

2022 Annual Water Quality Report

Leon County Public Works Division of Engineering Services

Prepared Under the Direction of Johnny Richardson Water Resource Scientist

December 2022

(Water Quality Data collected through December of 2021)

In continuing the County's commitment to environmental stewardship, LeonCountyWater.org, a one-stop water resources website, answers the most common and important questions about local water bodies, describes the regulations in place to protect water bodies from harmful development and educates the public on strategies to reduce personal pollution impacting water bodies.

Visit Leon County's one-stop water resources website to:

- See important and timely health advisories such as fish kills, algal blooms and boil water notices.
- Learn about the health of our County's many precious water bodies and the actions of our County team to preserve them.
- Review regulations in place that protect our water bodies from harmful development.
- Discover ways to reduce personal pollution affecting our water quality.



TABLE OF CONTENTS

BASINS

1. Bird Sink Basin		5
Waterbody: Nort	theast Black Creek	6
2. Fisher Creek Bas	sin	13
Waterbody: Fishe	er Creek	14
3. Lake Iamonia Ba	sin	17
Waterbody: Lake	e Iamonia	18
Waterbody: Plant	tation Stream	22
Waterbody: Tall	Timbers Creek	26
4. Lake Jackson Bas	sin	29
Waterbody: Jacks	son Heights Creek	30
Waterbody: Lake	e Carr	34
Waterbody: Lake	e Hall	
Waterbody: Lake	e Jackson	40
Waterbody: Lexi	ington Creek	43
Waterbody: Meg	ginnis Creek	49
Waterbody: Sum	nmer Creek	53
5. Lake Lafayette B	Basin	56
Waterbody: Alfor	ord Arm Creek	57
Waterbody: Apal	lachee Creek	61
Waterbody: Lafa	yette Creek	64
Waterbody: Lake	e Lafayette	69
Waterbody: Nort	theast Drainage Ditch	
Waterbody: Unna	amed Stream at Chaires Crossroad	
6. Lost Creek Basin	l	
Waterbody: Lost	Creek	
7. Lake Miccosukee	e Basin	
Waterbody: Lake	e Miccosukee	
Waterbody: Pantl	her Creek	
8. Lake Munson Ba	ISIN	
Waterbody: Gum		
Waterbody: Lake		110
Waterbody: Lake	e Cascade	
Waterbody: Lake	e Hiawaina	121
Waterbody: Lake	e Munson	121
• Ochlockonce Di	ISON Slough	120 125
9. UCHIOCKOHEE KI Watarbady: Eraa	wer Basili	135 126
Waterbody: Here	ver Creek	130
Waterbody I ale	- Talquin	139 1/17
Waterbody Och	lockonee River	1 4 2
wateroouy. Oem		143

Waterbody: Polk Creek	151
Waterbody: Soapstone Creek	155
Waterbody: West Black Creek	159
Patty Sink Basin	
Waterbody: Patty Sink Drain	164
St. Marks River Basin	167
Waterbody: Chicken Branch	168
Waterbody: Lake Weeks	172
Waterbody: Louvinia Creek	174
Waterbody: St. Marks River	
	Waterbody: Polk Creek Waterbody: Soapstone Creek Waterbody: West Black Creek Patty Sink Basin Waterbody: Patty Sink Drain St. Marks River Basin Waterbody: Chicken Branch Waterbody: Lake Weeks Waterbody: Louvinia Creek Waterbody: St. Marks River

1.Bird Sink Basin

Waterbody: Northeast Black Creek



Basin: Bird Sink

Northeast Black Creek is a tannic, acidic, predominantly nitrogen-limited stream located in northeastern Leon County. The stream forms near Centerville Road and the Chemonie Plantation subdivision and flows southeast through the Miccosukee Land Cooperative before crossing under Capitola Road. The creek then turns northeast to join Still Creek and then flows into Bird Sink.

As shown in the following pie chart, approximately 31% of the 15,783-acre watershed is comprised of urban, agriculture/rangeland, transportation, and utilities land uses. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Due to ongoing beaver activity, station BC1 is no longer sampled. Leon County staff continue to evaluate the hydrological and plant community changes that are occurring in this section.

Methods

Surface water samples were collected to determine the health of Northeast Black Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, four temporally independent samples per year are required to be collected to fulfill data requirements for the Numeric Nutrient Criteria (NNC) thresholds. Unfortunately, due to stagnant streamflow conditions not suitable for sampling, collecting the amount of data required by FDEP has been difficult (Tables 1 and 2). The NNC (based on a geometric mean) has never been exceeded during the period of record.

For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus or total nitrogen. Elevated nutrient values during the 2nd

quarter of 2020 and the 3rd quarter of 2021 were the result of localized rainfall events that occurred before the sampling events. The associated runoff pushed nutrient laden material into the stream, causing a temporary increase in nutrients.

Table 1. FDEP's total phosphorus criteria for streams applied to Northeast Black Creek. Due to conditions not suitable for sampling, the state Numeric Nutrient Criteria data requirements could not always be calculated for stations during the period of record.

Northeast	Instream Protection Criteria TP							
Black	(0.18 mg/L)							
Creek								
Year	BC1	BC1 BC2M BC3 BC4						
2006	-	-	-	-				
2007	0.18	-	-	-				
2008		-	-	-				
2009	0.08	-	0.07	0.06				
2010	0.08	-	-	-				
2011-2012	-	-	-	-				
2013	0.08	0.09	0.07	0.07				
2014	-	-	-	-				
2015	-	-	0.06	-				
2016-2017	-	-	-	-				
2018	-	-	0.07	0.03				
2019	-	-	-	-				
2020	-	0.08	-	-				
2021	-	-	-	-				

Table 2. FDEP's total nitrogen criteria for streams applied to Northeast Black Creek. Due to conditions not suitable for sampling, the state Numeric Nutrient Criteria data requirements could not always be calculated for stations during the period of record.

Northeast Black	Instream Protection Criteria TN (1.03 mg/L)						
Сгеек							
Year	BC1	BC2M	BC3	BC4			
2006	0.36	-	-	-			
2007	-	-	-	-			
2008	-	-	-	-			
2009	0.27	-	0.69	0.72			
2010	0.41	-	-	-			
2011-2012	-	-	-	-			
2013	0.40	0.71	0.61	0.47			
2014	-	-	-	-			
2015	-	-	0.66	-			
2016-2017	-	-	-	-			
2018	-	-	0.64	0.68			
2019	-						
2020	-	0.78	-	-			
2021	-	-	-	-			

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples collected over a thirty-day period was exceeded several times at stations BC2M, BC3 and BC4 (Figure 3). Based on anthropogenic land use, FDEP considers the exceedances possibly the result of residential development in the watershed (e.g., improperly functioning septic tanks). Other causes could be wild animals and/or agriculture.

Dissolved Oxygen

As Figure 4 shows, Northeast Black Creek stations occasionally did not meet the Class III criteria for dissolved oxygen (DO). Staff believes that this is a natural condition for this location, since the creek is a low gradient blackwater stream that drains wetlands.

Biochemical Oxygen Demand (BOD)

BOD levels were elevated at stations BC2M (5.5 mg/L) and BC3 (3.0 mg/L) during the 2^{nd} quarter sampling event in 2021. Other water quality parameters taken at station BC3 were typical of the stream, so it is unknown why the BOD level was elevated. However, along with an elevated BOD level at station BC2M, the pheophytin result (31.1 µg/L) was elevated at the station as well. Pheophytin (a degradation product of chlorophyll) can contribute to higher levels of BOD.

Stream Condition Index and Habitat Assessment

The Habitat Assessment Scores for stations BC2M (128) and BC3 (126) were in the Suboptimal/Optimal category while station BC4 (106) was in the Suboptimal category (Table 3). The Stream Condition Index (SCI) scores (Table 4) for stations BC2M (66), BC3 (51), and BC4 (52) indicate the presence of a stream biological community that is healthy.

Station BC2M

The results of the Habitat Assessment score (128) for station BC2M characterize the stream habitat between the high-Suboptimal to low-Optimal categories, with the score being influenced by substrate availability and areas with high bank angles, particularly in the bends. The SCI score (66) is the average of scores from the two independently sorted vials and translates to the high end of the Healthy category. For comparison, the previous sample event completed in November of 2018 scored 69 which is on the low end of the Exceptional category. During the March 2021 sample event, vial 1 scored within the Healthy category, while vial 2 scored within the Exceptional category. No taxa dominance was expressed in either vial, or in the sample as a whole. Within both vials (294 macroinvertebrates sorted), the most numerous taxa were the freshwater clam *Musculium* sp. (34), and the blackfly *Simulium ubiquitum* (36).

From the total taxa collected, nine are listed as sensitive taxa by the FDEP while three are listed as very tolerant. The Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa (EPT) are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. The EPT score for the station is five. No Plecoptera or Ephemeroptera taxa were noted in the SCI. However, the Trichoptera were represented by five species: three Leptoceridae (*Oecetis nocturna, Oecetis* sp. E and *Triaenodes ignita*), one Hydropsychidae (*Cheumatopsyche* sp.) and one Hydroptilidae (*Oxyethira* sp.). For reference, the EPT score in 2018 was four.

No long-lived taxa were noted in the 2021 SCI and only one long-lived taxa (a crayfish) was noted as present in the 2018 SCI. From observation over the years, this station is the first within the monitoring sites on East Black Creek to go dry in drought, especially during late-spring dry periods. Over the past five years the channel has been dry at least once in every year, although flow is maintained for most of the year.

Station BC3

The results of the Habitat Assessment score (126) for station BC3 characterize the stream habitat in the high-Suboptimal to low-Optimal range. Water levels and the lack of leaf material were the primary influencers on the scoring. The SCI score (51) is the average of scores from two independently sorted vials and translates to a categorical score of Healthy.

Compared to the 2018 event, this SCI score is 5 points lower but within the same Healthy categorical rating.

A total of 36 taxa were collected from station BC3 during the SCI sampling. The most numerous invertebrates sorted in both vials was the Trichopteran taxa Cheumatopsyche sp. Overall, this taxa expressed a slight dominance (28.4%) of total individuals sorted (84 of 296). From the total taxa collected, six are listed as sensitive taxa by the FDEP while five are listed as very tolerant. The Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa (EPT) are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. The EPT score for the station is four. No Plecoptera were noted in the SCI. One Ephemeropteran species was collected, the "sensitive" species Stenonema mexicanum. The Trichoptera were represented by three taxa, including the dominant taxa Cheumatopsyche sp.

Station BC4

The results of the Habitat Assessment score for Station BC4 characterize the stream habitat as Suboptimal, with the score being influenced by man-made modified channel morphology in the lower portion of the sampling transect and the lack of a major leaf habitat. The SCI score at BC4 is 52. This score is the average of scores from the two independently sorted vials and translates to a categorical score of Healthy. The last time a SCI was completed in this station was the winter of 2018. During that event, the station received a score of 69 which was in the Exceptional category.

The macroinvertebrate community at BC4 expressed a moderate dominance by the chironomid *Tribelos jucundum*, which is a FDEP sensitive species. Of the 313 invertebrates sorted between both samples, 108 (34.5%) of them were *Tribelos jucundum*. From the total taxa collected, nine are listed as sensitive taxa, while seven taxa are listed as very tolerant. The Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa (EPT) are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. The EPT score for the station is four. No Plecoptera were noted in the SCI. One Ephemeropteran species was collected, the "sensitive" genus *Stenonema*. The Trichoptera were represented by three taxa, including the "sensitive" genus *Triaenodes*. Also, of note, the rare new species of *Rhyacophila* previously collected at this station was not recovered during this sampling event.

The shift to a slightly lower SCI score lies in the reduction of Ephemeropteran and Trichopteran taxa present, fewer total taxa and an increase in very tolerant taxa.

For more information about the SCI and Habitat Assessment, click Here.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Northeast Black Creek met, with few exceptions, the nutrient thresholds for the East Panhandle Region. Occasionally the stations did not meet the Class III criteria for DO. This is the result of normally low DO in low gradient, wetland fed systems like this stream. The *E. coli* water quality limit was exceeded several times during the period of record.

BOD levels were elevated at stations BC2M and BC3 during the 2nd quarter sampling event. While other water quality parameters taken at station BC3 were typical of the stream, pheophytin was elevated at station BC2M and may have contributed to higher levels of BOD.

The Habitat Assessment Scores for stations BC2M and BC3 were in the Suboptimal/Optimal category while station BC4 was in the Suboptimal category. The SCI scores for all stations indicates the presence of a stream biological community that is healthy.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Stations BC2M, BC3 and BC4.







Figure 1. Total phosphorus results for Northeast Black Creek.

Attachment # 1 Page 10 of 178



Figure 3. E. coli results for Northeast Black Creek.



Figure 4. Dissolved Oxygen Percent Saturation results for Northeast Black Creek.

 Table 3. Habitat Assessment results for Northeast Black Creek.

Northeast Black Creek Stations	BC2M Score	Category	BC3 Score	Category	BC4 Score	Category
Substrate Diversity	12	Suboptimal	13	Suboptimal	10	Marginal
Substrate Availability	8	Marginal	7	Marginal	6	Marginal
Water Velocity	20	Optimal	12	Suboptimal	8	Marginal
Habitat Smothering	16	Suboptimal	14	Suboptimal	15	Suboptimal
Artificial Channelization	20	Optimal	20	Optimal	14	Suboptimal
Bank Stability	7,7	Suboptimal, Suboptimal	10, 10	Optimal, Optimal	7, 8	Suboptimal, Suboptimal
Riparian Zone Width	10, 10	Optimal, Optimal	10, 10	Optimal, Optimal	10, 10	Optimal, Optimal
Riparian Vegetation Quality	9, 9	Optimal, Optimal	10, 10	Optimal, Optimal	9, 9	Optimal, Optimal
Final Habitat Assessment Score		128		126	1	06
Interpretation	Suboptir	mal/Optimal	Suboptimal/Optimal		Subo	ptimal

 Table 4. Stream Condition Index results for Northeast Black Creek.

Northeast Black Creek Stations	BC2M Vial 1	BC2M Vial 2	BC3 Vial 1	BC3 Vial 2	BC4 Vial 1	BC4 Vial 2
Stream Condition Index Metrics Scores						
Total Taxa	6.52	7.39	2.61	3.04	6.09	6.52
Ephemeroptera Taxa	0	0	0	2	0	2
Trichoptera Taxa	5.71	5.71	2.86	2.86	2.86	2.86
% Filter Feeder	7.57	7.57	6.59	7.83	1.58	1.92
Long-lived Taxa	0	0	3.33	3.33	0	6.67
Clinger Taxa	5	7.5	3.75	7.5	2.5	6.25
% Dominance	9.78	9.92	7.23	6.87	5.49	6.35
% Tanytarsini Taxa	8.52	9.07	5.33	8.38	7.55	5.92
Sensitive Taxa	7	7	2	4	6	8
% Tolerant Taxa	7.54	7.55	5.88	6.59	8.19	7.23
SCI Vial Score	64.03	68.58	43.97	58.21	44.72	59.67
Stream Condition Index Score	6	6	5	1	5	2
Score Interpretation	Hea	lthy	Hea	lthy	Hea	lthy

2. Fisher Creek Basin

Waterbody: Fisher Creek



Basin: Fisher Creek

Located in the Apalachicola National Forest, Fisher Creek is a phosphorus-limited, naturally dark, tannic stream in southwestern Leon County. The stream eventually enters the Floridan aquifer via a sink located in the Leon Sinks Recreation Area. Dye trace studies have linked this sink to Wakulla Springs.

While the following pie chart shows the majority of the 17,984-acre watershed is relatively undeveloped, urban, residential, and rangeland land uses make up approximately 2% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but

excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Fisher Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC), expressed as an annual geometric mean, cannot be exceeded more than once in a three-year period. When viewing Table 1, the absence of a number means there were not enough data collected (due to lack of water or low water levels) to calculate a result. When data requirements were met (e.g., four samples collected in a calendar year), nutrient values were shown to not exceed the state criteria. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). Individual values did not exceed the instream criteria for total phosphorus and rarely exceeded total nitrogen criteria. **Table 1.** FDEP's total nitrogen and phosphorus criteria for streams applied to Fisher Creek.

Fisher Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2007	-	-
2008	0.48	0.01
2009	0.44	0.01
2010	0.61	0.01
2011- 2012	-	-
2013	0.65	0.01
2014	0.75	0.01
2015	0.68	0.01
2016	-	-
2017	0.68	0.01
2018	0.79	0.01
2019	-	-
2020	0.67	0.01
2021	-	-

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Fisher Creek met the nutrient thresholds for the Big Bend Bioregion. All other water quality parameters appear to be normal.

Thank you for your interest in maintaining the water quality of Leon County's aquatic resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 50.



Figure 1. Total phosphorus results for Fisher Creek.



3. Lake Iamonia Basin

<image>

Basin: Lake Iamonia

Lake lamonia is an approximately 5,554 acre, shallow, flat-bottomed, phosphorus-limited, prairie lake located in northern Leon County. Drastic water level fluctuations occur from discharge to the sinkhole and receiving floodwaters from the Ochlockonee River. Various control structures have been constructed (and ultimately dismantled) to attempt to control water level fluctuations.

Starting in the early 1900's, various management practices, especially water-level stabilization and changes in land use, have led to the overabundance of aquatic plants and the accumulation of organic sediment in Lake Iamonia which impede recreational usage and threaten its fish, wildlife, and ecosystem integrity. One of the largest modifications occurred in 1939, when an earthen dam was constructed to isolate the 20-acre sink basin from the lake. Other modifications continued, with the latest being the removal of two gates that were formerly used to control water levels. Prior to their removal in 2007, the gates had remained open since 1980, because the Northwest Florida Water Management District deemed the dam to be unsafe for impounding water. These latest modifications have been performed to protect the public and to allow the lake to have more naturally fluctuating water levels. Water quality monitoring continues to be used to evaluate the long-term health of the lake.

As shown in the following pie chart, approximately 14% of land use in the 66,727-acre Lake lamonia basin is agriculture, rangeland, urban, utilities or transportation. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of nuisance exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment sampling were conducted to determine the health of Lake Iamonia and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Dissolved Oxygen (DO)

As Figure 1 shows, Lake Iamonia often did not meet the state DO criteria. This was not unexpected, since all stations are shallow (usually less than 2.0 meters) and are normally covered with vegetation, which prevents rapid water exchange with the larger area of the lake and limits the air/water gas exchange. Plant respiration (samples were often taken in the morning hours) and sediment oxygen demand also contributed to the low DO saturation values. Staff considers this a natural condition for Lake lamonia.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Iamonia due to elevated levels of mercury.

Click here for more information about fish consumption advisories in Leon County.

Nutrients

During the sampling period, several stations were inaccessible due to drought or sinkhole activity. When viewing tables and figures, the absence of data means there was not enough data collected (due to lack of water) to fulfill data requirements.

The nutrient thresholds and results are found in Table 1. The state numeric nutrient criteria were not exceeded during the period of record. Due to low water conditions, FDEP data requirements for the Numeric Nutrient Criteria could not be met for 2011 through 2012.

During the August 2021 sampling event, the chlorophyll-a levels at station IA2 (72.5 μ g/L) and station IA4 (221 μ g/L) were extremely high for this lake. Other stations during the same event ranged from 1.0 to 13.6 μ g/L. It is unknown why the chlorophyll-a levels varied so much from the other stations, though it is thought that a large clump of algae cells (vs. a uniform water sample) was collected from one or both sites. The result from station IA4 is the highest chlorophyll-a result recorded from Lake Iamonia.

Table 1. FDEP's chlorophyll-*a*, total nitrogen and phosphorus criteria for lakes applied to Lake lamonia. Due to low water, the Numeric Nutrient Criteria data requirements could not be calculated for years 2011-2012.

		Total	Total
Colored		Nitrogen	Phosphorus
Colored		Threshold	Threshold
Lakes	20.0 µg/L	1.27-2.23	0.05-0.16
		mg/L	mg/L
2004	1.7	0.41	0.01
2005	3.9	0.48	0.01
2006	1.8	0.57	0.02
2007	5.0	0.90	0.02
2008	6.1	1.11	0.04
2009	5.8	0.53	0.02
2010	5.6	0.69	0.02
2011-	-	-	-
2012			
2013	14.52	0.72	0.04
2014	3.26	0.75	0.03
2015	15.4	0.61	0.04
2016	8.8	0.60	0.02
2017	7.1	0.60	0.02
2018	6.8	0.60	0.03
2019	6.2	0.50	0.02
2020	4.5	0.50	0.02
2021	3.1	0.62	0.03

Floral Assessment

The Lake Vegetation Index score for Lake Iamonia was 63, placing the lake's vegetative community in the Healthy category.

Forty-five species were found during the survey. The native species, fragrant water lily (*Nymphaea odora-ta*) and fanwort (*Cabomba caroliniana*) were the most dominant species. Other species include red maple (*Acer rubrum*), maidencane (*Panicum hemi-tomon*), water shield (*Brasenia schreberi*), and American lotus (*Nelumbo lutea*).

The exotic hydrilla (*Hydrilla verticillata*), torpedo grass (*Panicum repens*) and water hyacinth (*Eichhornia crassipes*) listed as Category I Invasive Exotics by the Florida Exotic Pest Control Council http://www.fleppc.org/ are a concern in Lake Iamonia. Alligator weed (*Alternanthera philoxeroides*), rattlebox (Sesbania punicea) were Category II Invasive Exotics found in the lake. Additionally, the exotic water spangles (*Salvinia minima*) was found in the lake.

Click here for more information on the Lake Iamonia LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

As Figure 2 shows, biochemical oxygen demand (BOD) levels have and continue to fluctuate over time. As mentioned previously, Lake Iamonia is relatively shallow: average bottom depth in 2021 was 1.6 meters. The large amount of naturally occurring coarse particulate organic material (CPOM) on the lake bottom is more readily disturbed by wind and wave action in a system as shallow as Lake Iamonia. This led the CPOM to resuspend in the water column, leading to an increase in potential microbial activity (i.e. higher BOD levels).

Other parameters appeared to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Lake Iamonia met the nutrient thresholds for the East Panhandle Region. DO criteria were not met, but staff considers the low DO results a natural condition.

BOD levels continue to fluctuate. The large amount of naturally occurring CPOM on the lake bottom is more readily disturbed by wind and wave action in shallower systems. The shallow water levels led to CPOM resuspending in the water column, leading to an increase in BOD levels.

Chlorophyll-a levels were extremely elevated at two stations during the August 2021 sampling event. It is unknown as to the reason behind this elevated level.

Other parameters appeared normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites IA2, IA4, IA6, IA7, IA8 and LI1B.

Attachment # 1 Page 21 of 178



Figure 1. Dissolved Oxygen Percent Saturation results for Lake Iamonia.



Figure 2. Biochemical Oxygen Demand (BOD) results for Lake Iamonia.

Waterbody: Plantation Stream



Basin: Lake Iamonia

Plantation Stream discharges from the Centerville watershed, essentially bounded by Proctor Road and Pisgah Church Road at Centerville Road, continuing west under Thomasville Road, before discharging into Lake Iamonia. The Centerville Conservation Community and Baker Place Subdivisions are located within the watershed. Most of the waterbodies are former farm ponds that were used for dairy and other agricultural practices.

While the following pie chart shows the majority of the 3,996-acre watershed is relatively undeveloped, agriculture, rangeland, transportation, utilities, and urban and residential uses make up approximately 24% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.



Methods

Surface water sampling was conducted to determine the health of Plantation Stream and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions and beaver activity, four temporally independent samples per year have not been collected from this station since 2011. During years which met the minimum number of sampling events required to apply NNC, the state criteria were not exceeded for either parameter. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus or total nitrogen. **Table 1.** FDEP's total nitrogen and phosphorus criteria for streams applied to Plantation Stream. The absence of data means there was not enough data collected to fulfill data requirements.

