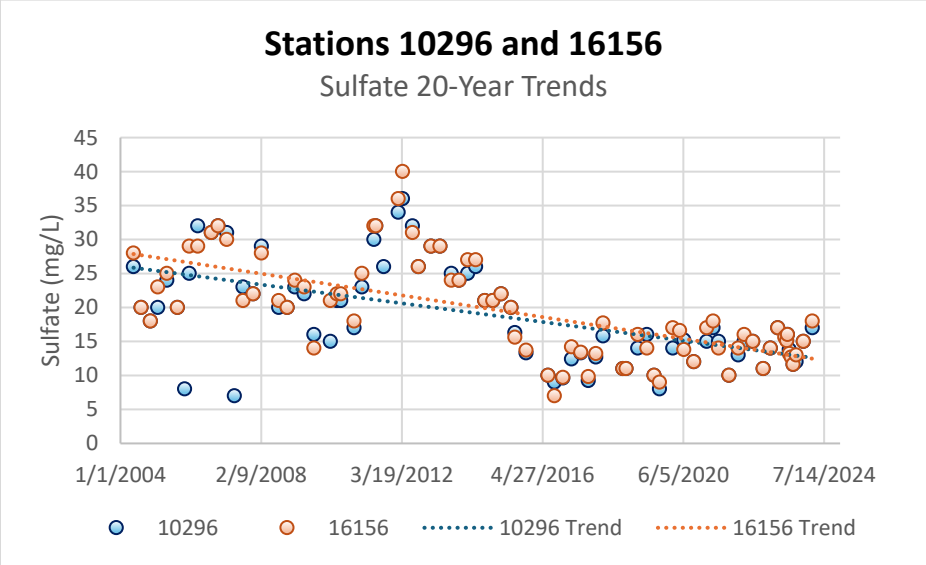

Figure 70: Decreasing 20-Year sulfate trends at stations 10296 and 16156

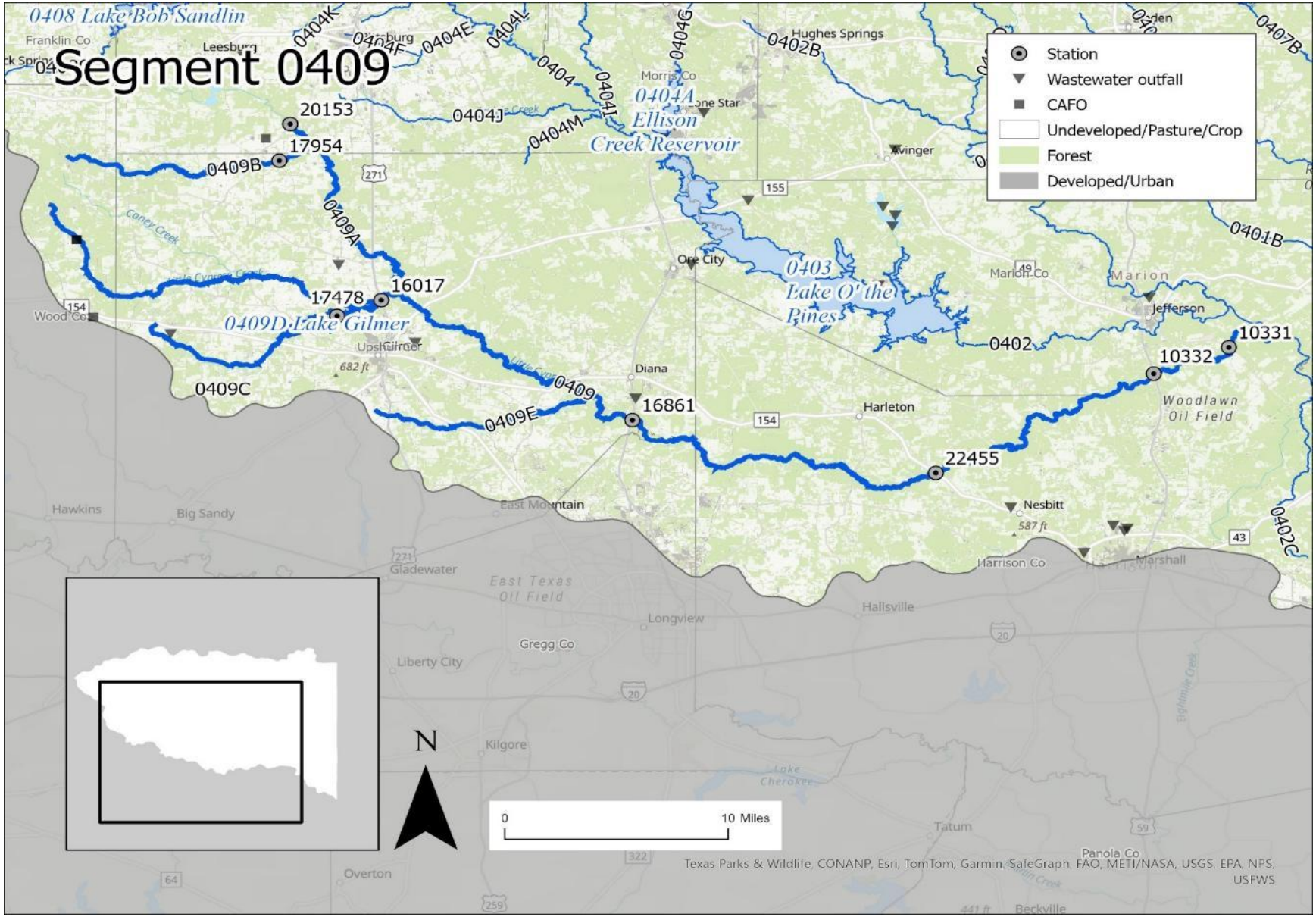

Figure 71: Map of stations in Segment 0409 – Little Cypress Creek

Segment 0409 – Little Cypress Creek (Bayou)

Little Cypress Bayou, a perennial stream, emerges along the margin of the Post Oak-Savannah region near FM 2088 in Wood County with the majority of the watershed located within the Pineywoods ecoregion. The approximately 163-kilometer bayou forms much of the southern boundary of the Cypress Creek Basin and joins Big Cypress Creek east of Jefferson. The stream traverses through priority bottomland hardwood forests in Marion and Harrison counties.

Segment 0409 is comprised of four assessment units and five unclassified water bodies. The lowest assessment unit is defined as the portion of the stream that extends from the confluence with Big Cypress Creek east of Jefferson upstream for 41 km to the confluence with Lawrence Creek, while AU 0409_02 is the 29.2-kilometer reach between Lawrence Creek and NHD RC 1114030700368. The 52.2-kilometer length of stream between NHD RC 1114030700368 and Kelsey Creek is AU 0409_03, and AU 0409_04 is the reach between the confluence with Lilly Creek and extending one kilometer upstream of FM 2088. The unclassified water bodies evaluated in the 2024 IR include 0409A – Lilly Creek; 0409B – South Lilly Creek; 0409D – Lake Gilmer; and 0409E – Clear Creek.

Segment 0409 Assessment Units		
Segment / AU	**Description**	**Station(s)**
0409_01	From the confluence with Big Cypress Creek upstream 41 km to Lawrence Creek	10331; 10332
0409_02	From the confluence with Lawrence Creek upstream 29.2 km to NHD RC 1114030700368	22455
0409_03	From the confluence with NHD RC1114030700368 upstream 52.2 km to Kelsey Creek	16861
0409_04	From the confluence with Lilly Creek upstream to 1.0 km above FM 2088	14975; 16017
0409A	Lilly Creek	20153
0409B	South Lilly Creek	17954
0409D	Lake Gilmer	17478; 18825
0409E	Clear Creek	No stations

Table 23: Stations and assessment unit descriptions in Segment 0409 and its unclassified water bodies

Segment 0409 is monitored by TCEQ Region 5 and by WMS for field and laboratory parameters, bacteria, and flow on a quarterly basis. Region 5 collects samples in all four assessment units of Little Cypress Creek along with two stations in Lake Gilmer while WMS monitors one station each in Lilly and South Lilly creeks.

2025 Monitoring Schedule							
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**
0409_01	10331	R5	LITTLE CYPRESS CREEK AT FM 134	4	4	4	
0409_02	22455	R5	LITTLE CYPRESS BAYOU AT SH 154	4	4	4	
0409_03	16861	R5	LITTLE CYPRESS BAYOU AT US 259	4	4	4	4
0409_04	16017	R5	LITTLE CYPRESS BAYOU AT US 271	4	4	4	4
0409A	20153	WMS	LILLY CREEK AT FM 556	4	4	4	4
0409B	17954	WMS	SOUTH LILLY CREEK AT FM 2454	4	4	4	4
0409D	17478	R5	LAKE GILMER AT MID DAM	4	4	4	
0409D	18825	R5	LAKE GILMER AT FM 852	4	4	4	

Table 24: FY 2025 Monitoring Schedule for Segment 0409

Little Cypress Creek is impaired for bacteria in all but the lowest assessment unit. The bacteria impairments were first added to the §303(d) List in 2006. Assessment unit 0409_02 was first impaired for 24-Hour DO Average in 2000. There were no impairments shown for AU 0409_01 in the 2024 IR. Lilly Creek is impaired for *E. coli* while South Lilly Creek is impaired for low dissolved oxygen grab measurements. There were no impairments or concerns in the lower assessment unit of Little Cypress Creek or in Lake Gilmer.

2024 Texas Integrated Report								
Parameter	**0409_01**	**0409_02**	**0409_03**	**0409_04**	**0409A**	**0409B**	**0409D**	**0409E**
Dissolved Oxygen Grab					CN, CS	NS, CN		
24 HR DO Average		NS						
E. coli		NS	NS	NS	NS			
Chlorophyll *a*					CS			
Benthic								CN
Habitat								CS

Table 25: Segment 0409 impairments and concerns in the 2024 IR

The uppermost reach of the segment extends from the headwaters near FM 2088 in Wood County downstream to the confluence with Lilly Creek. The assessment unit was included on the 2024 §303(d) List for not supporting the *E. coli* criterion. The geometric mean of the fifty bacteria samples collected during the assessment period was 391.4 MPN/100 mL, more than triple the 126 MPN/100 mL criterion. The watershed is primarily forested mixed with both unimproved and

improved pastures. The main sources of bacterial contributions were most likely from wildlife and livestock with possible contributions from malfunctioning on-site septic systems.

All dissolved oxygen readings assessed for the upper reach in the 2024 IR were reported above the grab minimum criterion and screening level while all nitrate and total phosphorus samples were below their respective screening levels. Two ammonia results exceeded the 0.33 mg/L screening level with a 0.54 mg/L mean of the exceedances and one chlorophyll *a* value of 27.1 µg/L was reported, exceeding the 14.1 µg/L screening level.

The upper-middle assessment unit of Little Cypress Creek extends 52.2 kilometers upstream to the confluence with Kelsey Creek. This reach is impaired for bacteria with a geometric mean of 154.3 MPN/100 mL based upon seventeen samples. The stream corridor between US 271 in AU 0409_04 and US 259 is almost entirely forested except for the north side of the stream immediately above station 16861. From Google Earth imagery, a large, improved pasture with cattle trails leading near the stream are visible. Therefore, the sources of *E. coli* were likely livestock and wildlife. Exclusionary fencing may help reduce bacterial contributions from livestock.

Figure 72: Google earth image of land use upstream of station 16861

Similar to AU 0409_04, all dissolved oxygen readings in 0409_03 were reported above the grab minimum criterion and screening level while all nitrate and total phosphorus samples were below

their respective screening levels in the 2024 IR. Two chlorophyll *a* values exceeded the 14.1 µg/L mg/L screening level with a 21.55 µg/L mean of the exceedances, while one ammonia value of 0.88 mg/L exceeded its 0.33 mg/L screening level.

The 29.2-kilometer reach extending upstream from Lawrence Creek, AU 0409_02, was on the 2024 §303(d) List for not supporting the 24-Hour DO Average and bacteria criteria. The assessment unit was first listed for 24-Hour DO Average in 2000, and the reach has been impaired for bacteria since 2006. The impairments were carried forward from previous assessments since no data were collected in this reach during the 2024 assessment period. All monitoring in the assessment unit had been conducted at station 15773, located at FM 450. Sampling was discontinued at this station in 2012 after TCEQ staff determined that the location was not representative of hydraulic conditions. After discussions at Coordinated Monitoring Committee meetings, it was determined that the SH 154 crossing was within the boundaries and is representative of the hydraulic conditions of the assessment unit. In November 2023, TCEQ Region 5 began sampling at station 22455, located at SH 154. These impairments will likely remain until adequate data have been collected to fully assess this reach. It should be noted that diel sampling has not been scheduled at this station to address the dissolved oxygen impairment and concern.

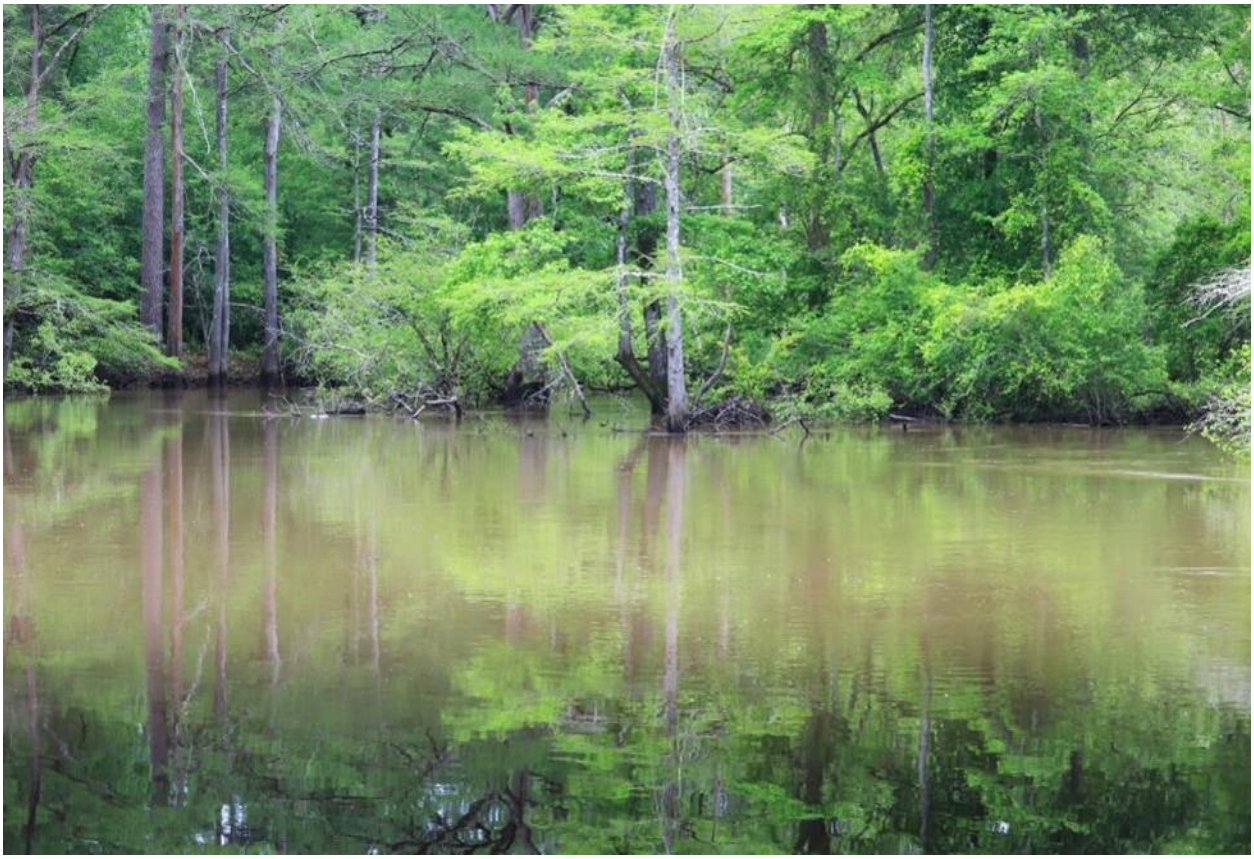

Figure 73: Station 10331 - Little Cypress Creek at FM 134

The lower 41 kilometers of Little Cypress Creek, or AU 0409_01, showed no impairments or concerns in the 2024 IR. The reach had been impaired for non-support of the 24-Hour DO Average and DO Minimum criteria in previous assessments. Sixteen diel studies were conducted between October 2016 and July 2020. Since only one of the diels assessed fell below the criteria, the impairments were removed from the §303(d) List in 2024.

Similar to the upstream assessment units, nutrient concentrations were within their associated screening levels. None of the ammonia, nitrate, or total phosphorus results were elevated while one chlorophyll *a* sample was over the screening level at 19.3 µg/L.

TRENDS

Trend analysis was conducted on all data that met the criteria, and four trends were identified during the past decade. Decreasing trends were discovered for total phosphorus, total organic carbon, and transparency at station 10332, located at the lower end of the segment, while an increasing trend was found for nitrate at the upper end of the segment at station 16017.

Although all nitrate concentrations were well below the 1.95 mg/L screening level, the increasing trend for nitrate in the uppermost assessment unit should continue to be monitored going forward. This increasing trend may be the result of higher runoff over the past decade. However, none of the nitrate samples in any assessment unit of Segment 0409 exceeded the screening level during either the 2024 assessment period or for samples reported thus far in the 2026 assessment period.

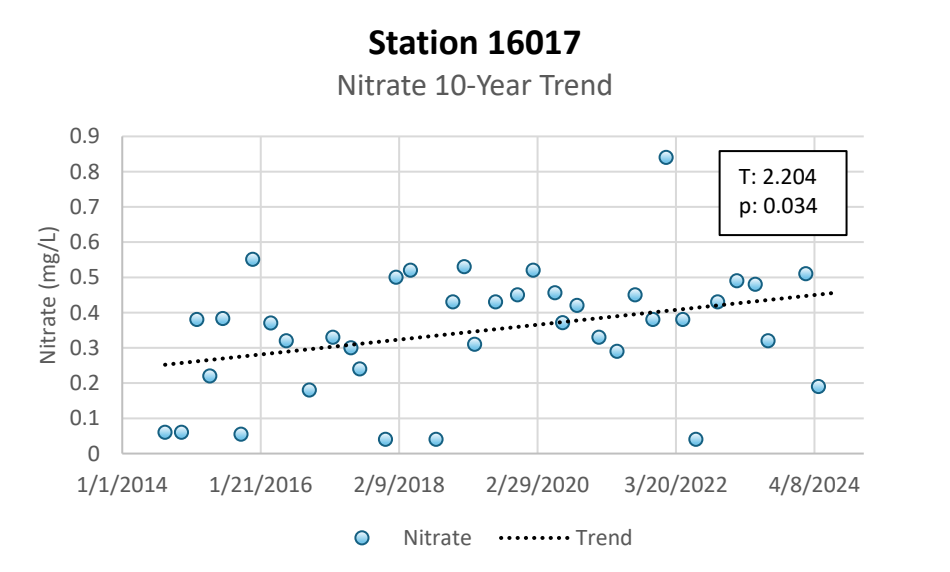

Figure 74: Increasing 10-Year nitrate trend at station 16017 in Little Cypress Creek

The decreasing trend for total phosphorus is encouraging since this constituent is often the limiting factor for phytoplankton production. The decreasing trends for total phosphorus and total organic carbon are also important since this station is not far from the confluence with the lower assessment unit of Big Cypress Creek which has a concern for chlorophyll *a*. The reduced concentrations of total phosphorus will hopefully lead to a decline in chlorophyll *a* concentrations in the lower reach of Big Cypress Creek.

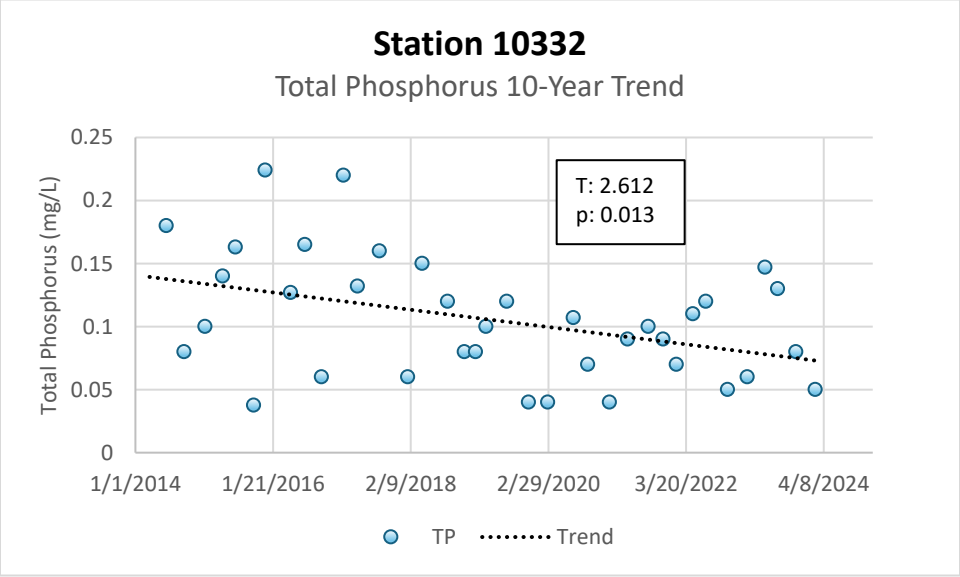

Figure 75: Decreasing 10-Year total phosphorus trend at station 10332 in Little Cypress Creek

Only one trend had been observed in this segment in previous basin summary reports. In the 2019 report, a decreasing trend for *E. coli* was identified at station 10332 for data collected between 1998 and 2018. This trend did not continue into the current analysis.

Figure 76: Station 20153 - Lilly Creek at FM 556 during low flow (left) and high flow (right)

Unclassified Segment 0409A – Lilly Creek

Lilly Creek originates two miles west of Pine in Camp County and flows southeast for nine miles to its confluence with Little Cypress Creek. The stream is classified as intermittent with perennial pools and has a limited aquatic life use designation. Monitoring in Lilly Creek has been conducted at station 20153 at FM 556 since October 2007. The station is located near the headwaters of the stream, and the upstream watershed is almost entirely forested.

Lilly Creek was impaired for bacteria in the 2024 §303(d) List. The geometric mean of the 22 *E. coli* samples was 240.3 MPN/100 mL. Since the watershed is primarily forested, the source of bacteria was likely wildlife. A Recreational Use Attainability Analysis was conducted in Lilly Creek by the Texas Institute for Applied Environmental Research in June and August 2021 (*Texas Institute for Applied Environmental Research, 2022*). No recreational use of the stream was observed during field measurements, and landowner interviews stated that people had rarely used the stream for hunting and fishing. At the time of this writing, the TCEQ had not made a recommendation to the Environmental Protection Agency about changing the designated use of the stream.

Concerns for dissolved oxygen grab minimum criterion and screening level were shown in the 2024 IR. Four samples out of 25 DO readings fell below the 2 mg/L minimum criterion and 3 mg/L screening level with a mean of 1.48 mg/L. There was no flow on the date of these low DO readings. In fact, “low flow” and “no flow” were commonly reported for flow severity at this station. Out of 63 values reported in SWQMIS, 52 percent of site visits had a flow status of “no flow” or “low flow.” Due to the proximity of the station to the headwaters, moving the station further downstream should be considered to address the dissolved oxygen concerns.

A concern for chlorophyll *a* screening level was also shown in the 2024 IR. Over a third of the chlorophyll *a* sample results exceeded the screening criterion of 14.1 µg/L with a mean of the exceedances of 28.3 µg/L. None of the nitrate samples exceeded the screening level while one total phosphorus value was reported over the 0.69 mg/L screening level at 0.73 mg/L. Three out of 21 ammonia samples were elevated with an average of 0.78 mg/L, exceeding the 0.33 mg/L screening level.

TRENDS

Trend analysis was conducted on all available data, but no trends were observed.

