

## Florida LAKEWATCH Report for Avalon in Flagler County Using Data Downloaded 12/9/2022

### Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

### Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

### Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	18 - 151	<b>36 (15)</b>
Total Nitrogen (µg/L)	776 - 1706	<b>1019 (15)</b>
Chlorophyll- uncorrected (µg/L)	3 - 61	<b>10 (15)</b>
Secchi (ft)	1.5 - 5.0	2.8 (13)
Secchi (m)	0.5 - 1.5	0.9 (13)
Color (Pt-Co Units)	14 - 23	19 (12)
Specific Conductance (µS/cm@25 C)	363 - 483	418 (7)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Avalon
GNIS Number	
Latitude	29.6242
Longitude	-81.2019
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2002 to 2018
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>36 (18 to 151)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1019 (776 to 1706)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

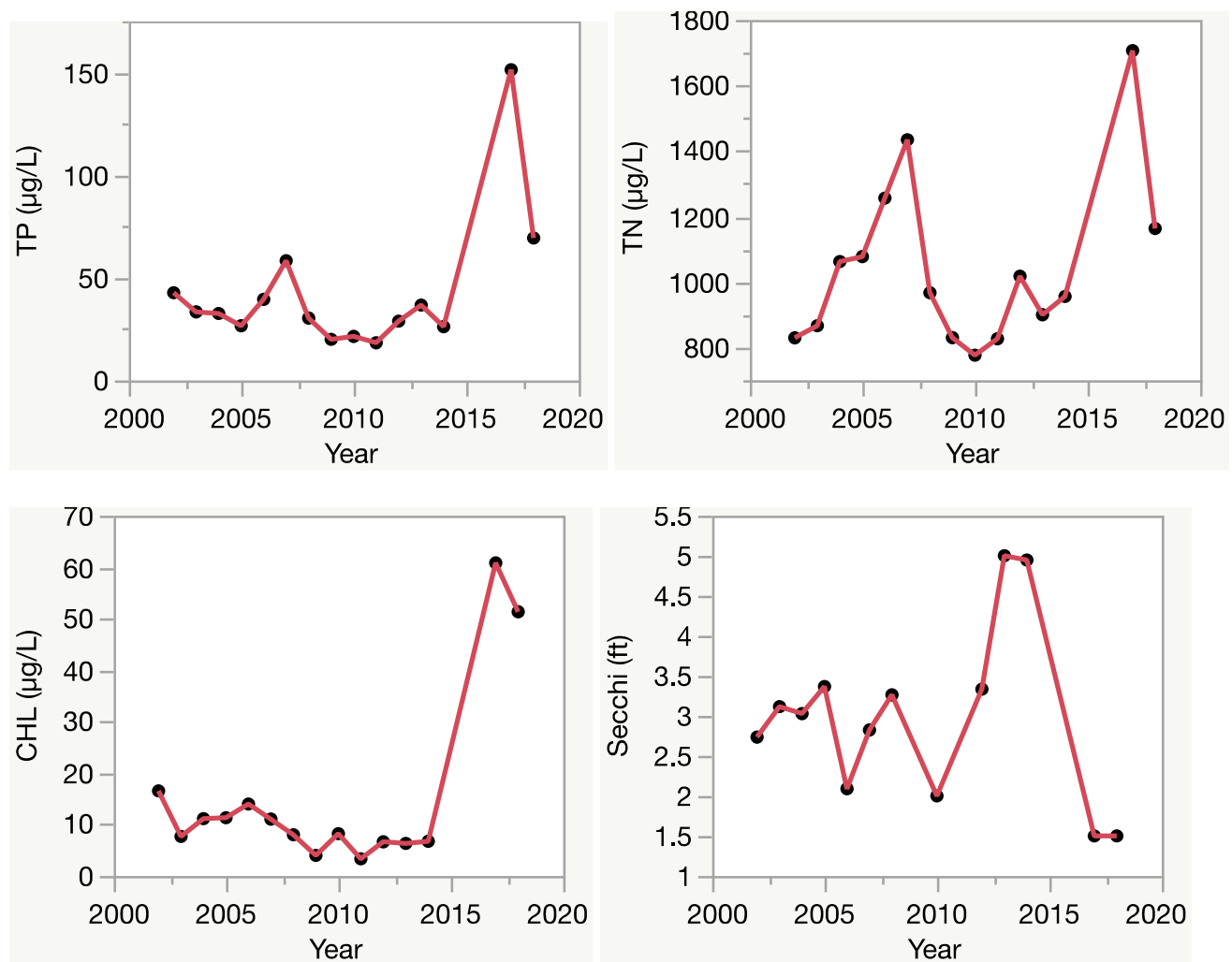
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Avalon trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.21$ ,  $p = 0.08$ ), total nitrogen (TN No Trend,  $R^2 = 0.10$ ,  $p = 0.25$ ), chlorophyll (CHL Increasing,  $R^2 = 0.30$ ,  $p = 0.03$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.01$ ,  $p = 0.80$ ).**



# Florida LAKEWATCH Report for Belle Aire in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	19 - 81	<b>41 (21)</b>
Total Nitrogen (µg/L)	523 - 948	<b>700 (21)</b>
Chlorophyll- uncorrected (µg/L)	4 - 24	<b>11 (21)</b>
Secchi (ft)	2.2 - 6.5	4.2 (21)
Secchi (m)	0.7 - 2.0	1.3 (21)
Color (Pt-Co Units)	19 - 43	28 (14)
Specific Conductance (µS/cm@25 C)	188 - 338	257 (12)
Lake Classification	<b>Clear Hardwater</b>	

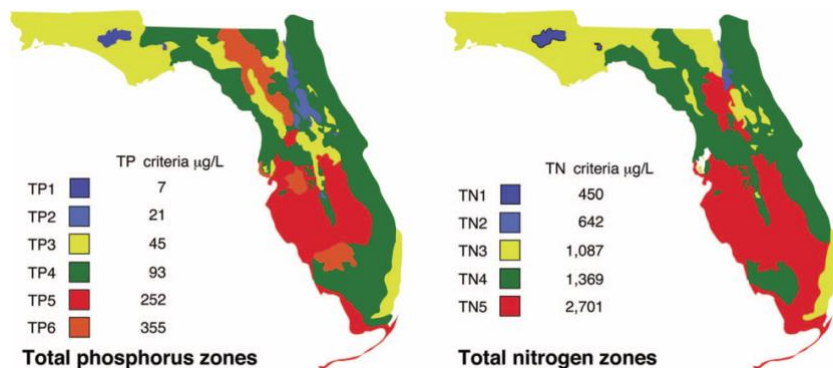
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Belle Aire
GNIS Number	
Latitude	29.5782
Longitude	-81.2392
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2019
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>41 (19 to 81)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>700 (523 to 948)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**



**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

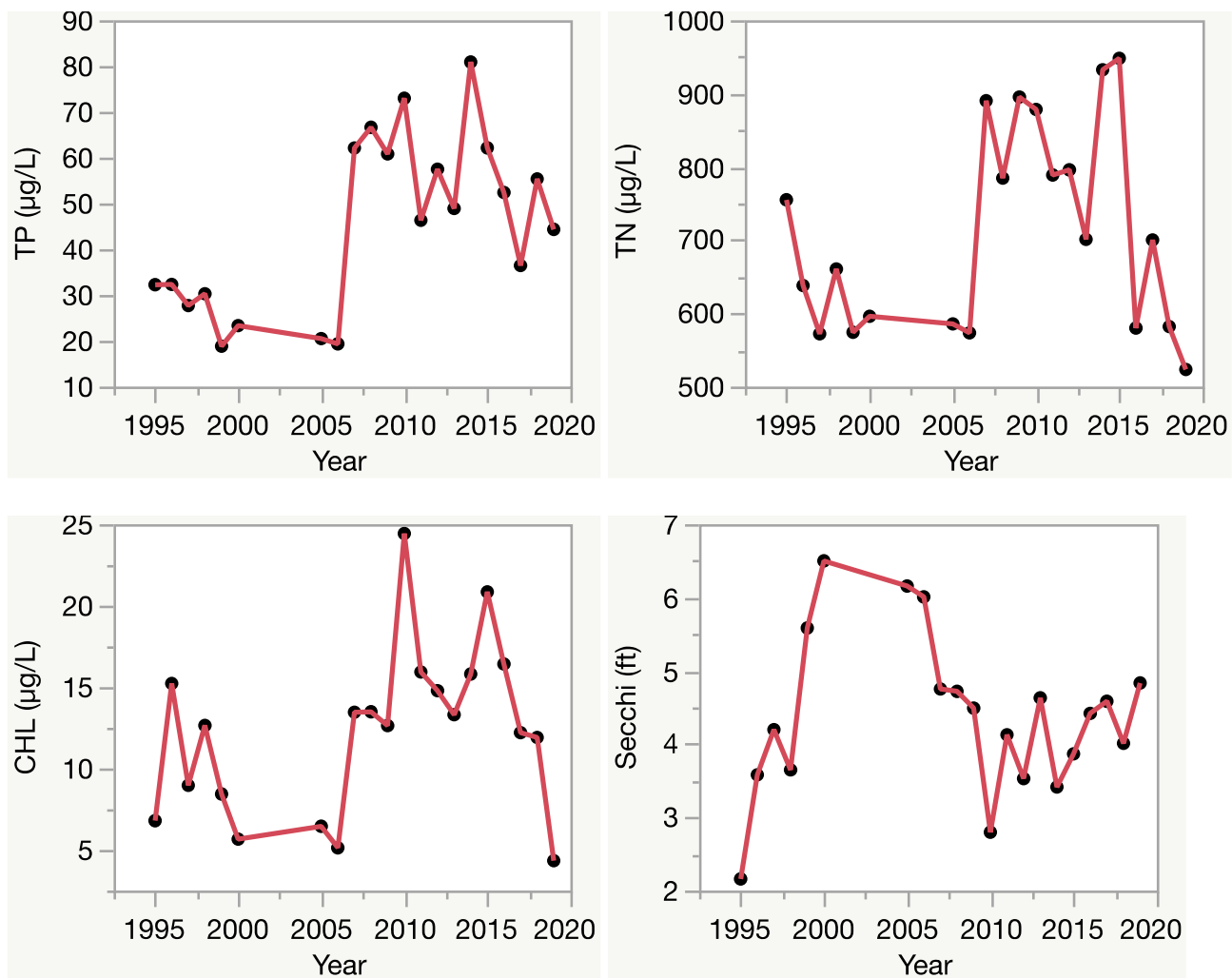
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

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1. Identify your lake's TP Zone in Table 3.
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2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Belle Aire trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.36$ ,  $p = 0.00$ ), total nitrogen (TN No Trend,  $R^2 = 0.04$ ,  $p = 0.36$ ), chlorophyll (CHL No Trend,  $R^2 = 0.11$ ,  $p = 0.15$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.00$ ,  $p = 0.98$ ).**



# Florida LAKEWATCH Report for Belle Aire South in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

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- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	40 - 40	<b>40 (1)</b>
Total Nitrogen (µg/L)	775 - 775	<b>775 (1)</b>
Chlorophyll- uncorrected (µg/L)	-	<b>(0)</b>
Secchi (ft)	2.6 - 2.6	2.6 (1)
Secchi (m)	0.8 - 0.8	0.8 (1)
Color (Pt-Co Units)	44 - 44	44 (1)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification	<b>Colored</b>	

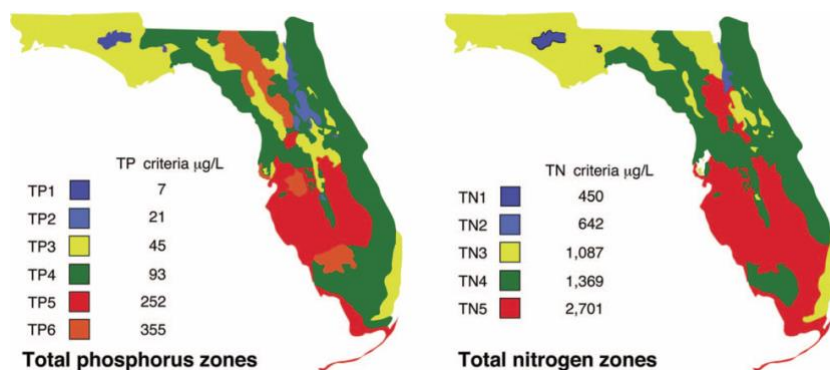
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Belle Aire South
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Period of Record (year)	2006 to 2006
Lake Trophic Status (CHL)	
TP Zone	
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>40 (40 to 40)</b>
TN Zone	
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>775 (775 to 775)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Belle Terre in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	22 - 48	<b>34 (8)</b>
Total Nitrogen (µg/L)	503 - 741	<b>608 (8)</b>
Chlorophyll- uncorrected (µg/L)	10 - 26	<b>16 (8)</b>
Secchi (ft)	2.4 - 4.5	3.2 (8)
Secchi (m)	0.7 - 1.4	1.0 (8)
Color (Pt-Co Units)	51 - 56	54 (2)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification	<b>Colored</b>	



## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Belle Terre
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2002
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>34 (22 to 48)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>608 (503 to 741)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

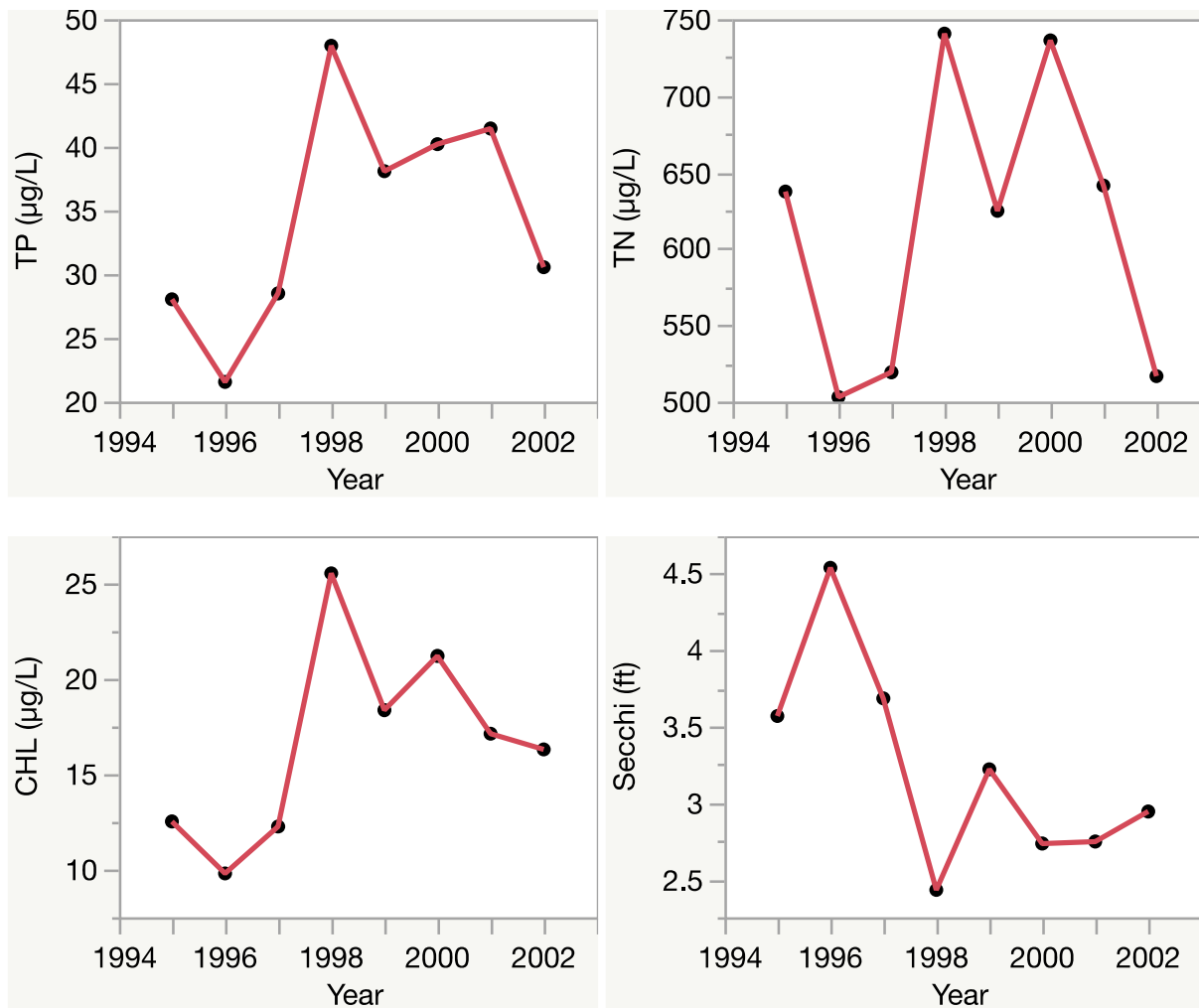
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Belle Terre trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.23$ ,  $p = 0.23$ ), total nitrogen (TN No Trend,  $R^2 = 0.01$ ,  $p = 0.78$ ), chlorophyll (CHL No Trend,  $R^2 = 0.22$ ,  $p = 0.24$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.44$ ,  $p = 0.07$ ).**