Plantation Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2006- 2007	-	-
2008	0.73	0.09
2009	0.21	0.07
2010	0.61	0.07
2011-2021	-	-

Dissolved Oxygen (DO)

As Figure 3 shows, Plantation Stream has seldom met the Class III criteria for DO. This is the result of normally low dissolved oxygen in low gradient, low flow systems like this stream. Another contributing source of naturally low oxygenated water to this stream is input from a nearby wetland.

Escherichia coli (E. coli)

The *E. coli* water quality limit > 410 in 10% of samples collected over a thirty-day period was exceeded for the 3^{rd} (830/100 mL) quarter of 2016. The elevated *E. coli* levels could possibly be the result of wild-life or faulty septic tanks in the area. The *E. coli* level has not exceeded water quality standards since 2016.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Due to low water conditions and beaver activity, four temporally independent samples per year have not been collected from this station since 2011. Based on the samples collected, Plantation Stream appeared to meet the nutrient thresholds for the Big Bend Bioregion. While DO results did not always meet Class III water quality standards, low gradient low flow streams normally have low DO values which, in this case, were further exacerbated by input from the adjacent wetland. The *E. coli* water quality limit has not been exceeded since 2016. Other water quality parameters appear to be normal for the area and no impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 20.





Figure 1. Total phosphorus results for Plantation Stream.





Figure 3. Dissolved Oxygen Percent Saturation results for Plantation Stream.

Waterbody: Tall Timbers Creek



Basin: Lake Iamonia

Tall Timbers Creek is a tannic stream located in northwestern Leon County. The stream flows south under County Road 12 through the Tall Timbers Research Station and Land Conservancy, eventually entering Lake lamonia on the north shore of the lake.

While the following pie chart shows the majority of the 80-acre watershed upstream of the sample station is relatively undeveloped, agriculture, urban and residential uses make up approximately 9% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Tall Timbers Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. When viewing Table 1, the absence of a number means there were not enough data collected (due to lack of water or low water levels) to calculate a result. When data requirements were met (e.g., four samples collected in a calendar year), nutrient values were shown to not exceed the state criteria.

Dissolved Oxygen (DO)

As Figure 1 shows, Tall Timbers Creek seldom met the Class III criteria for DO. Low gradient, tannic streams typically have low DO levels which can be further exacerbated by low water conditions.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples collected over a 30-day period was exceeded for the 2^{nd} (650/100 mL) quarter of 2017. The September 2018 result, while relatively high (310/100 mL), did not exceed the criteria. Since the watershed is relatively undeveloped, elevated *E. coli* levels are probably the result of wildlife in the area. There have been no exceedances since the September 2018 result.

Table 1. FDEP's total nitrogen and phosphorus criteria forstreams applied to Tall Timbers Creek. The absence of datameans there was not enough data collected (due to lack of wa-ter) to fulfill data requirements.

Tall Timbers Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2006- 2007	-	-
2008	0.22	0.03
2009	0.17	0.04
2010	0.23	0.04
2011- 2012	-	-
2013	0.11	0.03
2014	0.21	0.02
2015	0.24	0.06
2016	0.13	0.02
2017	0.13	0.03
2018	0.22	0.04
2019	0.28	0.04
2020	-	-
2021	0.14	0.03

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Tall Timbers Creek met the nutrient thresholds for the Panhandle East Region. While DO results did not meet Class III water quality standards, low gradient tannic streams normally have low DO values which, in this case, were further exacerbated by the typically low flow conditions. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 66.

Attachment # 1 Page 28 of 178



Figure 1. Dissolved Oxygen Percent Saturation results for Tall Timbers Creek.

4. Lake Jackson Basin

Waterbody: Jackson Heights Creek



Basin: Lake Jackson

Jackson Heights Creek is a heavily altered stream located off Hwy 27 in northern Leon County. The stream receives runoff from the Parkhill and Greenwood Hills subdivisions, and then continues north through Lake Jackson Heights and Harbinwood subdivisions before finally entering Lake Jackson. This watershed, with residential development dating from the 1950's, displays impacts from channelized flow and aging septic tanks. Sampling was intermittent from February 2007 through October 2008, due to low flow conditions and stormwater facility construction in the channel. The stormwater facility was constructed to mitigate development impacts and to benefit both the creek and Lake Jackson.

A sinkhole opened upstream of Jackson Heights Creek in a County stormwater facility in December 2018, causing low water conditions downstream of the feature. Because of the conditions, Leon County staff only collected one water quality sample in 2019 (January 24th). The sinkhole was filled, and the repairs completed in March 2020.

As shown in the following pie chart, transportation, utilities, urban and residential land uses make up approximately 79% of the 459-acre watershed. Increases in stormwater runoff and waterbody

nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other



contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

In late 2006, the U.S. Environmental Protection Agency (USEPA) set a TMDL target for total phosphorus of 0.15 mg/L, a 35% reduction of the previous existing concentration of 0.23 mg/L.

Methods

Surface water samples were collected to determine the health of Jackson Heights Creek and met the requirements of the Florida Department of Environmental Protection (FDEP). Due to low water conditions, several stations were dry or "puddled" during the sampling period. When viewing tables and figures, the absence of data means there was not enough data collected due to low water level conditions to fulfill data requirements.

Results

Nutrients

E

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Thresholds were never exceeded during the period of record.

Table	1.	FDEP's	total	nitrogen	and	phosphorus	criteria	for
stream	ns a	pplied to	o Jacks	on Height	s Cree	ek.		-

Jackson Heights Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2009	0.38	0.09
2010	0.56	0.12
2011- 2012	-	-
2013	0.30	0.08
2014	0.32	0.09
2015	-	-
2016	0.43	0.10
2017	0.39	0.09
2018	0.43	0.16
2019-2020	-	-
2021	0.69	0.14

As mentioned previously, the USEPA set a TMDL target for total phosphorus of 0.15 mg/L, a 35% reduction of the previous existing concentration of 0.23 mg/L. During the 2006-2021 sampling period, total phosphorus concentrations ranged from 0.036 mg/L to 0.32 mg/L (Figure 1), with an arithmetic mean of 0.13 mg/L. While overall phosphorus levels are still below the TMDL, recent results suggest that levels appear to be increasing, and are a cause of concern. Staff concerns prompted the inspection of the upstream Jackson Heights Creek stormwater management facilities, and the decision was made to perform major maintenance on the facilities. It is staff's belief that phosphorus levels will drop with the completion of the facilities' maintenance.

Fecal Coliforms and Escherichia coli (E. coli)

Jackson Heights Creek has a history of fecal coliform levels exceeding Class III water quality standard (400/100 mL in at least 10% of the samples). *E. coli* standards have now supplanted fecal coliform standards in Florida as an indicator of bacterial contamination. As Figure 2 shows, *E. coli* levels exceeded the Class III water quality standard daily limit of > 410 in 10% threshold value of samples collected over a 30day period. Aging septic tanks, or animal/pet waste could be contributing to the elevated *E. coli* levels in the creek.

Other Parameters

Several species of exotic plants line the bank of Jackson Heights Creek, primarily wild taro (*Colocasia* sp.). In many cases, exotic plants will crowd out and replace native plants. This may stress native wildlife, which have evolved to depend on native plants for food and shelter. The native wildlife may move away or perish if the native vegetation is replaced by exotic plants.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Jackson Heights Creek met the nutrient thresholds for the East Panhandle Region. While it appears that average phosphorus levels are lower due to upstream stormwater facilities, levels appear to be slowly increasing. Maintenance will be performed on the facilities, leading to lower phosphorus levels. *E. coli* levels exceeded the Class III water quality standard daily limit several times over the sampling period. Aging septic tanks, or animal/pet waste could be contributing to the elevated coliform levels. Several species of exotic plants line the bank of Jackson Heights Creek which may affect native wildlife dependent on native plants for food and shelter. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 31.



Figure 1. Total phosphorus results for Jackson Heights Creek.





Figure 2. E. coli results for Jackson Heights Creek.

Waterbody: Lake Carr



Basin: Lake Jackson

Lake Carr is an approximately 880 acre, primarily phosphorus-limited, shallow lake located north of Lake Jackson and is essentially surrounded by two property owners: Ayavalla Land Company and Orchard Pond LLC. Lake Carr is a valuable biological, aesthetic and recreational resource of Leon County and was designated as an Aquatic Preserve in 1973 for the primary purpose of preserving and maintaining the biological resources in their natural condition.

As shown in the following pie chart, 38% of land uses in the 5,931-acre Lake Carr watershed are agriculture, rangeland, transportation, utilities, urban and residential. The lake receives direct runoff from the surrounding agricultural property as well as flow from the residential areas east of Meridian Road (Summerbrooke and Ox Bottom Manor). Waterbodies in the residential areas are modified farm ponds serving as stormwater facilities dedicated to the respective homeowner's associations for maintenance. The Summerbrooke Golf Club (157 acres) also lies in this watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment samples were collected to determine the health of Lake Carr and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. FDEP requires four temporally independent samples per year to be collected to fulfill data requirements for the Numeric Nutrient Criteria (NNC) thresholds. When the specified number of samples were collected, state criteria were not exceeded.

Due to extremely low water levels and a plethora of aquatic vegetation, staff was unable to launch a boat to collect water quality samples in 2012 and the first quarter of 2013. Low water levels prevented water quality sampling during the third quarter of 2021. Based on three samples collected in 2021, chlorophyll-a (1.19 μ g/L), total nitrogen (0.27 mg/L) and total phosphorus (0.01 mg/L) levels were below the state criteria.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for	
lakes applied to Lake Carr.	

Clear Lake, Low Alkalinity	Chlorophyll-a 6.0 μg/L	Total Nitrogen Threshold 0.51-0.93 mg/L	Total Phosphorus Threshold 0.01-0.03 mg/L
2004	1.3	0.29	0.01
2005	1.4	0.27	0.01
2006	1.1	0.39	0.01
2007	2.2	0.61	0.02
2008	4.6	0.64	0.02
2009	4.8	0.50	0.02
2010	5.5	0.49	0.02
2011	5.2	0.44	0.01
2012- 2013	-	-	-
2014	1.4	0.35	0.01
2015	4.0	0.30	0.02
2016	2.4	0.28	0.01
2017	2.4	0.36	0.01
2018	2.5	0.31	0.01
2019	4.0	0.26	0.01
2020	2.0	0.71*	0.01
2021	-	-	-

* May 5, 2020 sample contaminated.

Dissolved Oxygen

As Figure 1 shows, station CA1 percent dissolved oxygen (DO) saturation values did not meet Class III water quality criteria while station CA2 failed to meet the criteria four times during the sampling period. This was not unexpected, since the CA1 station is a shallow station normally covered with vegetation, which prevents rapid water exchange with the larger area of the lake. Plant respiration (samples were often taken in the morning hours) also contributed to the low DO saturation values. While there is a substantial community of submerged vegetation at the CA2 station, emergent vegetation is relatively uncommon at this site, so conditions are more optimal for rapid water exchange with the remainder of the lake. Staff believes that this is a natural condition for both locations.

Floral Assessment

The Lake Vegetation Index (LVI) score for Lake Carr was 68, placing the lake's vegetative community in the Healthy category.

Thirty-three plant species were found during the survey. The native species, coontail (*Ceratophyllum demersum*) and fragrant waterlily (*Nymphaea odora-ta*) were the most dominant plants in the lake.

Other native vegetation included red maple (Acer rubrum), buttonbush (*Cephalanthus occidentalis*) fanwort (Cabomba caroliniana), leafy bladderwort (*Utricularia foliosa*) and pickerelweed (Pontederia cordata). The exotic spadeleaf (*Centella asiatica*) was also found in the littoral zone of the lake.

Click here for more information on the Lake Carr LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Lake Carr met the nutrient thresholds for the East Panhandle Region. Staff considers the DO results at Stations CA1 and CA2 a natural condition. The LVI score for Lake Carr was 68, placing the lake's vegetative community in the Healthy category.

Other water quality parameters appear to be normal for the area and no impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site CA2.


Figure 1. Dissolved Oxygen Percent Saturation results for Lake Carr.

Waterbody: Lake Hall



Basin: Lake Jackson

Lake Hall is an approximately 182-acre lake located in northern Leon County, just north of Interstate 10 and slightly west of U.S. Highway 319. Lake Hall is part of the Alfred B. Maclay Gardens State Park, a state recreation area and botanical garden, and is an "Outstanding Florida Waters" by the Florida Department of Environmental Protection (FDEP).

As shown in the figure below, approximately 45% of land uses in the 773-acre Lake Hall watershed are transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling, sediment sampling and a Lake Vegetation Index (LVI) survey was conducted to determine the health of Lake Hall and met the collection and analysis requirements of the FDEP.

Results

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria thresholds (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The State criteria were not exceeded during the period of record.

FDEP requires four temporally independent samples per year to be collected to fulfill data requirements for the Numeric Nutrient Criteria (NNC) thresholds. Due to access restrictions associated with the COVID-19 pandemic, staff could not access the lake during the 2nd quarter of 2020 and thus could not determine the NNC for 2020. However, based on three results, the geometric means of chlorophyll-a (3.1 µg/), total nitrogen (0.27 mg/L) and total phosphorus (0.01 mg/L) would appear to meet the NNC.
 Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Lake Hall.

Clear Lake, Low Alkalinity	Chlorophyll-a 6.0 μg/L	Total Nitrogen Threshold 0.51-0.93 mg/L	Total Phosphorus Threshold 0.01-0.03 mg/L
2004	2.1	0.13	0.01
2005	1.4	0.22	0.01
2006	1.3	0.22	0.01
2007	1.5	0.42	0.01
2008	2.2	0.33	0.00
2009	1.8	0.43	0.00
2010	2.2	0.33	0.01
2011	1.3	0.41	0.01
2012	1.4	0.34	0.01
2013	3.0	0.15	0.01
2014	1.6	0.26	0.01
2015	3.3	0.26	0.02
2016	4.1	0.32	0.01
2017	2.9	0.32	0.01
2018	3.6	0.31	0.01
2019	3.2	0.26	0.01
2020	-	-	-
2021	1.3	0.30	0.01

Other parameters

Other water quality parameters appeared to be normal for the area and no impairments were noted.

Floral Assessment

The Lake Vegetation Index (LVI) score for Lake Hall was 79, placing the lake's vegetative community at the low end of the Excellent category.

Thirty-five species were found during the survey. The native species, fanwort (*Cabomba caroliniana*), and watershield (*Brasenia schreberi*) were the most dominant species in the lake. Other native vegetation included red maple (*Acer rubrum*) and buttonbush (*Cephalanthus occidentalis*).

Unfortunately, hydrilla (*Hydrilla verticillata*) a Category I Invasive Exotic was found in Lake Hall. No other exotic plants were noted during this survey.

For more information concerning Florida Invasive Exotics, please click on the Florida Exotic Pest Control Council website; http://www.fleppc.org/_

Click here for more information on the Lake Hall LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Conclusions

Based on ongoing sampling, Lake Hall met the nutrient thresholds for the Eastern Panhandle Region and the floral community is considered "Excellent" by the LVI. Other water quality parameters appeared to be normal for the area and no impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site H07.

Waterbody: Lake Jackson



Basin: Lake Jackson

Lake Jackson is an approximately 4,254 acre, shallow, flat bottomed, prairie lake with two major sinkholes and is located north of the City of Tallahassee. Lake Jackson is a valuable biological, aesthetic, and recreational resource of Leon County and was designated (along with the neighboring Lake Carr and Mallard Pond) as an Aquatic Preserve in 1973 for the primary purpose of preserving and maintaining the biological resources in their natural condition.

The aforementioned sinkholes are the source of extreme water loss in the lake over the past several decades. Normally the sinkholes are plugged with sediments, but will collapse when groundwater levels drop, allowing the lake water to enter the aquifer, often dramatically lowering the water levels, most recently in 2021.

As shown in the following pie chart, approximately 40% of land use in the 27,096-acre Lake Jackson Basin is agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but



excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment sampling were conducted to determine the health of Lake Jackson and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

Low water levels caused by drought and sinkhole activity meant certain water quality stations could not be sampled during some months. The latest low water level event began in the latter half of 2020 with the lake completely draining through the Porter sinkhole in June 2021. Due to low water levels sampling did not occur for the last three quarters of 2021. Objective results of nutrient concentration continued to be skewed by water level fluctuations. The effects of water level fluctuation continue to be documented.

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Chlorophyll-a, total phosphorus, and nitrogen levels were exceeded several times over the sampling period, with the latest occurring in 2020.

As mentioned in the previous year's report, while yearly total nitrogen and phosphorus levels were not substantially different when compared to each other, the 2019 geometric mean chlorophyll-a level is the highest recorded since Leon County sampling began. It is thought that due to the aggressive herbicide spraying on Lake Jackson and the dominance of the invasive exotic hydrilla on the southern side of the lake, native emergent and floating vascular plants are no longer present in the numbers needed to "shade out" phytoplankton, allowing phytoplankton numbers to increase and contributing to the elevated chlorophyll-a numbers. While the chlorophylla in 2020 exceeded the NNC, the result was substantially lower than the 2019 result. Leon County staff noted that in some areas, floating vegetation, specifically the native Brasenia schreberi, had repopulated the previous open water areas. This is thought to have "shaded out" phytoplankton, that in turn lowered chlorophyll-a levels.

Dissolved Oxygen

As Figure 1 shows, several Lake Jackson stations showed percent dissolved oxygen (DO) saturation values that did not meet Class III water quality criteria. This was not unexpected, since the Lake Jackson stations are shallow stations normally covered with vegetation, which prevents rapid water exchange with the larger area of the lake. Plant respiration (samples were often taken in the morning hours), in addition to organic rich sediments, also contributed to the low DO saturation values.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Jackson due to elevated levels of mercury.

Click here for more information about fish consumption advisories.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for
lakes applied to Lake Jackson. Results in bold signify exceedances of the
State criteria. Due to low water, the Numeric Nutrient Criteria data re-
guirements could not be calculated for years 2012-2013 and 2021.

Clear Lake, Low Alkalinity	Chlorophyll-a 6.0 μg/L	Total Nitrogen Threshold 0.51-0.93 mg/L	Total Phosphorus Threshold 0.01-0.03 mg/L
2004	2.2	0.33	0.01
2005	3.2	0.29	0.03
2006	3.0	0.63	0.03
2007	2.1	0.77	0.03
2008	5.7	0.60	0.04
2009	8.4	0.49	0.02
2010	3.2	0.58	0.02
2011	6.9	0.61	0.02
2012- 2013	-	-	-
2014	2.6	0.69	0.02
2015	9.2	0.54	0.03
2016	6.4	0.47	0.02
2017	6.5	0.56	0.02
2018	6.0	0.50	0.02
2019	11.4	0.54	0.03
2020	7.4	0.54	0.03
2021	-	-	-

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Lake Jackson NNC for chlorophyll-a, total phosphorus, and nitrogen levels were exceeded several times over the sampling period. The exceedances in 2020 are thought to be at least partially the result of plant management practices. Ongoing sampling showed percent dissolved oxygen (DO) saturation values did not always meet Class III water quality criteria. This was not unexpected, since the Lake Jackson stations are shallow stations normally covered with vegetation, preventing rapid water/atmospheric exchange. Plant respiration and organic-rich sediment also contributed to low DO saturation values. As of July 2022, lake levels continue to be very low, preventing water quality sampling.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites J03, J05, J14 and J16.



Figure 1. Dissolved Oxygen Percent Saturation results for Lake Jackson.

Waterbody: Lexington Creek



Basin: Lake Jackson

Lexington Creek is a moderately altered stream located in the northern part of Tallahassee and drains into the Fords Arm of Lake Jackson. The watershed extends to Thomasville Road at I-10 on the east and is bounded by Maclay Road and Live Oak Plantation Road on the north and south, respectively.

As shown in the following pie chart, agriculture, rangeland, transportation, utilities, urban and residential uses make up approximately 69% of the 1,786-acre watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Samples were collected to determine the health of Lexington Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

To reduce flooding where Lexington Creek crosses under Meridian Road, Leon County improved drainage by installing large box culverts to move water beneath the roadway. Such improvements are also expected to better treat stormwater and reduce soil erosion, improving the health of adjacent wetlands and Lake Jackson. Due to construction associated with the drainage improvements to Meridian Road, sampling was temporarily stopped in the latter part of 2020. Sampling resumed during the first quarter of 2021.

According to FDEP requirements, Numeric Nutrient Criteria (NNC), expressed as an annual geometric mean, cannot be exceeded more than once in a threeyear period. The nutrient thresholds and results are found in Table 1. Due to low water conditions and the almost ephemeral nature of this system, four temporally independent samples per year could only be intermittently collected during the sampling period. However, up until 2018, when the appropriate number of samples were collected, nutrient criteria were being met. In 2018, and for the first time since Leon County sampling began, the total phosphorus criteria was exceeded and was again exceeded in 2019 and 2021.

This is not completely unexpected. Individual values were sometimes elevated during the sampling period

Figure 1). For example, due to a rainfall event that flushed phosphorus laden sediment into the creek, the August 2012 total phosphorus value (1.3 mg/L) was substantially higher than all other phosphorus values recorded at this site.

Lexington Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2007	-	-
2008	0.43	0.15
2009	0.13	0.14
2010	0.42	0.15
2011-2013	-	-
2014	0.33	0.12
2015-2017	-	-
2018	0.33	0.21
2019	0.40	0.20
2020	-	-
2021	0.35	0.23

 Table 1. FDEP's total nitrogen and phosphorus criteria for streams applied to Lexington Creek.

The total nitrogen results over the entire sampling period did not exceed FDEP's 1.03 mg/L threshold value. But individual nitrogen levels have exceeded twice since sampling began (Figure 2). One exceedance occurred during the same August 2012 sampling event (1.7 mg/L) previously mentioned; the other during the November 2008 event (1.1 mg/L).

The unusually high nitrogen and phosphorus levels during the August 2012 event can be attributed to stormwater runoff associated with the heavy rainfall in the area prior to the sampling event. The effects were probably more acute due to the previously dry streambed and the associated floodplain being inundated within a short time

While the August 2012 sample has been the only storm event grab sample that was taken that showed the effects of excessive scouring and runoff, staff notes that excessive sediment deposition is not an uncommon event. Elevated levels of phosphorus and continued high levels of sediment deposition suggest that current stormwater treatment and volume control were and are not adequate to protect downstream areas.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples during a 30-day period have been exceeded several times during the sampling period (Figure 3). Leon County and FDEP have been in cooperation in the investigation of the source(s) of the bacteria. The results of the Microbial Source Tracking (MST) analyses and other analyses that track probable wastewater indicators (e.g., sucralose, acetaminophen) suggest that the sources of *E. coli* are human in origin. As part of their normal inspection, the City of Tallahassee undertook the rehabilitation of the sewer lines in the immediate area of the creek. Levels are still elevated with the latest two exceedances occurring during the last two quarters of 2021.

Metals

Lexington Creek exceeded water quality criteria for lead during the 3rd and 4th quarters of 2021. While relict anthropogenic sources such as leaded gasoline are most likely to be the source of these exceedances, recent construction activity in the watershed allowed excessive amounts of runoff to enter the stream. It is thought that runoff that entered the stream contained levels of lead that caused the stream to exceed water quality criteria.

Click here for more information on metal levels in Leon County waterbodies.