Unclassified Segment 0409B – South Lilly Creek

South Lilly Creek is an unclassified water body that extends from its confluence with Lilly Creek to FM 1647 in Upshur County. The stream is classified as intermittent with perennial pools and has a limited aquatic life use designation. The watershed has no population centers and is comprised of improved pastures and forested land. Much of riparian vegetation along the stream has been removed and cattle often have direct access to the stream. Monitoring has been conducted at station 17954 since 2003. The site is located on FM 2454 near the lower end of the stream, approximately 3.5 kilometers from its confluence with Lilly Creek.

South Lilly Creek was first identified as impaired for bacteria in 2006 and continued into the 2022 IR. The impairment was removed from the §303(d) List in 2024. A Recreational Use Attainability Analysis was conducted in South Lilly Creek by the Texas Institute for Applied Environmental Research in 2016 (*Texas Institute for Applied Environmental Research, 2017*). No recreational use of the stream was observed during the study period, and landowner interviews indicated that the stream was not used for contact recreation. Barriers to recreational use included access to the stream limited to road crossings, barbed wire fencing, logjams, thick vegetation, and venomous snakes. The TCEQ recommended that the designated use be changed from Primary Contact Recreation 1 to Secondary Contact Recreation 1, which increased the *E. coli* criterion to a geometric mean of 630 MPN/100 mL. The Environmental Protection Agency accepted the change in its designation. Twenty bacteria samples collected during the 2024 assessment period had a geometric mean of 420.3 MPN/100 mL, well below the 630 MPN/100 mL criterion.

The segment was first listed as impaired for the dissolved oxygen grab minimum criterion on the 2022 §303(d) List. In the 2024 IR, five out of the 23 DO readings fell below the 2 mg/L criterion and 3 mg/L screening level with a mean of 1.06 mg/L. There was no flow on the dates of these low DO readings. As discussed with Lilly Creek, “low flow” and “no flow” were commonly reported for flow severity. Out of 93 flow severity values reported in SWQMIS, two-thirds of the site visits had a flow status of “no flow” or “low flow.”

Much of the watershed above station 17954 includes hay meadows along with cattle and poultry operations, and it is not uncommon to observe cattle in the stream immediately above station 17954 during site visits. Unsurprisingly, some nutrient and chlorophyll *a* samples were elevated. During the 2024 assessment period, five out of eighteen ammonia samples exceeded the 0.33 mg/L screening level with a mean of the exceedances of 2.09 mg/L. Three chlorophyll *a* concentrations were reported over the 14.1 µg/L screening level with a mean of 17.17 µg/L. One nitrate and one total phosphorus sample were above their screening levels at 2.17 mg/L and 0.89 mg/L, respectively.

Figure 77: Station 17954 - South Lilly Creek at FM 2454 during high flow (left) and no flow (right)

TRENDS

Trend analysis was conducted on all available data. No trends were identified using historical data, but a decreasing trend for dissolved oxygen was observed over the past decade. Despite experiencing higher than normal precipitation and flow during the period of analysis, this declining dissolved oxygen trend is troubling. The cause of this decreasing trend is unknown; it may be the result of changes to the stream morphology which has affected the flow status, but additional sampling is needed to determine the cause.

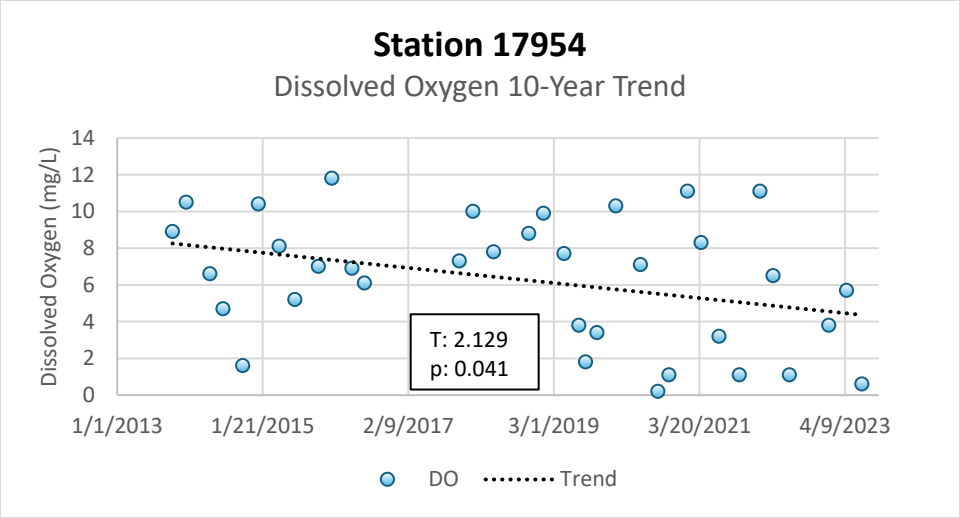

Figure 78: Decreasing 10-Year dissolved oxygen trend at station 17934 in South Lilly Creek

Unclassified Segment 0409D – Lake Gilmer

Lake Gilmer, located on Kelsey Creek in central Upshur County, was constructed in 2001 and covers approximately 1,010 surface acres. The reservoir serves as a municipal water supply for the City of Gilmer. The TCEQ Region 5 has been regularly sampling in Lake Gilmer at station 17478 located near the dam since 2001 and at station 18825 located at FM 852 since 2002.

There were no concerns or impairments shown in the 2024 IR. All dissolved oxygen grab measurements made during the assessment period met the 3 mg/L minimum criterion while two readings fell below the 5 mg/L screening level. None of the total phosphorus samples were reported above the screening level while one ammonia and four nitrate results exceeded their screening levels of 0.11 mg/L and 0.37 mg/L. The elevated ammonia result was 0.36 mg/L while the mean of the nitrate exceedances was 0.57 mg/L.

These available nutrients have supported phytoplankton production with one-third of the 49 chlorophyll *a* samples evaluated during the 2024 assessment period exceeding the 26.7 µg/L screening level. The mean of the exceedances was 40.89 µg/L. Although not at a statistically significant rate, chlorophyll *a* concentrations were generally increasing at both stations. This increase may be the result of the natural reservoir aging process; however, best management practices should be considered in the watershed to reduce the amount of nutrients entering the reservoir in order to mitigate the effects of eutrophication.

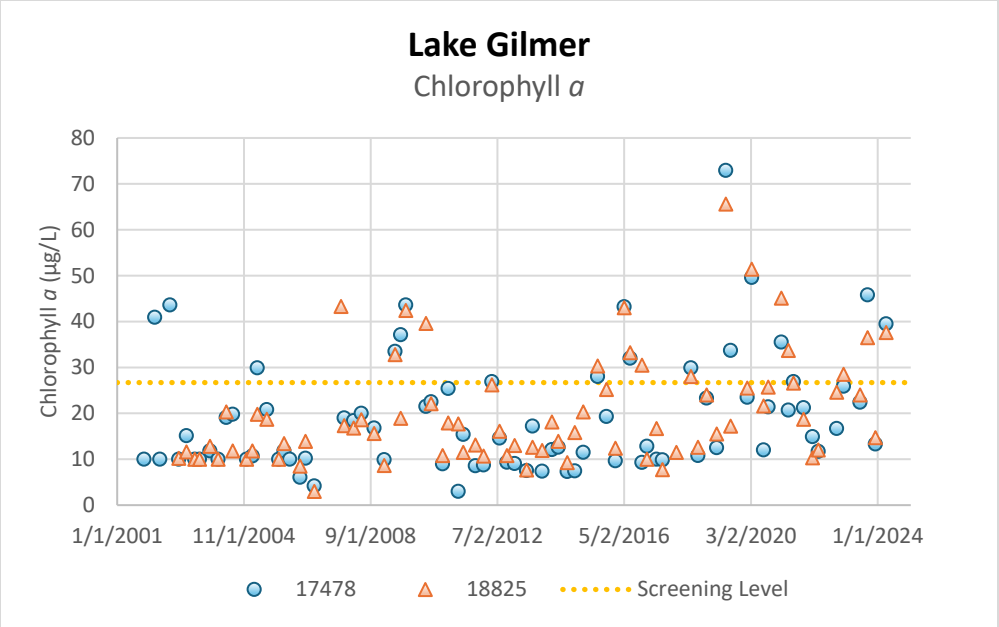

Figure 79: Chlorophyll a results in Lake Gilmer

TRENDS

Trend analysis was conducted on all data collected in the reservoir and data collected over the past decade at both stations. Decreasing trends for specific conductance were identified at both stations. The trend appears to follow the drought followed by flood cycle experienced in the region over the past two decades with a marked decline in specific conductance beginning around 2015. Due to the proximity of the stations, it is expected that the measurements would yield similar values during site visits resulting in the same trends.

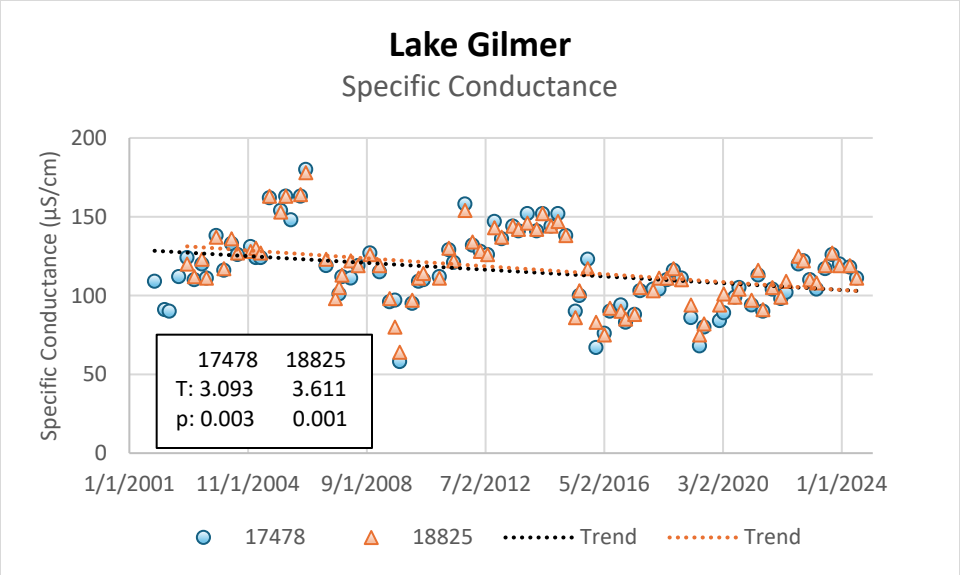

Figure 80: Decreasing historical trends in Lake Gilmer

Unclassified Segment 0409E – Clear Creek

Clear Creek, located in Upshur County, is a small tributary to Little Cypress Creek. The 2024 IR shows a concern for non-attainment for impaired benthic community along with a concern for screening level for habitat. Biological monitoring was conducted in Clear Creek at station 18590 (Bobwhite Road) in June and August 2006. The mean benthic score was 19, well below the criterion of 29. The habitat quality index was 15 which is considered limited. No monitoring is scheduled in Clear Creek in 2025, but may be considered for future biological studies.

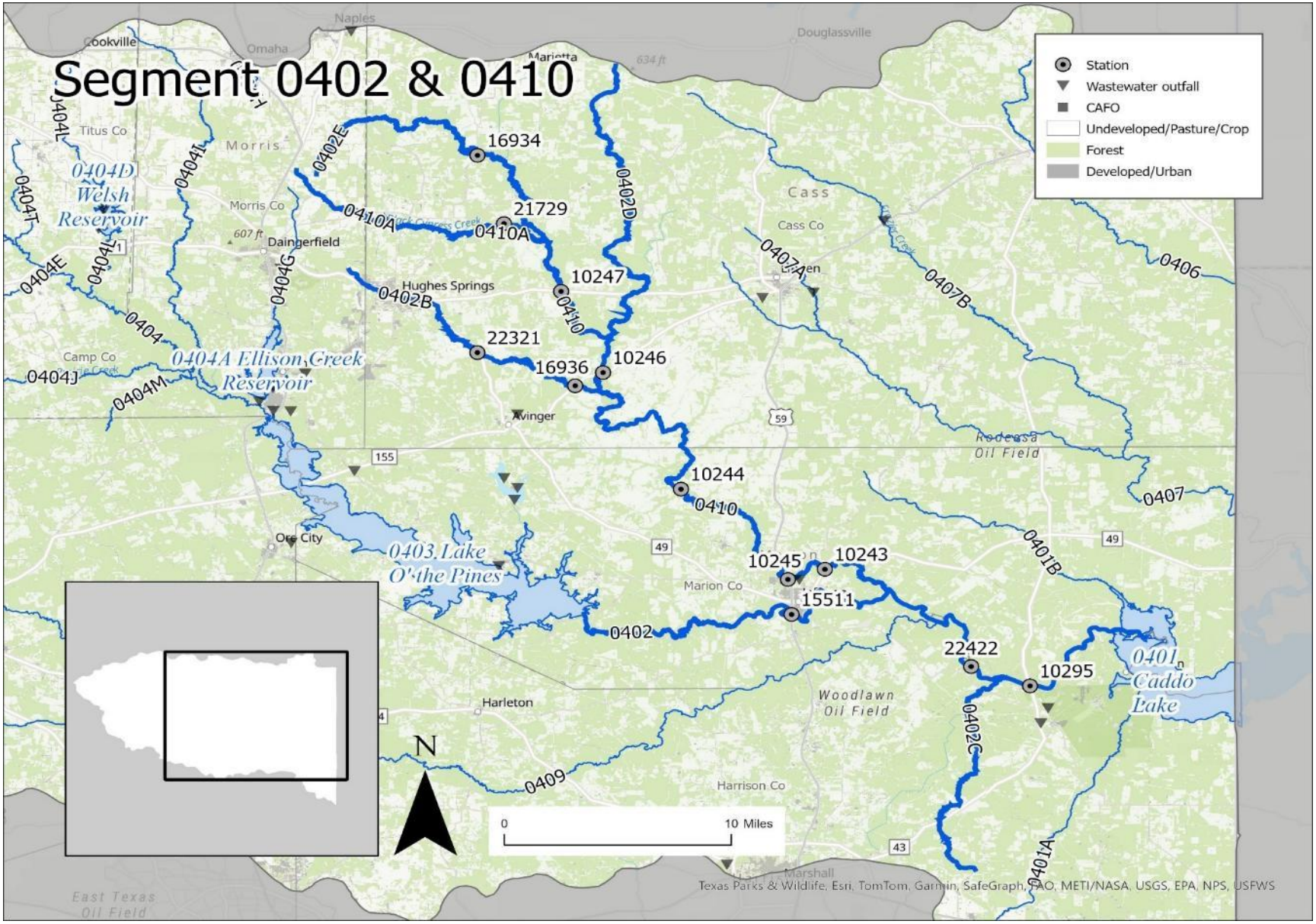

Figure 81: Map of stations in Segment 0402– Big Cypress Bayou and Segment 0410 - Black Cypress Bayou

Segment 0410 – Black Cypress Creek (Bayou)

Black Cypress Creek (Bayou) is a perennial stream that begins at the confluence with Big Cypress Creek and extends about 52 miles upstream to FM 250 while the intermittent reach of the stream extends northeast of Daingerfield in eastern Morris County. The channel meanders through a mostly forested watershed of bottomland hardwood and has numerous tributaries and sloughs. The confluence of Black Cypress Creek with Big Cypress Creek is located east of Jefferson and upstream of the Little Cypress Creek confluence with Big Cypress Creek. There are no impoundments on the stream, thus floodwaters flow through Big Cypress Creek directly into Caddo Lake.

Segment 0410 includes four assessment units along with Segment 0410A. Segment 0410A is the intermittent with perennial pools reach of Black Cypress Creek that extends from FM 250 north of Hughes Springs to its confluence with Kelly Creek (Segment 0402E). Black Cypress Creek was formerly designated as Segment 0402A, an unclassified stream that became a classified water body in the 2010 Texas Surface Water Quality Standards revision, and was first shown as Segment 0410 in the 2016 IR.

Segment 0410 Assessment Units		
Segment/AU	**Description**	**Station(s)**
0410_01	From the confluence with Big Cypress Creek upstream 25 km to White Oak Creek	10243; 10245
0410_02	From the confluence with White Oak Creek upstream 31.3 km to Pruitt Lake	10244
0410_03	Pruitt Lake near SH 155 upstream 1.8 km	10246
0410_04	From Pruitt Lake upstream 26.4 km to confluence with Kelly Creek	10247
0410A	From Kelly Creek upstream to FM 250	21729

Table 26: Stations and assessment unit descriptions in Segment 0410

Quarterly monitoring in 2025 is conducted by the TCEQ Region 5 at three stations including a site in the upper and lower assessment units and at a station in Segment 0410A. No monitoring is currently being conducted in the middle assessment units.

2025 Monitoring Schedule							
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**
0410_01	10243	R5	BLACK CYPRESS CREEK AT SH 49	4	4	4	4
0410_04	10247	R5	BLACK CYPRESS BAYOU AT SH 11	4	4	4	4
0410A	21729	R5	BLACK CYPRESS CREEK AT CR 2924	4	4	4	4

Table 27: FY 2025 Monitoring Schedule for Segment 0410

Segment 0410 was included on the 2024 §303(d) List for copper and lead in water, dissolved oxygen, *E. coli*, and mercury in fish tissue. At present, the source(s) of copper and lead in the stream have not been identified. Possible sources could include runoff from exposed soils from iron ore mining and/or from industrial processes such as creosote facilities. Additional monitoring is required to identify the source(s) of these metals.

2024 Texas Integrated Report					
Parameter	**0410_01**	**0410_02**	**0410_03**	**0410_04**	**0410A**
Copper, dissolved	NS, CN		NS		
Lead, dissolved			NS		
Dissolved Oxygen Grab				NS	
E. coli		CN			NS
Mercury in Tissue			NS		

Table 28: Segment 0410 impairments and concerns in the 2024 IR

The uppermost reach of Black Cypress Creek, AU 0410_04, has been impaired for dissolved oxygen grab minimum since the 2000 IR. WMS commenced diel monitoring to address the dissolved oxygen impairments in October 2020 at station 10247, located at SH 11. None of the eight diels assessed in the 2024 IR fell below the criteria. Four additional diels completed after the end of the 2024 assessment period also met the dissolved oxygen criteria. These results indicated that the stream was meeting its high aquatic life use designation, and as a result, WMS discontinued diel monitoring at this station in 2024.

Except for one chlorophyll *a* sample, all other parameters collected in AU 0410_04 during the assessment period met their associated criteria or screening levels. A single chlorophyll *a* value exceeded the 14.1 µg/L screening level with a value of 30.8 µg/L. This reach had been impaired for bacteria but was removed from the §303(d) List in the 2020 IR as data collected during the assessment period were below the 126 MPN/100 mL criterion with a geometric mean 107.5 MPN/100 mL.

Assessment Unit 0410_03, also known as Pruitt Lake, has been monitored at station 10243 at SH 49. The reach was first listed as impaired for acute toxicity of dissolved copper in water in the 2010 IR. The assessment unit was removed from the §303(d) List in 2020, but was added back as an impairment in the 2022 IR. The 2024 IR showed that none of the eleven samples exceeded the 2.29 µg/L chronic toxicity criterion while three values exceeded the 0.66 µg/L acute toxicity criterion with a mean of the exceedances of 0.92 µg/L. In SWQMIS, seven out of the eleven samples reported during the assessment period exceeded the criterion with a mean of 1.09 µg/L.

This assessment unit was first listed for chronic toxicity of dissolved lead in the 2020 IR. Fourteen samples were collected by TCEQ Region 5 between June 2015 and September 2018 in SWQMIS. Four samples fell below the limit of quantitation while five results exceeded the 0.4 µg/L chronic toxicity criterion. The maximum concentration was 1.7 µg/L. In contrast, the 2024 IR showed that twelve samples were evaluated for chronic toxicity of lead with one result exceeding the 0.4 µg/L criterion at 0.47 µg/L.

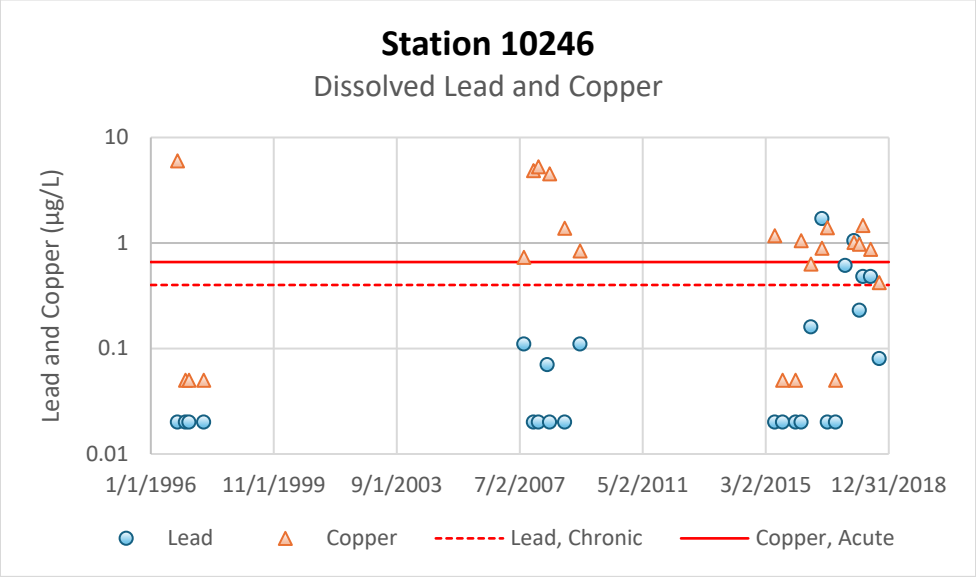

Figure 82: Historical lead and copper results at station 10246 - Pruitt Lake

Pruitt Lake has been impaired for mercury in fish tissue since 2000. Sampling was conducted by the TCEQ Region 5 in 1994 and 1997 while the Texas Department of State Health Services collected samples in 1998. Based upon the results of the 24 tissue samples collected in 1998, the Department issued ADV-16, a consumption advisory on April 23, 1999 for Pruitt Lake due to high levels of mercury in fish tissue.

No additional fish tissue samples have been collected since 1998 while no laboratory results have been reported since 2004. TCEQ Region 5 collected field parameters at station 10246 from December 2014 through September 2018 and all results met their screening levels and criteria. No monitoring is currently being conducted in Pruitt Lake in 2025.

Pruitt Lake was on the §303(d) List for low dissolved oxygen until the 2020 IR. WMS conducted sixteen diels between November 2009 and July 2014. None of the 24-Hour DO Average and one of the 24-Hour DO Minimum results fell below the criteria demonstrating that the reach was meeting its aquatic life use designation. The impairment was removed from the §303(d) List in the 2020 IR.

Assessment Unit 0410_02 is the portion of Black Cypress Creek that extends 31.3 km downstream from Pruitt Lake to the confluence with White Oak Creek. Sampling has been conducted at CC Bridge Road, located northwest of Berea and between US 59 and Liberty Road. Routine monitoring at station 10244 was performed by WMS from October 2014 through June 2021 but was discontinued due to the inability to access the stream during a number of high flow events. Diel monitoring was performed at this station from June 2015 through July 2019 to address impairments for 24-Hour DO Average and Minimum. These diels showed that the stream met its aquatic life use designation and resulted in the reach being removed from the §303(d) List in the 2024 IR.

Figure 83: Station 10244 - Black Cypress Creek at CC Bridge Road

This assessment unit showed a concern for *E. coli* in the 2024 IR with a geometric mean of 270.9 MPN/100 mL. It should be noted that a minimum of twenty bacteria samples is required to complete a full assessment, and since only fifteen samples were available for the assessment, a

concern for non-attainment was assigned to this reach. The source of bacteria was most likely wildlife because much of the watershed is heavily forested with very little residential development or livestock production. None of the nutrient results exceeded their associated screening levels while two out of nineteen chlorophyll *a* samples exceeded the 14.1 µg/L screening level with a mean of 40.8 µg/L.