# Florida LAKEWATCH Report for Birchwood in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	42 - 42	<b>42 (1)</b>
Total Nitrogen (µg/L)	473 - 473	<b>473 (1)</b>
Chlorophyll- uncorrected (µg/L)	7 - 7	<b>7 (1)</b>
Secchi (ft)	5.2 - 5.2	5.2 (1)
Secchi (m)	1.6 - 1.6	1.6 (1)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Birchwood
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 1995
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>42 (42 to 42)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>473 (473 to 473)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Birchwood Basin in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).



**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	56 - 56	<b>56 (1)</b>
Total Nitrogen (µg/L)	566 - 566	<b>566 (1)</b>
Chlorophyll- uncorrected (µg/L)	9 - 9	<b>9 (1)</b>
Secchi (ft)	5.7 - 5.7	5.7 (1)
Secchi (m)	1.7 - 1.7	1.7 (1)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Birchwood Basin
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 1995
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>56 (56 to 56)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>566 (566 to 566)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Bird of Paradise in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	16 - 38	<b>27 (8)</b>
Total Nitrogen (µg/L)	441 - 694	<b>559 (8)</b>
Chlorophyll- uncorrected (µg/L)	5 - 19	<b>11 (8)</b>
Secchi (ft)	3.0 - 5.4	3.8 (8)
Secchi (m)	0.9 - 1.7	1.1 (8)
Color (Pt-Co Units)	47 - 51	49 (2)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Bird of Paradise
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2002
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>27 (16 to 38)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>559 (441 to 694)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

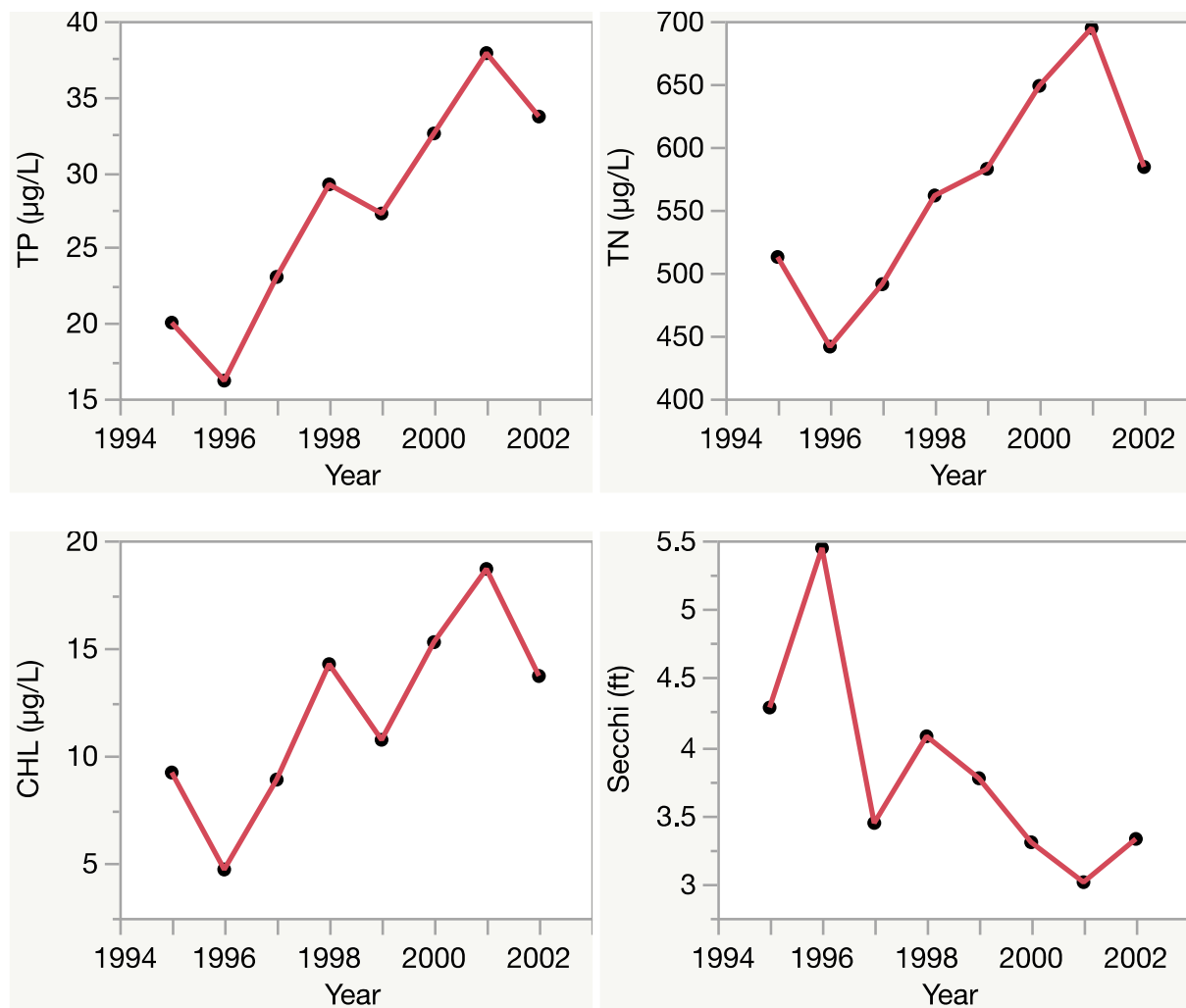
**Nutrient Zones and “Natural Background”**

Administrative code definitions 62-302.200 (19): “Natural background” shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above “Natural Background”.
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within “Natural Background”.
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Bird of Paradise trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.84$ ,  $p = 0.00$ ), total nitrogen (TN Increasing,  $R^2 = 0.63$ ,  $p = 0.02$ ), chlorophyll (CHL Increasing,  $R^2 = 0.60$ ,  $p = 0.02$ ) and Secchi depth (Secchi Decreasing,  $R^2 = 0.54$ ,  $p = 0.04$ ).**





# Florida LAKEWATCH Report for Birdway in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	15 - 25	<b>19 (2)</b>
Total Nitrogen (µg/L)	537 - 652	<b>592 (2)</b>
Chlorophyll- uncorrected (µg/L)	4 - 12	<b>7 (2)</b>
Secchi (ft)	2.4 - 4.6	3.3 (2)
Secchi (m)	0.7 - 1.4	1.0 (2)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Birdway
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1994 to 1995
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>19 (15 to 25)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>592 (537 to 652)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Brandon in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	7 - 24	<b>15 (11)</b>
Total Nitrogen (µg/L)	342 - 742	<b>487 (11)</b>
Chlorophyll- uncorrected (µg/L)	2 - 13	<b>5 (11)</b>
Secchi (ft)	3.9 - 6.6	5.4 (10)
Secchi (m)	1.2 - 2.0	1.6 (10)
Color (Pt-Co Units)	19 - 47	27 (6)
Specific Conductance (µS/cm@25 C)	74 - 76	75 (2)
Lake Classification	<b>Clear Softwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Brandon
GNIS Number	
Latitude	29.4408
Longitude	-81.2328
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2008
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>15 (7 to 24)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>487 (342 to 742)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

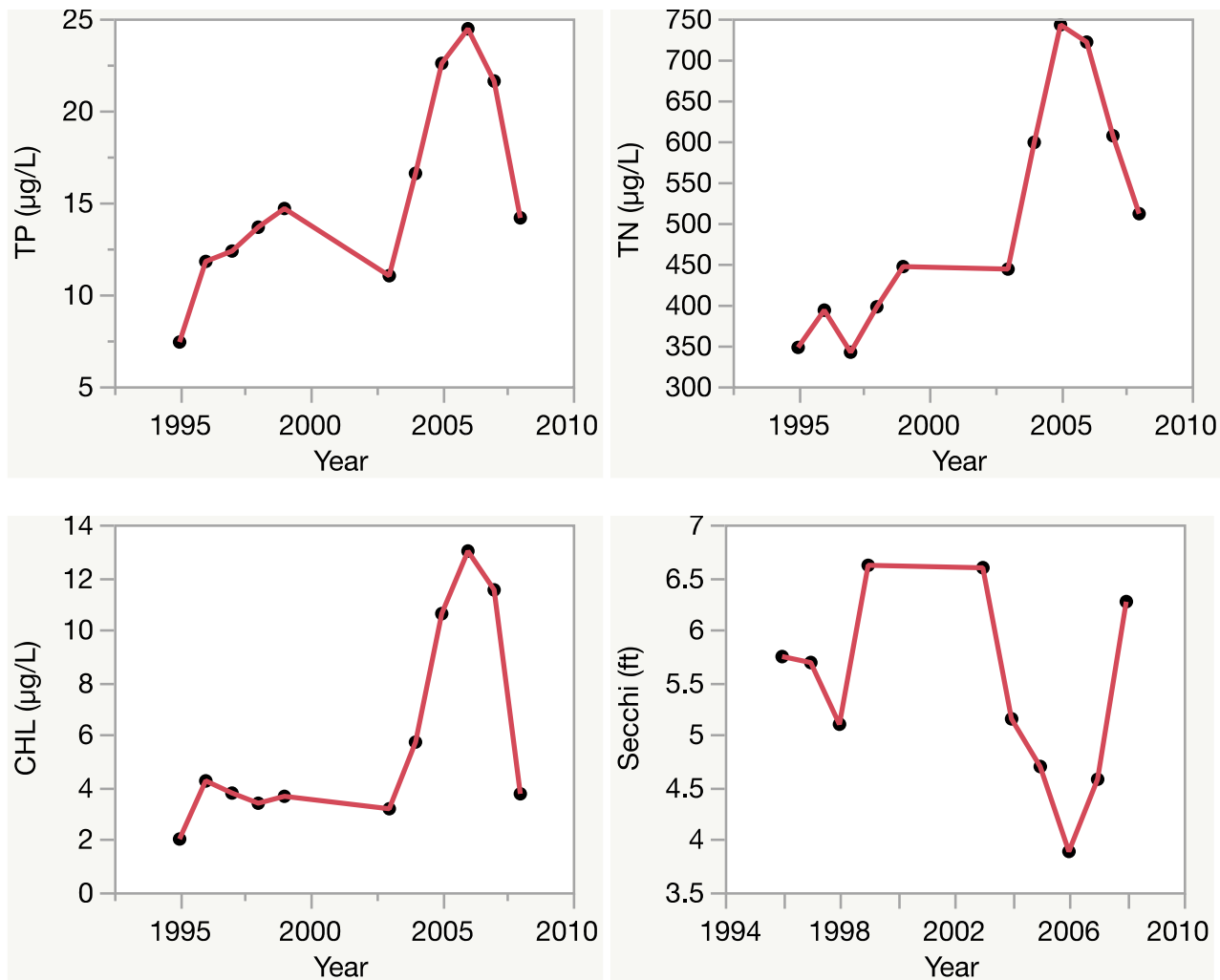
Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration



**Figure 2. Lake Brandon trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.52$ ,  $p = 0.01$ ), total nitrogen (TN Increasing,  $R^2 = 0.64$ ,  $p = 0.00$ ), chlorophyll (CHL Increasing,  $R^2 = 0.42$ ,  $p = 0.03$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.12$ ,  $p = 0.33$ ).**



# Florida LAKEWATCH Report for Brittany in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	27 - 53	<b>38 (2)</b>
Total Nitrogen (µg/L)	751 - 1249	<b>969 (2)</b>
Chlorophyll- uncorrected (µg/L)	4 - 18	<b>9 (2)</b>
Secchi (ft)	1.6 - 2.0	1.8 (2)
Secchi (m)	0.5 - 0.6	0.6 (2)
Color (Pt-Co Units)	17 - 54	30 (2)
Specific Conductance (µS/cm@25 C)	273 - 317	294 (2)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Brittany
GNIS Number	
Latitude	29.5571
Longitude	-81.2513
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2007 to 2008
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>38 (27 to 53)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>969 (751 to 1249)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Cheyenne Cove in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	50 - 100	<b>65 (18)</b>
Total Nitrogen (µg/L)	347 - 718	<b>459 (18)</b>
Chlorophyll- uncorrected (µg/L)	8 - 26	<b>13 (18)</b>
Secchi (ft)	2.8 - 4.5	3.5 (18)
Secchi (m)	0.9 - 1.4	1.1 (18)
Color (Pt-Co Units)	11 - 42	20 (18)
Specific Conductance (µS/cm@25 C)	33195 - 50649	41049 (16)
Lake Classification	<b>Clear Hardwater</b>	

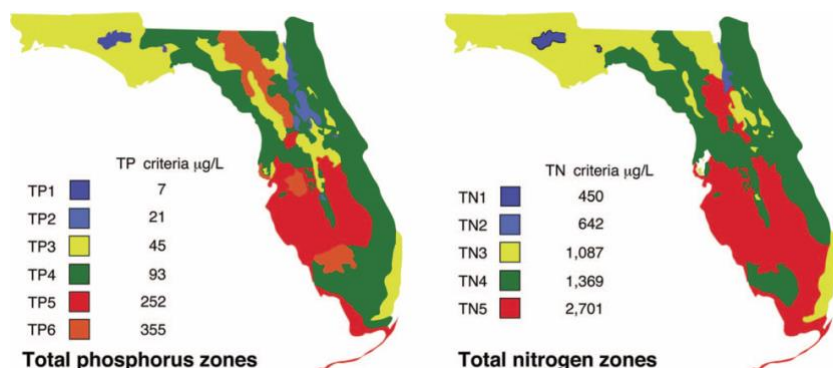
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Cheyenne Cove
GNIS Number	
Latitude	29.6003
Longitude	-81.2057
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2005 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>65 (50 to 100)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>459 (347 to 718)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**



