City of Palm Coast
Agenda
BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

City Hall
160 Lake Avenue
Palm Coast, FL 32164
www.palmcoastgov.com

Chairman Jeffery Seib
Vice Chair Kenneth Jones
Committee Member Edward Beier
Committee Member Marcia Foltz
Committee Member Glenn Partelow

Thursday, October 25, 2018 **5:00 PM** **COMMUNITY WING OF CITY HALL**

>In accordance with the Americans with Disabilities Act, persons needing assistance to participate in any of these proceedings should contact the City Clerk's Office at 386-986-3713 at least 48 hours prior to the meeting.

>Public comment on issues on the agenda or public participation shall be limited to 3 minutes.

>The City of Palm Coast is not responsible for any mechanical failure of recording equipment

>All pagers and cell phones are to remain OFF during the Committee meeting.

>Other matters of concern may be discussed as determined by Committee during the meeting.

>If you wish to obtain more information regarding the agenda, please contact the City Clerk's office at 386-986-3713.

CALL TO ORDER AND PLEDGE OF ALLEGIANCE

ROLL CALL

MINUTES

1 MINUTES OF THE SEPTEMBER 27, 2018 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

OLD BUSINESS

2 PALM COAST WATER QUALITY REPORTS

3 BEAUTIFICATION AND ENVIRONMENTAL ENHANCEMENTS

4 MATANZAS WOODS PARKWAY/US 1 ROUNDABOUT SIGNAGE AND LIGHTING ENHANCEMENTS

NEW BUSINESS

PUBLIC PARTICIPATION

DISCUSSION OF MATTERS NOT ON THE AGENDA

ADJOURNMENT

City of Palm Coast, Florida
Agenda Item

Agenda Date: October 25, 2018

Department	PLANNING	**Amount**	
Item Key	4566	**Account #**	

Subject MINUTES OF THE SEPTEMBER 27, 2018 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

Background :

Recommended Action :
Approve as presented

City of Palm Coast
Minutes
BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

City Hall
160 Lake Avenue
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CALL TO ORDER AND PLEDGE OF ALLEGIANCE

Chair Seib called the September 27, 2018 meeting of the Beautification and Environmental Advisory Committee (BEAC) @ 5:02PM.

ROLL CALL

Present and responding to roll call were:

Mr. Partelow
Vice Chair Jones
Mr. Beier
Ms. Foltz
Chair Seib

City Staff:

William Butler - Landscape Architect
Beth Dawson - Landscape Architect

MINUTES

1 MINUTES OF THE AUGUST 23, 2018 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

Pass
Motion made to approve as presented made by Committee Member Foltz and seconded by Vice Chair Jones

Approved - 5 - Committee Member Edward Beier, Committee Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Vice Chair Kenneth Jones

OLD BUSINESS

2 BEAUTIFICATION AND ENVIRONMENTAL ENHANCEMENTS

Chair Seib discussed with the BEAC members the idea of having some sections of the City having a "special or enhanced development standard".
Some of the sections Chair Seib discussed having these new standards being applied to were Florida Park Dr (going east), Old Kings Rd., & US North by Princess Place, State Rd. 100 (going east- Graham Swamp area). Ms. Foltz clarified that what was being suggested is an "overlay district" and that would involve a major change to the Land Development Code (LDC).

Discussion ensued between the members with regards to the process that would need to be undertaken to implement such an "overlay district".

Mr. Butler said that Ms. Dawson would provide a City limits map at the next meeting.

Mr. Bulter reminded the BEAC members to keep in mind any of their "overlay district" ideas would require City staff to maintain the additional shrubs, trees, and plants.

Received and Filed

3 PALM COAST WATER QUALITY REPORT

Mr. Butler gave an update to the BEAC members that there is a volunteer group called "Lakewatch" which works through the Univerity of Florda that monitors the lakes and ponds throughout Florida. Ms. Dawson will provide an update at the next BEAC meeting in October with the report from Lakewatch.

NEW BUSINESS

4 PROPOSAL FOR DONATION OF TURTLE SCULPTURE - LONG CREEK NATURE PRESERVE

Pass
Motion made to approve as presented made by Committee Member Foltz and seconded by Committee Member Beier

Vice Chair Jones provided an update on the September 20, 2018 Arts Commission meeting where the Town Center Art project and the Long Creek Nature Preserve project were reviewed and approved.

Ms. Nancy Crouch gave an update on the Turtle Sculpture Project, one turtle has been installed at the Palm Coast Arts Foundation, the 2nd is being gifted to the City and installed at Long Creek Nature Preserve.

Approved - 5 - Committee Member Edward Beier, Committee Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Vice Chair Kenneth Jones

5 PROPOSAL FOR SCULPTURE GARDEN/ART WORK DONATIONS - CENTRAL PARK

Mr. Harry Messersmith, artist, addressed the BEAC members regarding five pieces of sculpture dealing with the theme of views from our natural world, which are being recommended for placement around the lake at Central Park in Town Center.

Mr. Partelow left the meeting at 6:07PM.

Discussion ensued among the members about the placement of the art sculptures.

Mr. Butler informed the BEAC members that the next steps would involve this item being presented to the Parks Team for review and their approval.

Pass
Motion made to approve as presented the placement of sculpture number 1 (Burro with Bird on its Shoulder) and the concept of the other 4 sculptures (placment to be determined in the future) made by Committee Member Beier and seconded by Committee Member Foltz

Approved - 4 - Committee Member Edward Beier, Committee Member Marcia Foltz, Chairman Jeffery Seib, Vice Chair Kenneth Jones

PUBLIC PARTICIPATION

Chair Beier opened the meeting to public comment @ 6:18PM.

A gentlemen from the audience (not identified for the record) commented on how beautiful Belle Terre medians looked on his ride up from Deland.

DISCUSSION OF MATTERS NOT ON THE AGENDA

Ms. Foltz asked for an update on the Matanzas "roundabout" signage and enhanced lighting from last month's meeting. This will be added to the October BEAC meeting.

Mr. Butler gave an update on a recent City Council vote regarding the shielding from public view of storage facilities.

ADJOURNMENT

Motion made that the meeting be adjourned by Vice Chair Jones and seconded by Ms. Foltz.

The meeting was adjourned at 6:22 P.M.

Respectfully Submitted by:
Irene Schaefer, Recording Secretary

City of Palm Coast, Florida
Agenda Item

Agenda Date: October 25, 2018

Department	PLANNING	**Amount**	
Item Key	4619	**Account #**	

Subject PALM COAST WATER QUALITY REPORTS

Background :

Recommended Action :
Presentation only

LAKEWATCH Report for Avalon in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Avalon in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Avalon
Latitude	29.6242
Longitude	-81.2019
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2002 to 2014
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	34 (18 to 66)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	992 (805 to 1444)

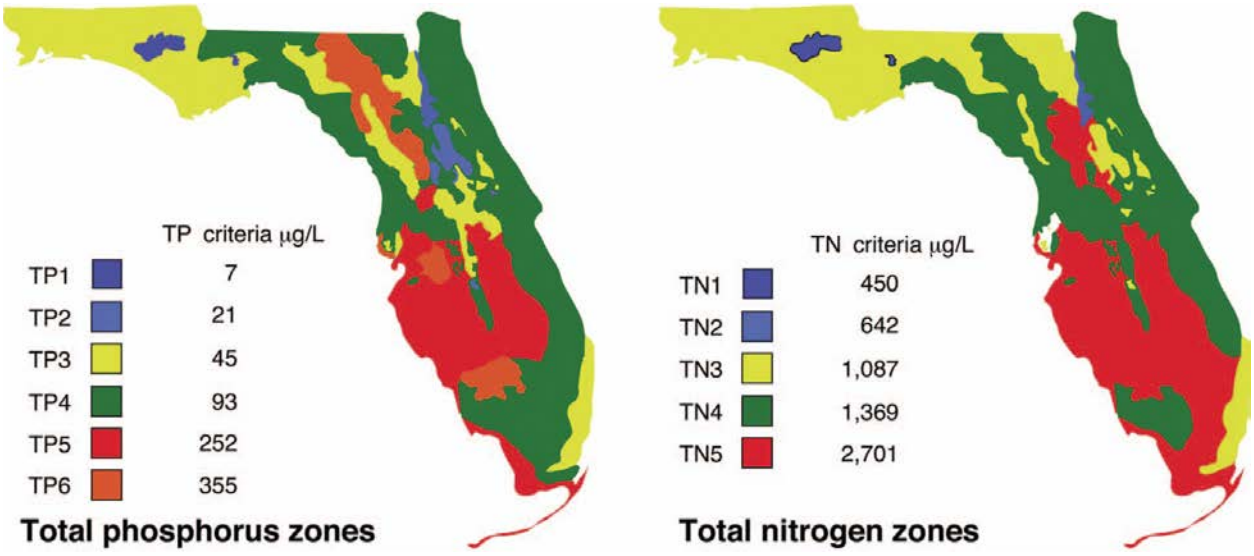


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Avalon in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Avalon in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	18 - 66	34 (13)
Total Nitrogen (µg/L)	805 - 1444	992 (13)
Chlorophyll- uncorrected (µg/L)	3.3 - 17.7	11.2 (13)
Secchi (ft)	2.0 - 5.0	3.3 (13)
Secchi (m)	0.6 - 1.5	1.0 (13)
Color (Pt-Co Units)	14 - 23	19 (12)
Specific Conductance (µS/cm@25 C)	364 - 483	420 (7)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Avalon in Flagler County
Using Data Downloaded 10/17/2016

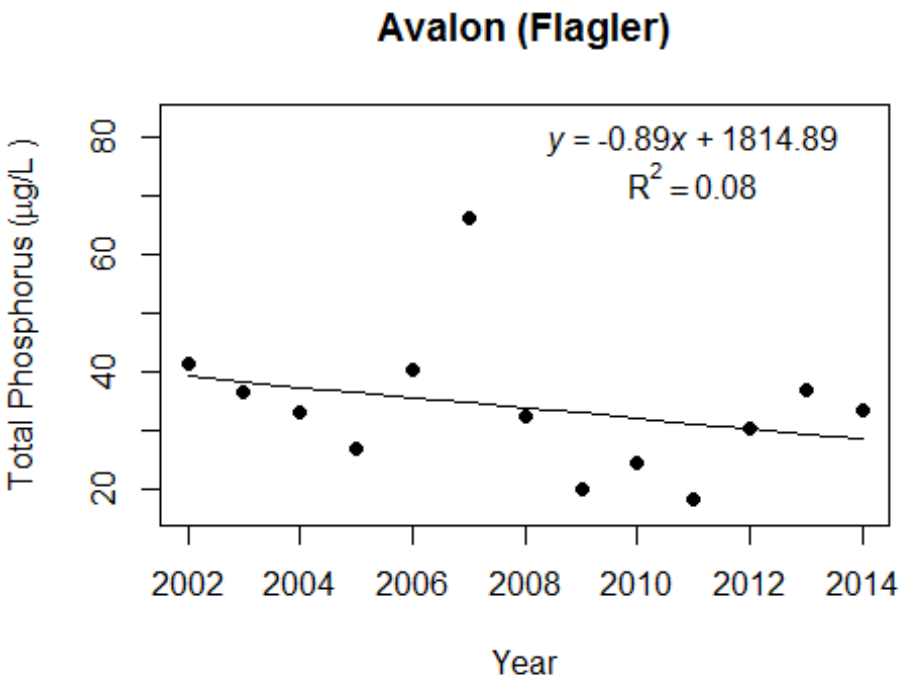
Trend Analyses Lakes

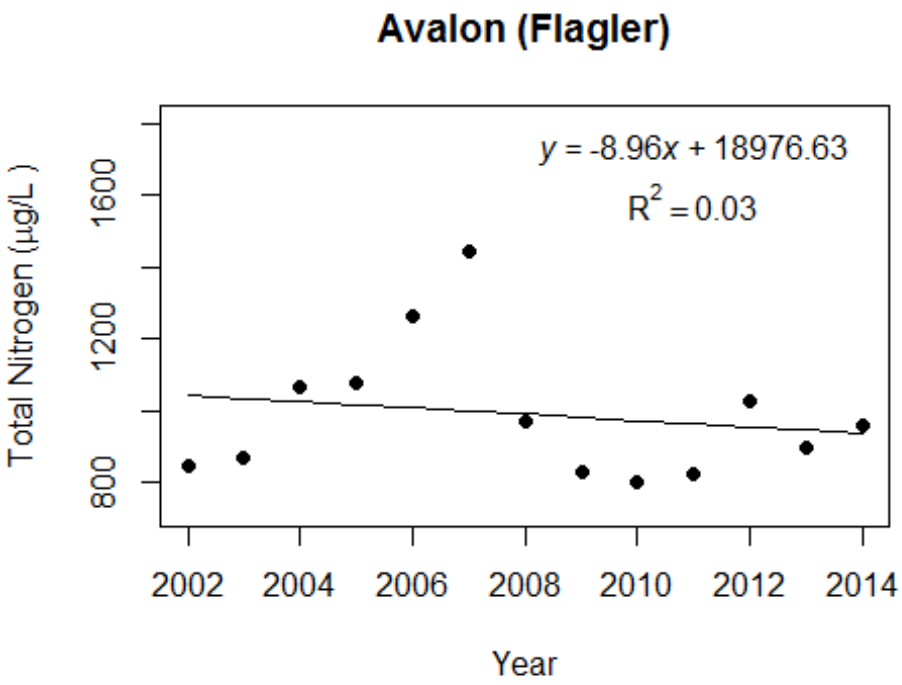
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

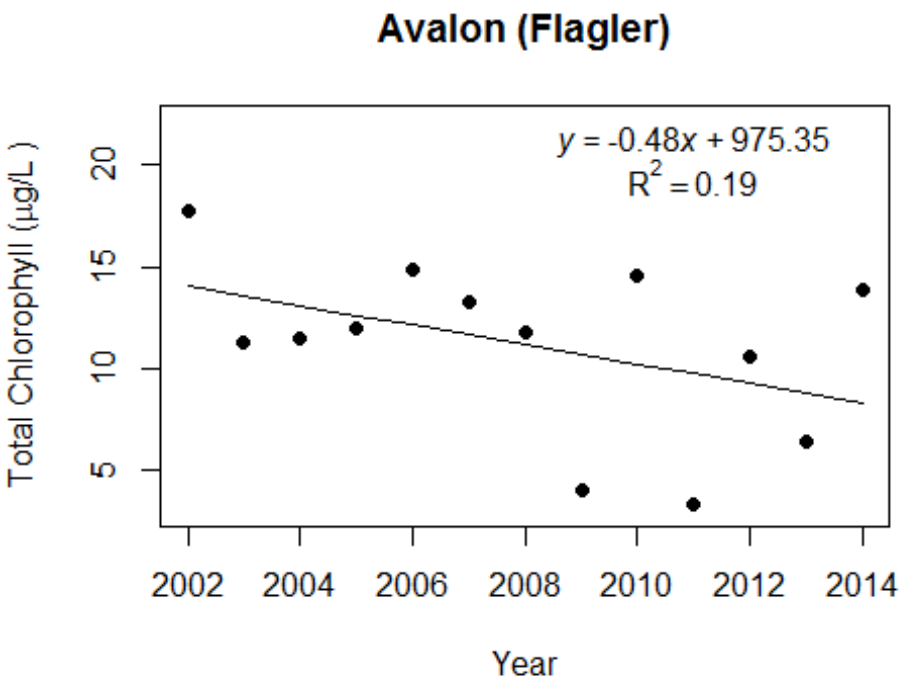
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

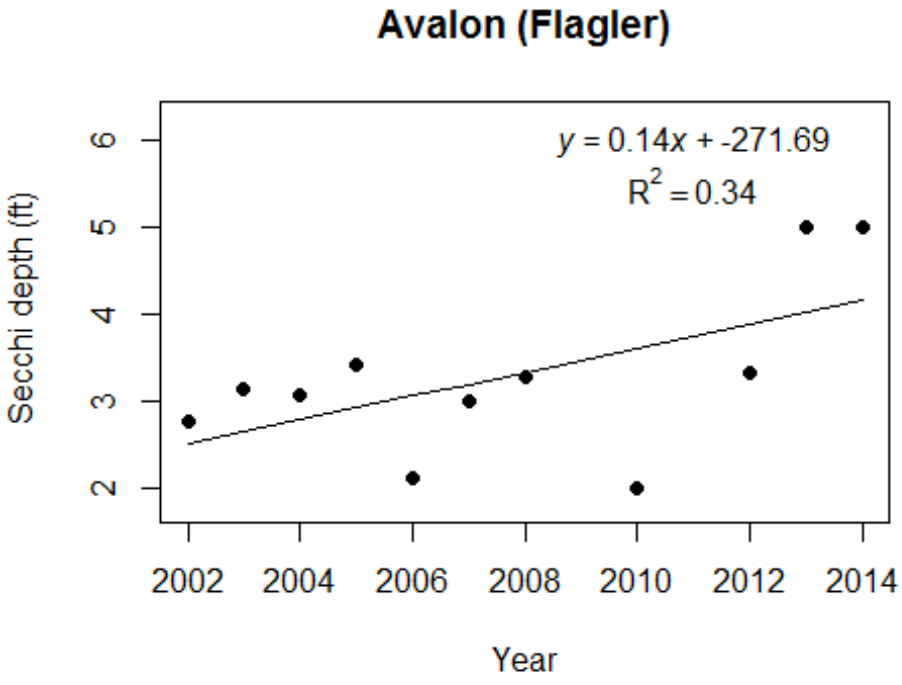
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	13	13	13	13
Intercept (a)	1815	18977	975	-272
Slope (b)	-0.89	-8.96	-0.48	0.14
Coefficient of Determination (R^2)	0.08	0.03	0.19	0.34
Probability of Significance (p)	0.34	0.55	0.13	0.06
Potential Trend	No Trend	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Avalon in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Avalon (Flagler)
y = -0.89x + 1814.89
R2 = 0.08
Total Phosphorus (µg/L)
20
40
60
80
2002
2004
2006
2008
2010
2012
2014
Year


Avalon (Flagler)
y = -8.96x + 18976.63
R2 = 0.03
Total Nitrogen (µg/L)
800
1200
1600
2002
2004
2006
2008
2010
2012
2014
Year


Avalon (Flagler)
y = -0.48x + 975.35
R2 = 0.19
Total Chlorophyll (µg/L)
5
10
15
20
2002
2004
2006
2008
2010
2012
2014
Year


Avalon (Flagler)
y = 0.14x + -271.69
R2 = 0.34
Secchi depth (ft)
2
3
4
5
6
2002
2004
2006
2008
2010
2012
2014
Year

LAKEWATCH Report for Belle Aire in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

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- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Belle Aire in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Belle Aire
Latitude	29.5781
Longitude	-81.2394
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	50 (20 to 98)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	747 (574 to 1000)

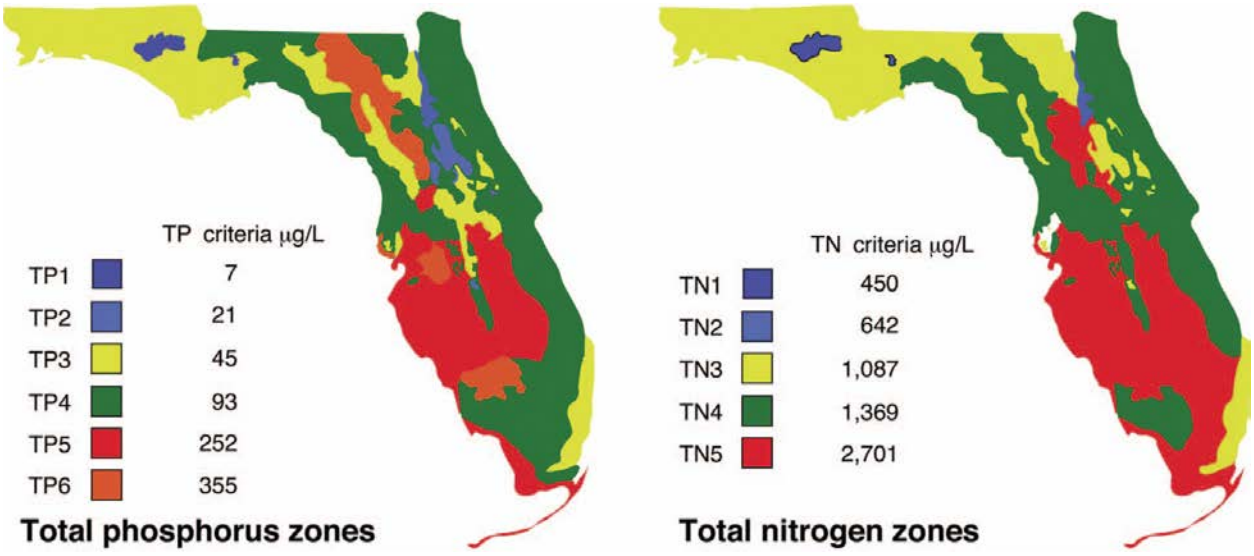

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Belle Aire in Flagler County
Using Data Downloaded 10/17/2016

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LAKEWATCH Report for Belle Aire in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	20 - 98	50 (18)
Total Nitrogen (µg/L)	574 - 1000	747 (18)
Chlorophyll- uncorrected (µg/L)	6.5 - 28.3	14.7 (18)
Secchi (ft)	2.5 - 6.5	4.5 (18)
Secchi (m)	0.8 - 2.0	1.4 (18)
Color (Pt-Co Units)	15 - 48	29 (11)
Specific Conductance (µS/cm@25 C)	203 - 342	274 (9)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
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[1] 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.

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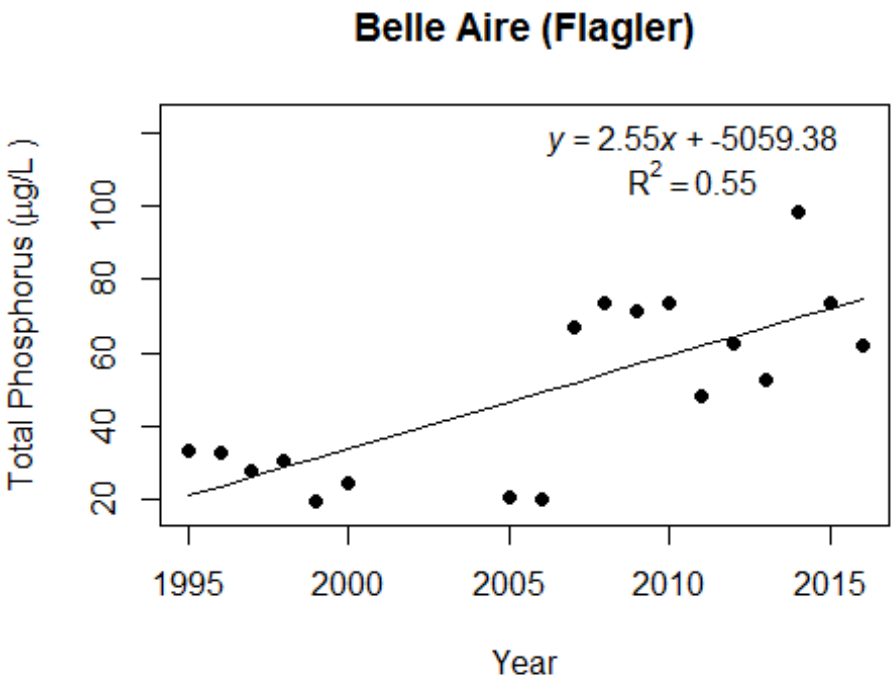
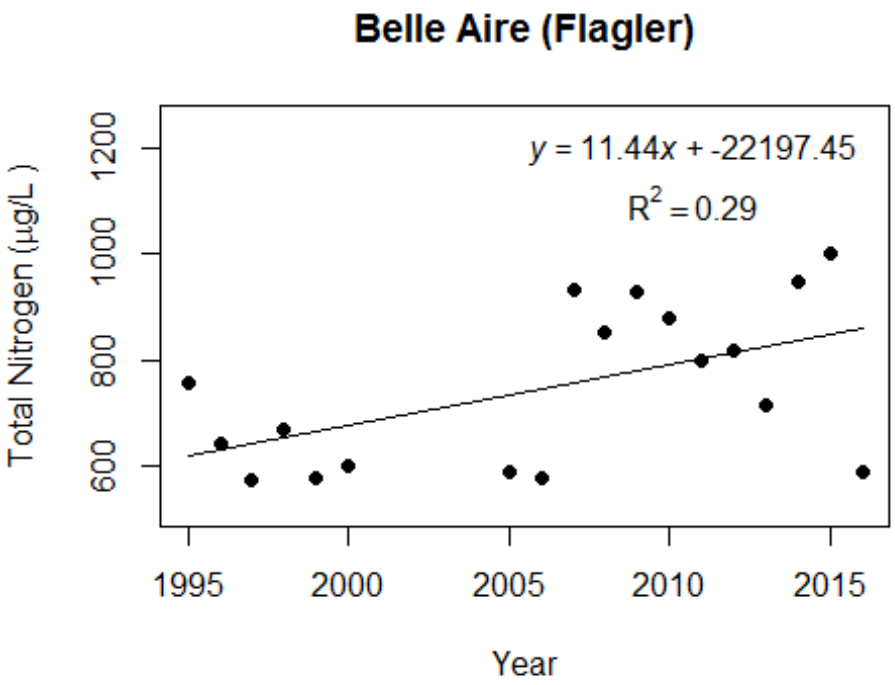
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

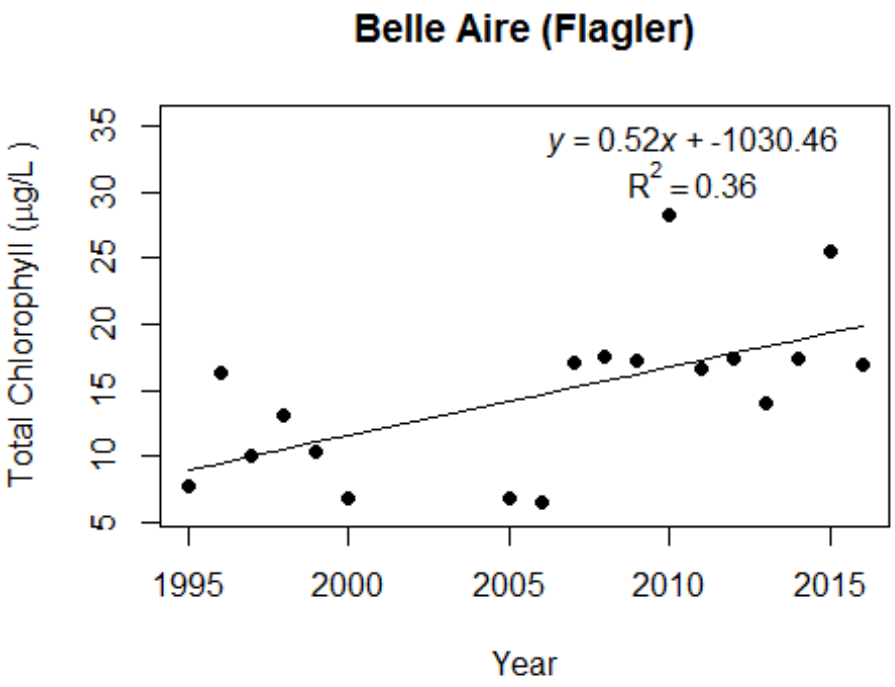
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

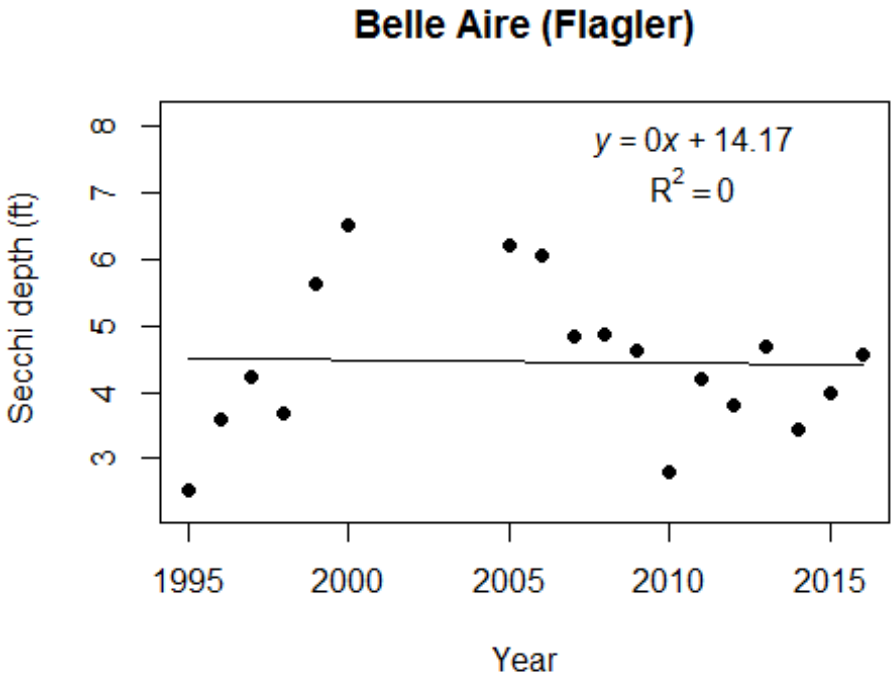
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	18	18	18	18
Intercept (a)	-5059	-22197	-1030	14
Slope (b)	2.55	11.44	0.52	-0.00
Coefficient of Determination (R^2)	0.55	0.29	0.36	0.00
Probability of Significance (p)	0.00	0.02	0.01	0.90
Potential Trend	Increasing	Increasing	Increasing	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Belle Aire in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Belle Aire (Flagler)
y = 2.55x + -5059.38
R2 = 0.55
Total Phosphorus (µg/L)
20
40
60
80
100
1995
2000
2005
2010
2015
Year


Belle Aire (Flagler)
y = 11.44x + -22197.45
R2 = 0.29
Total Nitrogen (µg/L)
600
800
1000
1200
1995
2000
2005
2010
2015
Year


Belle Aire (Flagler)
y = 0.52x + -1030.46
R2 = 0.36
Total Chlorophyll (µg/L)
5
10
15
20
25
30
35
1995
2000
2005
2010
2015
Year


Belle Aire (Flagler)
y = 0x + 14.17
R2 = 0
Secchi depth (ft)
3
4
5
6
7
8
1995
2000
2005
2010
2015
Year

LAKEWATCH Report for Belle Aire South in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Belle Aire South in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Belle Aire South
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2006 to 2006
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	
TP Zone	
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	40 (40 to 40)
TN Zone	
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	775 (775 to 775)