Stream Condition Index and Habitat Assessment

The results of the Habitat Assessment score for Lexington Creek characterize the stream habitat in the Suboptimal category (Table 2). Human induced channel impacts are most apparent in the first 40 meters of the 100-meter transect but some anthropogenic debris is located throughout the channel (and floodplain), along with sedimentation. The Stream Condition Index (SCI) score was in the low to mid Healthy category with a score of 36. Vial 1 and vial 2 individually scored within one point of each other. The last time a SCI was performed on this stream was in November of 2018. At that time the SCI scored in the Healthy category with a numerical score of 42.

Further analysis of the macroinvertebrate community of the stream presents an inconsistent mixture of results. The Ephemeroptera/Plecoptera/Trichoptera (EPT) taxa are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. However, the total for EPT taxa score is only two with one Ephemeroptera taxon and one Trichoptera taxon recovered. No Plecoptera taxa were present in the SCI. Although the stream is in a suburban landscape, FDEP sensitive taxa (seven) outnumbered very tolerant taxa (three) but no long-lived taxa were recovered. Sedimentation is a very real threat to this stream biotic community. By example, in the 2018 sample event, a small section of cobble was noted and sampled as a minor habitat. During the 2021 sample event, that section of the stream had no visible cobble present. However, field samplers did relocate the previously documented cobble habitat about two inches below the surface of the sand streambed.

For more information about the SCI and Habitat Assessment, click Here.

Conclusions

Inconsistent water levels made FDEP sampling frequency requirements difficult to meet. However, when the appropriate number of samples were collected, the NNC was being met, until 2018. The total phosphorus criteria was exceeded in 2018, 2019 and 2021. The SCI score for Lexington Creek was at the low to middle level of the Healthy range, while the Habitat Assessment Score was in the Suboptimal range. The *E. coli* water quality limit has been exceeded several times during the sampling period, with the latest two exceedances occurring during the last two quarters of 2021. Sedimentation continues to be a threat to the stream biotic community and is contributing to the elevated phosphorus levels. It is probable that the ongoing issue of *E. coli* exceedances are the result of malfunctioning septic tanks or failing sewer lines.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 26.

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Lexington Creek	Score	Category
Substrate Diversity	11	Suboptimal
Substrate Availability	6	Marginal
Water Velocity	20	Optimal
Habitat Smothering	9	Suboptimal
Artificial Channelization	20	Optimal
Bank Stability	6, 7	Suboptimal, Suboptimal
Riparian Zone Width	10, 8	Optimal, Suboptimal
Riparian Vegetation Quality	6, 6	Suboptimal, Suboptimal
Final Habitat Assessment Score		109
Interpretation	Sub	ooptimal

Table 2. Lexington Creek Habitat Assessment Score.

Table 3. Lexington Creek Stream Condition Index Score.

Lexington Creek	Vial 1	Vial 2
Stream Condition Index		
Metrics Scores		
Total Taxa	0.71	1.43
Ephemeroptera Taxa	1.25	0
Trichoptera Taxa	0	0
% Filter Feeder	10	10
Long-lived Score	0	0
Clinger Taxa	3	3
% Dominance	2.43	2.45
% Tanytarsini Taxa	8.71	7.60
Sensitive Taxa	2.67	3.33
% Tolerant Taxa	3.85	4.47
SCI Vial Score	36.24	35.88
Stream Condition Index		36
Score		
Score Interpretation	Hea	althy







Attachment # 1 Page 47 of 178





Figure 3. Escherichia coli values in Lexington Creek.

Waterbody: Meginnis Creek



Basin: Lake Jackson

Meginnis Creek is a substantially altered, nitrogenlimited stream located in the northern part of Tallahassee and drains into Lake Jackson.

As shown in the pie chart below, residential, commercial and transportation uses make up approximately 85% of the 2,416-acre watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life use support), and exceedances of these standards are associated with interference with the designated use.

Methods

Surface water samples were collected to determine the health of Meginnis Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as annual geometric means) cannot be exceeded more than once in a three-year period. Due to low water conditions, four temporally independent samples per year were not collected from the original sampling station. Staff established the new Meginnis Arm station in April 2010, so the 1st guarter sample was not collected for that year. Low water levels precluded staff from collecting water samples during the latter half of 2011 and all of 2012 - 2013. Sampling activities resumed in 2014, and the NNC sampling requirements were beginning to be met in 2015 (Table 1). Due to low water levels, Leon County staff could only collect samples for the first two guarters of 2020 with none being collected in 2021. When sampling requirements were met, the NNC were never exceeded during the period of record.

For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus and never exceeded the criteria for total nitrogen.

Other Parameters

Dissolved oxygen often did not meet Class III water quality standards (Figure 3). This is not surprising

since this system is a low velocity system. Lower velocity systems generally have lower levels of dissolved oxygen than high velocity systems because they are less aerated.

Specific conductivity and dissolved solids in Meginnis Creek (averaged 116 μ mhos/cm and 71.5 mg/L respectively for the first two quarters of 2020) were elevated when compared to Lake Jackson (averaged 46 μ mhos/cm and 31.5 mg/L during the same time period).

Table	1.	FDEP's	total	nitrogen	and	phosphorus	criteria	for
stream	ns a	pplied to	o Megi	nnis Creel	κ.			

	Total	Total
Maginaia Croak	Nitrogen	Phosphorus
weginns creek	Threshold	Threshold
	1.03 mg/L	0.18 mg/L
2010- 2014	-	-
2015	0.38	0.05
2016	0.26	0.05
2017	0.35	0.05
2018	-	-
2019	0.30	0.04
2020-2021	-	-

The combination of relatively high levels of conductivity and dissolved solids with relatively low nutrients suggest that the dissolved solids may be the result of impervious surfaces in the watershed. Water is more efficiently transported over impervious surfaces where it can pick up weathered calcium carbonate and other calcium salts (found in concrete) due to efflorescence in the increased expanses of impervious surfaces and drainage systems.

Other water quality parameters were typical of the stream, and no exceedances were noted.

Vegetation

Several species of exotic plants are associated with the Meginnis Creek stream corridor including Taro (Colocasia sp.), alligator weed (Alternanthera philoxeroides), Chinese tallow (Sapium sebiferum), rattlebox (Sesbania punicea) and hydrilla (Hydrilla verticillata). In many cases exotic plants will crowd out native plants which in turn stress native wildlife which has evolved to depend on native plants for food and shelter. The native wildlife may move away or perish if the native vegetation is replaced by exotic plants. The Florida Fish and Wildlife Conservation Commission have an aquatic plant management program that manages the creek and the greater Lake Jackson area. The program is effective to the degree that the exotic vegetation does not overwhelm the native vegetation, but staff recommends that the problem of exotic plants be more aggressively pursued in this area of the watershed.

Conclusions

Based on ongoing sampling, Meginnis Creek met the nutrient thresholds for the East Panhandle Region. Specific conductivity and dissolved solids were elevated when compared to Lake Jackson. The combination of relatively high levels of conductivity and dissolved solids with relatively low nutrients suggest that the dissolved solids may be the result of impervious surfaces in the watershed. Dissolved oxygen rarely meets Class III water quality standards. Several species of exotic plants are associated with the Meginnis Creek stream corridor. The Florida Fish and Wildlife Conservation Commission have an aquatic plant management program and continues to manage the creek and the greater Lake Jackson area.

Thank you for your interest in maintaining the water quality of Leon County's aquatic resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site JL01.



Figure 1. Total phosphorus results for Meginnis Creek.



Figure 2. Total nitrogen results for Meginnis Creek.



Figure 3. Dissolved Oxygen Percent Saturation results for Meginnis Creek.

Waterbody: Summer Creek



Basin: Lake Jackson

Summer Creek is a slightly tannic stream located in northwestern Leon County and discharges to Lake Carr.

As shown in the figure below, approximately 69% of land use in the 103-acre watershed is urban, residential, transportation and utilities. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Summer Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions at Station 22, FDEP data requirements for the NNC could not be met in 2007 and 2010 through 2017 (Table 1). The 2008 and 2009 results showed that the NNC thresholds were not exceeded. Because of persistent low water/dry conditions, staff eliminated this sampling station in the 3rd quarter of 2017 and established Station SB2 further downstream. Based on two samples (in 2017), the geometric mean of total nitrogen (0.29 mg/L) and phosphorus (0.05 mg/L) at Station SB2 were below the NNC values. The 2018-2021 FDEP data requirements for the NNC were met and results demonstrated that NNC thresholds were not exceeded for Station SB2.

Dissolved Oxygen (DO)

As Figure 1 shows, Summer Creek did not always meet the Class III criteria for DO. Staff believes the low DO in Summer Creek is due to upstream wetlands and the naturally low gradient, low flow condition of the creek. **Table 1.** FDEP's total nitrogen and phosphorus criteria for streams applied to Summer Creek. Station SB2 was established during the third quarter of 2017. 2018 is the first calendar year that four samples were collected at SB2.

Summer Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2007	-	-
2008	0.37	0.02
2009	0.20	0.03
2010- 2017	-	-
2018	0.36	0.07
2019	0.38	0.07
2020	0.26	0.08
2021	0.22	0.07

Low DO is typical of these conditions. The recently established Station SB2 is more characteristic of a typical north Florida perennial stream and met Class III criteria in 2017 and 2018, though it did not meet the criteria in the latter half of 2019 and 2020.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples collected over a thirty-day period was exceeded at Station SB2 during the September 2017 sampling event (1,000 cfu). Elevated bacteria levels could be the result of beaver activity or other wild-life in the area.

Conclusions

When sampling requirements were met, Summer Creek met the nutrient thresholds for the East Panhandle Region. Dissolved oxygen criteria were seldom met during the sampling period. The stream is a low gradient, low flow stream that drains a wetland, so these results are not unexpected. The lone *E. coli* water quality limit exceedance was during the September 2017 sampling event. Elevated bacteria levels could be the result of beaver activity or other wildlife in the area.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites 22 and SB2.

Attachment # 1 Page 55 of 178



Figure 1. Dissolved Oxygen Percent Saturation results for Summer Creek.

5. Lake Lafayette Basin

Waterbody: Alford Arm Creek



Basin: Lake Lafayette

The Alford Arm tributary is a moderately altered, nitrogen-limited stream located in the northern part of Leon County. The tributary flows from Lake McBride in the Bradfordville area and receives runoff from the heavily developed Killearn Estates and Killearn Acres neighborhoods. Many of the waterbodies within these neighborhoods are former agricultural ponds, most notably the Velda Dairy impoundments that are now seen as residential amenities.

As shown in the following pie chart, approximately 55% of land use in the 26,913-acre watershed is agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation.

Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals.



State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Alford Arm Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water and back flow conditions, four temporally independent samples per year have never been collected from this station, with no samples being collected in 2020 or 2021. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total nitrogen or total phosphorus.

Dissolved Oxygen

As Figure 3 shows, Alford Arm Creek did not always meet the Class III criteria for % dissolved oxygen

(DO) saturation. This is not surprising since low gradient, low flow streams often have low DO levels.

Vegetation

Several species of invasive exotic plants are in the water and line the bank of the tributary including tallow tree (*Sapium sebiferum*) and privet (*Ligustrum* sp.). In many cases, exotic plants will crowd out and replace native plants. This may stress native wildlife, which have evolved to depend on native plants for food and shelter. The native wildlife may move away or perish if the native vegetation is replaced by exotic plants.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Past sampling showed that Alford Arm nutrient levels appear, in most cases, to meet the nutrient thresholds for the East Panhandle Region. Over the sampling period, the Class III criterion for % DO saturation was not always met. This is not a surprising result in this low gradient, low flow stream. Several species of invasive exotic plants are in and around the tributary.

Thank you for your interest in maintaining the water quality of Leon County's aquatic resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 1

Attachment # 1 Page 59 of 178



Figure 1. Total nitrogen results for Alford Arm Creek.



Figure 2. Total phosphorus results for Alford Arm Creek.

Attachment # 1 Page 60 of 178



Figure 3. Dissolved Oxygen Percent Saturation results for Alford Arm Creek.

Waterbody: Apalachee Creek



Basin: Lake Lafayette

Apalachee Creek is a slightly tannic stream that flows north and drains into Lower Lake Lafayette.

As shown in the following pie chart, approximately 52% of land use in the 800-acre watershed is agriculture, transportation, utilities, urban and residential. Increases in stormwater runoff, and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Apalachee Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, FDEP data requirements for the NNC could not be met for several years (Table 1). The 2009, 2013, 2014 and 2021 results showed that the NNC thresholds were not exceeded. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total nitrogen or total phosphorus.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples collected over a thirty-day period was exceeded during the 4^{th} quarter of 2021 (670 cfu). The exceedance was probably the result of wildlife. Another cause could be residential development in the watershed (e.g., improperly functioning septic tanks).

Vegetation

Several species of exotic plants line the bank of Apalachee Creek including wild taro (*Colocasia* sp.)

and privet (*Ligustrum* sp.). In many cases, exotic plants will crowd out and replace native plants. This may stress native wildlife, which have evolved to depend on native plants for food and shelter. The native wildlife may move away or perish if the native vegetation is replaced by exotic plants.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Apalachee Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2007- 2008	-	-
2009	0.32	0.11
2010-2012	-	-
2013	0.41	0.12
2014	0.30	0.10
2015-2020	-	-
2021	0.39	0.10

Table 1. FDEP's total nitrogen and phosphorus criteria for streams applied to Apalachee Creek.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Apalachee Creek met the nutrient thresholds for the East Panhandle Region. Several species of exotic plants line the bank of Apalachee Creek which may affect native wildlife dependent on native plants for food and shelter. The *E. coli* water quality limit was exceeded during the 4th quarter of 2021. The exceedance was probably the result of wildlife or improperly functioning septic tanks.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the water quality of Leon County's aquatic resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 63

Attachment # 1 Page 63 of 178



Figure 1. Total nitrogen results for Apalachee Creek.



Figure 2. Total phosphorus results for Apalachee Creek.

Waterbody: Lafayette Creek



Basin: Lake Lafayette

Lafayette Creek is a slightly tannic stream that flows north and drains into Upper Lake Lafayette. Station 1 (Sample site 65) is located on Apalachee Parkway, while Station 2 (LafayetteCreek3) is located further downstream where Lafayette Creek enters Upper Lake Lafayette.

As shown in the figure below, approximately 60% of land use acreage in the 1,860-acre watershed is agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Lafayette Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC), expressed as an annual geometric mean, cannot be exceeded more than once in a three-year period. Due to low water conditions, FDEP data requirements for the Numeric Nutrient Criteria (NNC) could not be met for 2010 through 2012 for Station 1 (Table 1) and were only met once (2021) at Station 2 since 2007. While the NNC have never exceeded the state criteria at Station 1, individual values were oftentimes above the protection criteria (Figures 1 and 2) with the latest occurring in July 30, 2020. Total nitrogen (1.5 mg/L) and chlorophyll-a (30.3 µg/L) results were extremely elevated when compared to other 2020 results. Recent rainfall (1.24 inches of rain was recorded at the Tallahassee Airport on July 28) suggests that elevated results were the result of nutrient laden stormwater runoff entering the system. The turbidity result (29.3 NTU) further collaborates that stormwater runoff was a

factor in the elevated levels of nitrogen and chlorophyll-a.

For illustrative purposes, individual data points were plotted for Station 2 to determine any possible trends (Figures 3 and 4). With only one exception in 2009 (phosphorus), individual values did not exceed the instream criteria for total nitrogen or total phosphorus. As was mentioned before, FDEP data requirements for the NNC were met in 2021 for Station 2. The geometric means for total nitrogen (0.27 mg/L) and total phosphorus (0.07 mg/L) values were well below the NNC criteria.

Lafayette Creek Station 1	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2008	0.77	0.16
2009	0.59	0.18
2010- 2012	-	-
2013	0.76	0.10
2014	0.47	0.07
2015	0.80	0.13
2016	0.85	0.11
2017	0.52	0.08
2018	0.53	0.10
2019	0.49	0.13
2020	0.78	0.12
2021	0.48	0.10

Table 1. FDEP's total nitrogen	and phosphorus criteria for streams ap-
plied to Lafavette Creek.	

Iron Bacteria

As mentioned in previous reports, the sediment in Station 1 has an orange/brown cast. This is the result of naturally occurring iron bacteria. Iron bacteria are a group of bacteria that grow by producing enzymes that promote chemical reactions involving iron within the water. After several reactions, the dissolved iron in the water converts into insoluble iron hydroxides, forming a brown/orange mass of gelatinous material that coats surfaces under the water. This often occurs in streams that receive "seepage" from subsurface water flow. While it may appear unsightly, there is no evidence to suggest that it is harmful to human health, but there is a potential loss of animal habitat in the tributary due to the ferric iron precipitate covering existing habitat. The iron bacteria may also be contributing to the previously mentioned turbidity concern.

Escherichia coli (E. coli)

E. coli levels at Station 2 exceeded the Class III water quality standard daily limit of > 410 in 10% threshold value of samples collected over a 30-day period during the third (540 cfu) and fourth (720 cfu) quarters of 2021. Exceedances are possibly the result of residential development in the watershed and/or domestic or wild animals.

Exotic Plants

Several species of exotic plants line the bank of Lafayette Creek including wild taro (*Colocasia esculenta*), coral ardesia (*Ardesia crenata*) and privet (*Ligustrum* spp.). In many cases, exotic plants will crowd out and replace native plants. This may stress native wildlife, which have evolved to depend on native plants for food and shelter. The native wildlife may move away or perish if the native vegetation is replaced by exotic plants.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

While individual nutrient results occasionally spiked above threshold criteria, Lafayette Creek continued to meet the NNC thresholds for the East Panhandle Region. Elevated turbidity values were identified in past sampling and remain somewhat an issue for Lafayette Creek and could negatively affect the native creek fauna. *E. coli* levels at Station 2 exceeded Class III water quality standards during the third and fourth quarters of 2021. Exceedances are possibly the result of residential development in the watershed and/or domestic or wild animals. Several species of exotic plants line the bank of Lafayette Creek which may affect native wildlife dependent on native plants for food and shelter. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of watershed – Sample Sites 65 and LafayetteCreek3.

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Figure 1. Total nitrogen results for Station 1 on Lafayette Creek.

Attachment # 1 Page 67 of 178



Figure 2. Total phosphorus results for Station 1 on Lafayette Creek.





Attachment # 1 Page 68 of 178



Figure 4. Total phosphorus results for Station 2 on Lafayette Creek.

Waterbody: Lake Lafayette



Basin: Lake Lafayette

Lake Lafayette was historically a meandering, wetland/prairie lake system located in eastern Leon County, but land alterations in the mid-1900s separated the lake into four distinct sections, known as Upper Lake Lafayette, Lake Piney Z, Alford Arm, and Lower Lake Lafayette. Limited hydraulic connectivity occurs between the various sections, much of which is present only during high water elevations. Because of the compartmentalization of the four sections, each section is treated as a separate "lake" with its own watershed.

Wetland or Lake?

Lower Lake Lafayette appears and functions like a cypress dominated swamp, while Alford Arm is a combination of cypress and various emergent/floating plant species. Typical of wetlands, there is little open water at either location, and the open water that currently exists in Lower Lake Lafayette is due to Fish and Wildlife's maintenance of the canoe trails. Due to access issues (low water and the extreme amounts of vegetation) Leon County staff have been unable to sample Alford Arm for several years and have only intermittently sampled Lower Lake Lafayette.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment samples were collected to determine the health of Upper Lake Lafayette, Piney Z and Lower Lake Lafayette and met the requirements of the Florida Department of Environmental Protection (FDEP). Although Alford Arm contains areas of standing water, the vast majority is covered by dense stands of both submergent and emergent wetland vegetation. Because of the dense vegetation and low water conditions, samples could not be collected for most of 2010, and no samples were collected in 2011-2015. The station was eliminated in 2015.



The typically phosphorus-limited Upper Lake Lafayette is the westernmost lake in this system. The most dominant feature of Upper Lake Lafayette is the sinkhole (Lafayette Sink) located in the northeastern portion of the lake and draining into the Floridan Aquifer. Much of the water entering Upper Lake Lafayette ultimately discharges into the sink area. As a result, the area and volume of the lake is highly variable. During typical rainfall periods, the area around Lafayette Sink becomes a 354-acre lake, but following dry periods, the lakebed can drain almost completely into the sinkhole. The heavily urbanized Northeast Drainage Ditch and Lafavette Creek are the primary sources of water for the lake. Three other minor contributing sources are two small tributaries to the north of the lake and Lake Piney Z.

As shown in the following pie chart, agriculture, rangeland, transportation, utilities, urban and residential uses make up approximately 74% of the 14,792-acre Upper Lake Lafayette watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

The U.S. EPA established a TMDL on Upper Lake Lafayette in March 2012 that requires a 36% reduction in total phosphorus. Upstream of Upper Lake Lafayette is a stormwater facility known as the Weems Pond Regional Stormwater Treatment Facility (Weems Pond). The City of Tallahassee converted Weems Pond into an alum-injection facility that was brought online in October 2015. The retrofit of the facility is hoped to reduce pollutant loads leaving the pond, which flow downstream through the Northeast Drainage Ditch and into Upper Lake Lafayette.



The construction of the stormwater treatment facility for a single-family subdivision immediately north of Upper Lake Lafayette is underway. The stormwater treatment facility is planned to be a wet detention facility with littoral plantings, with the discharge from the facility approximately 600 feet west of the sinkhole. The construction of this facility is challenging because an existing stream located immediately adjacent to the planned facility discharges directly into the sink. However, the facility is constructed (berm and outfall structure) in such a matter to protect the stream from additional impact of the subdivision. The construction has, at times limited Leon County staff access to the sample location and prevented water quality sampling during the latter part of the 2021.

Results

Nutrients

The nutrient thresholds and results for Upper Lake Lafayette are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. When viewing tables and figures, the absence of data means there was not enough data collected (due to lack of access) to fulfill data requirements. FDEP's current NNC data requirements state "that there shall be at least four temporally independent samples per year ...".

The table shows that the geometric means of chlorophyll-a and total phosphorus exceeded the state criteria several times since sampling began. This is the result of urbanized inflow streams combined with fluctuating lake levels and rainfall. Oftentimes, the reduced lake volume concentrates incoming pollutants, thus reducing the lake's ability to assimilate incoming nutrients. While chlorophyll-a and nitrogen levels met the NNC in 2020, total phosphorus levels slightly exceeded the criteria. Land clearing due to the development of the adjacent Falls Chase property prevented water quality sampling during the latter part of the 2021. Based on the two samples collected in 2021, the geometric means of chlorophyll-a (1 μ g/L), and total nitrogen (0.45 mg/L) were below the NNC criteria, while total phosphorus (0.10 mg/L) was slightly above the criteria.

Fish Kills

Upper Lake Lafayette has a history of fish kills. The latest reported fish kill occurred in September of 2019. Lake levels at the time of the fish kill were at the level of the sinkhole, meaning that the fish community was concentrated to a very small area. The elevated phosphorus and nitrogen levels caused increased microbial activity, causing lower oxygen levels in the water. In this case, it was concluded that the fish, already stressed from being in a concentrated area, died mostly from low oxygen levels.

For more information regarding fish kills, please visit: https://myfwc.com/research/saltwater/health/abno rmalities/causes/

Other Parameters

Historically, elevated Biological Oxygen Demand (BOD) results (average is 4.2 mg/L) have been an issue since Leon County sampling began in 2006 (Figure 1). Like the elevated nutrients and chloro-

phyll-*a* levels, urbanized inflow streams and a fluctuating lake volume appear to be detrimentally affecting water quality.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for

 lakes applied to Upper Lake Lafayette. Results in bold signify exceed

 ances of the State criteria.