The lowest assessment unit, AU 0410_01, has historically been sampled north of Jefferson at station 10243, located at SH 49, and at station 10245 at US 59. TCEQ Region 5 discontinued monitoring at station 10245 in 2017 and samples quarterly at station 10243. This reach was first shown as impaired for acute toxicity of dissolved copper in the 2010 IR. The assessment unit also had a concern for non-attainment of the chronic toxicity criterion for copper. Both the concern and the impairment were based upon limited data. None of the dissolved copper samples shown in the 2024 IR exceeded the acute or chronic criteria of 2.29 µg/L. In the SWQMIS database, ten samples were collected by TCEQ Region 5 between August 2017 and November 2020. Two results were reported below the limit of quantitation. The mean of the reportable samples was 0.84 µg/L, or about one-third of the criteria. These recent data suggests that the assessment unit supports both the acute and chronic toxicity criteria for dissolved copper.

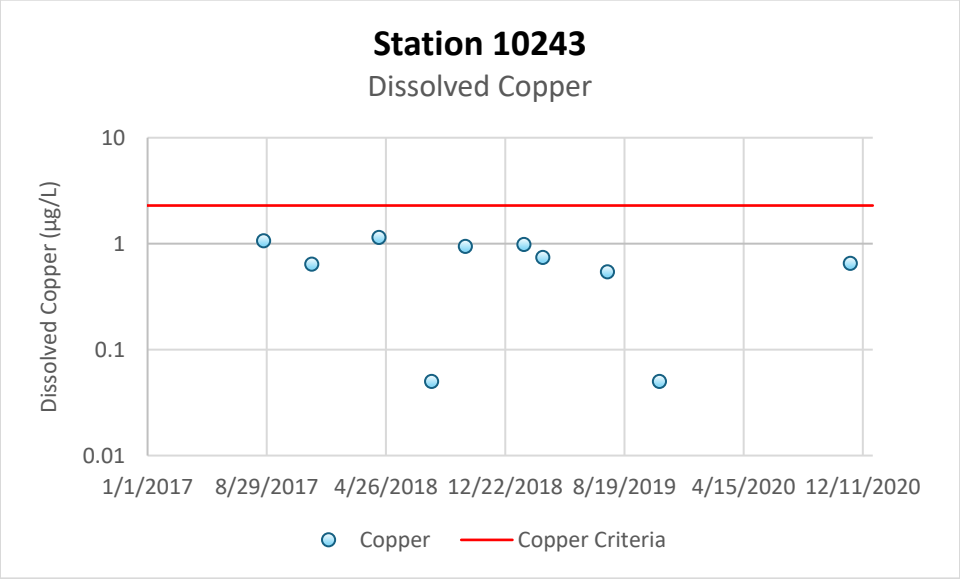

Figure 84: Dissolved copper values at station 10243

Twenty to 22 samples were assessed for nutrients, chlorophyll *a*, and bacteria collected in the assessment unit. One total phosphorus result exceeded the 0.69 mg/L screening level with a concentration of 0.71 mg/L. All results for nitrate, ammonia, and chlorophyll *a* were reported below the screening levels. The geometric mean of twenty *E. coli* samples was 110.8 MPN/100 mL, falling well below the 126 MPN/100 mL criterion.

TRENDS

Trend analysis was conducted on all data at stations that met the criteria. A decreasing trend for transparency was identified at station 10247 over the past decade. Since the region had experienced higher rainfall amounts than in the previous decade, the decreasing trend may be the result of higher flows carrying more sediment load than in the past. Transparency and flow weakly correlated with a coefficient of 0.18. The low coefficient was likely influenced by only having nineteen flow values reported as compared with 51 transparency measurements. No trends have been identified for this segment in past basin summary reports.

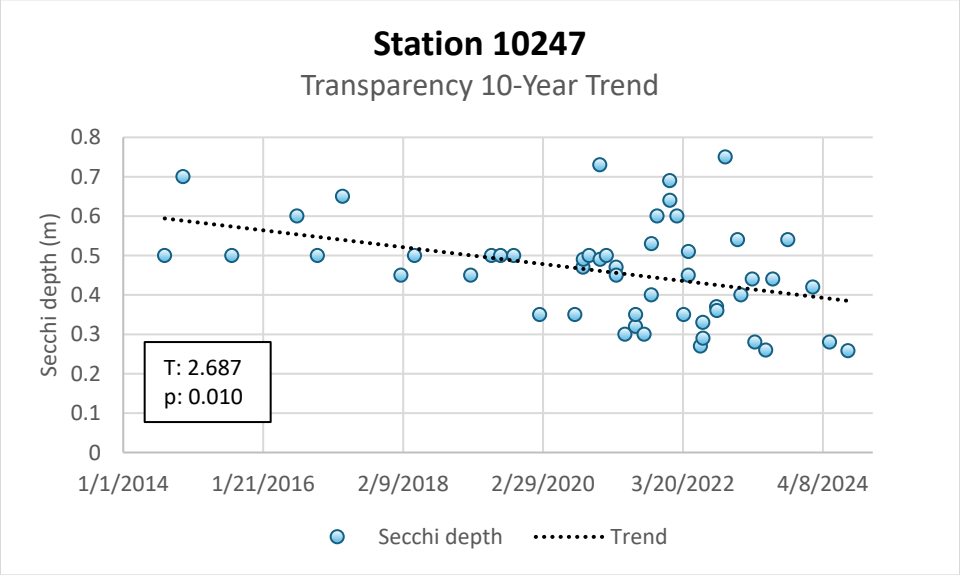

Figure 85: Decreasing 10-Year transparency trend at station 10247

Unclassified Segment 0410A Black Cypress Creek

Segment 0410A is an intermittent reach of Black Cypress Creek that extends from FM 250 downstream to its confluence with Kelly Creek. The TCEQ Region 5 began sampling at station 21729, located at CR 2924 northeast of Hughes Springs in October 2015 and is scheduled to sample quarterly for field and laboratory parameters, bacteria, and flow at this station in 2025.

The 2024 §303(d) List showed an impairment for bacteria and was first listed in the 2018 IR. The geometric mean of the nineteen *E. coli* samples analyzed during the assessment period was 189.7 MPN/100 mL, well above the 126 MPN/100 mL criterion. Several elevated results have been recorded during the 2026 assessment period suggesting that the impairment will continue into the next IR. Since the watershed of the reach is almost entirely forested, the most likely source of bacteria is wildlife.

A Recreational Use Attainability Analysis was performed by the Texas Institute for Applied Environmental Research in this stream to address the bacteria impairment in 2022. No recreation was observed by staff during field measurements in either June or September 2022, and no one surveyed was aware of people using the stream for contact recreation. Only one pool deeper than one meter was encountered while the mean thalweg depth was 0.37 meter. Due to its shallow depth, limited public access, and lack of substantial pools, the likelihood of the public using the stream for contact recreation was diminished. In a draft document, the TCEQ recommended that the designated use be changed from Primary Contact Recreation 1 to Secondary Contact Recreation 1 which increases the *E. coli* criterion to a geometric mean of 630 MPN/100 mL. The change in designation must first be approved by the Environmental Protection Agency for it to take effect.

The segment had been impaired for 24-Hour DO Average and Minimum since 2000. From April 2015 to February 2018, TCEQ Region 5 collected ten diel measurements. The results demonstrated that the stream met its aquatic life designation, and the impairment was removed from the §303(d) List in the 2020 IR. Only one out of 23 dissolved oxygen grab samples failed to meet the 5 mg/L screening level while all samples met the dissolved oxygen grab minimum criterion.

As found throughout the rest of the segment, nutrients were low with none of the ammonia, nitrate, total phosphorus, or chlorophyll *a* concentrations exceeding their associated screening levels.

TRENDS

No significant trends were identified, and none were observed in previous summary reports.

Caddo Lake Watershed

The Caddo Lake and its watershed straddles the Texas and Louisiana border. It is in the rolling terrain of the Pineywoods Ecoregion. The landscape is a mix of rich bottomlands and pine and oak forests with scattered areas of cropland, improved pastures, and native pastures. Caddo Lake has a surface area of approximately 26,800 acres with approximately half of the water body located within each state. Texas encompasses approximately 358 square miles of the 2,700 square-mile drainage basin. Caddo Lake and much of the surrounding watershed are swampland with shallow waters and towering bald cypress trees, some of which are at least 400 years old.

Urban development is sparse. The largest city is Jefferson, with a population of around 1,900 residents. The land is predominantly used for agriculture, including forestry, poultry, and cattle production. Major tributaries include Black Cypress Bayou (0410), Little Cypress Bayou (0409), Harrison Bayou (0401A), Kitchen Creek (0401B), Haggerty Creek (0401C), and Big Cypress Creek below Lake O' the Pines (0402). Note that Black Cypress Bayou and Little Cypress Bayou are discussed in their respective sections.

Figure 86: Station 10295 - Big Cypress Creek at SH 43

Segment 0402 – Big Cypress Creek (Bayou) Below Lake O' the Pines

Segment 0402 is the portion of Big Cypress Bayou that flows between Ferrell's Bridge Dam (Lake O' the Pines) and Caddo Lake. This segment is classified as perennial and with a high aquatic life use designation. The reach is generally deep, wide, and supports heavy recreational use including boating, fishing, paddling, and camping activities. The Big Cypress Creek watershed contains over five thousand acres of bottomland hardwood forest dominated by cypress swamps. Because of the uniqueness of the habitat, the TPWD has designated it as an important recovery area for the state-threatened paddlefish.

Big Cypress Bayou is divided into four assessment units extending from Lake of the Pines to Caddo Lake. The uppermost unit covers 13 kilometers from Ferrell's Bridge Dam to the confluence with French Creek. Assessment Unit 0402_03 is the 23.8-kilometer reach between French Creek and the confluence with Black Cypress Bayou while AU 0402_02 extends 25 kilometers between Black Cypress Bayou to Haggerty Creek. This assessment unit includes the confluence with Little Cypress Bayou. The lowest unit is 15 kilometers between Haggerty Creek and Caddo Lake.

Segment 0402 Assessment Units		
Assessment Unit	**Description**	**Station**
0402_01	From the confluence with Caddo Lake upstream 15 km to Haggerty Creek	10295
0402_02	From Haggerty Creek upstream 25 km to the confluence with Black Cypress Bayou	22422
0402_03	From Black Cypress Bayou upstream 23.8 km to French Creek	15511
0402_04	From French Creek upstream 13 km to Lake O' the Pines	No stations

Table 29: Stations and assessment unit descriptions in Segment 0402

Monitoring is conducted in three of the four assessment units of Big Cypress Bayou along with stations in the unclassified water bodies of Hughes Creek (0402B) and Kelley Creek (0402E). TCEQ Region 5 samples quarterly at station 15511 located at US 59 in Jefferson. All other stations are monitored by WMS on a quarterly basis.

2025 Monitoring Schedule								
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**	**24 HR DO**
0402_01	10295	WMS	BIG CYPRESS CREEK AT SH 43	4	4	4	4	
0402_02	22422	WMS	BIG CYPRESS BAYOU BACKWATER JACKS	4				4
0402_03	15511	R5	BIG CYPRESS BAYOU AT US 59	4	4	4	4	
0402B	22321	WMS	HUGHES CREEK AT CR 2985	4			4	
0402E	16934	WMS	KELLEY CREEK AT FM 250	4			4	

Table 30: FY 2025 Monitoring Schedule for Segment 0402

Segment 0402 was first included on the §303(d) List for having elevated mercury in fish tissue in 1998. The fish consumption advisory extends across the entire segment. Assessment Unit 0402_02 was added to the §303(d) List in 2010 for not meeting the diel DO average criterion. Concerns for benthic community structure and chlorophyll *a* were included in the 2024 IR along with a concern for dissolved oxygen grab screening level in Kelley Creek.

2024 Texas Integrated Report						
Parameter	**0402_01**	**0402_02**	**0402_03**	**0402_04**	**0402B**	**0402E**
Mercury in Tissue	NS	NS	NS	NS		
24 HR DO Average		NS				
DO Grab						CS
Chlorophyll *a*	CS					
Benthic			CN			

Table 31: Segment 0402 impairments and concerns in the 2024 IR

Except for mercury in fish tissue, there were no concerns or impairments in AU 0402_04. Sampling was conducted at stations 13630 and station 15135, both near the spillway. Station 13630 was monitored sporadically between 1983 and 2004 while twenty samples were collected at station 15135 between July 2006 and May 2007. No samples were collected in this reach during the assessment period, and no sampling is scheduled for 2025.

Apart from mercury in fish tissue, there were no other impairments in AU 0402_03. The 2024 IR showed a concern for impaired macroinvertebrate community. This concern was carried forward from previous assessments as the last bioassessment was conducted in May 2007. The benthic organisms scored 24, falling below the 29 criterion. Critical period monitoring was not performed that year due to high water levels in the stream. More recent studies of this reach have been conducted by the TPWD. The TPWD River Studies team is planning to sample in Segment 0402 in September or October of 2025 or 2026.

Assessment Unit 0402_02 was first listed for depressed dissolved oxygen in 2010. At the time, the impairment was based upon five out of 28 diels failing to meet the 5 mg/L 24-Hour DO Average criterion. The mean of the exceedances was 4.0 mg/L. Most of the diels in this assessment unit were collected at the City of Marshall Intake (station 16254) between 2000 and 2009. During the 2010 coordinated monitoring meeting, the committee determined that this station was not representative of the hydraulic conditions of the assessment unit. Sampling was moved upstream to station 20635 at Skeeter's Marina. Four diels were conducted in FY 2010 with one reading falling below the criterion at 4.9 mg/L. These four diels were used for the assessment in the 2014 IR, and data from station 16254 were not evaluated. All sampling at station 20635 was discontinued in 2012 after permission to access the stream was terminated due to a change in property ownership.

In 2023, NETMWD secured access to Big Cypress Bayou at Backwater Jack's RV Park on AU 0402_02. Five diels were conducted between October 2023 and October 2024. Two of those events fell below the criterion at 4.5 mg/L in October 2023 and 4.0 mg/L in August 2024. Three more diel monitoring events are scheduled in 2025, but based upon these results, the impairment will likely continue into future assessments. It should be noted that only one of the forty 24-Hour DO Minimum values fell below the 3 mg/L criterion. A reading of 0.67 mg/L was obtained in July 2004 at station 16254.

Assessment Unit 0402_01 is monitored at station 10295 located at the SH 43 crossing. The first sample reported for this station was in September 1968 and was regularly monitored through 1997. Sampling was also conducted from 2003 through 2007. Quarterly monitoring resumed in September 2016 and continues through 2025. The Caddo Lake Institute collected field parameters monthly at station 15022 at the Caddo Lake State Park boat ramp from July 1994 to May 2020.

For AU 0402_01, the 2024 IR showed a concern for chlorophyll *a* with seven out of the 22 results assessed exceeding the 14.1 µg/L screening level. The mean of the exceedances was 17.97 µg/L. The highest sample, 24.6 µg/L, was collected in October 2018. Most of the elevated chlorophyll *a* results were obtained at lower flows and tended to be during the warm weather months, when

lower flows are most often encountered. A review of the data collected since September 2016 showed that five of the seven highest chlorophyll *a* values were obtained during periods with flows of less than 600 cfs.

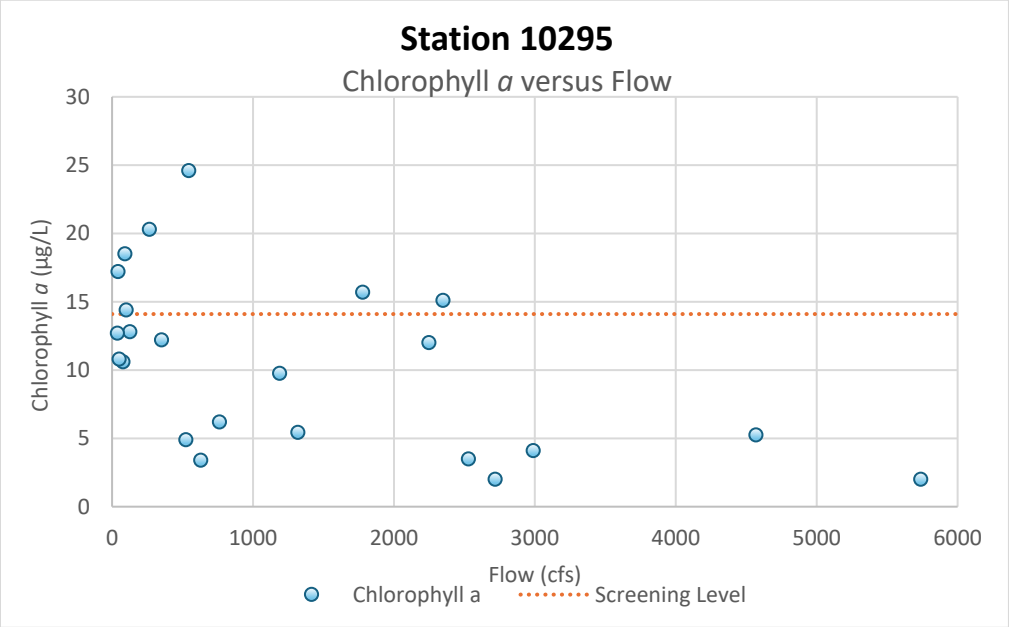

Figure 87: Chlorophyll a results versus flow at station 10295

Of interest was that none of the 22 nitrate or total phosphorus samples exceeded their screening levels while only one ammonia value was elevated during the assessment period. An ammonia result of 0.42 mg/L was reported in June 2022. Similarly, none of the nitrate or ammonia samples were elevated upstream in AU 0402_03 while one total phosphorus result was reported above the 0.69 mg/L screening level at 1.75 mg/L. Four out of nineteen chlorophyll *a* results in AU 0402_03 were reported over the screening level with a mean of the exceedances at 23.58 µg/L.

TRENDS

Trend analysis was conducted for all stations that met the criteria. The only trend identified was an increasing trend for alkalinity at station 15511. The trend was from data collected over the past two decades. Increasing alkalinity and pH trends were identified at this station in the *2019 Cypress Creek Basin Summary Report* while pH was increasing at statistically significant rates at this station in the 2009 and the 2014 basin summary reports. As detailed in the Trend Analysis section of this report, increasing alkalinity may help raise the pH in the water body. Research has shown that mercury more readily methylates, creating a form of mercury that can accumulate in organisms, in waters with pH less than 7.3 s.u. (Kelly, Rudd, Holoka, 2003). As a result, the increasing alkalinity trend may signal the possibility that mercury is less likely to bioaccumulate

in organisms as it was in the past. 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 the consumption advisories need to remain in place.

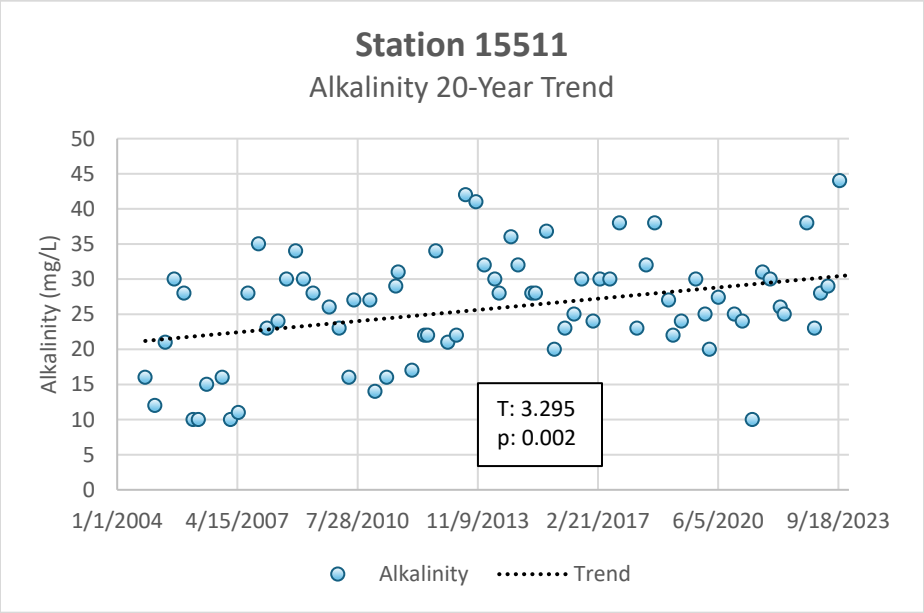

Figure 88: Increasing 20-Year alkalinity trend at station 15511

Figure 89: Station 16934 - Kelly Creek at FM 250

Segment 0402B Hughes Creek

Hughes Creek is a perennial stream that originates about two miles northwest of Hughes Springs and generally flows southeast for approximately fourteen miles to its confluence with Black Cypress Bayou. The watershed is almost entirely forested with little residential development.

An impairment for DO grab minimum was first included on the 2020 §303(d) List. Over the years, the site conditions changed at this location causing the stream to become pooled and stagnated. The cause of this change could not be determined but may have been due to a downstream log jam or beaver dam. The Coordinated Monitoring Committee determined that station 16936 at SH 155 was no longer representative of hydraulic conditions and discontinued sampling at this location in July 2021. Due to the station not being representative, the TCEQ removed the impairment from the §303(d) List in the 2022 IR.

In October 2021, quarterly sampling for field parameters and flow was moved to station 22321, located at CR 2985 northwest of Avinger. In the 2024 IR, five samples were evaluated with no result falling below the 3 mg/L DO grab minimum criterion or the 5 mg/L DO grab screening level. As of November 2024, thirteen site visits have been completed with no dissolved oxygen readings falling below the criterion or screening level. These results indicate that the stream is meeting its high aquatic life use designation.

Three biological monitoring events have taken place at station 16936. The first event was conducted in June 2001 followed by sampling in July and October 2008. Habitat and benthic metrics fell into the Intermediate range while fish scored in the Exceptional range during both 2008 events.

TRENDS

Trend analysis was not performed on Hughes Creek due to not meeting the criteria for analysis.

Segment 0402E Kelly Creek

Kelly Creek is a perennial stream with a high aquatic life use designation. The stream arises five miles north of Daingerfield and flows southeast for approximately 17 miles to its confluence with Black Cypress Bayou. Much of the stream corridor is heavily forested and interspersed with pastures.

Kelly Creek was first sampled at station 16934, located at the FM 250 crossing about 1.5 miles south of the Cornett community, in October 2000 but was discontinued in 2001. In 2009, WMS conducted biological monitoring at this station and quarterly routine sampling for field

parameters and flow commenced in October 2012. Fifty site visits have been reported as of October 2024. Monitoring is scheduled quarterly at this station for the remainder of fiscal year 2025.

The 2024 IR included a concern for the dissolved oxygen grab screening level. Four of the eighteen samples assessed fell below the 5 mg/L grab screening level with a mean of the exceedances of 3.43 mg/L. One of these grab samples failed to meet the dissolved oxygen grab minimum criterion of 3.0 mg/L with a value of 2.3 mg/L. Many of the low values will also be included in the 2026 assessment period so the concern will likely continue into future integrated reports. It should be noted that all of the low dissolved oxygen values collected in the 2024 IR were obtained during the typically low flow months of July and early October.

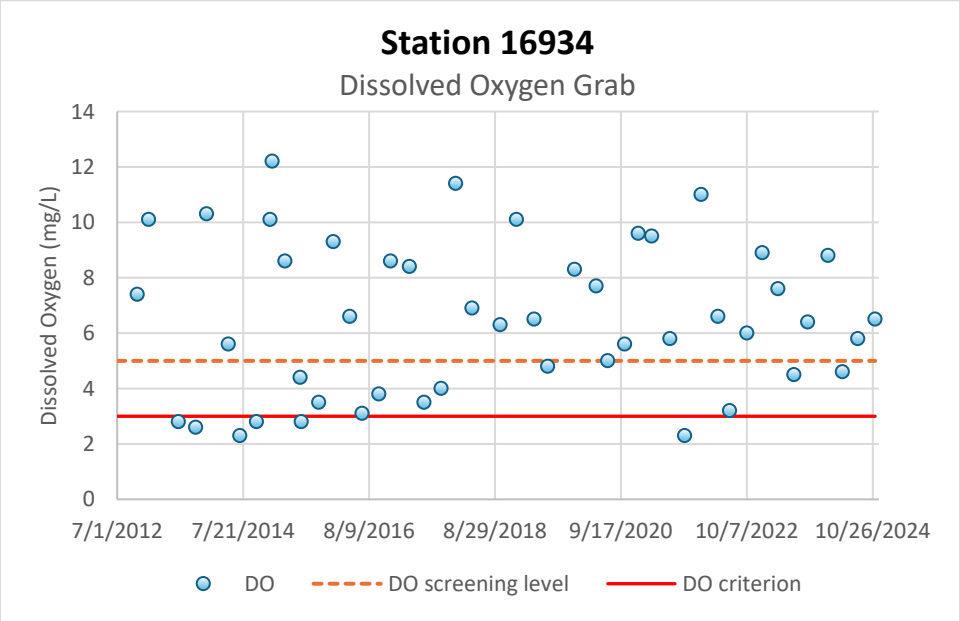

Figure 90: Dissolved oxygen readings at station 16934

TRENDS

Trend analysis was conducted on all data collected since 2012. A decreasing trend for pH was identified at station 16934. This is the only station where pH was decreasing at a statistically significant rate anywhere in the basin. The cause of the decreasing trend is not evident since there is little development within its watershed. Due to the station being located in a heavily forested area, one possible explanation of this decreasing trend may be the result of tannic acids entering the stream from runoff from the forest floor where tannins had accumulated during the extended drought.