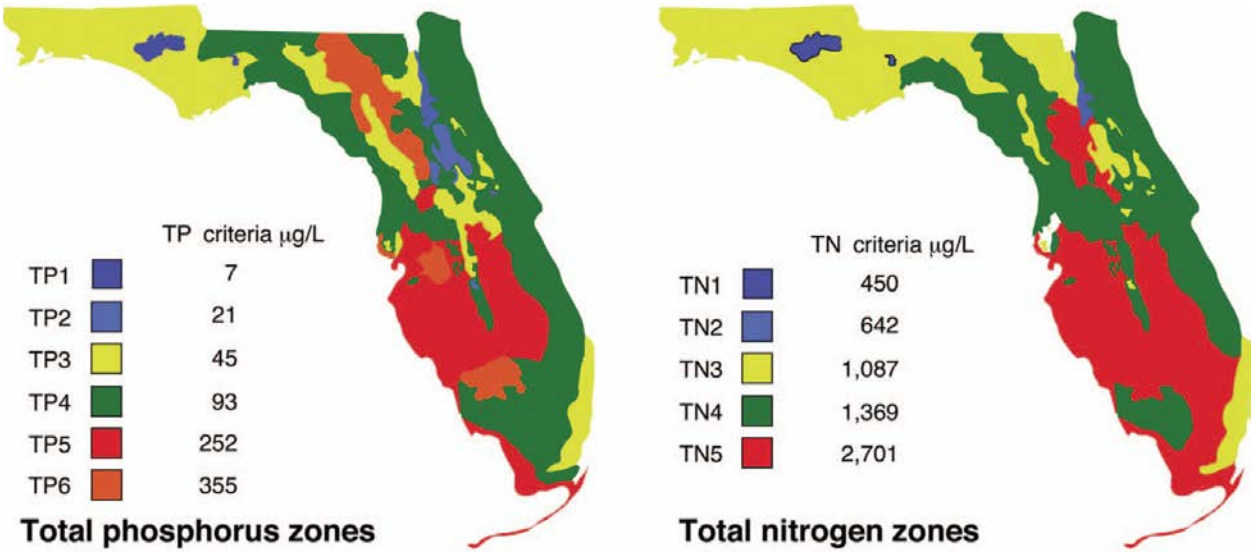


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Belle Aire South in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Belle Aire South in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	40 - 40	40 (1)
Total Nitrogen (µg/L)	775 - 775	775 (1)
Chlorophyll- uncorrected (µg/L)	-	(1)
Secchi (ft)	2.7 - 2.7	2.7 (1)
Secchi (m)	0.8 - 0.8	0.8 (1)
Color (Pt-Co Units)	44 - 44	44 (1)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Belle Aire South in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Belle Aire South in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Belle Terre in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Belle Terre in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Belle Terre
Latitude	29.6044
Longitude	-81.2539
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2002
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	37 (22 to 56)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	641 (506 to 854)

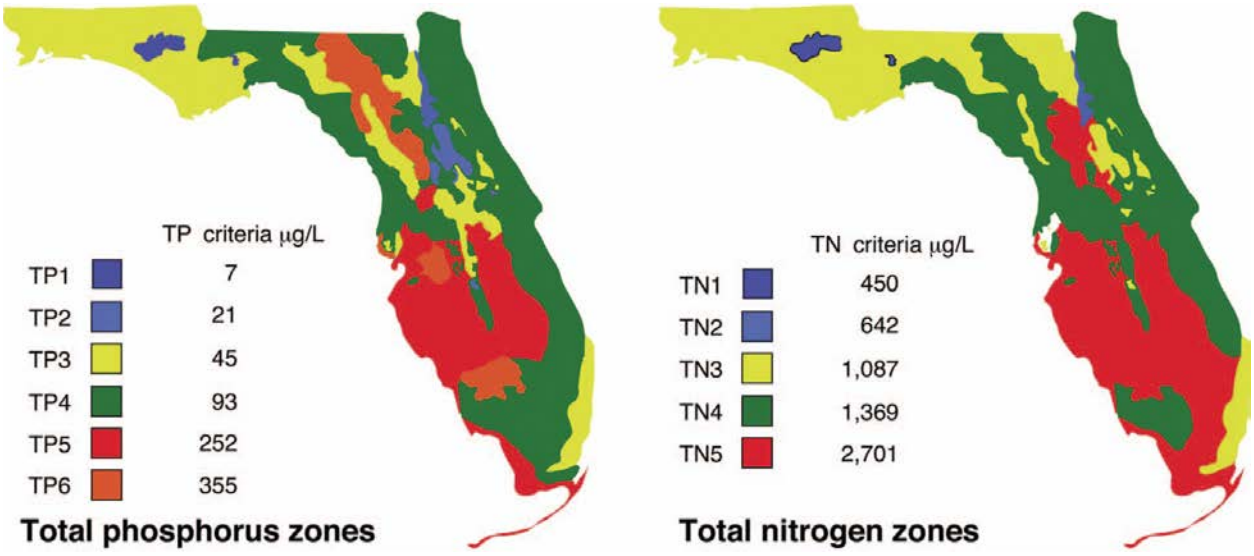


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Belle Terre in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Belle Terre in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	22 - 56	37 (8)
Total Nitrogen (µg/L)	506 - 854	641 (8)
Chlorophyll- uncorrected (µg/L)	11.1 - 50.2	22.1 (8)
Secchi (ft)	2.6 - 4.6	3.3 (8)
Secchi (m)	0.8 - 1.4	1.0 (8)
Color (Pt-Co Units)	55 - 60	57 (2)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Belle Terre in Flagler County
Using Data Downloaded 10/17/2016

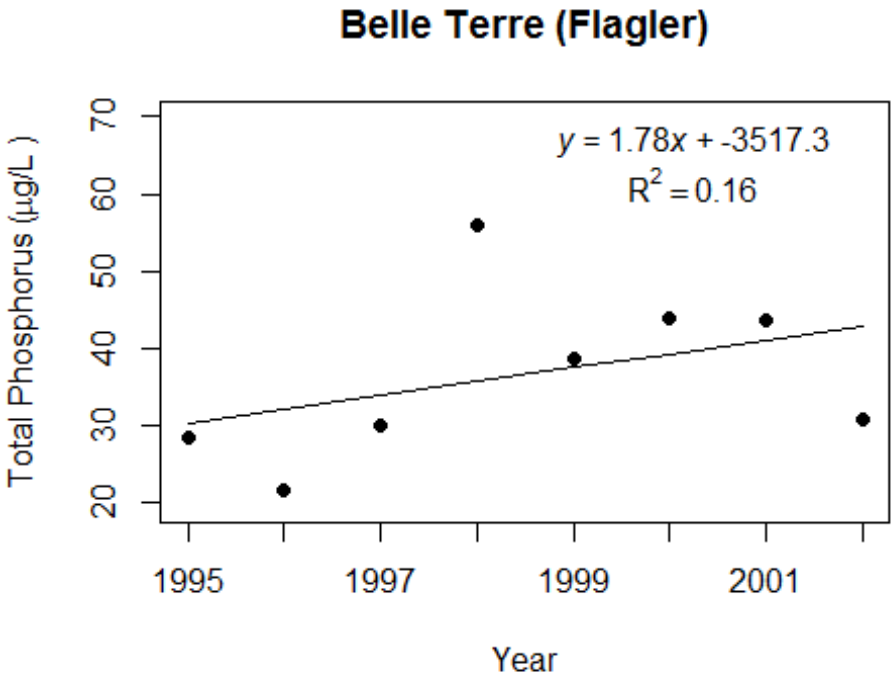
Trend Analyses Lakes

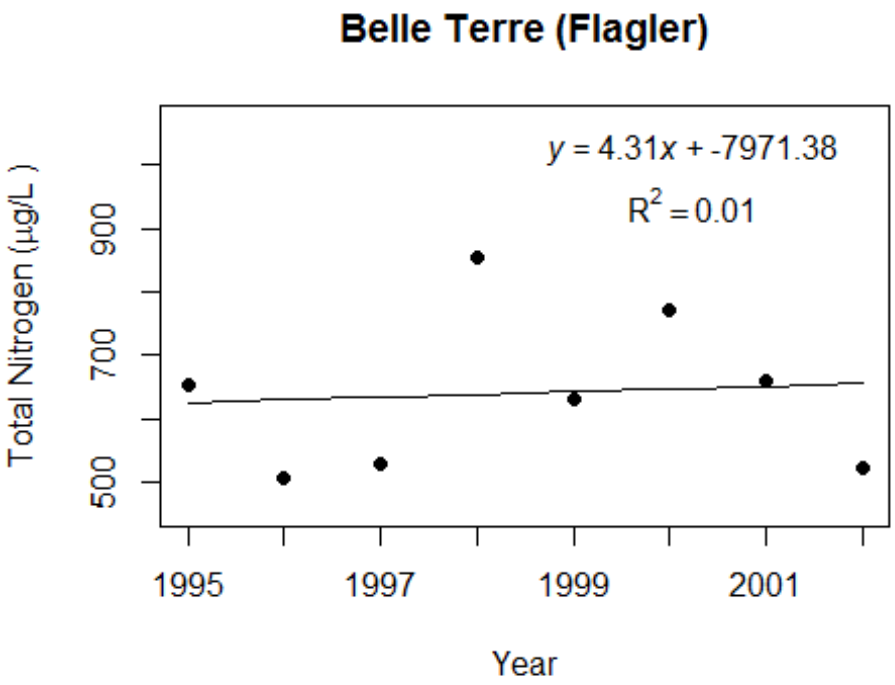
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

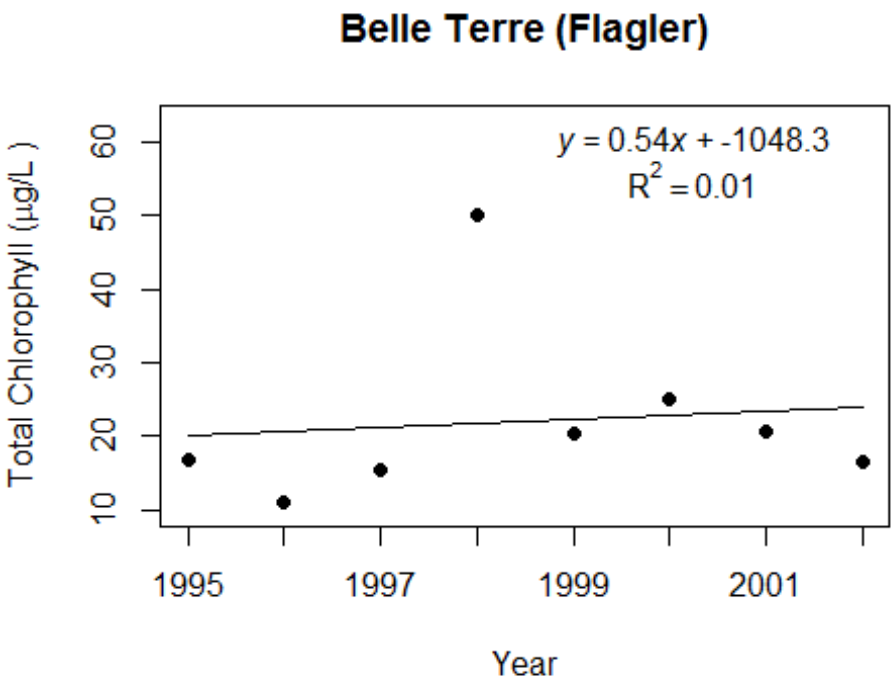
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

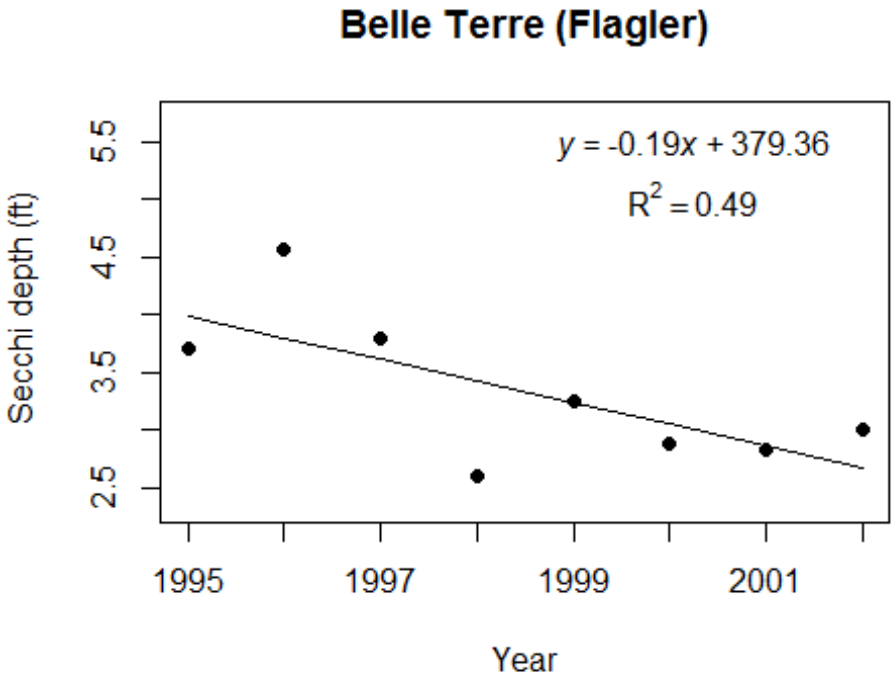
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	8	8	8	8
Intercept (a)	-3517	-7971	-1048	379
Slope (b)	1.78	4.31	0.54	-0.19
Coefficient of Determination (R^2)	0.16	0.01	0.01	0.49
Probability of Significance (p)	0.33	0.84	0.80	0.05
Potential Trend	No Trend	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Belle Terre in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Belle Terre (Flagler)
y = 1.78x + -3517.3
R2 = 0.16
Total Phosphorus (µg/L)
20
30
40
50
60
70
1995
1997
1999
2001
Year


Belle Terre (Flagler)
y = 4.31x + -7971.38
R2 = 0.01
Total Nitrogen (µg/L)
500
700
900
1995
1997
1999
2001
Year


Belle Terre (Flagler)
y = 0.54x + -1048.3
R2 = 0.01
Total Chlorophyll (µg/L)
10
20
30
40
50
60
1995
1997
1999
2001
Year


Belle Terre (Flagler)
y = -0.19x + 379.36
R2 = 0.49
Secchi depth (ft)
2.5
3.5
4.5
5.5
1995
1997
1999
2001
Year

LAKEWATCH Report for Birchwood in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Birchwood in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Birchwood
Latitude	29.5794
Longitude	-81.2389
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 1995
Lake Classification	
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	42 (42 to 42)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	473 (473 to 473)

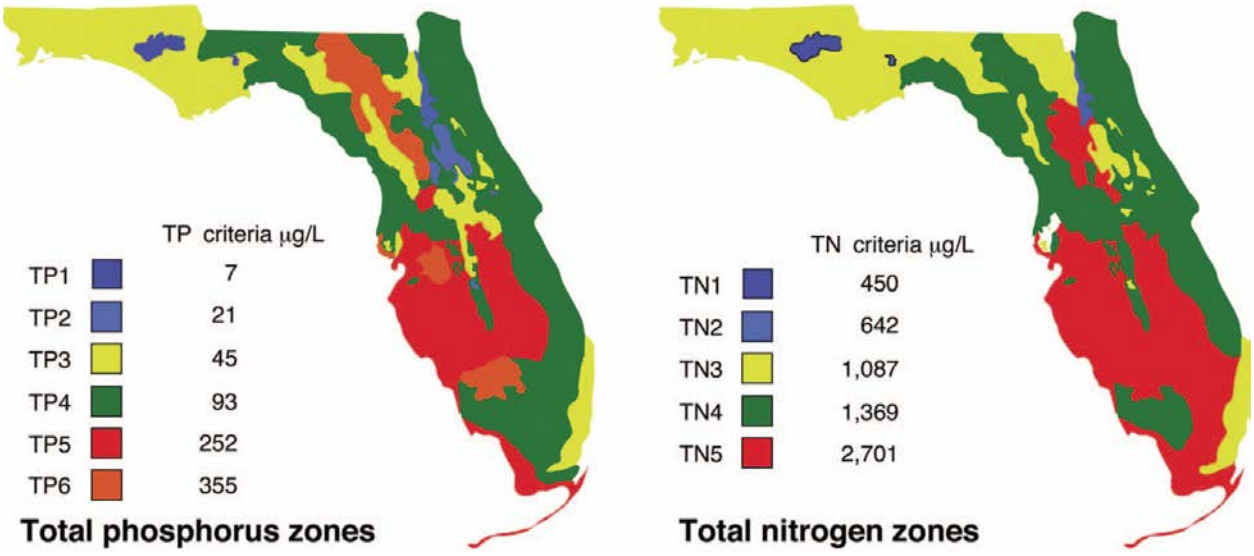


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Birchwood in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Birchwood in Flagler County
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Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	42 - 42	42 (1)
Total Nitrogen (µg/L)	473 - 473	473 (1)
Chlorophyll- uncorrected (µg/L)	6.7 - 6.7	6.7 (1)
Secchi (ft)	5.2 - 5.2	5.2 (1)
Secchi (m)	1.6 - 1.6	1.6 (1)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Birchwood in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Birchwood in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Birchwood Basin in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Birchwood Basin in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Birchwood Basin
Latitude	29.5794
Longitude	-81.2397
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 1995
Lake Classification	
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	59 (59 to 59)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	568 (568 to 568)

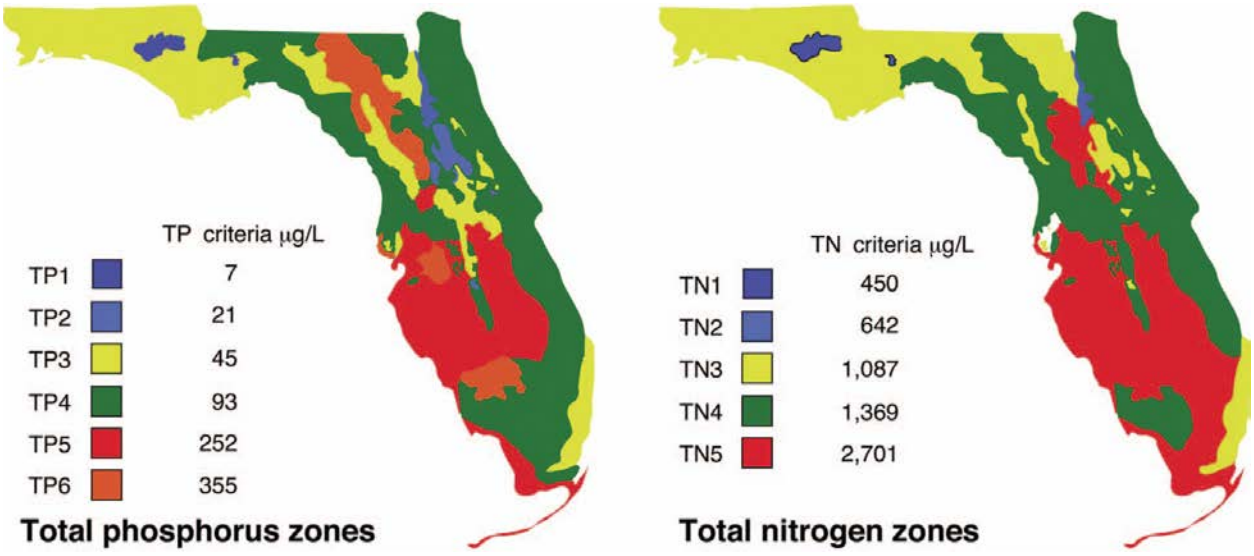

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Birchwood Basin in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Birchwood Basin in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	59 - 59	59 (1)
Total Nitrogen (µg/L)	568 - 568	568 (1)
Chlorophyll- uncorrected (µg/L)	8.8 - 8.8	8.8 (1)
Secchi (ft)	5.7 - 5.7	5.7 (1)
Secchi (m)	1.7 - 1.7	1.7 (1)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Birchwood Basin in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Birchwood Basin in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Bird of Paradise in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Bird of Paradise in Flagler County
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Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Bird of Paradise
Latitude	29.5919
Longitude	-81.2467
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2002
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	29 (16 to 40)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	577 (443 to 713)

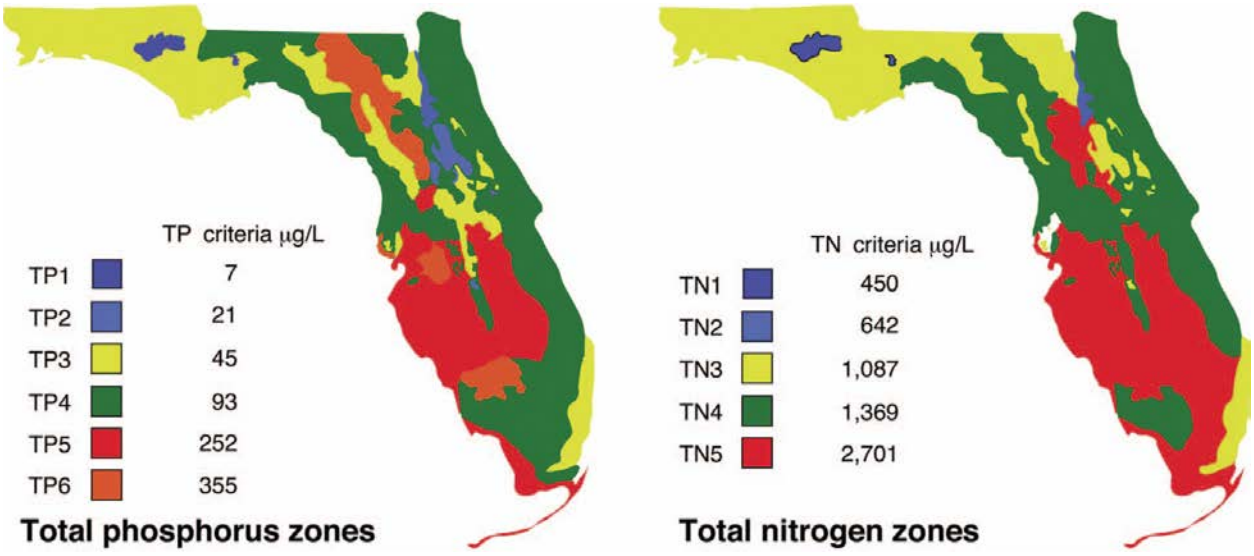

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Bird of Paradise in Flagler County
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FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Bird of Paradise in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	16 - 40	29 (8)
Total Nitrogen (µg/L)	443 - 713	577 (8)
Chlorophyll- uncorrected (µg/L)	6.1 - 22.8	15.2 (8)
Secchi (ft)	3.1 - 5.4	3.9 (8)
Secchi (m)	1.0 - 1.7	1.2 (8)
Color (Pt-Co Units)	50 - 51	51 (2)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Bird of Paradise in Flagler County
Using Data Downloaded 10/17/2016

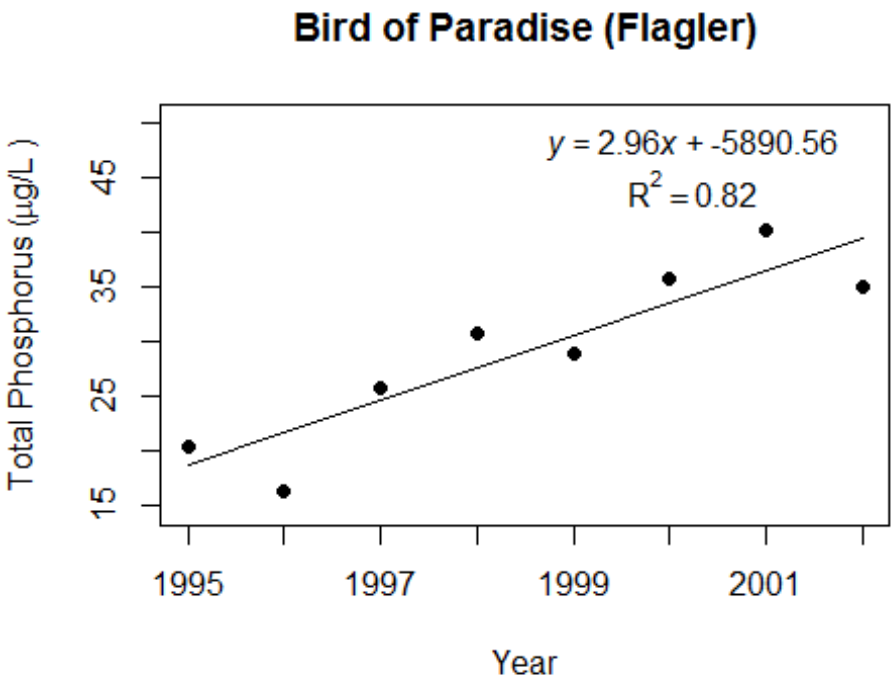
Trend Analyses Lakes

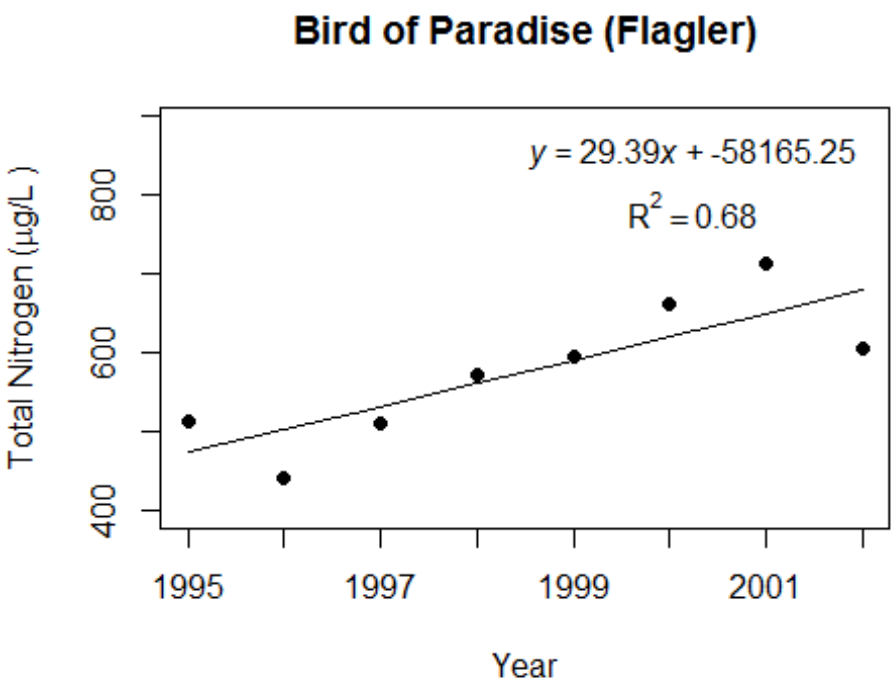
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

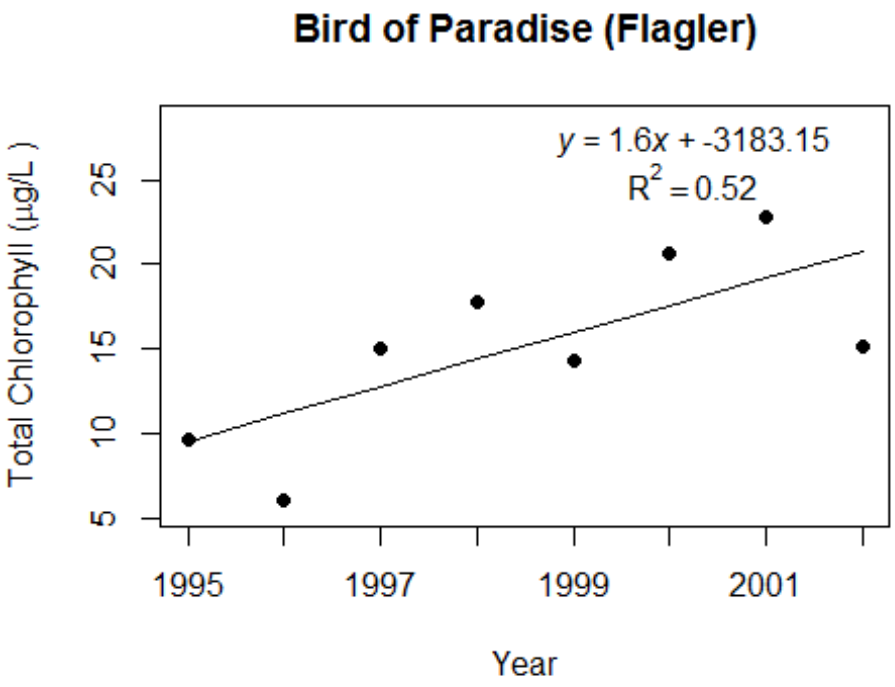
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

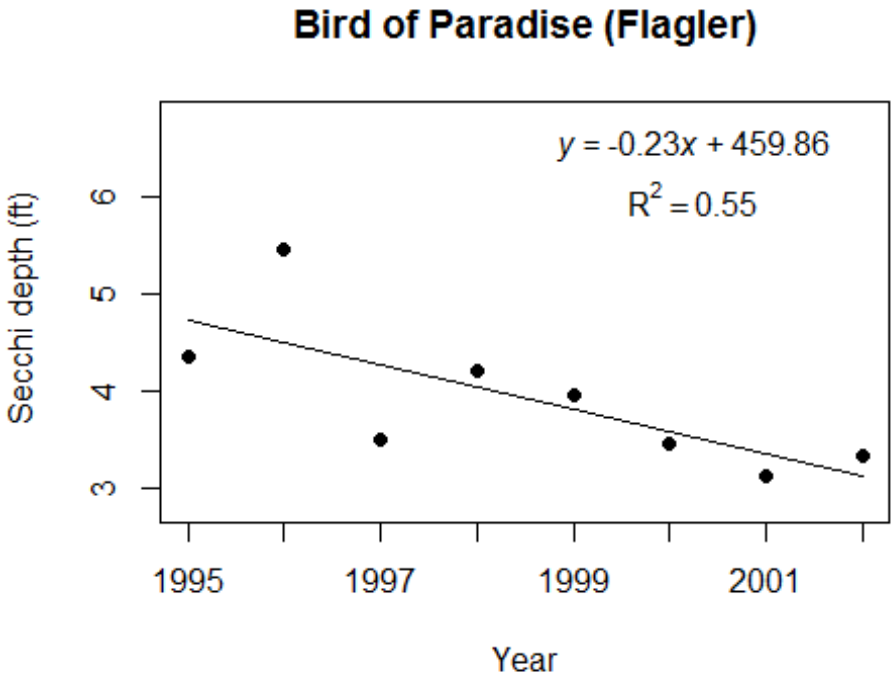
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	8	8	8	8
Intercept (a)	-5891	-58165	-3183	460
Slope (b)	2.96	29.39	1.60	-0.23
Coefficient of Determination (R^2)	0.82	0.68	0.52	0.55
Probability of Significance (p)	0.00	0.01	0.04	0.03
Potential Trend	Increasing	Increasing	Increasing	Decreasing

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Bird of Paradise in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Bird of Paradise (Flagler)
y = 2.96x + -5890.56
R2 = 0.82
Total Phosphorus (µg/L)
15
25
35
45
1995
1997
1999
2001
Year


Bird of Paradise (Flagler)
y = 29.39x + -58165.25
R2 = 0.68
Total Nitrogen (µg/L)
400
600
800
1995
1997
1999
2001
Year