Clear Lakes, High Alkalinity	Chlorophyll-a 20.0 µg/L	Total Nitrogen Threshold 1.05-1.91 mg/L	Total Phosphorus Threshold 0.03-0.09 mg/L
2004	2.3	0.33	0.04
2005	25.2	0.81	0.10
2006	3.3	0.56	0.09
2007	4.9	0.60	0.07
2008	24.5	0.60	0.15
2009	6.9	0.43	0.08
2010	6.9	0.77	0.07
2011	32.7	0.68	0.10
2012	31.0	0.90	0.15
2013	16.8	0.79	-
2014	-	-	-
2015	48.5	0.88	0.12
2016	-	-	-
2017	40.4	1.24	0.08
2018	-	-	-
2019	48.2	1.55	0.14
2020	14.1	0.39	0.10
2021	-	-	-

Conclusions

Upper Lake Lafayette has a history of elevated nutrients, chlorophyll-a levels and microbial activity and continues to not meet the NNC. Fish kills continue to occur with the latest reported fish kill occurring in September of 2019. Urbanized inflow streams combined with fluctuating lake volume exacerbated the various challenges that Upper Lake Lafayette continues to have.



Figure 1. BOD results for Upper Lake Lafayette.

Lake Piney Z



Lake Piney Z is a 228-acre waterbody located between Upper Lake Lafayette and Lower Lake Lafayette which consists primarily of an open water system, although substantial stands of vegetation were historically present within the lake.

As shown in the following pie chart, transportation, utilities, urban and residential land uses make up approximately 45% of the 691-acre Piney Z watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Lake Piney Z can discharge to Lower Lake Lafayette via two outfalls located on the east end of the lake and/or discharge to Upper Lake Lafayette via a ditch and outfall located on the west side of the lake. Lake Piney Z receives stormwater inflow from the Piney Z Plantation development and the Swift Creek Middle School stormwater pond on its northern shore, from a few holding ponds near the southern portion of the lake and from the dirt road that surrounds the lake.

In 1997, Lake Piney Z was drawn down and organic matter was scraped from the bottom and used to construct fishing fingers extending north from the southern bank. Following construction of the fishing fingers, the lake was restocked with game fish. Currently, the Florida Fish and Wildlife Conservation Commission, in cooperation with the City of Tallahassee, manage Piney Z as a Fish Management Area.


Results

Nutrients

The nutrient thresholds and results are found in Table 2. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as annual geometric means) cannot be exceeded more than once in a three-year period. FDEP's current numeric nutrient data requirements state "that there shall be at least four temporally independent samples per year . . .". When viewing tables and figures, the absence of data means there was not enough data collected (due to low water levels or the inability to access the lake) to fulfill data requirements.

The table shows that the geometric mean of chlorophyll-a and total phosphorus normally exceeds the state criteria throughout the sampling period. The 2021 results showed that the NNC was met for all parameters. This is the first time the chlorophyll-a criteria has been met since 2009.

Past excessive chlorophyll-a and nutrient levels are the result of past lake management practices. The overuse of herbicides and the addition of grass carp to Piney Z have led to an almost completely open water system. Nutrients are being assimilated by algae instead of being taken up by vascular plants, leading to massive and long-lasting algal blooms. Fortunately, management practices have changed, most notably with the replanting of emergent vegetation and the reestablishment of other native vegetation via the natural seedbank. With the apparent improvement in chlorophyll-a, it is hoped that long term ecosystem health will continue to improve.

Floral Assessment

The Lake Vegetation Index (LVI) score for Piney Z was 46, placing the lake's vegetative community at the lower end of the Healthy category.

Forty-three species were found during the survey. Denseflower knotweed (*Polygonum densiflorum*) and the Invasive Exotic water hyacinth (*Eichornia crassipes*) were the most dominant species at the lake. Other native vegetation included buttonbush (*Cephalanthus occidentalis*), American lotus (*Nelumbo lutea*), red maple (*Acer rubrum*), and maidencane (*Panicum hemitomon*).

Unfortunately, camphor tree (*Cinnamomum camphora*), the aforementioned water hyacinth (*Eichhornia crassipes*), wild taro (*Colocasia esculenta*), torpedo grass (*Panicum repens*), Peruvian primrose willow (*Ludwigia peruviana*), and Chinese tallow (*Sapium sebiferum*), all listed as Category I Invasive Exotics by the Florida Exotic Pest Control Council were found in or along the shoreline of Piney Z. Alligator weed (*Alternanthera philoxeroides*) is a Category II Invasive Exotic found in the lake. Water spangles (*Salvina minima*) was another exotic plant found in Lake Piney Z.

For more information concerning Florida Invasive Exotics, please click on the Florida Exotic Pest Control Council website; http://www.fleppc.org/.

Click here for more information on the Lake Piney Z LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Piney Z due to elevated levels of mercury.

Click here for more information about fish consumption advisories.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Table 2. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Lake Piney Z. Results in bold signify exceedances of the State criteria.

Class		Total	Total
Clear	Chlorophyll-a	Nitrogen	Phosphorus
Lаке,	6.0	Threshold	Threshold
	μg/L	0.51-0.93	0.01-0.03
Аіканпіту		mg/L	mg/L
2004	6.48	0.45	0.04
2005	12.98	0.78	0.05
2006	25.17	0.70	0.08
2007	2.92	0.96	0.04
2008	8.78	0.73	0.04
2009	4.43	1.33	0.06
2010	17.2	1.06	0.07
2011	36.43	1.28	0.08
2012	32.62	1.65	0.06
2013	27.01	1.12	-
2014	6.02	1.05	0.04
2015	15.00	0.67	0.04
2016	-	-	-
2017	17.3	1.01	0.05
2018	21.6	0.84	0.04
2019	23.5	0.87	0.05
2020	-	-	-
2021	1.92	0.58	0.03

Conclusions

Based on ongoing sampling, Lake Piney Z did not meet the nutrient thresholds for the East Panhandle Region. The elevated nutrients and chlorophyll-a are in response to past fishery management strategies. Fortunately, management practices have changed, most notably with the replanting of emergent vegetation and the reestablishment of other native vegetation via the natural seedbank. The LVI score for Piney Z was 46, placing the lake's vegetative community at the lower end of the Healthy category. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Lower Lake Lafayette



Lower Lake Lafayette is the largest of the four lake compartments, covering an area of 1,006 acres and bordered by the Leon County Apalachee Regional Park Solid Waste Facility, Talquin Electric Sewage Treatment Plant and various residential and commercial developments. Lower Lake Lafayette is also home to a wood stork colony.

As shown in the following pie chart, agriculture, rangeland, transportation, utilities, urban and residential uses make up approximately 54% of the 36,966-acre Lower Lake Lafayette watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Water from Alford Arm enters Lower Lake Lafayette via pipes located under the FGA railroad track. Discharges from Lower Lake Lafayette occur through an

earthen channel on the eastern end of the lake and pass under Chaires Crossroad before entering the wetland system associated with the St. Marks River. Depending on water levels, water from the St. Marks River will flow into Lower Lake Lafayette.

Lake or Wetland?

Lower Lake Lafayette has gradually transitioned from a lake to what appears and functions like a cypress dominated swamp, Florida Administrative Code 62-302(16) defines a lake as ". . . a lentic fresh waterbody with a relatively long water residence time and an open water area that is free from emergent vegetation under typical hydrologic and climatic conditions. Aquatic plants, as defined in subsection 62-340.200(1), F.A.C., may be present in the open water." As Figure 2 shows, there is little open water; the open water that currently exists is due to Fish and Wildlife's maintenance of the canoe trails. Leon County staff and FDEP were in discussions regarding the re-classification of this waterbody from a lake to a wetland. FDEP decided that they would not reclassify the system.

Due to access issues (low water and the extreme amounts of vegetation) Leon County staff have only been able to intermittently sample the system.

Results

Nutrients

The nutrient thresholds and results are found in Table 3. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. State Numeric Nutrient Criteria were not exceeded during the period of record.

Other Parameters

Due to the wetland like nature of Lower Lake Lafayette, dissolved oxygen (DO) levels can be very low. Staff considers the low DO levels normal for this type of system (Figure 3).

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

When the sampling requirements were met, State criteria were not exceeded for the NNC. Due to the wetland like nature of Lower Lake Lafayette, Staff considers the lake's low DO levels normal for this type of system.

Table 3. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for
lakes applied to Lower Lake Lafayette.

Colored Lakes	Chlorophyll-a 20.0 μg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L	
2004	3.0	0.49	0.02	
2005	2.9	0.56	0.02	
2006	2.3	0.72	0.03	
2007	1.9	0.62	0.02	
2008	2008 -		-	
2009	2.2	0.42	0.02	
2010	2.6	0.53	0.01	
2011-2015	-	-	-	
2016	5.5	0.52	0.02	
2017	5.4	0.64	0.02	
2018-2021	-	-	-	



Figure 2. Lower Lake Lafayette.



Figure 3. Dissolved Oxygen Percent Saturation results for Lower Lake Lafayette. The data gap reflects low (or no) water in the system at that time.

Alford Arm



Alford Arm is a 371-acre waterbody which was separated from Lower Lake Lafayette by construction of the FGA Railroad. As shown in the following pie chart, agriculture, rangeland, transportation, utilities, urban and residential uses make up approximately 55% of the 30,116-acre Alford Arm watershed. Low water crossings constructed in the 1950's affected water flow through the system. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Although Alford Arm contains areas of standing water, the vast majority is covered by dense stands of both submergent and emergent wetland vegetation.



Because of the dense vegetation and low water conditions, samples could not be collected for most of 2010, and no samples were collected in 2011 through 2014. Because of ongoing conditions, staff eliminated this sampling station in 2015. Like Lower Lake Lafayette, Leon County staff and FDEP are in discussions regarding the re-classification of this waterbody from a lake to a wetland.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for map of watershed – Sample sites L02, L30, LPZ3, LLL2, LLL3, and LLL10.

Johnny Richardson, Water Resource Scientist (850) 606-1500 Richardsonjo@leoncountyfl.gov



Basin: Lake Lafayette

The Northeast Drainage Ditch is a heavily urbanized stream located within the City of Tallahassee. The stream flows east and eventually enters Upper Lake Lafayette. Directly upstream of the water quality sampling station is a stormwater facility known as Weems Pond Regional Stormwater Treatment Facility (Weems Pond). The City of Tallahassee converted Weems Pond into an alum-injection facility that was brought online in October 2015. The retrofit of the facility reduces pollutant loads leaving the pond, which flow downstream through the Northeast Drainage Ditch and into Upper Lake Lafayette.

As part of the Weems Road Pedestrian and Street Safety (PASS) project, the drainage system, pedestrian, and bicycle transportation were all improved. Upgrades to the stormwater and roadway drainage system will help alleviate flooding that has historically occurred in the area. The project began in June 2019 and was completed in September of 2020. Water quality sampling resumed in October 2020.

Portions of the Northeast Drainage Ditch west of Weems Road were historically altered for mosquito control and/or drainage purposes. The greatly altered flow conditions create channel scour during storms and contribute to low base flow east of Weems Road. In comparison, the area east of Weems Road is relatively unaltered beyond the Weems Road right of way; the effects of upstream canalization extend only a short distance downstream of Weems Road. However, effects of the upstream modifications are reflected in the altered flow conditions of the stream.

As shown in the following pie chart, approximately 82% of land use in the 7,851-acre Northeast Drainage Ditch watershed upstream of the sample station is agriculture, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use. In late 2006, the U.S. Environmental Protection Agency (EPA) set a Total Maximum Daily Load (TMDL) target for fecal and total coliforms. The TMDL establishes the allowable loadings to the creek that would restore the creek to applicable water quality thresholds. In this case, fecal coliforms would have to be reduced by 63% to meet the criterion of fecal coliforms not exceeding 400/100 mL Most Probable Number (MPN) in 10 percent of the samples. When the TMDL was established, the EPA expected a reduction of 52% to meet the criterion for total coliform. However, the fecal coliform standard in Florida has been supplanted by standards developed for *Escherichia coli* as an indicator of bacterial contamination.

Methods

Samples were collected to determine the health of the Northeast Drainage Ditch and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

Due to low water conditions, and the recent road work in the vicinity of the water quality station, FDEP data requirements for the Numeric Nutrient Criteria (NNC) could not always be met (Table 1). When requirements were met, nutrient values did not exceed the state criteria. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With very few exceptions, individual values did not exceed the instream criteria for total nitrogen or total phosphorus.

Fecal coliforms and Escherichia coli

As mentioned previously, the EPA set a fecal coliform TMDL for the Northeast Drainage Ditch. While fecal coliforms were elevated above the 400/100 mL Class III limit in 12.9% of the samples for Class III waters, there has only been two exceedances since December 2009, with the latest being the June 11, 2015 event (530/100 mL). The adopted *E. coli* water quality limit of > 410 in 10% of samples collected over a 30-day period was also exceeded (490/100 mL) during the June 2015 sampling event (Figure 3).

Stream Condition Index and Habitat Assessment

The results of the Habitat Assessment scoring (90), characterize the stream habitat in the high Marginal to low Suboptimal category. A review of historical aerial photography starting in 1937 shows that what is now called Northeast Ditch was originally a natural stream that has been re-purposed for stormwater management. Weems Pond was constructed in the 1960-1966 period with associated stream canalization apparently extending only a short distance below (downstream of) Weems Road. In 2019, construction began on Weems Road in an effort to address flooding concerns in the area. Extensive improvements to the discharge structures below the roadway and surrounding riparian zone around the bridge were completed by September of 2020. In response to these changes, the station transect was moved approximately 25 meters downstream past a bend. The upper 10-20 meters of the SCI transect appears to have been historically altered. However, erosion caused by high stormwater flow is evident throughout the transect. For example, there are areas in which large portions of the root wads of the riparian trees are exposed to the air with soils having been washed away. Additionally, the channel bed is comprised primarily of exposed clay. Most of these zones of clay are covered by a thick layer of fine silt.

The 2021 SCI collected at this sample station achieved a score of 29 which equates to the high end of the FDEP Impaired category. The previous SCI collected on this station was completed two years prior to the Weems Road reconstruction and received a score of 38 which is on the low end of the Healthy category. The macroinvertebrate community during the 2021 event was strongly dominated by two mollusks: the freshwater snail *Physa* sp. and the exotic Asian clam *Corbicula fluminea*. Between both samples, a total of 291 macroinvertebrates were sorted. Of those 291 macroinvertebrates, 124 (42.6%) were *Physa sp.* and 78 (26.8%) were *Corbicula fluminea*. Looking at the EPT species, no Plecoptera (stoneflies) or Ephemeroptera (mayflies) were collected in the SCI. Three species of Trichoptera (caddisflies) were collected in the SCI. Two are micro-caddisflies (Hy-droptilidae), *Oxyethira* sp. (both vials) and *Hydroptila* sp. (vial two only). Two specimens of the Polycentropodidae caddisfly, *Cernotina* sp. were recovered from vial one.

For more information about the SCI and Habitat Assessment, click Here.

Other Parameters

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Other water quality parameters appear to be normal for the area and no impairments were noted.

Table 1. FDEP's tota	l nitrogen ar	nd phospho	orus criteria	for st	treams a	ap-	
plied to the Northeast Drainage Ditch.							

Northeast Drainage Ditch	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L	
2006- 2008	-	-	
2009	0.17	0.07	
2010- 2011	-	-	
2012	0.81	0.10	
2013	0.30	0.09	
2014	-	-	
2015	0.35	0.11	
2016	0.27	0.03	
2017	0.23	0.02	
2018-2020	-	-	
2021	0.20	0.02	

Conclusions

Based on ongoing sampling, the Northeast Drainage Ditch met the nutrient thresholds for the East Panhandle Region. The greatly altered flow conditions continue to create channel scour during storms and contribute to low base flow east of Weems Road. The results of the Habitat Assessment scoring characterize the stream habitat in the high Marginal to low Suboptimal category. The 2021 SCI achieved a score of 29 which equates to the high end of the FDEP Impaired category. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site NE Ditch at Weems.

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Northeast Drainage Ditch	Score	Category
Substrate Diversity	8	Marginal
Substrate Availability	6	Marginal
Water Velocity	7	Marginal
Habitat Smothering	11	Suboptimal
Artificial	13	Suboptimal
Channelization		
Bank Stability	6, 6	Poor, Poor
Riparian Zone Width	9, 9	Optimal,
		Optimal
Riparian Vegetation	8, 7	Suboptimal,
Quality		Suboptimal
Final Habitat		90
Assessment Score		
Interpretation	Marginal/Suboptimal	

 Table 2. Northeast Drainage Ditch Habitat Assessment Score.

Table 3. Northeast Drainage Ditch Stream Condition Index Score. Vial 1 Vial 2 **Northeast Drainage** Ditch **Stream Condition Index Metrics Scores Total Taxa** 3.48 2.61 0 Ephemeroptera Taxa 0 Trichoptera Taxa 2.86 2.86 6.01 % Filter Feeder 4.87 Long-lived Score 3.33 6.67 **Clinger Taxa** 1.25 1.25 % Dominance 5.17 3.73 % Tanytarsini Taxa 1.64 2.86 Sensitive Taxa 2 1 % Tolerant Taxa 0.91 0.49 SCI Vial Score 33.56 25.31 **Stream Condition Index** 29 Score **Score Interpretation** Impaired



Figure 1. Total nitrogen results for Northeast Drainage Ditch.

Attachment # 1 Page 82 of 178



Figure 2. Total phosphorus results for Northeast Drainage Ditch.



Figure 3. E. coli results for Northeast Drainage Ditch.

Waterbody: Unnamed Stream at Chaires Crossroad



Basin: Lake Lafayette

The Unnamed Stream at Chaires Crossroad is a highly altered stream/ditch draining Alford Arm and Lower Lake Lafayette and is located in eastern Leon County.

As shown in the following pie chart, approximately 54% of land use in the 36,966-acre watershed is agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of the Chaires Crossroad stream and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low or backflow water conditions, four temporally independent samples per year have only been achieved once (2009) during the period of record (2007-2021). For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). Individual values did not exceed the instream criteria for total phosphorus, but did occasionally exceed the nitrogen criteria, with the last exceedance being in 2015.

Dissolved Oxygen

As Figure 3 shows, the unnamed creek seldom met the Class III criteria for dissolved oxygen. This is not

surprising since low gradient, low flow streams often have low dissolved oxygen levels.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Due to low water conditions, four temporally independent samples per year have only been achieved once (2009) during the period of record. Individual values did not exceed the instream criteria for total phosphorus, but did occasionally exceed the nitrogen criteria, with the last exceedance being in 2015. Dissolved oxygen levels have seldom met the Class III criteria. This is not surprising since low gradient, low flow streams often have low dissolved oxygen levels. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 57.

Johnny Richardson, Water Resource Scientist (850) 606-1500 Richardsonjo@leoncountyfl.gov

Attachment # 1 Page 85 of 178



Figure 1. Total phosphorus results for Unnamed Stream at Chaires Crossroad.



Figure 2. Total nitrogen results for Unnamed Stream at Chaires Crossroad.

Attachment # 1 Page 86 of 178



Figure 3. Dissolved Oxygen Percent Saturation results for Unnamed Stream at Chaires Crossroad.

6. Lost Creek Basin

Waterbody: Lost Creek

Basin: Lost Creek

Lost Creek is a tannic, acidic, phosphorus-limited stream located in southwestern Leon County. The Lost Creek water quality station was moved from Bloxham Cutoff to U.S. Forest Road 309 in 2011.

As the following pie chart shows, the majority of the 30,499-acre Lost Creek basin is relatively undeveloped with rangeland, transportation and utilities making up 2% of land use.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water was collected to determine the health of Lost Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Table 1. Total nitrogen levels exceeded state criteria in 2007 and 2014 while phosphorus levels met the criteria for all measured years. When viewing Table 1, the absence of a number means there were not enough data collected (due to lack of water or low water levels) to calculate a result. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). As mentioned in previous reports, most of the nitrogen analyzed continues to consist mostly of organic nitrogen (Figure 3). Organic nitrogen consists of dissolved organic nitrogen (organic molecules and compounds, viruses and small bacteria) and particulate organic nitrogen (dead organic matter and living organisms). Because organic nitrogen is "locked up" in organic material, it is not considered immediately available for biological activity.

Table 1. FDEP's total nitrogen and phosphorus criteria for streams applied to Lost Creek. Results in bold signify exceedances of the State criteria.

Lost Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2007	1.10	0.03
2008	1.01	0.00
2009	0.78	0.00
2010	0.85	0.02
2011	0.88	0.03
2012	-	-
2013	0.65	0.01
2014	1.16	0.02
2015	0.90	0.01
2016-2017	-	-
2018	0.83	0.01
2019-2021	-	-

Dissolved Oxygen

Lost Creek percent Dissolved Oxygen (DO) saturation values were occasionally below the 34 percent limit during certain events (Figure 4). Staff believes that this is a natural condition for this location, since the creek is a low gradient blackwater stream that drains wetlands.

Fecal Coliforms and Escherichia coli (E. coli)

While the former fecal coliform standard was exceeded several times at Lost Creek, the current *E. coli* standard has never been exceeded since the analysis was implemented in 2015.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

With the exception of total nitrogen in 2007 and 2014, Lost Creek met the nutrient thresholds for the Big Bend Bioregion. No other water quality impairments were noted in 2021.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site LC at FR309.

Johnny Richardson, Water Resource Scientist (850) 606-1500 Richardsonjo@leoncountyfl.gov

Attachment # 1 Page 90 of 178



Figure 1. Total nitrogen results for Lost Creek.



Figure 2. Total phosphorus results for Lost Creek.

Attachment # 1 Page 91 of 178



Figure 3. Total vs. organic nitrogen results for Lost Creek.



Figure 4. Dissolved Oxygen Percent Saturation results for Lost Creek.

7. Lake Miccosukee Basin



Basin: Lake Miccosukee

Lake Miccosukee is a 6,257-acre, phosphorus-limited lake that forms the northeastern border of Leon County. Lake Miccosukee is considered a shallow, prairie lake which historically drained via sinkholes becoming nearly dry in the process. The result of the natural drawdowns was a large reduction in the amount of organic matter content found in the bottom sediments.

In 1954, a control structure was constructed around the northern sinkhole and a wooden weir constructed at the southern end of the lake to stabilize water levels. Water level stabilization led to increased emergent vegetation in the lake, so that vegetation covered as much as 80% of the lake's surface. By taking up space and decreasing oxygen levels, the increased vegetation also contributed to the diminishment of the fish population and increased the amount of organic material in the sediment.

Because of rising concerns about the health of the lake, the control structure gate was opened during the 1999 drought, allowing part of the lake to drain into the aquifer via the sinkhole. Several areas of the lake were excavated, and part of the lake bottom was burned during the drawdown. The burning and excavation led to increased lake volume and removed a portion of the organic rich sediment. After tropical storms Allison and Barry passed through the area in 2001, Lake Miccosukee quickly refilled. A second drawdown was done in 2012. Prescribed burning was performed on a portion of the woody tussocks that float on the lake. The drawdown affected field operations with staff being unable to collect water samples for the 4th quarter of 2012.

In 2010, an additional sinkhole developed on the southeast side of the lake. While it's thought that this sinkhole won't completely drain the lake, it may keep the lake levels lower during dry periods.

As shown in the following pie chart, approximately 15% of land use in the 147,861-acre Lake Miccosukee basin is agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment sampling were conducted and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period.

No exceedances were noted, but chlorophyll-*a* values and total nitrogen values were elevated in 2013, possibly as a result of nutrient fluxes associated with the most recent lake refilling. Values in 2014 were slightly lower, but chlorophyll-*a* and total phosphorus values increased in 2015. Sampling conditions prevented sampling during the 2nd quarter of 2016, but based on three samples, chlorophyll-a (13.0 μ g/L) and total nitrogen (0.79 mg/L) levels were similar to what was seen in 2015. Total phosphorus levels (0.03 mg/L) had decreased to 2014 levels. Nutrient and chlorophyll-a levels in 2017 were similar to what was found in 2014 with lower or similar levels in 2018 and 2019.

