

## 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.

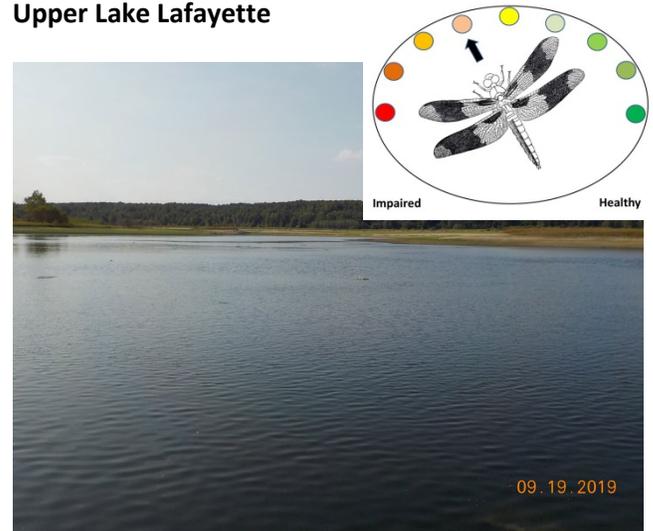
### Background

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. An annual Lake Vegetation Index (LVI) on Lake Piney Z is used to evaluate the health of the floral (plant) community.

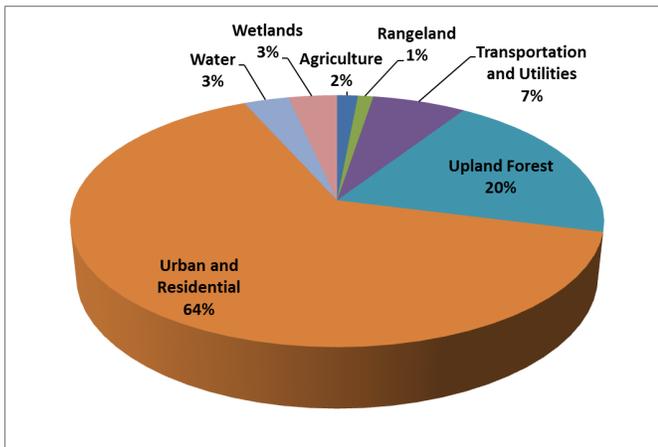
### Upper Lake Lafayette



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) that is located in the northeastern portion of the lake and drains 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 Lafayette 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.

## 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.

**Table 1.** FDEP’s chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Upper Lake Lafayette. Results in bold signify exceedances 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	<b>25.2</b>	0.81	<b>0.10</b>
2006	3.3	0.56	0.09
2007	4.9	0.60	0.07
2008	<b>24.5</b>	0.60	<b>0.15</b>
2009	6.9	0.43	0.08
2010	6.9	0.77	0.07
2011	<b>32.7</b>	0.68	<b>0.10</b>
2012	<b>31.0</b>	0.90	<b>0.15</b>
2013	16.8	0.79	-
2014	-	-	-
2015	<b>48.5</b>	0.88	<b>0.12</b>
2016	-	-	-
2017	<b>40.4</b>	<b>1.24</b>	<b>0.08</b>
2018	-	-	-
2019	<b>48.2</b>	<b>1.55</b>	<b>0.14</b>

The table shows that the geometric means of chlorophyll-a and total phosphorus exceeded the state criteria several times since sampling began. Due to an apparent erroneous reading, the total phosphorus result could not be calculated for 2013. Staff could not access and collect samples from the Upper Lake during portions of 2014, 2016 and 2018, so data requirements could not be calculated for those years. The 2017 geometric means of total chlorophyll-a, total nitrogen and total phosphorus were above the numeric nutrient criteria thresholds and was the first time that total nitrogen did not meet the NNC. While the NNC could not be calculated for 2018, the geometric mean (based on three quarters of data) of chlorophyll-a (16.34 µg/L), total nitrogen (0.44 mg/L) and total phosphorus (0.08 mg/L) were below the numeric nutrient criteria thresholds, suggesting that the lake could meet the numeric nutrient criteria. The 2019 results again showed both phosphorus and

nitrogen exceeding the NNC. This is the result of urbanized inflow streams combined with fluctuating lake volume and extremely low rainfall for the year. The reduced volume concentrates incoming pollutants, thus reducing the lake's ability to assimilate incoming nutrients.

### Fish Kill

Upper Lake Lafayette has a history of fish kills. The latest 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, which caused 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/abnormalities/causes/>.