Bird of Paradise (Flagler)
y = 1.6x + -3183.15
R2 = 0.52
Total Chlorophyll (µg/L)
5
10
15
20
25
1995
1997
1999
2001
Year


Bird of Paradise (Flagler)
y = -0.23x + 459.86
R2 = 0.55
Secchi depth (ft)
3
4
5
6
1995
1997
1999
2001
Year

LAKEWATCH Report for Birdway in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Birdway in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Birdway
Latitude	29.5875
Longitude	-81.2491
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1994 to 1995
Lake Classification	
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	21 (15 to 26)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	600 (538 to 663)

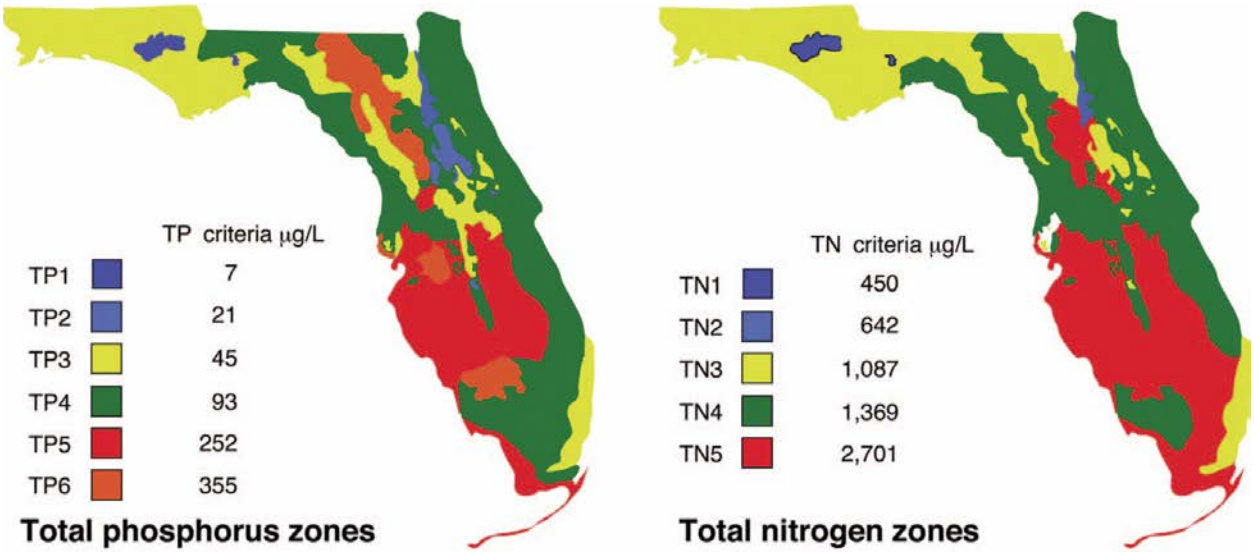


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Birdway in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Birdway in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	15 - 26	21 (2)
Total Nitrogen (µg/L)	538 - 663	600 (2)
Chlorophyll- uncorrected (µg/L)	4.0 - 14.6	9.3 (2)
Secchi (ft)	2.5 - 4.6	3.5 (2)
Secchi (m)	0.7 - 1.4	1.1 (2)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Birdway in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Birdway in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Brandon in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Brandon in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Brandon
Latitude	29.4408
Longitude	-81.2328
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2008
Lake Classification	Clear Soft Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	16 (8 to 25)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	515 (344 to 761)

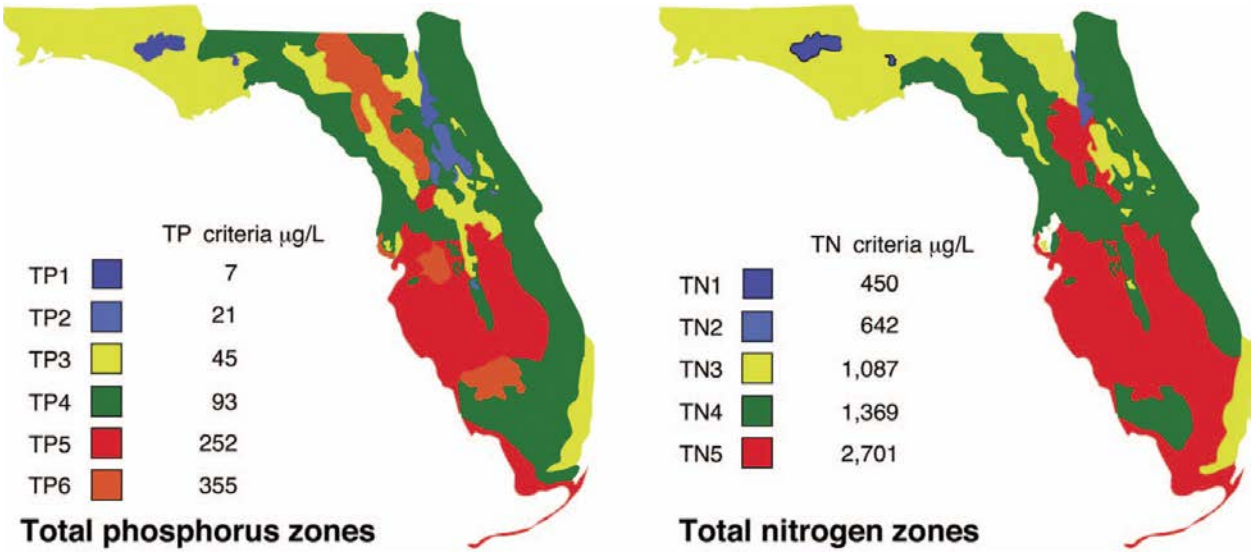


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Brandon in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Brandon in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	8 - 25	16 (11)
Total Nitrogen (µg/L)	344 - 761	515 (11)
Chlorophyll- uncorrected (µg/L)	2.4 - 13.9	7.2 (11)
Secchi (ft)	3.9 - 6.7	5.5 (11)
Secchi (m)	1.2 - 2.0	1.7 (11)
Color (Pt-Co Units)	24 - 49	30 (6)
Specific Conductance (µS/cm@25 C)	74 - 76	75 (2)
Lake Classification	Clear Soft Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Brandon in Flagler County
Using Data Downloaded 10/17/2016

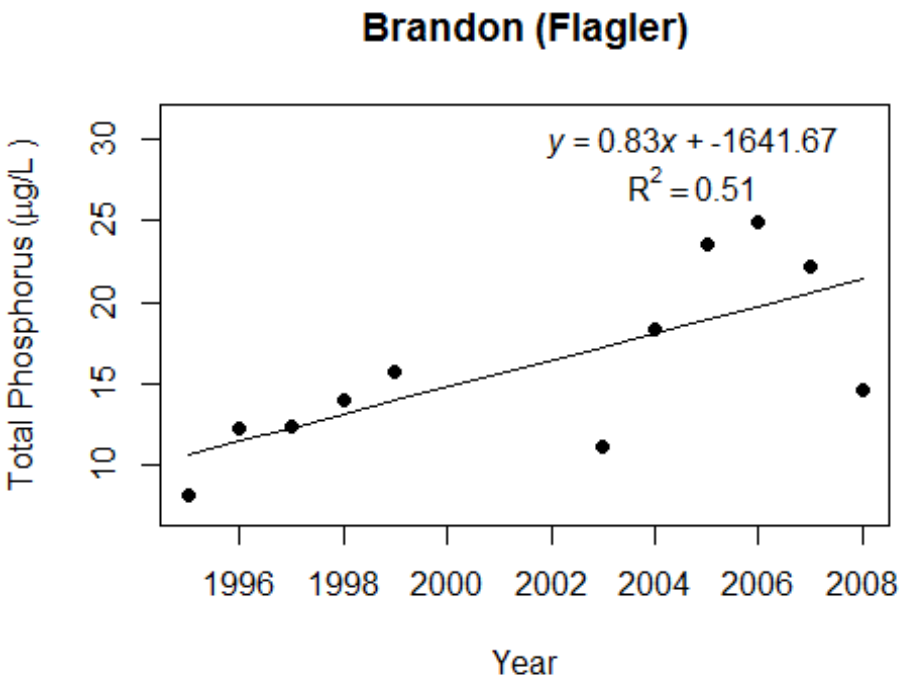
Trend Analyses Lakes

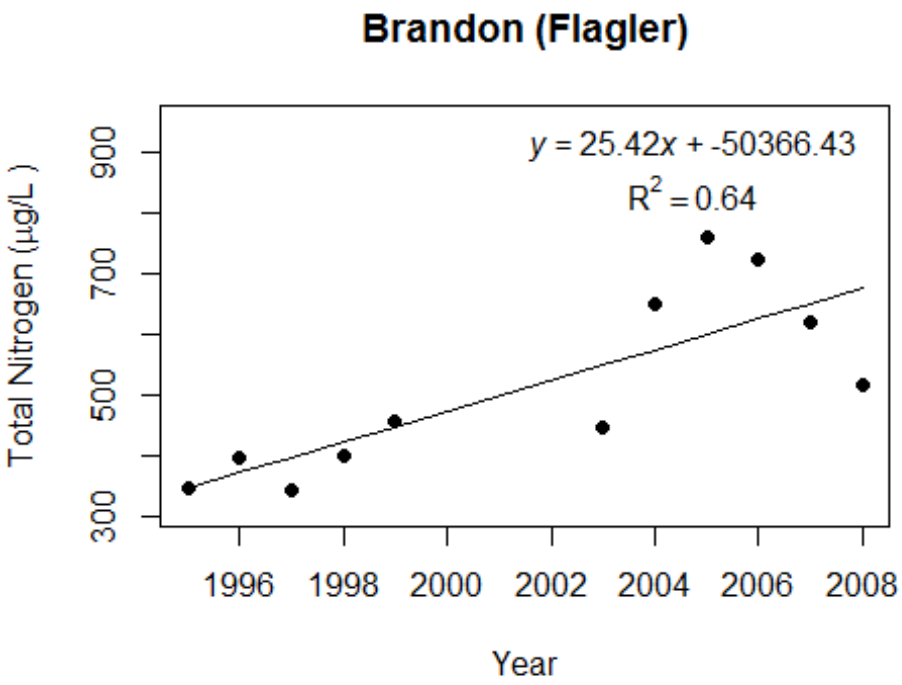
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

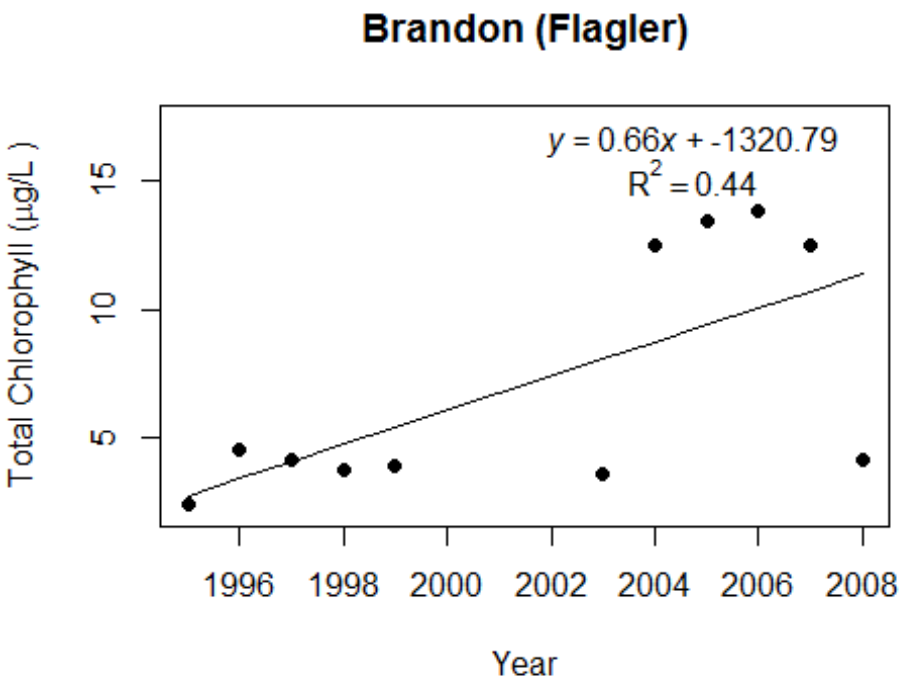
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

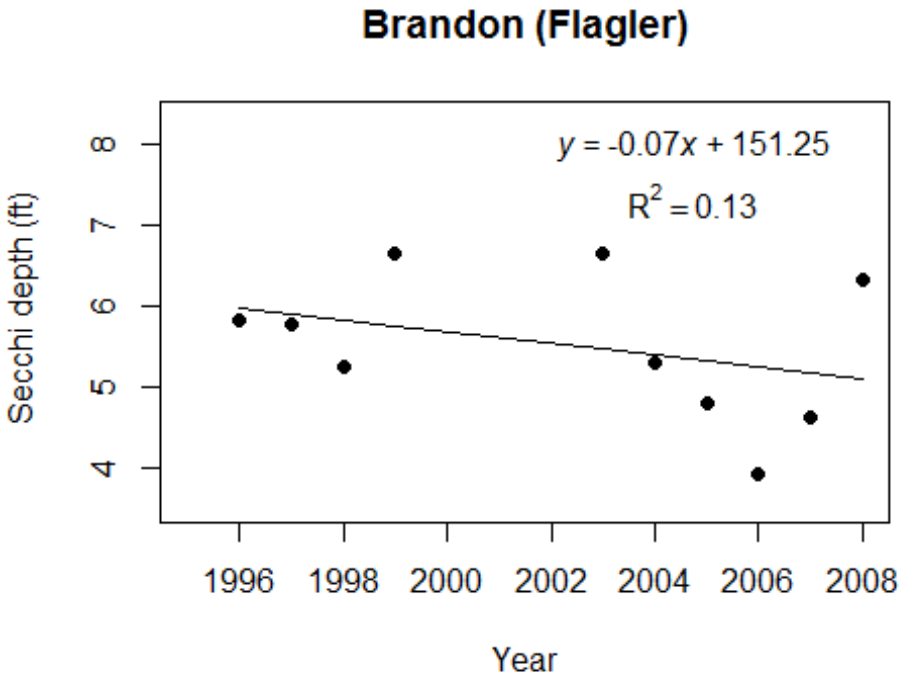
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	11	11	11	11
Intercept (a)	-1642	-50366	-1321	151
Slope (b)	0.83	25.42	0.66	-0.07
Coefficient of Determination (R^2)	0.51	0.64	0.44	0.13
Probability of Significance (p)	0.01	0.00	0.03	0.31
Potential Trend	Increasing	Increasing	Increasing	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Brandon in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Brandon (Flagler)
y = 0.83x + -1641.67
R2 = 0.51
Total Phosphorus (µg/L)
10
15
20
25
30
1996
1998
2000
2002
2004
2006
2008
Year


Brandon (Flagler)
y = 25.42x + -50366.43
R2 = 0.64
Total Nitrogen (µg/L)
300
500
700
900
1996
1998
2000
2002
2004
2006
2008
Year


Brandon (Flagler)
y = 0.66x + -1320.79
R2 = 0.44
Total Chlorophyll (µg/L)
5
10
15
1996
1998
2000
2002
2004
2006
2008
Year


Brandon (Flagler)
y = -0.07x + 151.25
R2 = 0.13
Secchi depth (ft)
4
5
6
7
8
1996
1998
2000
2002
2004
2006
2008
Year

LAKEWATCH Report for Brittany in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Brittany in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Brittany
Latitude	29.5571
Longitude	-81.2513
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2007 to 2008
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	43 (29 to 57)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1074 (835 to 1313)

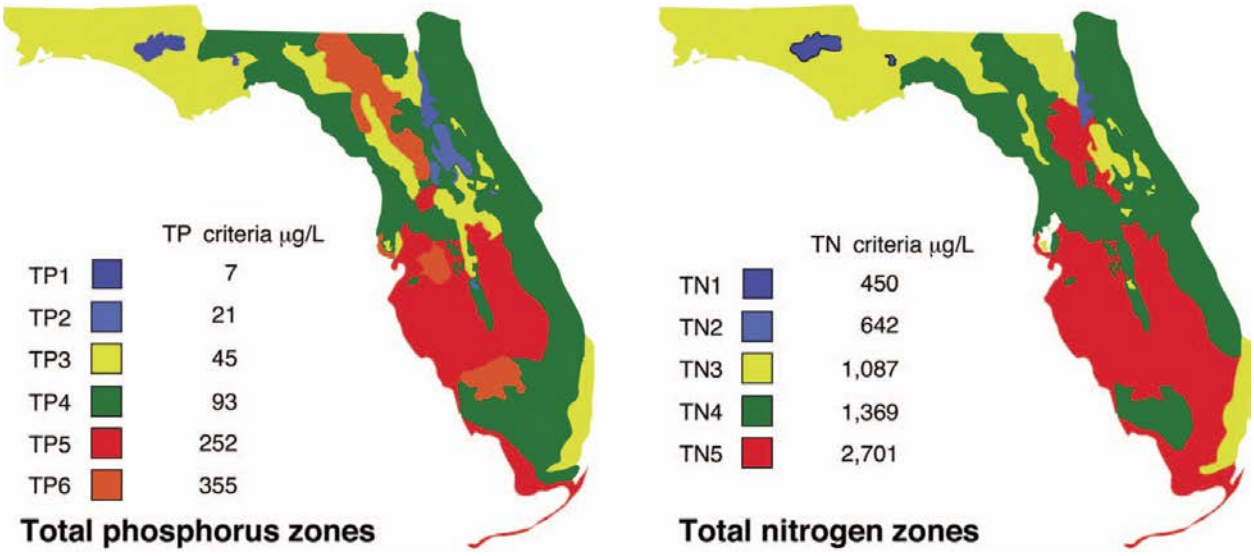


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Brittany in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Brittany in Flagler County
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Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	29 - 57	43 (2)
Total Nitrogen (µg/L)	835 - 1313	1074 (2)
Chlorophyll- uncorrected (µg/L)	4.7 - 19.0	11.8 (2)
Secchi (ft)	1.7 - 2.0	1.8 (2)
Secchi (m)	0.5 - 0.6	0.6 (2)
Color (Pt-Co Units)	17 - 59	38 (2)
Specific Conductance (µS/cm@25 C)	273 - 321	297 (2)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Brittany in Flagler County
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Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Brittany in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Cheyenne Cove in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Cheyenne Cove in Flagler County
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Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Cheyenne Cove
Latitude	29.6003
Longitude	-81.2057
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2005 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	70 (53 to 84)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	476 (354 to 529)

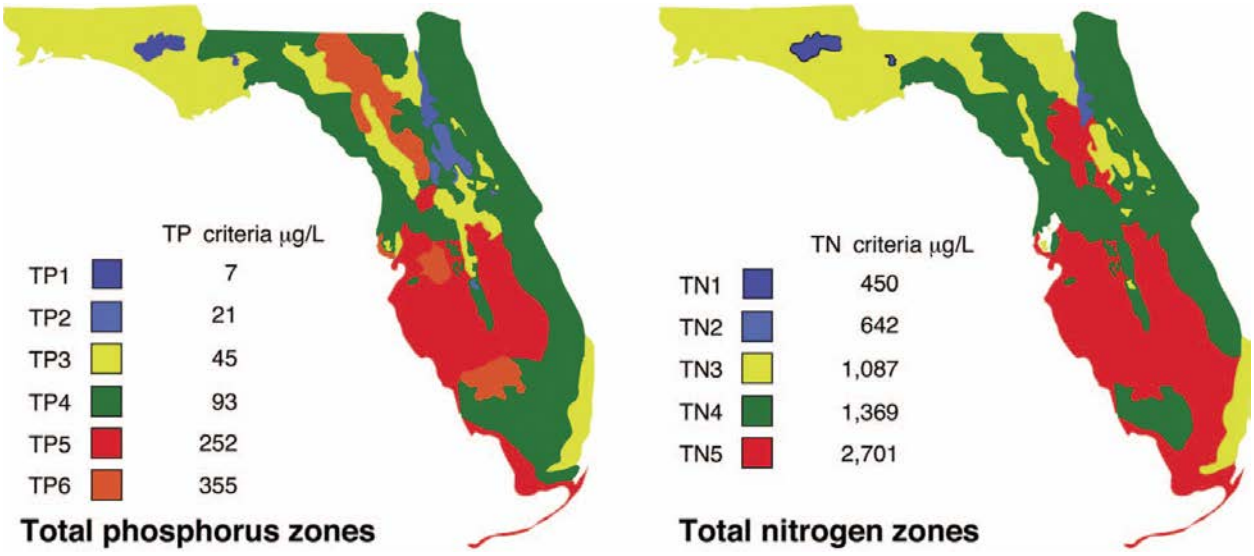


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Cheyenne Cove in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Cheyenne Cove in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	53 - 84	70 (12)
Total Nitrogen (µg/L)	354 - 529	476 (12)
Chlorophyll- uncorrected (µg/L)	10.0 - 20.6	14.8 (12)
Secchi (ft)	3.1 - 4.6	3.8 (12)
Secchi (m)	0.9 - 1.4	1.1 (12)
Color (Pt-Co Units)	10 - 44	20 (12)
Specific Conductance (µS/cm@25 C)	36364 - 50667	44424 (10)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Cheyenne Cove in Flagler County
Using Data Downloaded 10/17/2016

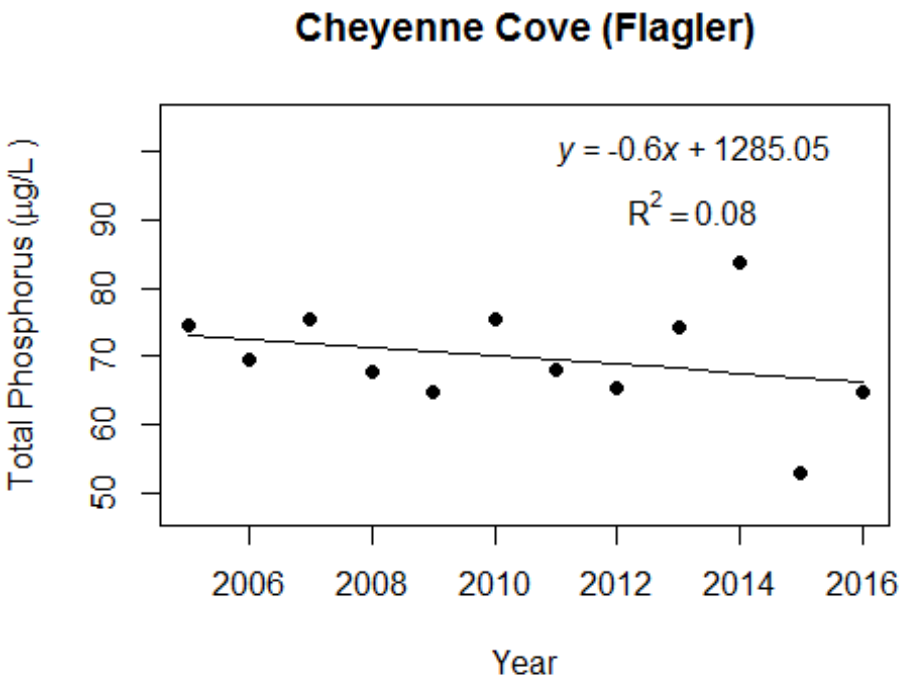
Trend Analyses Lakes

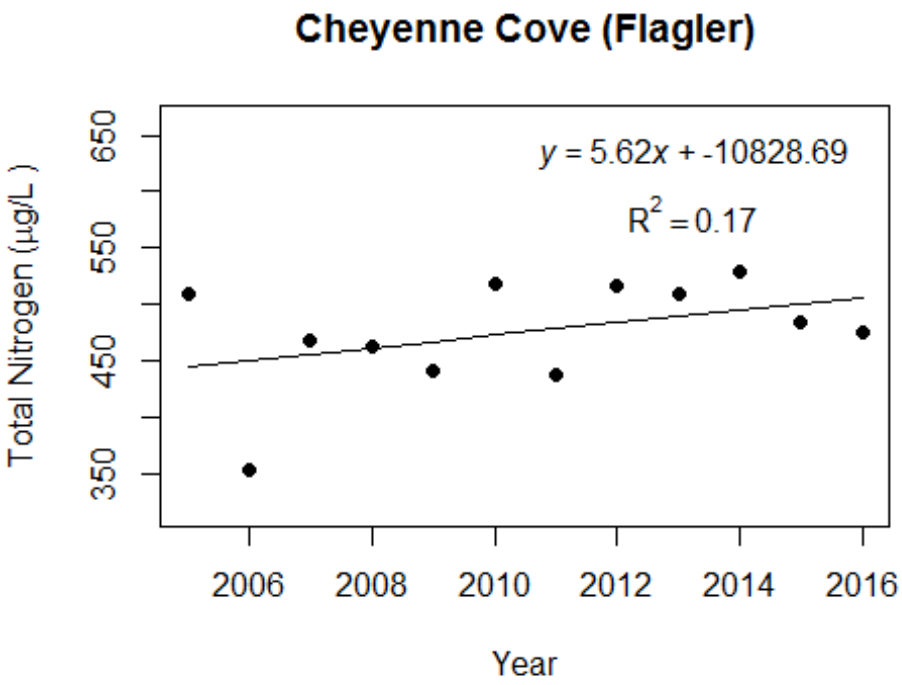
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

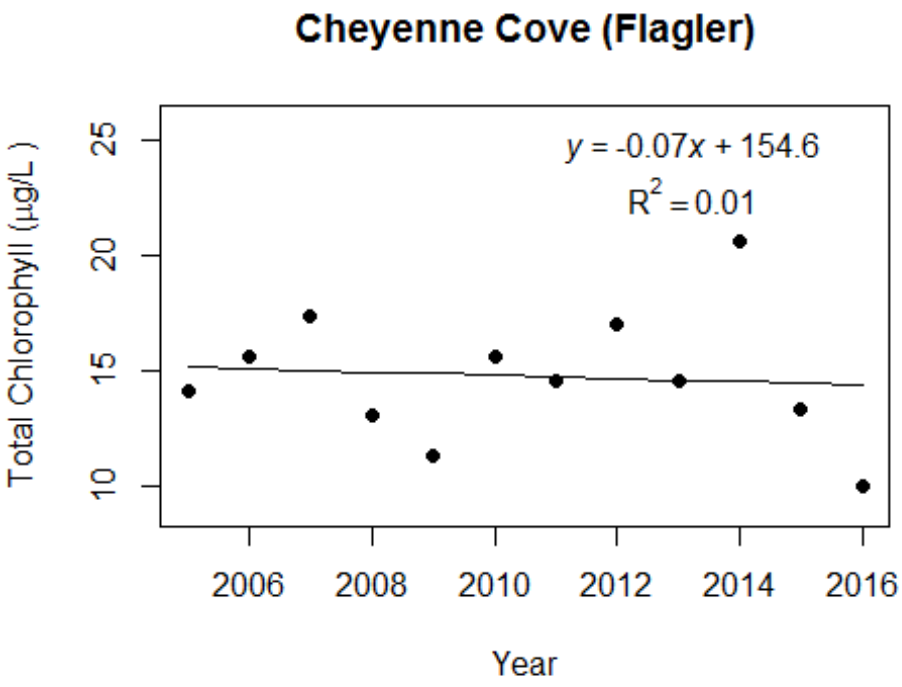
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

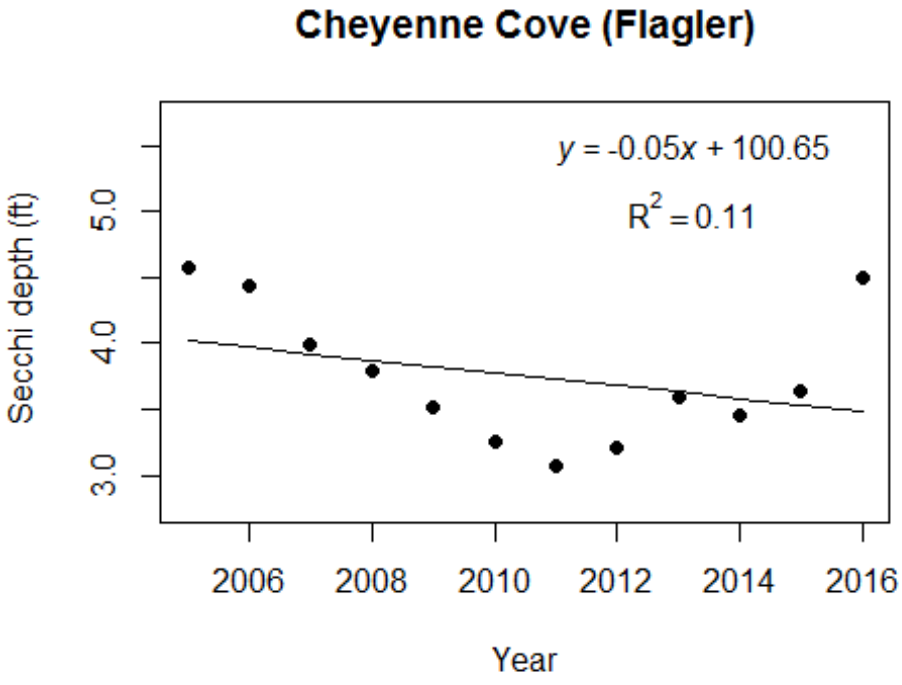
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	12	12	12	12
Intercept (a)	1285	-10829	155	101
Slope (b)	-0.60	5.62	-0.07	-0.05
Coefficient of Determination (R^2)	0.08	0.17	0.01	0.11
Probability of Significance (p)	0.38	0.18	0.78	0.28
Potential Trend	No Trend	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Cheyenne Cove in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Cheyenne Cove (Flagler)
y = -0.6x + 1285.05
R2 = 0.08
Total Phosphorus (µg/L)
50
60
70
80
90
2006
2008
2010
2012
2014
2016
Year


Cheyenne Cove (Flagler)
y = 5.62x + -10828.69
R2 = 0.17
Total Nitrogen (µg/L)
350
450
550
650
2006
2008
2010
2012
2014
2016
Year


Cheyenne Cove (Flagler)
y = -0.07x + 154.6
R2 = 0.01
Total Chlorophyll (µg/L)
10
15
20
25
2006
2008
2010
2012
2014
2016
Year


Cheyenne Cove (Flagler)
y = -0.05x + 100.65
R2 = 0.11
Secchi depth (ft)
3.0
4.0
5.0
2006
2008
2010
2012
2014
2016
Year

LAKEWATCH Report for Dead in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Dead in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Dead
Latitude	29.4084
Longitude	-81.4359
Water Body Type	Lake
Surface Area (ha and acre)	162 ha or 398 acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2007 to 2010
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	219 (180 to 260)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1837 (1804 to 1923)