**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

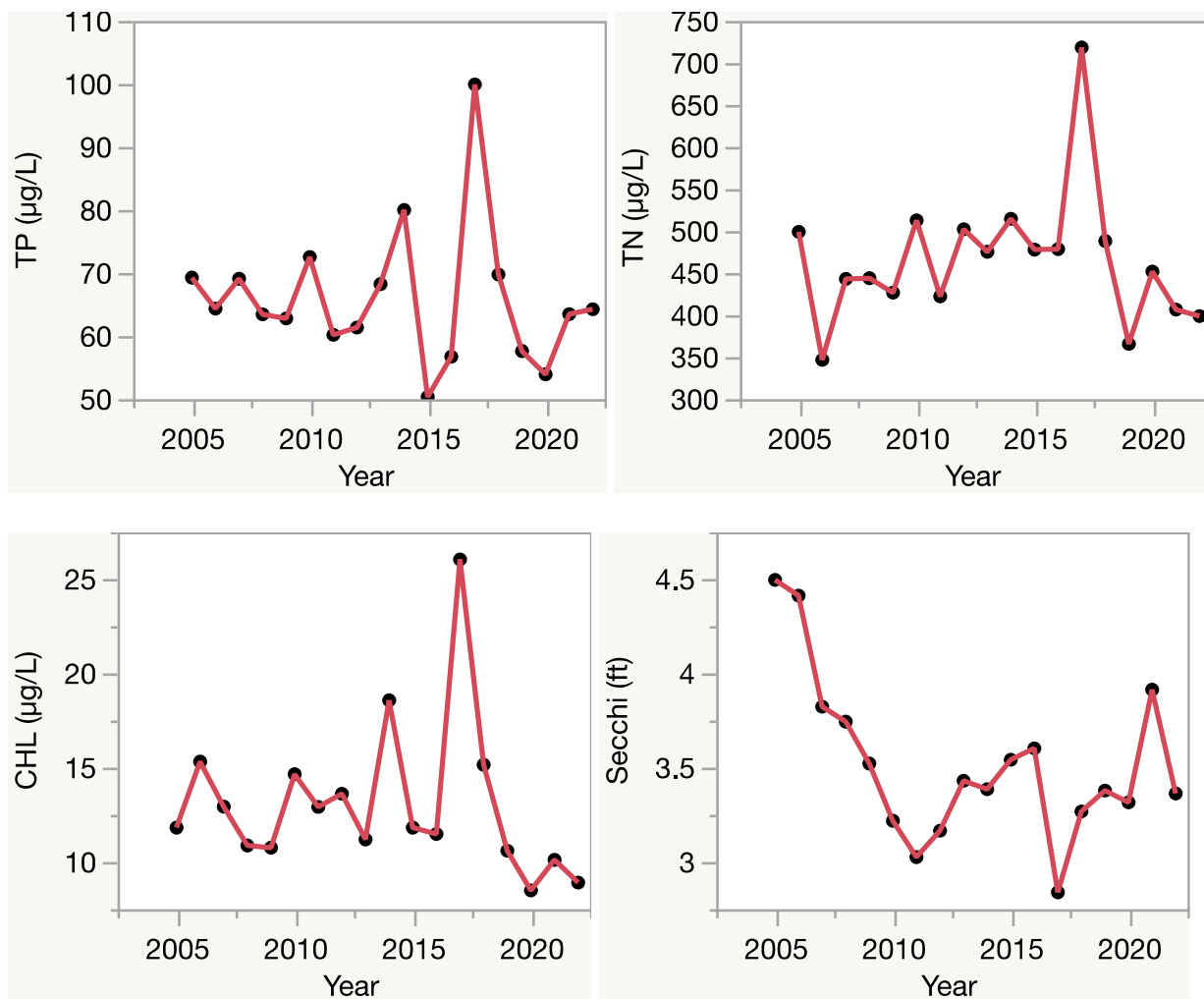
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Cheyenne Cove trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.01$ ,  $p = 0.78$ ), total nitrogen (TN No Trend,  $R^2 = 0.00$ ,  $p = 0.85$ ), chlorophyll (CHL No Trend,  $R^2 = 0.01$ ,  $p = 0.69$ ) and Secchi depth (Secchi Decreasing,  $R^2 = 0.24$ ,  $p = 0.04$ ).**



# Florida LAKEWATCH Report for Dead in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	153 - 226	<b>185 (4)</b>
Total Nitrogen (µg/L)	1704 - 1923	<b>1799 (4)</b>
Chlorophyll- uncorrected (µg/L)	8 - 27	<b>16 (4)</b>
Secchi (ft)	1.3 - 1.8	1.5 (4)
Secchi (m)	0.4 - 0.6	0.5 (4)
Color (Pt-Co Units)	99 - 266	146 (3)
Specific Conductance (µS/cm@25 C)	590 - 804	686 (3)
Lake Classification	<b>Colored</b>	

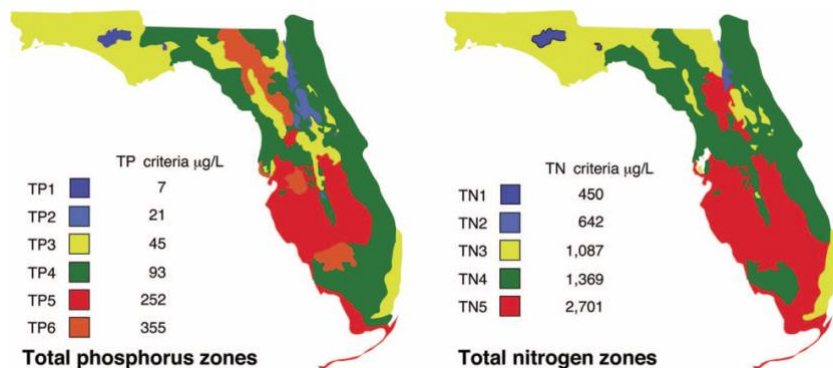
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Dead
GNIS Number	281379
Latitude	29.4084
Longitude	-81.4359
Water Body Type	Lake
Surface Area (ha and acre)	162 ha or 398 acre
Period of Record (year)	2007 to 2010
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>185 (153 to 226)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1799 (1704 to 1923)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
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3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
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**Nutrient Zones and "Natural Background"**

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**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
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  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Disston in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

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For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
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- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	22 - 46	<b>31 (31)</b>
Total Nitrogen (µg/L)	970 - 2308	<b>1305 (31)</b>
Chlorophyll- uncorrected (µg/L)	1 - 8	<b>3 (31)</b>
Secchi (ft)	0.9 - 2.0	1.3 (31)
Secchi (m)	0.3 - 0.6	0.4 (31)
Color (Pt-Co Units)	149 - 615	346 (21)
Specific Conductance (µS/cm@25 C)	72 - 360	108 (15)
Lake Classification	<b>Colored</b>	



## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Disston
GNIS Number	281592
Latitude	29.2828
Longitude	-81.3989
Water Body Type	Lake
Surface Area (ha and acre)	1060 ha or 2619 acre
Period of Record (year)	1992 to 2022
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>31 (22 to 46)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1305 (970 to 2308)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

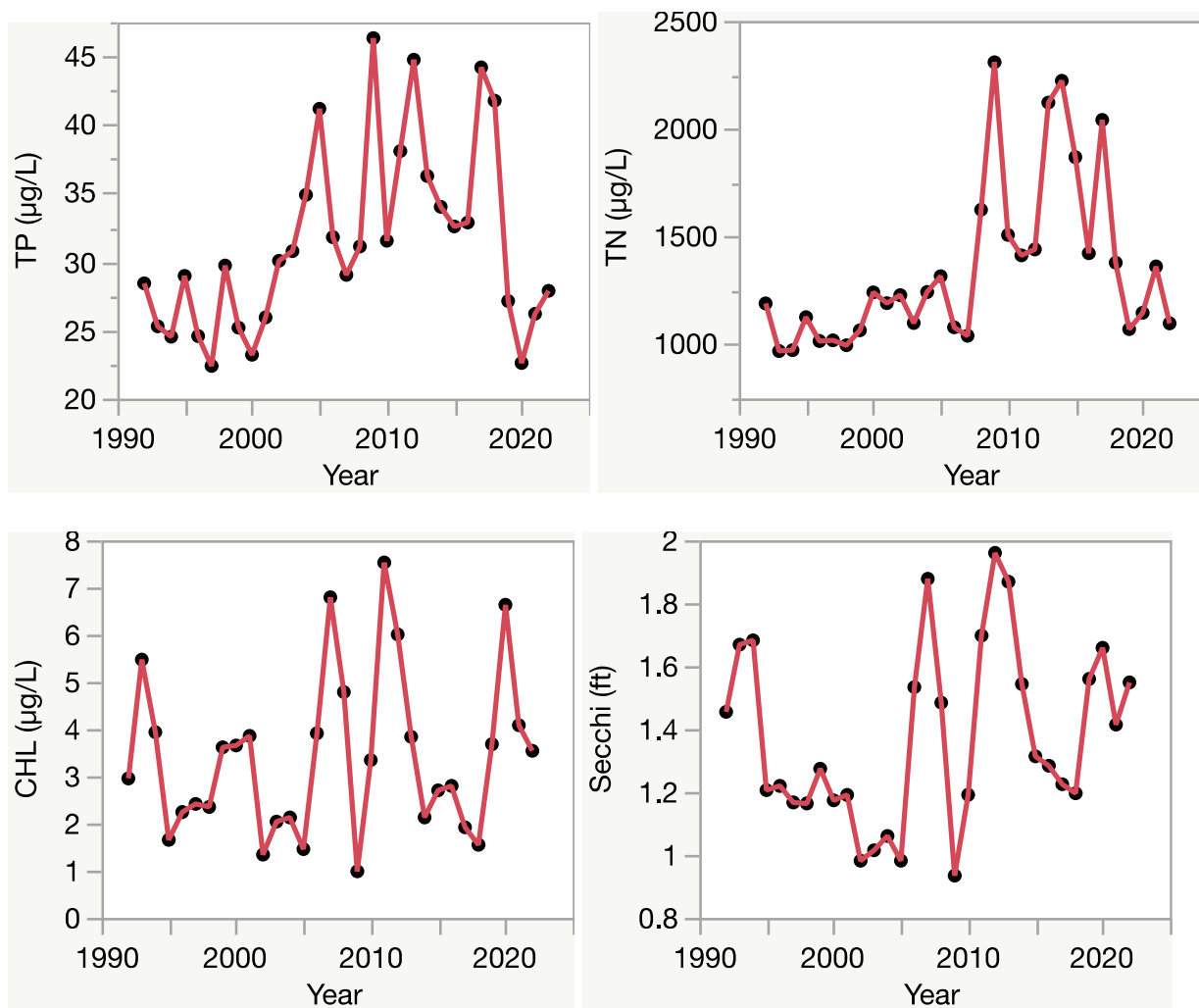
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Disston trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.14$ ,  $p = 0.04$ ), total nitrogen (TN Increasing,  $R^2 = 0.21$ ,  $p = 0.01$ ), chlorophyll (CHL No Trend,  $R^2 = 0.02$ ,  $p = 0.41$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.05$ ,  $p = 0.21$ ).**



# Florida LAKEWATCH Report for Emerald in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	49 - 94	<b>69 (11)</b>
Total Nitrogen (µg/L)	1143 - 2227	<b>1550 (11)</b>
Chlorophyll- uncorrected (µg/L)	47 - 87	<b>61 (11)</b>
Secchi (ft)	1.4 - 2.4	1.9 (11)
Secchi (m)	0.4 - 0.7	0.6 (11)
Color (Pt-Co Units)	21 - 33	27 (11)
Specific Conductance (µS/cm@25 C)	504 - 577	532 (11)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Emerald
GNIS Number	
Latitude	29.5207
Longitude	-81.1610
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2012 to 2022
Lake Trophic Status (CHL)	Hypereutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>69 (49 to 94)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1550 (1143 to 2227)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

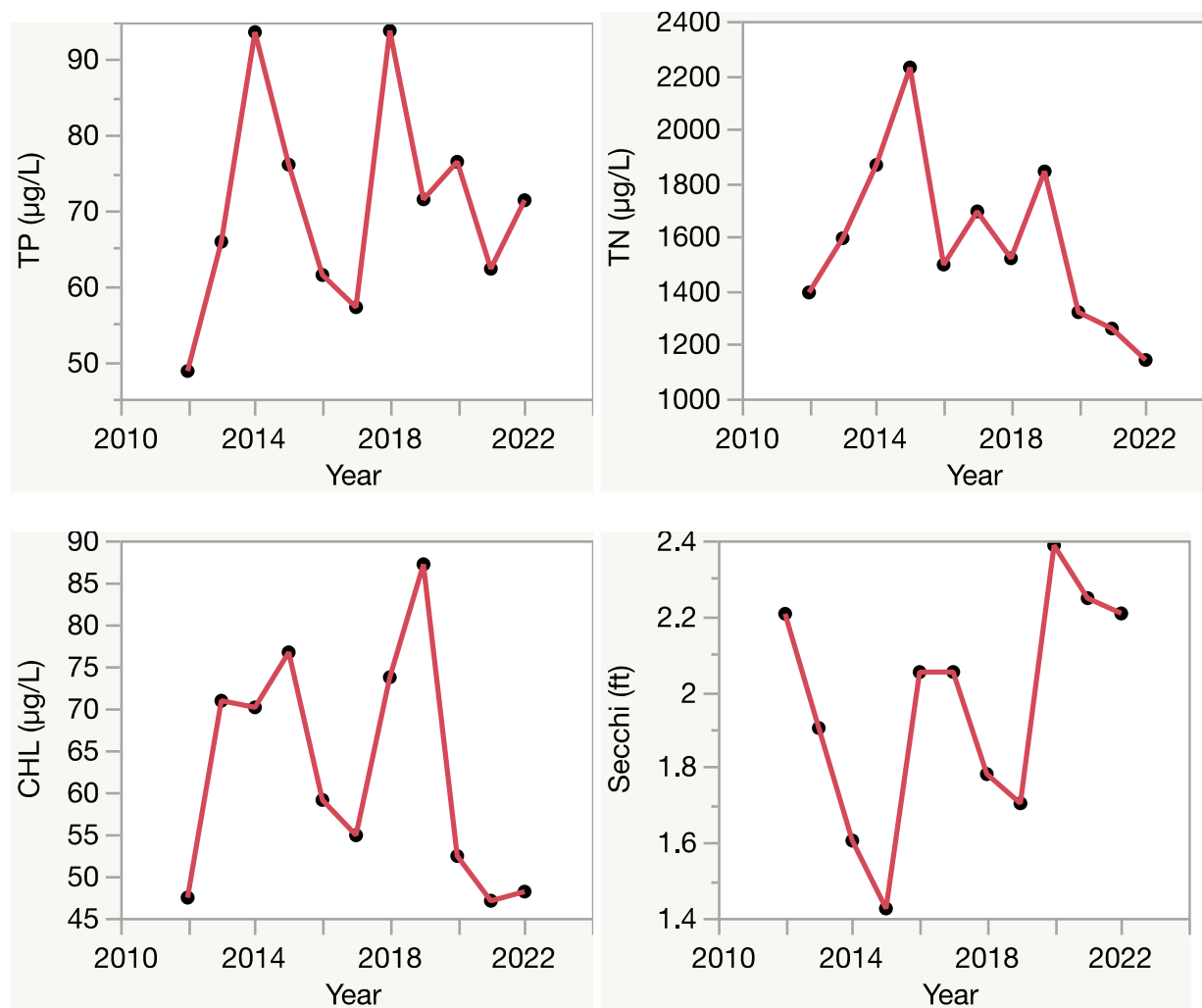
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Emerald trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.02$ ,  $p = 0.66$ ), total nitrogen (TN No Trend,  $R^2 = 0.23$ ,  $p = 0.14$ ), chlorophyll (CHL No Trend,  $R^2 = 0.06$ ,  $p = 0.48$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.16$ ,  $p = 0.22$ ).**