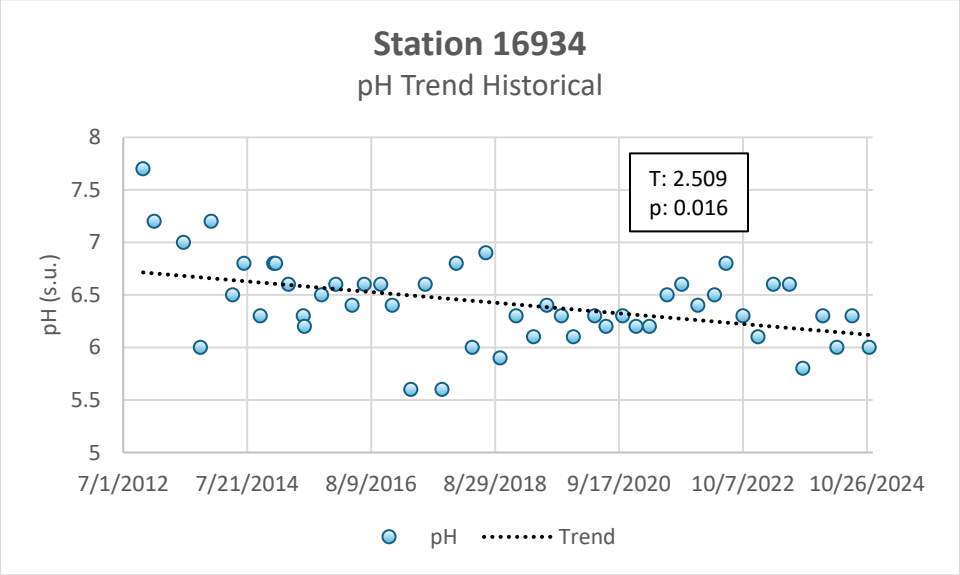

Figure 91: Decreasing pH trend at station 16934

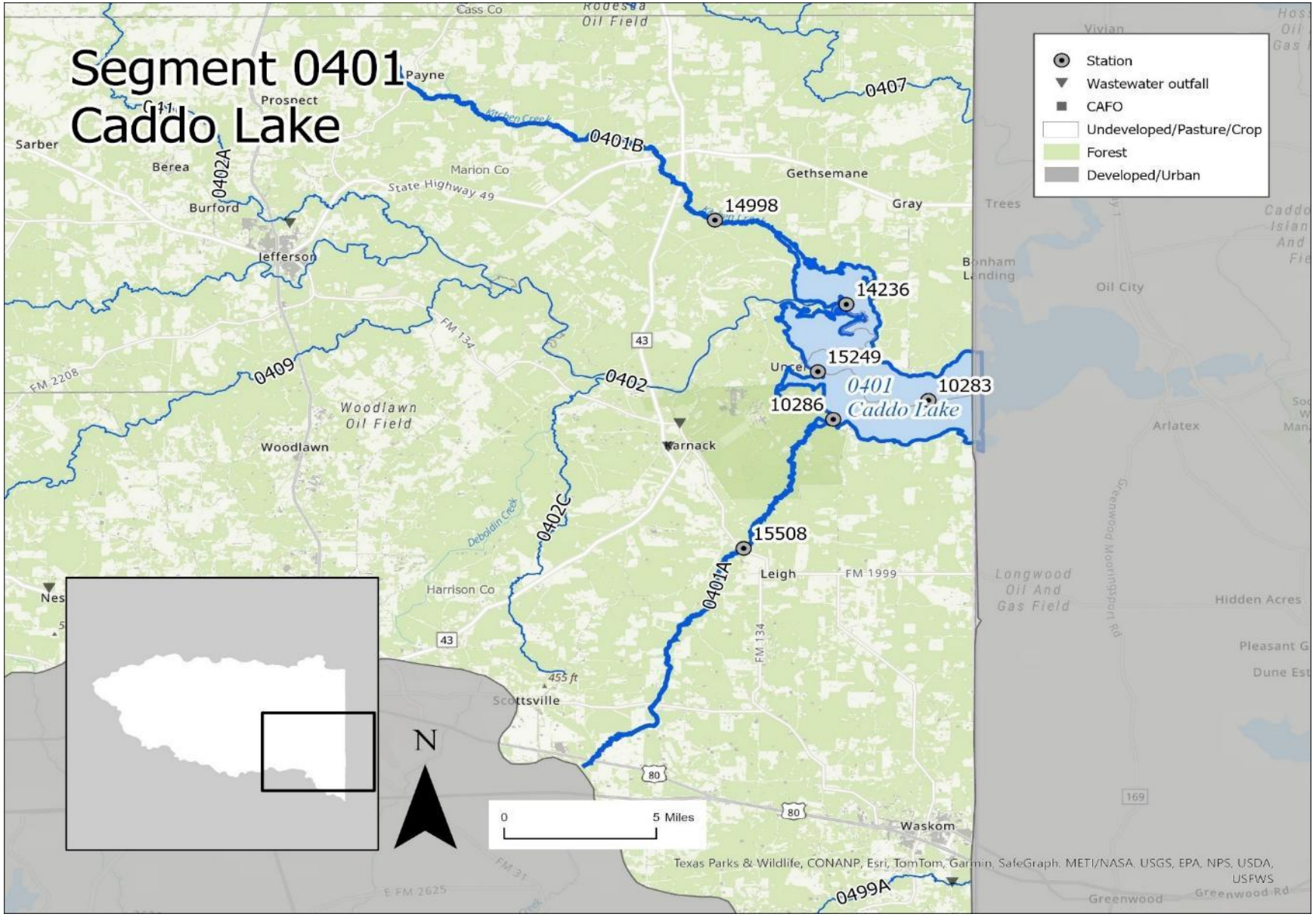

Figure 92: Map of stations in Segment 0401 – Caddo Lake

Segment 0401 – Caddo Lake

Caddo Lake is impounded by Caddo Dam in Caddo Parish, Louisiana with half of the lake extending into Texas. The uppermost portion of the lake includes portions of Harrison and Marion counties. Believed to have been formed by a log jam in the Red River, Caddo Lake was one of the largest natural lakes in the south before it was dammed in 1914. The upper half of the lake is shallow and swamp-like, creating an unique and diverse ecosystem that is one of the best examples in the southern United States of a mature bald cypress forest. In recent years, it has been invaded by nonnative aquatic plants such as hydrilla, water hyacinth (*Eichhoria crassipes*), giant salvinia (*Salvinia molesta*), and crested floating heart (*Nymphoides hydrophylla*). Chemical and biological control methods of the invasive species were discussed in detail in the *2018 Cypress Creek Basin Highlights Report*.

The Texas side of Caddo Lake is divided into five assessment units including the lower 5,000 acres or Midlake (0401_01) located in open water near the Louisiana state line along with four assessments units in the upper portions of the lake. These four assessment units are the Harrison Arm (0401_02), Goose Prairie Arm (0401_03), Clinton Lake (0401_05), and Mid-lake near Uncertain which is also referred to as “Turtle Shell” (0401_07). Historically, most sampling in Caddo Lake has occurred at stations 10283 in the Midlake assessment unit; station 10286, Harrison Arm; station 10288, Goose Prairie Arm; station 14236, Clinton Lake; and station 15249, Turtle Shell.

Caddo Lake Assessment Units		
Assessment Unit	**Description**	**Station**
0401_01	Lower 5,000 acres (Midlake)	10283
0401_02	Harrison Arm	10286
0401_03	Goose Prairie Arm	10288
0401_05	Clinton Lake	14236
0401_07	Mid-lake near Uncertain (Turtle Shell)	15249

Table 32: Stations and assessment unit descriptions in Segment 0401

The primary tributaries of Caddo Lake include Segment 0402 – Big Cypress Creek with contributions from Segment 0409 – Little Cypress Creek and Segment 0410 – Black Cypress Creek, along with unclassified water bodies 0401A – Harrison Bayou and 0401B – Kitchen Creek. Segment 0407 – James Bayou enters the lake in Louisiana. Segment 0401 is monitored quarterly by WMS at five locations including three stations in Caddo Lake and one station each in Harrison Bayou and Kitchen Creek.

2025 Monitoring Schedule							
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**
0401_01	10283	WMS	CADDO LAKE MID LAKE	4	4	4	
0401_03	10288	WMS	CADDO LAKE IN GOOSE PRAIRIE ARM	4	4	4	
0401_07	15249	WMS	CADDO LAKE NEAR SHORE AT END OF FM 2198 (TURTLE SHELL)	4	4	4	
0401A	15508	WMS	HARRISON BAYOU AT FM 134	4	4	4	4
0401B	14998	WMS	KITCHEN CREEK AT MARION CR 3416	4			4

Table 33: FY 2025 Monitoring Schedule for Segment 0401

All of Caddo Lake is impaired for mercury in fish tissue, and the impairment was first shown in the 1996 §303(d) List. In 1995, the Texas Department of State Health Services issued ADV-12, a consumption advisory for Caddo Lake due to high levels of mercury in fish tissue. A follow-up study was conducted in 2004 and found no appreciable difference in the results between the two studies. In May 2024, the TCEQ Region 5 office collected fish tissue for analysis in the Clinton Lake assessment unit. Mercury concentrations from fish samples were all below the levels of concern. Additional tissue sampling is being planned by TCEQ to further address this impairment.

2024 Texas Integrated Report						
Parameter	**0401_01**	**0401_02**	**0401_03**	**0401_05**	**0401_07**	**0401A**
DO Grab Minimum			NS			
DO Grab Screening Level			CS			
24 HR DO Average		NS		NS	NS	NS
24 HR DO Minimum		NS		NS	NS	NS
E. coli						NS
Iron in Sediment	CS					

Table 34: Segment 0401 impairments and concerns in the 2024 IR

Caddo Lake is shallow across the entire water body with an average depth of around one meter in all assessment units except 0401_01 which has a mean depth of 2.2 meters. Due to its shallow, swamp-like conditions, the most common water quality impairment in Caddo Lake is for low dissolved oxygen concentrations. Impairments for low diel dissolved oxygen average and minimum values were included in the 2024 §303(d) List in the Harrison Arm, Clinton Lake, and Turtle Shell assessment units. These impairments were first included on the §303(d) List in 2000. Invasive aquatic plants often cover the entire surface of these arms of the lake, preventing sunlight from entering the water column, thereby limiting photosynthesis and the production of oxygen. It should be noted that low dissolved oxygen is not an issue in the Midlake assessment unit, likely because the water surface tends to remain mostly free of surface vegetation.

Eleven diels were conducted at the open water station 10283 between 2000 and 2003. All eleven diels met the 24-Hour DO Average and 24-Hour DO Minimum criteria. Seventy-one diel studies were conducted in the impaired assessment units between 2000 and 2009. Over seventy percent of the diels failed to meet the 24-Hour DO Average and 24-Hour DO Minimum criteria of 5 mg/L and 3 mg/L, respectively. The majority of the low oxygen values occurred during the warm weather months of May through October when surface vegetation coverage is highest. About six percent of the low 24-Hour DO Average and 3.6 percent of the low 24-Hour DO Minimum measurements were collected during the cool weather months.

Diels in Caddo Lake were discontinued after FY 2009 since the studies continued to yield similar low dissolved oxygen results that were possibly reflective of the natural oxygen cycles in the arms of Caddo Lake. As a result, stakeholders recommended that the limited CRP resources be allocated elsewhere within the basin. Since no further diels have been conducted, the impairments will likely be carried forward in future assessments.

Figure 93: Station 15249 - Caddo Lake at Turtle Shell with vegetative cover

Dissolved oxygen grab samples have been reported for the Midlake station 10283 since 1973 while data were available for the upper assessment units beginning in 1996. Stations 10283 and

15249 had the most observations (n) with 384 and 337 samples, respectively. The fewest measurements were recorded in the Goose Prairie assessment unit, station 10288, with 122.

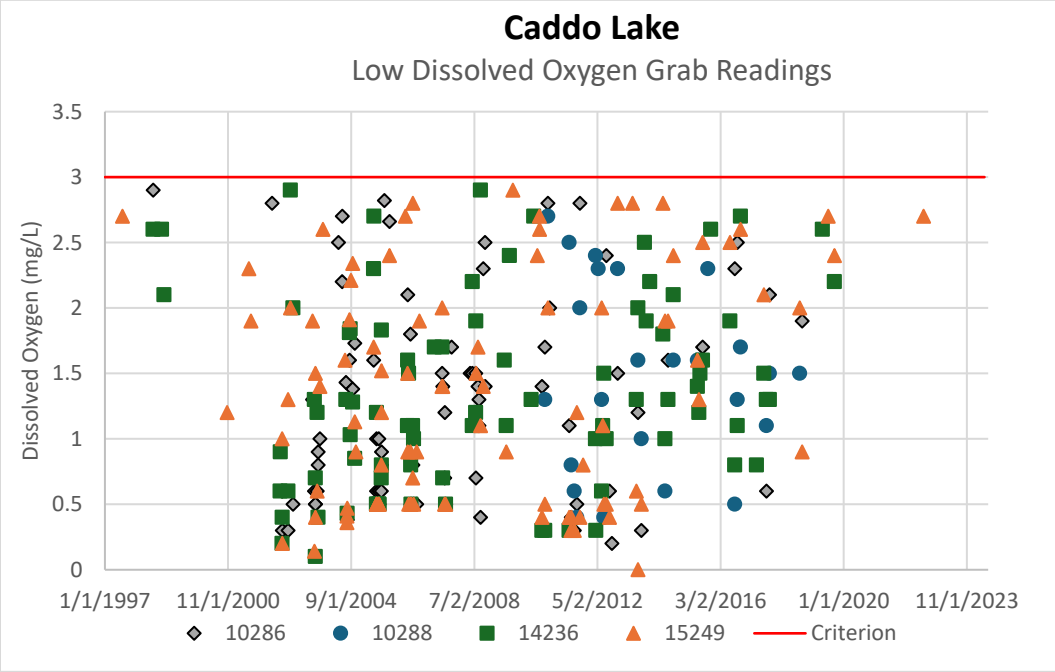

Figure 94: Low dissolved oxygen grab readings in Caddo Lake

Similar to the diel results, a review of all historical surface dissolved oxygen grab data showed that low dissolved oxygen grab readings were also most common in the warm weather months. Out of 971 grab samples collected in the upper assessment units, 276 readings fell below the 3 mg/L dissolved oxygen grab minimum criterion. Of those low dissolved oxygen values, 254 were acquired during the warm weather months of May through October. At stations 14236 and 15249, almost all low dissolved oxygen measurements occurred during the warm weather months while two-thirds of the low surface readings were obtained in the warm months at station 10288.

Dissolved Oxygen Grab Readings					
AU	Station	n	All Months n < 3 mg/L	Warm Months n < 3 mg/L	% Low DO in Warm Months
0401_01	10283	384	2	2	100.0%
0401_02	10286	253	79	69	87.3%
0401_03	10288	122	24	16	66.7%
0401_05	14236	259	87	86	98.9%
0401_07	15249	337	86	83	96.5%

Table 35: Dissolved oxygen grab sample results by station in Caddo Lake

In contrast, only two surface samples from the open water assessment unit (station 10283) fell below 3 mg/L. Both low readings were obtained in July and August 2007 at 2.4 and 2.6 mg/L, respectively. The last dissolved oxygen value reported below the 5 mg/L dissolved oxygen screening level was in May 2019 at 4.9 mg/L. These results suggest that the impairments in the upper assessment units are likely the result of the limited light penetrance due to the water surface coverage by invasive aquatic plants.

In the 2010 IR, the Goose Prairie assessment unit (0401_03) was listed as impaired for low pH. The impairment was carried forward from previous assessments as no sampling had been conducted during that assessment period. In September 2010, monitoring at station 10288 commenced to address the impairment. The impairment was removed from the §303(d) List in the 2016 IR after enough data had been collected for a full assessment. No readings have been reported below the 5.5 s.u. low pH criterion in this assessment unit since 2012. In fact, no low pH values were reported in any assessment unit in Caddo Lake during the 2024 IR assessment period.

Although elevated nutrients are common concerns across much of the Cypress Creek Basin, they are relatively low in Caddo Lake. Out of all 324 historical nitrate and nitrite plus nitrate samples, slightly more than one-quarter of results were reported above the limit of quantitation with a mean of 0.09 mg/L. Ammonia had similar results with only 37 percent of the 362 samples reported above the limit of quantitation and an average concentration of 0.09 mg/L. Twenty percent of the total phosphorus samples fell below the limit of quantitation. The mean of the reported results was 0.11 mg/L. Out of 329 chlorophyll *a* samples collected in Caddo Lake, 85 results were reported below the limit of quantitation. The average of the reportable samples was well below the 26.7 µg/L screening level at 17.7 µg/L. Over half of the reportable results were collected at the Midlake station 10283 while 29 percent were from the Turtle Shell station 15249.

The *2024 Integrated Report* included a concern for screening level for iron in sediment in AU 0401_01. This concern was a carry-forward from previous assessments as no data were collected during the assessment period. This concern is suspected to be due to the naturally high levels of iron in the soils of East Texas. In May 2002, the USGS collected 27 sediment samples in Caddo Lake. These samples were collected at stations 10283, 10288, and 16365 (Harrison Bayou Arm). None of the ten samples from station 10288 exceeded the 40,000 µg/L screening level while two out of nine samples were elevated at station 16365. The mean of the two exceedances was 41,150 µg/L. In contrast, six of the eight samples at station 10283 were elevated ranging from 42,000 to 56,600 µg/L with an average of the exceedances at 50,950 µg/L. Since no iron in sediment sampling is currently scheduled, the concern will likely continue into future assessments.

TRENDS

Trend analysis was conducted on all stations that met the criteria for analysis which included stations 10283, 10288, 15249, and 14236. Trend analysis was conducted on field parameters and laboratory results including nutrients, chlorophyll *a*, solids, and bacteria. Two trends were identified in Caddo Lake for increasing alkalinity at station 10283 and a decreasing trend for chloride at station 15249.

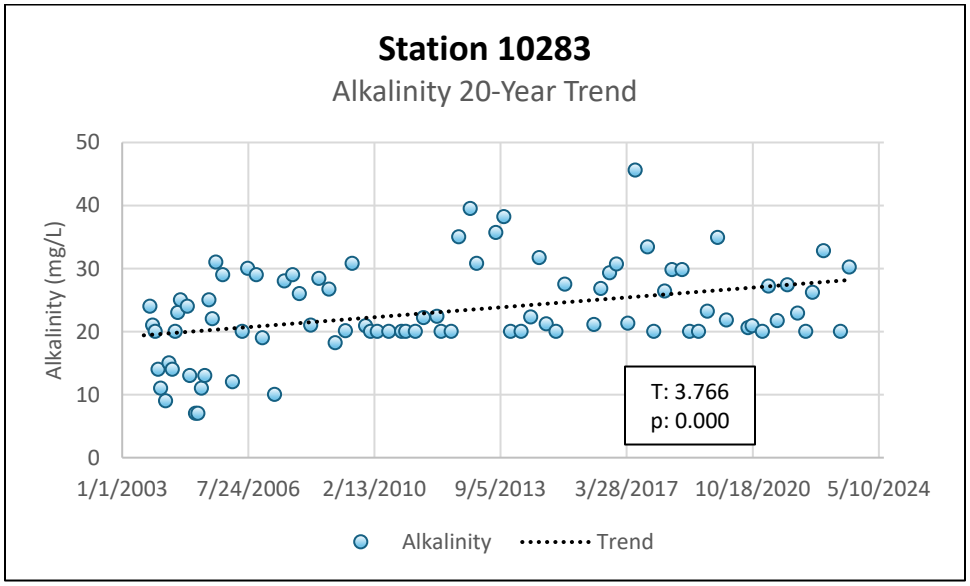

Figure 95: Increasing 20-Year alkalinity trend at station 10283

The increasing alkalinity trend is interesting since this trend was found at other stations during this analysis and in the *2019 Cypress Creek Basin Summary Report*. As detailed in the Trend Analysis section of this report, increasing alkalinity may help raise the pH in the water body. Research has shown that mercury more readily methylates, a form of mercury that can accumulate in organisms, in waters with pH less than 7.3 s.u. (Kelly, Rudd, Holoka, 2003). As a result, the increasing alkalinity trend may signal the possibility that mercury is less likely to bioaccumulate in organisms as it was in the past. In other words, the increasing pH and alkalinity trends may indicate the reduction of the availability of mercury to bioaccumulate in organisms. The fish tissue analysis that is being planned by TCEQ Region 5 may validate these assumptions and determine whether the consumption advisories need to remain in place.

The decreasing trend for chloride at station 15249 appears to be the result of the concentration of salts from the extended drought period of 1999 through 2014 followed by the dilution of those salts from the above-normal rainfall period over the last decade. In the 2009 and 2014 basin summary reports, specific conductance increased at statistically significant rates at station 15249. These reports included data collected during the pervasive drought supporting the

assertion that the increasing trends were due to low flows resulting in the concentration of salts. No trends were identified at this station during the 2019 analysis.

Segment 0401A – Harrison Bayou

Harrison Bayou (0401A) is a tributary of Caddo Lake. The stream is approximately 14 miles long and extends from its confluence with the Harrison Bayou Arm of Caddo Lake toward the southwest to a point just upstream of FM 1998, east of Marshall and near Scottsville, Texas. Harrison Bayou flows through the Caddo Lake National Wildlife Refuge immediately prior to entering the lake. The 8,416-acre property was formerly the Longhorn Army Ammunition Plant and was added to the National Priorities List by the Environmental Protection Agency in August 1990 due to soil and groundwater contamination from volatile organic compounds, perchlorate, metals, and explosives. The plant was closed in 1997, and the U.S. Army is the lead agency tasked with the remediation of the Longhorn Army Ammunition Superfund site.

Figure 96: Station 15508 - Harrison Bayou at FM 134

Harrison Bayou is currently sampled at station 15508, located at the FM 134 crossing south of Karnack. All monitoring has been conducted at this station since 2004. From 2002 to 2004, samples were also collected upstream at station 15507 at FM 1998 and downstream at station 15509 at CR 2607. Station 15508 is frequently too deep to wade for making flow measurements yet tends to have little to no velocity. The average of the 45 historical flow measurements was 2.3 cfs. Most flow measurements were reported prior to the bridge construction which was completed around 2015. The stream was channelized above and below the bridge and had low transparency with an average of 0.48 meter. Due to these conditions, sampling is being moved to a new station in the Caddo Lake National Wildlife Refuge.

The diel dissolved oxygen criteria for Harrison Bayou are site-specific and variable as determined by using a multiple regression equation which includes the water temperature, stream flow, and watershed size. Using the equation, 1.5 mg/L is the minimum 24-Hour DO Average criterion allowed. To read more about how the site-specific criteria are calculated, see Appendix D of the TSWQS.

Harrison Bayou was first listed for low dissolved oxygen in 2000 and was included in the 2024 §303(d) List for not meeting the 24-Hour DO Average and 24-Hour DO Minimum criteria. These 2024 listings were carried forward from previous assessments since no diels were conducted during the assessment period. Thirty-eight diel studies were conducted in Harrison Bayou between March 2002 and July 2012. The mean of the 24-Hour DO Average values was 4.9 mg/L while the mean of the 24-Hour DO Minimum readings was 4.3 mg/L.