In 2020, an unusual chlorophyll-a result (59.3 μ g/L) during the fourth quarter sampling event skewed the 2020 chlorophyll-*a* geometric mean. This result is by far the highest chlorophyll-a reading measured by Leon County staff since sampling begin. Other readings taken at the same station in 2020 ranged from 6.1 to 7.5 μ g/L. While nothing unusual was noted at the time of sampling, it is possible that a filamentous strand or large clump of algae could have been dislodged from the surrounding emergent/floating vegetation and inadvertently introduced into the sample container, thus biasing the result. Elevated

BOD (3.6 mg/L) and total suspended solids (12.0 mg/L) levels also suggest a possibility of "clumps" of organic material in the water, including masses of algae. In contrast, chlorophyll-a values in 2021 were very low, while nutrient values were similar to the preceding three years.

Changes in the area around the station may have contributed to changes in nutrient concentrations (Figure 1). Previously, the area in the vicinity of station MI2 was dominated by *Nymphaea odorata*, the fragrant water lily. Florida Fish and Wildlife (FWC) contractors enlarged an open water area adjacent to the station that had encompassed the station area. More recently, emergent vegetation has again become more dominant, with the addition of floating tussock islands having formed, or floated into the sampling area. Because of the anthropogenic disturbances to the vegetative community, fluctuating water chemistry results have continued to occur.

Dissolved Oxygen (DO)

As Figure 2 shows, the Lake Miccosukee stations showed percent DO saturation values that did not meet Class III water quality criteria. Staff considers the low DO normal for this lake because the stations are shallow and normally covered with vegetation, preventing rapid water exchange with the larger area of the lake. Plant respiration (samples were often taken in the morning hours) and organic sediments also contributed to the low DO saturation values. Because station MI2 has become less vegetated, more water circulation is occurring along with less plant respiration, thus allowing DO saturation values to increase.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Miccosukee due to elevated levels of mercury.

Click here for more information about fish consumption advisories.
 Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Lake Miccosukee.

		Total	Total
Colored	Chlorophyll a	Nitrogen	Phosphorus
		Threshold	Threshold
Lаке	20.0 µg/L	1.27-2.23	0.05-0.16
		mg/L	mg/L
2004	4.6	0.28	0.02
2005	6.1	0.40	0.03
2006	2.9	0.52	0.02
2007	2.3	0.69	0.02
2008	3.3	0.61	0.01
2009	3.5	0.42	0.02
2010	8.8	0.70	0.03
2011	011 5.8 0.82		0.04
2012	-	-	-
2013	11.7	1.05	0.04
2014	9.5	0.86	0.03
2015	11.6	0.78	0.06
2016	-	-	-
2017	10.5	0.83	0.03
2018	7.5	0.68	0.02
2019	7.7	0.63	0.03
2020	11.5	0.67	0.02
2021	1.3	0.63	0.02

Conclusions

Based on ongoing sampling, Lake Miccosukee met the nutrient thresholds for the East Panhandle Region. Changes in the plant community are influencing nutrient, chlorophyll-a and percent DO saturation value levels at station MI2. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site MI2.

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Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.







Figure 2. Dissolved Oxygen Percent Saturation results for Lake Miccosukee. Gaps in the data are due to low water, preventing sampling.

Waterbody: Panther Creek



Basin: Lake Miccosukee

Panther Creek is a tannic, nitrogen-limited stream that flows southeast and eventually drains into Lake Miccosukee.

As shown in the following pie chart, approximately 24% of land use in the 3,374-acre watershed is agricultural, rangeland, transportation, utilities or residential/urban. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Panther Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, four temporally independent samples per year have only been collected in years 2009, 2013 and 2021. When criteria were met, results showed that Panther Creek met FDEP's NNC criteria. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus or total nitrogen.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples collected over a thirty-day period was exceeded with the latest (and highest) exceedance occurring during the July and October 2021 sampling event (Figure 3). Since the watershed is relatively undeveloped, elevated *E. coli* levels are probably the result of wildlife in the area.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Panther Creek met the nutrient thresholds for the East Panhandle Region. The *E. coli* water quality limits were exceeded several times. Since the watershed is relatively undeveloped, elevated *E. coli* levels are probably the result of wildlife in the area. Other water quality parameters appear to be normal for the area and no impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 12.

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Figure 1. Total Nitrogen results for Panther Creek.



Figure 2. Total phosphorus results for Panther Creek.



Figure 3. E. coli results for Panther Creek.

8. Lake Munson Basin

Waterbody: Gum Creek



Basin: Lake Munson

The urbanized Gum Creek system is located in central Leon County. Gum Creek meanders south through several wetlands, and eventually flows into Munson Slough.

As shown in the following pie chart, approximately 53% of the land uses in the 5,291-acre watershed are urban, utilities, transportation, and rangeland. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Gum Creek and met the requirements of the FDEP.

Results

Nutrients

Tables 1 and 2 represent Gum Creek's annual geometric means of total nitrogen and total phosphorus. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, beaver activity, and construction activity related to the Capital Circle southwest widening, the required number of samples could not always be collected from the Gum Creek stations. The lack of data means that FDEP requirements for determining Numeric Nutrient Criteria for some stations for several years could not be calculated. When the NNC criteria could be met, it was shown that no exceedances for nitrogen or phosphorus have occurred since 2006.

For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus or total nitrogen. **Table 1.** FDEP's total nitrogen criteria for streams applied to Gum Creek.Results in bold signify exceedances of the State criteria. Station GC2 is nolonger sampled.

Gum Crock	Instream Protection Criteria							
Guin Creek	TN (1.03 mg/L)							
Year	GC1	GC1 GC2 GC3 GC4 GC2T						
2005	0.69	0.63	0.53	0.69	-			
2006	1.10	0.89	-	0.57	-			
2007-2008	-	-	-	-	-			
2009	0.66	-	0.53	0.77	0.59			
2010	0.93	-	0.82	1.03	0.75			
2011-2012	-	-	-	-	-			
2013	0.68	-	0.66	-	-			
2014	-	-	-	-	-			
2015	-	-	-	-	0.71			
2016	-	-	0.59	-	-			
2017	-	-	0.73	0.95	-			
2018	0.56	-	0.65	0.74	-			
2019	-	-	0.65	-	-			
2020-2021	-	-	-	-	-			

Table 2. FDEP's total phosphorus criteria for streams applied to GumCreek. All results were within the State criteria. Station GC2 is no longersampled.

Gum	Instream Protection Criteria						
Creek	TP (0.18 mg/L)						
Year	GC1 GC2 GC3 GC4 GC2T						
2005	0.05	0.05	0.10	0.15	-		
2006	0.11	0.13	0.08	0.09	-		
2007-2008	-	-	-	-	-		
2009	0.06	-	0.05	0.08	0.05		
2010	0.05	-	0.05	0.07	0.04		
2011-2012	-	-	-	-	-		
2013	0.04	-	0.06	-	-		
2014	-	-	-	-	-		
2015	-	-	-	-	0.05		
2016	-	-	0.05	-	-		
2017	-	-	0.04	0.05	-		
2018	0.05	-	0.05	0.07	-		
2019	-	-	0.05	-	-		
2020-2021	-	-	-	-	-		

Dissolved Oxygen (DO)

As Figure 3 shows, Gum Creek station GC2T periodically failed to meet the Class III criteria for DO. Station GC4 failed to meet the limit once over the period of record. Due to beaver activity, the flow at station GC2T is often stagnant or flowing very slowly, leading to low DO levels.

Fecal Coliforms and Escherichia coli (E. coli)

The *E. coli* water quality limit of > 10% threshold value of 410 in 10% or more of samples in a 30-day period was occasionally exceeded during the sampling period (Figure 4). There has not been an exceedance since 2017.

Stream Condition Index and Habitat Assessment

The Habitat Assessment Score for station GC1 (126) was in the Suboptimal/Optimal category while station GC3 (76) was in the Suboptimal/Marginal and GC4 (106) was in the Marginal category (Table 3). The Stream Condition Index (SCI) scores (Table 4) for stations GC1 (60) and GC3 (39) indicates the presence of a stream biological community that is Healthy. The SCI score for station GC4 (68) was in the Exceptional category.

Station GC1

The results of the Habitat Assessment score for Station GC1 characterize the stream habitat between high Suboptimal and low Optimal. The SCI score at station GC1 indicates the presence of a stream biological community that is Healthy, scoring within the mid to upper Healthy category. The last time a SCI was performed on this site was January of 2018. During that event, the station scored in the low end of the Healthy category with a score of 38 after experiencing some drought related lack of flow. This station hosts a surprisingly large quantity of aquatic moss covering much of the substrate, though much of this habitat was not in the water in 2021 and could not be sampled.

The macroinvertebrate community at GC1 was not dominated by any single species or trophic group. Asellid isopods (detritus feeders), filter feeding blackflies (Simuliidae) and caddis flies (*Cheumatopsyche* sp.) were abundant. From the total taxa collected, five are listed as sensitive taxa and five are listed as very tolerant. No Plecoptera (stoneflies) were noted in the SCI. *Caenis punctata* was the only Ephemeropteran (mayflies) collected. The Trichoptera (caddisflies) were represented by a single taxon, the filter feeding *Cheumatopsyche* sp. The EPT score for the station is two.

Station GC3

The results of the Habitat Assessment score for Station GC3 characterize the stream habitat as between high Marginal and low Suboptimal. As a result of the total stream channel modification, this station contains relatively little habitat outside of a few tree falls creating leaf packs, some root material, a few snags, and rock (as a minor but key habitat). It is clear that habitat conditions are easily altered by heavy rain events. The SCI score at GC3 indicates the presence of a stream biological community that is Healthy, albeit scoring on the low end of the Healthy category.

The macroinvertebrate community at GC3 expressed a moderate to strong taxa dominance. In both vials the two most numerically dominant taxa were the freshwater snail Micromenetus dilatatus and the amphipod Hyalella azteca complex. Of the 307 macroinvertebrates collected in both vials, Micromenetus dilatatus (considered very tolerant) accounted for 95 (30.9%) individuals and Hyalella azteca complex accounted for 52 (16.9%) of the individuals. The top four most numerous taxa in both vials account for 71.3% of all individuals sorted. From the total taxa collected, two are listed as sensitive taxa by the FDEP while three are listed as very tolerant. The Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa (EPT) are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. The EPT score for GC3 is three. No Plecoptera (stoneflies) were noted in the SCI. Two Trichopteran and one Ephemeropteran species were collected but none are FDEP listed "sensitive" species. The single Ephemeropteran species, Caenis diminuta, is widely regarded as one of the two most tolerant of the mayfly species in Florida.

Station GC4

The results of the Habitat Assessment score for Station GC4 characterize the stream habitat in the high part of the Marginal category. The 2021 habitat assessment score increased compared to the previous event for three reasons: First, an increase in water velocity; second, the recruitment of invasive riparian species into the nearly denuded left bank; and third, the inclusion of a second major habitat. While two major habitats are present, the overwhelming habitat abundance was aquatic macrophytes. The dominant macrophytes in the system were Alternanthera philoxeroides followed by Myriophyllum aquaticum. Due to the lack of habitat, several sweeps had to be reapportioned in to the major and minor habitats that are present. Eight of the 20 sweeps collected were portioned into the aquatic macrophytes. Four sweeps were portioned into snags/woody debris, two sweeps were portioned into roots/undercut banks, one sweep was portioned into leaf packs/mats, three sweeps were portioned into sand, one sweep was portioned into silt/mud, and one sweep was portioned into long strand algae. All the habitats outside of aquatic macrophytes were sediment influenced to varying degrees and in low abundance. It is clear from vegetative and erosional signatures that habitat conditions are routinely altered by runoff from heavy rain events. Surprisingly, the SCI score at GC4 indicates the presence of a stream biological community in the Exceptional category, albeit scoring on the low end of that category. This is likely due to the variety of invertebrates found within the aquatic macrophyte sweeps.

The macroinvertebrate community at GC4 was dominated by dipterans, particularly of the genus *Simulium* and *Rheotanytarsus* with a moderate dominance expressed by the taxa Simulium sp. and *Rheotanytarsus exiguus* grp. Of the 298 individuals collected within the two sample vials, 91(30.5%) were *Simulium* sp. and 52(17.4%) were *Rheotanytarsus exiguus* grp. From the total taxa collected, five are listed as sensitive taxa by the FDEP, while seven are listed as very tolerant. The Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa (EPT) are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. No Plecoptera (stoneflies) were noted in the SCI. Three Ephemeropteran species and two Trichopteran taxa were collected but none are FDEP listed "sensitive" species, although of note is the presence of a single mature specimen of the Baetidae mayfly *Acentrella alachua*, which based upon data from the southcentral portion of the peninsula is one of the most sensitive taxa to dissolved oxygen concentrations below 5.0 mg/l. The EPT score for the site is five.

For more information about the SCI and Habitat Assessment, click Here.

Conclusions

Apart from Station GC1's total nitrogen levels exceeding the state criteria in 2006, Gum Creek met the nutrient thresholds in the East Panhandle Region. Station GC2T periodically failed to meet the Class III criteria for DO. Station GC4 failed to meet the limit once over the period of record. The *E. coli* water quality limit of > 10% threshold value of 410 in 10% or more of samples in a 30-day period was oc-

casionally exceeded during the sampling period. There has not been an *E. coli* exceedance since 2017.

The Habitat Assessment Score for station GC1 was in the Suboptimal/Optimal category while station GC3 was in the Suboptimal/Marginal and GC4 was in the Marginal category. The SCI scores for stations GC1 and GC3 indicates the presence of a stream biological community that is Healthy. The SCI score for station GC4 was in the Exceptional category.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Stations GC1, GC2T, GC3 and GC4.

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Figure 1. Total Nitrogen results for Gum Creek.



Figure 2. Total Phosphorus results for Gum Creek.





Figure 3. Dissolved Oxygen Percent Saturation results for Gum Creek.



Figure 4. Escherichia coli results for Gum Creek.
Table 3. Habitat Assessment results for Gum Creek.

Gum Creek Stations	GC1 Score	Category	GC3 Score	Category	BC4 Score	Category
Substrate Diversity	13	Suboptimal	13	Suboptimal	10	Marginal
Substrate Availability	9	Marginal	6	Marginal	6	Marginal
Water Velocity	12	Suboptimal	7	Suboptimal	8	Marginal
Habitat Smothering	18	Optimal	6	Suboptimal	15	Suboptimal
Artificial Channelization	18	Optimal	5	Optimal	14	Suboptimal
Bank Stability	8, 8	Suboptimal, Suboptimal	6, 6	Optimal, Optimal	7, 8	Suboptimal, Suboptimal
Riparian Zone Width	10, 10	Optimal, Optimal	7, 8	Optimal, Optimal	10, 10	Optimal, Optimal
Riparian Vegetation Quality	10, 10	Optimal, Optimal	6, 6	Optimal, Optimal	9, 9	Optimal, Optimal
Final Habitat Assessment Score		126	76		1	06
Interpretation	Suboptii	mal/Optimal	Suboptimal/Marginal		Subo	ptimal

 Table 4. Stream Condition Index results for Gum Creek.

Gum Creek Stations	GC1 Vial 1	GC1 Vial 2	GC3 Vial 1	GC3 Vial 2	GC4 Vial 1	GC4 Vial 2
Stream Condition Index Metrics Scores						
Total Taxa	3.48	3.91	0.87	1.74	6.09	6.52
Ephemeroptera Taxa	2	2	2	2	0	2
Trichoptera Taxa	1.43	1.43	1.43	2.86	2.86	2.86
% Filter Feeder	7.23	7.67	5.40	5.11	1.58	1.92
Long-lived Taxa	3.33	3.33	3.33	3.33	0	6.67
Clinger Taxa	6.25	6.25	3.75	3.75	2.5	6.25
% Dominance	9.31	8.99	5.37	7.77	5.49	6.35
% Tanytarsini Taxa	7.46	8.76	7.89	7.22	7.55	5.92
Sensitive Taxa	5	4	1	1	6	8
% Tolerant Taxa	7.65	7.68	1.25	2.28	8.19	7.23
SCI Vial Score	59.03	60.03	35.88	41.18	44.72	59.67
Stream Condition Index Score	60		39		52	
Score Interpretation	Hea	lthy	Hea	lthy	Hea	lthy

Waterbody: Lake Bradford



Basin: Lake Munson

The Bradford Brook Chain of Lakes is composed of the cypress rimmed, dark water Lakes Bradford (179 acres), Hiawatha (51 acres) and Cascade (124 acres) and is located in western Leon County. Water typically flows east via Bradford Brook into Lake Cascade. Lake Hiawatha receives flow from Lake Cascade via a culvert beneath Capital Circle Southwest. Much of the water entering Lake Bradford is via Lake Hiawatha, though at times Grassy Lake flows into Lake Bradford. On occasion, flow is reversed and Lake Bradford flows into Lake Hiawatha which then flows into Lake Cascade. In addition, groundwater sources of flow are possible.

As shown in the pie chart, approximately 31% of land uses in the 17,637-acre Bradford Brook watershed are rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation.



Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use. Leon County also conducted a vegetation survey to evaluate the health of floral (plant) communities.

Methods

Surface water and sediment samples were collected to determine the health of Lake Bradford and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC and expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period.

Table 1. FDEP's chlorophyll-a,	total	nitrogen	and	phosphorus	criteria	for
lakes applied to Lake Bradford						

Colored Lake	Chlorophyll-a 20 μg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L
2004	3.0	0.34	0.01
2005	3.0	0.35	0.02
2006	2.0	0.46	0.02
2007	3.3	0.68	0.03
2008	10.1	0.75	0.03
2009	3.4	0.64	0.03
2010	4.4	0.61	0.03
2011	10.0	0.83	0.05
2012	12.7	0.59	0.03
2013	13.0	0.67	0.02
2014	2.6	0.69	0.02
2015	12.7	0.64	0.03
2016	10.5	0.63	0.02
2017	11.7	0.67	0.02
2018	13.6	0.71	0.03
2019	7.8	0.50	0.02
2020	-	-	-
2021	1.4	0.50	0.01

While state Numeric Nutrient Criteria were not exceeded during the sampling period, chlorophyll-a results in the latter half of the sampling period tended to be elevated. Originally it was thought that lake levels were lower at the time and lake water was not as tannic, so nutrients were concentrated and greater light penetration occurred, enhancing algal growth. However, even when the lake color levels increased, the higher algal levels have persisted. An algal bloom during the August 2015 sampling event elevated chlorophyll-a levels (82.5 μ g/L). The cause of the bloom is unknown. Other chlorophyll-a values taken in 2015 were relatively low (6.2, 10.1 and 5 μ g/L). The levels in 2018 ranged from 2.8 μ g/L to an elevated 35.0 μ g/L, while levels in 2019 were the lowest levels since 2015; ranging from 4.6 to 13.4 μ g/L. Due to the pandemic, samples could not be collected in the 2nd quarter of 2020 which prevented the calculation of the NNC. Chlorophyll-a levels continue to be elevated in 2020, with a geometric mean (three samples) of 17 μ g/L. Both nitrogen and phosphorus geometric means (0.62 mg/L and 0.04 mg/L) were also elevated in 2020. In contrast, the geometric mean chlorophyll-a level (1.45 μ g/L) for 2021 was the lowest geometric mean recorded since sampling begin. Both nitrogen and phosphorus levels were low in 2021 as well.

Metals

Elevated lead levels during the 1st quarter 2021 in Lake Bradford are thought to be due to both relict and potentially current sources. Relict anthropogenic sources of lead in the area include a former shooting range and the former Dale Mabry airfield, while possible current sources include the Tallahassee Regional Airport (aviation fuel). The acidic nature of these lakes causes increased lead levels in the water due to the enhanced solubility of lead under low pH conditions. Because acidic systems like Lake Bradford Chain of Lakes are more sensitive to metals contamination, exceedance levels tend to be lower and oftentimes more frequent than a similar metal level in a more alkaline system.

Click here for more information on metal levels in Leon County waterbodies.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Bradford due to elevated levels of mercury.

Click here for more information about fish consumption advisories.

Floral Assessment

The Lake Vegetation Index score for Lake Bradford was 72, placing the lake's vegetative community in the Healthy category.

Twenty-six plant species were found during the survey. The native species, pond cypress (*Taxodium ascendens*), maidencane (*Panicum hemitomon*), and the Invasive Exotic torpedo grass (*Panicum repens*) were the most dominant species. Other species include red maple (*Acer rubrum*) and buttonbush (*Cephalanthus occidentalis*).

The aforementioned torpedo grass (*Panicum repens*) is listed as a Category I Invasive Exotic by the Florida Exotic Pest Control Council and is a concern in Lake Bradford. No other exotic plants were noted in the surveyed area.

For more information concerning Florida Invasive Exotics, please click on the Florida Exotic Pest Control Council website; http://www.fleppc.org/.

Click here for more information on the Lake Bradford LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Lake Bradford met the nutrient thresholds for the East Panhandle Region, though increasing chlorophyll levels continue to be a cause of concern. The Lake Vegetation Index score for Lake Bradford was 72, placing the lake's vegetative community in the Healthy category.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site BOB.

<image>

Basin: Lake Munson

The Bradford Brook Chain of Lakes is composed of the cypress rimmed Lakes Bradford (179 acres), Hiawatha (51 acres) and Cascade (124 acres) and is located in western Leon County. Water typically flows east via Bradford Brook into Lake Cascade. Lake Hiawatha receives flow from Lake Cascade via a culvert beneath Capital Circle Southwest. Much of the water entering Lake Bradford is via Lake Hiawatha, though at times Grassy Lake flows into Lake Bradford. On occasion, flow is reversed and Lake Bradford flows into Lake Hiawatha which then flows into Lake Cascade. In addition, groundwater sources of flow are possible.

As shown in the following pie chart, approximately 32% of land uses in the 16,591-acre Lake Cascade watershed are agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat



or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Lake Cascade has an active sinkhole and is affected by drought conditions more than either Bradford or Hiawatha. Due to drought conditions, sampling has been intermittent, and results remain inconclusive.

Methods

Surface water sampling was performed to determine the health of Lake Cascade and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, the required number of samples could not always be collected. The lack of data means that FDEP requirements for determining Numeric Nutrient Criteria for some stations for several years could not be calculated. When the NNC criteria could be met, it was shown that no exceedances for nitrogen or phosphorus have occurred since 2006.

For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1-3). With few exceptions, individual values did not exceed the in-lake criteria.

While the geometric means for the NNC parameters were never exceeded, individual values occasionally rose above the threshold values. There was a large increase in total nitrogen and phosphorus in 2013 (4th and 1st quarters, respectively) and a smaller increase in phosphorus levels during the 1st guarter of 2018. Increased levels of nutrients could be attributed to the decay of terrestrial plants that grew in the lake bottom during drought conditions or possibly stormwater runoff associated with the southwest Capital Circle widening. Post nutrient levels have decreased. The chlorophyll-a value for the 1st quarter of 2019 (89.3 μ g/L) is by far the highest chlorophyll-a value recorded on Lake Cascade. Other water quality parameters taken during that time frame did not suggest an algal bloom or nutrient problem, so it is unknown why the chlorophyll-a value was so elevated.

Metals

Elevated lead levels in Lake Cascade during the third quarter of 2021 are thought to be due to both relict and potentially current sources. Relict anthropogenic sources of lead in the area include a former shooting range and the former Dale Mabry airfield, while possible current sources include the Tallahassee Regional Airport (aviation fuel). The acidic nature of these lakes causes increased lead levels in the water due to the enhanced solubility of lead under low pH conditions. Because acidic systems like Lake Bradford Chain of Lakes are more sensitive to metals contamination, exceedance levels tend to be lower and oftentimes more frequent than a similar metal level in a more alkaline system. Click here for more information on metal levels in Leon County waterbodies.