# Florida LAKEWATCH Report for Gore in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	10 - 13	<b>11 (3)</b>
Total Nitrogen (µg/L)	590 - 741	<b>652 (3)</b>
Chlorophyll- uncorrected (µg/L)	1 - 3	<b>2 (3)</b>
Secchi (ft)	2.3 - 2.5	2.4 (3)
Secchi (m)	0.7 - 0.8	0.7 (3)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Gore
GNIS Number	283227
Latitude	29.4625
Longitude	-81.2175
Water Body Type	Lake
Surface Area (ha and acre)	34 ha or 85 acre
Period of Record (year)	1994 to 1996
Lake Trophic Status (CHL)	Oligotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>11 (10 to 13)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>652 (590 to 741)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and “Natural Background”**

Administrative code definitions 62-302.200 (19): “Natural background” shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above “Natural Background”.
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within “Natural Background”.
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Grand Haven 1 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	44 - 45	<b>44 (3)</b>
Total Nitrogen (µg/L)	767 - 1147	<b>950 (3)</b>
Chlorophyll- uncorrected (µg/L)	13 - 30	<b>21 (3)</b>
Secchi (ft)	3.1 - 4.3	3.8 (3)
Secchi (m)	0.9 - 1.3	1.2 (3)
Color (Pt-Co Units)	13 - 32	19 (3)
Specific Conductance (µS/cm@25 C)	338 - 394	368 (3)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 1
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2008 to 2010
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>44 (44 to 45)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>950 (767 to 1147)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.



# Florida LAKEWATCH Report for Grand Haven 4 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
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- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
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<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	36 - 73	<b>56 (10)</b>
Total Nitrogen (µg/L)	923 - 1228	<b>1066 (10)</b>
Chlorophyll- uncorrected (µg/L)	6 - 32	<b>13 (10)</b>
Secchi (ft)	3.3 - 6.6	4.7 (10)
Secchi (m)	1.0 - 2.0	1.4 (10)
Color (Pt-Co Units)	36 - 58	46 (10)
Specific Conductance (µS/cm@25 C)	445 - 607	535 (10)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

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- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 4
GNIS Number	
Latitude	29.5488
Longitude	-81.1690
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2013 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>56 (36 to 73)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1066 (923 to 1228)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
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4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

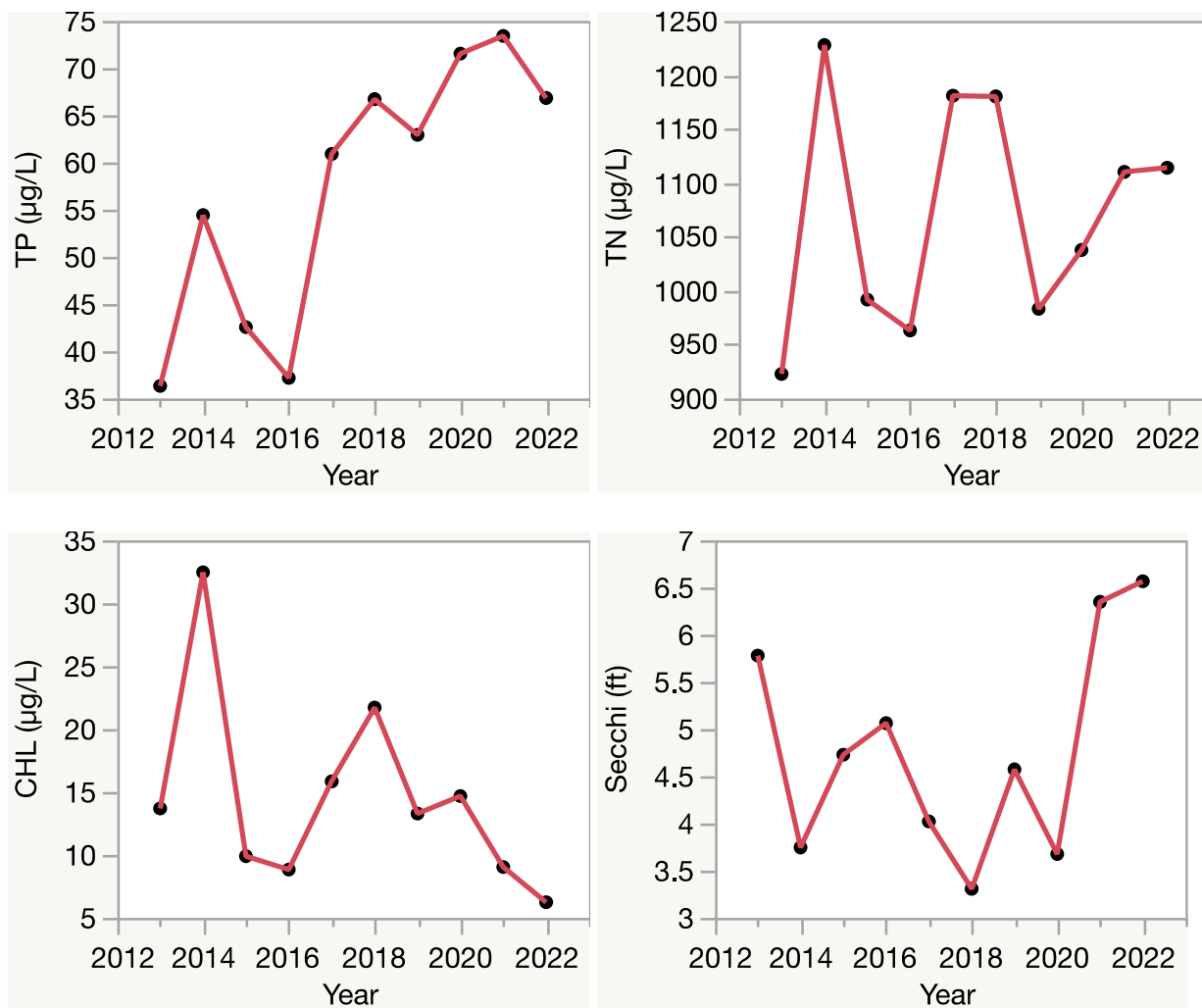
**Nutrient Zones and "Natural Background"**

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  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Grand Haven 4 trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.70$ ,  $p = 0.00$ ), total nitrogen (TN No Trend,  $R^2 = 0.04$ ,  $p = 0.57$ ), chlorophyll (CHL No Trend,  $R^2 = 0.20$ ,  $p = 0.19$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.08$ ,  $p = 0.42$ ).**



# Florida LAKEWATCH Report for Grand Haven 5 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

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- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

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- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	41 - 69	<b>57 (3)</b>
Total Nitrogen (µg/L)	1281 - 1485	<b>1395 (3)</b>
Chlorophyll- uncorrected (µg/L)	14 - 25	<b>19 (3)</b>
Secchi (ft)	3.7 - 4.2	4.0 (3)
Secchi (m)	1.1 - 1.3	1.2 (3)
Color (Pt-Co Units)	45 - 64	54 (3)
Specific Conductance (µS/cm@25 C)	492 - 581	537 (3)
Lake Classification	<b>Colored</b>	

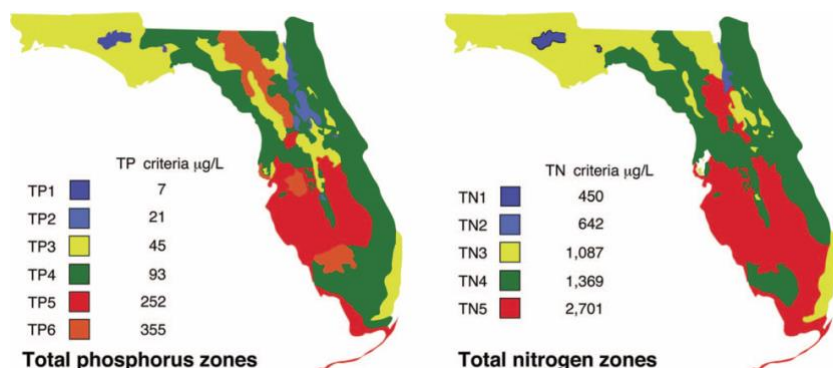
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

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- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 5
GNIS Number	
Latitude	29.5443
Longitude	-81.1669
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2008 to 2010
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>57 (41 to 69)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1395 (1281 to 1485)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**



**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Grand Haven 12 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	35 - 66	<b>45 (10)</b>
Total Nitrogen (µg/L)	656 - 1491	<b>968 (10)</b>
Chlorophyll- uncorrected (µg/L)	7 - 37	<b>17 (10)</b>
Secchi (ft)	1.5 - 4.1	2.7 (10)
Secchi (m)	0.5 - 1.3	0.8 (10)
Color (Pt-Co Units)	13 - 28	17 (10)
Specific Conductance (µS/cm@25 C)	255 - 405	321 (10)
Lake Classification	<b>Clear Hardwater</b>	

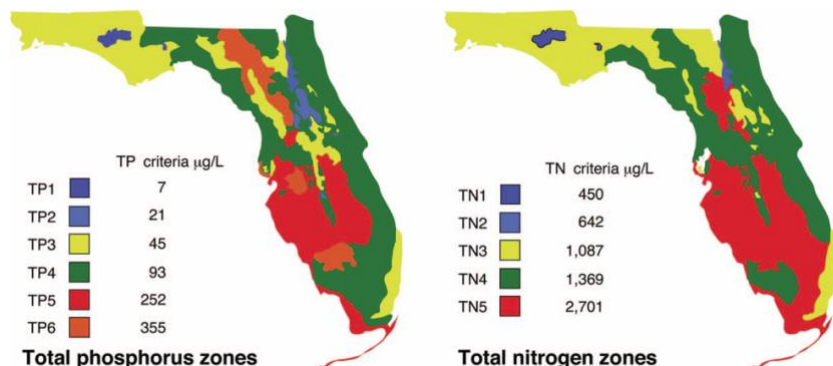
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 12
GNIS Number	
Latitude	29.5337
Longitude	-81.1617
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2013 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>45 (35 to 66)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>968 (656 to 1491)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

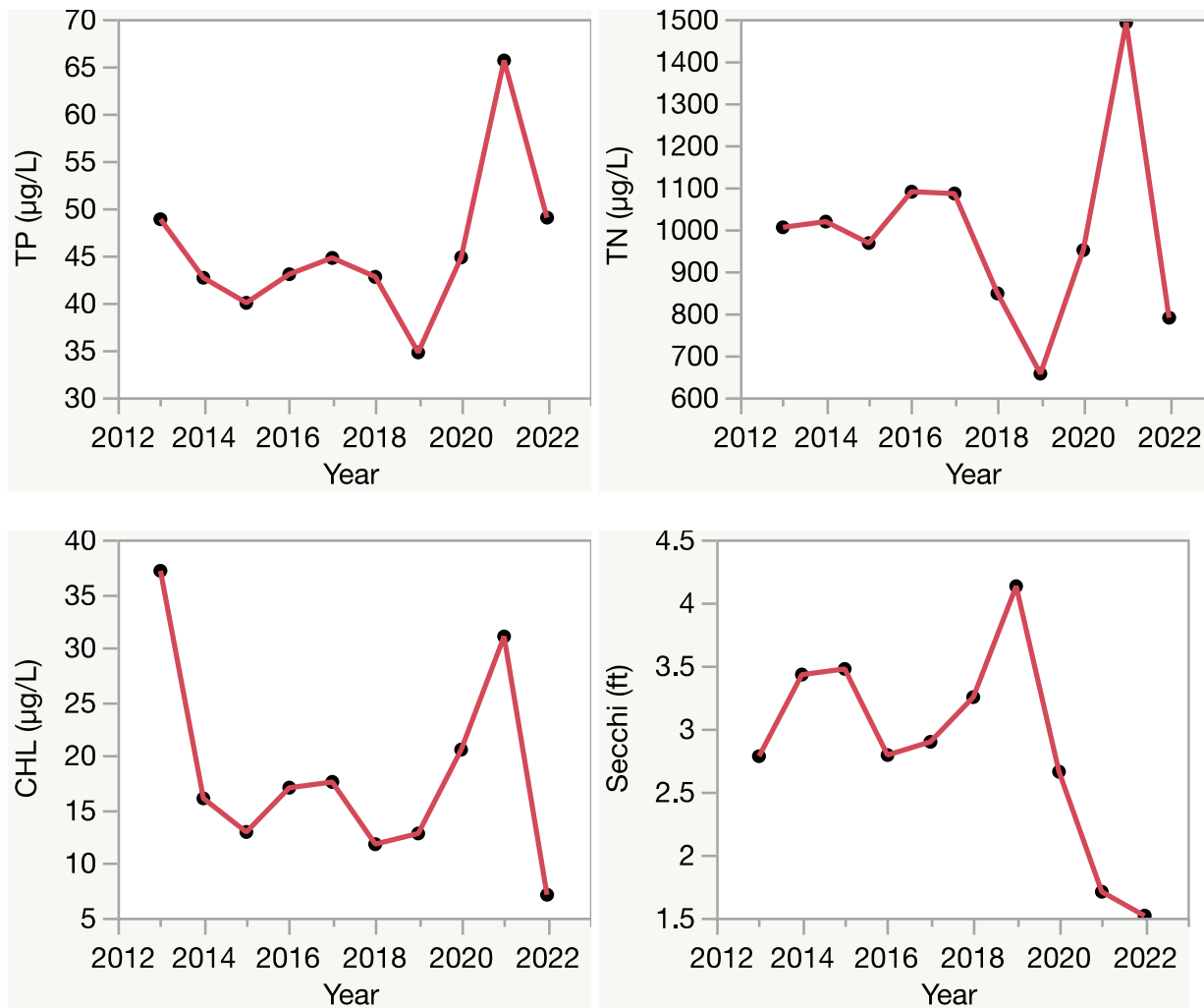
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Grand Haven 12 trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.13$ ,  $p = 0.31$ ), total nitrogen (TN No Trend,  $R^2 = 0.00$ ,  $p = 0.96$ ), chlorophyll (CHL No Trend,  $R^2 = 0.08$ ,  $p = 0.41$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.29$ ,  $p = 0.11$ ).**