### Other Parameters

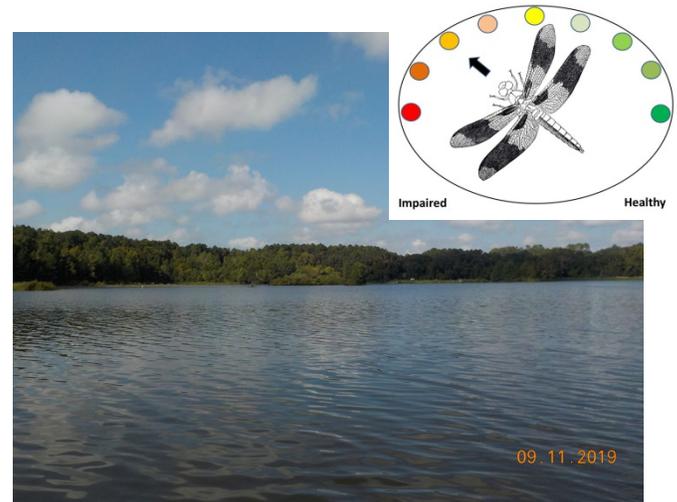
Historically, elevated Biological Oxygen Demand (BOD) results (average is 4.3 mg/L) have been an issue since Leon County sampling began in 2006. Like the elevated nutrients and chlorophyll-*a* levels, urbanized inflow streams and a fluctuating lake volume appear to be detrimentally affecting water quality. While the 2018 results (ranging from 2.0 mg to 2.5 mg/L) showed an improvement to BOD levels, the 2019 results were considerably worse with numbers ranging from 2.5 to 11.2 mg/L. Low rainfall in 2019 and continued nutrient inputs probably contributed to the elevated microbial activity.

### 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 happening in September of 2019. Lake levels at the time of the fish kill were at the level of the sinkhole, meaning that the fish

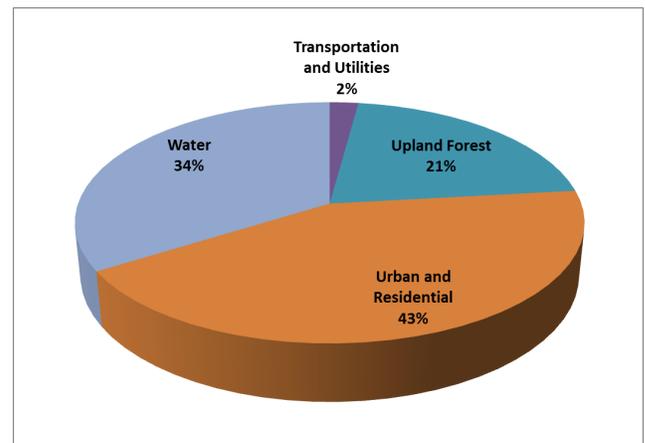
community was concentrated to a very small area. It was concluded that the fish, already stressed from being concentrated in the sinkhole, died mostly from low oxygen levels. Urbanized inflow streams combined with fluctuating lake volume and low rainfall in 2019 exacerbated the various problems that Upper Lake Lafayette continues to have.

### 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 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as annual geometric means) cannot be exceeded more than once in a three-year period.

The table shows that the geometric mean of chlorophyll-a and total phosphorus exceeded the state criteria throughout the sampling period. Due to an apparent erroneous reading, the total phosphorus result could not be calculated for 2013. Staff were unable to collect samples during the 2<sup>nd</sup> quarter of 2016. However, the 2016 geometric means (based on three quarters of data) of chlorophyll-a (15.9 µg/L), and total phosphorus (0.05 mg/L) were above the numeric nutrient criteria thresholds, suggesting that the lake would not meet the numeric nutrient criteria. Total nitrogen (0.71 mg/L) was below the threshold. All NNC were exceeded in 2017, 2018 and in 2019.

The 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. It is hoped that long term ecosystem health will improve.

**Table 1.** 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.

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	<b>6.48</b>	0.45	<b>0.04</b>
2005	<b>12.98</b>	<b>0.78</b>	<b>0.05</b>
2006	<b>25.17</b>	<b>0.70</b>	<b>0.08</b>
2007	2.92	<b>0.96</b>	<b>0.04</b>
2008	<b>8.78</b>	<b>0.73</b>	<b>0.04</b>
2009	4.43	<b>1.33</b>	<b>0.06</b>
2010	<b>17.2</b>	<b>1.06</b>	<b>0.07</b>
2011	<b>36.43</b>	<b>1.28</b>	<b>0.08</b>
2012	<b>32.62</b>	<b>1.65</b>	<b>0.06</b>
2013	<b>27.01</b>	<b>1.12</b>	-
2014	<b>6.02</b>	<b>1.05</b>	<b>0.04</b>
2015	<b>15.00</b>	0.67	<b>0.04</b>
2016	-	-	-
2017	<b>17.3</b>	<b>1.01</b>	<b>0.05</b>
2018	<b>21.6</b>	<b>0.84</b>	<b>0.04</b>
2019	<b>23.5</b>	<b>0.87</b>	<b>0.05</b>

### Floral Assessment

The Lake Vegetation Index score for Piney Z was 60, placing the lake’s vegetative community in the healthy category.