Floral Assessment

The Lake Vegetation Index (LVI) score for Lake Cascade was 90, placing the lake's vegetative community in the Exceptional category.

Twenty-five plant species were found during the survey. The native species pond cypress (*Taxodium ascendens*) was the most dominant species on the lake. Other native shoreline vegetation included: red maple (*Acer rubrum*), buttonbush (*Cephalanthus oc-cidentalis*) and swamp tupelo (Nyssa sylvatica var. biflora).

Unfortunately, Chinese Tallow Tree (*Sapium sebifer-um*), a Category I Invasive Exotic by the Florida Exotic Pest Control Council was found at Lake Cascade. Alligator weed (*Alternanthera philoxeroides*), is listed as a Category II Invasive Exotic that was found in the lake.

For more information concerning Florida Invasive Exotics, please click on the Florida Exotic Pest Control Council website; http://www.fleppc.org/.

Click here for more information on the Lake Cascade LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Lake Cascade continued to meet the nutrient thresholds for the East Panhandle Region and no impairments were noted. The LVI score for Lake Cascade was 90, placing the lake's vegetative community in the Exceptional category.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Colored Lake	Chlorophyll-a 20 μg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L
2004	2.8	0.21	0.01
2005	2.4	0.43	0.01
2006	3.6	0.38	0.01
2007-2012	-	-	-
2013	4.7	1.16	0.02
2014	4.5	0.79	0.02
2015	-	-	-
2016	5.7	0.76	0.01
2017	4.8	0.83	0.01
2018-2021	-	-	-

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for	r
lakes applied to Lake Cascade.	

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site BOC.

Attachment # 1 Page 116 of 178



Figure 1. Total Nitrogen results for Lake Cascade.



Figure 2. Total Phosphorus results for Lake Cascade.



Figure 3. Chlorophyll-a results for Lake Cascade.

Waterbody: Lake Hiawatha



Basin: Lake Munson

The Bradford Brook Chain of Lakes is composed of the cypress rimmed, dark water Lakes Bradford (179 acres), Hiawatha (51 acres) and Cascade (124 acres) and is located in western Leon County. Water typically flows east via Bradford Brook into Lake Cascade. Lake Hiawatha receives flow from Lake Cascade via a culvert beneath Capital Circle Southwest. Much of the water entering Lake Bradford is via Lake Hiawatha, though at times Grassy Lake flows into Lake Bradford. On occasion, flow is reversed and Lake Bradford flows into Lake Hiawatha which then flows into Lake Cascade. In addition, groundwater sources of flow are possible.

As shown in the following pie chart, approximately 32% of land uses in the 17,023-acre Lake Hiawatha watershed are agriculture, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of



habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment sampling were conducted to determine the health of Lake Hiawatha and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water or lack of access, the required number of samples could not always be collected for Lake Hiawatha. The lack of data means that FDEP requirements for determining Numeric Nutrient Criteria could not be calculated for some years. When data requirements were met, nutrient values did not exceed the state criteria. However, nitrogen values in some years have more than doubled since 2004. The highest single total nitrogen result (1.3 mg/L) recorded in Lake Hiawatha was in February of 2020. Water levels were low (0.8 meters; average is 1.2 meters) during that sampling event, suggesting that nutrients had concentrated as water levels dropped. At the same time, all nitrogen analyzed during the same sampling event was in the organic form and would temporarily be unavailable for nutrient uptake.

Colored Lake	Chlorophyll-a 20 μg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L
2004	1.6	0.33	0.01
2005	3.4	0.37	0.01
2006	1.9	0.47	0.01
2007	2.4	0.63	0.02
2008	-	-	-
2009	1.9	0.76	0.02
2010	3.2	0.60	0.02
2011-2013	-	-	-
2014	2.2	0.67	0.01
2015	6.7	0.68	0.01
2016	7.1	0.74	0.01
2017	8.3	0.72	0.02
2018	5.5	0.70	0.02
2019	7.7	0.52	0.02
2020	-	-	-
2021	1.5	0.66	0.02

Table 1. FDEP's chlorophyll-a,	total nitrogen and phospho	orus criteria for
lakes applied to Lake Hiawatha	I.	

While still relatively low, chlorophyll-a levels steadily increased in the latter half of the sampling period (2015-2020). Chlorophyll-a levels in 2021 sharply dropped.

Metals

Elevated lead levels in Lake Hiawatha during the third quarter of 2021 are thought to be due to both relict and potentially current sources. Relict anthropogenic sources of lead in the area include a former shooting range and the former Dale Mabry airfield, while possible current sources include the Tallahassee Regional Airport (aviation fuel). The acidic nature of these lakes causes increased lead levels in the water due to the enhanced solubility of lead under low pH conditions. Because acidic systems like Lake Bradford Chain of Lakes are more sensitive to metals contamination, exceedance levels tend to be lower and oftentimes more frequent than a similar metal level in a more alkaline system.

Click here for more information on metal levels in Leon County waterbodies.

Floral Assessment

The Lake Vegetation Index score for Lake Hiawatha (LVI) was 93, placing the lake's vegetative community in the Exceptional category.

Nineteen species were found during the survey. The native species pond cypress (*Taxodium ascendens*) and maidencane (*Panicum hemitomon*) were the most dominant species in the lake. Other native shoreline vegetation included red maple (*Acer rubrum*), buttonbush (Cephalanthus occidentalis), and myrtle dahoon (*Ilex myrtifolia*). No exotic plants were noted during this survey.

Click here for more information on the Lake Hiawa-tha LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Lake Hiawatha met the nutrient thresholds for the East Panhandle Region. Despite the substantial drop in the 2021 chlorophylla level, the more than doubling of nitrogen values over the sampling period and the elevated chlorophyll-a levels in the last several years continue to be a concern. The Lake Vegetation Index score (LVI) was 93, placing the lake's vegetative community in the Exceptional category.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site BOH.



Basin: Lake Munson

Lake Munson is an approximately 288-acre, cypressrimmed, nitrogen-limited lake located south of the City of Tallahassee. The lake is believed to have originally been a cypress swamp but has since been impounded and now functions as a shallow man-made lake. Lake Munson receives much of its water from the heavily altered Munson Slough and its tributaries. Lake outflow continues southward via Munson Slough and finally drains into Ames Sink. Dye trace studies have confirmed a direct connection between Ames Sink and Wakulla Springs.

The lake has a history of severe water quality and ecological problems including fish kills, algal blooms, exotic vegetation and snails, high nutrient and bacterial levels, low game fish productivity, sediment contamination, and depressed oxygen levels.

As shown in the following pie chart, approximately 54% of land use in the 38,790-acre Lake Munson basin is rangeland, transportation, utilities, urban or residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but



excessive human disturbance may result in waterbody degradation.

Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

The lake received a Total Maximum Daily Load (TMDL) by the Florida Department of Environmental Protection (FDEP) in 2013. The TMDL requires the lake to meet the dissolved oxygen criterion and nutrient TMDL concentrations, which, based on mean concentrations from the 2004-2008 period, will require a 50 percent reduction for Biological Oxygen Demand (BOD), a 32.5 percent reduction for Total Nitrogen (TN), a 76.7 percent reduction for Total Phosphorus (TP) and a 31.9 percent reduction in turbidity.

There has been a consensus that the organic and nutrient-rich sediments in Lake Munson are contributing to the poor water quality and that sediment removal would be the best way to improve the lake's water quality. Unfortunately, sediment removal would be logistically very difficult and extremely expensive. Another option is to periodically drain the lake. The lake drawdowns are expected to result in de-watering, compaction, and partial oxidation of sediments thus creating a sediment "cap" that would serve to improve water quality and simultaneously generate suitable habitat for fish spawning.

On April 27, 2010, the Leon County Board of County Commissioners directed staff to implement the County's Science Advisory Committee lake drawdown recommendations. After additional meetings, which included staff and committee members from the Florida Fish and Wildlife Conservation Commission, FDEP, U.S. Forest Service, Leon County Science Advisory and Water Resource Committees, and the community surrounding the lake, it was decided to start the lake drawdown October 18, 2010. The drawdown continued until June 14, 2011. Sampling recommenced in the third quarter of 2011.

Algal blooms have been a long-term problem on Lake Munson. Due to the on-going algae problem and geographic location of the lake, Lake Munson was chosen as the original site for a pilot project presented by the Northwest Florida Water Management District (NWFWMD) in response to an innovative technology grant sponsored by the Florida Department of Environmental Protection (FDEP). The project was selected for grant funding and AECOM was selected by the NWFWMD for implementation. The objective of the project was to collect representative data of treatment system efficiency and demonstrate how the export of intact cellular algae using an algae harvesting and Harmful Algal Bloom (HAB) mitigation system would help achieve Total Maximum Daily Load (TMDL) goals for Lake Munson and Munson Slough. The official startup, media and stake holder event was held on June 17, 2021. The event was the first day the harvester was up and running for any considerable amount of time but, ironically, was not run consistently since, due to low levels of algae in the lake. Because conditions at Lake Munson were not immediately conducive to demonstrate the effectiveness of this technology, AECOM and NWFWMD identified a pond with an active algae bloom at the Apalachee Regional Park. The relocation of the equipment to the selected pond was approved and contracts were amended, permits were updated and approved, with site preparation completed on October 12, 2021. The relocation was completed on November 2, 2021.

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC and expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period.

Geometric means of chlorophyll-a, total nitrogen, and total phosphorus exceeded the state criteria several times over the sampling period. The geometric mean for chlorophyll-a in 2013 (85.0 µg/L) was the highest reading on record. However, starting in 2017 there was a substantial drop in chlorophyll-a values. While total phosphorus values still exceeded the NNC values in 2017 and 2019, total phosphorus, total nitrogen, and chlorophyll-a values continue to drop over time. The 2020 and 2021 phosphorus and nitrogen NNC results are among the lowest levels recorded by Leon County staff. Staff believe that a combination of upstream nutrient reduction and the re-establishment of aquatic vegetation are contributing to the reduction of chlorophyll-a and water column nutrients.

As shown in Figures 1 through 4, past levels of BOD, total nitrogen, total phosphorus, and turbidity levels were consistently above the TMDL limits, but levels are slowly dropping. Algal blooms, represented by chlorophyll-a (Figure 5), continue to be a problem in Lake Munson, but values continue to drop.

Metals

Lake Munson (Station LMU7) exceeded Class III water quality criteria for both lead and copper during the 2nd quarter. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the lead exceedance. The possible sources of the copper exceedance are unknown. Click here for more information on metal levels in Leon County waterbodies.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Lake Munson. Due to the lake drawdown, staff could not collect samples for the first and second quarters of 2011. Results in bold signify exceedances of the State criteria.

Clear Lakes High Alkalinity	Chl-a 20 µg/L	Total Nitrogen 1.05-1.91 mg/L	Total Phosphorus 0.03-0.09 mg/L
2004	3.6	0.35	0.06
2005	13.8	0.62	0.11
2006	12.4	1.38	0.19
2007	10.9	1.49	0.30
2008	13.1	0.76	0.20
2009	5.5	0.88	0.17
2010	8.7	1.07	0.16
2011	-	-	-
2012	39.0	1.08	0.18
2013	85.0	1.51	0.24
2014	13.9	1.27	0.24
2015	54.3	1.37	0.22
2016	24.9	0.70	0.15
2017	8.0	0.50	0.11
2018	19.2	0.60	0.09
2019	11.1	0.52	0.11
2020	5.6	0.38	0.05
2021	1.4	0.49	0.06

Fish Consumption Advisory

The Florida Department of Health (FDOH) has issued consumption limits for certain fish in Lake Munson due to elevated levels of mercury.

Click here for more information about fish consumption advisories.

State agencies performed fish tissue sampling in 2019 to revisit the need to continue the consumption advisories for polychlorinated biphenyls (PCBs). FDOH determined in 2021 that PCB levels in fish tissues were at very low levels and that the current

mercury advisories would be protective of human health.

Floral Assessment

The Lake Vegetation Index score for Lake Munson was 43, a substantial decline from the previous year's (2020) score of 53, placing the lake's vegetative community in the lower end of the Healthy category.

Fifty species were found during the 2021 survey vs. the sixty-six species that were found in 2020. Units surveyed can vary from year to year with the resultant change in number of taxa, so while this is somewhat surprising, the drop in taxa found in 2021 is not the main reason for decline in the LVI score.

In 2020, the native species coontail (Ceratophyllum *demersum*) and pond cypress (*Taxodium ascendens*) were the most dominant species in the lake but, several invasive exotic plants were quickly establishing themselves in the water. The two most prevalent plants in the system in 2021 were hydrilla (Hydrilla verticillata), and water hyacinth (Eichhornia crassipes). Leon County staff were concerned with the rapid proliferation of these and other exotics, so in the latter part of 2020, the Florida Fish and Wildlife Conservation Commission (FWC) was contacted about the overabundance of exotic vegetation in the lake. The FWC sent teams out in October of 2020 to apply herbicides to the emergent and submersed invasive exotics in Lake Munson. A substantial amount of exotic plants were treated, and it was hoped that natives would continue to proliferate in the water column. Unfortunately, the Category I Invasive Exotic hydrilla (Hydrilla verticillata), quickly reestablished itself in the early part of 2021. An additional herbicide treatment was performed in late August for water hyacinth. Due to the rapid proliferation of hydrilla, the 2021 survey showed that coontail and the exotic hydrilla were now either the dominant or codominant species found in the lake.

Consequently, the LVI score is substantially lower than in past years.

Exotic apple snails

In 2006 - 2007 the exotic apple snail Pomacea maculate (previously misidentified as P. canaliculata), consumed most vegetation in Lake Munson, allowing the lake to transition from macrophytic vegetation dominated community to a community dominated by algae. Ironically, Lake Munson's past LVI scores were influenced by the invasive exotic apple snail. Historically, Lake Munson was dominated by exotic vegetation. Over time, the snails consumed all vegetation in the water column including water hyacinth (Eichhornia crassipes), water lettuce (Pistia stratiotes) and hydrilla (Hydrilla verticillata), all listed as Category I Invasive Exotics by the Florida Exotic Pest Control Council. The presence of these species would have contributed to a lower LVI score. The snail also consumed native plants including the American lotus (Nelumbo lutea), but the overwhelming abundance of exotic plants in the water column would probably have negated any positive effects the native vegetation would have had on the LVI. Efforts to eradicate the exotic apple snails were met with little success, but there was a precipitous decline (probably due to a lack of food) in apple snails beginning in the latter part of 2015. While still present in the watershed, and for reasons unknown, the snails have been unable to reestablish themselves to their previous numbers. The decline allowed native emergent and floating plants to proliferate in the lake including the welcome additions of southern waternymph (Najas guadalupensis) and coontail (Ceratophyllum demersum). Unfortunately, with the advent of the native submersed plants, hydrilla and water hyacinth have also reestablished themselves and are currently overwhelming the native species.

For a complete list of plants found during the LVI survey, please see Table 2.

For additional information about the LVI please go to the Florida Department of Environmental Protection webpage: https://floridadep.gov/dear/waterquality-standards-program/documents/lakevegetation-index-primer

For additional information about exotic Category I and II invasive exotic plants, please go to the Florida Exotic Pest Plant Council:

https://myfwc.com/wildlifehabitats/habitat/invasive -plants/.

Click here for more information on the Lake Munson LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.



Figure 1. BOD results for Lake Munson.



Figure 2. Total Nitrogen results for Lake Munson.

Attachment # 1 Page 126 of 178



Figure 3. Total phosphorus results for Lake Munson.



Figure 4. Turbidity results for Lake Munson.



Figure 5. Chlorophyll-a results for Lake Munson.

Conclusions

Nutrient and chlorophyll-*a* values did not exceed NNC limits in 2021. Staff believe that a combination of upstream nutrient reduction and the reestablishment of aquatic vegetation are contributing to the reduction of chlorophyll-a and water column nutrients.

Lake Munson (Station LMU7) exceeded Class III water quality criteria for both lead and copper during the 2nd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the lead exceedance. The possible sources of the copper exceedance are unknown.

The LVI score for Lake Munson was 43, a substantial decline from the previous year's (2020) score of 53, placing the lake's vegetative community in the lower end of the Healthy category. Due to the rapid proliferation of hydrilla, coontail and the exotic hydrilla were now either the dominant or codominant species found in the lake. Consequently, the LVI score is substantially lower than in past years.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

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Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites LMU7 and LMU8.

Waterbody: Munson Slough



Basin: Lake Munson

The heavily urbanized Munson Slough and its tributaries are located in central Leon County and drain a portion of the City of Tallahassee. The Slough flows south into and out of Lake Munson, then continues to Eight Mile Pond. After exiting Eight Mile Pond, the Slough flows under Oak Ridge Road and enters Ames Sink, which is known to be connected to Wakulla Springs.

As shown in the figure below, approximately 54% of land use in the 38,790-acre basin is residential, commercial, industrial or transportation. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Total Maximum Daily Load (TMDL)

The Florida Department of Environmental Protection (FDEP) issued several TMDLs for Munson Slough including both upstream and downstream of Lake Munson. The TMDLs are as follows:

TMDLs upstream of Lake Munson

The dissolved oxygen TMDL targets are 5-day biological oxygen demand (BOD₅) of 2.00 mg/L, total nitrogen (TN) of 0.72 mg/L, and total phosphorus (TP) of 0.15 mg/L and are allocated as follows. To meet the dissolved oxygen TMDL criterion, water chemistry concentrations will require a 50 percent reduction for BOD₅, an 8.35 percent reduction for TN, and a 17.53 percent reduction for TP at sources contributing to exceedances of the TMDLs.

The fecal coliform TMDL for portions of Munson Slough would require a 96.9 percent reduction at sources contributing to exceedances of the criteria where the Slough crosses under Springhill Road, and a 91.5 percent reduction at the Slough where it crosses under Capital Circle southwest. However, the fecal coliform standard in Florida has been supplanted by standards developed for *Escherichia coli*.

TMDLs downstream of Lake Munson

The dissolved oxygen TMDL is an in-stream concentration for BOD₅ of 2.00 mg/L and is allocated as follows. In-stream concentrations must meet the dissolved oxygen criterion and BOD₅ TMDL concentrations will require a 52.9 percent reduction at sources contributing to exceedances.

The un-ionized ammonia impairment will be addressed by reductions in total ammonia. The total ammonia TMDL is an in-stream concentration of 0.32 mg/L and is allocated as follows. The in-stream un-ionized ammonia concentrations must meet the water quality criterion, which requires a 33.3 percent reduction of total ammonia at sources contributing to exceedances. However, the un-ionized ammonia criterion has been replaced with the Total Ammonia Nitrogen (TAN) criterion.

Methods

Surface water samples were collected to determine the health of Munson Slough and met the requirements of the FDEP.

Results

Due to drought, stations were occasionally dry, stagnant or "puddled" during the sampling period. When viewing tables and figures, the absence of data means there was not enough data collected (due to lack of water, or in the case of Station MS2, activities related to the Lake Munson Dam project) to fulfill data requirements. FDEP's current Numeric Nutrient data requirements state "that there shall be at least four temporally independent samples per year . . .". Due to low water conditions, four temporally independent samples per year could not be collected from stations during some years with the latest being in 2021. As of 2010, Station MS3 is no longer sampled.

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Tables 1 and 2.

Table 1. FDEP's total nitrogen criteria for streams applied to Munson
Slough. Results in bold signify exceedances of the State criteria.

Munson	Instream Protection Criteria				
Slough		TN (1.	03 mg/	L)	
Year	MS1	MS2	MS3	MS4	MS5
2006	0.75	1.44	1.32	1.43	-
2007	1.36	1.59	-	-	-
2008	0.89	0.73	-	-	0.87
2009	0.62	0.73	0.74	-	-
2010	1.09	1.35	-	1.35	1.14
2011	0.80	-	-	-	-
2012	0.90	-	-	1.02	-
2013	1.27	-	-		
2014	0.97	1.08	-	1.16	1.08
2015	0.81	1.41	-	1.39	-
2016	-	0.89	-	0.89	-
2017	0.73	-	-	-	-
2018	0.69	0.63	-	0.60	-
2019	-	-	-	-	-
2020	0.51	-	-	-	-
2021	-	-	-	-	-

Table 2. FDEP's total phosphorus criteria for streams applied to Munson
Slough. Results in bold signify exceedances of the State criteria.

Munson	Instream Protection Criteria				
Slough	TP (0.18 mg/L)				
Year	MS1	MS5			
2006	0.16	0.24	0.19	0.22	-
2007	0.21	0.28	-	-	-
2008	0.12	0.25	-	-	0.28
2009	0.11	0.18	0.18	-	-
2010	0.13	0.16	-	0.17	0.18
2011	0.11	-	-	-	-
2012	0.20	-	-	0.17	-
2013	0.17	-	-	-	-
2014	0.14	0.23	-	0.23	0.21
2015	0.11	0.23	-	0.23	-
2016	-	0.19	-	0.18	-
2017	0.09	-	-	-	-
2018	0.11	0.09	-	0.08	-
2019	-	-	-	-	-
2020	0.08	-	-	-	-
2021	-	-	-	-	-

The Munson Slough total nitrogen and phosphorus levels exceeded the NNC at all stations during the

period of record. However, recent trends suggest that nutrient levels are dropping in the Slough. The 2017, 2018 and 2020 nitrogen and phosphorus levels for station MS1 both met the NNC. Stations MS2 and MS4 met the NNC for both nitrogen and phosphorus in 2018. While nitrogen levels occasionally exceeded TMDL levels in recent years (2017-2018), overall, levels appear to be decreasing (Figures 1 and 2).

Since the Munson Slough watershed is heavily urbanized, and the Slough itself has been significantly altered over the years, there are elevated nutrients in this system for several reasons. Urban runoff tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc. In recent years, improvements in upstream stormwater facilities and Best Management Practices (BMPs) have contributed to lower nutrient levels.

Total Ammonia Nitrogen (TAN)

The TAN criterion (0.29 mg/L and based on water temperature and pH) was exceeded (0.57 mg/L) during the 2^{nd} quarter of 2015 at Station MS2. No exceedances were noted from 2016-2021.

Escherichia coli

An extremely high result was recorded during the June 2018 sampling event at station MS4. The result, 6,900/100 mL, exceeded the Class III water quality standard (410 in 10% or more samples), was extremely unusual since other water quality parameters that could be associated with bacterial contamination (e.g. total suspended solids, biological oxygen demand) appeared normal for this site. Staff expects that it was an abnormal event, either related to wildlife, or possibly, a sampling or laboratory error. There have been no *E. coli* exceedances since.

Dissolved Oxygen (DO) and Chlorophyll-a

FDEP's DO criterion shows very few results that did not meet the threshold (Figure 3). However, this does not in any way invalidate the TMDL. Algal blooms represented by chlorophyll-a (Figure 4) can produce large amounts of oxygen during daylight hours via photosynthesis. Conversely, during nighttime hours, respiration occurs and algal blooms remove DO from the water, which may lead to little or no oxygen in the water column. The chlorophyll-*a* result (503 μ g/L) from Station MS2 during the February 2013 sampling event is the highest chlorophylla value recorded from any Leon County water quality station.

Biological Oxygen Demand (BOD)

Elevated BOD levels (Figure 5) during some sampling events showed that elevated microbiological activity may be contributing to changes in DO. The microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

Conclusions

Based on ongoing sampling, the more recent results suggest that Munson Slough meets the nutrient thresholds for the East Panhandle Region.