# Florida LAKEWATCH Report for Grand Haven 13 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	40 - 102	<b>57 (10)</b>
Total Nitrogen (µg/L)	928 - 1744	<b>1246 (10)</b>
Chlorophyll- uncorrected (µg/L)	9 - 59	<b>23 (10)</b>
Secchi (ft)	1.1 - 4.0	2.2 (10)
Secchi (m)	0.3 - 1.2	0.7 (10)
Color (Pt-Co Units)	24 - 42	29 (10)
Specific Conductance (µS/cm@25 C)	329 - 471	386 (10)
Lake Classification	<b>Clear Hardwater</b>	



## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 13
GNIS Number	
Latitude	29.5326
Longitude	-81.1637
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2013 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>57 (40 to 102)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1246 (928 to 1744)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

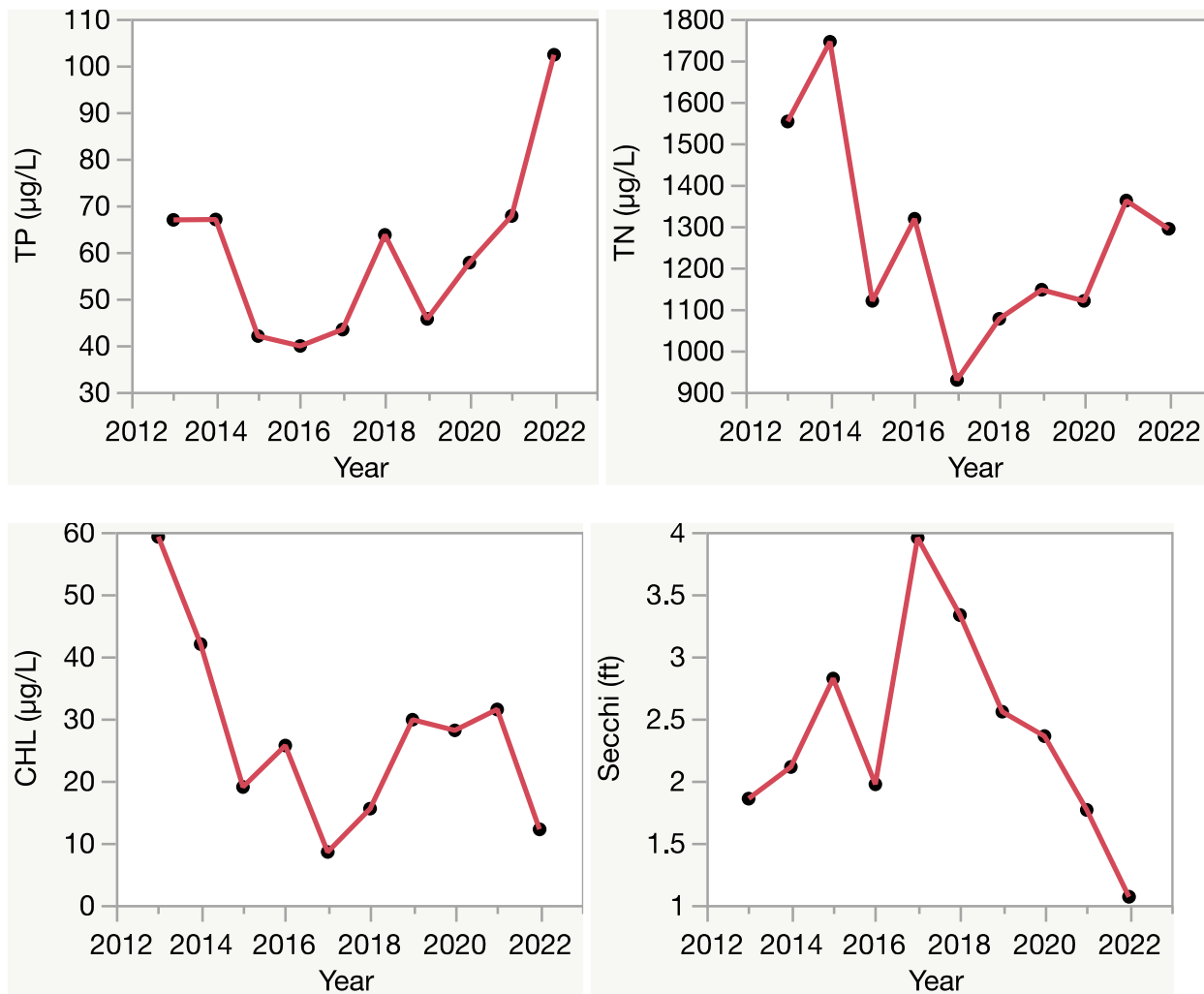
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Grand Haven 13 trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.19$ ,  $p = 0.21$ ), total nitrogen (TN No Trend,  $R^2 = 0.17$ ,  $p = 0.24$ ), chlorophyll (CHL No Trend,  $R^2 = 0.28$ ,  $p = 0.12$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.06$ ,  $p = 0.51$ ).**



# Florida LAKEWATCH Report for Grand Haven 18A in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	43 - 58	<b>50 (3)</b>
Total Nitrogen (µg/L)	742 - 1052	<b>864 (3)</b>
Chlorophyll- uncorrected (µg/L)	11 - 20	<b>14 (3)</b>
Secchi (ft)	2.8 - 4.2	3.7 (3)
Secchi (m)	0.9 - 1.3	1.1 (3)
Color (Pt-Co Units)	20 - 33	25 (3)
Specific Conductance (µS/cm@25 C)	339 - 415	374 (3)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 18A
GNIS Number	
Latitude	29.5236
Longitude	-81.1642
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2008 to 2010
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>50 (43 to 58)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>864 (742 to 1052)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Grand Haven 28 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).



**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	18 - 44	<b>31 (13)</b>
Total Nitrogen (µg/L)	506 - 976	<b>707 (13)</b>
Chlorophyll- uncorrected (µg/L)	4 - 19	<b>10 (13)</b>
Secchi (ft)	3.6 - 6.1	4.4 (13)
Secchi (m)	1.1 - 1.9	1.4 (13)
Color (Pt-Co Units)	19 - 51	28 (13)
Specific Conductance (µS/cm@25 C)	235 - 382	307 (13)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven 28
GNIS Number	
Latitude	29.5566
Longitude	-81.1734
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2008 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>31 (18 to 44)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>707 (506 to 976)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

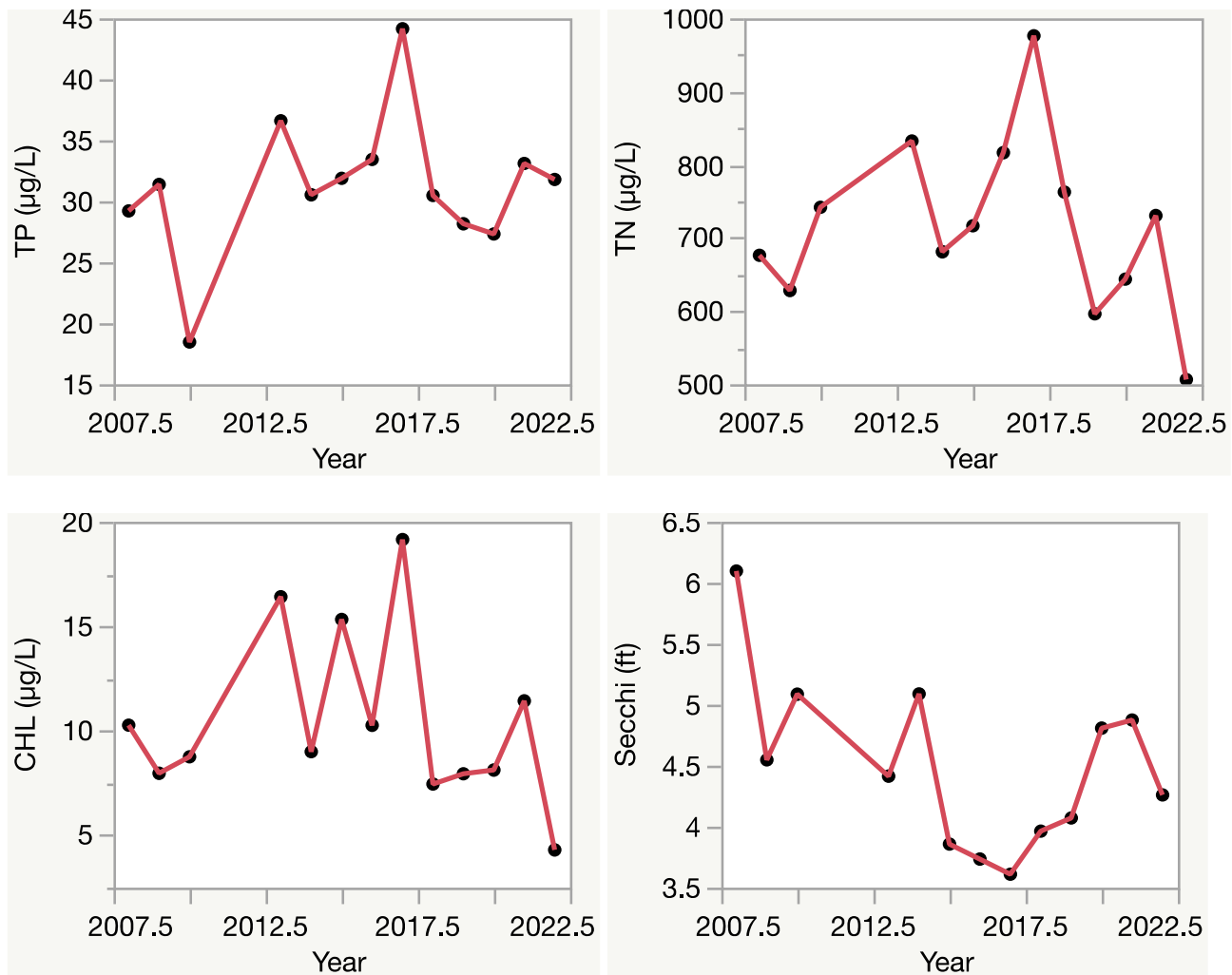
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Grand Haven 28 trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.06$ ,  $p = 0.43$ ), total nitrogen (TN No Trend,  $R^2 = 0.02$ ,  $p = 0.62$ ), chlorophyll (CHL No Trend,  $R^2 = 0.03$ ,  $p = 0.60$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.24$ ,  $p = 0.09$ ).**



# Florida LAKEWATCH Report for Grand Haven W6 in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	163 - 504	<b>252 (13)</b>
Total Nitrogen (µg/L)	715 - 1196	<b>905 (13)</b>
Chlorophyll- uncorrected (µg/L)	2 - 13	<b>7 (13)</b>
Secchi (ft)	3.1 - 5.4	4.0 (13)
Secchi (m)	1.0 - 1.6	1.2 (13)
Color (Pt-Co Units)	30 - 150	83 (13)
Specific Conductance (µS/cm@25 C)	381 - 2317	568 (13)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Grand Haven W6
GNIS Number	
Latitude	29.5471
Longitude	-81.1899
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2008 to 2022
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>252 (163 to 504)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>905 (715 to 1196)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

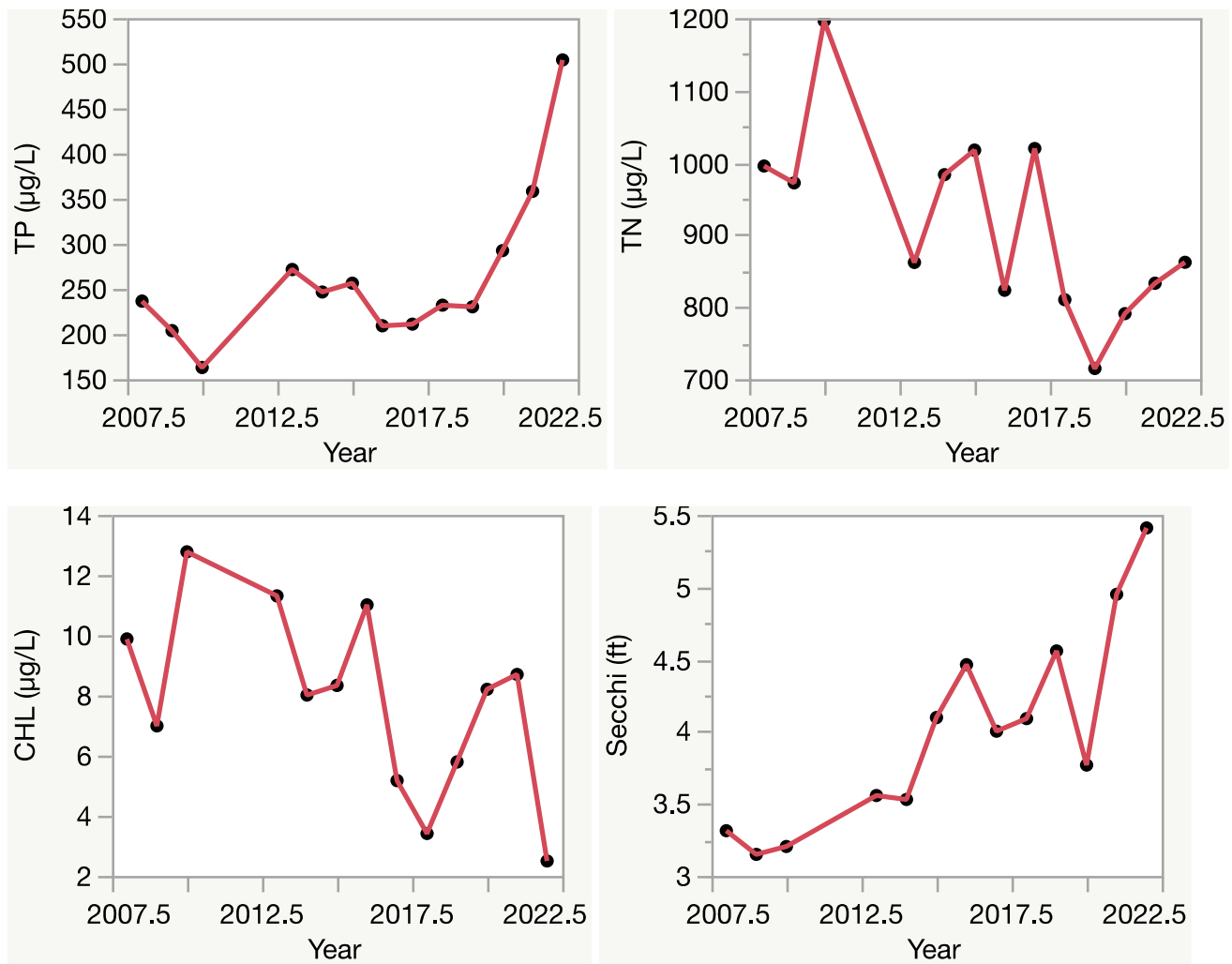
Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration