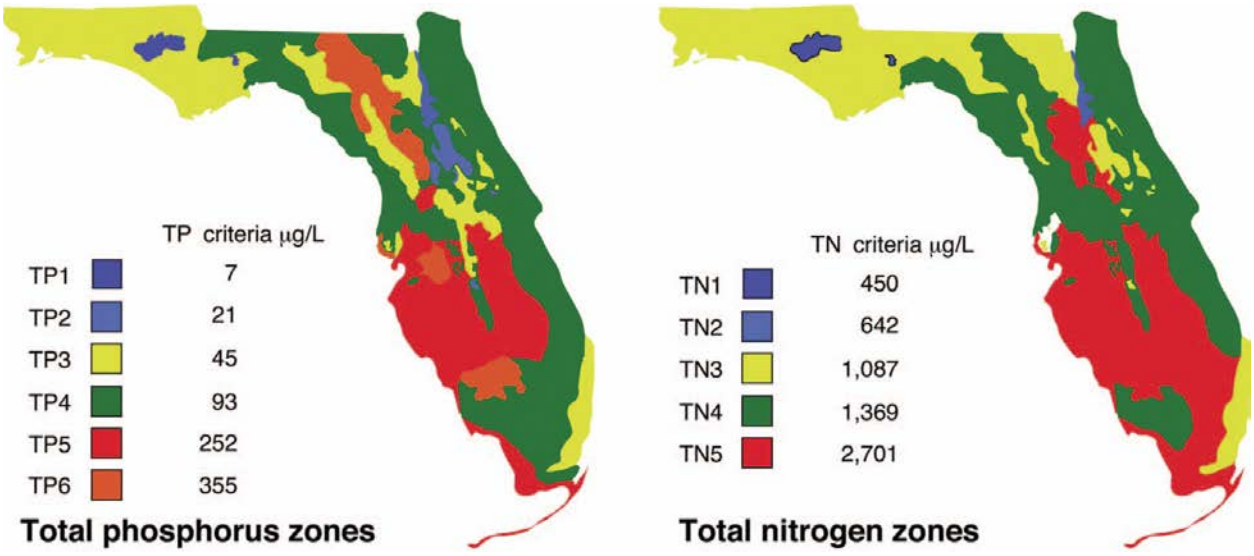


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Dead in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Dead in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	180 - 260	219 (4)
Total Nitrogen (µg/L)	1804 - 1923	1837 (4)
Chlorophyll- uncorrected (µg/L)	8.3 - 64.3	35.5 (4)
Secchi (ft)	1.3 - 1.9	1.6 (4)
Secchi (m)	0.4 - 0.6	0.5 (4)
Color (Pt-Co Units)	107 - 306	196 (3)
Specific Conductance (µS/cm@25 C)	681 - 880	754 (3)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Dead in Flagler County
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Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Dead in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Disston in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Disston in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Disston
Latitude	29.2828
Longitude	-81.3989
Water Body Type	Lake
Surface Area (ha and acre)	1060 ha or 2619 acre
Mean Depth (m and ft)	2.6 m or 8.4 ft
Period of Record (year)	1992 to 2016
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	32 (23 to 47)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1391 (966 to 2629)

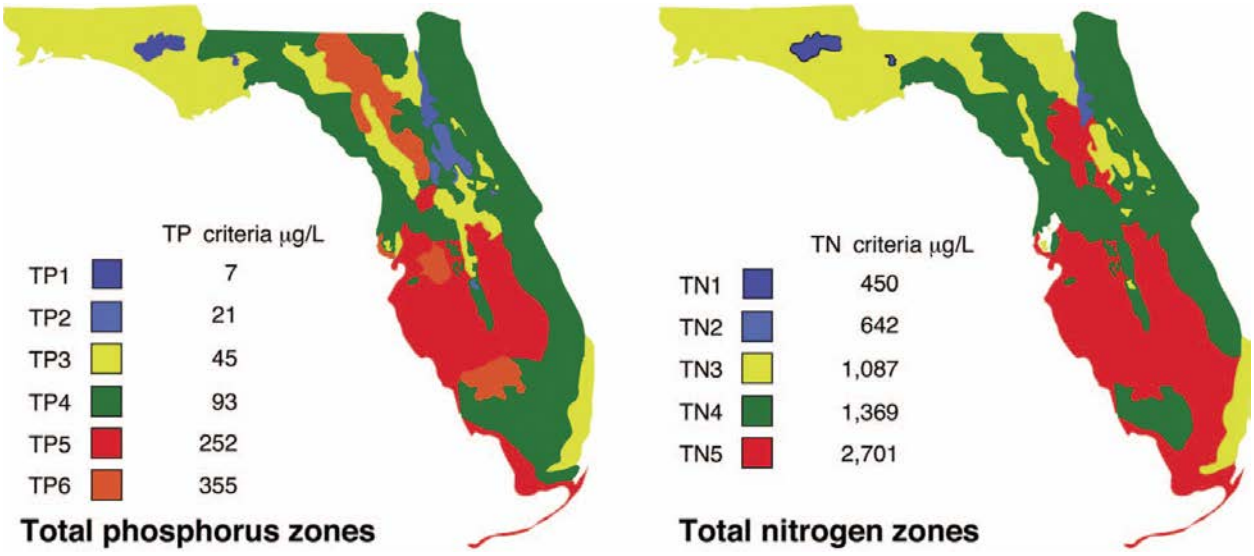


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Disston in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Disston in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	23 - 47	32 (25)
Total Nitrogen (µg/L)	966 - 2629	1391 (25)
Chlorophyll- uncorrected (µg/L)	1.1 - 8.4	3.9 (25)
Secchi (ft)	0.9 - 2.0	1.4 (25)
Secchi (m)	0.3 - 0.6	0.4 (25)
Color (Pt-Co Units)	149 - 617	360 (16)
Specific Conductance (µS/cm@25 C)	86 - 145	109 (10)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Disston in Flagler County
Using Data Downloaded 10/17/2016

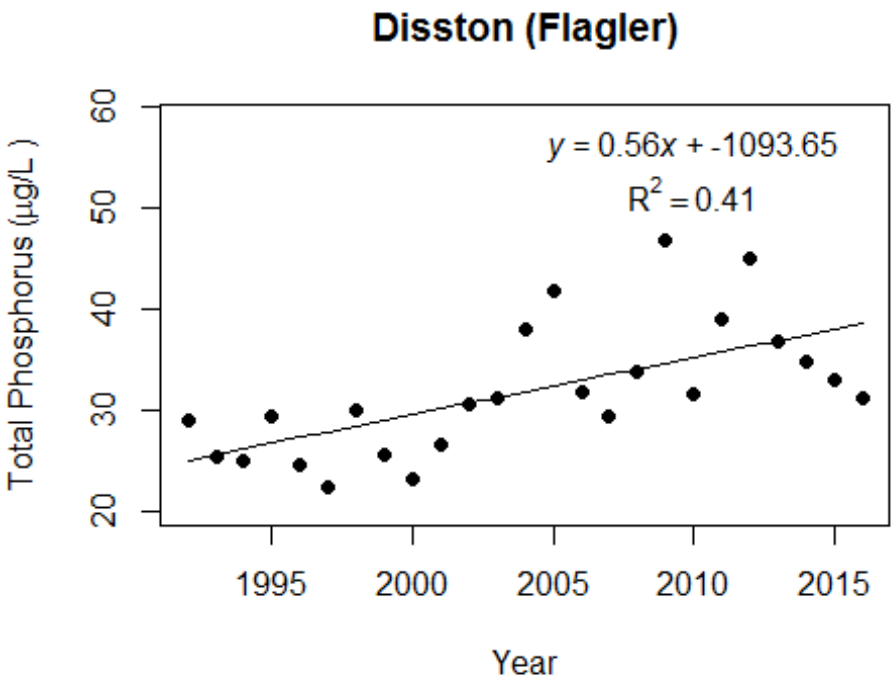
Trend Analyses Lakes

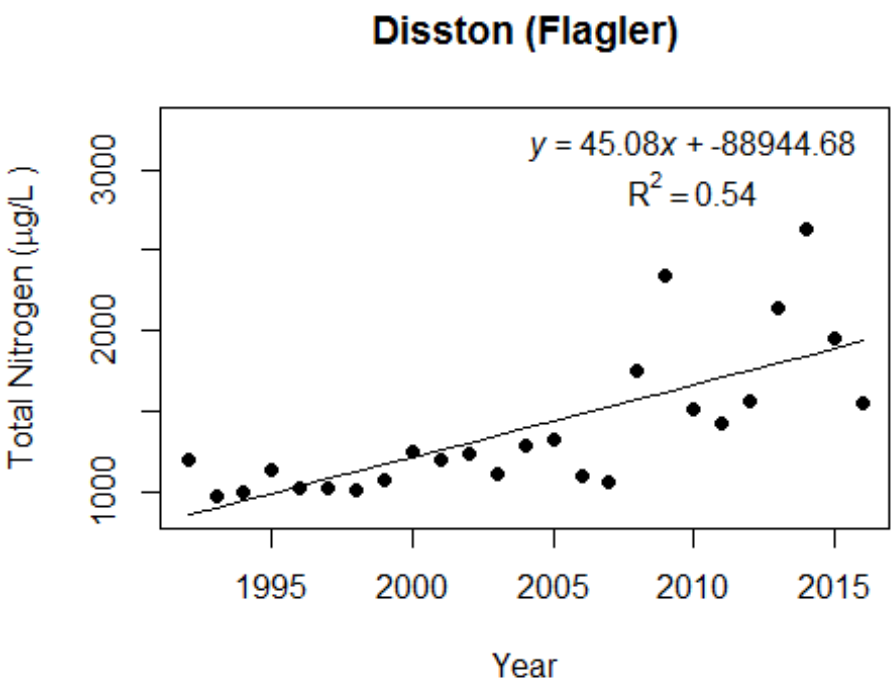
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

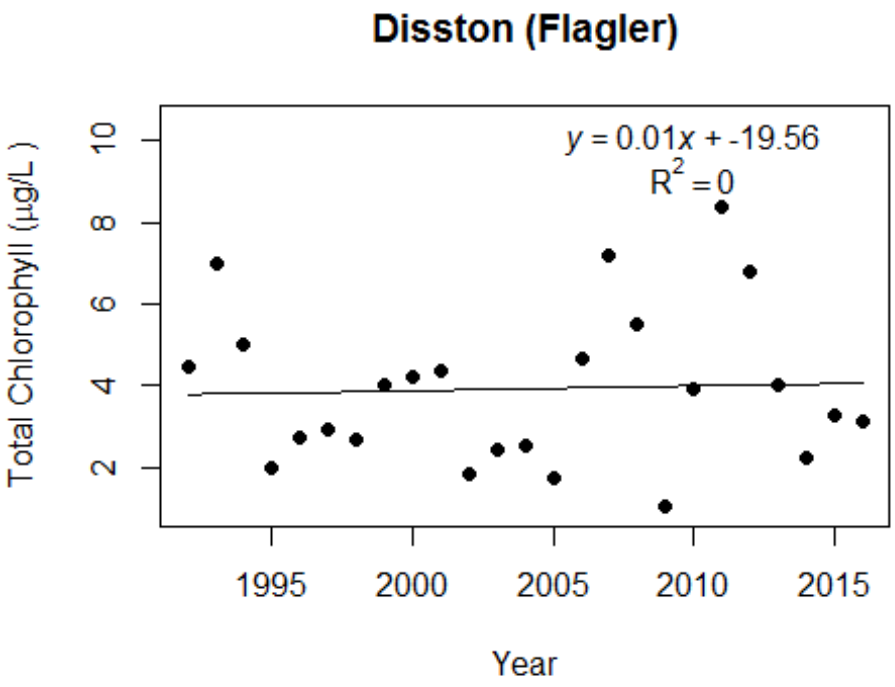
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

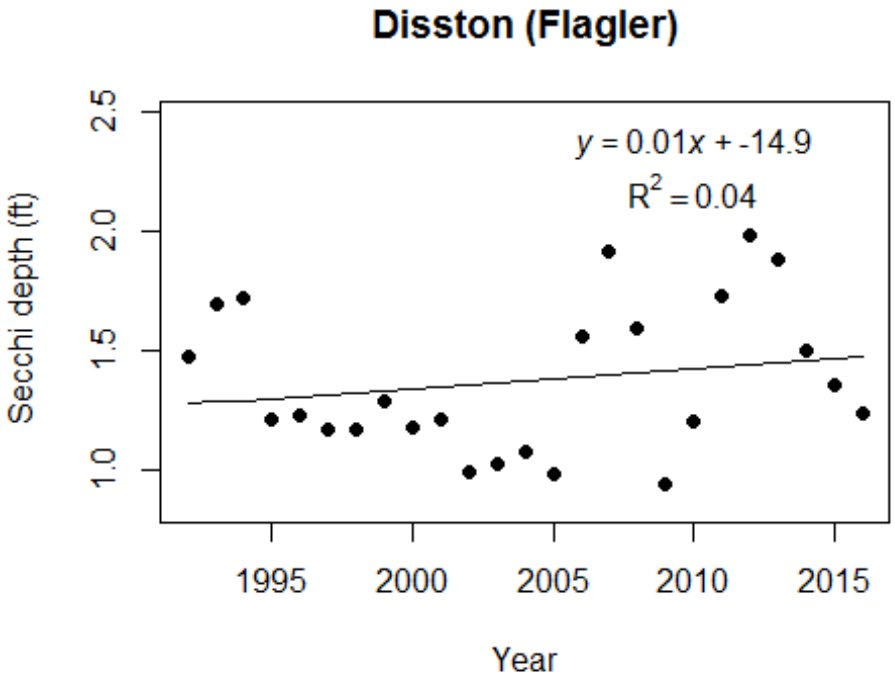
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	25	25	25	25
Intercept (a)	-1094	-88945	-20	-15
Slope (b)	0.56	45.08	0.01	0.01
Coefficient of Determination (R^2)	0.41	0.54	0.00	0.04
Probability of Significance (p)	0.00	0.00	0.83	0.36
Potential Trend	Increasing	Increasing	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Disston in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Disston (Flagler)
y = 0.56x + -1093.65
R2 = 0.41
Total Phosphorus (µg/L)
20
30
40
50
60
1995
2000
2005
2010
2015
Year


Disston (Flagler)
y = 45.08x + -88944.68
R2 = 0.54
Total Nitrogen (µg/L)
1000
2000
3000
1995
2000
2005
2010
2015
Year


Disston (Flagler)
y = 0.01x + -19.56
R2 = 0
Total Chlorophyll (µg/L)
2
4
6
8
10
1995
2000
2005
2010
2015
Year


Disston (Flagler)
y = 0.01x + -14.9
R2 = 0.04
Secchi depth (ft)
1.0
1.5
2.0
2.5
1995
2000
2005
2010
2015
Year

LAKEWATCH Report for Emerald in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Emerald in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Emerald
Latitude	29.5207
Longitude	-81.161
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2012 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Hypereutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	76 (53 to 106)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1750 (1409 to 2303)

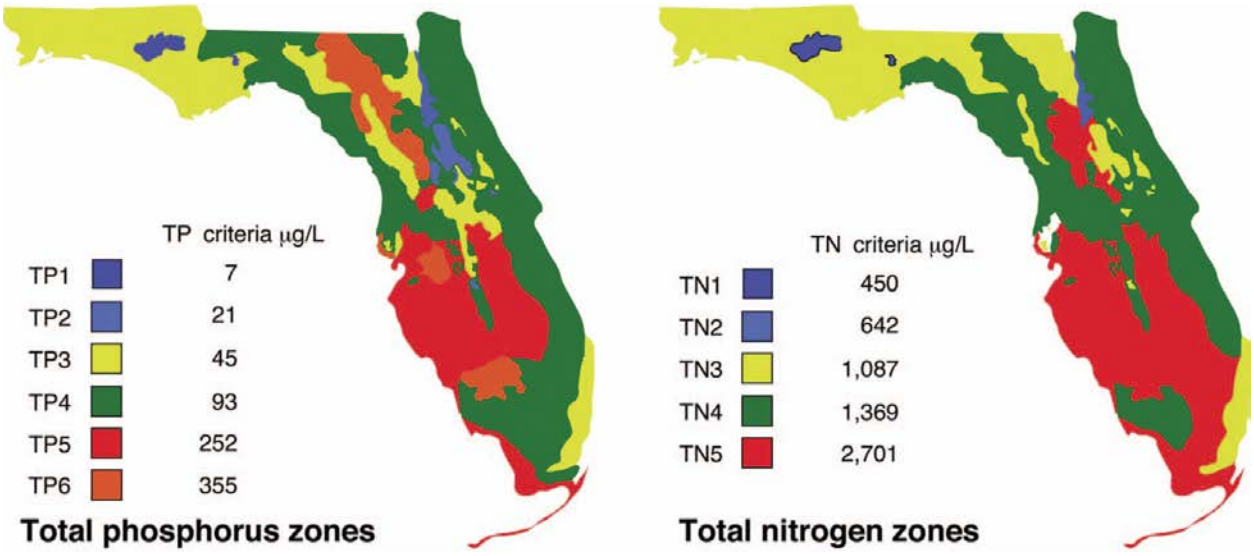


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Emerald in Flagler County
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FDEP Nutrient Criteria Lakes

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

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Long-Term Data Summary Lakes: Definitions

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- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
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- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Emerald in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	53 - 106	76 (5)
Total Nitrogen (µg/L)	1409 - 2303	1750 (5)
Chlorophyll- uncorrected (µg/L)	49.0 - 82.8	69.7 (5)
Secchi (ft)	1.4 - 2.3	1.9 (5)
Secchi (m)	0.4 - 0.7	0.6 (5)
Color (Pt-Co Units)	23 - 29	26 (5)
Specific Conductance (µS/cm@25 C)	504 - 554	524 (5)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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.

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LAKEWATCH Report for Emerald in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

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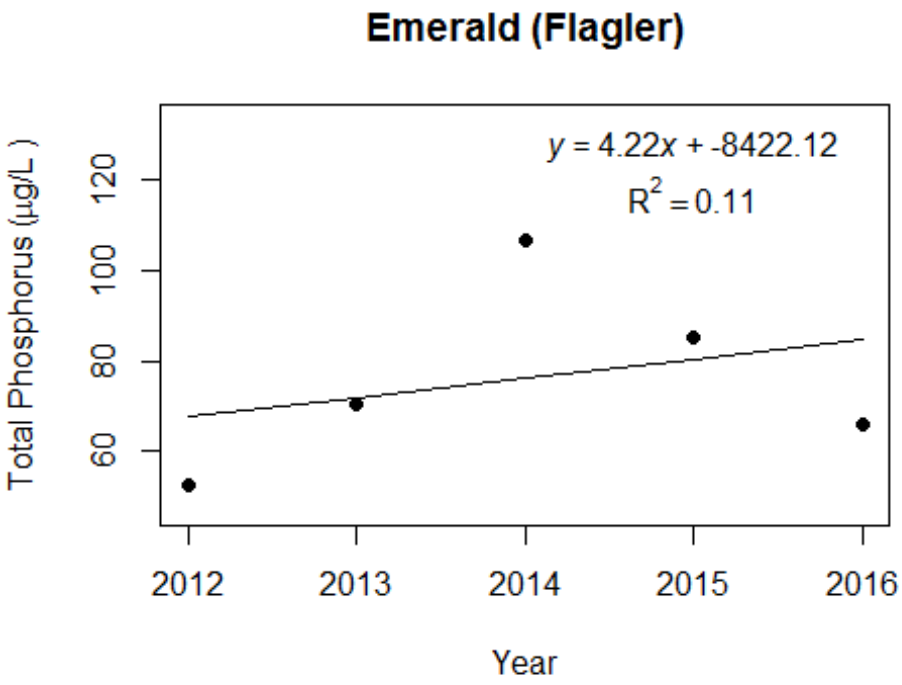
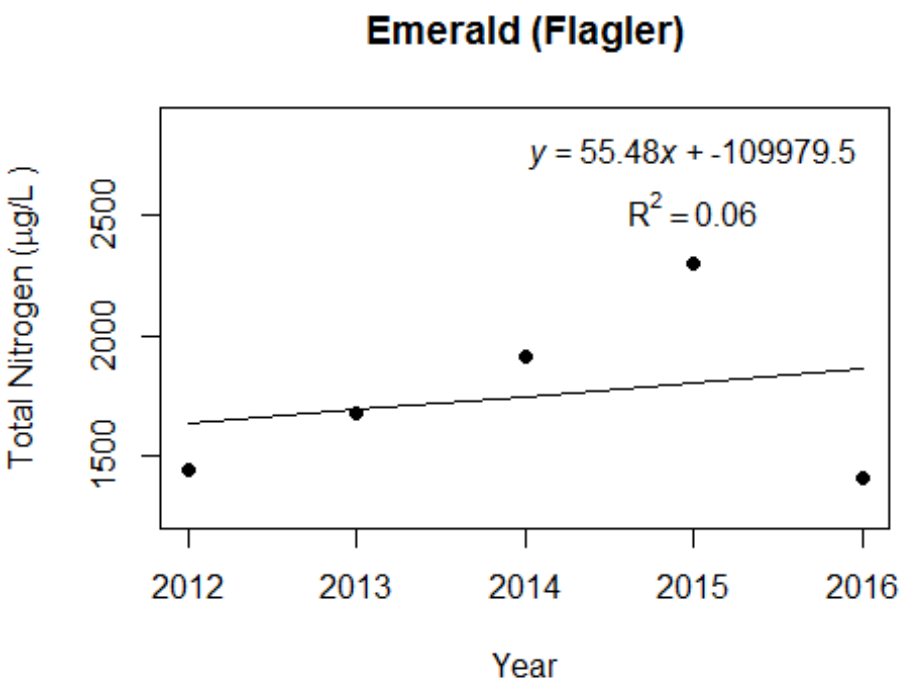
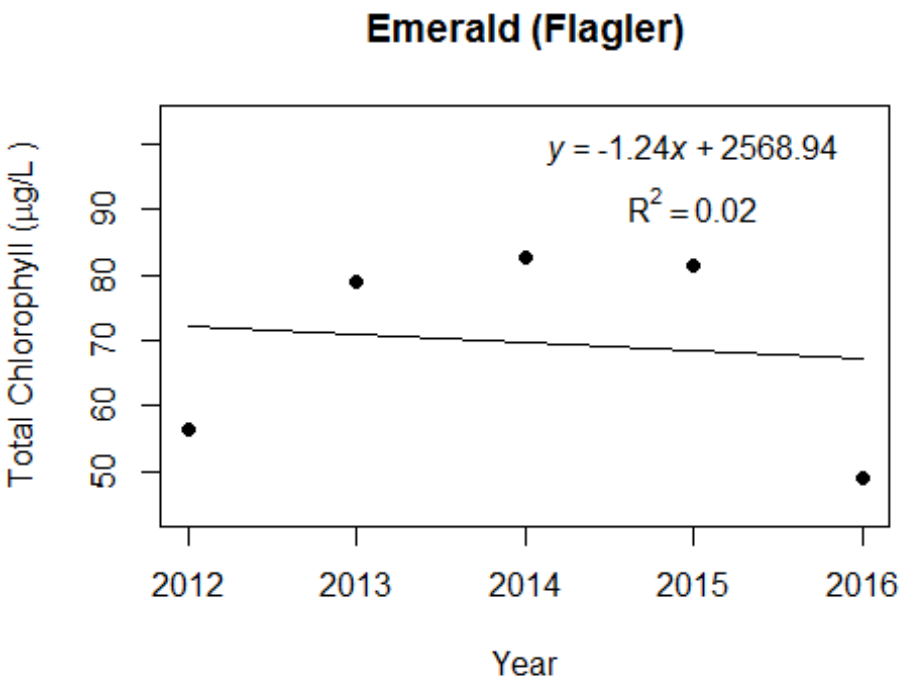
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

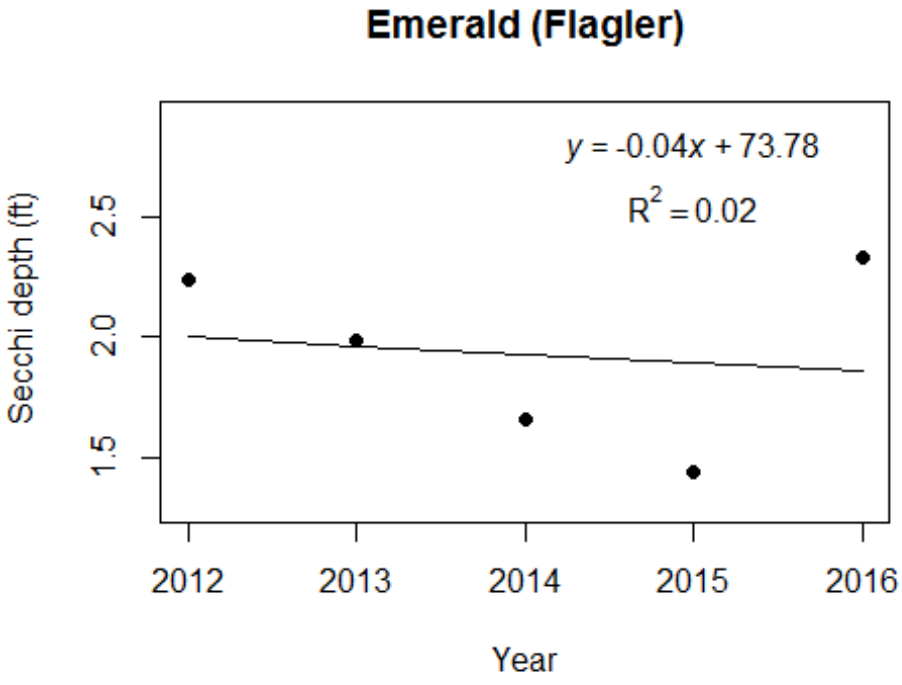
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	5	5	5	5
Intercept (a)	-8422	-109980	2569	74
Slope (b)	4.22	55.48	-1.24	-0.04
Coefficient of Determination (R^2)	0.11	0.06	0.02	0.02
Probability of Significance (p)	0.59	0.70	0.84	0.81
Potential Trend	No Trend	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Emerald in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Emerald (Flagler)
y = 4.22x + -8422.12
R2 = 0.11
Total Phosphorus (µg/L)
60
80
100
120
2012
2013
2014
2015
2016
Year


Emerald (Flagler)
y = 55.48x + -109979.5
R2 = 0.06
Total Nitrogen (µg/L)
1500
2000
2500
2012
2013
2014
2015
2016
Year


Emerald (Flagler)
y = -1.24x + 2568.94
R2 = 0.02
Total Chlorophyll (µg/L)
50
60
70
80
90
2012
2013
2014
2015
2016
Year


Emerald (Flagler)
y = -0.04x + 73.78
R2 = 0.02
Secchi depth (ft)
1.5
2.0
2.5
2012
2013
2014
2015
2016
Year

LAKEWATCH Report for Gore in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Gore in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Gore
Latitude	29.4625
Longitude	-81.2175
Water Body Type	Lake
Surface Area (ha and acre)	34 ha or 85 acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1994 to 1996
Lake Classification	
Lake Trophic Status (CHL)	Oligotrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	12 (11 to 13)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	657 (590 to 744)

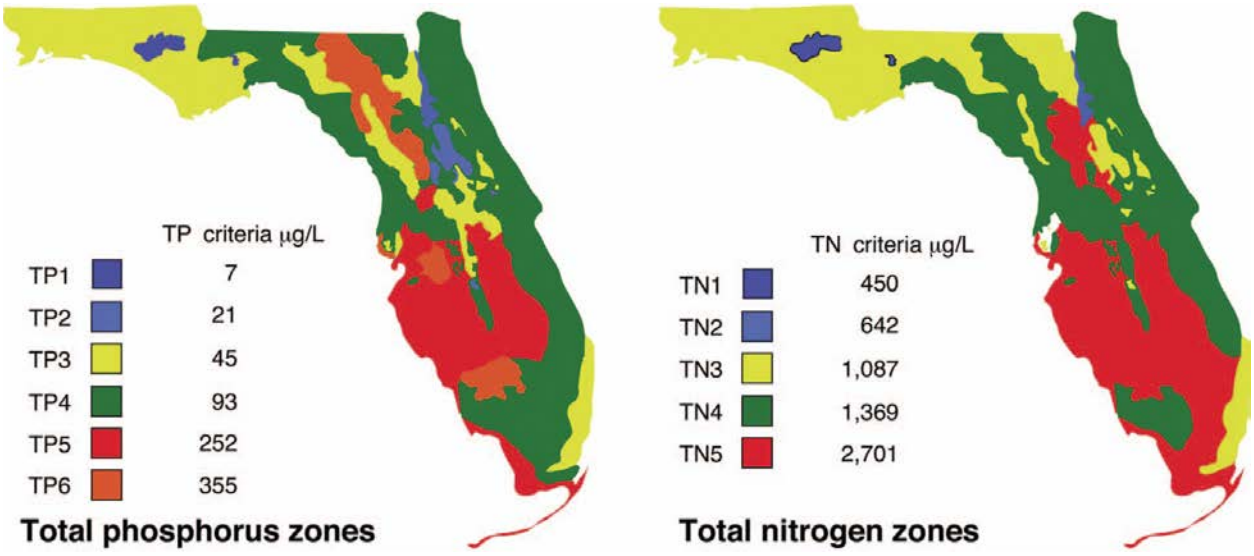


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Gore in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Gore in Flagler County
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Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	11 - 13	12 (3)
Total Nitrogen (µg/L)	590 - 744	657 (3)
Chlorophyll- uncorrected (µg/L)	1.0 - 2.7	1.9 (3)
Secchi (ft)	2.4 - 2.6	2.5 (3)
Secchi (m)	0.7 - 0.8	0.7 (3)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Gore in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Gore in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 1 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 1 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 1
Latitude	
Longitude	
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2008 to 2010
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	47 (46 to 49)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	985 (817 to 1158)