Nitrogen levels occasionally exceeded TMDL levels in recent years, but overall, nitrogen levels appear to be decreasing. Total phosphorus has not exceeded the TMDL limit since 2016 and, like nitrogen, appears to be on a downward trend.

While nutrient levels have decreased in recent years, elevated BOD levels during some sampling events suggest that microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites MS1, MS2, MS4 and MS5.



Figure 1. Total nitrogen results for Munson Slough.



Figure 2. Total phosphorus results for Munson Slough.





Figure 3. Dissolved Oxygen Percent Saturation results for Munson Slough.



Figure 4. Chlorophyll-*a* results for Munson Slough.



Figure 5. Biological Oxygen Demand results for Munson Slough.

9. Ochlockonee River Basin

Waterbody: Freeman Creek



Basin: Ochlockonee River

Freeman Creek is a tannic, slightly acidic, phosphorus limited stream that flows into Lake Talquin and is located in western Leon County.

The following pie chart shows the majority of the 4,013-acre watershed is relatively undeveloped. Transportation and utilities land uses make up approximately 1% of the watershed upstream of the sampling location. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Freeman Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The State criteria were not exceeded for either parameter. It does appear that nitrogen levels are increasing. It is unknown at this time what the cause(s) may be.

In June 2021, and for the first time since sampling began in 2006, Freeman Creek was not flowing with water levels low enough that the stream was composed of a series of disconnected puddles. In contrast, the creek was flooded and had extended far into the floodplain during September 2021 sampling event. Because sampling conditions were not appropriate in either case, water quality samples were not collected, which prevented the Numeric Nutrient Criteria from being calculated.

Dissolved Oxygen

Freeman Creek's percent dissolved oxygen (DO) saturation values were below the criteria several times during the sampling period (Figure 1). Staff believes that this condition is natural since Freeman Creek has passed several bioassessments and there appears to be no anthropogenic causes of the low DO levels.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410, 10% threshold value of samples collected over a 30-day period was exceeded (5,400/100 mL) during the November 2016 sampling event. It is probable that the extremely high number was the result of wildlife in the area or possibly due to laboratory error. No exceedances were noted since.

Freeman Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L	
2006	0.19	0.00	
2007	0.27	0.00	
2008	0.27	0.00	
2009	0.24	0.00	
2010	0.34	0.01	
2011	0.44	0.01	
2012	0.44	0.01	
2013	0.42	0.00	
2014	0.44	0.01	
2015	0.50	0.01	
2016	0.48	0.01	
2017	0.59	0.01	
2018	0.48	0.01	
2019	0.30	0.01	
2020	0.54	0.01	
2021	-	-	

 Table 1. FDEP's total nitrogen and phosphorus criteria for streams applied to Freeman Creek.

Conclusions

Based on ongoing sampling, Freeman Creek met the nutrient thresholds for the Big Bend Bioregion. The DO saturation values were below the criteria several times during the sampling period. Staff believes that this condition is natural since Freeman Creek has passed several bioassessments and there appear to be no anthropogenic causes of the low DO levels (e.g., elevated nutrient levels).

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 44.

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Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Attachment # 1 Page 138 of 178



Figure 1. Dissolved Oxygen Percent Saturation results for Freeman Creek.

Waterbody: Harvey Creek



Basin: Ochlockonee River

Harvey Creek is a tannic, slightly acidic, phosphoruslimited stream that flows into Lake Talquin and is located in western Leon County.

While the following pie chart shows that the majority of the 5,679-acre watershed is relatively undeveloped, agriculture, urban and residential land uses make up approximately 4% of the watershed upstream of the sampling station. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Harvey Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Escherichia coli

E. coli levels exceeded the Class III water quality standard daily limit of > 410, 10% threshold value of samples collected over a 30-day period in December 2016 (770/100 mL). The standard has not been exceeded since that time. Since the watershed is relatively undeveloped, the exceedance could be attributed to wildlife in the area, though FDEP, through their own sampling, have determined that anthropogenic sources were identified using genetic marker and tracer data. To better track potential sources of *E. coli*, Leon County added additional water quality stations to the watershed in 2021 (Figure 1). The standard has not been exceeded at the newly established stations.

Nutrients

The nutrient thresholds and results are found in Tables 1 & 2. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The State criteria were not exceeded for either parameter.
 Table 1. FDEP's total nitrogen criteria for streams applied to Harvey Creek.

Harvey	Instream Protection Criteria			
Creek	TN (1.03 mg/L)			
Year	HAR1 HAR2 HAR			
2006	0.11	-	-	-
2007	0.17	-	-	-
2008	0.15	-	-	-
2009	0.15	-	-	-
2010	0.33	-	-	-
2011	0.43	-	-	-
2012	0.39	-	-	-
2013	0.21	-	-	-
2014	0.35	-	-	-
2015	0.22	-	-	-
2016	0.29	-	-	-
2017	0.33	-	-	-
2018	0.40	-	-	-
2019	0.20	-	-	-
2020	0.29	-	-	-
2021	0.24	0.34	0.20	0.20

Table 2. FDEP's total phosphorus criteria for streams applied to Harvey Creek.

Harvey	Instream Protection Criteria				
Creek	TP (0.18 mg/L)				
Year	HAR1 HAR2 HAR3				
2006	0.00	-	-	-	
2007	0.00	-	-	-	
2008	0.00	-	-	-	
2009	0.00	-	-	-	
2010	0.00	-	-	-	
2011	0.01	-	-	-	
2012	0.00	-	-	-	
2013	0.00	-	-	-	
2014	0.00	-	-	-	
2015	0.01	-	-	-	
2016	0.01	-	-	-	
2017	0.01	-	-	-	
2018	0.01	-	-	-	
2019	0.01	-	-	-	
2020	0.01	-	-	-	
2021	0.01	0.00	0.00	0.00	

Habitat Assessment and Stream Condition Index (SCI)

The habitat assessment and SCI sampling are not performed every year, so the following results are from 2019.

The results of the Habitat Assessment score for Harvey Creek characterize the overall stream habitat in the Optimal category. Habitat availability, although sub-optimal, presented high quality leaf packs, roots, and snags (Table 3). Channel characteristics were very natural with the expected pools, bends, and stable streambanks. In keeping with the habitat assessment and the water quality that exhibited a high dissolved oxygen concentration, low conductivity and low turbidity, the Stream Condition Index score was Exceptional (Table 4).

The macroinvertebrate community present at the monitoring site was rich (56 taxa) and displayed numerous sensitive (per FDEP) taxa (18). In contrast, only three FDEP very tolerant taxa were noted. No single group or taxon numerically dominated the community. Tanytarsini chironomids of the *Rheotanytarsus exiguus* grp. were the most abundant single taxon. Both long-lived and sensitive taxa were well represented in the SCI sample with 14.3% of taxa being long-lived (eight taxa) and 32.1% being sensitive (18 taxa). Included in the sensitive taxa are three taxa of ephemeroptera (mayflies), three taxa of plecoptera (stoneflies), and two taxa of trichoptera (caddisflies).

For more information about the SCI and Habitat Assessment, click Here.

Conclusions

Based on ongoing sampling, Harvey Creek met the nutrient thresholds for the Big Bend Bioregion. Additional water quality sampling showed no further water quality exceedances in *E. coli*.

The results of the Habitat Assessment characterize the stream habitat in the Optimal category. In keeping with the habitat assessment, the Stream Condition Index score was Exceptional.

Other water quality parameters appear to be normal and no other impairments were noted.

Harvey Creek	Score	Category
Substrate Diversity	14	Suboptimal
Substrate Availability	11	Suboptimal
Water Velocity	19	Optimal
Habitat Smothering	19	Optimal
Artificial Channelization	20	Optimal
Bank Stability	8, 8	Suboptimal, Suboptimal
Riparian Zone Width	10, 10	Optimal, Optimal
Riparian Vegetation Quality	10, 10	Optimal, Optimal
Final Habitat Assessment Score	139	
Interpretation	nterpretation Optimal	

 Table 3. Harvey Creek Habitat Assessment Score.

Table 4. Harvey Creek Stream Condition Index Score.

Harvey Creek	Rep 1	Rep 2
Stream Condition Index Metrics		
Scores		
Total Taxa	6.07	8.93
Ephemeroptera	1.25	3.75
Taxa		
Trichoptera Taxa	2.22	5.56
% Filter Feeder	6.38	7.44
Long-lived Score	10	6
Clinger Taxa	8	9
% Dominance	8.20	7.21
% Tanytarsini	10	10
Taxa		
Sensitive Taxa	6.67	10
% Tolerant Taxa	5.17	7.39
SCI Vial Score	71.06	83.63
Stream Condition Index Score	77.35	
Score	Exceptional	
Interpretation		[····/

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites 39, HAR1, HAR2, and HAR3.



Figure 1. Locations of water quality station 39 and the newly established HAR1, HAR2, and HAR3 on Harvey Creek.

Waterbody: Lake Talquin



Basin: Ochlockonee River

The 7,782-acre Lake Talquin is considered an Outstanding Florida Water by the Florida Department of Environmental Protection (FDEP) and is located in western Leon County. Its basin extends into surrounding Florida counties as well as southern Georgia. In 1970, Florida Power Corporation donated the land that is now Lake Talquin State Park along the southern shoreline of the lake.

The lake was formed in 1929 when the Jackson Bluff Dam was constructed on the Ochlockonee River to produce hydroelectric power. The dam, built and managed by the West Florida Power Company (later to become Florida Power Corporation) who operated the facility until 1970, was abandoned as a power plant and turned over to the Florida Department of Natural Resources (later to become FDEP). FDNR/FDEP managed the dam without producing power until 1981. The City of Tallahassee then took over the dam, and in August 1985, the plant became operational as the C. H. Corn Hydroelectric Power Generating Plant. In 2017, the City did not renew its lease to operate the power plant and turned the dam back over to the State.

As shown in the following pie chart, approximately 35% of land use in the 1,019,525-acre Ochlockonee Basin is agriculture, rangeland, urban, transportation or utilities. Increases in stormwater runoff and

waterbody nutrient loads can often be attributed to these types of land uses.



Because of nitrogen and phosphorus issues in Lake Talquin, the lake received a Total Maximum Daily Load (TMDL) by the Florida Department of Environmental Protection (FDEP) in 2022. The TMDL requires the lake to meet the nutrient TMDL concentrations, which, based on mean concentrations from the 2008-2014 period, will require a 19 percent reduction for total nitrogen (TN), and a 21 percent reduction for total phosphorus (TP).

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water and sediment sampling were conducted and met the collection and analysis requirements of the FDEP.

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Taken as a whole, Lake Talquin's chlorophyll-a standard was exceeded in 2011 (29 μ g/L), 2013 (22 μ g/L), 2015 (31 μ g/L), 2016 (29 μ g/L) 2017 (22 μ g/L) and 2019 (25 μ g/L). Total phosphorus thresholds were exceeded during the same years and have, in general, increased over time. Nitrogen levels, while not exceeding the NNC, have generally increased over the period of record.

Dissolved Oxygen (DO)

Dissolved oxygen saturation values were below the Class III water quality limits during certain events (Figure 1). In most cases, the low oxygen values are results from deep water (> 4 meter) readings. There does not appear to be any stratification in the water column, which could prevent oxygen transfer from the surface to lower levels. It is thought that microbial activity in the organic sediment demands more oxygen than can be readily replaced leading to the low DO levels. While the run of the river reservoir cannot be considered "natural", it is normal for organic rich sediments to result in low DO levels immediately above the sediment surface. Anthropogenic activities upstream (e.g. agricultural) can make such conditions worse. However, when the lake was created, organic-rich bottomland forest was flooded. These pre-existing bottomland trees (still onsite and submersed) are continuing to release nutrients into the system, contributing to oxygen demand.

FDEP now requires oxygen level readings to be taken only in the top two meters of the water column for TMDL purposes, so Leon County no longer takes deep water readings, hence the "improved" DO readings.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for
lakes applied to Lake Talquin WBIDs. Results in bold signify exceedances
of the State criteria

Colored Lakes	Chlorophyll-a > 20.0 µg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L
2004	5	0.49	0.04
2005	6	0.52	0.04
2006	4	0.66	0.05
2007	8	0.83	0.06
2008	9	0.83	0.06
2009	3	0.65	0.07
2010	10	0.75	0.05
2011	31.3	0.78	0.06
2012	21.7	0.72	0.05
2013	26.8	0.81	0.08
2014	5.3	0.78	0.06
2015	31.0	0.78	0.06
2016	28.9	0.86	0.07
2017	25.8	0.83	0.08
2018	19.5	0.88	0.07
2019	25.2	0.70	0.07
2020	19.9	0.71	0.09
2021	2.7	0.68	0.06

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in Lake Talquin due to elevated levels of mercury.

Click here for more information about fish consumption advisories in Leon County.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Long term sampling demonstrates that Lake Talquin continues to not meet the chlorophyll-a and phosphorus thresholds for the Big Bend Bioregion. Nitrogen, and to a lesser extent, phosphorus levels, have increased over time. Staff considers the low DO results taken in deeper water a normal condition for Lake Talquin.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites LT1, TOC2, TOD, TOE2, and TOLR.



Figure 1. Dissolved Oxygen Percent Saturation results for Lake Talquin. Several sampling stations have been deactivated while others have been added over the sampling period.


Waterbody: Ochlockonee River

Basin: Ochlockonee River

The Ochlockonee River originates in south-central Georgia and flows about 206 miles south to Ochlockonee Bay in Florida, draining approximately 2,400 square miles in all or part of eleven counties between the two states. The river is impounded by the Jackson Bluff Dam, forming Lake Talquin.

The river has been declared an Outstanding Florida Water by the Florida Department of Environmental Protection (FDEP) and identified as an Integrated Wildlife Habitat (formerly known as a Strategic Habitat Conservation Area) by the Florida Fish and Wildlife Conservation Commission. Parts of the Ochlockonee River have been designated critical habitat for mussels by the U. S. Fish and Wildlife Service (F.A.C. 62-302, 2006, and Federal Register, 2007). Unfortunately, past agricultural and silvicultural practices, as well as point source problems, have led to increased turbidity, higher nutrient concentrations, bacterial problems, and increased sedimentation of the river.

As shown in the following pie chart, approximately 35% of land use in the 1,019,525-acre Ochlockonee River Basin upstream of the southernmost sample station is agriculture, rangeland, urban, transportation or utilities. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced river communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of the Ochlockonee River and met the collection and analysis requirements of the FDEP.

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Table 1. The State criteria were exceeded several times for nitrogen at the furthermost upstream station (Fairbanks Ferry), and the Highway 90 station. Phosphorus levels were exceeded only once at the Highway 20 station. This suggests that excessive nutrients are being released into the river in the upper reaches, probably as the result of excessive erosion and/or fertilizer application. As the nutrients move downstream, they are assimilated through biological activity and bind to bottom sediments, as demonstrated by the lower levels in the downstream stations. The assimilation of nutrients is most noticeable with nitrogen.

Due to hazardous water conditions during the 4th quarter of 2018, and low water /backflow condition in 2019 through 2021, the appropriate number of water quality samples to calculate the NNC could not be collected for those years. While the sampling requirements could not be met, nutrient levels at all stations appear to be similar to what had been found in previous years.

For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus. Total nitrogen levels, especially in the upstream areas, were consistently higher than the criteria, though data "spikes" have decreased over time.

Dissolved Oxygen

While all three stations occasionally did not meet Class III water quality standards for DO (Figure 3), the Highway 20 station (located downstream from the Jackson Bluff Dam) was the most notable. This may be attributed to the operation of the dam. The gates of the dam have the ability to release water from either the surface (relatively oxygenated), or middle layer of water (lower levels of oxygen). During events where the water being released is mostly the "middle" layer of water, DO levels would tend to be depressed. Recent results are showing higher oxygen levels at the Highway 20 station. Staff believe that this is the result of changes to the operation of the dam. Low flow conditions can also contribute to depressed oxygen levels, which may affect all stations along the river.

Metals

The river station directly upstream of U.S. Route 90 (OCHat90) had lead levels that exceeded Class III water quality criteria during the 3rd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the elevated levels of lead in these systems.

Click here for more information on metal levels in Leon County waterbodies.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 410 in 10% of samples during a 30-day period was exceeded at station OCHat90 during the 4th quarter of 2021. This is the first time this station has exceeded the *E. coli* standard since sampling for this parameter began in 2014. It is not known why *E. coli* levels were elevated.

Other Parameters

Chlorophyll-a results are consistently elevated at the Ochlockonee River station located below the dam (T02-Och. River at 20) (Figure 4). As in previous years, it is assumed that the majority of the station's algal community (which chlorophyll-a indirectly measures) is being flushed out of Lake Talquin and levels would not normally be so elevated in the river. Other water quality parameters appear to be normal for the area and no other impairments were noted.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in the Ochlockonee River due to elevated levels of mercury.

Click here for more information about fish consumption advisories in Leon County.

Conclusions

Based on ongoing sampling, the upper reaches of the Ochlockonee River did not meet the nitrogen nutrient threshold for the Panhandle East Region for several years. Sample stations occasionally did not meet Class III water quality standards for DO; the Highway 20 station (located downstream from the Jackson Bluff Dam) was the most notable, but oxygen levels have increased in the last two years, probably as the result of changes in the operation of the dam. That same station's chlorophyll-a concentrations were consistently elevated when compared to the other stations. Lead levels at station OCHat90 exceeded Class III water quality criteria during the 3rd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely the cause of the exceedance. E. coli levels exceeded water quality standards at station OCHat90 during the 4th quarter of 2021. It is not known why *E. coli* levels were elevated.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites 100, OCHat90 and T02.

Ochlockonee River	Instream Protection Criteria TN (1.03 mg/L)			Instream Protection Criteria TP (0.18 mg/L)		
Year	Och at FF	Och at 90	Och at 20	Och at FF	Och at 90	Och at 20
2000	1.63	-	0.14	0.20	-	0.06
2001	1.21	-	0.75	0.18	-	0.07
2002	2.08	-	0.76	0.14	-	0.08
2003	0.68	-	0.34	0.07	-	0.05
2004	0.68	-	0.64	0.06	-	0.03
2005	0.92	-	0.52	0.07	-	0.04
2006	1.07	1.12	0.70	0.09	0.07	0.04
2007	1.56	1.16	0.68	0.14	0.13	0.07
2008	1.41	1.02	0.70	0.16	0.12	0.07
2009	0.88	0.67	0.79	0.11	0.10	0.07
2010	1.32	1.07	0.72	0.13	0.09	0.06
2011	1.60	0.69	0.80	0.13	0.07	0.06
2012	1.26	0.99	0.77	0.14	0.15	0.06
2013	1.17	0.92	0.85	0.12	0.12	0.11
2014	1.09	0.88	0.68	0.11	0.08	0.06
2015	1.20	1.08	0.73	0.12	0.12	0.07
2016	1.10	1.13	0.79	0.14	0.12	0.07
2017	1.20	1.10	0.77	0.13	0.13	0.07
2018-2019	-	-	-	-	-	-
2020	1.01	-	0.74	0.11	-	0.08
2021	-	-	-	-	-	-

Table 1. FDEP's total nitrogen and phosphorus criteria for rivers applied to Ochlockonee River. Results in bold signify exceedances of the State criteria.



Figure 1. Total phosphorus results for the Ochlockonee River.



Figure 2. Total nitrogen results for the Ochlockonee River.



Figure 3. Dissolved Oxygen Percent Saturation results for the Ochlockonee River.



Figure 4. Chlorophyll-a results for the Ochlockonee River.

Waterbody: Polk Creek



Basin: Ochlockonee River

Polk Creek is a minimally disturbed, slightly tannic stream located in western Leon County. The stream flows west, eventually reaching Lake Talquin.

As the following pie chart shows, urban and residential, transportation and utilities land uses make up approximately 12% of the 2,328-acre watershed upstream of the sample station. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to this type of land use.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Polk Creek and met the collection and analysis requirements of Florida Department of Environmental Protection (FDEP).

Results

Escherichia coli (E. coli)

E. coli levels exceeded the Class III water quality standard several times over the sampling period. Since the watershed is relatively undeveloped, it was thought that elevated bacteria levels could be the result of wildlife in the area. FDEP, through their own sampling, have determined that anthropogenic sources have been identified using genetic marker and tracer data. To better track potential sources of *E. coli*, Leon County added additional water quality stations to the watershed in 2021 (Figure 1). The latest *E. coli* exceedances were noted during the 4th quarter of 2021 at both stations.

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria for phosphorus and nitrogen (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Table 1. While the State criteria were not exceeded for either parameter, nutrient levels have been slowly increasing over time.

Habitat Assessment and Stream Condition Index (SCI)

The habitat assessment and SCI sampling are not performed every year, so the following results are from 2019.

The results of the Habitat Assessment (HA) score for Polk Creek characterize the overall stream habitat in the Optimal category (Table 2). Habitat availability, (a component of the HA) was sub-optimal, especially roots, and to a lesser extent snags, although high quality leaf packs were present. Channel characteristics were very natural with the expected pools, bends, and stable streambanks.

 Table 1. FDEP's total nitrogen criteria for streams applied to Polk Creek.

 Due to low water levels, the Numeric Nutrient Criteria data

 requirements could not be calculated for 2011

	Instream Protection	Instream Protection
Polk Creek	Criteria	Criteria
	TN (1.03	TP (0.18
	mg/L)	mg/L)
Year		
2007	0.44	0.02
2008	0.42	0.03
2009	0.22	0.04
2010	0.48	0.04
2011	-	-
2012	0.46	0.04
2013	0.78	0.04
2014	0.54	0.04
2015	0.48	0.06
2016	0.56	0.05
2017	0.73	0.05
2018	0.63	0.05
2019	0.43	0.08
2020	0.54	0.06
2021	0.44	0.05

In keeping with the habitat assessment and the water quality that exhibited a high dissolved oxygen concentration, low conductivity and low turbidity, the Stream Condition Index score was Healthy (Table 3).

The macroinvertebrate community present at the monitoring site consisted of 47 taxa including 12

sensitive (per FDEP) taxa and four FDEP very tolerant taxa. No single group or taxon numerically dominated the community. The stoneflies of the *Perlesta placida* complex were the most abundant single taxon followed by tanytarsini chironomids of the *Rheotanytarsus exiguus* grp. Sensitive taxa were well represented in the SCI sample with 25.5% of total richness. Only a single long-lived taxon was recovered from the SCI subsampling although both *Procambarus* sp. and *Progomphus obscurus* are present in the total sample.

Polk Creek	Score	Category	
Substrate Diversity	14	Suboptimal	
Substrate Availability	10	Marginal	
Water Velocity	19	Optimal	
Habitat Smothering	18	Optimal	
Artificial Channelization	20	Optimal	
Bank Stability	9,9	Optimal, Optimal	
Riparian Zone Width	10, 10	Optimal, Optimal	
Riparian Vegetation Quality	10, 10	Optimal, Optimal	
Final Habitat Assessment Score	139		
Interpretation	Optimal		

Table 2. Polk Creek Habitat Assessment Score.

Included in the sensitive taxa are a single taxa each of both ephemeroptera (mayflies) and plecoptera (stoneflies). No FDEP listed sensitive trichoptera (caddisflies) were recovered. These three EPT taxa are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. In total, four EPT taxa, were recovered in the SCI; one ephemeropteran taxa, one plecopteran taxa and two trichopteran taxa.

For more information about the SCI and Habitat Assessment, click Here.

Table 3. Polk Creek Stream Condition Index Score.