**Figure 2. Lake Grand Haven W6 trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.41$ ,  $p = 0.02$ ), total nitrogen (TN Decreasing,  $R^2 = 0.44$ ,  $p = 0.01$ ), chlorophyll (CHL Decreasing,  $R^2 = 0.32$ ,  $p = 0.04$ ) and Secchi depth (Secchi Increasing,  $R^2 = 0.74$ ,  $p = 0.00$ ).**



# Florida LAKEWATCH Report for Lakeside in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	15 - 24	<b>19 (2)</b>
Total Nitrogen (µg/L)	660 - 668	<b>664 (2)</b>
Chlorophyll- uncorrected (µg/L)	2 - 7	<b>4 (2)</b>
Secchi (ft)	5.0 - 5.3	5.1 (2)
Secchi (m)	1.5 - 1.6	1.6 (2)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Lakeside
GNIS Number	
Latitude	29.6523
Longitude	-81.2081
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1998 to 1999
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>19 (15 to 24)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>664 (660 to 668)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Medford in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	36 - 137	<b>62 (14)</b>
Total Nitrogen (µg/L)	1053 - 2334	<b>1528 (14)</b>
Chlorophyll- uncorrected (µg/L)	7 - 38	<b>17 (14)</b>
Secchi (ft)	1.4 - 3.3	2.3 (13)
Secchi (m)	0.4 - 1.0	0.7 (13)
Color (Pt-Co Units)	43 - 75	54 (12)
Specific Conductance (µS/cm@25 C)	330 - 534	440 (7)
Lake Classification	<b>Colored</b>	

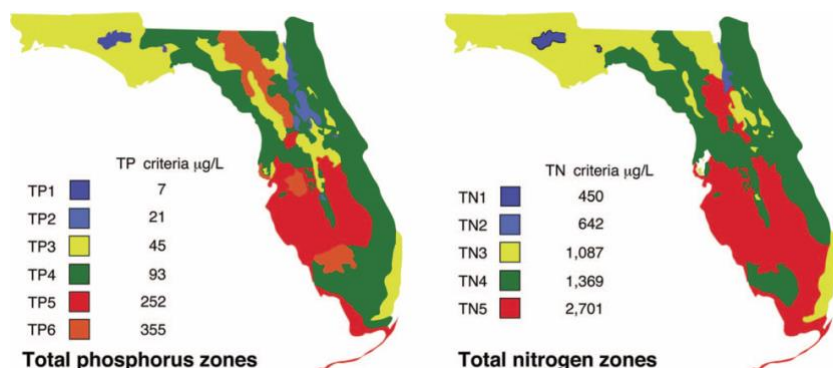
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Medford
GNIS Number	
Latitude	29.6243
Longitude	-81.1974
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2002 to 2017
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>62 (36 to 137)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1528 (1053 to 2334)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**



**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

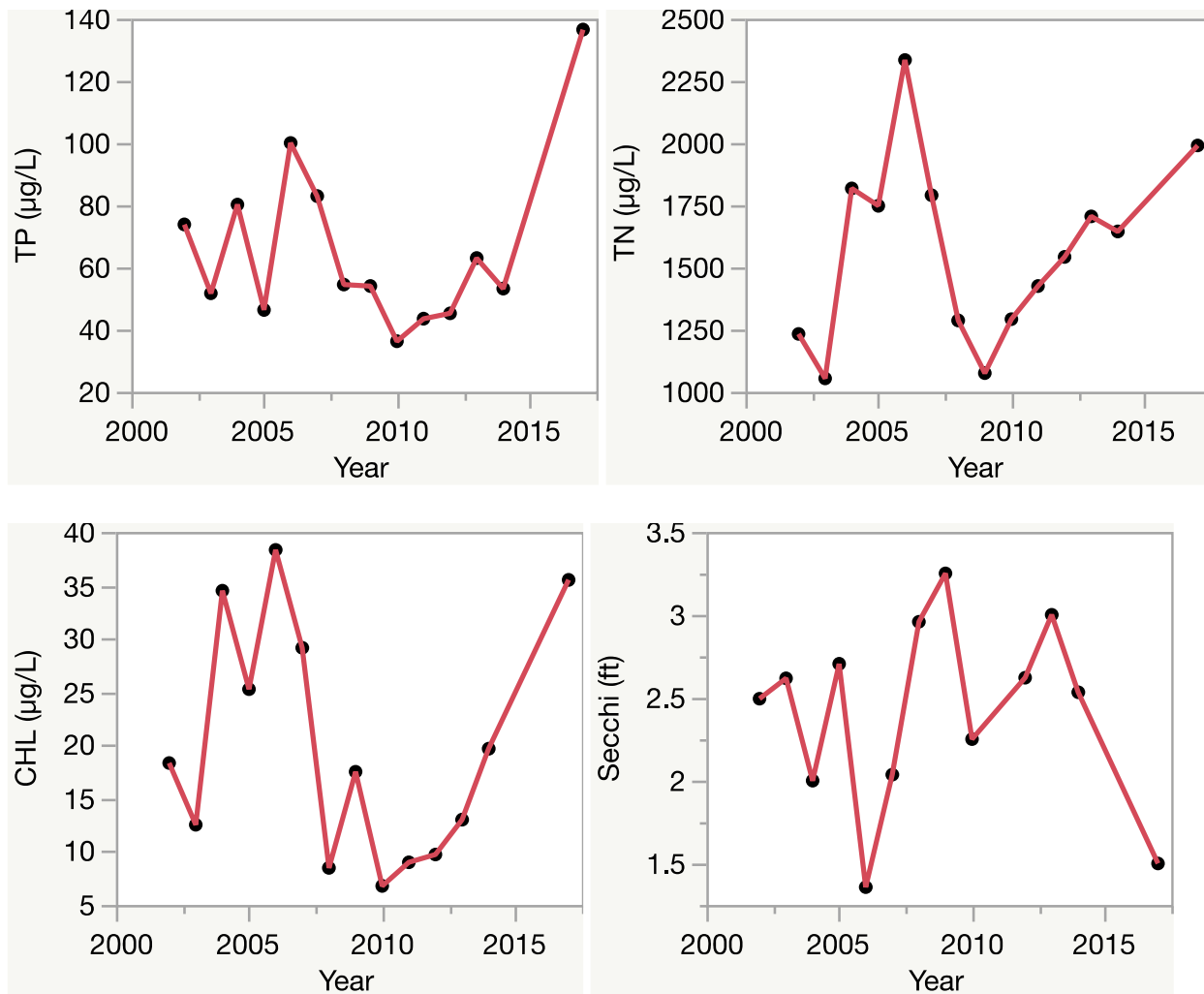
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Medford trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.03$ ,  $p = 0.56$ ), total nitrogen (TN No Trend,  $R^2 = 0.05$ ,  $p = 0.45$ ), chlorophyll (CHL No Trend,  $R^2 = 0.01$ ,  $p = 0.70$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.00$ ,  $p = 0.88$ ).**



# Florida LAKEWATCH Report for Nantucket in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	21 - 206	<b>40 (15)</b>
Total Nitrogen (µg/L)	821 - 2009	<b>1090 (15)</b>
Chlorophyll- uncorrected (µg/L)	3 - 83	<b>11 (15)</b>
Secchi (ft)	1.2 - 4.3	2.6 (12)
Secchi (m)	0.4 - 1.3	0.8 (12)
Color (Pt-Co Units)	19 - 35	25 (12)
Specific Conductance (µS/cm@25 C)	372 - 512	452 (7)
Lake Classification	<b>Clear Hardwater</b>	

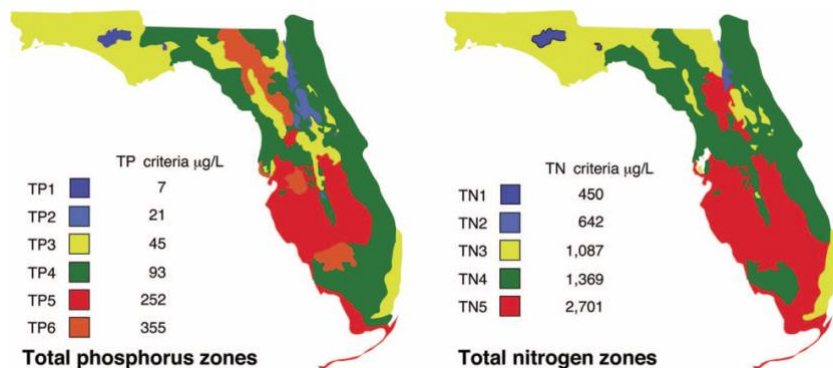
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Nantucket
GNIS Number	
Latitude	29.6253
Longitude	-81.1962
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2002 to 2018
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>40 (21 to 206)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>1090 (821 to 2009)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

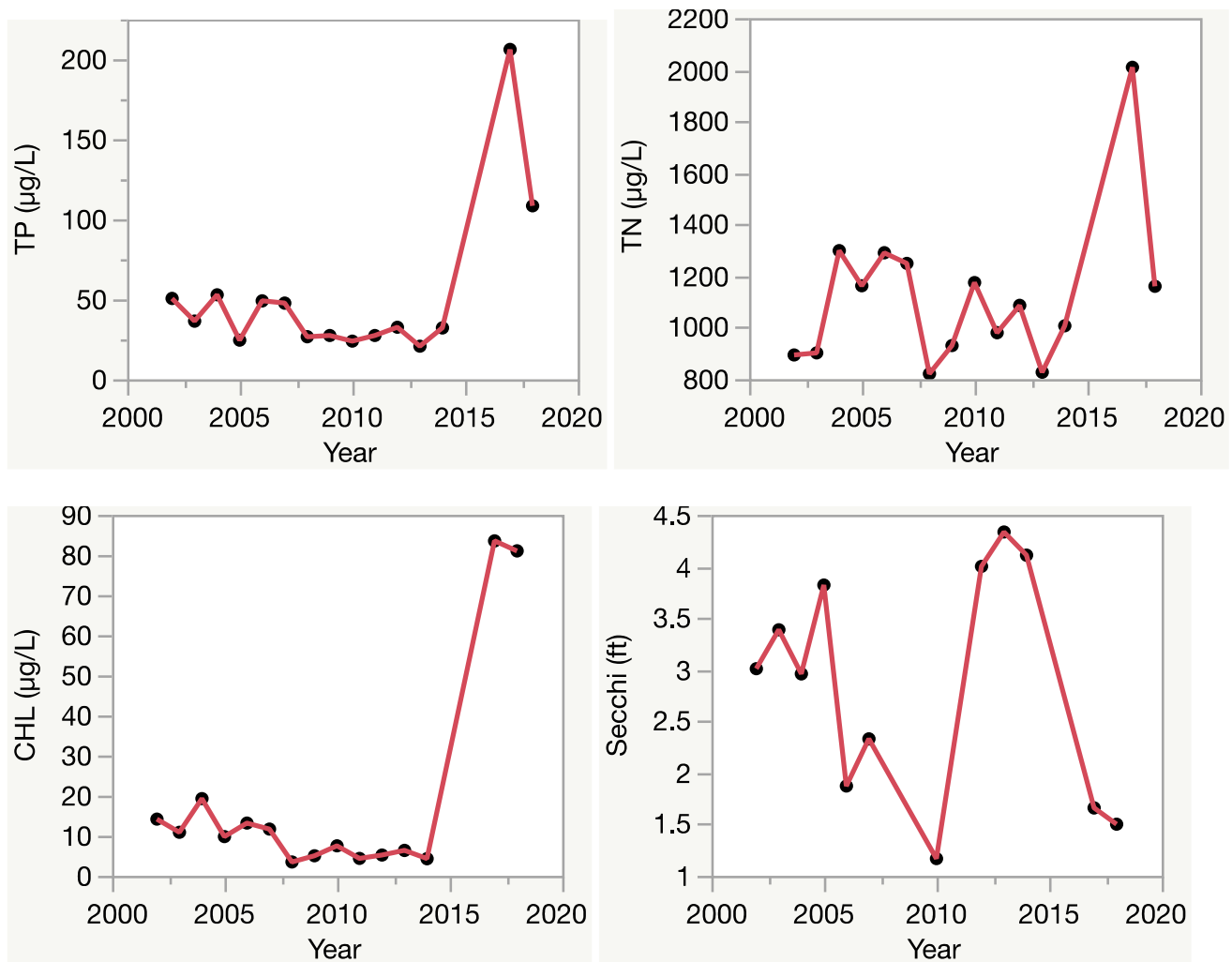
**Nutrient Zones and “Natural Background”**

Administrative code definitions 62-302.200 (19): “Natural background” shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above “Natural Background”.
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within “Natural Background”.
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Nantucket trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.24$ ,  $p = 0.06$ ), total nitrogen (TN No Trend,  $R^2 = 0.11$ ,  $p = 0.22$ ), chlorophyll (CHL Increasing,  $R^2 = 0.33$ ,  $p = 0.03$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.03$ ,  $p = 0.57$ ).**



# Florida LAKEWATCH Report for Parkview Stream in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).



**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	30 - 63	<b>42 (9)</b>
Total Nitrogen (µg/L)	693 - 1144	<b>891 (9)</b>
Chlorophyll- uncorrected (µg/L)	8 - 18	<b>10 (9)</b>
Secchi (ft)	1.3 - 3.7	2.0 (9)
Secchi (m)	0.4 - 1.1	0.6 (9)
Color (Pt-Co Units)	93 - 236	172 (3)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Parkview Stream
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2003
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>42 (30 to 63)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>891 (693 to 1144)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