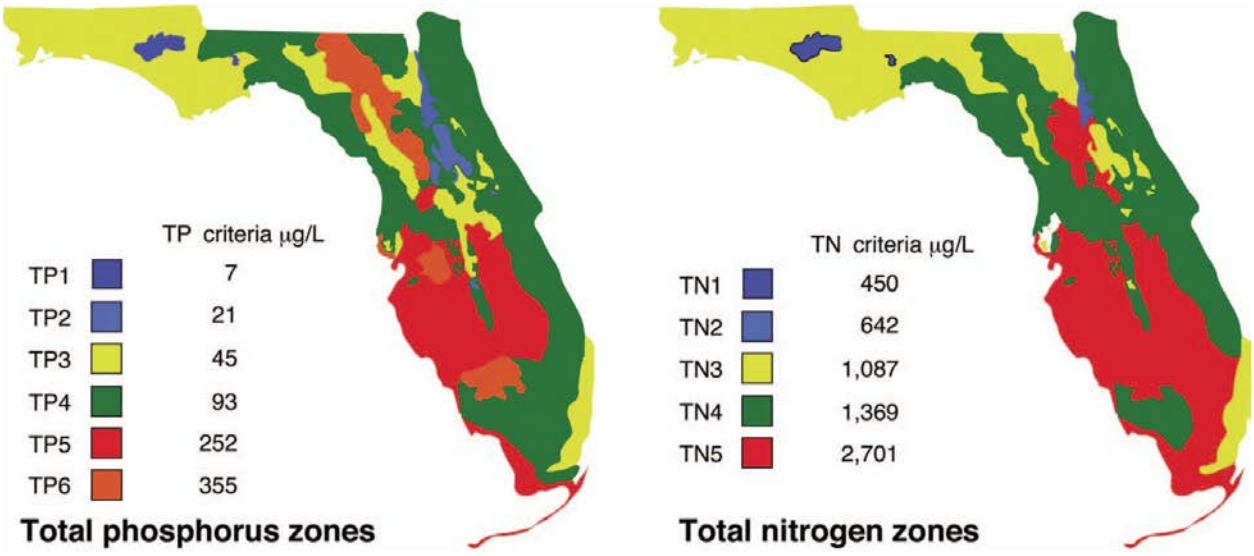

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 1 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 1 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	46 - 49	47 (3)
Total Nitrogen (µg/L)	817 - 1158	985 (3)
Chlorophyll- uncorrected (µg/L)	20.1 - 36.4	27.0 (3)
Secchi (ft)	3.2 - 4.9	4.1 (3)
Secchi (m)	1.0 - 1.5	1.3 (3)
Color (Pt-Co Units)	13 - 32	20 (3)
Specific Conductance (µS/cm@25 C)	339 - 394	369 (3)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 1 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 1 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 12 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 12 in Flagler County
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Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 12
Latitude	29.5337
Longitude	-81.1617
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2013 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	43 (39 to 50)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1018 (950 to 1103)

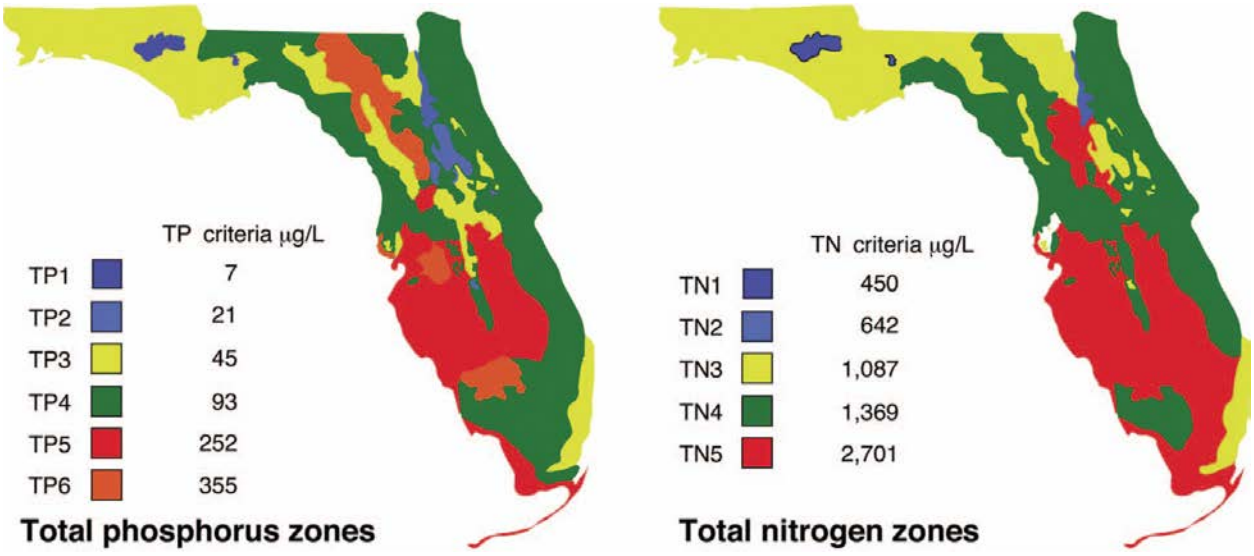

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 12 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 12 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	39 - 50	43 (4)
Total Nitrogen (µg/L)	950 - 1103	1018 (4)
Chlorophyll- uncorrected (µg/L)	13.4 - 38.7	21.3 (4)
Secchi (ft)	2.8 - 4.0	3.6 (4)
Secchi (m)	0.9 - 1.2	1.1 (4)
Color (Pt-Co Units)	14 - 18	15 (4)
Specific Conductance (µS/cm@25 C)	259 - 321	284 (4)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 12 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 12 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 13 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 13 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 13
Latitude	29.5326
Longitude	-81.1637
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2013 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Hypereutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	58 (43 to 71)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1608 (1139 to 1930)

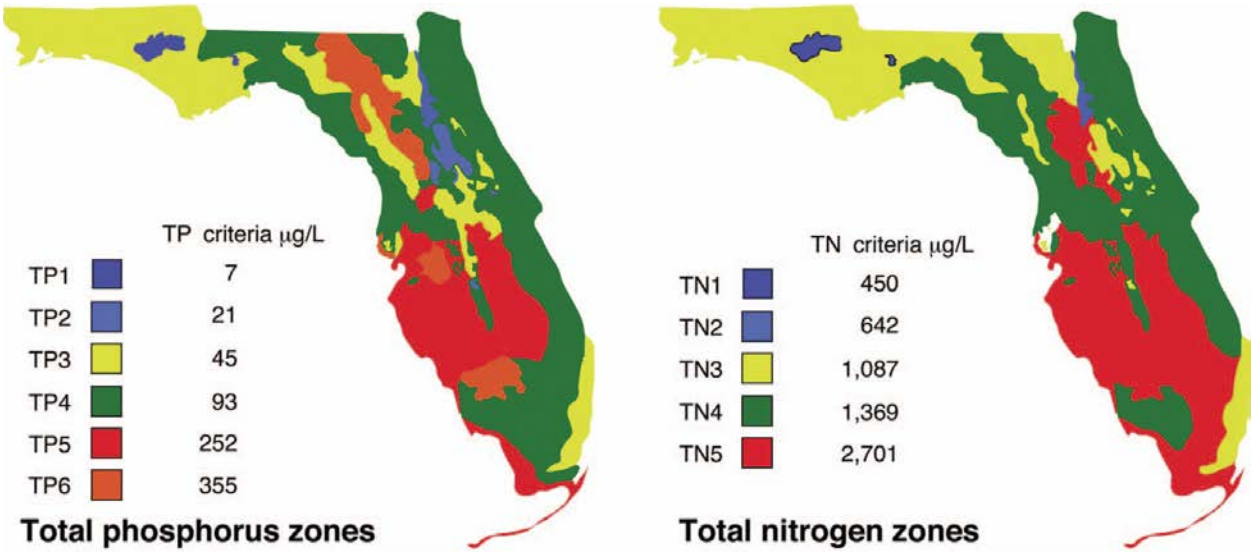

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 13 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 13 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	43 - 71	58 (4)
Total Nitrogen (µg/L)	1139 - 1930	1608 (4)
Chlorophyll- uncorrected (µg/L)	22.9 - 62.3	45.1 (4)
Secchi (ft)	1.6 - 3.0	2.2 (4)
Secchi (m)	0.5 - 0.9	0.7 (4)
Color (Pt-Co Units)	25 - 37	31 (4)
Specific Conductance (µS/cm@25 C)	325 - 363	344 (4)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 13 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 13 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 18A in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 18A in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 18A
Latitude	29.5236
Longitude	-81.1642
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2008 to 2010
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	54 (43 to 63)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	897 (767 to 1091)

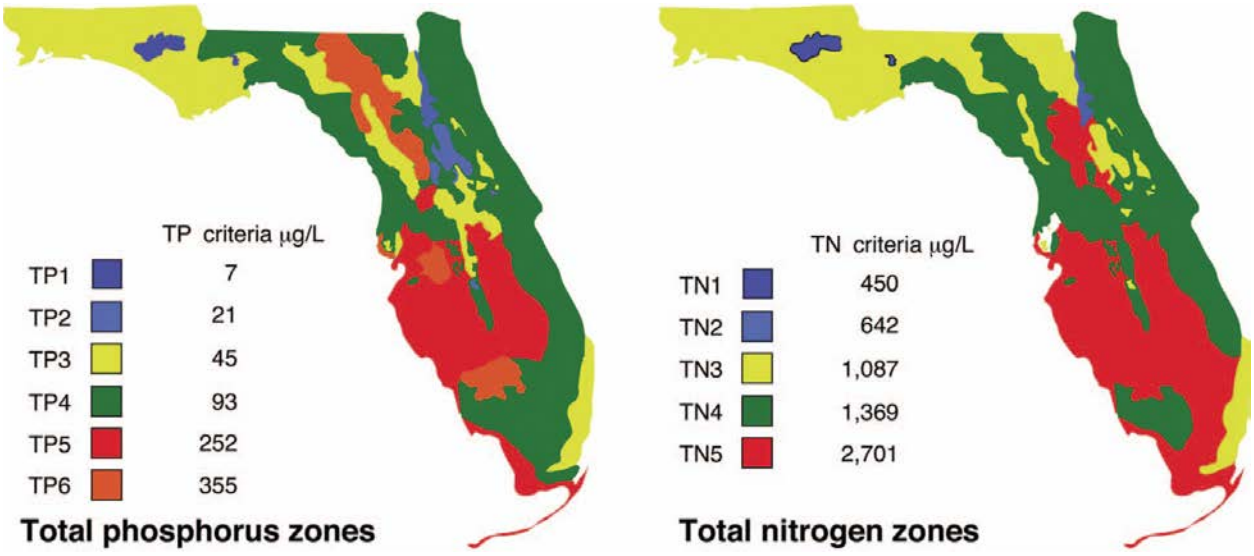

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 18A in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

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- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 18A in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	43 - 63	54 (3)
Total Nitrogen (µg/L)	767 - 1091	897 (3)
Chlorophyll- uncorrected (µg/L)	11.7 - 27.9	17.6 (3)
Secchi (ft)	2.9 - 4.4	3.8 (3)
Secchi (m)	0.9 - 1.3	1.2 (3)
Color (Pt-Co Units)	21 - 33	26 (3)
Specific Conductance (µS/cm@25 C)	339 - 417	379 (3)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 18A in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

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- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
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- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 18A in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 28 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
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- **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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 28 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 28
Latitude	29.5566
Longitude	-81.1734
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2008 to 2016
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	33 (22 to 42)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	775 (646 to 1035)

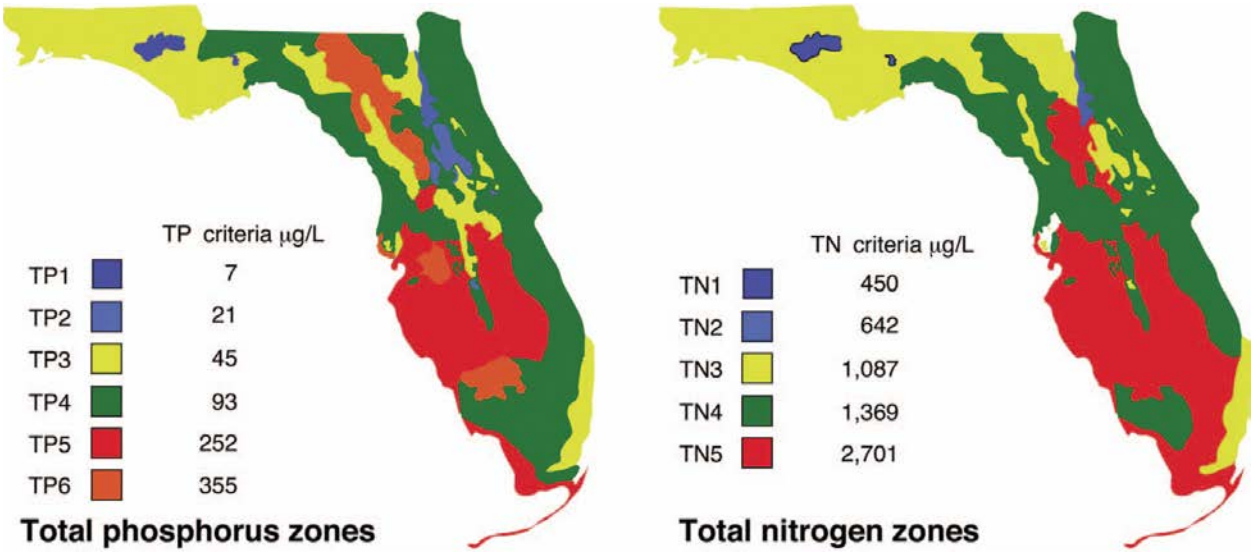

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 28 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
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- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 28 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	22 - 42	33 (7)
Total Nitrogen (µg/L)	646 - 1035	775 (7)
Chlorophyll- uncorrected (µg/L)	9.7 - 20.1	15.2 (7)
Secchi (ft)	3.9 - 6.2	4.8 (7)
Secchi (m)	1.2 - 1.9	1.5 (7)
Color (Pt-Co Units)	20 - 35	27 (7)
Specific Conductance (µS/cm@25 C)	259 - 324	284 (7)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 28 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

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- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	7	7	7	7
Intercept (a)	-2216	-51559	-1396	403
Slope (b)	1.12	26.01	0.70	-0.20
Coefficient of Determination (R^2)	0.28	0.37	0.31	0.58
Probability of Significance (p)	0.22	0.15	0.20	0.05
Potential Trend	No Trend	No Trend	No Trend	Decreasing

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 28 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 4 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 4 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 4
Latitude	29.5488
Longitude	-81.169
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2013 to 2016
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	44 (36 to 61)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1051 (943 to 1271)

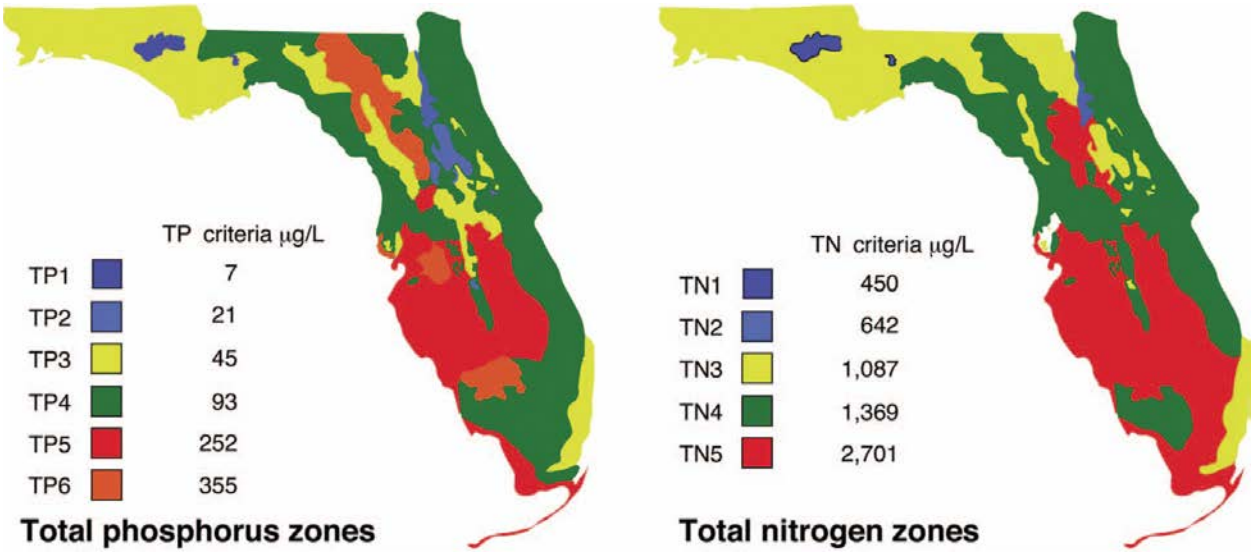


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 4 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 4 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	36 - 61	44 (4)
Total Nitrogen (µg/L)	943 - 1271	1051 (4)
Chlorophyll- uncorrected (µg/L)	8.6 - 45.1	19.9 (4)
Secchi (ft)	3.9 - 5.8	5.0 (4)
Secchi (m)	1.2 - 1.8	1.5 (4)
Color (Pt-Co Units)	36 - 46	41 (4)
Specific Conductance (µS/cm@25 C)	454 - 546	500 (4)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 4 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 4 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven 5 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven 5 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven 5
Latitude	29.5443
Longitude	-81.1669
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2008 to 2010
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	61 (43 to 70)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1414 (1287 to 1495)

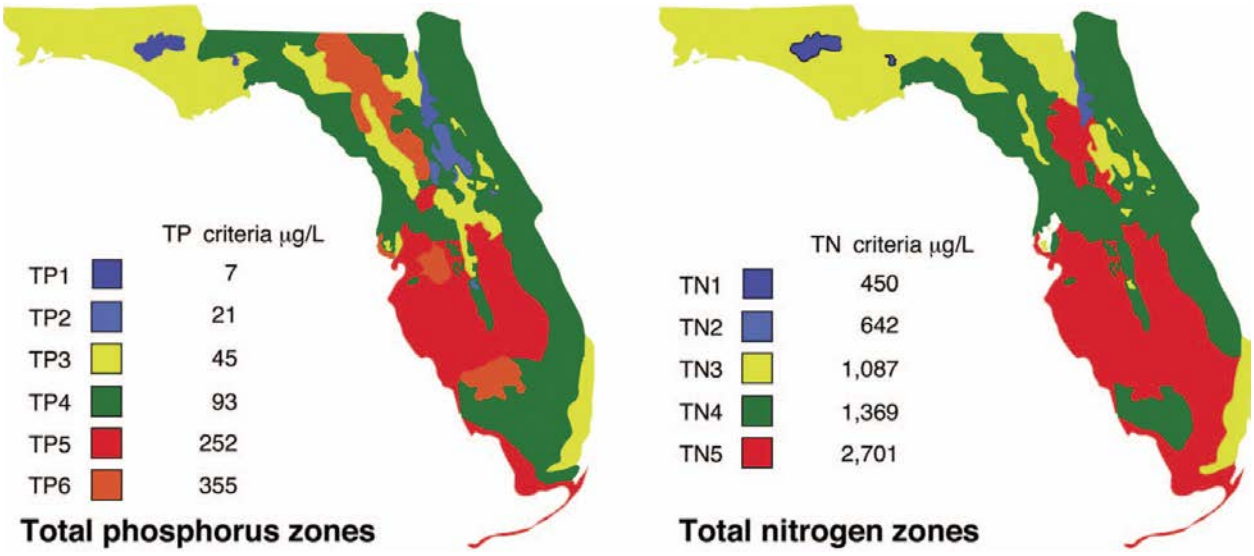


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven 5 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven 5 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	43 - 70	61 (3)
Total Nitrogen (µg/L)	1287 - 1495	1414 (3)
Chlorophyll- uncorrected (µg/L)	14.8 - 38.0	25.6 (3)
Secchi (ft)	4.2 - 4.3	4.2 (3)
Secchi (m)	1.3 - 1.3	1.3 (3)
Color (Pt-Co Units)	46 - 64	55 (3)
Specific Conductance (µS/cm@25 C)	492 - 582	540 (3)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven 5 in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven 5 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Grand Haven W6 in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Grand Haven W6 in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Grand Haven W6
Latitude	29.5471
Longitude	-81.1899
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2008 to 2016
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	241 (166 to 281)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1016 (864 to 1256)

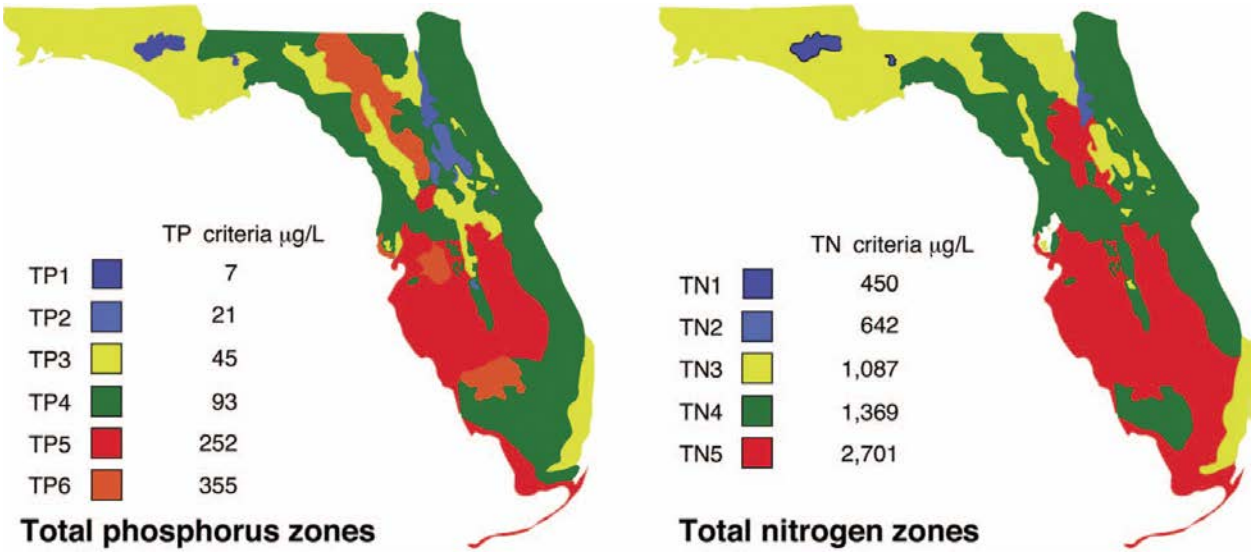


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Grand Haven W6 in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Grand Haven W6 in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	166 - 281	241 (7)
Total Nitrogen (µg/L)	864 - 1256	1016 (7)
Chlorophyll- uncorrected (µg/L)	7.8 - 18.1	13.1 (7)
Secchi (ft)	3.2 - 4.3	3.7 (7)
Secchi (m)	1.0 - 1.3	1.1 (7)
Color (Pt-Co Units)	31 - 150	86 (7)
Specific Conductance (µS/cm@25 C)	390 - 13509	3730 (7)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Grand Haven W6 in Flagler County
Using Data Downloaded 10/17/2016

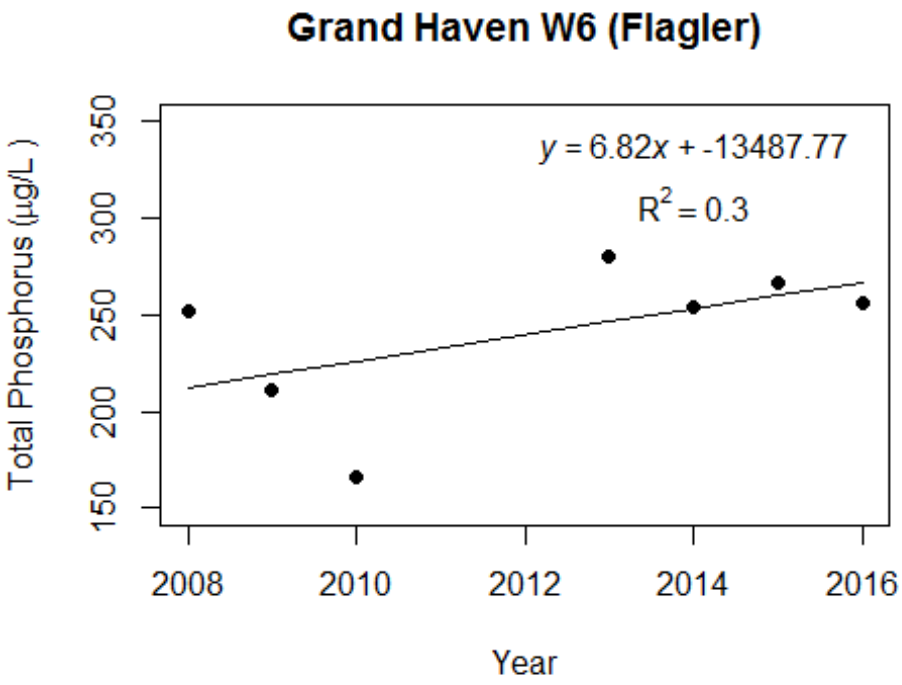
Trend Analyses Lakes

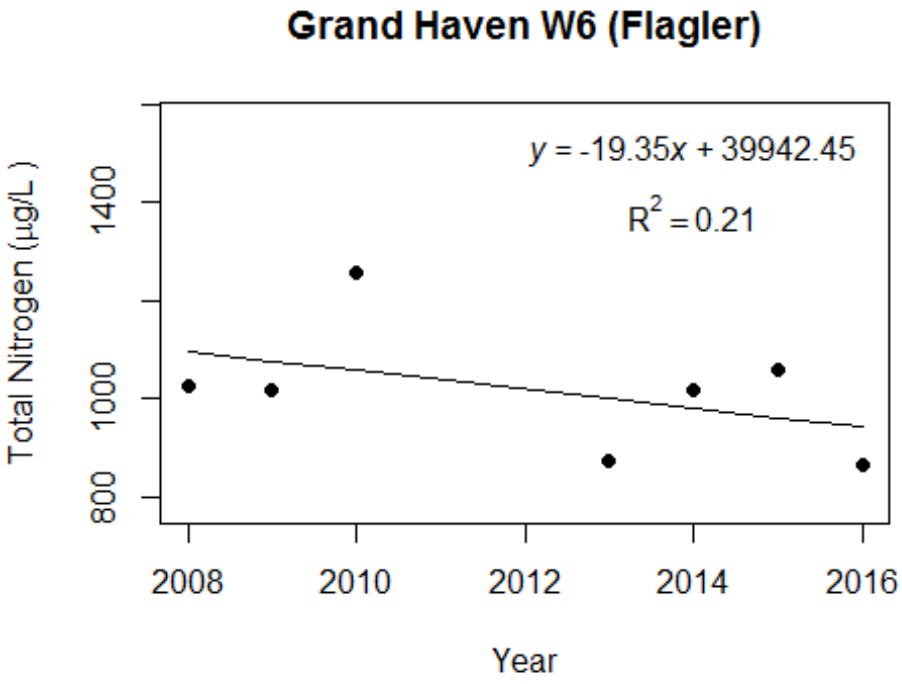
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

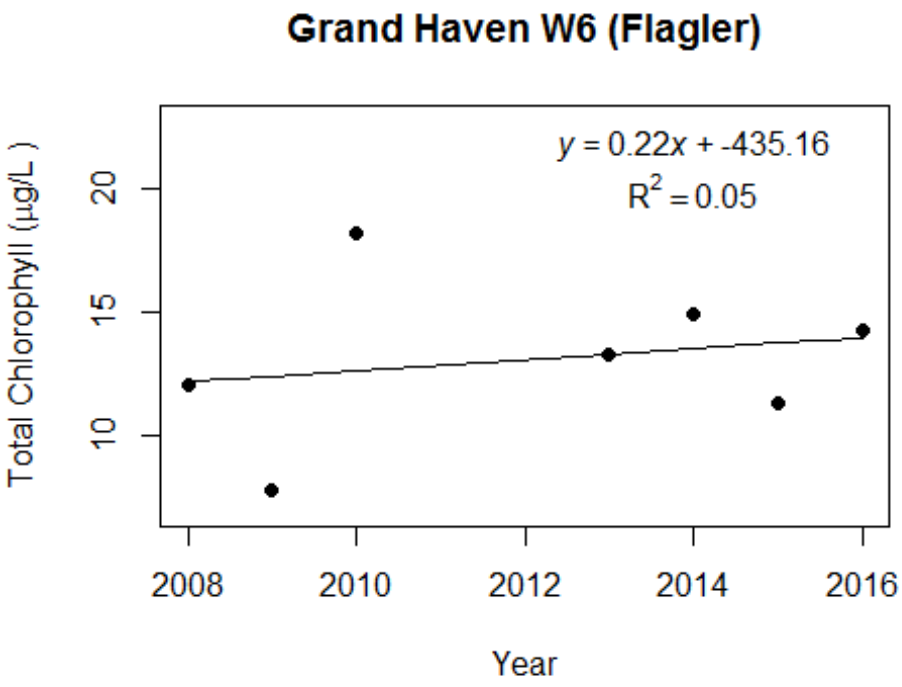
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

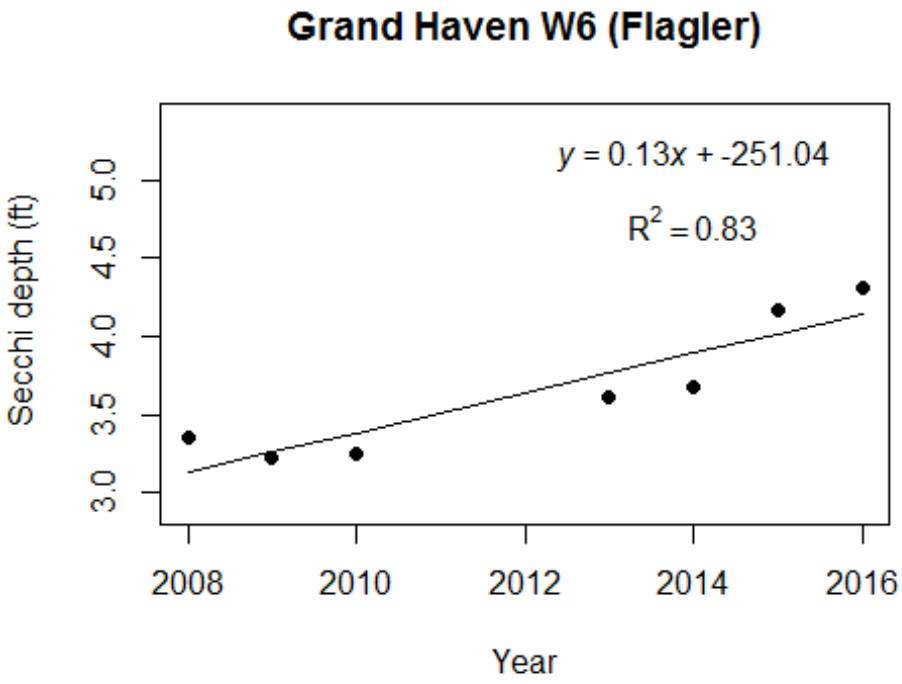
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	7	7	7	7
Intercept (a)	-13488	39942	-435	-251
Slope (b)	6.82	-19.35	0.22	0.13
Coefficient of Determination (R^2)	0.30	0.21	0.05	0.83
Probability of Significance (p)	0.21	0.30	0.64	0.00
Potential Trend	No Trend	No Trend	No Trend	Increasing

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Grand Haven W6 in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Grand Haven W6 (Flagler)
y = 6.82x + -13487.77
R2 = 0.3
Total Phosphorus (µg/L)
150
200
250
300
350
2008
2010
2012
2014
2016
Year


Grand Haven W6 (Flagler)
y = -19.35x + 39942.45
R2 = 0.21
Total Nitrogen (µg/L)
800
1000
1400
2008
2010
2012
2014
2016
Year


Grand Haven W6 (Flagler)
y = 0.22x + -435.16
R2 = 0.05
Total Chlorophyll (µg/L)
10
15
20
2008
2010
2012
2014
2016
Year


Grand Haven W6 (Flagler)
y = 0.13x + -251.04
R2 = 0.83
Secchi depth (ft)
3.0
3.5
4.0
4.5
5.0
2008
2010
2012
2014
2016
Year