Polk Creek	Rep 1	Rep 2
Stream Condition Index Metrics		
Scores		
Total Taxa	5.71	4.64
Ephemeroptera	1.25	1.25
Taxa		
Trichoptera Taxa	1.11	0
% Filter Feeder	3.25	3.53
Long-lived Score	2	2
Clinger Taxa	7	5
% Dominance	7.65	7.65
% Tanytarsini	8.80	9.03
Taxa		
Sensitive Taxa	5.33	4
% Tolerant Taxa	1.59	3.18
SCI Vial Score	48.55	44.75
Stream Condition Index Score	46	5.65
Score	Healthy	
Interpretation		•/

Metals

Polk Creek's (station PK1) lead levels exceeded Class III water quality criteria during the 3rd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the elevated levels of lead in these systems.

Click here for more information on metal levels in Leon County waterbodies.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Additional water quality sampling in 2021 showed *E. coli* exceedances occurring at both stations. Nutrient thresholds were met for the Big Bend Bioregion. The results of the Habitat Assessment score characterize the stream habitat in the Optimal category. In keeping with the habitat assessment

and the water quality, the Stream Condition Index score was Healthy. Station PK1 lead levels exceeded Class III water quality criteria during the 3rd quarter of 2021. Other water quality parameters appear to be normal.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Sites 38 and PK1.



Figure 1. Locations of the water quality station 38 and the newly established PK1 on Polk Creek.



Figure 2. E. coli levels for Polk Creek.

Waterbody: Soapstone Creek



Basin: Ochlockonee River

Soapstone Creek is a minimally disturbed, phosphorus-limited stream located in southwestern Leon County. The stream flows west, eventually reaching the Ochlockonee River downstream of Lake Talquin.

Soapstone Creek is aptly named due to its tendency to have foam form on the water's surface giving it a "soap sudsy" appearance. While foam is sometimes associated with pollution, it naturally forms under certain conditions. In this case, foam is naturally formed when water surface tension is reduced as natural oils and organic compounds (i.e., tannins) are released into the water from the surrounding wooded and boggy areas and float to the surface. Turbulence introduces air into the water forming foam.

The culvert associated with the bridge spanning the creek at County Road 375 frequently prevents the creek from flowing during low water conditions, preventing staff from sampling. Due to low water conditions, staff was only able to collect water quality samples intermittently throughout the sampling period.

While the following pie chart shows the majority of the 4,025-acre watershed is relatively undeveloped, urban and residential, utilities and transportation land uses make up approximately 3% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Soapstone Creek and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Table 1. Due to low water conditions, four temporally independent samples per year could not be collected from this station for several years (2011-2014 and 2016-2020). The State criteria were not exceeded for either parameter in the samples obtained. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total nitrogen and never exceeded the criteria for total phosphorus.

Table 1. FDEP's total nitrogen and phosphorus criteria for streams ap-
plied to Soapstone Creek.

Soapstone Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2008	0.64	0.01
2009	0.50	0.00
2010	0.51	0.01
2011- 2014	-	-
2015	0.60	0.01
2016-2021	-	-

Dissolved Oxygen

As Figure 1 shows, Soapstone Creek occasionally did not meet the Class III criteria for dissolved oxygen (DO). Staff believes that this is a natural condition for this location, since the creek is a low gradient blackwater stream that drains wetlands.

Metals

Soapstone Creek's lead levels exceeded Class III water quality criteria during the 3rd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely the cause of the elevated levels of lead in these systems.

Click here for more information on metal levels in Leon County waterbodies.

Escherichia coli (E. coli)

The *E. coli* water quality limit of > 10% threshold value of 410 in 10% or more of samples in a 30-day period was exceeded during the March 2018 sampling event (630/100 mL). Since the watershed is relatively undeveloped, elevated bacteria levels are probably the result of wildlife in the area.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Soapstone Creek met the nutrient thresholds for the East Panhandle Region. As a result of low flow, the Class III criterion for dissolved oxygen was not always met during the sampling period. *E. coli* levels exceeded Class III water quality standard daily limits during the 1st quarter 2018 sampling event. Lead levels exceeded Class III water quality criteria during the 3rd quarter in 2021. Relict anthropogenic sources such as leaded gasoline are most likely the cause of the elevated levels of lead.

Other water quality parameters appear to be normal for the area and no impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site Soapstone.

Attachment # 1 Page 157 of 178



Figure 1. Total nitrogen results for Soapstone Creek.



Figure 2. Total phosphorus results for Soapstone Creek.



Figure 3. Dissolved Oxygen Percent Saturation results for Soapstone Creek.

Waterbody: West Black Creek



Basin: Ochlockonee River

West Black Creek is a minimally disturbed, phosphorus-limited stream located in southwestern Leon County. The stream flows west, eventually reaching the Ochlockonee River downstream of Lake Talquin.

As the following pie chart shows, upland forest and wetlands make up the entirety of the 11,237-acre watershed upstream of the sample station.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

The creek was verified impaired by the Florida Department of Environmental Protection (FDEP) in 2008 and received a Total Maximum Daily Load (TMDL) for fecal coliforms that same year. The TMDL establishes the allowable loadings to the creek which would restore the creek to applicable water quality thresholds. In this case, fecal coliforms would have to be reduced by 33% to meet the criterion of fecal coliforms not exceeding 400/100 mL Most Probable Number (MPN) in 10% of the samples. However, the fecal coliform standard in Florida has been supplanted by standards developed for Escherichia coli as an indicator of bacterial contamination. FDEP is currently using the E. coli standard which states, "cannot exceed the 10% threshold value of 410 in 10% of more of the samples in any 30-day period".

Methods

Surface water sampling was conducted to determine the health of Black Creek and met the collection and analysis requirements of FDEP.

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) for phosphorus and nitrogen (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. While the State criteria were not exceeded for either parameter, the 2018 nitrogen level was the highest recorded during the period of record. Due to the stream being flooded out of its banks during the 3rd quarter of 2021, water quality samples were not collected. Based on three samples, total nitrogen (0.25 mg/L) and total phosphorus (0.02 mg/L) were below FDEP's nutrient thresholds.

West Black Creek	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2006	0.15	0.01
2007	0.41	0.01
2008	0.29	0.02
2009	0.29	0.01
2010	0.34	0.02
2011	0.34	0.02
2012	0.38	0.02
2013	0.18	0.02
2014	0.53	0.02
2015	0.63	0.02
2016	0.54	0.02
2017	0.44	0.02
2018	0.68	0.02
2019	0.23	0.03
2020	0.60	0.02

Table 1. FDEP's total nitrogen and phosphorus criteria forstreams applied to West Black Creek.

Fecal Coliforms and Escherichia coli

As mentioned previously, FDEP has set a TMDL for West Black Creek. While fecal coliform levels were elevated above the 400/100 mL Class III limit in 18% of the samples for Class III waters, there has been only one exceedance since 2008 (February 2012). Since the watershed is relatively undeveloped, the high coliform levels could be the result of wildlife in the area. As mentioned previously, *E. coli* standards have now replaced fecal coliform standards in Florida. The *E. coli* water quality limit of > 410 in 10% of samples collected over a 30-day period was never exceeded since *E. coli* sampling began (Figure 1).

Biology

Stream Condition Index and Habitat Assessment

The Stream Condition Index (SCI) sampling is not performed every year, so the following results are from 2019.

The Stream Condition Index score at West Black Creek (31) is in the Exceptional category. A total of 47 taxa were collected from West Black Creek during the SCI sampling. No single group or taxon numerically dominated the community. The riffle beetle Microcylloepus pusillus was the most abundant single taxon in both vials of the SCI. Both long-lived and sensitive taxa were well represented in the SCI sample with 21.3% of taxa being long-lived (10 taxa) and 36.2% being sensitive (17 taxa). Included in the sensitive taxa are four taxa of ephemeroptera (mayflies), two taxa of plecoptera (stoneflies), and three taxa of trichoptera (caddisflies). These three EPT taxa are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. In total, seventeen EPT taxa were recovered in the SCI; four ephemeropteran taxa, two plecopteran taxa and eleven trichopteran taxa.

The results of the Habitat Assessment score characterize the stream habitat in the Optimal category. Habitat availability, although suboptimal, presented high quality leaf packs, roots and snags. The 100-meter transect channel characteristics were very natural, with the expected pools, bends, and stable streambanks. In keeping with the habitat assessment and the water quality that exhibited adequate dissolved oxygen concentration, low conductivity, and low turbidity, the Stream Condition Index score was Exceptional.

For more information on the Stream Condition Index and Habitat Assessment, click here.

Conclusions

Based on ongoing sampling, West Black Creek met the nutrient thresholds for the East Panhandle Region. Coliforms have been elevated in the past, but there were no water quality exceedances since the first quarter of 2012, and no *E. coli* exceedances since *E. coli* sampling began in 2015. The 2019 SCI score is in the Exceptional category, while the Habitat Assessment score characterizes the stream habitat at Optimal. Other water quality parameters appear to be normal. Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

West Black Creek	Rep 1	Rep 2
Stream Condition Index Metrics Scores		
Total Taxa	5.71	6.43
Ephemeroptera Taxa	5	5
Trichoptera Taxa	10	7.78
% Filter Feeder	4.29	3.35
Long-lived Score	10	10
Clinger Taxa	8	10
% Dominance	6.85	7.88
% Tanytarsini Taxa	5.01	3.91
Sensitive Taxa	8.67	8.67
% Tolerant Taxa	10	7.54
SCI Vial Score	81.70	78.40
Stream Condition Index Score	80	.05
Score Interpretation	Excer	otional

 Table 2. West Black Creek Stream Condition Index Score.

Table 3.	West	Black	Creek	Habitat	Assessment Score
Tuble 3.	VV CJU	Diack	CICCK	indbitut	/ 0000000000000000000000000000000000000

West Black Creek	Score	Category	
Substrate Diversity	15	Suboptimal	
Substrate Availability	11	Suboptimal	
Water Velocity	20	Optimal	
Habitat Smothering	19	Optimal	
Artificial Channelization	20	Optimal	
Bank Stability	9, 9	Optimal, Optimal	
Riparian Zone Width	10, 10	Optimal, Optimal	
Riparian Vegetation Quality	9, 9	Optimal, Optimal	
Final Habitat Assessment Score	141		
Interpretation	Optimal		

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 43.

Attachment # 1 Page 162 of 178



Figure 1. West Black Creek fecal coliforms and Escherichia coli.

10. Patty Sink Basin

Waterbody: Patty Sink Drain



Basin: Patty Sink

Patty Sink Drain is a slightly tannic, nitrogen-limited stream that flows south and eventually drains into Patty Sink and the Floridan Aquifer.

As shown in the following pie chart, approximately 28% of land use in Patty Sink's 12,975 acre watershed is agriculture, open land, rangeland, transportation, utilities, urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Patty Sink Drain and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, four temporally independent samples per year have never been collected from this station. Even though staff was not able to collect the required number of samples per calendar year, some conclusions can be made. For illustrative purposes, individual data points were plotted to determine any possible trends (Figures 1 and 2). With few exceptions, individual values did not exceed the instream criteria for total phosphorus or total nitrogen.

Fecal Coliforms and Escherichia coli (E. coli)

Patty Sink Drain has a history of fecal coliform levels exceeding the Class III water quality standard (400/100 mL in at least 10% of the samples). *E. coli* standards have now supplanted fecal coliform standards in Florida. The *E. coli* water quality limit of > 410 in 10% of samples collected over a 30-day period have been exceeded three times (Figure 3) since *E. coli* sampling started (1st quarter of 2015). Since the watershed is relatively undeveloped, elevated *E. coli* levels are probably the result of wildlife or livestock (i.e., cattle) in the area. There have been no exceedances since 2018.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Total phosphorus and total nitrogen levels appear to meet the Numeric Nutrient Criteria. *E. coli* water quality limits were exceeded during the sampling period, but levels have been below Class III water quality standards since 2018. Other water quality parameters appear to be normal for the area and no other impairments were noted. Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 5.



Figure 1. Total nitrogen results for Patty Sink Drain.



Figure 2. Total phosphorus results for Patty Sink Drain.



Figure 3. E. coli results for Patty Sink Drain.

11. St. Marks River Basin

Waterbody: Chicken Branch



Basin: St. Marks River

Chicken Branch is located in southeastern Leon County. The stream is partially fed by Chicken Branch Spring and flows southeast, eventually draining into the St. Marks River.

While the following pie chart shows the majority of the 6,572-acre watershed is relatively undeveloped, agriculture, rangeland, transportation, utilities, urban and residential uses make up approximately 14% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses. Watershed land use is changing; logging in the area adjacent to Chicken Branch and its spring impacted the system and may continue to do so.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Chicken Branch and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions, four temporally independent samples per year could not always be collected from this station. When sampling conditions were conducive to collecting the required number of samples, the State criteria were not exceeded for either parameter. While not exceeding the NNC threshold, the 2017 geometric mean nitrogen levels are the highest on record; the June 2017 result (0.81 mg/L) is the third highest individual result since sampling begin in 2006. Substantial rainfall in the area immediately prior to the sampling could have affected nitrogen values via increased runoff into the system. The elevated color levels during the same event (150 PCU vs. a median of 40 PCU) suggest that runoff was a factor in the

results. The 2018, 2019, and 2021 geometric mean nitrogen results were considerably lower, so the elevated total nitrogen value in 2017 was probably an isolated event. Low water levels in 2020 prevented staff from collecting the appropriate number of samples to calculate the NNC.

Table 1. FDEP's total nitrogen and phosphorus criteria for streams applied to Chicken Branch. The absence of data means there was not enough data collected (due to lack of water) to fulfill data requirements.

Chicken Branch	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2006- 2008	-	-
2009	0.15	0.04
2010	0.43	0.05
2011- 2012	-	-
2013	0.27	0.03
2014	0.41	0.05
2015	-	-
2016	0.38	0.05
2017	0.50	0.05
2018	0.40	0.04
2019	0.30	0.06
2020	-	-
2021	0.38	0.05

Dissolved Oxygen

As Figure 1 shows, Chicken Branch did not always meet the Class III criteria for dissolved oxygen (DO). Low DO levels are typical of Florida spring-run streams and are considered normal for Chicken Branch.

Stream Condition Index and Habitat Assessment

The 2020 Stream Condition Index (SCI) score matches the natural channel condition of the habitat. The presence of a varied and reasonably rich biological community with several sensitive taxa resulted in a SCI score (64) in the Healthy range. Interestingly, this score is seven points lower than the SCI score received in 2017, dropping the station from the lower end of the Exceptional range into the higher end of the Healthy range. This is likely due to

drought conditions experienced in the system during the spring. The most abundant two macroinvertebrate taxa collected in both vials were the Asellid isopod Caecidotea sp. and the mayfly Caenis diminuta. From the total taxa collected, six are listed as sensitive taxa by the FDEP and four as very tolerant. The Ephemeroptera, Plecoptera, Trichoptera (EPT) fauna are widely regarded as the groups of aquatic insects that contain a large number of pollution sensitive taxa. No Plecoptera (stoneflies) were noted in the SCI. Three Ephemeropteran (mayflies) species were collected, including the "sensitive" genus Stenacron. The Trichoptera (caddisflies) were also represented by two species: Cheumatopsyche and Oxyethria.

The results of the Habitat Assessment score (127) characterize the stream habitat as Suboptimal. Given the natural, non-dredged condition of the system, this score reflects a limitation on the availability of some of the major habitats within the channel. The system still displays impacts within the riparian zone as result of extensive timbering of the surrounding swamp forest. Numerous downed trees in the channel allow for increased light to reach the stream. This increased light combined with the dry/non-flowing channel conditions in the spring supported the growth of wetland herbaceous plants within the channel to an extent not previously noted in this system.

For more information about the SCI and Habitat Assessment, click Here.

Other Parameters

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Conclusions

Based on ongoing sampling, Chicken Branch met the nutrient thresholds for the Panhandle East Region. Staff considers the occasionally low DO values at Chicken Branch to be a natural condition for spring fed systems. The 2020 SCI sampling and analysis score resulted in a score in the Healthy range and showed the presence of a varied and reasonably rich biological community with several sensitive taxa.

Table 2. Stream Condition Index results for Chicken Brand	:h.
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Chicken Branch	Rep 1	Rep 2
Stream Condition Index		
Metrics Scores		
Total Taxa	5.65	3.04
Ephemeroptera Taxa	6	6
Trichoptera Taxa	1.43	2.86
% Filter Feeder	3.21	2.25
Long-lived Taxa	6.67	3.33
Clinger Taxa	7.50	6.25
% Dominance	8.45	7.26
% Tanytarsini Taxa	9.56	8.58
Sensitive Taxa	6	5
% Tolerant Taxa	8.16	7.96
SCI Vial Score	69.59	58.38
Stream Condition Index Score	64	
Score Interpretation	Healthy	

Chicken Branch	Score	Category
Substrate Diversity	18	Optimal
Substrate Availability	10	Marginal
Water Velocity	13	Suboptimal
Habitat Smothering	10	Marginal
Artificial Channelization	18	Optimal
Bank Stability	10, 10	Optimal, Optimal
Riparian Zone Width	9, 9	Optimal, Optimal
Riparian Vegetation Quality	10, 10	Optimal, Optimal
Final Habitat Assessment Score	127	
Interpretation	Suboptimal	

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 53.



Figure 1. Dissolved Oxygen Percent Saturation results for Chicken Branch.

Waterbody: Lake Weeks



Basin: St. Marks River

Lake Weeks is a small, shallow, 11-acre, tannic lake located in southeastern Leon County.

As shown in the following pie chart, approximately 41% of land use in the Lake Weeks 150 acre watershed is urban and residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water samples were collected to determine the health of Lake Weeks and met the requirements of the Florida Department of Environmental Protection (FDEP).

Results

Sinkholes

In late February 2015, Lake Weeks developed two sinkholes that quickly drained the lake to levels that prevented sampling (< 1.2 feet by March 2nd) for the first two quarters of 2015. Lake levels rose to high enough levels that staff was able to resume sampling in the third quarter of 2015.

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to an apparent erroneous reading, the total phosphorus result could not be calculated for 2013. Low water levels prevented staff from collecting the required number of samples so the NNC could not be calculated for 2015.

Low water levels in 2012, along with a relatively constant source of nutrients, substantially concentrated the nutrients in the lake, exceeding the Numeric Nutrient Criteria in 2012. As the area returned to a more normal rainfall pattern, chlorophyll-*a* and nutrient levels dropped to levels that met the state criteria for 2014. As in 2012, low water levels in 2015 concentrated nutrients in the lake, resulting in elevated nutrient (1.4 mg/L total nitrogen, 0.08 mg/L total phosphorus) and chlorophyll-a (106 μ g/L) levels during the September 2015 sampling event. By November 2015, while still elevated, levels had dropped (total nitrogen 1.2 mg/L, total phosphorus 0.05 mg/L and chlorophyll-a 10.4 μ g/L). Nutrient values met the Numeric Nutrient Criteria in 2016 -2020.

Table 1. FDEP's chlorophyll-*a*, total nitrogen and phosphorus criteria for lakes applied to Lake Weeks. Results in bold signify exceedances of the State criteria.

Colored Lake	Chlorophyll-a 20.0 µg/L	Total Nitrogen Threshold 1.27-2.23 mg/L	Total Phosphorus Threshold 0.05-0.16 mg/L
2004	3.3	0.33	0.01
2005	1.7	0.42	0.01
2006	3.5	0.58	0.03
2007	4.9	1.00	0.02
2008	13.9	0.80	0.04
2009	2.6	0.32	0.01
2010	5.3	0.59	0.01
2011	14.2	0.79	0.03
2012	47.5	1.49	0.07
2013	19.7	0.87	-
2014	3.9	0.71	0.01
2015	-	-	-
2016	16.2	0.72	0.02
2017	6.0	0.60	0.01
2018	7.0	0.55	0.01
2019	8.0	0.44	0.02
2020	7.9	0.61	0.02
2021	1.9	0.49	0.02

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, Lake Weeks met the nutrient thresholds for the Big Bend Bioregion. Other water quality parameters appear to be normal for the area and no impairments were noted. Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site LW1.

Waterbody: Louvinia Creek



Basin: St. Marks River

Louvinia Creek is an intermittently flowing creek located in eastern Leon County.

While the following pie chart shows the majority of the 2,981-acre watershed is relatively undeveloped, agriculture, rangeland, transportation and utilities, urban and residential uses make up approximately 44% of the watershed. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water sampling was conducted to determine the health of Louvinia Creek and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. Due to low water conditions and the ephemeral nature of the stream, four temporally independent samples per year have never been collected from this station. Even though staff was not able to collect the required number of samples, some conclusions can be made. Based on the samples taken during the study period, most total phosphorus and total nitrogen values did not exceed the total phosphorus and nitrogen thresholds (Figures 1 and 2).

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

While sampling requirements were not met to calculate the NNC results, most total phosphorus and total nitrogen levels appear to meet the nutrient thresholds. Other water quality parameters appear

to be normal for the area and no other impairments were noted.

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Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site LC at WW.



Figure 1. Total nitrogen results for Louvinia Creek.



Figure 2. Total phosphorus results for Louvinia Creek.

Waterbody: St. Marks River



Basin: St. Marks River

The predominantly nitrogen-limited St. Marks River, declared an Outstanding Florida Water by the Florida Department of Environmental Protection (FDEP), originates in the hardwood and cypress swamps of the Red Hills area and flows approximately 35 miles south before emptying into Apalachee Bay. At Natural Bridge Road, the river disappears underground and reappears approximately a mile downstream. It should be noted that there are interactions between the St. Marks River and Lake Lafayette during elevated water conditions. Significant storms, such as Tropical Storm Fay, create interactions between different systems that include Bird Sink, Patty Sink and Lloyd Creek (Jefferson County).

As shown in the following pie chart, approximately 17% of land use in the 60,015-acre St. Marks Basin is agriculture, rangeland, transportation, utilities or urban and residential. Increases in stormwater run-off and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced river communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation.



Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Methods

Surface water was collected to determine the health of the St. Marks River and met the requirements of the FDEP.

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The State criteria were not exceeded for either parameter at the Natural Bridge station.

The station located at State Road 27 was frequently dry or too low to sample and is not included in the aforementioned table since the State's data requirements could not be met. Even though staff was not able to collect the required number of samples, some conclusions can be made. Based on the samples taken during the study period, most total phosphorus and total nitrogen values did not exceed the total phosphorus and nitrogen thresholds (Figures 1 and 2).

St. Marks River	Total Nitrogen Threshold 1.03 mg/L	Total Phosphorus Threshold 0.18 mg/L
2006	0.39	0.03
2007	0.34	0.14
2008	0.27	0.04
2009	0.27	0.05
2010	0.58	0.05
2011	0.40	0.05
2012	0.43	0.05
2013	0.38	0.05
2014	0.49	0.05
2015	0.46	0.07
2016	0.39	0.03
2017	0.58	0.04
2018	0.63	0.05
2019	0.35	0.05
2020	0.43	0.06
2021	0.45	0.05

Table 1. FDEP's total nitrogen and phosphorus criteria for rivers applied to the St. Marks River at Natural Bridge Road.

Fish Consumption Advisory

The Florida Department of Health has issued consumption limits for certain fish in the St. Marks River due to elevated levels of mercury.

Click here for more information about fish consumption advisories in Leon County.

Other Parameters

Other water quality parameters appear to be normal for the area and no impairments were noted.

Conclusions

Based on ongoing sampling, the St. Marks River met the nutrient thresholds for the East Panhandle Region. Other water quality parameters appear to be normal for the area and no impairments were noted.

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Contact and resources for more information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2021.

Click here for a map of the watershed – Sample Site 54 and St. Marks at 27.

Attachment # 1 Page 178 of 178



Figure 1. Total nitrogen results for St. Marks River at 27.



Figure 2. Total phosphorus results for St. Marks River at 27.