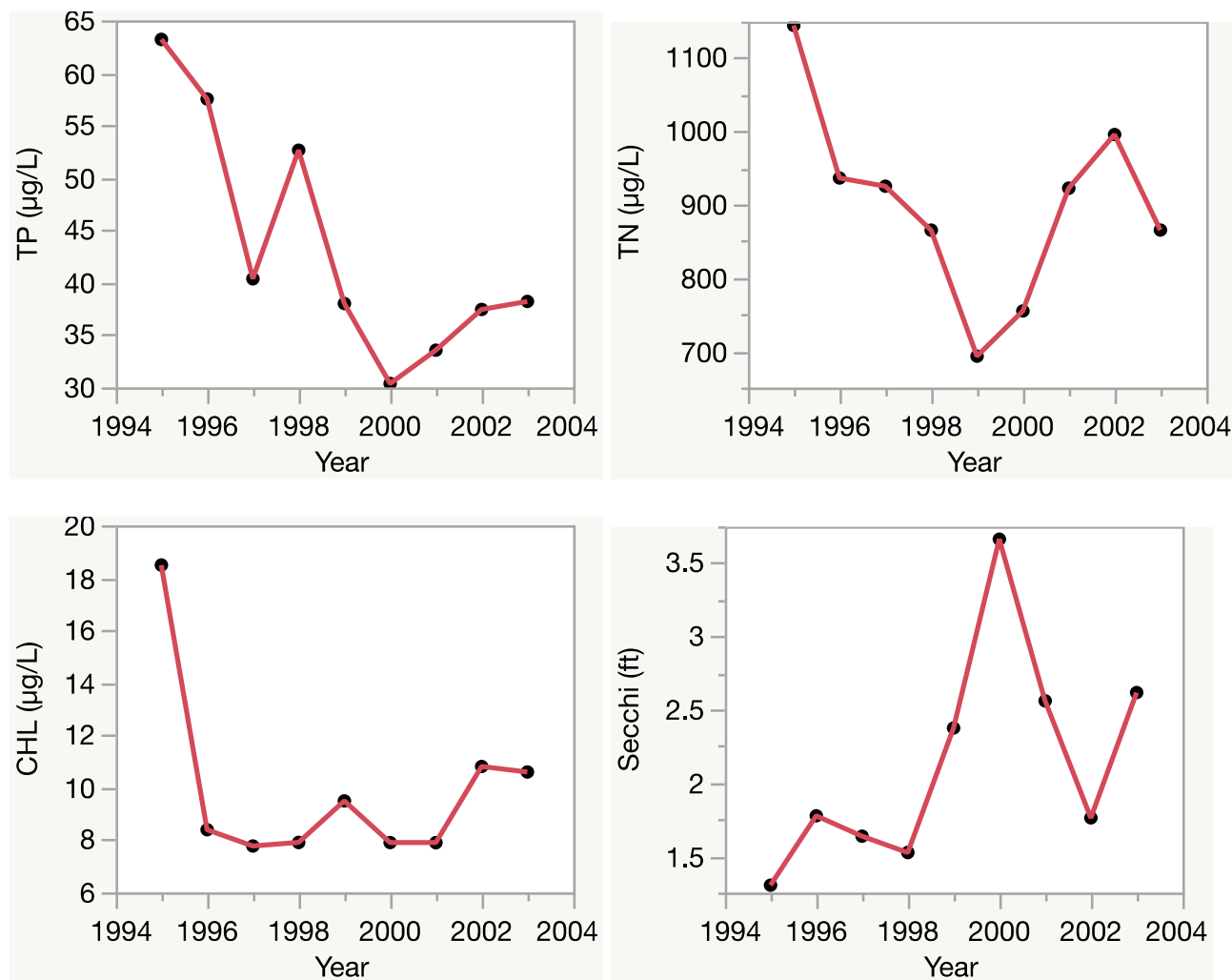
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Parkview Stream trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Decreasing,  $R^2 = 0.61$ ,  $p = 0.01$ ), total nitrogen (TN No Trend,  $R^2 = 0.13$ ,  $p = 0.33$ ), chlorophyll (CHL No Trend,  $R^2 = 0.10$ ,  $p = 0.40$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.32$ ,  $p = 0.11$ ).**



# Florida LAKEWATCH Report for Pine Grove in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	78 - 172	<b>126 (8)</b>
Total Nitrogen (µg/L)	637 - 1217	<b>915 (8)</b>
Chlorophyll- uncorrected (µg/L)	6 - 30	<b>11 (8)</b>
Secchi (ft)	2.4 - 4.4	3.6 (7)
Secchi (m)	0.7 - 1.4	1.1 (7)
Color (Pt-Co Units)	33 - 86	53 (7)
Specific Conductance (µS/cm@25 C)	320 - 350	331 (3)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Pine Grove
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2000 to 2009
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>126 (78 to 172)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>915 (637 to 1217)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

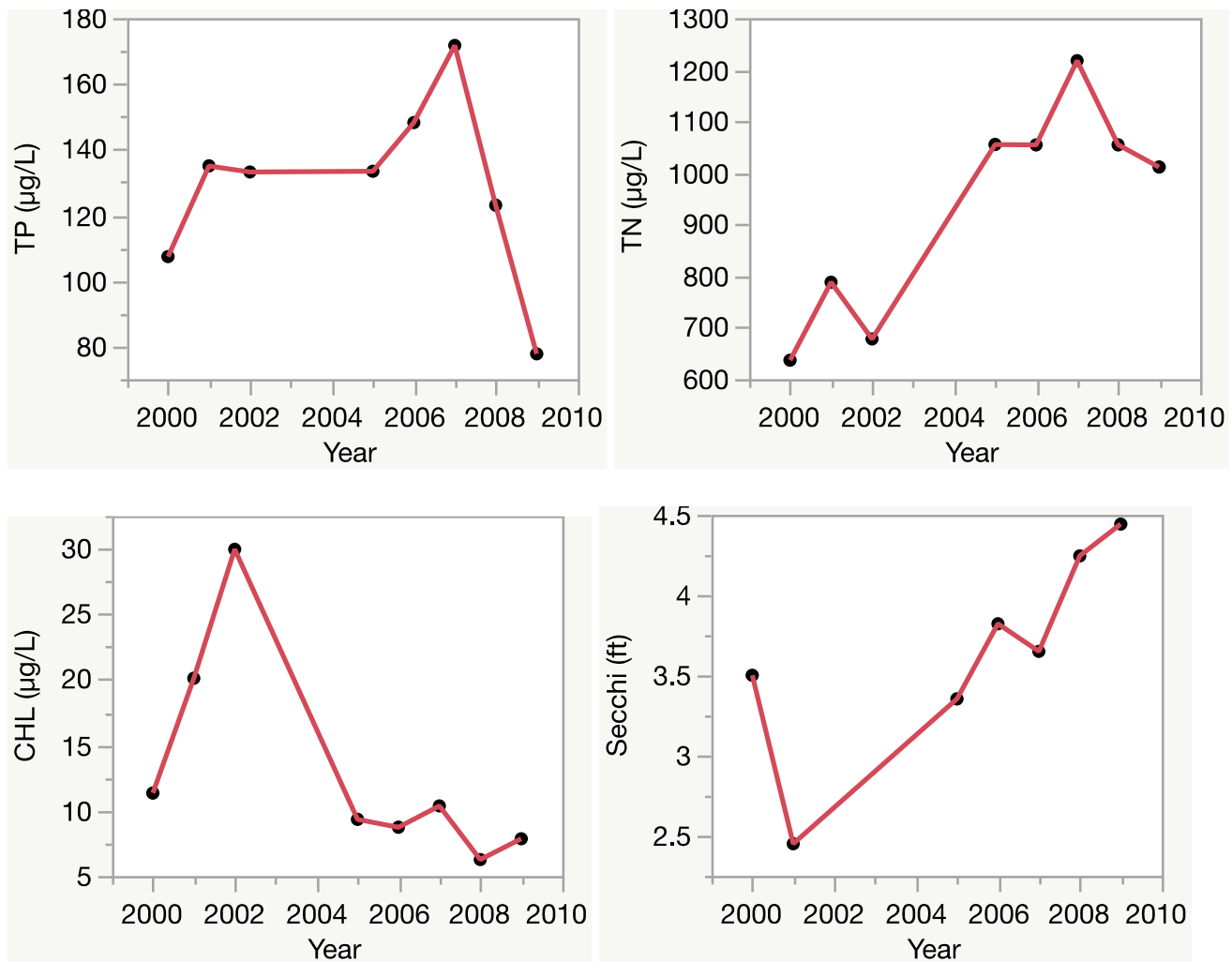
Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration



**Figure 2. Lake Pine Grove trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.01$ ,  $p = 0.87$ ), total nitrogen (TN Increasing,  $R^2 = 0.73$ ,  $p = 0.01$ ), chlorophyll (CHL No Trend,  $R^2 = 0.41$ ,  $p = 0.09$ ) and Secchi depth (Secchi Increasing,  $R^2 = 0.63$ ,  $p = 0.03$ ).**



# Florida LAKEWATCH Report for Ribbon North in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	11 - 23	<b>17 (20)</b>
Total Nitrogen (µg/L)	463 - 699	<b>600 (20)</b>
Chlorophyll- uncorrected (µg/L)	3 - 12	<b>6 (20)</b>
Secchi (ft)	4.2 - 8.1	5.5 (19)
Secchi (m)	1.3 - 2.5	1.7 (19)
Color (Pt-Co Units)	22 - 47	37 (12)
Specific Conductance (µS/cm@25 C)	228 - 325	260 (6)
Lake Classification	<b>Clear Hardwater</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Ribbon North
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1993 to 2012
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>17 (11 to 23)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>600 (463 to 699)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

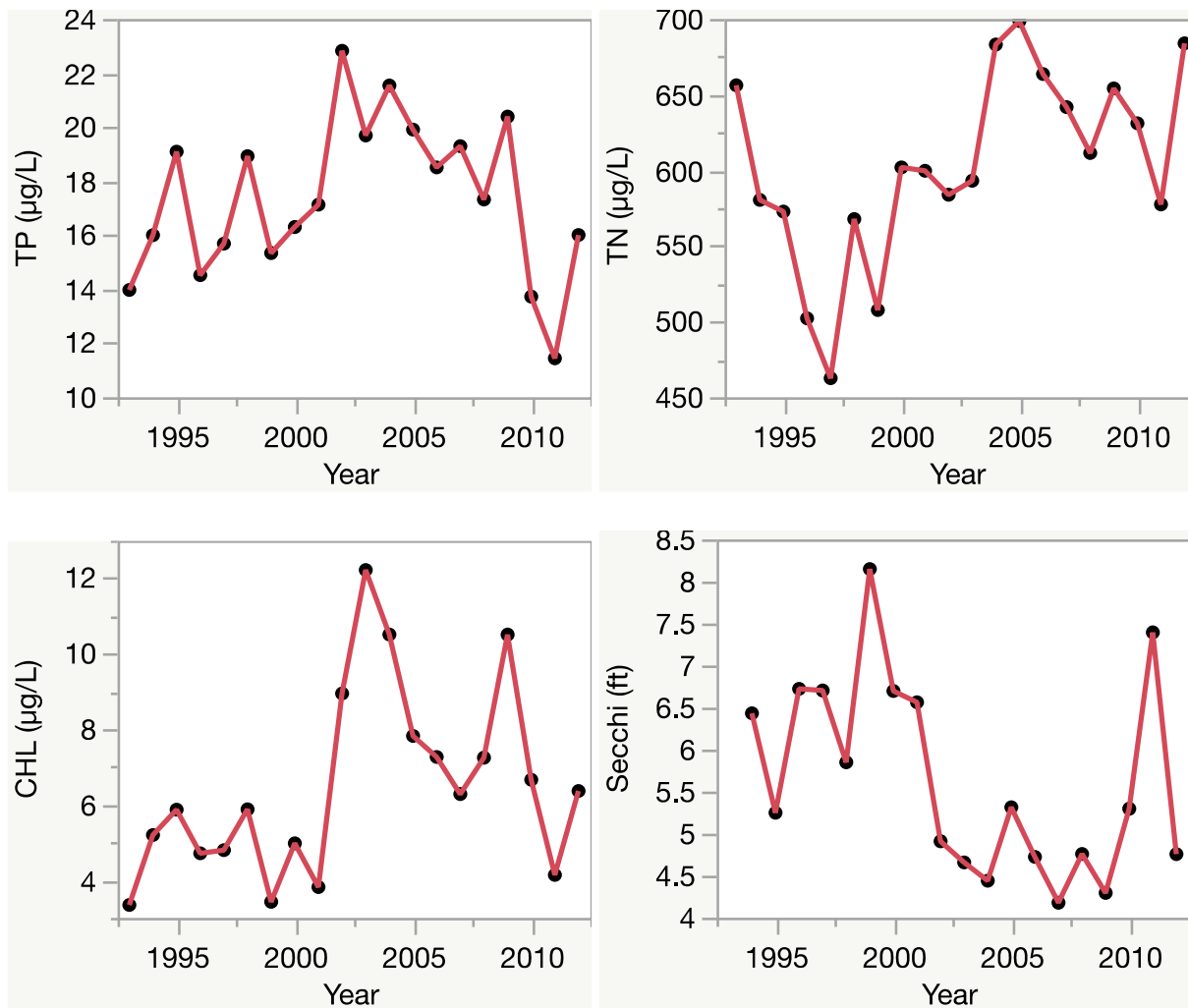
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Ribbon North trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.00$ ,  $p = 0.85$ ), total nitrogen (TN Increasing,  $R^2 = 0.27$ ,  $p = 0.02$ ), chlorophyll (CHL No Trend,  $R^2 = 0.16$ ,  $p = 0.08$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.20$ ,  $p = 0.05$ ).**



# Florida LAKEWATCH Report for Rippling in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	29 - 32	<b>30 (2)</b>
Total Nitrogen (µg/L)	700 - 882	<b>786 (2)</b>
Chlorophyll- uncorrected (µg/L)	5 - 8	<b>7 (2)</b>
Secchi (ft)	1.7 - 2.0	1.9 (2)
Secchi (m)	0.5 - 0.6	0.6 (2)
Color (Pt-Co Units)	-	(0)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		



## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Rippling
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 1996
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>30 (29 to 32)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>786 (700 to 882)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Rodgers in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	9 - 10	<b>9 (4)</b>
Total Nitrogen (µg/L)	467 - 563	<b>522 (4)</b>
Chlorophyll- uncorrected (µg/L)	2 - 5	<b>3 (4)</b>
Secchi (ft)	4.4 - 5.1	4.9 (4)
Secchi (m)	1.4 - 1.6	1.5 (4)
Color (Pt-Co Units)	33 - 33	33 (1)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

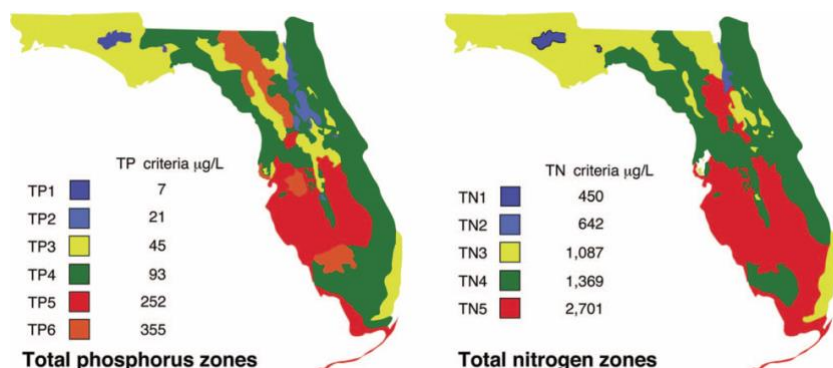
## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Rodgers
GNIS Number	
Latitude	29.4406
Longitude	-81.2314
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1998 to 2001
Lake Trophic Status (CHL)	Oligotrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>9 (9 to 10)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>522 (467 to 563)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Sea Vista in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	25 - 200	<b>53 (14)</b>
Total Nitrogen (µg/L)	920 - 2975	<b>1400 (14)</b>
Chlorophyll- uncorrected (µg/L)	4 - 73	<b>14 (14)</b>
Secchi (ft)	1.0 - 2.7	2.1 (13)
Secchi (m)	0.3 - 0.8	0.6 (13)
Color (Pt-Co Units)	54 - 89	65 (12)
Specific Conductance (µS/cm@25 C)	446 - 644	534 (7)
Lake Classification	<b>Colored</b>	



## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration (µg/L: min and max):** Grand Geometric Means of all annual geometric means (µg/L) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Sea Vista
GNIS Number	
Latitude	29.6248
Longitude	-81.1959
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2002 to 2017
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration (µg/L, min. and max.)	<b>53 (25 to 200)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration (µg/L, min. and max.)	<b>1400 (920 to 2975)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