LAKEWATCH Report for Lakeside in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Lakeside in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Lakeside
Latitude	29.6523
Longitude	-81.2081
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1998 to 1999
Lake Classification	
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	21 (16 to 25)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	677 (672 to 682)

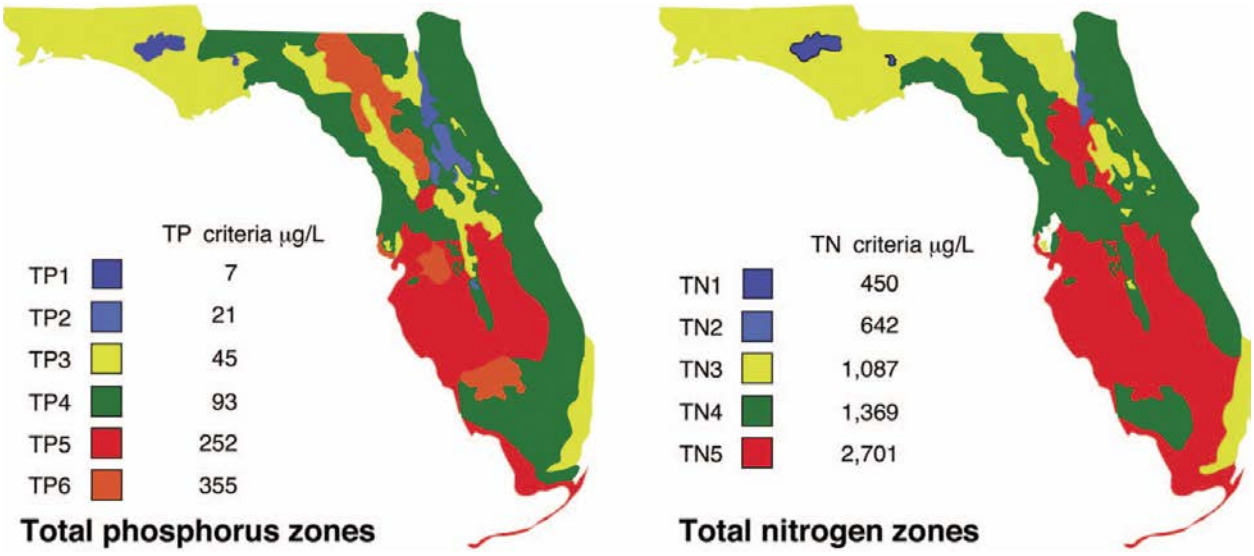


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Lakeside in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Lakeside in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	16 - 25	21 (2)
Total Nitrogen (µg/L)	672 - 682	677 (2)
Chlorophyll- uncorrected (µg/L)	3.1 - 7.3	5.2 (2)
Secchi (ft)	5.0 - 5.3	5.2 (2)
Secchi (m)	1.5 - 1.6	1.6 (2)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Lakeside in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Lakeside in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Medford in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Medford in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Medford
Latitude	29.6243
Longitude	-81.1974
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2002 to 2014
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	62 (38 to 114)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1552 (1060 to 2512)

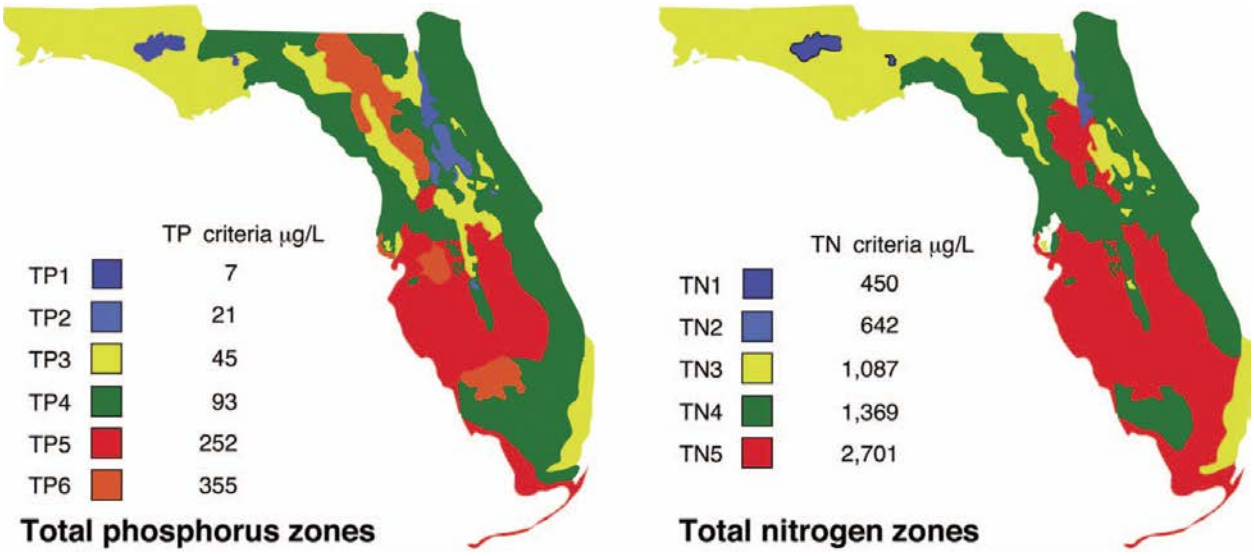


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Medford in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Medford in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	38 - 114	62 (13)
Total Nitrogen (µg/L)	1060 - 2512	1552 (13)
Chlorophyll- uncorrected (µg/L)	9.0 - 51.0	21.6 (13)
Secchi (ft)	1.5 - 3.3	2.5 (13)
Secchi (m)	0.5 - 1.0	0.8 (13)
Color (Pt-Co Units)	43 - 76	55 (12)
Specific Conductance (µS/cm@25 C)	334 - 534	448 (7)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Medford in Flagler County
Using Data Downloaded 10/17/2016

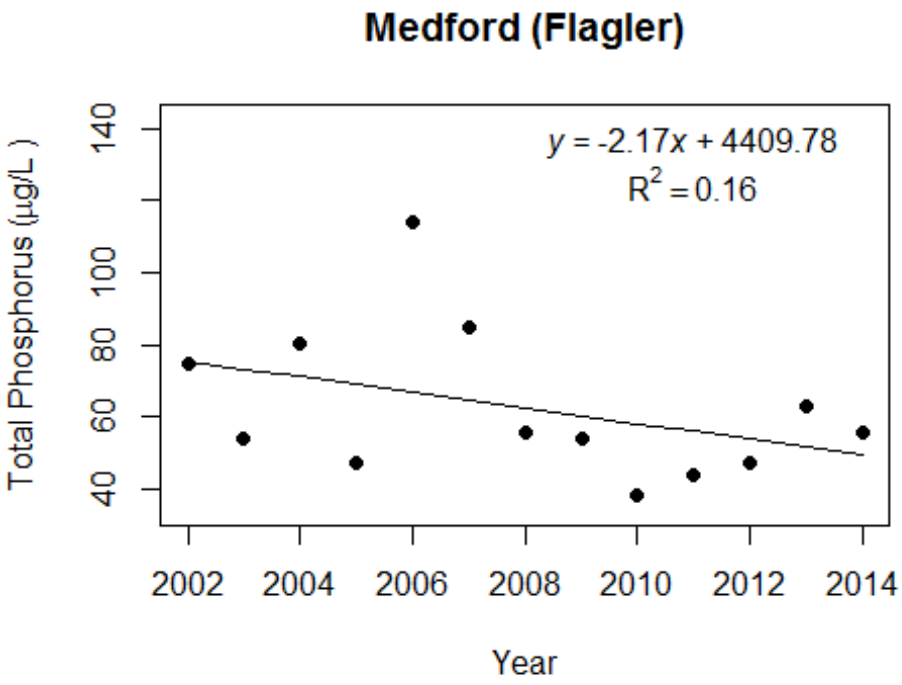
Trend Analyses Lakes

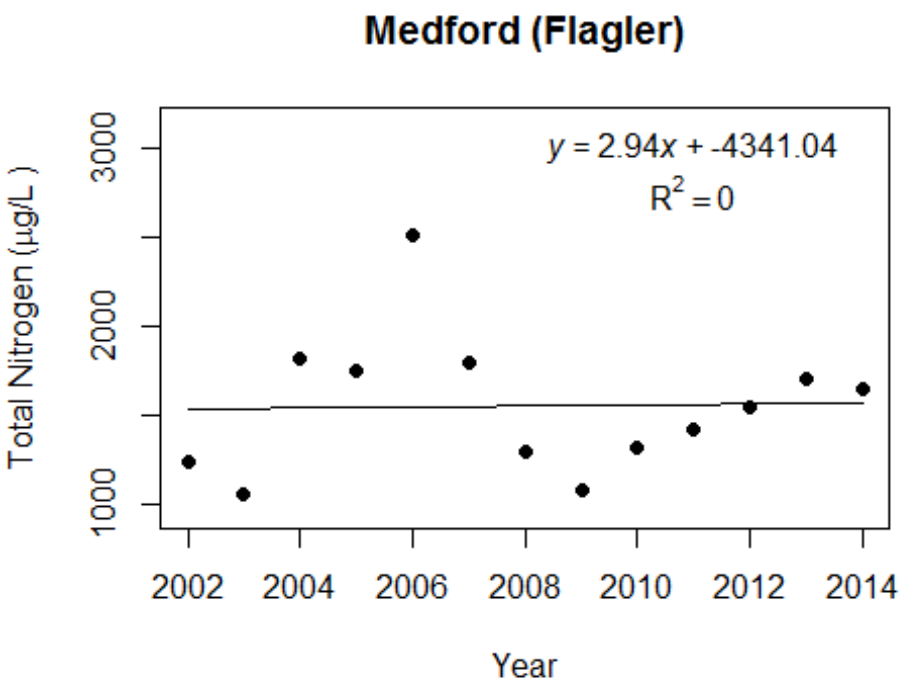
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

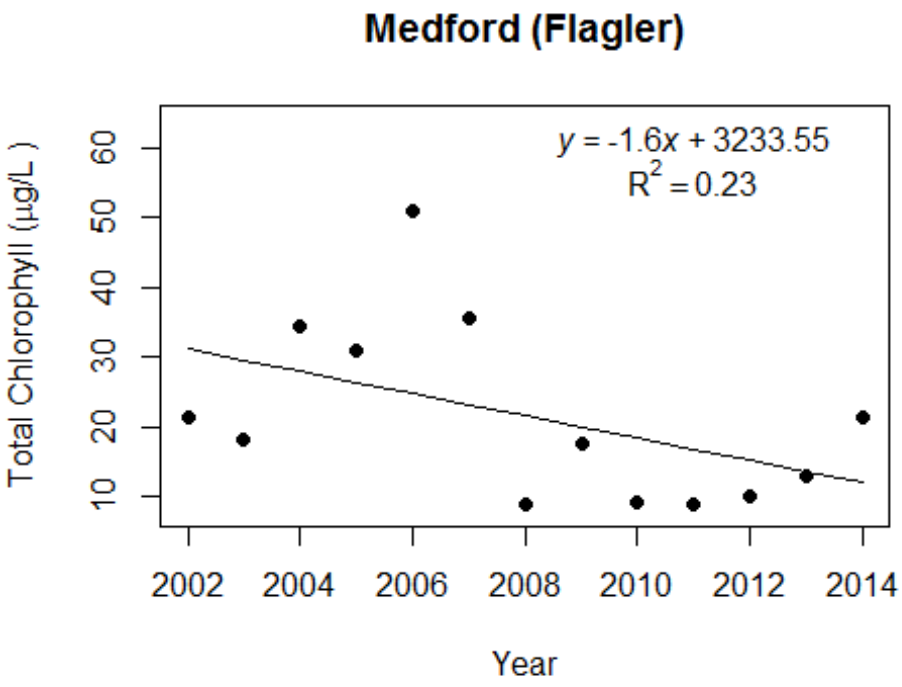
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

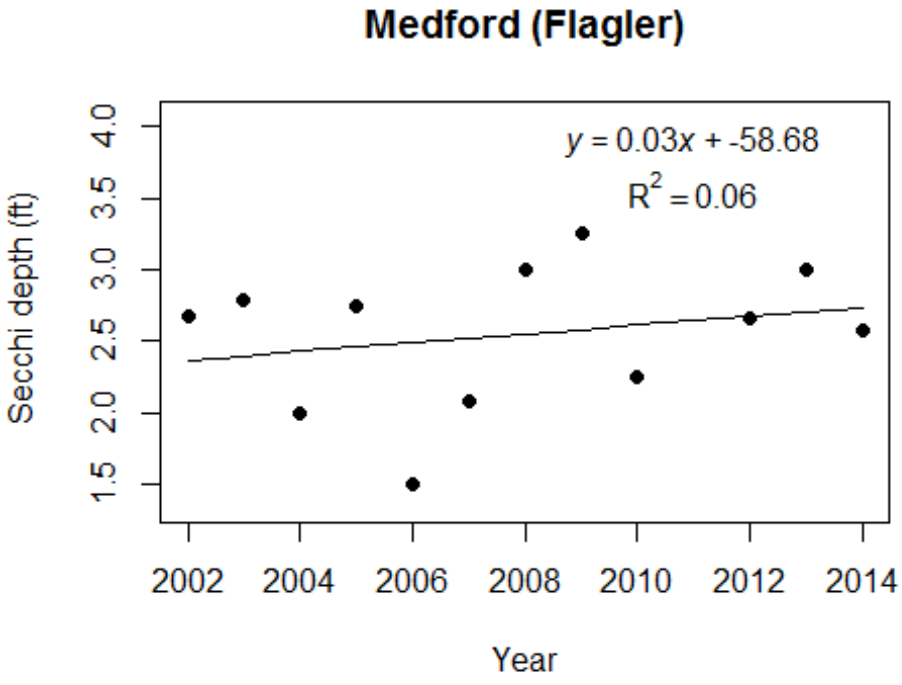
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	13	13	13	13
Intercept (a)	4410	-4341	3234	-59
Slope (b)	-2.17	2.94	-1.60	0.03
Coefficient of Determination (R^2)	0.16	0.00	0.23	0.06
Probability of Significance (p)	0.17	0.92	0.10	0.45
Potential Trend	No Trend	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Medford in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Medford (Flagler)
y = -2.17x + 4409.78
R2 = 0.16
Total Phosphorus (µg/L)
40
60
80
100
140
2002
2004
2006
2008
2010
2012
2014
Year


Medford (Flagler)
y = 2.94x + -4341.04
R2 = 0
Total Nitrogen (µg/L)
1000
2000
3000
2002
2004
2006
2008
2010
2012
2014
Year


Medford (Flagler)
y = -1.6x + 3233.55
R2 = 0.23
Total Chlorophyll (µg/L)
10
20
30
40
50
60
2002
2004
2006
2008
2010
2012
2014
Year


Medford (Flagler)
y = 0.03x + -58.68
R2 = 0.06
Secchi depth (ft)
1.5
2.0
2.5
3.0
3.5
4.0
2002
2004
2006
2008
2010
2012
2014
Year

LAKEWATCH Report for Nantucket in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Nantucket in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Nantucket
Latitude	29.6253
Longitude	-81.1962
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2002 to 2014
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	37 (21 to 55)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1063 (827 to 1339)

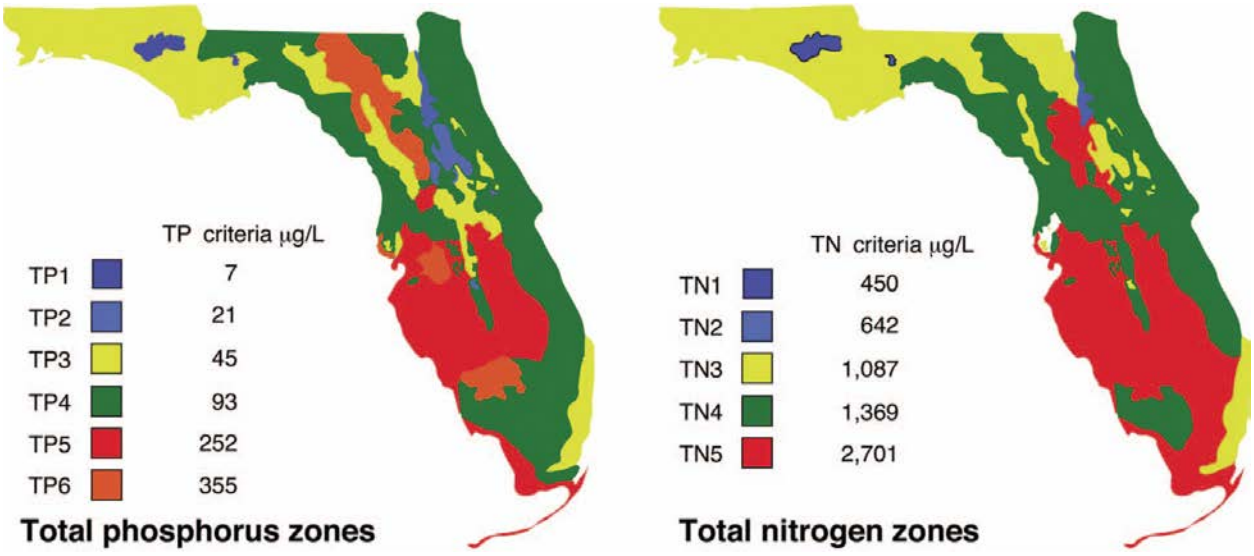


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Nantucket in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Nantucket in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	21 - 55	37 (13)
Total Nitrogen (µg/L)	827 - 1339	1063 (13)
Chlorophyll- uncorrected (µg/L)	4.3 - 21.7	10.9 (13)
Secchi (ft)	1.2 - 4.3	3.1 (13)
Secchi (m)	0.4 - 1.3	1.0 (13)
Color (Pt-Co Units)	20 - 36	26 (12)
Specific Conductance (µS/cm@25 C)	377 - 514	457 (7)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Nantucket in Flagler County
Using Data Downloaded 10/17/2016

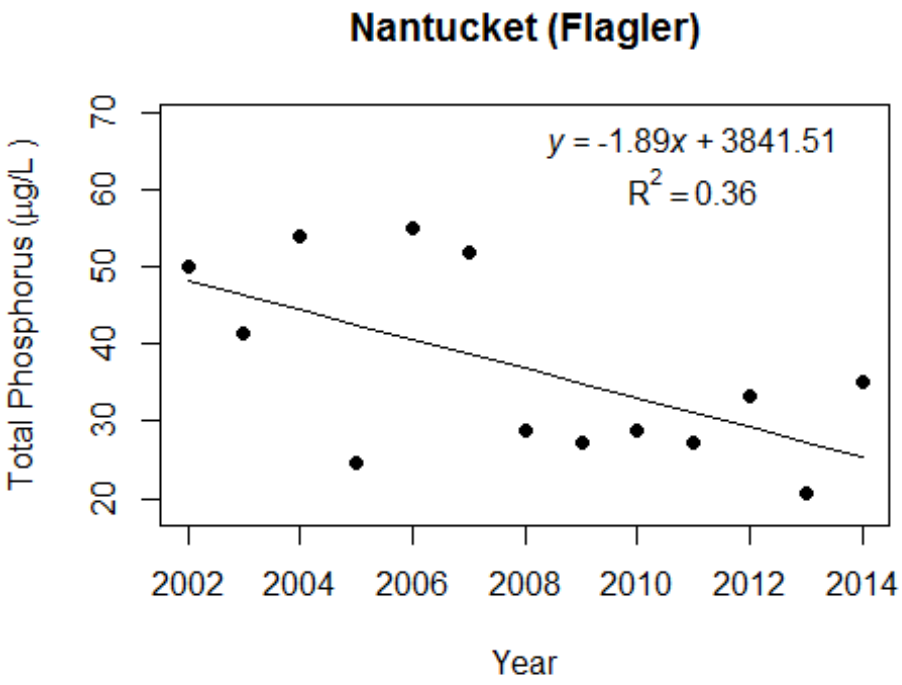
Trend Analyses Lakes

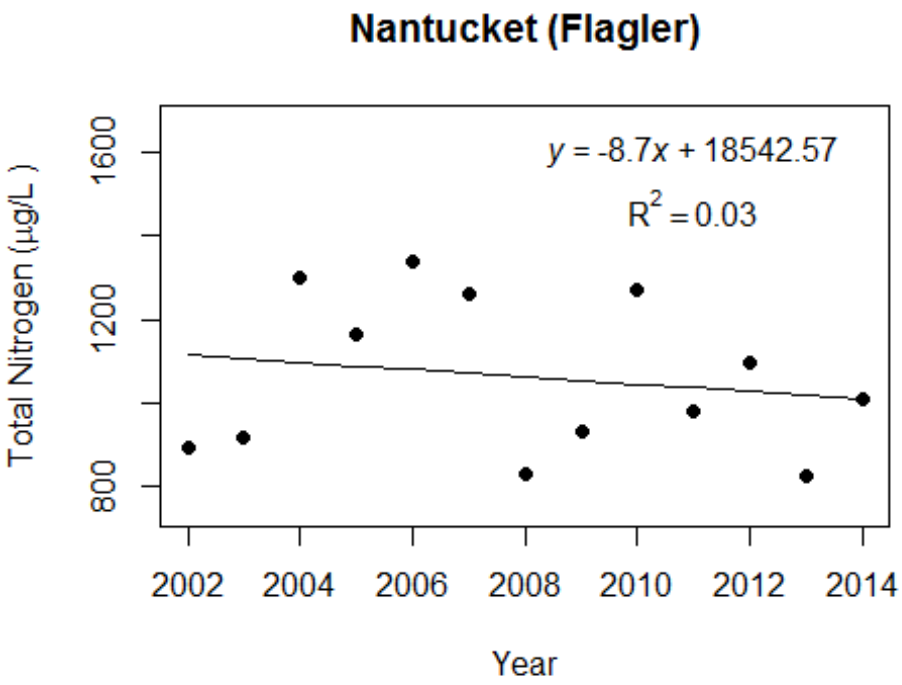
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

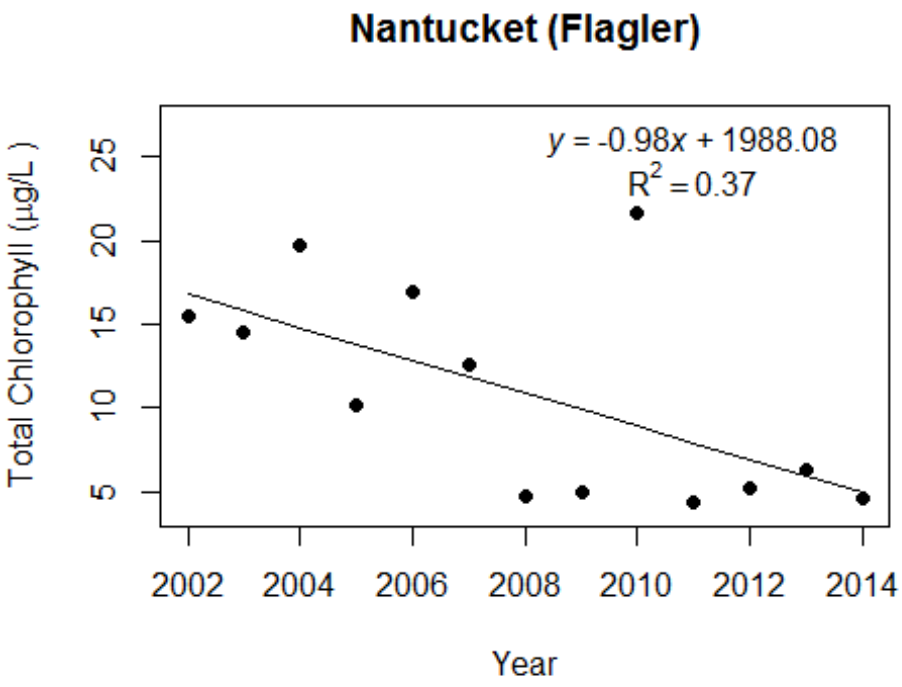
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

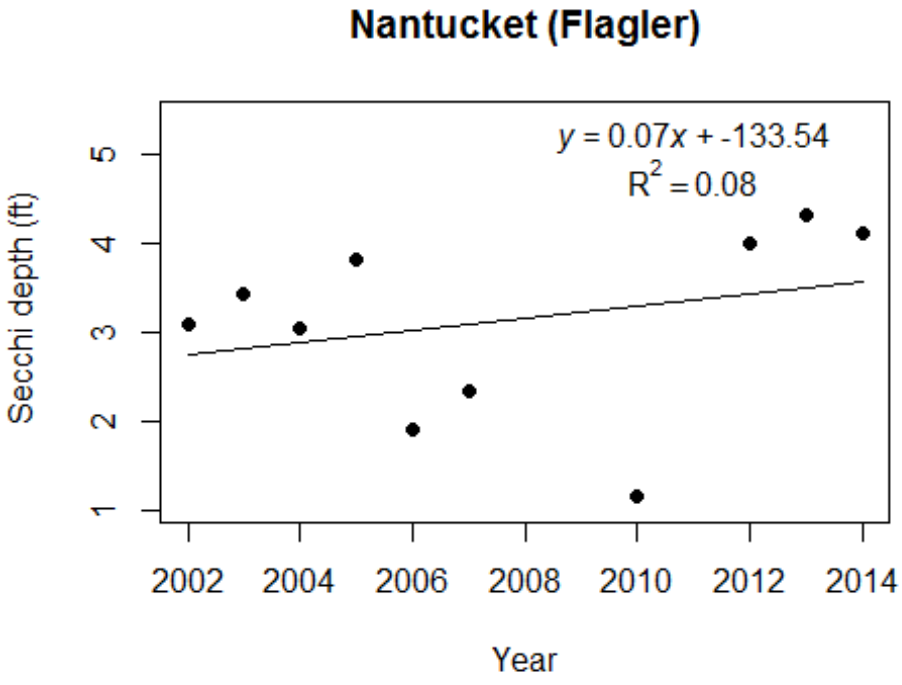
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	13	13	13	13
Intercept (a)	3842	18543	1988	-134
Slope (b)	-1.89	-8.70	-0.98	0.07
Coefficient of Determination (R^2)	0.36	0.03	0.37	0.08
Probability of Significance (p)	0.03	0.55	0.03	0.42
Potential Trend	Decreasing	No Trend	Decreasing	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Nantucket in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Nantucket (Flagler)
y = -1.89x + 3841.51
R2 = 0.36
Total Phosphorus (µg/L)
20
30
40
50
60
70
2002
2004
2006
2008
2010
2012
2014
Year


Nantucket (Flagler)
y = -8.7x + 18542.57
R2 = 0.03
Total Nitrogen (µg/L)
800
1200
1600
2002
2004
2006
2008
2010
2012
2014
Year


Nantucket (Flagler)
y = -0.98x + 1988.08
R2 = 0.37
Total Chlorophyll (µg/L)
5
10
15
20
25
2002
2004
2006
2008
2010
2012
2014
Year


Nantucket (Flagler)
y = 0.07x + -133.54
R2 = 0.08
Secchi depth (ft)
1
2
3
4
5
2002
2004
2006
2008
2010
2012
2014
Year

LAKEWATCH Report for Parkview Stream in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

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LAKEWATCH Report for Parkview Stream in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Parkview Stream
Latitude	29.5505
Longitude	-81.2455
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2003
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	48 (34 to 76)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	932 (708 to 1168)

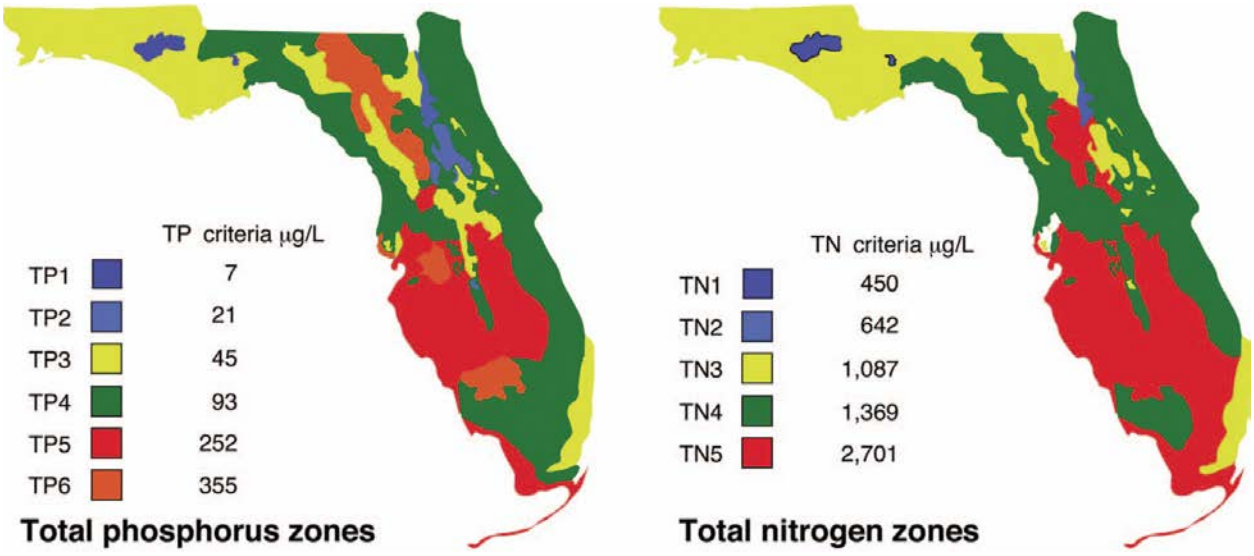

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Parkview Stream in Flagler County
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Long-Term Data Summary Lakes: Definitions

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LAKEWATCH Report for Parkview Stream in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	34 - 76	48 (9)
Total Nitrogen (µg/L)	708 - 1168	932 (9)
Chlorophyll- uncorrected (µg/L)	9.1 - 22.5	12.6 (9)
Secchi (ft)	1.6 - 3.8	2.3 (9)
Secchi (m)	0.5 - 1.1	0.7 (9)
Color (Pt-Co Units)	145 - 288	237 (3)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

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LAKEWATCH Report for Parkview Stream in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