Twenty-nine diels were performed in Segment 0401A between 2002 and 2004. None of the ten diels from the upstream station 15507 fell below 5 mg/L while five out of nine diels at the most downstream station 15509 had 24-Hour DO Average values of less than 0.5 mg/L. Nineteen diels were completed at station 15508 between 2002 and 2012. The mean of the 24-Hour DO Average readings was 5.4 mg/L, and the average of the 24-Hour DO Minimum values was 4.8 mg/L. Diel monitoring should be considered in the future to address these impairments.

About one-quarter of the thirty dissolved oxygen grab samples reported during the 2024 assessment period fell below the 4 mg/L grab minimum criterion. All low readings were obtained during low flows in the summer and early October site visits.

Harrison Bayou was first included on the §303(d) List for *E. coli* in 2022. The geometric mean of the 25 samples collected during the assessment period was 222.4 MPN/100 mL exceeding the 126 MPN/100 mL criterion. Since the watershed is mostly forested, contributions from wildlife were the most likely source of bacteria. A Recreational Use Attainability Analysis should be considered to address the impairment.

There were no concerns shown in the 2024 IR for Harrison Bayou. None of the 26 ammonia and nitrate samples collected during the assessment period were reported above screening levels while one total phosphorus and three chlorophyll *a* values were elevated.

TRENDS

A decreasing trend for specific conductance over the past twenty years was identified at station 15508. Since specific conductance is a measure of the amount of salts in the water column, specific conductance tends to increase through concentration during extended drought periods and decrease due to dilution during periods with normal to high rainfall. The decreasing trend is likely due to concentration during the extended drought followed by dilution from the normal to above-normal rainfall the area has received over much of the past decade.

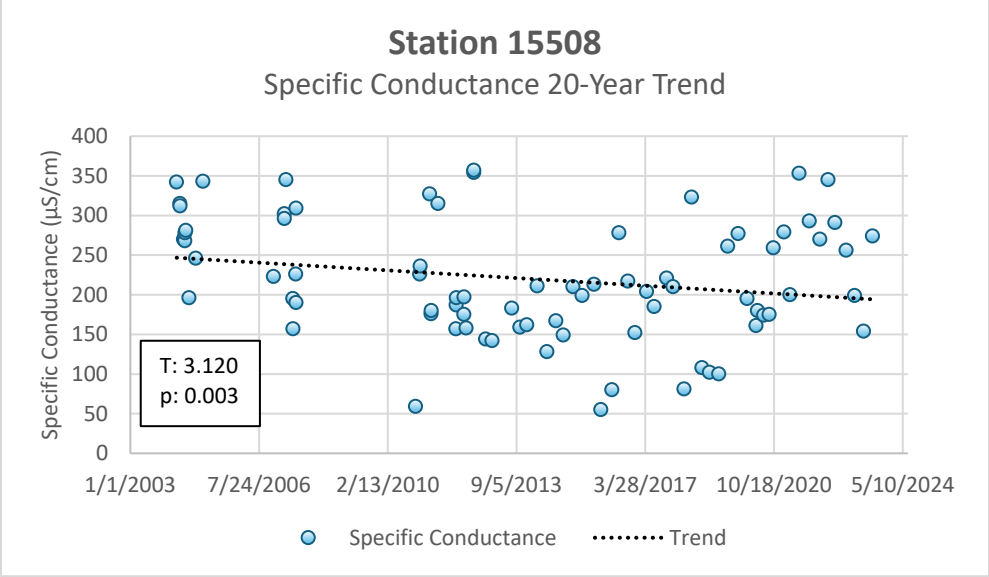

Figure 97: Decreasing 20-Year specific conductance trend at station 15508

Segment 0401B – Kitchen Creek

Kitchen Creek is an unclassified water body and a tributary of Caddo Lake. The stream crosses SH 49 near Smithland and drains into Clinton Lake east of Goat Island. The stream is monitored quarterly at station 14998 at CR 3416 by WMS for field and flow parameters.

The earliest reported data for Kitchen Creek was in July 1998 and was sampled infrequently until October 2006. Sampling was conducted somewhat routinely through July 2011. Regular quarterly sampling for field parameters began in 2016.

There were no impairments or concerns shown for this stream in the 2024 IR. Since the stream was sampled only for field parameters during the assessment period, dissolved oxygen was the only parameter assessed. One dissolved oxygen reading out of 24 fell below the 2 mg/L dissolved oxygen grab minimum criterion.

Trend analysis was not performed at this station due to not meeting the criteria for analysis.

Figure 98: Station 14998 - Kitchen Creek at CR 3416

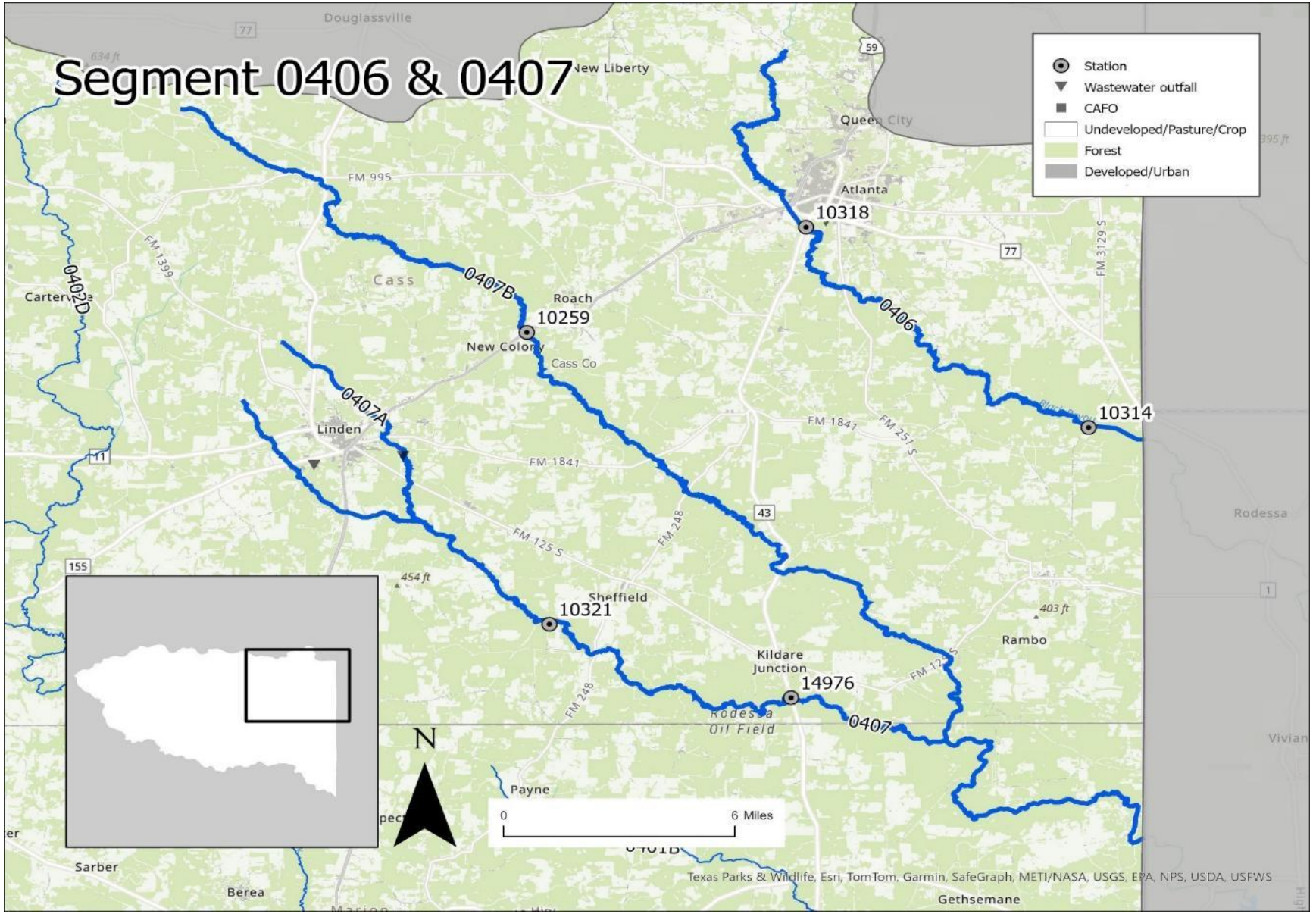

Figure 99: Map of stations in Segment 0406 – Black Bayou and in Segment 0407 - James' Bayou

Segment 0406 – Black Bayou

Black Bayou, a relatively small watershed, emerges near Wright Patman Reservoir in northeastern Cass County, flows through Atlanta, Texas, and continues into Louisiana where it is impounded to form Black Bayou Lake. The stream is intermittent and traverses flat to gently rolling terrain that supports grasses, mixed hardwoods, and pines. Black Bayou is generally a slow, meandering water body with a mostly sand and clay loam bottom. The upper assessment unit of Black Bayou, AU 0406_02, is a 28.6 km reach that extends from its headwaters downstream to its confluence with Hurricane Creek. The lower assessment unit (AU 0406_01) ranges from Hurricane Creek downstream 19.1 km to the Louisiana state line.

Figure 100: Bioassessment at station 10318 - Black Bayou at SH 43

Monitoring is conducted by the TCEQ Region 5 office at station 10314 at CR 4659 in lower assessment unit near the Louisiana state line and at station 10318 at SH 43 south of Atlanta. Samples for field and laboratory parameters, bacteria, and flow are collected quarterly at both stations along with one diel at station 10314.

2025 Monitoring Schedule								
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**	**24 HR DO**
0406_01	10314	R5	BLACK BAYOU AT CR 4659	4	4	4	4	1
0406_02	10318	R5	BLACK BAYOU AT SH 43	4	4	4	4	

Table 36: FY 2025 Monitoring Schedule for Segment 0406

Although the entire segment is classified as intermittent with perennial pools, Black Bayou has a high aquatic life use designation. Concerns for impaired benthic macroinvertebrate community are shown in both assessment units while concerns for fish and habitat are included for AU 0406_01 in the 2024 IR. Aquatic Life Monitoring was conducted in Black Bayou in September and October 2012 and in May and July 2014. Despite station 10314 being the most downstream site and located below the City of Atlanta WWTP outfall, the site was either completely dry or had only small pools during every sampling event except for May 2014. Additional ALMs will need to be conducted to address these concerns.

2024 Texas Integrated Report		
Parameter	**0406_01**	**0406_02**
Dissolved Oxygen Grab	NS	NS, CS
E. coli	CN	NS
Fish	CN	
Benthic	CN	CN
Habitat	CS	

Table 37: Segment 0406 impairments and concerns in the 2024 IR

The upper assessment unit was impaired for *E. coli* with a geometric mean of 331 MPN/100 mL. There are no permitted dischargers and very limited residential development within this assessment unit of the stream suggesting that the high bacteria values are possibly due to non-point sources such as livestock and wildlife. The lower assessment unit shows a concern for non-attainment for bacteria, but since only nine samples were reported during the assessment period, a full assessment could not be completed. A Recreation Use Attainability Analysis may be considered to address the bacteria concern and impairment in this stream.

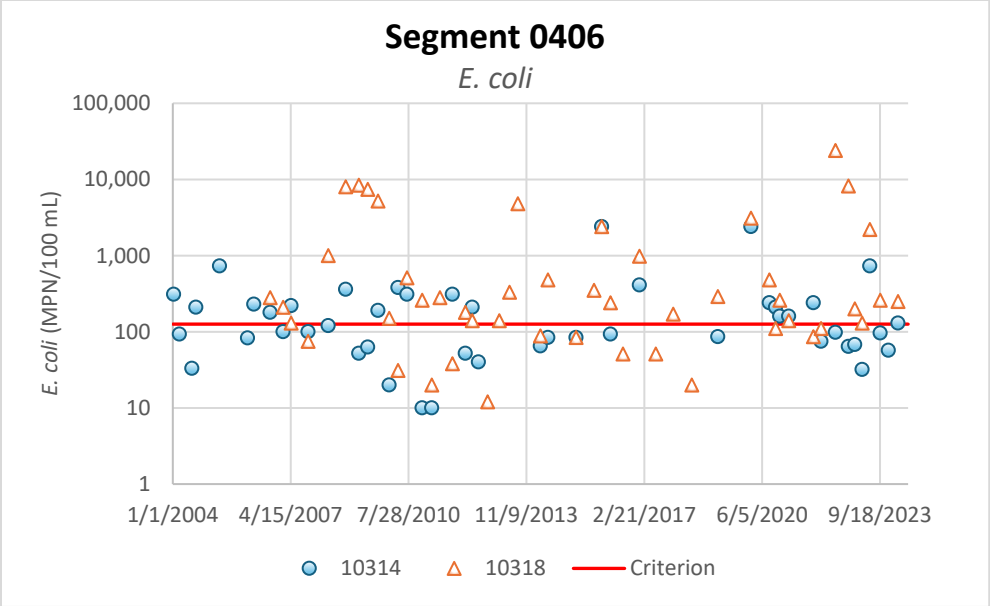

Figure 101: Historical E. coli results in Segment 0406

It should be noted that, for Black Bayou, diel dissolved oxygen criteria are site-specific, and variable as determined by using a multiple regression equation which includes the water temperature, stream flow, and watershed size. Using the equation, 1.5 mg/L is the minimum 24-Hour DO Average criterion allowed. To read more about how the site-specific criteria are calculated, see Appendix D of the TSWQS.

Both assessment units of Black Bayou were impaired for depressed dissolved oxygen. During periods of low flow, the stream tends to become stagnant and dissolved oxygen levels decrease under these conditions. Between 1999 and 2014, five diels were completed at station 10314 while four were performed at station 10318. The diels at station 10318 were included as part of bioassessments discussed previously. To address the dissolved oxygen impairments, TCEQ Region 5 began diel monitoring in both assessment units in 2021. As of July 2024, ten diels had been completed in both assessment units. Four diels in AU 0406_01 were assessed in the 2024 IR while only one event was assessed in AU 0406_02. None of the diels in AU 0406_01 fell below the criteria while the diel in upper assessment unit failed to meet the 24-Hour DO Minimum and Average criteria. The mean 24-Hour DO Average was 7.1 mg/L at station 10314 and 7.2 mg/L at station 10318.

Fourteen dissolved oxygen grab samples were collected during the 2024 assessment period at station 10314 and none of the values fell below the 3.1 mg/L criterion while one sample fell below the 4.1 mg/L screening level with a value of 3.3 mg/L. For the upper assessment unit, three out of 24 values fell below the 4 mg/L DO grab minimum criterion with a mean of the exceedances of 1.27 mg/L while five results were below the 5 mg/L DO grab screening level. The available data that will be used in the 2026 IR show similar results in both assessment units. Low DO grab values

were occasionally reported in the upper unit while the lower unit met the criterion for all but one result. Based upon these values, the upper unit will likely remain impaired for dissolved oxygen while all dissolved oxygen samples (grab and diel) have supported the criteria in AU 0406_01.

Nutrient and chlorophyll *a* values were low during the 2024 assessment period. For AU 0406_01, none of the thirteen ammonia, nitrate, total phosphorus, or chlorophyll *a* samples exceeded their screening levels. In the upper assessment unit, nineteen to 22 samples were reported for these parameters with one total phosphorus, one chlorophyll *a*, and two ammonia results exceeding their screening levels while none of the nitrate values were elevated. The elevated total phosphorus sample exceeded the 0.69 mg/L screening level at 0.76 mg/L, while the chlorophyll *a* value was 23 µg/L, well over the 14.1 µg/L screening level. The mean of the elevated ammonia results was 1.24 mg/L or about four times the 0.33 mg/L screening level. The high ammonia samples were collected on June 21 and November 1, 2022.

For station 10318, none of the chlorophyll *a*, nitrate, or total phosphorus samples collected during the 2026 assessment period were elevated while sixteen of 23 ammonia results collected through March 2024 were reported below the limit of quantitation. Four values exceeded the screening criterion with a mean of 1.27 mg/L. Since the highest results were collected in June 2022 and September 2023, the application of commercial fertilizers on improved pastures upstream of the station could be a possible source of ammonia.

TRENDS

Two trends were identified at station 10314: a decreasing trend for total Kjeldahl nitrogen over the past ten years and a twenty-year increasing dissolved oxygen trend. The decreasing TKN trend appears to be a result of the drought and flood period over the past decade. Sample values were elevated in 2014 and declined though the rest of the decade with the lowest results of 0.2 mg/L collected in December 2020 and January 2022.

Of interest is the increasing dissolved oxygen trend over the past twenty years. Decreasing dissolved oxygen trends were identified at station 10314 in the 2009 and 2014 basin summary reports. Coupled with these past decreasing trends and low dissolved oxygen impairment, the long-term increasing trend is encouraging. These results also support the grab sample and diel results discussed previously which show suggest that the assessment unit appeared to be meeting its high aquatic life use designation.

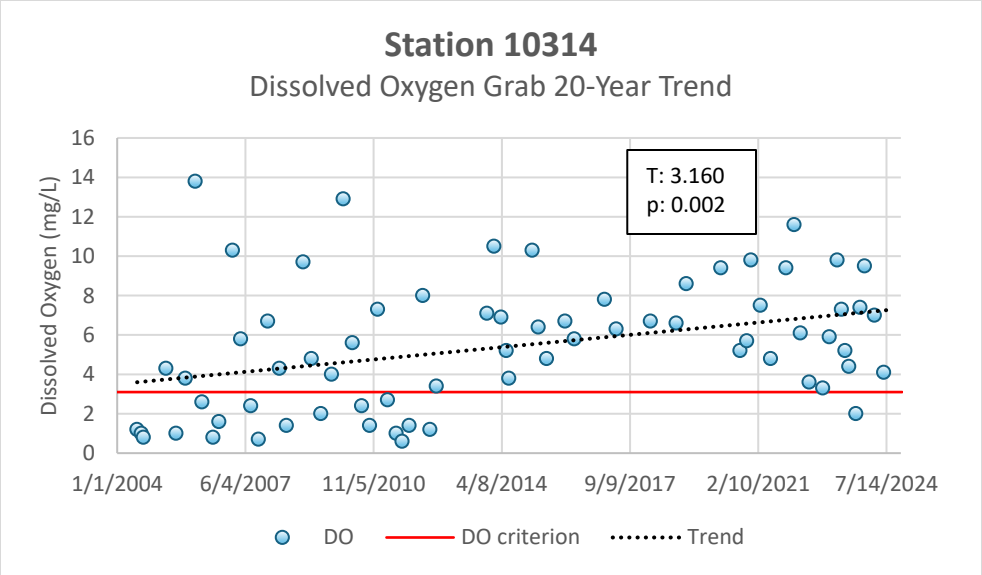

Figure 102: Increasing 20-Year dissolved oxygen trend at station 10314

Figure 103: Station 14976 - James' Bayou at SH 43

Segment 0407 – James' Bayou

James' Bayou originates west of Linden and flows toward the southeast through pine and hardwood forests before crossing the Louisiana state line and ultimately into Caddo Lake. James' Bayou is also referred to as Jim's Bayou and Jeems' Bayou. The headwaters of the stream are impounded to form Morse Lake and continue through mostly forested and undeveloped land to the west and south of Linden. The stream is impounded again southeast of US 59 to form Iron Ore Lake. After being released from Iron Ore Lake, the stream flows through dense forests into Louisiana.

The segment is classified as intermittent with perennial pools and has a high aquatic life use designation. James' Bayou is divided into two assessment units with the upper unit (AU 0407_02) extending from its headwaters to the confluence with Bear Creek near the CR 1779 crossing. The lower assessment unit, AU 0407_01, runs 31.6 km from Bear Creek to the Louisiana state line.

James' Bayou is monitored quarterly by WMS at station 14976 located at SH 43, and upstream at station 10321 at the CR 1775 crossing. Field and laboratory parameters, bacteria, and flow are collected at station 14976 while flow, field parameters, and diels are measured at station 10321.

2025 Monitoring Schedule								
Segment/AU	**Station**	**CE**	**Description**	**Field**	**Lab**	**Bacteria**	**Flow**	**24 HR DO**
0407_01	14976	WMS	JIMS BAYOU AT SH 43	4	4	4	4	
0407_02	10321	WMS	JAMES BAYOU AT CR 1775	4			4	4

Table 38: FY 2025 Monitoring Schedule for Segment 0407

Since 2000, the upper assessment unit of James' Bayou has been impaired for not meeting the 24-Hour DO Average and Minimum criteria. These impairments continued into the 2024 §303(d) List. From 2015 through 2018, WMS conducted diels at station 10321 to address the DO impairments. Out of fourteen diel studies, two of the results fell below the 24-Hour DO Average criterion while four were reported below the 24-Hour DO Minimum criterion. All but one of the low 24-Hour DO values were reported in the month of July. The stream had no flow when the low readings were obtained. The mean of the 24-Hour DO Average readings was 6.4 mg/L while the mean 24-Hour DO Minimum was 5.8 mg/L. Based upon input from the Coordinated Monitoring Committee, WMS resumed diel monitoring in this assessment unit in October 2024 to address the impairments.

Similar to other segments in the basin, diel dissolved oxygen criteria are site-specific in James' Bayou and are variable as determined by using a multiple regression equation which includes the

water temperature, stream flow, and watershed size. Using the equation, 1.5 mg/L is the minimum 24-Hour DO Average criterion allowed. To read more about how the site-specific criteria are calculated, see Appendix D of the TSWQS.

2024 Texas Integrated Report			
Parameter	**0407_01**	**0407_02**	**0407B_02**
Dissolved Oxygen Grab	CS		CS
24 HR DO Average & Minimum		NS	
E. coli	NS	NS	
Benthic	CN	CN	
Habitat	CS		CS

Table 39: Segment 0407 impairments and concerns in the 2024 IR

There is a concern in AU 0407_01 for not meeting the dissolved oxygen grab screening level. Five out of 33 dissolved oxygen readings did not meet the screening level in the 2024 IR with a mean of the exceedances of 2.28 mg/L. The low DO grabs primarily occurred during the summer months and all had flow severity reported as no flow.

Both assessment units were first included on the §303(d) List for bacteria in 2006 for exceeding the 126 MPN/100 mL geometric mean criterion. In the 2024 IR, the lower assessment unit had a geometric mean of 199.8 MPN/100 mL based upon 25 samples while the geometric mean in the upper assessment was 155.5 MPN/100 mL from 31 samples. It should be noted that no laboratory samples have been collected in the upper assessment unit since 2018, so this impairment will likely continue into the future. Recent bacteria results from station 14976 in the lower assessment unit indicate that the impairment will continue into the 2026 assessment. Since the watershed of James' Bayou is almost entirely forested, the most likely contributor of bacteria are wildlife. Public access to the stream is limited to a few road crossings making James' Bayou a good candidate for a Recreational Use Attainability Analysis to address the bacteria impairment

Nutrient and chlorophyll *a* concentrations were low in both assessment units. For AU 0407_01, none of the 28 ammonia, nitrate, total phosphorus, or chlorophyll *a* results exceeded their screening levels. These parameters were also generally below the screening levels in the upper assessment unit. None of the nine nitrate samples were reported above the screening level while one total phosphorus and one ammonia result were elevated. Two of the nine chlorophyll *a* samples exceeded the 14.1 µg/L screening level with an average of the exceedances at 16.3 µg/L.

The 2024 IR showed a concern for the benthic macroinvertebrate community in both assessment units along with a concern for habitat in AU 0407_01. The benthic community concern in AU 0407_02 was carried forward from previous assessments since no biological monitoring has been

performed in this reach since 2006. Four ALM events were conducted in AU 0407_01 in 2016 and 2017 at station 14976. Both the mean benthic and habitat scores fell into the intermediate range while fish scored in the high category. A complete discussion of biological monitoring in James' Bayou was presented in the *2019 Cypress Creek Basin Summary Report*.