Sixty-two species were found during the survey. Buttonbush (*Cephalanthus occidentalis*), American lotus (*Nelumbo lutea*), denseflower knotweed (*Polygonum densiflorum*), Pond cypress (*Taxodium ascendens*) and the exotic wild taro (*Colocasia esculenta*) were the most dominant species at the lake. Other native shoreline vegetation included; red maple (*Acer rubrum*), coastal plain willow (*Salix carolina*) and maidencane (*Panicum hemitomon*). Unfortunately, camphor tree (*Cinnamomum camphora*), the aforementioned wild taro (*Colocasia esculenta*), water hyacinth (*Eichhornia crassipes*), 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 <http://www.fleppc.org/> 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 (*Salvinia minima*) was another exotic plant found in Lake Piney Z.

[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 in Leon County.](#)

### Other Parameters

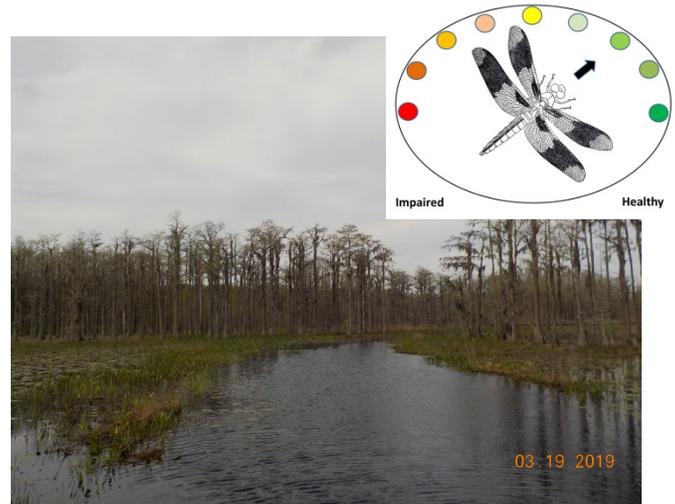
Other water quality parameters appear to be normal for the area and no other impairments were noted.

### Conclusions

Based on ongoing sampling, Lake 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 Lake Vegetation Index score for Lake Piney Z placed the lake's vegetative community in the healthy category. Other water quality parameters appear to be normal for the area and no other impairments were noted.

### Lower Lake Lafayette

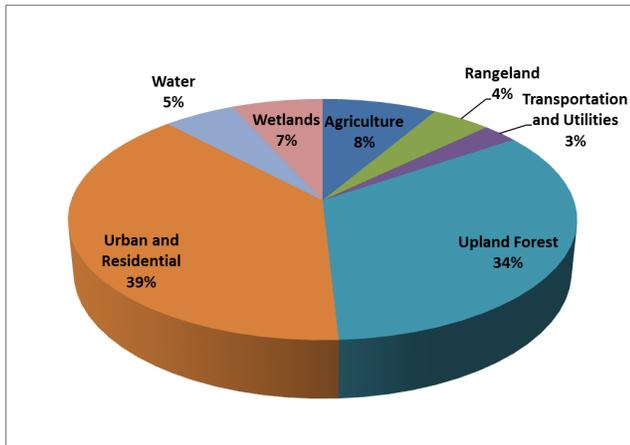


Lower Lake Lafayette is the largest of the four lake compartments, covering an area of 1,006 acres and bordered by the Leon County Apalachee Regional Park Solid Waste Facility, Talquin Electric Sewage Treatment Plant and various residential and commercial developments. Lower Lake Lafayette is also home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

Although pockets of open water are scattered throughout Lower Lake Lafayette, the "lake" functions more like a wetland; much of the area is

covered by dense growths of emergent and submerged vegetation, including many mature trees.



Water from Alford Arm enters Lower Lake Lafayette via pipes located under the CSX 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.

## 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. State numeric nutrient criteria were not exceeded during the period of record.

Intermittent sampling has made conclusions difficult. Due to low water conditions, four temporally independent samples per year could not be collected from Lower Lake Lafayette for several years (2007-2008 and 2010-2011). No water quality samples were collected in 2012 and only one water sample was collected in 2013. Access issues prevented sample collection during the latter part of 2014 and all of 2015. Sampling resumed in 2016 with four quarters of samples collected in 2016 and 2017. Low water conditions prevented the collection of the required number of samples in 2018 and 2019.

While the State sampling requirements in 2018 or 2019 could not be met due to low water, the 2018 results (based on three samples in 2018), show that the geometric mean for chlorophyll-a (5.71 µg/L), total nitrogen (0.57 mg/L) and total phosphorus (0.01 mg/L) were below the NNC. The 2019 value for chlorophyll-a (3.7 µg/L), total nitrogen (0.40) and total phosphorus (0.03 mg/L) were also below the criteria.