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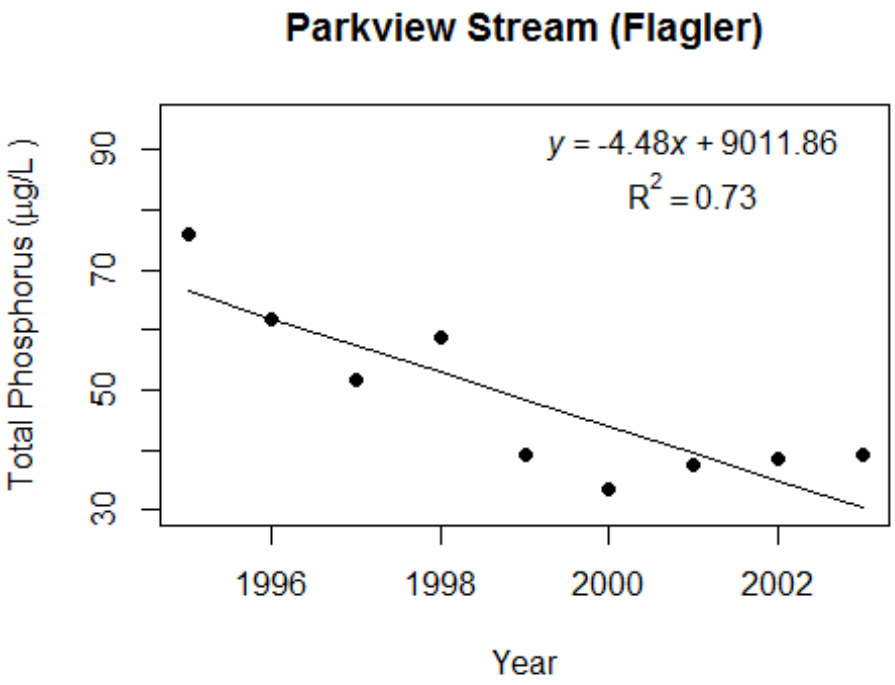
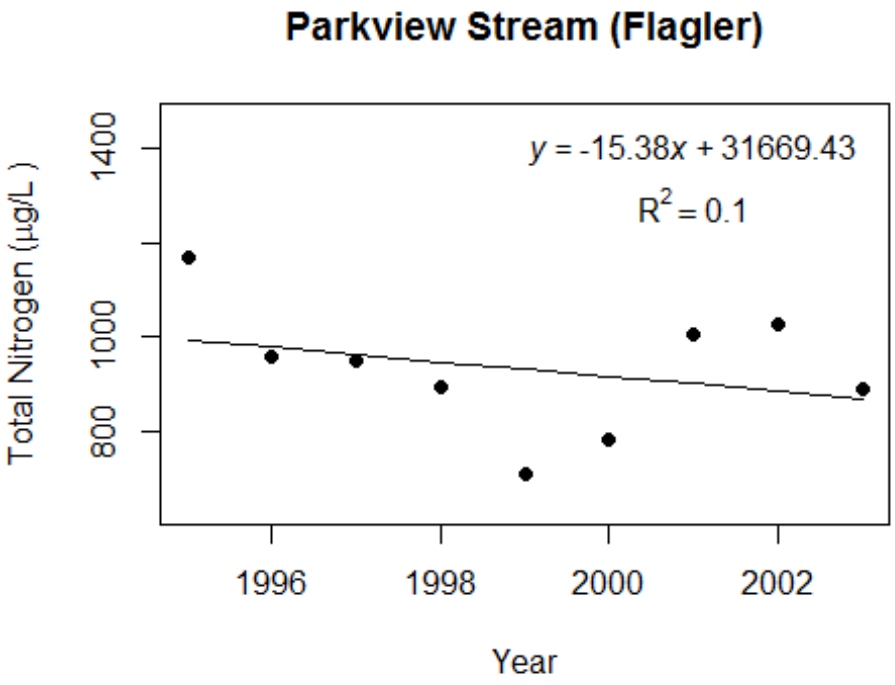
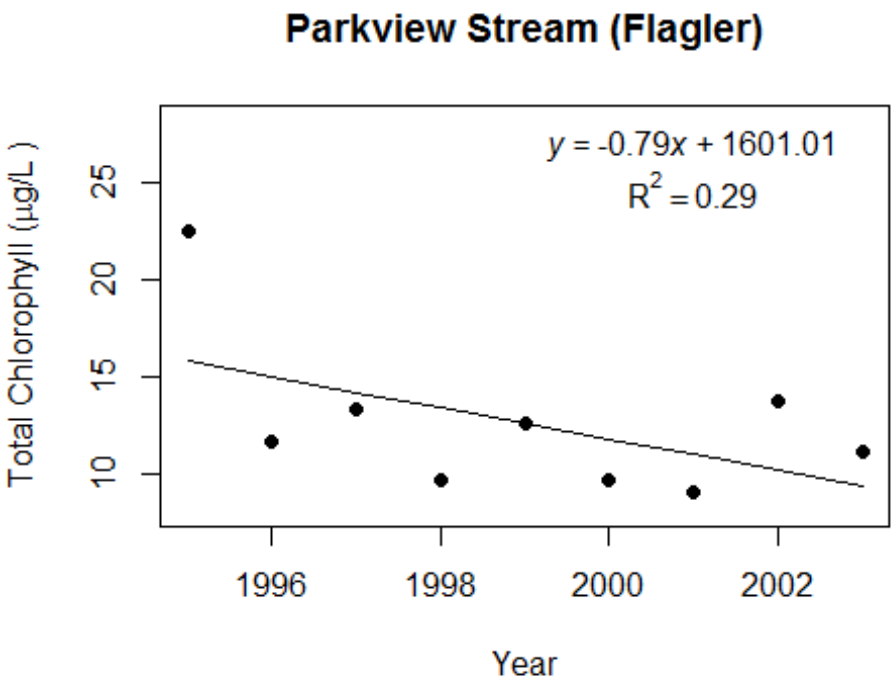
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

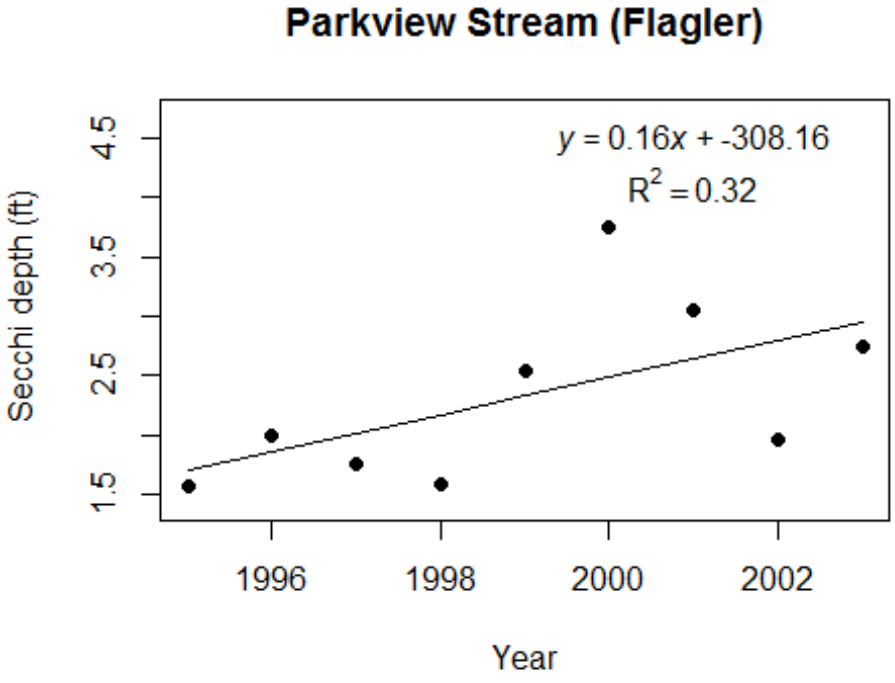
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	9	9	9	9
Intercept (a)	9012	31669	1601	-308
Slope (b)	-4.48	-15.38	-0.79	0.16
Coefficient of Determination (R^2)	0.73	0.10	0.29	0.32
Probability of Significance (p)	0.00	0.42	0.14	0.11
Potential Trend	Decreasing	No Trend	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Parkview Stream in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Parkview Stream (Flagler)
y = -4.48x + 9011.86
R2 = 0.73
Total Phosphorus (µg/L)
30
50
70
90
1996
1998
2000
2002
Year


Parkview Stream (Flagler)
y = -15.38x + 31669.43
R2 = 0.1
Total Nitrogen (µg/L)
800
1000
1400
1996
1998
2000
2002
Year


Parkview Stream (Flagler)
y = -0.79x + 1601.01
R2 = 0.29
Total Chlorophyll (µg/L)
10
15
20
25
1996
1998
2000
2002
Year


Parkview Stream (Flagler)
y = 0.16x + -308.16
R2 = 0.32
Secchi depth (ft)
1.5
2.5
3.5
4.5
1996
1998
2000
2002
Year

LAKEWATCH Report for Pine Grove in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

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- **Name**: Lake name that LAKEWATCH uses for the 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, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Pine Grove in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Pine Grove
Latitude	29.5086
Longitude	-81.2061
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2000 to 2009
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	136 (80 to 176)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	946 (637 to 1224)

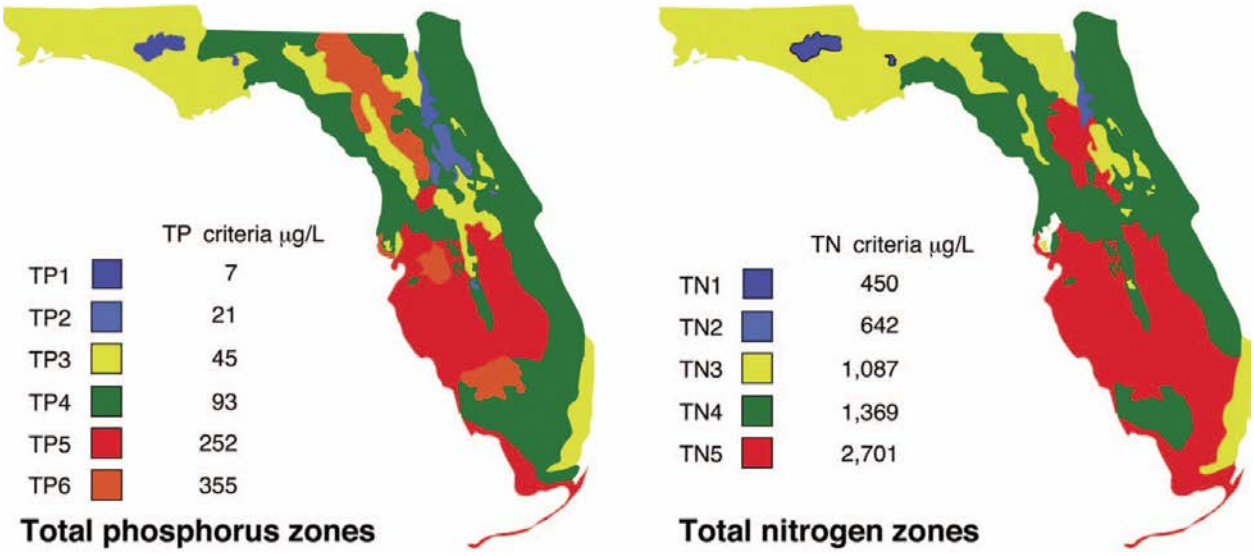


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Pine Grove in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Pine Grove in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	80 - 176	136 (8)
Total Nitrogen (µg/L)	637 - 1224	946 (8)
Chlorophyll- uncorrected (µg/L)	8.0 - 30.5	16.0 (8)
Secchi (ft)	2.5 - 4.4	3.7 (8)
Secchi (m)	0.8 - 1.4	1.1 (8)
Color (Pt-Co Units)	33 - 90	57 (7)
Specific Conductance (µS/cm@25 C)	322 - 352	334 (3)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Pine Grove in Flagler County
Using Data Downloaded 10/17/2016

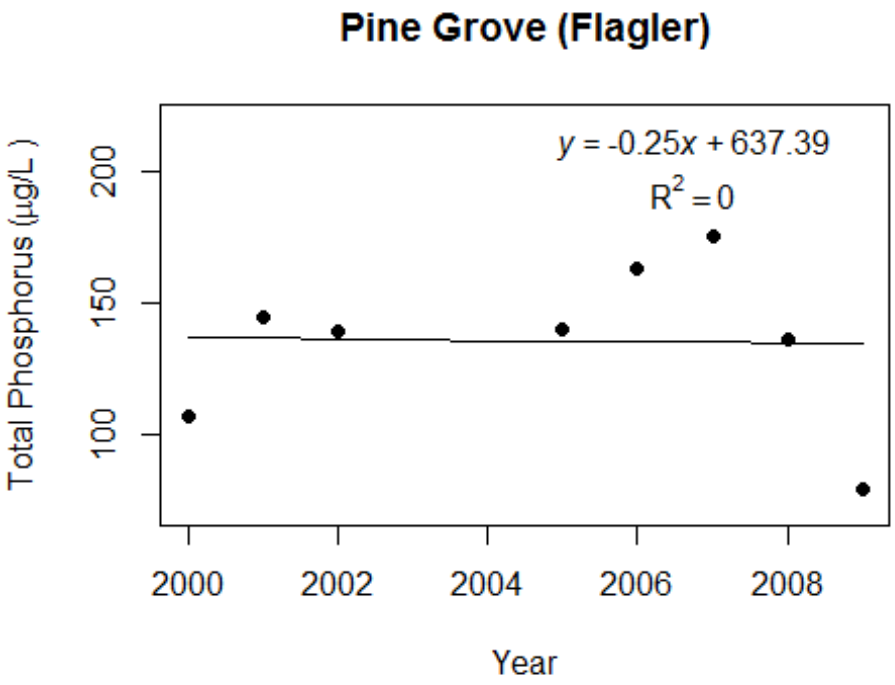
Trend Analyses Lakes

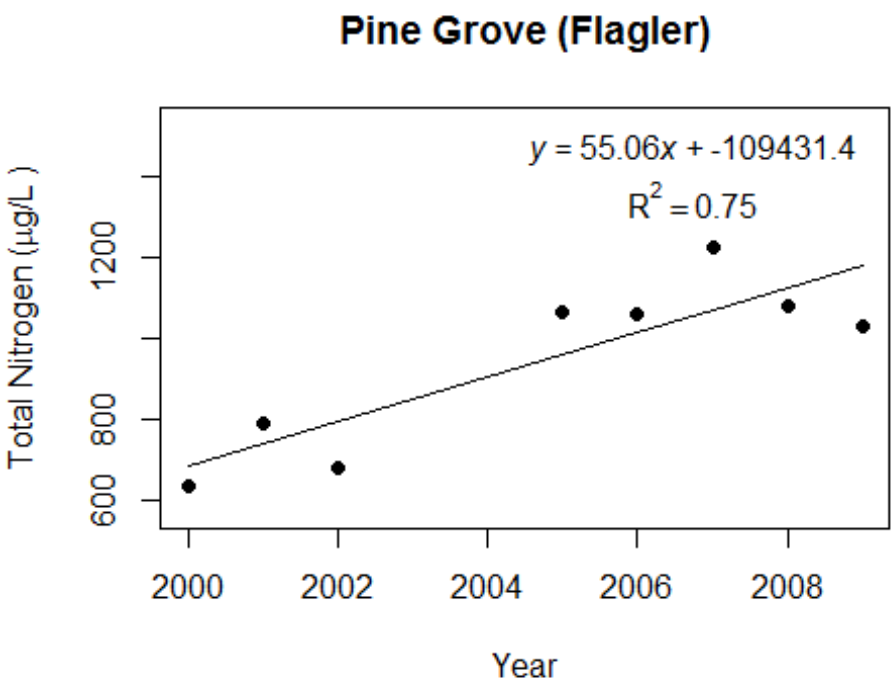
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

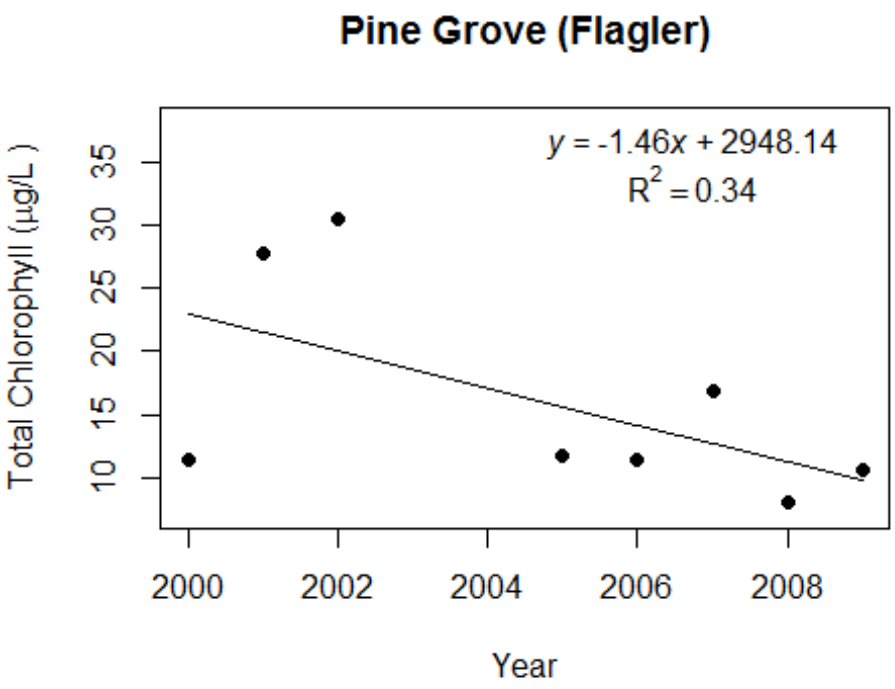
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

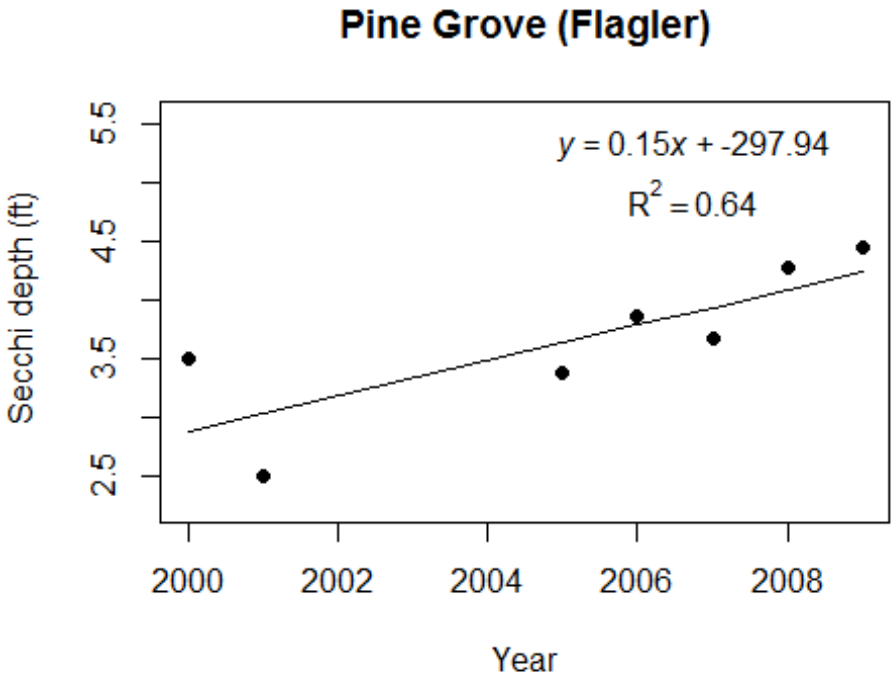
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	8	8	8	8
Intercept (a)	637	-109431	2948	-298
Slope (b)	-0.25	55.06	-1.46	0.15
Coefficient of Determination (R^2)	0.00	0.75	0.34	0.64
Probability of Significance (p)	0.95	0.01	0.13	0.03
Potential Trend	No Trend	Increasing	No Trend	Increasing

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Pine Grove in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Pine Grove (Flagler)
y = -0.25x + 637.39
R2 = 0
Total Phosphorus (µg/L)
100
150
200
2000
2002
2004
2006
2008
Year


Pine Grove (Flagler)
y = 55.06x + -109431.4
R2 = 0.75
Total Nitrogen (µg/L)
600
800
1200
2000
2002
2004
2006
2008
Year


Pine Grove (Flagler)
y = -1.46x + 2948.14
R2 = 0.34
Total Chlorophyll (µg/L)
10
15
20
25
30
35
2000
2002
2004
2006
2008
Year


Pine Grove (Flagler)
y = 0.15x + -297.94
R2 = 0.64
Secchi depth (ft)
2.5
3.5
4.5
5.5
2000
2002
2004
2006
2008
Year

LAKEWATCH Report for Ribbon North in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Ribbon North in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Ribbon North
Latitude	29.5591
Longitude	-81.2191
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1993 to 2012
Lake Classification	Clear Hard Water Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	18 (12 to 23)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	609 (466 to 726)

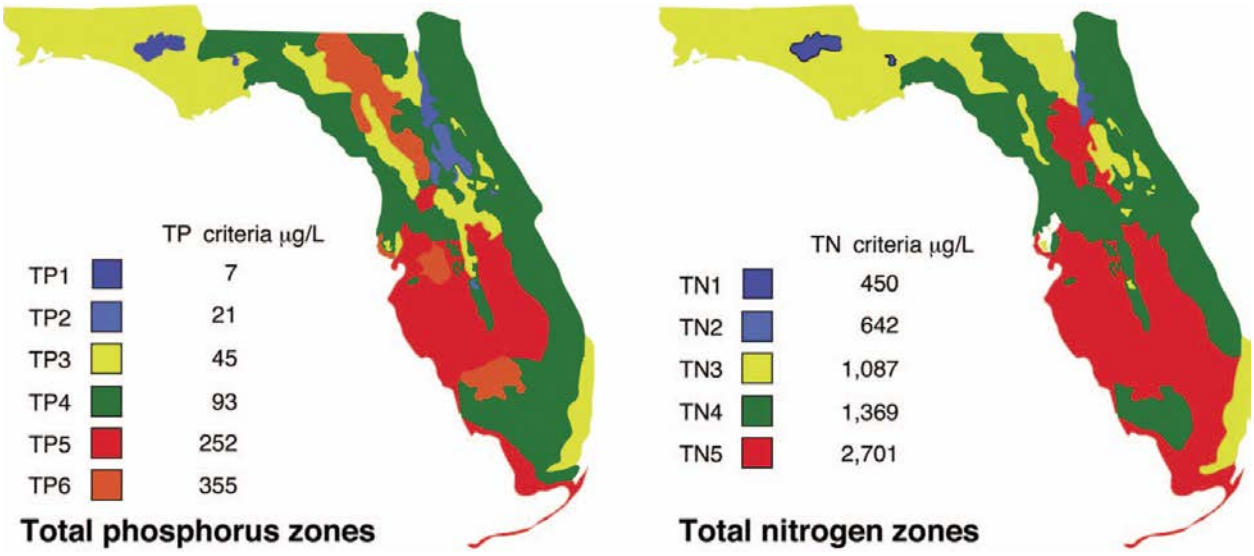


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Ribbon North in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Ribbon North in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	12 - 23	18 (20)
Total Nitrogen (µg/L)	466 - 726	609 (20)
Chlorophyll- uncorrected (µg/L)	3.6 - 13.5	7.4 (20)
Secchi (ft)	4.6 - 8.2	5.7 (20)
Secchi (m)	1.4 - 2.5	1.7 (20)
Color (Pt-Co Units)	22 - 53	40 (12)
Specific Conductance (µS/cm@25 C)	229 - 326	264 (6)
Lake Classification	Clear Hard Water Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Ribbon North in Flagler County
Using Data Downloaded 10/17/2016

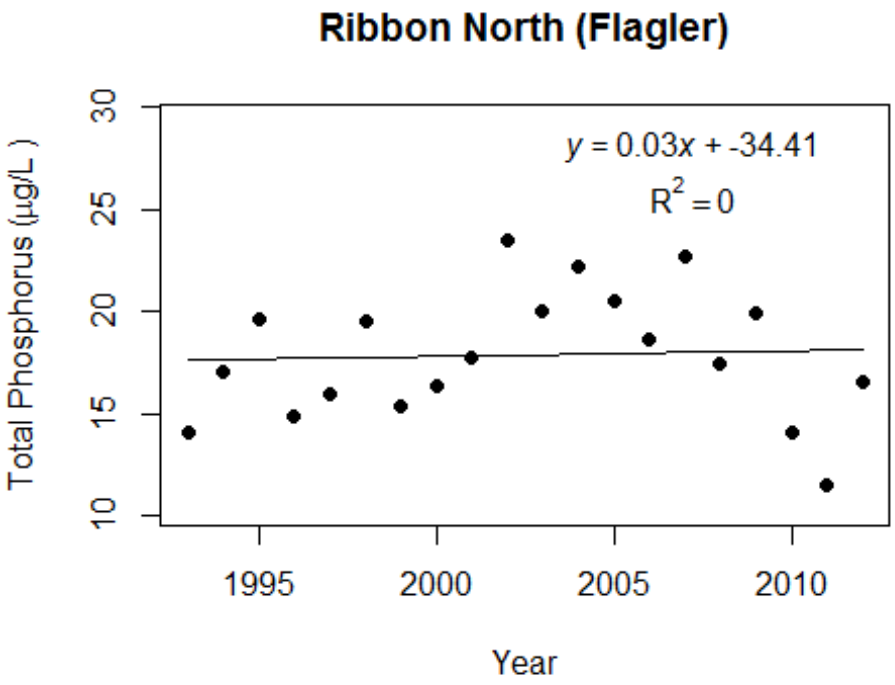
Trend Analyses Lakes

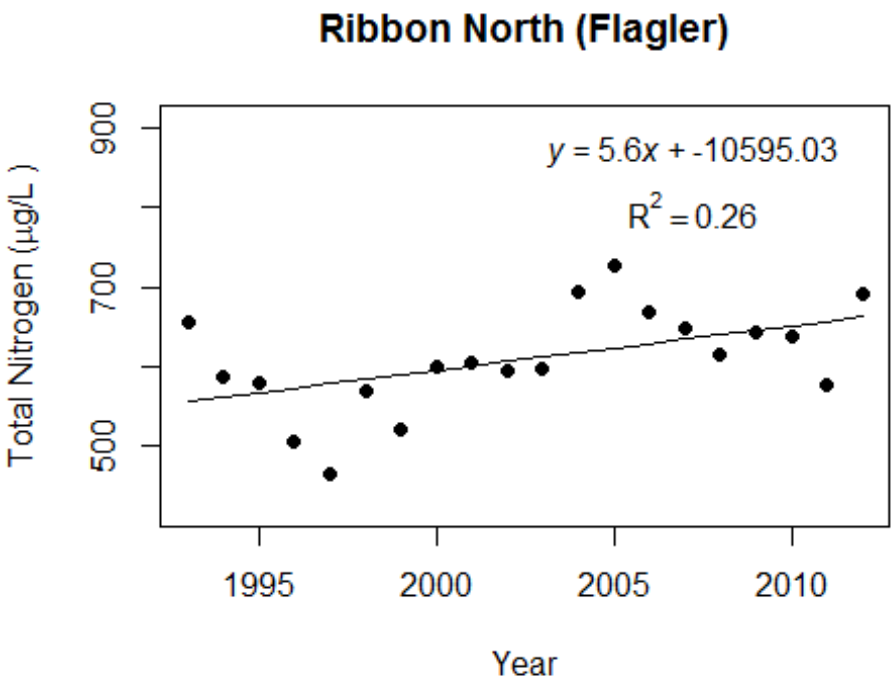
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

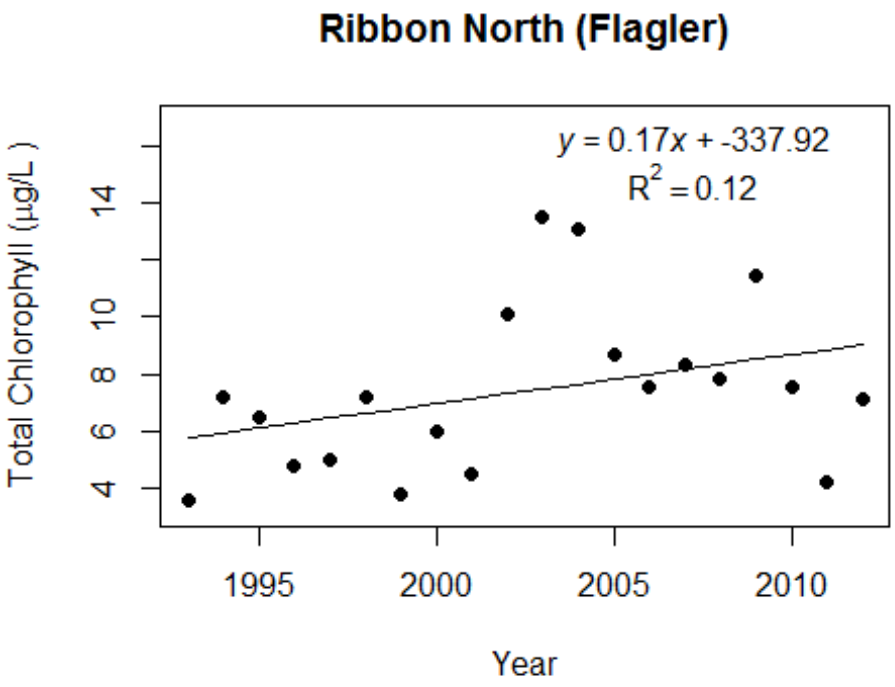
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

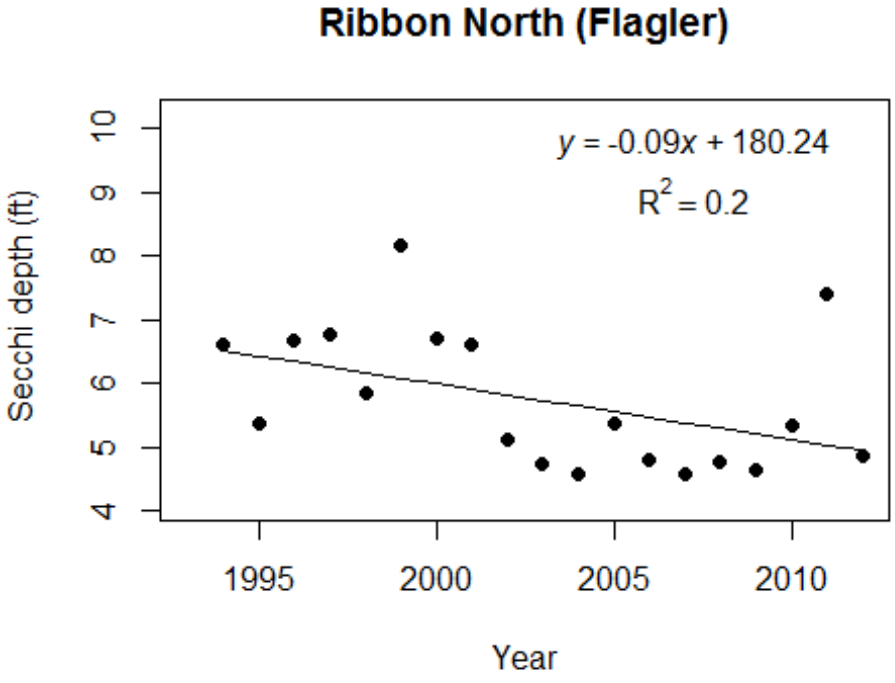
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	20	20	20	20
Intercept (a)	-34	-10595	-338	180
Slope (b)	0.03	5.60	0.17	-0.09
Coefficient of Determination (R^2)	0.00	0.26	0.12	0.20
Probability of Significance (p)	0.84	0.02	0.13	0.05
Potential Trend	No Trend	Increasing	No Trend	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Ribbon North in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Ribbon North (Flagler)
y = 0.03x + -34.41
R2 = 0
Total Phosphorus (µg/L)
10
15
20
25
30
1995
2000
2005
2010
Year