TRENDS

Monitoring for field parameters at station 10321 commenced in 1982 and continued through 2018 while samples for laboratory analysis have been sporadic during this period. Station 14976 has been routinely monitored since 2005 with sampling for laboratory parameters being regularly collected since 2016. Trend analysis was performed at both stations, but none were identified. Further, no trends were identified in Segment 0407 in either the 2014 or 2019 basin summary reports.

Unclassified Segment 0407B –Frazier Creek

Frazier Creek is an unclassified water body that originates near US 59 in Cass County and flows southeast for 38.6 kilometers to its confluence with James' Bayou in Marion County. The stream has a relatively low level of human disturbance, serves as an ecoregion reference stream for the watershed, and is considered a Least Disturbed Stream.

Frazier Creek is classified as a perennial stream with a high aquatic life use designation. It is divided into two assessment units with the lower unit extending 38.6 kilometers upstream from the confluence with James' Bayou to near US 59 while AU 0407B_02 extends from this point 24.7 kilometers upstream to its headwaters.

The lower assessment unit was not assessed in the 2024 IR as no sampling has been conducted in this reach since 2003. Ten site visits were reported between October 2002 and August 2003. For AU 0407B_02, the stream showed no impairments in the 2024 IR but had a concern for dissolved oxygen grab screening level and for habitat. Almost all sampling in Frazier Creek has been conducted in the upper assessment unit at station 10259, located at the US 59 crossing. Regular monitoring was performed at this station from 1988 through 2001. From 2013 through 2017, TCEQ R5 sampled this station for field parameters and flow. In fiscal years 2022 and 2023, WMS collected field and laboratory parameters, bacteria, and flow.

Three low dissolved oxygen grab samples were noted out of the fifteen readings evaluated in the 2024 IR. The mean of the exceedances was 4.37 mg/L, falling below the 5 mg/L screening level. Two of the low readings occurred in June 2022 while the third was in November 2016. The flow was measured at 0.4 cfs on both June 20, 2022 and June 22, 2022. Another low grab result was

reported in August 2023 with a concentration of 4.8 mg/L. Flow was not reported for the 2016 reading but flow severity was shown as low.

Three ALMs were completed in 2022 and 2023. Monitoring could not be conducted in the critical period of 2022 because the stream was dry throughout the entire period which extends from July 1 to September 30. While both the average fish and benthic organisms scored in the high categories, habitat fell into the intermediate category. The lower habitat score is likely due to using statewide rather than regionalized scoring metrics. This topic is covered in more detail in the Biological Discussions section of the report. Please visit the *2024 Cypress Creek Basin Highlights Report* for more details about these biological events.

TRENDS

Trend analysis could only be performed on the field data collected at station 10259 over the past decade, but no significant trends were identified. No trends were found for this segment in past reports.

Figure 104: Station 10259 - Frazier Creek at US 59

Biological Discussions

- Species of Concern
- Aquatic Life Monitoring

Species of Concern

Rare, Threatened, and Endangered species are taxa that are listed on the state and/or federal level. Endangered species are at serious risk of becoming extinct, while threatened species are organisms that are likely to become endangered in the near future. On the state level, TPWD also includes species that are considered imperiled or vulnerable of becoming threatened.

The TPWD maintains a list of state and federally listed rare, threatened, and endangered species. There are currently eleven aquatic species in the Cypress Creek Basin that are listed as threatened or imperiled by the State of Texas including nine fish, six mollusk, one crustacean, and two reptile species.

The statewide list of aquatic threatened (T) and imperiled (S) species in the Cypress Creek Basin is shown below. Imperiled species are identified as S1 – Critically Imperiled, S2 – Imperiled, and S3 – Vulnerable.

Taxon	Common Name	Scientific Name	State Listing
Fish	bluehead shiner	*Pteronotropis hubbsi*	T
	blackside darter	*Percina maculata*	T
	western creek chubsucker	*Erimyzon claviformis*	T
	paddlefish	*Polyodon spathula*	T
	taillight shiner	*Notropis maculatus*	S1
	ironcolor shiner	*Notropis chalybaeus*	S3
	western sand darter	*Ammocrypta clara*	S3
	blackspot shiner	*Notropis atrocaudalis*	S3
	Sabine shiner	*Notropis sabinae*	S3
Mollusk	Louisiana pigtoe	Pleurobema riddellii	T
	sandbank pocketbook	*Lampsilis satura*	T
	Texas heelsplitter	*Potamilus amphichaenus*	T
	southern hickorynut	*Obovaria arkansasensis*	T
	Texas pigtoe	*Fusconaia askewi*	T
Crustacean	Kisatchie painted crayfish	*Orconectes maletae*	S2
Reptile	alligator snapping turtle	*Macrochelys temminckii*	T
	western chicken turtle	*Deirochelys reticularia miaria*	S2, S3

Table 40: Threatened and Imperiled aquatic species in the Cypress Creek Basin

Threatened fish species include the bluehead shiner (*Pteronotropis hubbsi*), blackside darter (*Percina maculate*), western creek chubsucker (*Erimyzon claviformis*), and the paddlefish (*Polyodon spathula*). The only critically imperiled fish is the taillight shiner (*Notropis maculatus*)

while vulnerable species are the ironcolor shiner (*Notropis maculatus*), western sand darter (*Ammocrypta clara*), blackspot shiner (*Notropis atrocaudalis*), and Sabine shiner (*Notropis sabinae*).

Western Chicken Turtle

The western chicken turtle, *Deirochelys reticularia miaria*, is small to medium sized semi-aquatic turtle. The range of the western chicken turtle includes much of the Gulf Coast west of the Mississippi River, and is found in portions of Texas, Louisiana, Arkansas, Missouri, and Oklahoma. Western chicken turtles are ephemeral wetland habitat dwellers associated with watersheds throughout East Texas. This cryptic species exhibits a seasonal activity pattern, with most activity occurring in the spring and early summer months. The turtle is typically found in wetland areas; shallow, slow-moving streams; and in the littoral areas of ponds and lakes. The turtle prefers soft soils and vegetation for burrowing for hibernation and to escape drought periods.

In 2011, the US Fish and Wildlife Service issued a partial 90-day finding that a listing as Threatened and Endangered was warranted for this species. In 2020 to 2023, the Environmental Institute of Houston at the University of Houston–Clear Lake began developing partnerships with private landowners and stakeholders in East Texas to conduct surveys for the Western Chicken Turtle and Alligator Snapping Turtle throughout their historic range. These surveys were funded by the Texas Comptroller of Public Accounts Natural Resources Program and are aimed at providing the U.S. Fish and Wildlife Service with the most current and relevant data to make listing decisions.

Figure 105: Western chicken turtle detected by Laura Speight's dog, Raine (left); western chicken turtle observed near the author's home (right)

Due to their cryptic nature and narrow window of opportunity for observation, surveys for the Western Chicken Turtle were aimed at testing a suite of traditional and novel sampling techniques for detection of the species. These included trapping surveys, visual surveys, environmental DNA sampling, drone surveys, and canid scent surveys using trained detector dogs. Multiple sites have yielded positive detections of Western Chicken turtles via eDNA, canid scent surveys, and visual surveys.

It should be noted that the western chicken turtle is currently shown as endangered in Missouri and is a species of greatest conservation need in Louisiana and Oklahoma but holds no protection in Texas. The U.S. Fish and Wildlife Service is completing a more in-depth review and will issue a 12-month finding in 2025.

Alligator Snapping Turtle

The alligator snapping turtle, *Macrochelys temminckii*, is the largest freshwater turtle in North America, with some records of individuals weighing over 200 pounds. The turtle lurks along the bottom of waterways in the Midwest, Southeast, and some parts of the Southwest. It is a member of the *Chelydridae* family of turtles, which includes the common snapping turtle. People often mistake the common snapping turtle for the alligator snapping turtle, but the alligator snapping turtle stands out due to its prehistoric appearance and massive size.

In 2015, the US Fish and Wildlife Service issued a partial 90-day finding that a listing as Threatened and Endangered was warranted for this species. In 2021 to 2023, the Environmental Institute of Houston at the University of Houston–Clear Lake conducted genetic and trapping surveys for the Alligator Snapping Turtle throughout their historic range in Texas. These surveys were funded by the Texas Comptroller of Public Accounts Natural Resources Program and were aimed at providing the U.S. Fish and Wildlife Service with the most current and relevant data to make listing decisions.

Threats to the alligator snapping turtle include fishing activities such as accidentally being snagged by a hook, drowning from capture on trot lines, swallowing fishing lures, and boat strikes; loss of habitat; and nest predation as well as poaching to meet global demand for pet turtles and turtle meat. The alligator snapping turtles are being raised at the Tishomingo and Natchitoches National Fish Hatcheries in an effort to restore and bolster populations within its historical range.

Below are pictures of alligator snapping turtles collected at Caddo Lake. The turtle on the left was collected in 2012 by Levi Sparks who, at that time, was a graduate student at West Texas A&M

University. The turtle on the right was foul hooked on a trotline at Caddo Lake in the spring of 2016. This photo caused quite a sensation on the internet due to its size. Its weight was estimated to be around 100 pounds. Catching an alligator snapping turtle on Caddo Lake is not a rare event; although, they are not usually this large. Both turtles were released unharmed after photos were taken.

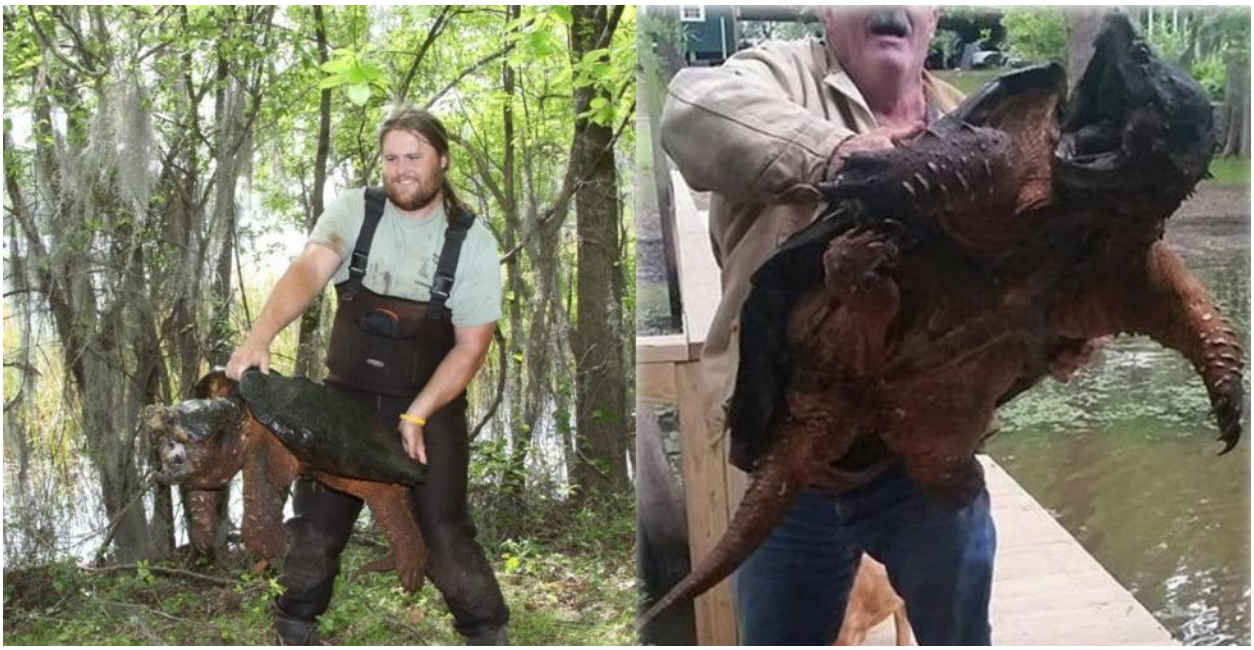

Figure 106: Photos of alligator snapping turtles captured and released on Caddo Lake

Louisiana Pigtoe Mussel

Freshwater mussels play an important role in aquatic ecosystems. They provide a food source for many organisms, and as filter feeders, help clean the waters in which they reside by collecting organic particulate, bacteria, and algae, as well as accumulating contaminants in their soft tissues. Because they have limited mobility and are typically long-lived, freshwater mussels are sensitive to changes in their environment and can serve as bioindicators of water quality. Unfortunately, severe declines in freshwater mussel populations have been documented prompting broader population studies and focus on potentially endangered and threatened species.

The decline of freshwater mussel populations has become an important topic for research over the past decade as fifteen Texas species are being considered for listing as threatened or endangered by the U.S. Fish and Wildlife Service. Current literature suggested that of the three East Texas species under consideration by the U.S. Fish and Wildlife Service, the Louisiana pigtoe (*Pleurobema riddellii*) is found in the Cypress Creek Basin. The Louisiana pigtoe occurs

only in stream and river habitats with low to moderate flow and with silty sand, clay, and sand with gravel substrates. They are often relatively small, but individuals about five inches in length have been collected in Texas.

Over the past few years, the U.S. Fish and Wildlife Service engaged river authorities and water districts to review and comment on the proposed listings of these East Texas species in the Species Status Assessment. However, responding to the request was difficult as there is a limited amount of sampling data available in the literature. Although TCEQ has not established mussels sampling protocols, all collection methods require tactile sampling, meaning that the sampler must reach into the sediments and feel for the mussels. Depending upon the depth of the water body, sampling may require the use of snorkels and/or diving gear. Since most waters in East Texas are tannin-laden, limiting visibility. As a result, sampling of mussels is typically labor-intensive, time-consuming, and expensive.

Fish play a significant role in the life-history of freshwater mussels, as the immature form, or glochidia, of most species become encysted on their fish hosts. Research suggests that glochidia will only successfully attach to specific fish species. Glochidia that fail to attach to a suitable host or attach to the wrong location will die. Glochidia will implant into the host fish and develop into juvenile mussels over a period of weeks to months. Once fully developed, the juvenile mussel detaches from the host fish and matures on the stream bed. The dispersal of most mussels is dependent upon the distribution of suitable host fish, and therefore, the distribution of a mussel species is likely heavily influenced by the effectiveness and breadth of host fish utilized (Schwalb *et al*. 2013).

In a 2018 study of wild-caught East Texas fishes (Marshall, *et. al.* 2018), the Louisiana pigtoe glochidia were found at low prevalence and intensities suggesting that the conservation status of the mussel is strongly influenced by its ability to successfully encounter and attach to a suitable host fish. Glochidia were only found on the Blacktail Shiner (*Cyprinella venustra*), Bullhead Minnow (*Pimephales vigilax*), and Red Shiner (*Cyprinella lutrensis*) making them suitable host species (Ford and Oliver, 2015; Ford, Plants-Paris, Ford, 2020).

Due to this relationship, sampling fish populations and abundance in streams may be used as an indicator for the potential presence of the Louisiana pigtoe. The assertion was that if these host fish species were not present, or were not present in relative abundance, then the Louisiana pigtoe was less likely to be found at the location. In this way, the fish sampling data could be used to prioritize watersheds and to use mussels sampling funds more efficiently.

A review of the TCEQ database showed that these potential host fish species were collected in several streams within the Cypress Creek Basin, although they were found in very low abundance. For example, out of the four sampling events conducted in Tankersley Creek in 1997, 1998, and

2003, a combined total of eighteen individual host fish were collected. However, the sampling effort in Tankersley Creek in 2020 and 2021 indicated that the present sampling techniques and electrofishing technology may yield better sampling efficiencies than those of past decades. The Tankersley Creek sampling demonstrated that the host fish species for the Louisiana pigtoe were in relative abundance at this station. The June 2021 effort alone yielded 209 individual host fish. These results suggested that stations last sampled in the late 1990s and early 2000s should be reevaluated to provide a better representation of the overall health of the biotic community.

Figure 107: Bullhead minnow, Pimephales vigilax (top); Blacktail shiner, Cyprinella venusta (middle); Red Shiner, Cyprinella lutrensis (bottom)

The NETMWD identified six priority watersheds that were suspected of supporting the Louisiana pigtoe mussel. Five of these streams are in Segment 0404 (Big Cypress Creek below Lake Bob Sandlin) or tributaries to Big Cypress Creek. The most recent bioassessments in these watersheds were conducted in 2003. Aquatic life monitoring was already being performed in Hart Creek and

Frazier Creek through the CRP, and the NETMWD requested additional funding to support ALM studies in the other four streams.

In July 2022, the TCEQ CRP awarded funding to support ALM studies in those four watersheds that are tributaries to Big Cypress Creek. In addition to gathering the information needed to assess whether the streams met their Aquatic Life Use designations, these studies assisted NETMWD in identifying and prioritizing streams for potential Louisiana pigtoe mussel sampling in the future, thereby using their funds more efficiently and effectively. These resulting fish data were used to evaluate the prevalence and abundance of known host species of the Louisiana pigtoe mussel. The assumption was that if the host species were not collected or the individuals were not in abundance, then one can assume that the Louisiana pigtoe mussel was less likely to be found in the watershed. Through CRP regular funding and the additional funds award, bioassessments were conducted during the critical and non-critical periods of 2022 and 2023 in Big Cypress, Boggy, Frazier, Greasy, Hart, Prairie, and Swauano creeks.

In the summer of 2023, we were disappointed to learn that genetic testing revealed that several individual mussels collected in Big Cypress Creek from 2016 to 2018 were incorrectly identified as Louisiana pigtoe, but were in fact Wabash pigtoe (*Fusconaia flava*). This information was reported by the University of Texas Tyler and noted that both species share over 99 percent of their genetic identities (Dickinson and Greenwold, 2023). These results called into question the identification of all Louisiana pigtoe mussels in the historical record for Big Cypress Creek.

The U.S. Fish and Wildlife Service released a draft document, Environmental Assessment for the Designation of Critical Habitat for the Louisiana Pigtoe (*Pleurobema riddellii*), in August 2023. Due to the lack of genetically identified Louisiana pigtoe mussels, the Cypress Creek Basin was not included as a critical habitat for the species.

Kisatchie Painted Crayfish

Crayfish, in general, are keystone species that may indicate the health of a watershed, and nearly half of crayfish species are vulnerable, threatened, or endangered. The Kisatchie painted crayfish, *Faxonius* (or *Orconectes*) *maletae*, has few historical records and is believed to be restricted to the Kisatchie Bayou and Bayou Teche watersheds in Louisiana and in the Cypress Creek Basin. The Kisatchie painted crayfish is considered an imperiled species by the State of Texas and is currently being considered for potential listing as a threatened species by the U.S. Fish and Wildlife Service.

The crayfish is characterized by an olive carapace or hard, upper shell and the red marks on the legs and above the eyes while its chelae (claws) have red, yellow, and blue markings. The size of Kisatchie painted crayfish appears to be influenced by water depth. Individuals found in deep water have been documented to reach lengths of 101.6 mm whereas those found in shallow water rarely reach lengths over 50.8 mm.

Figure 108: Kisatchie painted crayfish captured and released during bioassessments in Big Cypress Creek

Little is known about the habitat requirements of the Kisatchie painted crayfish. They have historically been collected in freshwater streams with sand, gravel, mud, or silt; however, the Texas habitat tended to be more stagnant and muddier than in Louisiana. The Kisatchie painted crayfish may prefer streams with varying water depth, heavy leaf litter, and cobble-lined stream bottoms. Historical collection locations were obtained from TPWD, and recent field surveys determined that the Kisatchie painted crayfish was absent from 60 percent of its historical range in Texas.

In 2021, researchers from Stephen F. Austin State University collected and confirmed the identification of Kisatchie painted crayfish in Prairie Creek, a tributary of Big Cypress Creek. Three individuals were collected in 2021 by Texas Tech researchers in Little Cypress Creek and its tributaries.

Since 2022, NETMWD and WMS staff have been observing crayfish incidentally collected while seining and electrofishing as part of aquatic life monitoring efforts. It is important to note that the species was not targeted for collection during these field efforts and all individuals were immediately returned to their habitat after identification. At present, no incidental mortalities during collection and identification have been observed by field biologists. In total, sixteen

Kisatchie painted crayfish have been collected in the Cypress Creek Basin during these assessments. Six individuals were captured in Hart Creek in 2022 while ten were observed in Big Cypress Creek in 2023 and 2024.

Station	Description	Date	Number
10266	Hart Creek	6/20/2022	6
16458	Big Cypress near Greasy Creek	6/3/2023	4
16458	Big Cypress near Greasy Creek	8/12/2023	2
22423	Big Cypress below Walker's Creek	10/20/2023	1
22423	Big Cypress below Walker's Creek	8/24/2024	3

Table 41: Kisatchie painted crayfish collected around the Cypress Creek Basin

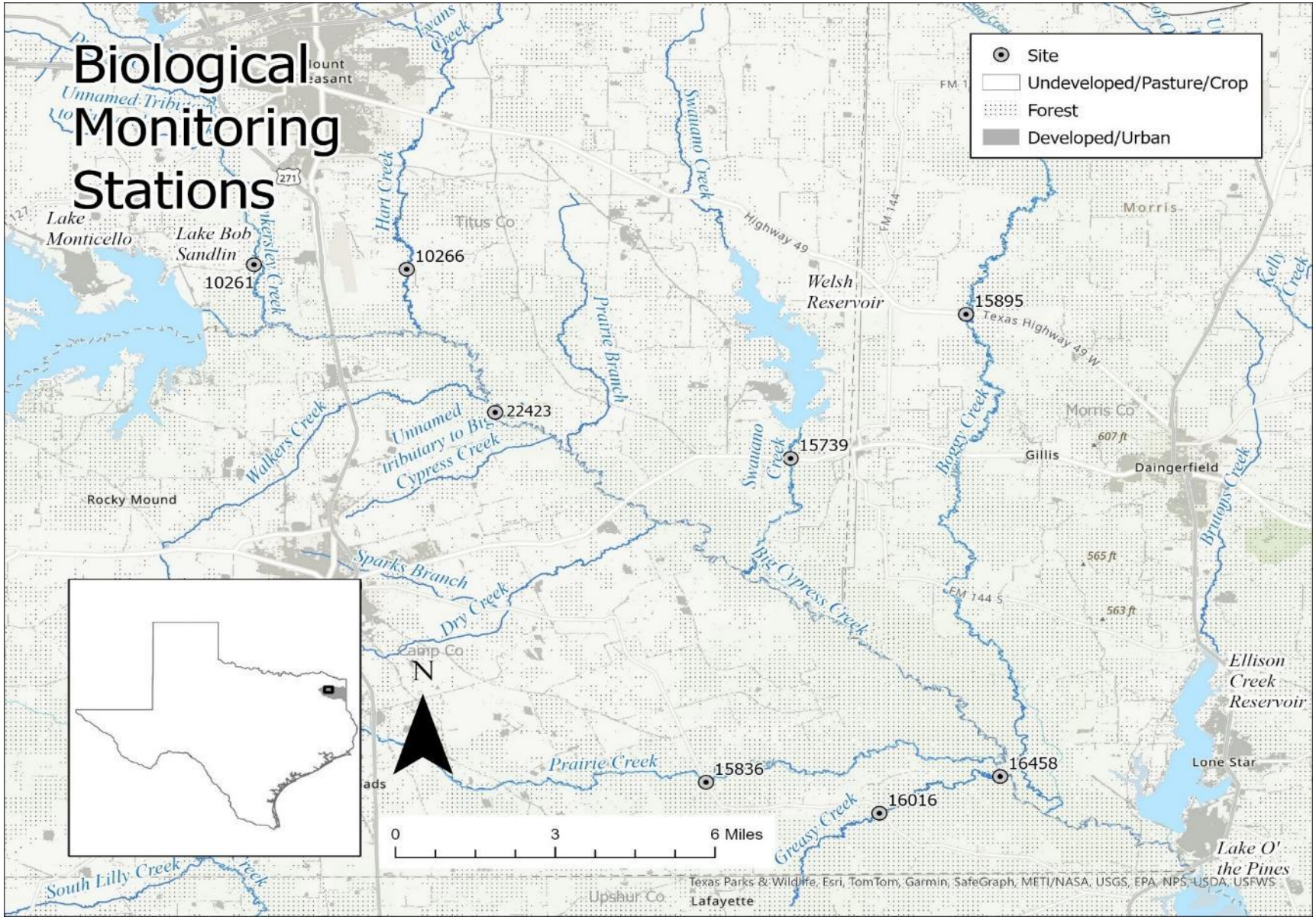

Figure 109: Map of Aquatic Life Monitoring stations, 2020 to 2024

Aquatic Life Monitoring

The NETMWD has long recognized the importance and value of biological monitoring in the Cypress Creek Basin as the fisheries of East Texas tend to be the most diverse in Texas. Aquatic Life Monitoring (ALM) consists of collecting fish using electrofishing and seining techniques, collecting benthic macroinvertebrates using dip, sweep, and kick-net techniques, measuring habitat conditions at five to six transects over the reach length, and performing stream flow and diel water quality measurements. Organisms are identified, enumerated, and evaluated using species diversity, functional feeding groups, biotic index, as well as other scoring metrics. Unless a microscope is required for identification, all fish are returned to the stream after enumeration and voucher photos are taken. Similarly, an assessment of the habitat is performed using the results of the field measurements.