### 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 1).

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 1.** 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	-	-	-
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
2018-2019	-	-	-

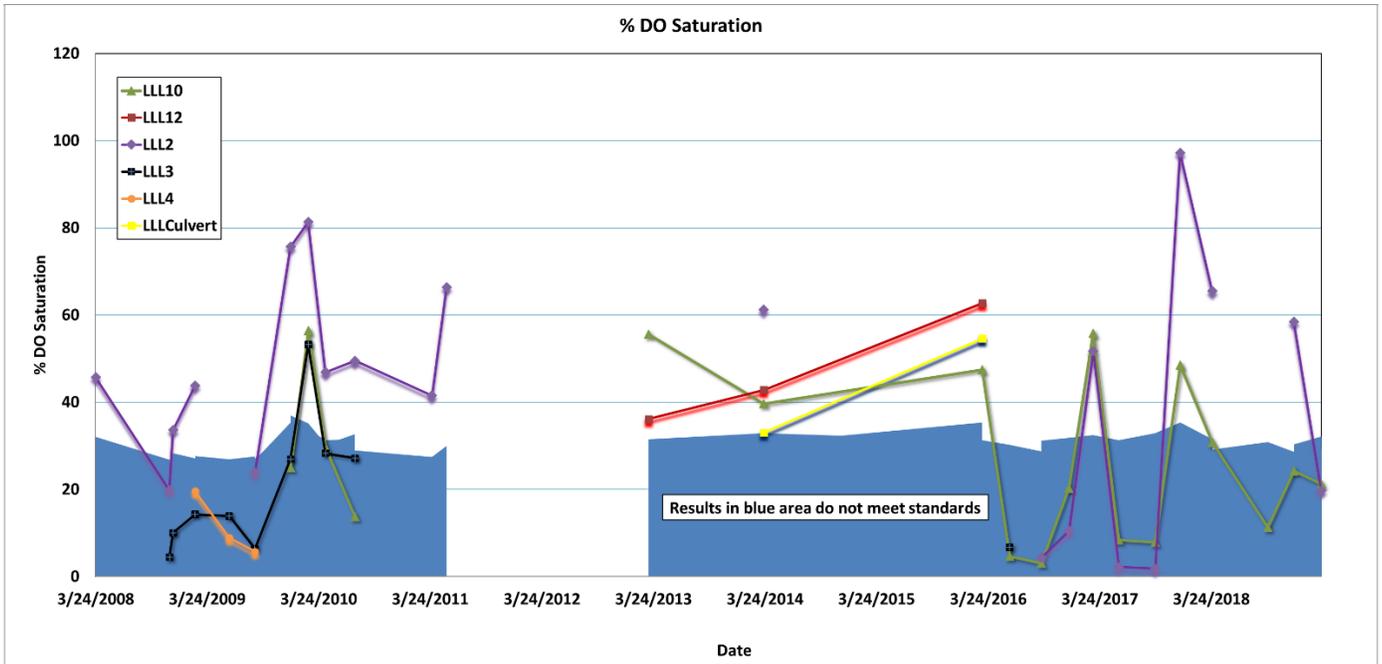


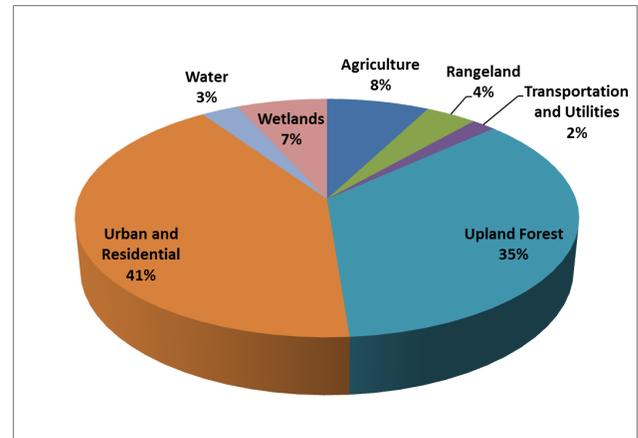
Figure 1. Dissolved Oxygen Percent Saturation results for Lower Lake Lafayette. The data gap reflects low (or no) water in the lake at that time.

### Alford Arm



Alford Arm is a 371-acre waterbody which was separated from Lower Lake Lafayette by construction of the CSX 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. 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. For information regarding upstream of Alford Arm, please see the Alford Arm Tributary report (Station 1).

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.LeonCountyFL.gov/WaterResources](http://www.LeonCountyFL.gov/WaterResources)

[Click here to access the results for all water quality stations sampled in 2019.](#)

[Click here for map of watershed – Sample sites L02, L30, LPZ3, LLL2, LLL3, and LLL10.](#)

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