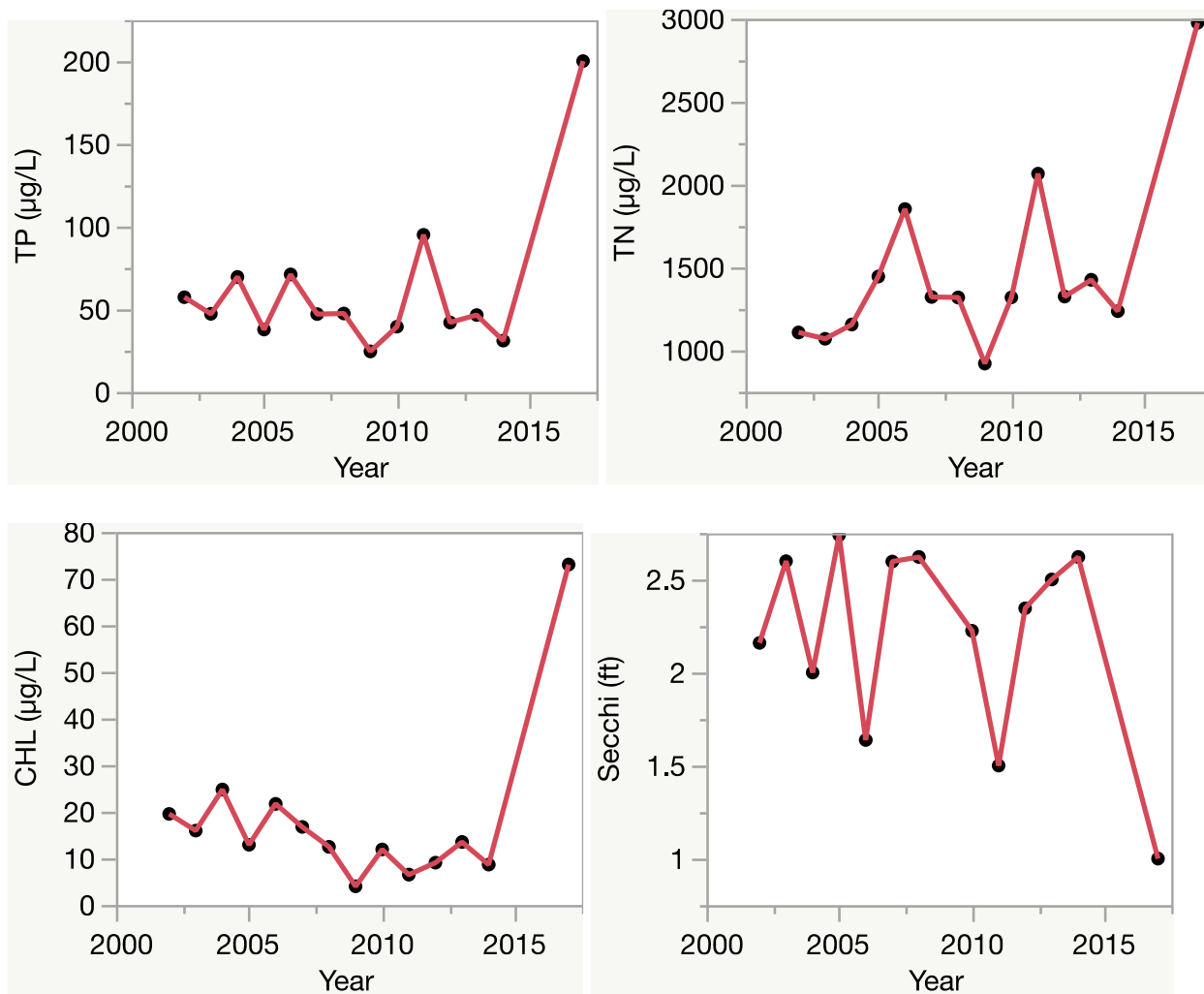
**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Sea Vista trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP No Trend,  $R^2 = 0.18$ ,  $p = 0.14$ ), total nitrogen (TN Increasing,  $R^2 = 0.32$ ,  $p = 0.04$ ), chlorophyll (CHL No Trend,  $R^2 = 0.10$ ,  $p = 0.28$ ) and Secchi depth (Secchi No Trend,  $R^2 = 0.12$ ,  $p = 0.25$ ).**



# Florida LAKEWATCH Report for Walker West in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).

**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	33 - 41	<b>37 (2)</b>
Total Nitrogen (µg/L)	528 - 696	<b>606 (2)</b>
Chlorophyll- uncorrected (µg/L)	8 - 11	<b>10 (2)</b>
Secchi (ft)	4.3 - 4.7	4.5 (2)
Secchi (m)	1.3 - 1.4	1.4 (2)
Color (Pt-Co Units)	22 - 33	27 (2)
Specific Conductance (µS/cm@25 C)	-	(0)
Lake Classification		

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Walker West
GNIS Number	
Latitude	29.5329
Longitude	-81.2159
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	2003 to 2004
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>37 (33 to 41)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>606 (528 to 696)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration.

# Florida LAKEWATCH Report for Wynnfield in Flagler County Using Data Downloaded 12/9/2022

## Introduction for Lakes

This report summarizes data collected on systems that have been part of the LAKEWATCH program. Data are from the period of record for individual systems. Part one allows the comparison of data with Florida Department of Environmental Protection's Numeric Nutrient Criteria. Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; <https://lakewatch.ifas.ufl.edu/resources/bibliography/>). Finally, this report examines data for long-term trends that may be occurring in individual systems but only for systems with **five or more years of data**. Step by step instructions on how to use the data tables are provided on page 4 of this report.

## Florida Department of Environmental Protection (FDEP) Nutrient Criteria for Lakes (Table 1)

For lakes, the numeric interpretations of the nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., based on chlorophyll are shown in Table 1. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability and concentration of chlorophyll data for the lake. The numeric interpretations for TN, TP, and chlorophyll shall not be exceeded more than once in any consecutive three year period.

- a. If annual geometric mean chlorophyll does not exceed the chlorophyll value for one of three lake classification groups listed in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of the maximum calculated numeric interpretation in Table 1.
- b. If there are insufficient data to calculate the annual geometric mean chlorophyll for a given year or the annual geometric mean chlorophyll exceeds the values in Table 1 for the correct lake classification group, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1.

## Long-Term Data Summary for Lakes (Table 2): Definitions

- **Total Phosphorus ( $\mu\text{g/L}$ ):** Nutrient most often limiting growth of plant/algae.
- **Total Nitrogen ( $\mu\text{g/L}$ ):** Nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10 (by mass).
- **Chlorophyll-uncorrected ( $\mu\text{g/L}$ ):** Chlorophyll concentrations are used to measure relative abundances of open water algae.
- **Secchi (ft), Secchi (m):** Secchi measurements are estimates of water clarity.
- **Color (Pt-Co Units):** LAKEWATCH measures true color, which is the color of the water after particles have been filtered out.
- **Specific Conductance ( $\mu\text{S/cm@25}^\circ\text{C}$ ):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolved materials in water.
- **Lake Classification:** Numeric nutrient criteria for Florida require that lakes must first be classified into one of three group based on color and alkalinity or specific conductance; **colored lakes** (color greater than 40 Pt-Co units), **clear soft water lakes** (color less than or equal to 40 Pt-Co units and alkalinity less than or equal to 20 mg/L as  $\text{CaCO}_3$  or specific conductance less than or equal to 100  $\mu\text{S/cm @ 25 C}$ ), and **clear hard water lakes** (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as  $\text{CaCO}_3$  or specific conductance greater 100  $\mu\text{S/cm @ 25 C}$ ).



**Table 1. Florida Department of Environmental Protection's Numeric Nutrient Criteria for lakes.**

Long Term Geometric Mean Lake Color and Long-Term Geometric Mean Color, Alkalinity and Specific Conductance	Annual Geometric Mean Chlorophyll-corrected	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units <b>Colored Lakes</b>	20 µg/L	50 µg/L	1270 µg/L	160 µg/L <sup>1</sup>	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO <sub>3</sub> or >100 µS/cm@25 C <b>Clear Hard Water Lakes</b>	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO <sub>3</sub> or < 100 µS/cm@25 C <b>Clear Soft Water Lakes</b>	6 µg/L	10 µg/L	510 µg/L	30 µg/L	930 µg/L

<sup>1</sup> For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 490 µg/L TP streams threshold for the region.

For the purpose of subparagraph 62-302.531(2)(b)1., F.A.C., color shall be assessed as true color and shall be free from turbidity. Lake color and alkalinity shall be the long-term geometric mean, based on a minimum of ten data points over at least three years with at least one data point in each year. If insufficient alkalinity data are available, long-term geometric mean specific conductance values shall be used, with a value of <100 µS/cm@25 C used to estimate the mg/L CaCO<sub>3</sub> alkalinity concentration until such time that alkalinity data are available.

**Table 2. Long-term trophic state data collected monthly by LAKEWATCH volunteers and classification variables color and specific conductance (collected quarterly). Values in bold can be used with Table 1 to evaluate compliance with nutrient criteria.**

Parameter	Minimum and Maximum Annual Geometric Means	Grand Geometric Mean (Sampling years)
Total Phosphorus (µg/L)	29 - 95	<b>48 (11)</b>
Total Nitrogen (µg/L)	601 - 1230	<b>802 (11)</b>
Chlorophyll- uncorrected (µg/L)	5 - 24	<b>10 (11)</b>
Secchi (ft)	2.0 - 3.5	2.7 (11)
Secchi (m)	0.6 - 1.1	0.8 (11)
Color (Pt-Co Units)	40 - 61	48 (4)
Specific Conductance (µS/cm@25 C)	255 - 264	259 (2)
Lake Classification	<b>Colored</b>	

## Base File Data for Lakes: Definitions and Nutrient Zone Maps

The long-term data summary will include the following parameters listed with a definition after each one:

- **County:** Name of county in which the lake resides.
- **Name:** Lake name that LAKEWATCH uses for the system.
- **GNIS Number:** Number created by USGS's Geographic Names Information System.
- **Latitude and Longitude:** Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type:** Four different types of systems; lakes, estuaries, river/streams and springs.
- **Surface Area (ha and acre):** LAKEWATCH lists the surface area of a lake if it is available.
- **Mean Depth (m and ft):** This mean depth is calculated from multiple depth finder transects across a lake that LAKEWATCH uses for estimating plant abundances.
- **Period of Record (year):** Years a lake has been in the LAKEWATCH program.
- **TP Zone and TN Zone:** Nutrient zones defined by Bachmann et al (2012).
- **Long-Term TP and TN Geometric Mean Concentration ( $\mu\text{g/L}$ : min and max):** Grand Geometric Means of all annual geometric means ( $\mu\text{g/L}$ ) with minimum and maximum annual geometric means.
- **Lake Trophic Status (CHL):** Tropic state classification using the long-term chlorophyll average.

**Table 3. Base File Data, long-term nutrient grand geometric means and Nutrient Zone classification listing the 90<sup>th</sup> percentile concentrations in Figure 1. Values in bold can be used for Nutrient Zone comparisons.**

County	Flagler
Name	Wynnfield
GNIS Number	
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	. ha or . acre
Period of Record (year)	1995 to 2009
Lake Trophic Status (CHL)	Eutrophic
TP Zone	<b>TP4</b>
Grand TP Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>48 (29 to 95)</b>
TN Zone	<b>TN4</b>
Grand TN Geometric Mean Concentration ( $\mu\text{g/L}$ , min. and max.)	<b>802 (601 to 1230)</b>



**Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012). Explanation on how to interpret the Nutrient Zones on page 4.**

**Interpreting FDEP's Numeric Nutrient Criteria (NNC): These are instructions for using Table 1 and 2 to determine impairment status based on FDEP's NNC.**

1. Identify your lake's *Lake Classification* in Table 2 (Colored, Clear Hard Water, or Clear Soft Water) (if no classification is listed then there is not enough data available to classify your lake).
  - a. The *Lake Classification* tells you which row to use in Table 1.
2. Identify your waterbody's *Grand Geometric Mean* Chlorophyll-uncorrected in Table 2.
  - a. Compare this number to the *Annual Geometric Mean Chlorophyll-corrected* (2<sup>nd</sup> column) in Table 1.
  - b. If your lake's Chlorophyll-uncorrected concentration is greater than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Minimum calculated numeric interpretation* columns.
  - c. If your lake's *Chlorophyll-uncorrected* concentration is less than the *Annual Geometric Mean Chlorophyll-corrected* concentration use the *Maximum calculated numeric interpretation* columns.
3. Identify your lake's Total Phosphorus and Total Nitrogen *Grand Geometric Mean* concentration in Table 2 and compare them to the appropriate *Annual Geometric Mean Total Phosphorus* and *Annual Geometric Mean Total Nitrogen* values in Table 1.
4. If your lake's concentrations from Table 2 are greater than FDEP's NNC values from Table 1, your lake may be considered impaired. If they are below, it may be considered unimpaired.

**Nutrient Zones and "Natural Background"**

Administrative code definitions 62-302.200 (19): "Natural background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody, historical pre-alteration data, paleolimnological examination of sediment cores, or examination of geology and soils. When determining natural background conditions for a lake, the lake's location and regional characteristics as described and depicted in the U.S. Environmental Protection Agency document titled Lake Regions of Florida (EPA/R-97/127, dated 1997, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-06267>), which is incorporated by reference herein, shall also be considered. The lake regions in this document are grouped Nutrient Zones according to ambient total phosphorus and total nitrogen concentrations listed in Table 1 found in Bachmann, R. W., Bigham D. L., Hoyer M. V., Canfield D. E, Jr. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reservoir Management. 28:84-92.

**Interpreting Florida LAKEWATCH's Nutrient Zones: These are instructions for using Table 3 and Figure 1 to determine nutrient status based on Nutrient Zones.**

1. Identify your lake's TP Zone in Table 3.
  - a. Locate this TP Zone (left map) and its corresponding nutrient concentration in Figure 1.
2. Locate your lake's Long-Term Grand Geometric Mean TP Concentration value in Table 3.
3. Compare your lake's Long-Term Grand Geometric Mean TP Concentration from Table 3 to the appropriate TP Zone nutrient concentration from Figure 1.
  - a. If your lake's Long-Term Grand Geometric Mean TP Concentration number is higher than the TP zone nutrient concentration, your lake's nutrient concentration is above "Natural Background".
  - b. If your lake's Long-Term Grand Geometric Mean TP Concentration number is lower than the TP zone nutrient concentration, your lake's nutrient concentration is within "Natural Background".
4. Repeat these same steps with the TN Zone and Long-term Grand Geometric Mean TN Concentration

**Figure 2. Lake Wynnfield trend plots of year by average. The  $R^2$  value indicates the strength of the relations (ranges from 0.0 to 1.0; higher the  $R^2$  the stronger the relation) and the p value indicates if the relation is significant ( $p < 0.05$  is significant). Total phosphorus (TP Increasing,  $R^2 = 0.68$ ,  $p = 0.00$ ), total nitrogen (TN Increasing,  $R^2 = 0.82$ ,  $p = 0.00$ ), chlorophyll (CHL Increasing,  $R^2 = 0.64$ ,  $p = 0.00$ ) and Secchi depth (Secchi Decreasing,  $R^2 = 0.44$ ,  $p = 0.03$ ).**