The TSWQS establishes the criteria for water quality conditions that need to be met in order to support and protect designated uses as detailed in Title 30 Texas Administrative Code, Chapter 307. To evaluate support of existing Aquatic Life Uses, the TCEQ established an index period, representing the warm-weather seasons, during which most bioassessments of aquatic assemblages in freshwater river and stream systems should be conducted. Bioassessment sampling for freshwater streams must be conducted during the non-critical period of March 15 to June 30 and from October 1 to October 15. A subset of the samples should be collected during critical conditions (July 1–September 30) when maximum temperatures, minimum stream flows, and minimum dissolved oxygen concentrations typically occur in Texas streams. These data help determine whether the criteria set for the designated uses are being met and maintained when streamflow is at or above critical low flow. The assessors work under the assumption that criteria met under these conditions would also be met during other seasons when water temperature is expected to be lower, and stream flow and dissolved oxygen are higher.

The non-critical period was established to:

- Minimize year-to-year variability resulting from natural events.
- Maximize gear efficiency.
- Maximize accessibility of targeted assemblages.
- Ensure that a portion of the samples is collected during critical low-flow and temperature conditions.

The NETMWD and its contractors have performed aquatic life monitoring in numerous watersheds over the years to gain an understanding of the biological integrity of the streams within the basin. At present, over thirty water bodies have been studied since 2001. In total, 101 bioassessments have been conducted across the basin since June 2001 with almost one-third (32) of those events completed between 2020 and 2024.

Fishing is conducted using seining and electroshocking techniques. A minimum of six seine hauls of ten meters each are performed. Seining continues until no new species are collected. Woody debris, snags, Cypress knees, and logjams frequently obstruct the seine net in East Texas streams so seine hauls of less than ten meters are not uncommon. As a result, ALM studies in the Cypress Creek Basin often have more than six seine hauls.

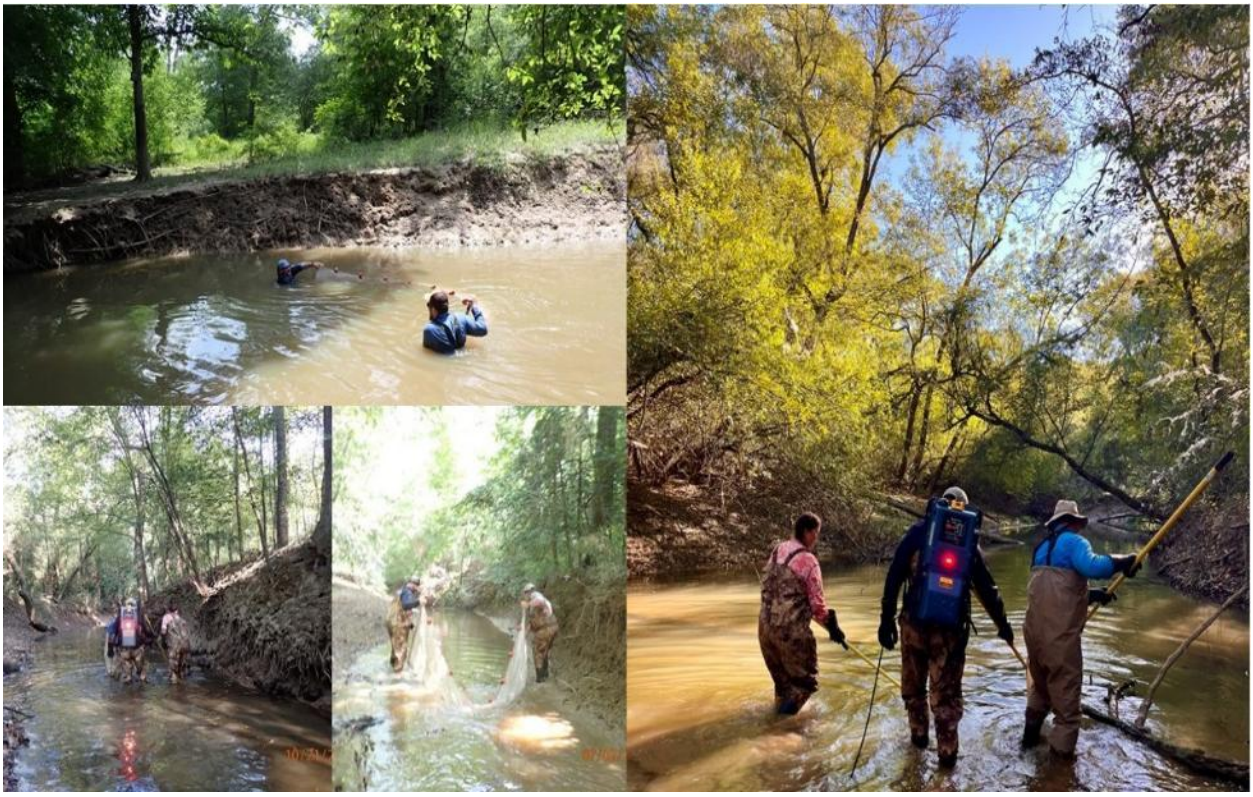

Figure 110: Collage of electrofishing and seining activities in the Cypress Creek Basin

The electroshocking method is non-lethal and is used to stun and turn fish. Shocking is performed for a minimum of 900 seconds or until no new species are collected. During collection, fish are netted and are placed in an aerated bucket until identification, enumeration, and photo-vouchering are completed.

Since 2020, ALM studies have been conducted in Segment 0404B – Tankersley Creek, 0404C – Hart Creek, 0404I – Boggy Creek, 0404J – Prairie Creek, 0404L – Swauano Creek, 0404M – Greasy Creek, 0407B – Frazier Creek, along with two stations in 0404 - Big Cypress Creek below Lake Bob Sandlin. The two Big Cypress Creek stations were 16458 below the confluence with Greasy Creek in AU 0404_01, and upstream of SH 11 at station 22423 located below the confluence with Walker Creek in AU 0404_02. These ALM studies are detailed in the *2022 Cypress Creek Basin Highlights Report* and the *2024 Cypress Creek Basin Highlights Report*.

Except for Frazier Creek and Big Cypress Creek stations 16458 and 22423, all stations were sampled four times with two events in the critical period (July 1 – September 30) and two events in the non-critical period (March 15 – June 30; October 1 – 15). Only two events were scheduled and completed for Big Cypress Creek station 16458 in 2023. Three events were conducted in Frazier Creek because the stream went completely dry in the summer of 2022. At the time of this writing, three monitoring events have been completed at station 22423 in Big Cypress Creek. A critical period ALM is currently planned for July or August 2025.

Despite being the receiving water for the Pilgrim's Pride wastewater treatment plant, Segment 0404B - Tankersley Creek monitoring yielded the most fish out of these studies with 920 individuals. However, Tankersley Creek had the fewest number of taxa with 24. In contrast, Segment 0404C - Hart Creek, the receiving stream for the City of Mount Pleasant wastewater treatment plant, had 34 taxa collected, making it the second highest number of species observed during this period.

Sampling in Prairie and Swauano creeks was postponed during the summer of 2022 due to the stream bed being completely dry with no pools observed within the sample reach. All four monitoring events in Swauano Creek were conducted in 2023. Rainfall in September 2022 reconnected Prairie Creek with Big Cypress Creek, and sampling was conducted in mid-October with the remaining three collections performed in 2023. Boggy Creek was intermittent with perennial pools during both 2022 monitoring events and had dissolved oxygen readings reported as low as 0.6 mg/L during this period. By late summer 2023, these streams all became intermittent once more. Similarly, Greasy Creek was intermittent and pooled throughout the reach during both sampling events in 2022.

Despite the streams being stagnant with extremely low dissolved oxygen or going completely dry, the fishery recovered quickly once they reconnected with Big Cypress Creek. Boggy and Greasy creeks supported 30 and 29 fish taxa, respectively, while Prairie and Swauano had 29 and 26 species. Except for Swauano Creek, all streams scored in the High Aquatic Life Use (ALU) category.

Combined, a total of 5,158 individuals representing 55 fish species were collected. On average, 573 individuals were captured in each stream. The most frequently collected species were bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), western blacktail shiner (*Cyprinella venusta*), and western mosquitofish (*Gambusia affinis*). These four species represented 43 percent of the total individuals captured through electrofishing and seining techniques combined. Please see the Appendices for a full taxa list by station.

2020 to 2024 Fish Sampling Results				
Stream	**Station**	**# Taxa**	**# Individuals**	**ALU**
Big Cypress Creek*	16458	28	265	High
Big Cypress Creek**	22423	36	657	High
Boggy Creek	15895	30	667	High
Frazier Creek**	10259	25	279	High
Greasy Creek	16016	29	414	High
Hart Creek	10261	34	669	High
Prairie Creek	15836	29	687	High
Swauano Creek	15739	26	600	Intermediate
Tankersley Creek	10266	24	920	High
** 2 events*	**Totals**	**55**	**5,158**	
*** 3 events*	**Mean**	**29**	**573**	

Table 42: Fish sampling results, 2020 to 2024

It should be noted that darters are the most imperiled group of North American fishes, with roughly one-third of all darters in some degree of decline (Boschung and Mayden, 2004; Walsh et al., 2011). Darter species richness varies greatly among river basins and has decreased in their relative proportion of species richness in Texas streams by more than half since 1953 (Anderson *et al.*, 1995). Relative abundance of invertivorous species decreases with degradation, possibly in response to variability in the invertebrate food supply, which in turn reflects alterations of water quality, energy sources, and/or instream habitat (Karr *et al*., 1986). For these reasons, careful attention should be paid to this group of fishes due to their present abundance and sensitivity to water quality impairments and habitat disturbance.

Ten darter taxa were collected during these ALM events with a total of 251 individuals. The logperch (*Percina caprodes*) was the most captured darter representing half of all darters collected in these studies at 127 total individuals. Surprisingly, the greatest number of darter individuals (91) were collected in Boggy Creek despite being intermittent with very low oxygen concentrations during half of the sampling events. Three darter species were collected in Boggy Creek including 85 logperch, four slough darters (*Etheostoma gracile*), and two bluntnose darters (*Etheostoma chlorosomum*). The second highest number of darter individuals was found in Tankersley Creek with 51 from five taxa. Of note, two harlequin darters (*Etheostoma histrio*) were collected in this stream. Although nine other individuals were reported in SWQMIS, harlequin darters are not regularly captured in the basin. This species prefers water of fairly high quality, so they were not anticipated to be found in this stream. Four other darter taxa were collected in Tankersley Creek including the three bluntnose, sixteen dusky (*Percina sciera*), 21 logperch, and nine slough darters.

Station 22423 in Big Cypress Creek has a prolific and diverse darter population with six taxa collected during the October 2024 ALM alone. This station had the most darter species at eight with 25 individuals collected over the course of three sampling events. The taxa collected included the redspot darter (*Etheostoma artesiae*), mud (*Etheostoma asprigene*), bluntnose, slough, harlequin, blackside (*Percina maculata*), and dusky darters along with logperch.

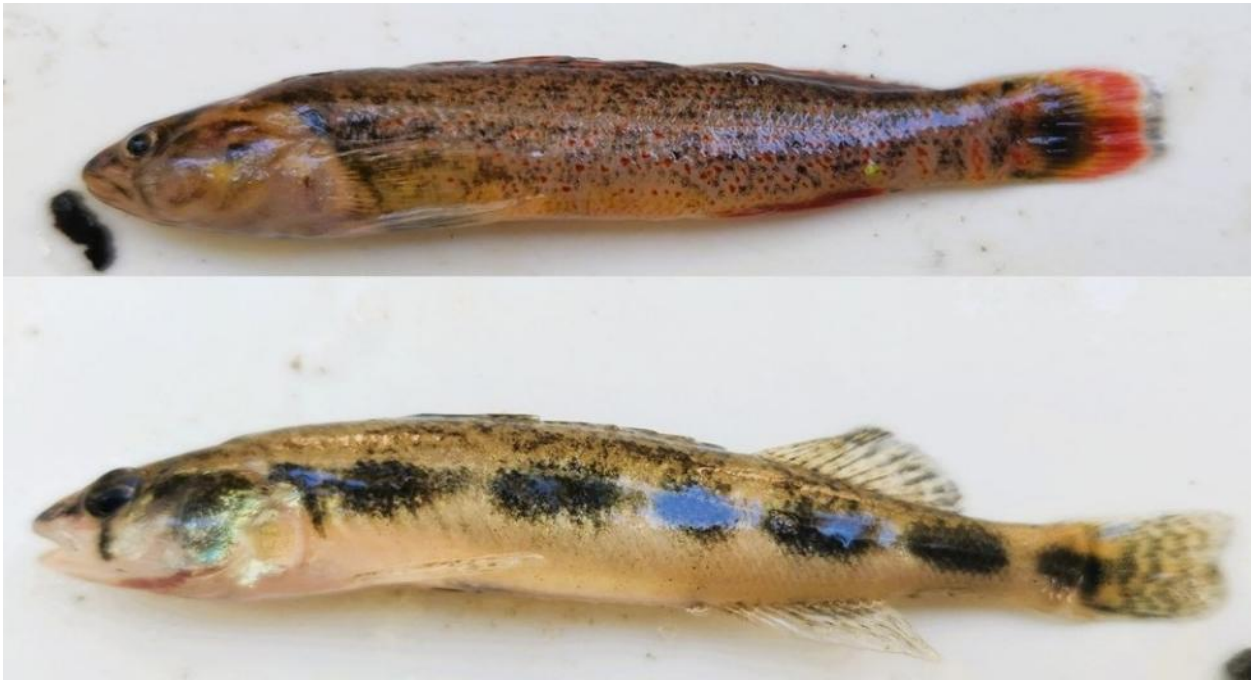

Figure 111: Voucher photos of redspot darter, Etheostoma artesiae (top) and blackside darter, Percina maculata (bottom)

This was the first reported collection of a redspot darter for the basin in SWQMIS; however, this species has been collected by TPWD and other researchers. Fifteen blackside darters have been recorded in SWQMIS including one found in Walkers Creek in 2000. The other individuals were captured in Frazier Creek and James' Bayou in the early 2000s. It should be noted that the blackside darter is listed as a "Species of Greatest Conservation Need" by TPWD and that all individuals were returned unharmed to the stream after identification and photo vouchering.

As an aside, Dr. Carmen Montana at Stephen F. Austin State University conducted surveys of fish communities at five sites in or associated with Big Cypress Creek in southeastern Camp County on September 17 and 18, 2021. Overall, 439 individuals of 35 fish species were collected including the ironcolor shiner (*Notropis chalybaeus*), a species of greatest conservation need.

Due to the low prevalence of riffles in East Texas streams, benthic macroinvertebrates are most often collected using a five-minute kicknet technique using a D-frame net. The kicknet technique consists of sweeping the net for five minutes over habitat such as aquatic macrophytes, overhanging vegetation, root mats, undercut banks, leaf packs, and woody debris. The sample is

placed on a sorting tray and up to 210 invertebrates are collected and placed in ethanol. The organisms are then identified and enumerated in the laboratory. In cases where fewer than 100 organisms are collected, the kicknet technique is repeated for another five minutes. If the sample size is still inadequate, then snag sampling is conducted which involves searching for organisms attached to woody debris such as logs and limbs.

Once collected, these data are processed and scored using a set of metrics specific to the ecoregion where the stream is located. Until recently, benthic analysis was also scored using statewide metrics. Recently, regionalized metrics for benthic analysis have been developed. Occasionally, regionalized benthic scores have been lower than statewide, however, both the regionalized and statewide scores generally fell within the same ALU category.

Figure 112: Benthic macroinvertebrate sampling (left) and habitat measurements (right)

Bioassessments of benthic organisms often fall into the Intermediate category in the Cypress Creek Basin (Crowe and Bayer, 2005, Rogers and Harrison, 2007). One might infer that impaired water quality is negatively affecting benthic diversity; however, the benthic population is diverse with over 285 species collected in the basin. Impaired water quality that negatively affects the benthic community should also negatively impact the fish community. Biological monitoring results indicate this is not the case in the Cypress Creek Basin. Rather, scoring metrics along with other factors may not accurately reflect the benthic populations in the basin.

It should be noted that high flow events, also referred to as scouring events, can negatively affect benthic populations. These disturbances can redistribute the organisms which may take several days to weeks to become reestablished in the stream. Further, aquatic insects typically complete

two to three stages of their life cycle (egg, nymph or larvae, pupae) in the water prior to emergence as a terrestrial species. Due to this process, immature insects may not be abundant during certain times of year. Most insects emerge as adults during the late spring and summer before returning to lay eggs. As a result, the absence or low abundance of these species may be due to their life cycle stage rather than an indication of water quality conditions.

Habitat analysis includes the measurement of stream width, depth, bank slope, and tree canopy at five to six transects throughout the stream reach. Observations such as bed substrate type(s), channel sinuosity, erosion potential, instream cover, riparian vegetation, and riparian buffer width are also recorded. Habitat is scored using statewide metrics.

The average habitat score of the entire basin is on the borderline of Intermediate and High. Some components of the statewide habitat assessment metrics include the number of riffles, substrate type, and emergent vegetation. Many streams in the basin will have an artificially reduced habitat score due in part to these metrics (Crowe and Hambleton, 1998). Most perennial streams in East Texas function as glide/pool rather than as riffle/run systems. Streams typically have low velocity and due to the murkiness of the water, it is often difficult to determine where a pool begins and ends without making stream width and depth measurements. Riffles are uncommon and are mostly found in the western portion of the basin. When riffles are present, they are usually found in small, intermittent streams that often become completely dry without pools during extended periods without rainfall.

Riffles and emergent vegetation are important to support diverse biota. An ecoregion-specific habitat assessment would better describe streams within the Cypress Creek Basin especially when considering that the least impacted reference sites should represent realistic, attainable conditions for aquatic ecosystems (Omernik, 2014).

Although it is not uncommon to find aquatic plants along stream margins, due to the high turbidity, erosional sediments, and heavy tree canopy, emergent macrophytes are seldom encountered within the stream channel. Even though the riparian zone may be natural and show few, if any, signs of human impact, the habitat may still score in the Intermediate range. For example, Frazier Creek is considered an ecoregion reference stream and has been classified as a “Least Disturbed Stream” (Bayer *et al*., 1992; Linam *et al*., 2002). Due to these designations, one would expect HQI scores for Frazier Creek to be in the High or Exceptional categories. However, the average habitat score was 14.5 (Intermediate) from the three monitoring events in 2022 and 2023.

Conclusions and Recommendations

The 2024 Texas Integrated Report 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 §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 *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.

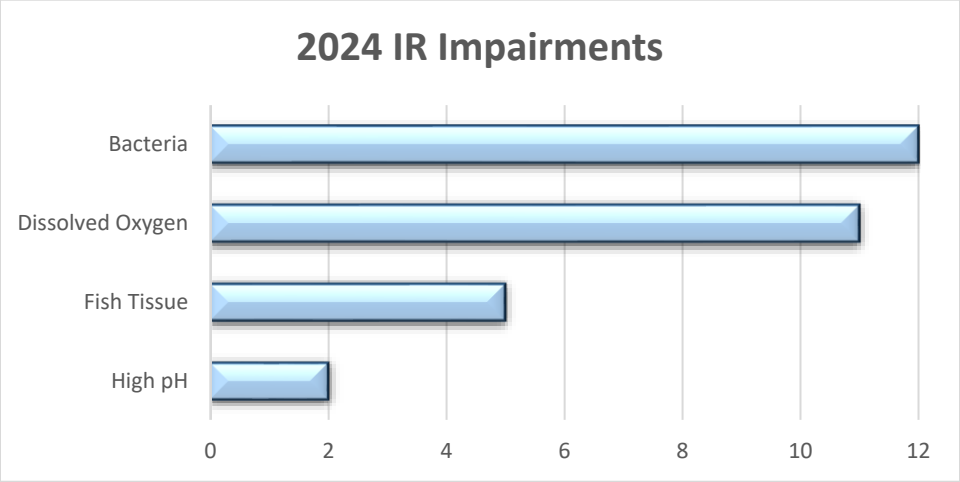

Figure 113: Number of impairments by segment from the 2024 IR

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 DO 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 DO 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 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 TMDL, 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.

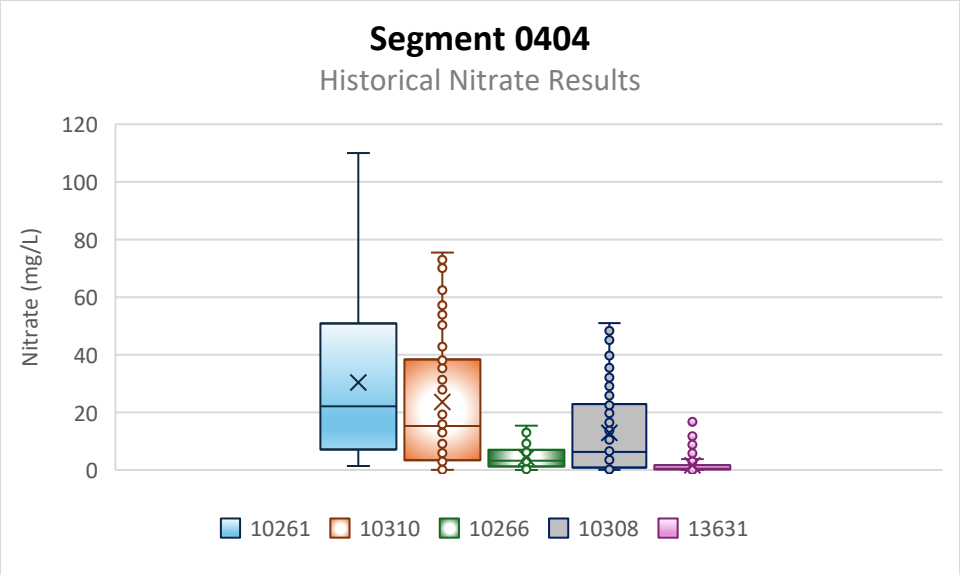

Figure 114: Segment 0404 historical nitrate results

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.

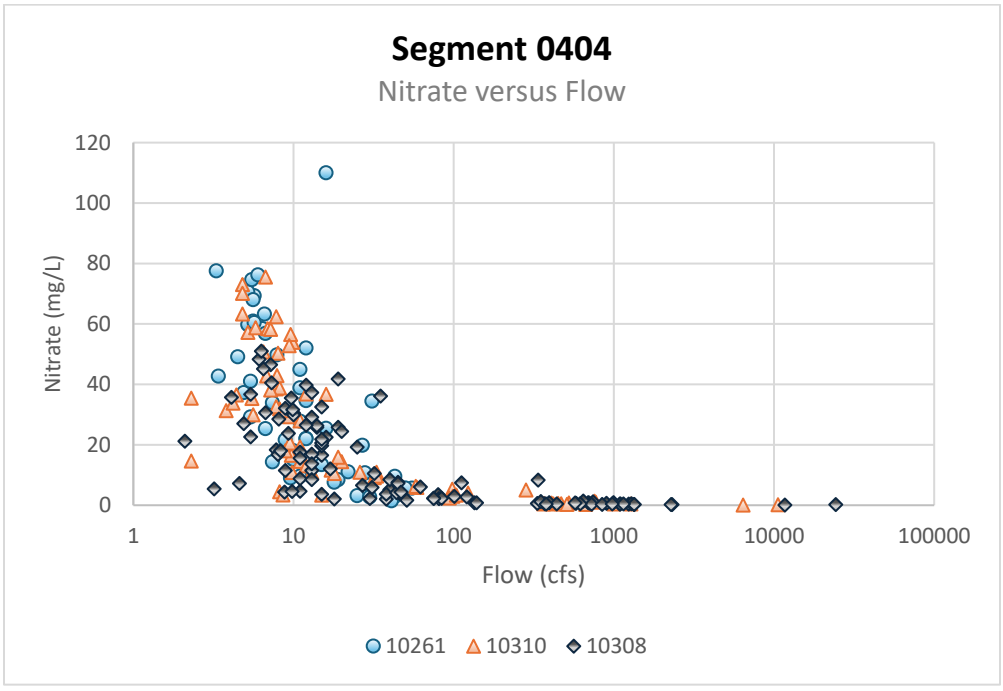

Figure 115: Segment 0404 nitrate versus flow

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 in Big Cypress Creek were also found at flows less than 15 cfs.

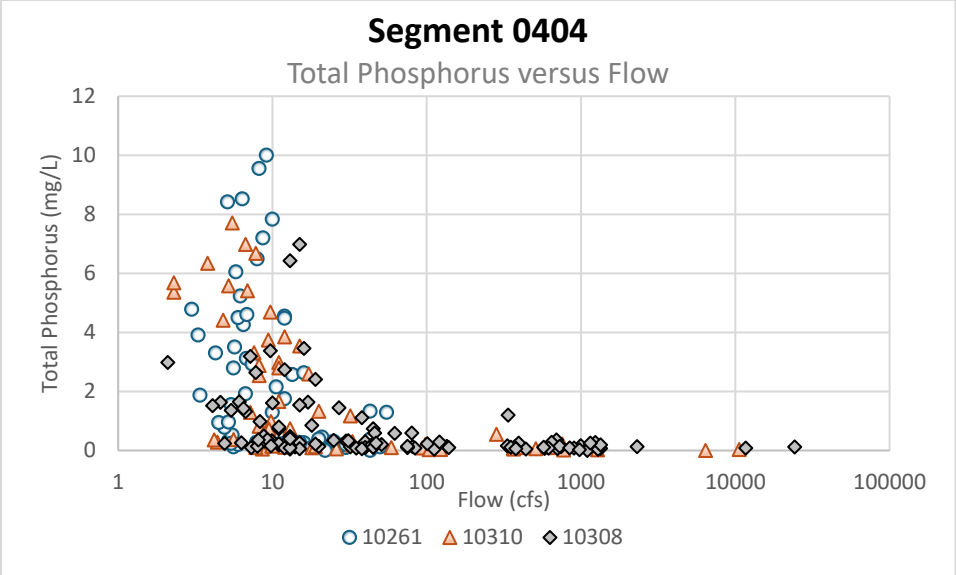

Figure 116: Segment 0404 total phosphorus versus flow

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.

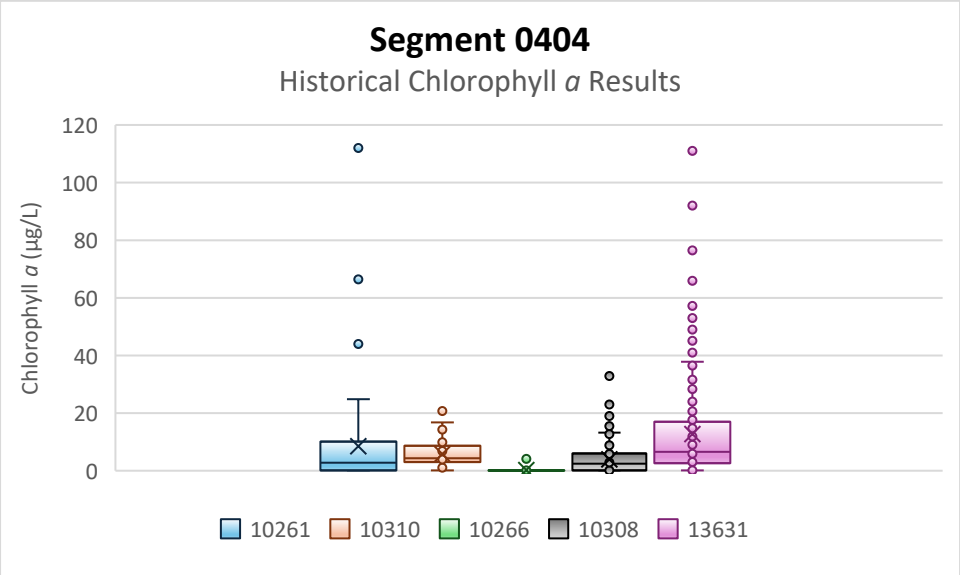

Figure 117: Segment 0404 historical chlorophyll a results

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.

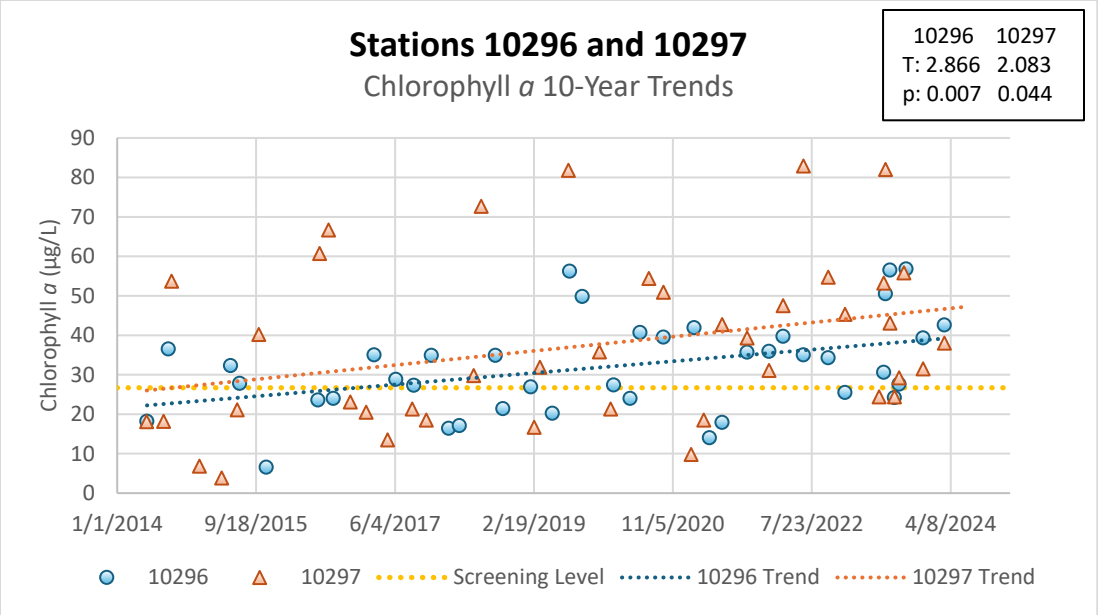

Figure 118: Increasing chlorophyll a trends at stations 10296 and 10297 in Lake O' the Pines

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.

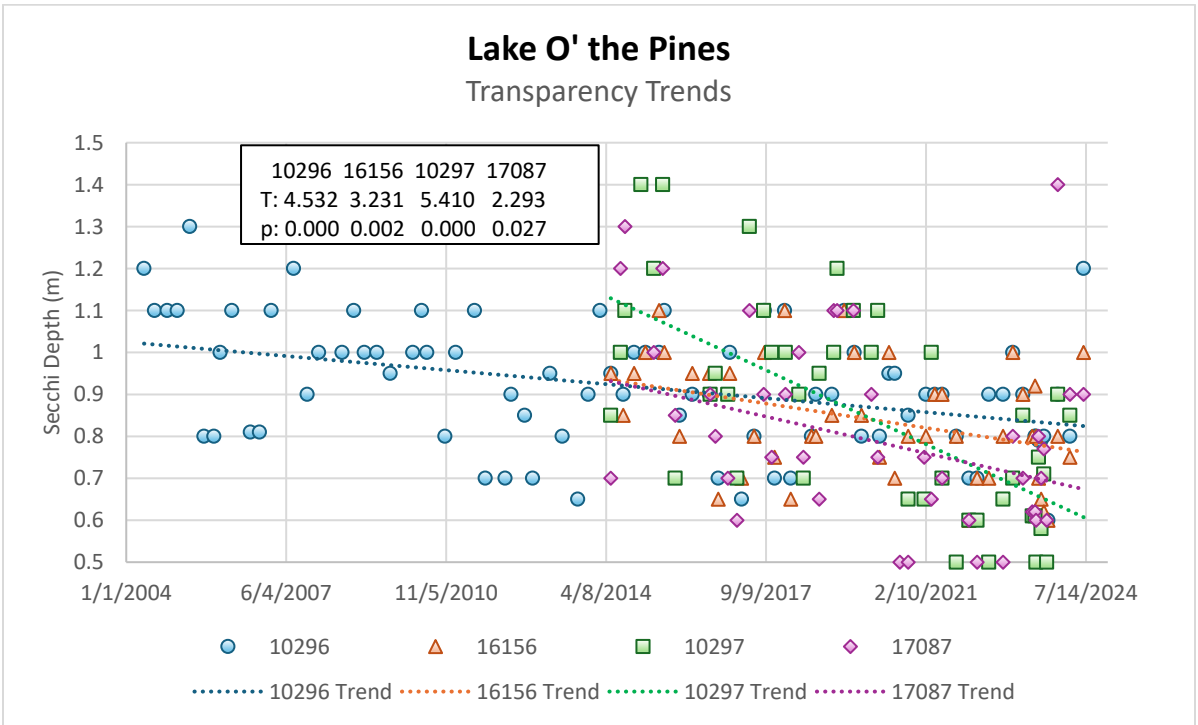

Figure 119: Decreasing transparency trends in Lake O' the Pines

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.

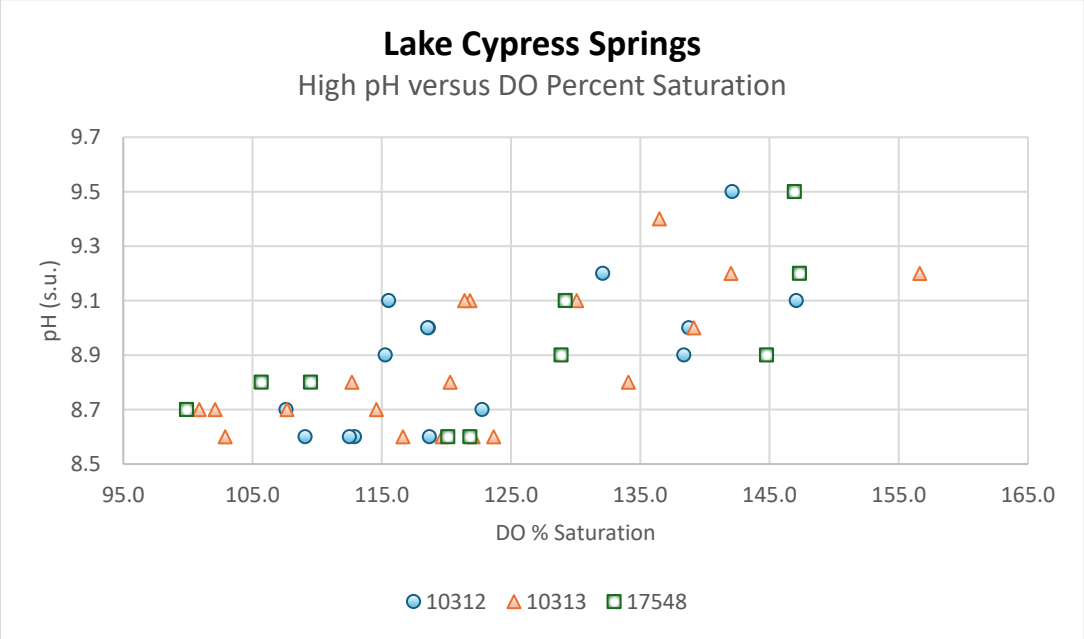

Figure 120: High pH readings versus DO percent saturation in Lake Cypress Springs

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.

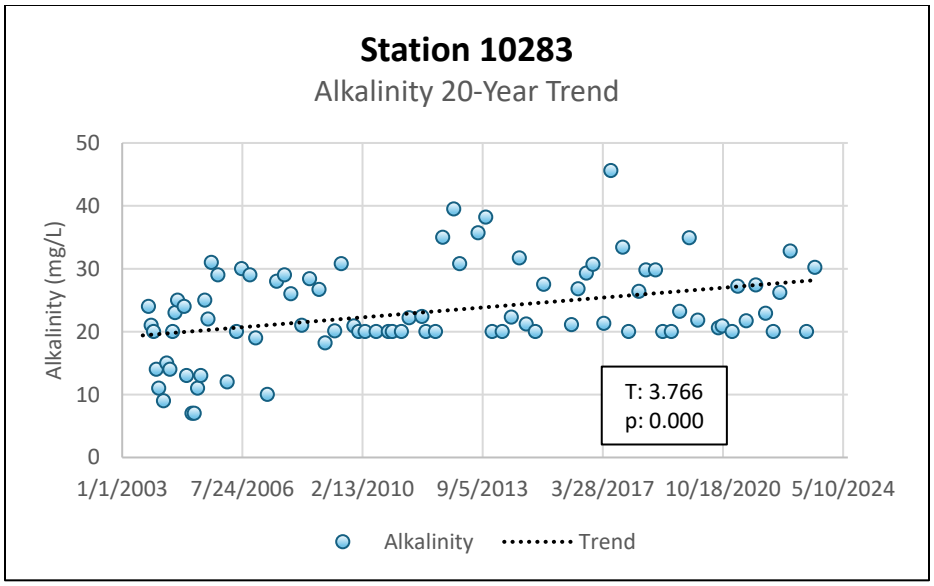

Figure 121: Increasing 20-year alkalinity trend at station 10283 in Caddo Lake

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 s.u. (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 whether 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.

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Appendices

Segment	Station	Parameter	Trend	Type	n	T-stat	p-value	R^2	Skewness	Kurtosis
0405	10313	Chloride	Decreasing	20 Years	80	3.008	0.004	0.104	0.835	1.614
		Sulfate	Decreasing	20 Years	79	4.422	0.000	0.203	1.927	0.324
		Secchi	Decreasing	Historical	116	3.997	0.000	0.123	0.347	1.690
0408	AU_01	Alkalinity	Increasing	Historical	90	9.049	0.000	0.482	0.220	0.601
		Chloride	Decreasing	20 Years	66	4.912	0.000	0.274	0.073	1.473
		Sp. Cond.	Decreasing	20 Years	69	2.809	0.006	0.105	1.396	1.152
		Sulfate	Decreasing	20 Years	68	4.136	0.000	0.206	0.330	2.092
	10329	Secchi	Decreasing	10 Years	38	3.025	0.005	0.203	0.563	0.730
		TKN	Decreasing	10 Years	35	3.186	0.003	0.235	0.263	1.012
	16158	Alkalinity	Increasing	Historical	90	9.049	0.000	0.482	0.220	0.601
		Chloride	Decreasing	20 Years	71	3.714	0.000	0.167	0.401	1.343
		Sulfate	Decreasing	20 Years	73	3.036	0.003	0.115	0.687	2.020
		Secchi	Decreasing	10 Years	38	3.025	0.005	0.203	0.563	0.730
		TKN	Decreasing	10 Years	35	3.186	0.003	0.235	0.263	1.012
0404	10308	TKN	Decreasing	10 Years	75	4.353	0.000	0.206	1.006	0.290
	13631	TKN	Decreasing	10 Years	55	3.265	0.002	0.167	1.564	0.142
0404A	14473	Sp. Cond.	Decreasing	Historical	68	2.724	0.008	0.102	0.541	0.024
		DO	Increasing	Historical	67	3.918	0.000	0.189	1.873	0.892
		Secchi	Decreasing	10 Years	31	3.296	0.003	0.273	1.529	0.345
0404B	10261	Alkalinity	Increasing	10 Years	39	2.204	0.034	0.116	1.639	0.326
		pH	Increasing	10 Years	67	3.660	0.001	0.171	1.657	0.335
0404C	10266	Alkalinity	Increasing	10 Years	37	3.192	0.003	0.225	0.111	0.623
		Secchi	Decreasing	10 Years	55	3.258	0.002	0.167	0.856	0.047

(n = number of observations)

Segment	Station	Parameter	Trend	Type	n	T-stat	p-value	R^2	Skewness	Kurtosis
0403	10296	Chl. *a*	Increasing	10 Years	40	2.866	0.007	0.178	0.873	0.107
		Sulfate	Decreasing	20 Years	80	6.071	0.000	0.321	1.782	1.233
		Secchi	Decreasing	20 Years	81	4.532	0.000	0.206	0.500	0.797
		TOC	Decreasing	10 Years	39	3.019	0.005	0.198	1.168	0.015
	16156	Sp. Cond.	Decreasing	20 Years	82	3.100	0.003	0.107	1.036	0.390
		Sulfate	Decreasing	Historical	102	6.680	0.000	0.309	1.590	0.523
		Secchi	Decreasing	10 Years	46	3.232	0.002	0.192	0.378	1.104
		TOC	Decreasing	10 Years	37	2.357	0.024	0.137	0.853	0.360
		TKN	Decreasing	10 Years	41	2.109	0.041	0.102	0.653	1.241
	10297	Alkalinity	Increasing	20 Years	77	4.155	0.000	0.187	0.034	0.303
		Chl. *a*	Increasing	10 Years	41	2.083	0.044	0.100	1.592	0.473
		Secchi	Decreasing	10 Years	44	5.410	0.000	0.411	1.064	0.778
	17087	DO	Increasing	10 Years	45	2.851	0.007	0.159	1.530	0.479
		pH	Increasing	10 Years	45	3.587	0.001	0.230	1.370	0.809
		Secchi	Decreasing	10 Years	45	2.293	0.027	0.109	1.450	0.214
0402	15511	Alkalinity	Increasing	20 Years	76	3.295	0.002	0.128	0.585	0.151
0402E	16934	pH	Decreasing	10 Years	45	2.509	0.016	0.128	1.351	2.087
0409	10332	Secchi	Decreasing	10 Years	39	4.391	0.000	0.343	1.975	0.100
		TP	Decreasing	10 Years	37	2.612	0.013	0.163	1.595	0.014
		TOC	Decreasing	10 Years	37	2.614	0.013	0.163	1.961	0.822
	16017	Nitrate	Decreasing	10 Years	39	2.204	0.034	0.116	0.175	0.791
0409B	17954	DO	Decreasing	10 Years	35	2.129	0.041	0.121	0.612	1.308
0409D	17478	Sp. Cond.	Decreasing	20 Years	88	3.093	0.003	0.100	0.847	0.002
	18825	Sp. Cond.	Decreasing	20 Years	84	3.611	0.001	0.137	0.849	0.033
0410	10247	Secchi	Decreasing	10 Years	50	2.687	0.010	0.131	1.058	0.473
0401	10283	Alkalinity	Increasing	20 Years	87	3.766	0.000	0.143	0.889	1.098
	15249	Chloride	Decreasing	20 Years	88	3.109	0.003	0.101	1.515	0.167
0401A	15508	Sp. Cond.	Decreasing	20 Years	42	3.120	0.003	0.196	0.181	0.558
0406	10314	DO	Increasing	20 Years	69	3.160	0.002	0.130	1.306	0.814
		TKN	Decreasing	10 Years	23	4.059	0.001	0.440	1.504	0.090

Fish Taxa List by Station 2020 - 2024

Common Name	Scientific Name	16458	10266	15895	15836	15739	16016	10259	10261	22423	Total
banded pygmy sunfish	*Elassoma zonatum*							1			1
bantam sunfish	*Lepomis symmetricus*		1								1
black bullhead	*Ameiurus melas*		4		4	5					13
black crappie	*Pomoxis nigromaculatus*	1	4	7	1		6		2	5	26
blackside darter	*Percina maculata*									3	3
blackspot shiner	*Notropis atrocaudalis*	1	15	2			6				24
blackstripe topminnow	*Fundulus notatus*	20	41	80	27	12	45	31	29	24	309
bluegill	*Lepomis macrochirus*	22	43	182	94	143	44	9	47	34	618
bluntnose darter	*Etheostoma chlorosomum*	2		2	10		6	7	3	4	34
bowfin	*Amia calva*							1			1
brook silverside	*Labidesthes sicculus*			1		1					2
bullhead minnow	*Pimephales vigilax*	11	106		18	5	20		162	60	382
channel catfish	*Ictalurus punctatus*	3	1	3	1		2		58	15	83
common carp	*Cyprinus carpio*			1		2					3
creek chub	*Semotilus atromaculatus*					1					1
cypress darter	*Etheostoma proeliare*	2	1		3						6
dusky darter	*Percina sciera*		2				2	3	16	2	25
fathead minnow	*Pimephales promelas*	1	3		1		1				6
flathead catfish	*Pylodictis olivaris*	1	1							3	5
flier	*Centrarchus macropterus*		4	2	12			2		8	28
freckled madtom	*Noturus nocturnus*			1	2		1	1		1	6
gizzard shad	*Dorosoma cepedianum*	3		7		37	7			4	58
golden shiner	*Notemigonus crysoleucas*				39	1	14	1	2		57
green sunfish	*Lepomis cyanellus*		10	7	8	11	3		15	9	63
harlequin darter	*Etheostoma histrio*								2	10	12
inland silverside	*Menidia beryllina*	6		49		1	3			2	61
largemouth bass	*Micropterus salmoides*	8	4	4	26	7	2	3	83	8	145
logperch	*Percina caprodes*	3	1	85	12		2	2	21	1	127
longear sunfish	*Lepomis megalotis*	15	81		44	30	73	26	65	97	431

Common Name	Scientific Name	16458	10266	15895	15836	15739	16016	10259	10261	22423	Total
mimic shiner	*Notropis volucellus*									1	1
mud darter	*Etheostoma asprigene*	1	1				1			1	4
orangespotted sunfish	*Lepomis humilis*				5					1	6
pirate perch	*Aphredoderus sayanus*	14	12	23	29	17	23	30	4	7	159
pugnose minnow	*Opsopoeodus emiliae*				2						2
red shiner	*Cyprinella lutrensis*		23	19		27	41	13		9	132
red spotted	*Lepomis miniatus*	1	6	1	1	2	1	2		3	17
redear sunfish	*Lepomis microlophus*	3	5	5	173		54	2		59	301
redfin darter	*Etheostoma whipplei*		2								2
redfin pickerel	*Esox americanus*	2	14	4	8	1	4	16	1	9	59
redfin shiner	*Lythrurus umbratilis*		24		2	6		54			86
redspot darter	*Etheostoma artesiae*									1	1
ribbon shiner	*Lythrurus fumeus*	19	70	28	75	46	16	51	10	87	402
slough darter	*Etheostoma gracile*		5	4		1	2	13	9	3	37
spotted bass	*Micropterus punctulatus*									2	2
spotted gar	*Lepisosteus oculatus*	2		2		1			4		9
spotted sucker	*Minytrema melanops*	2	2	1	1	6	1	1	1		15
striped shiner	*Luxilus chrysocephalus*							3			3
tadpole madtom	*Noturus gyrinus*		3	1					1	5	10
threadfin shad	*Dorosoma petenense*	1									1
W. blacktail shiner	*Cyprinella venusta*	99	128			15			343	125	710
W. mosquitofish	*Gambusia affinis*	18	25	87	69	198	27	3	24	23	474
warmouth	*Lepomis gulosus*	3	6	31	2	7	1	1		3	54
weed shiner	*Notropis texanus*	1		9	3					12	25
white crappie	*Pomoxis annularis*		1	1					5		7
yellow bullhead	*Ameiurus natalis*		20	18	15	17	6	3	13	16	108
	Total	**265**	**669**	**667**	**687**	**600**	**414**	**279**	**920**	**657**	**5158**
	Taxa	28	34	30	29	26	29	25	24	36	**55**