Ribbon North (Flagler)
y = 5.6x + -10595.03
R2 = 0.26
Total Nitrogen (µg/L)
500
700
900
1995
2000
2005
2010
Year


Ribbon North (Flagler)
y = 0.17x + -337.92
R2 = 0.12
Total Chlorophyll (µg/L)
4
6
8
10
14
1995
2000
2005
2010
Year


Ribbon North (Flagler)
y = -0.09x + 180.24
R2 = 0.2
Secchi depth (ft)
4
5
6
7
8
9
10
1995
2000
2005
2010
Year

LAKEWATCH Report for Rippling in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

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- **County**: Name of county in which the lake resides.
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- **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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Rippling in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Rippling
Latitude	29.5014
Longitude	-81.2400
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 1996
Lake Classification	
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	31 (29 to 34)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	794 (700 to 887)

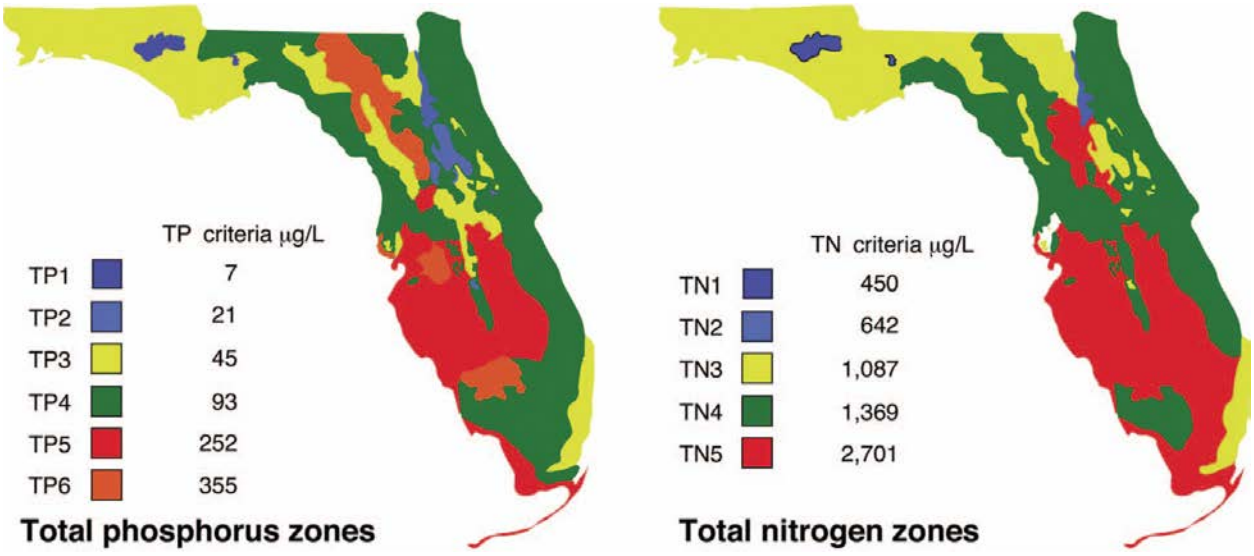

Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Rippling in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Rippling in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	29 - 34	31 (2)
Total Nitrogen (µg/L)	700 - 887	794 (2)
Chlorophyll- uncorrected (µg/L)	7.2 - 11.0	9.1 (2)
Secchi (ft)	1.8 - 2.0	1.9 (2)
Secchi (m)	0.5 - 0.6	0.6 (2)
Color (Pt-Co Units)	-	()
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Rippling in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Rippling in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Rodgers in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Rodgers in Flagler County
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Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Rodgers
Latitude	29.4406
Longitude	-81.2314
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1998 to 2001
Lake Classification	
Lake Trophic Status (CHL)	Mesotrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	9 (9 to 10)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	528 (468 to 569)

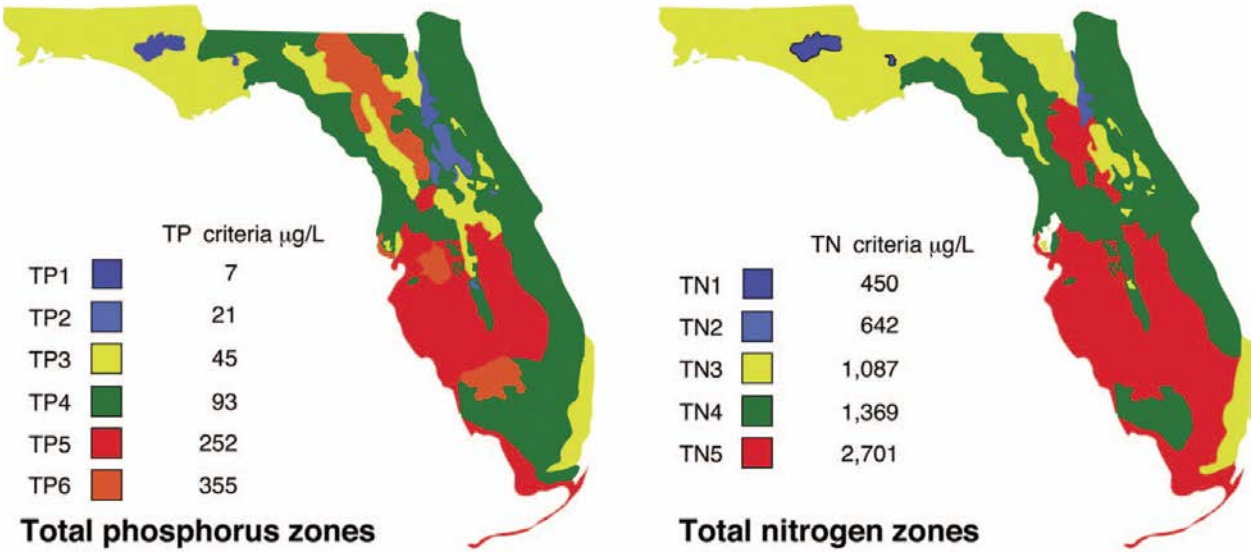


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Rodgers in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Rodgers in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	9 - 10	9 (4)
Total Nitrogen (µg/L)	468 - 569	528 (4)
Chlorophyll- uncorrected (µg/L)	2.4 - 6.3	4.0 (4)
Secchi (ft)	4.6 - 5.2	4.9 (4)
Secchi (m)	1.4 - 1.6	1.5 (4)
Color (Pt-Co Units)	34 - 34	34 (1)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Rodgers in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Rodgers in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Sea Vista in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Sea Vista in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Sea Vista
Latitude	29.6248
Longitude	-81.1959
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2002 to 2014
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	51 (25 to 95)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	1366 (920 to 2065)

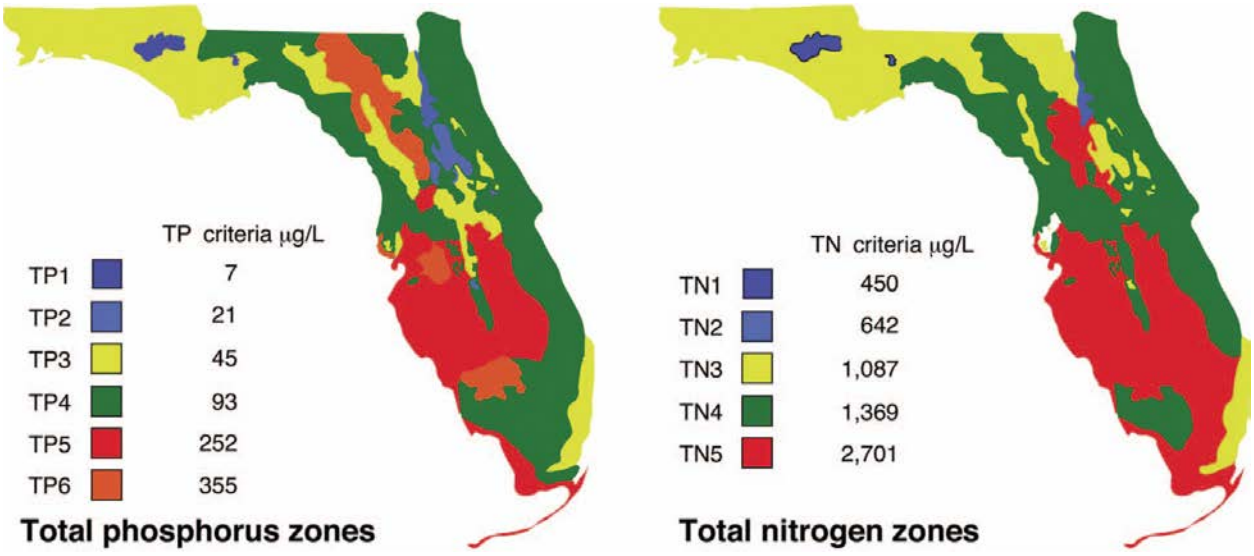


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Sea Vista in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Sea Vista in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	25 - 95	51 (13)
Total Nitrogen (µg/L)	920 - 2065	1366 (13)
Chlorophyll- uncorrected (µg/L)	4.0 - 25.0	14.9 (13)
Secchi (ft)	1.5 - 2.8	2.3 (13)
Secchi (m)	0.5 - 0.8	0.7 (13)
Color (Pt-Co Units)	54 - 92	67 (12)
Specific Conductance (µS/cm@25 C)	446 - 644	545 (7)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Sea Vista in Flagler County
Using Data Downloaded 10/17/2016

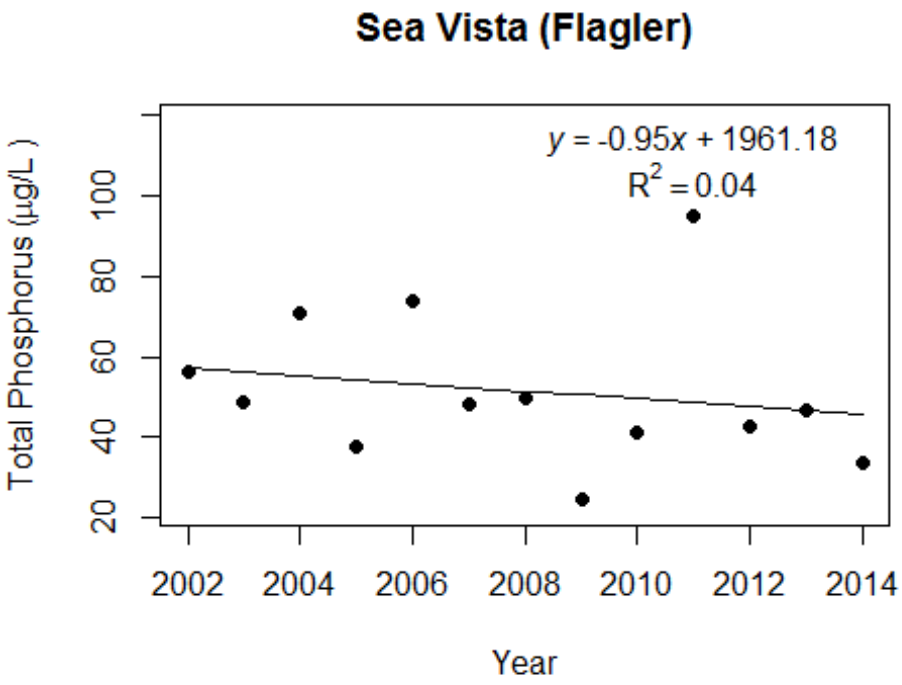
Trend Analyses Lakes

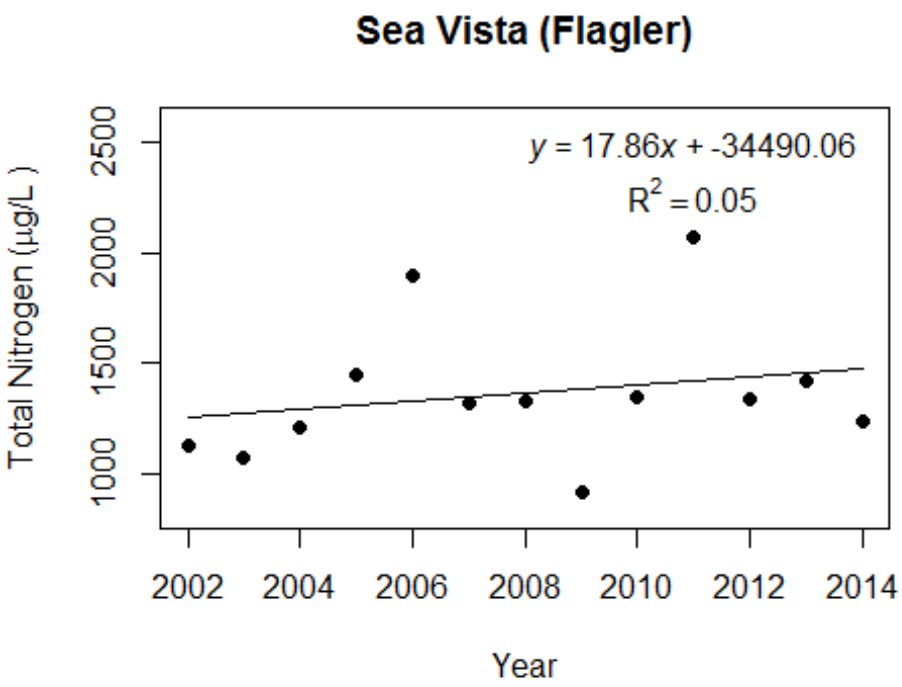
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

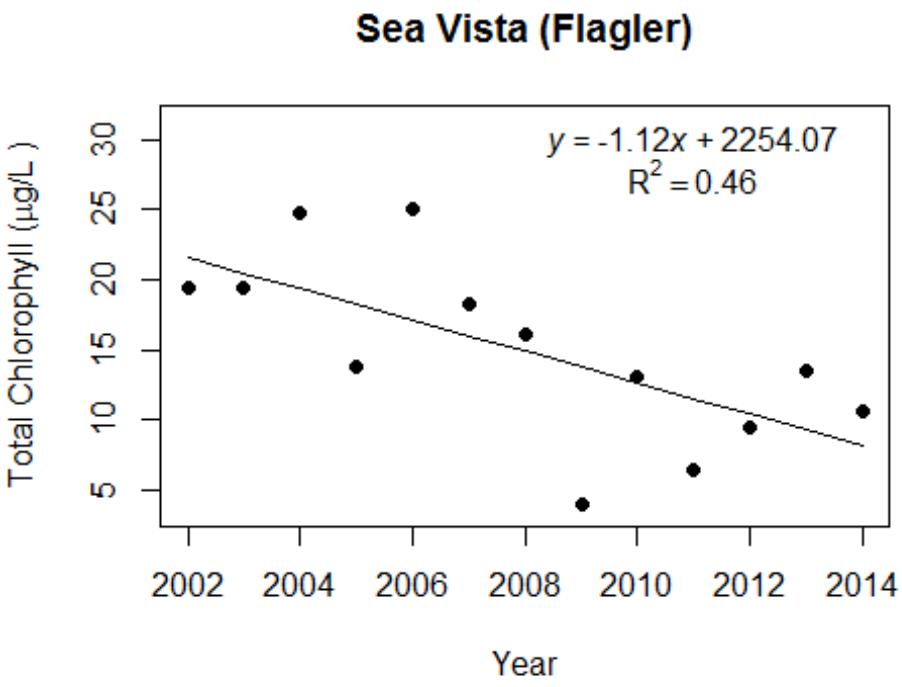
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

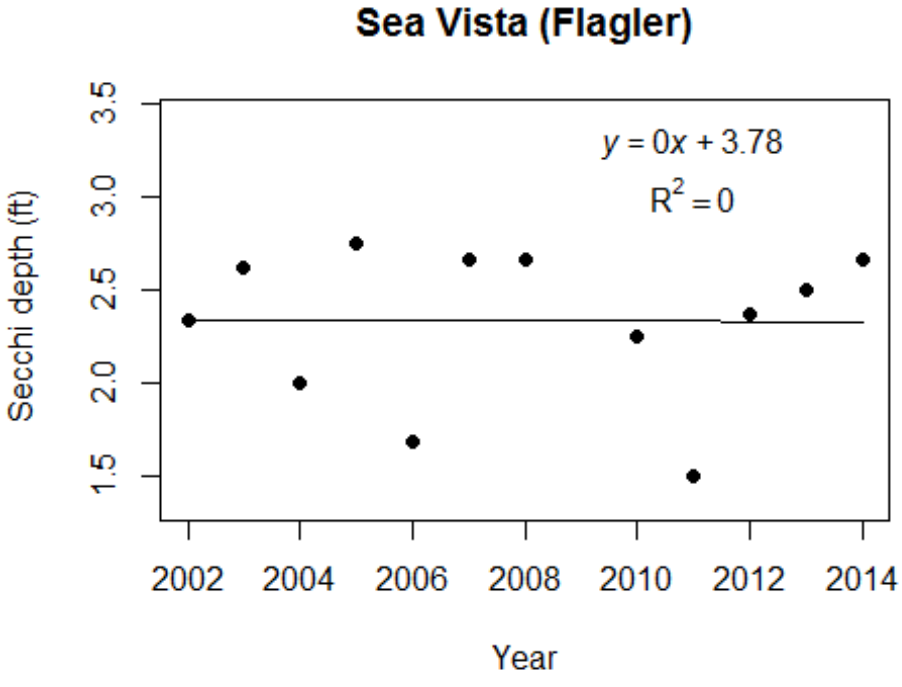
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	13	13	13	13
Intercept (a)	1961	-34490	2254	4
Slope (b)	-0.95	17.86	-1.12	-0.00
Coefficient of Determination (R^2)	0.04	0.05	0.46	0.00
Probability of Significance (p)	0.52	0.46	0.01	0.98
Potential Trend	No Trend	No Trend	Decreasing	No Trend

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Sea Vista in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Sea Vista (Flagler)
y = -0.95x + 1961.18
R2 = 0.04
Total Phosphorus (µg/L)
20
40
60
80
100
2002
2004
2006
2008
2010
2012
2014
Year


Sea Vista (Flagler)
y = 17.86x + -34490.06
R2 = 0.05
Total Nitrogen (µg/L)
1000
1500
2000
2500
2002
2004
2006
2008
2010
2012
2014
Year


Sea Vista (Flagler)
y = -1.12x + 2254.07
R2 = 0.46
Total Chlorophyll (µg/L)
5
10
15
20
25
30
2002
2004
2006
2008
2010
2012
2014
Year


Sea Vista (Flagler)
y = 0x + 3.78
R2 = 0
Secchi depth (ft)
1.5
2.0
2.5
3.0
3.5
2002
2004
2006
2008
2010
2012
2014
Year

LAKEWATCH Report for Walker West in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Walker West in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Walker West
Latitude	29.5329
Longitude	-81.2159
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	2003 to 2004
Lake Classification	
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	42 (40 to 43)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	703 (534 to 871)

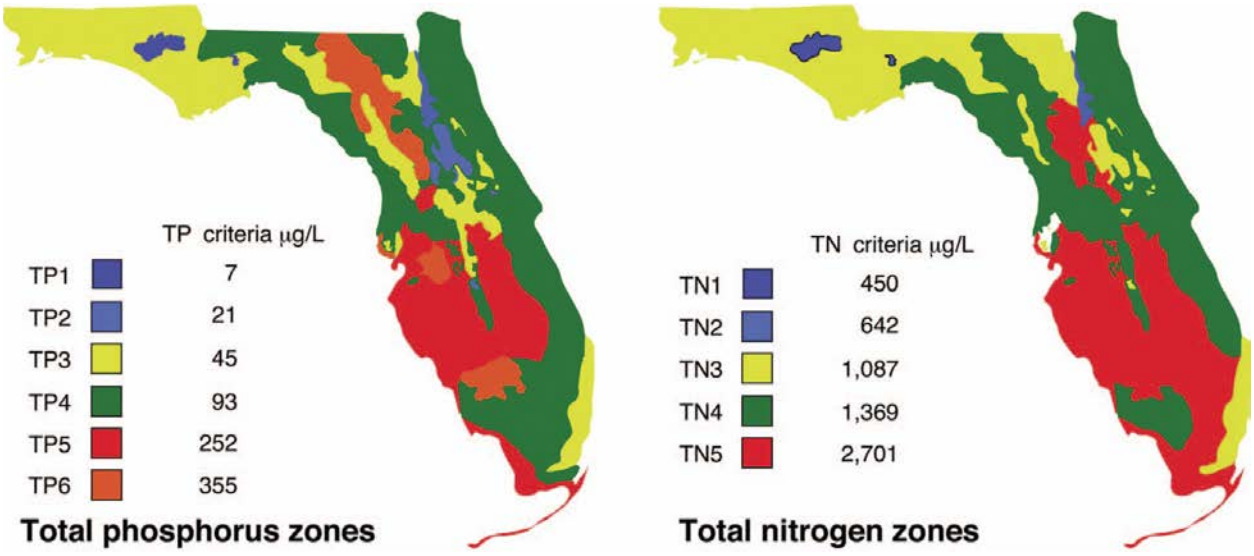


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Walker West in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Walker West in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	40 - 43	42 (2)
Total Nitrogen (µg/L)	534 - 871	703 (2)
Chlorophyll- uncorrected (µg/L)	11.6 - 12.4	12.0 (2)
Secchi (ft)	4.4 - 4.8	4.6 (2)
Secchi (m)	1.3 - 1.5	1.4 (2)
Color (Pt-Co Units)	23 - 33	28 (2)
Specific Conductance (µS/cm@25 C)	-	()
Lake Classification		

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Walker West in Flagler County
Using Data Downloaded 10/17/2016

Trend Analyses Lakes

The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)				
Intercept (a)				
Slope (b)				
Coefficient of Determination (R^2)				
Probability of Significance (p)				
Potential Trend				

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Walker West in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

LAKEWATCH Report for Wynnfield in Flagler County
Using Data Downloaded 10/17/2016

Introduction for Lakes

In this report, we present summary data collected on individual systems that have been part of the LAKEWATCH program. This summary is from the whole period of record for individual systems. The first part of this summary will allow a comparison of the long-term mean nutrient concentrations with the nutrient zone concentrations published by LAKEWATCH staff (Bachmann et al. 2012; http://lakewatch.ifas.ufl.edu/publications.shtml). The second part of the summary will allow the comparison of data with Florida Department of Environmental Protections Numeric Nutrient Criteria. Finally, this report examines data for any long-term trends that may be occurring in individual systems but only for systems with five or more years of data.

Base File Data: Definitions

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.
- **Latitude and Longitude**: Coordinates identifying the exact location of station 1 for each system.
- **Water Body Type**: Four different types of systems; lakes, estuaries, 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 Mean Concentration (µg/L: min and max)**: Average of all annual means (µg/L) listed with minimum and maximum annual means.
- **Lake Classification**: The new numeric nutrient criteria for Florida require that lakes must first be classified into three group based on color and alkalinity or specific conductance; colored (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 $CaCO_3$ or specific conductance less the or equal to 100 µs/cm @25 C), and clear hard water lakes (color less than 40 Pt-Co units and alkalinity greater than 20 mg/L as $CaCO_3$ or specific conductance greater 100 µS/cm @ 25 C).
- **Lake Trophic Status (CHL)**: Tropic state classification using the long-term chlorophyll average concentration and the classification system from; Forsberg, C and S. R. Ryding. 1980. Eutrophication parameters and trophic state indices in 30 Swedish waste receiving lakes. Arch. Hydrobiol. 89:189-207).

LAKEWATCH Report for Wynnfield in Flagler County
Using Data Downloaded 10/17/2016

Base File Data and Nutrient Zone Comparisons for Lakes

County	Flagler
Name	Wynnfield
Latitude	29.5361
Longitude	-81.2533
Water Body Type	Lake
Surface Area (ha and acre)	ha or acre
Mean Depth (m and ft)	m or ft
Period of Record (year)	1995 to 2009
Lake Classification	Colored Lake
Lake Trophic Status (CHL)	Eutrophic
TP Zone	TP4
Long-Term TP Mean Concentration (µg/L, minimum and maximum)	59 (30 to 113)
TN Zone	TN4
Long-Term TN Mean Concentration (µg/L, minimum and maximum)	858 (611 to 1404)

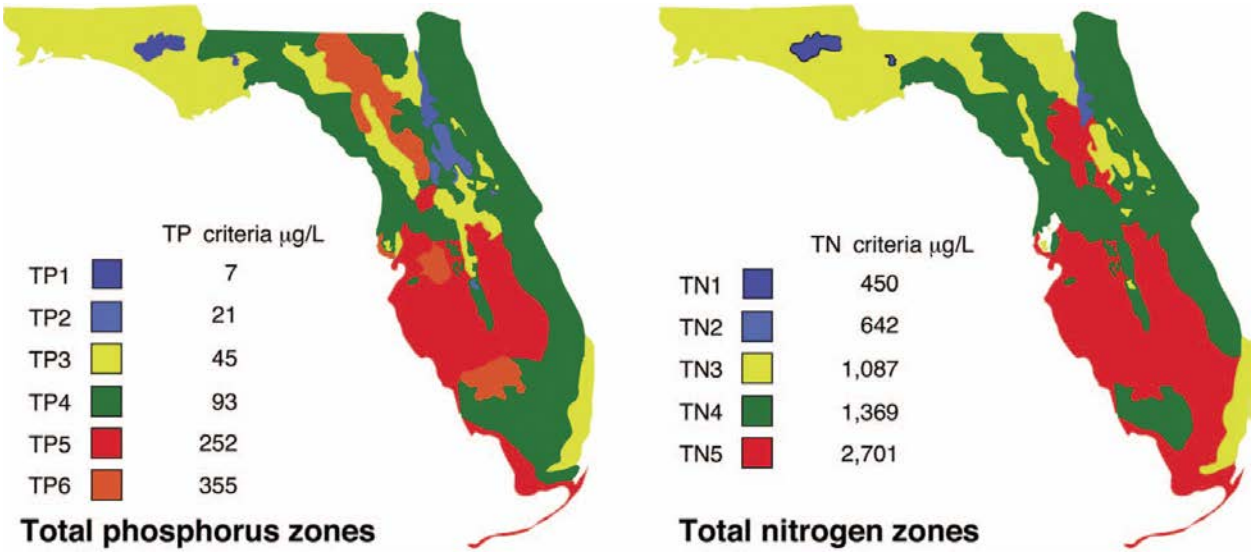


Figure 1. Maps showing Florida phosphorus and nitrogen zones and the nutrient concentrations of the upper 90% of lakes within each zone (Bachmann et al. 2012c).

LAKEWATCH Report for Wynnfield in Flagler County
Using Data Downloaded 10/17/2016

FDEP Nutrient Criteria Lakes

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

If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, 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; or if there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below.

Long-Term Data Summary Lakes: Definitions

The following long-term data are the primary trophic state parameters collected by LAKEWATCH volunteers and classification variables color and specific conductance (LAKEWATCH recently began analyzing samples quarterly for color and specific conductance):

- **Total Phosphorus (µg/L)**: The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen (µg/L)**: Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected (µg/L)**: Chlorophyll concentrations are used to measure relative abundances of open water algal population.
- **Secchi (ft), Secchi (m)**: Secchi measurements are estimates of water clarity (how far one can see into the water) and are listed with English and metric units.
- **Color (Pt-Co Units)**: LAKEWATCH measures true color, which is the color of the water after particles have been filter out.
- **Specific Conductance (µS/cm@25°C)**: Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

LAKEWATCH Report for Wynnfield in Flagler County
Using Data Downloaded 10/17/2016

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	30 - 113	59 (11)
Total Nitrogen (µg/L)	611 - 1404	858 (11)
Chlorophyll- uncorrected (µg/L)	5.5 - 46.9	17.1 (11)
Secchi (ft)	2.1 - 3.5	2.9 (11)
Secchi (m)	0.6 - 1.1	0.9 (11)
Color (Pt-Co Units)	42 - 62	50 (4)
Specific Conductance (µS/cm@25 C)	260 - 271	265 (2)
Lake Classification	Colored Lake	

FDEP Numeric Nutrient Criteria

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 **Colored Lakes**	20 µg/L	50 µg/L	1270 µg/L	160 µg/L[1]	2230 µg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$ or >100 µS/cm@25 C **Clear Hard Water Lakes**	20 µg/L	30 µg/L	1050 µg/L	90 µg/L	1910 µg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$ or < 100 µS/cm@25 C **Clear Soft Water Lakes**	6 µg/L	10 µg/L	51 µg/L	30 µg/L	930 µg/L

[1] 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 $CaCO_3$ alkalinity concentration until such time that alkalinity data are available.

LAKEWATCH Report for Wynnfield in Flagler County
Using Data Downloaded 10/17/2016

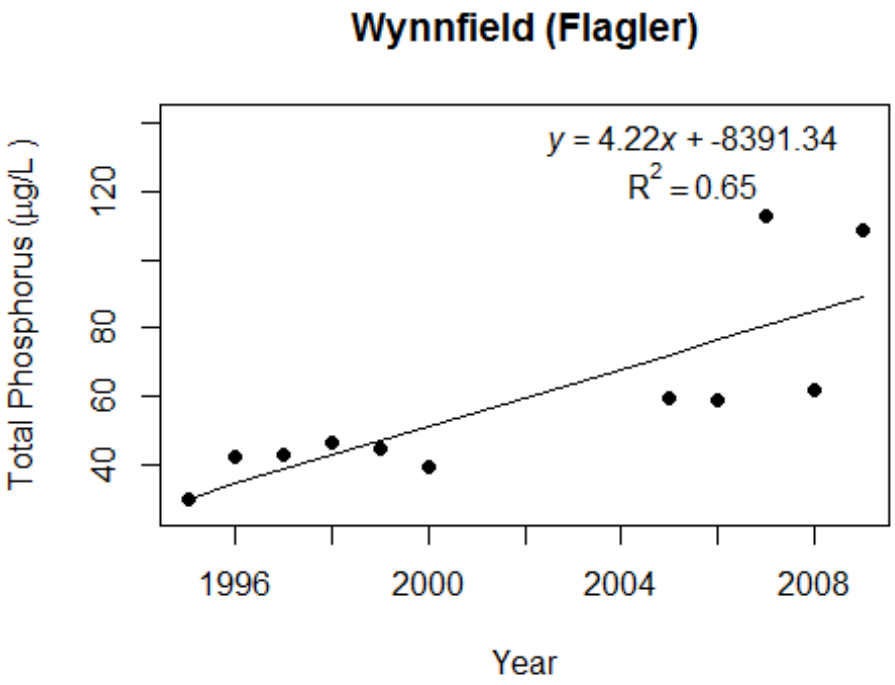
Trend Analyses Lakes

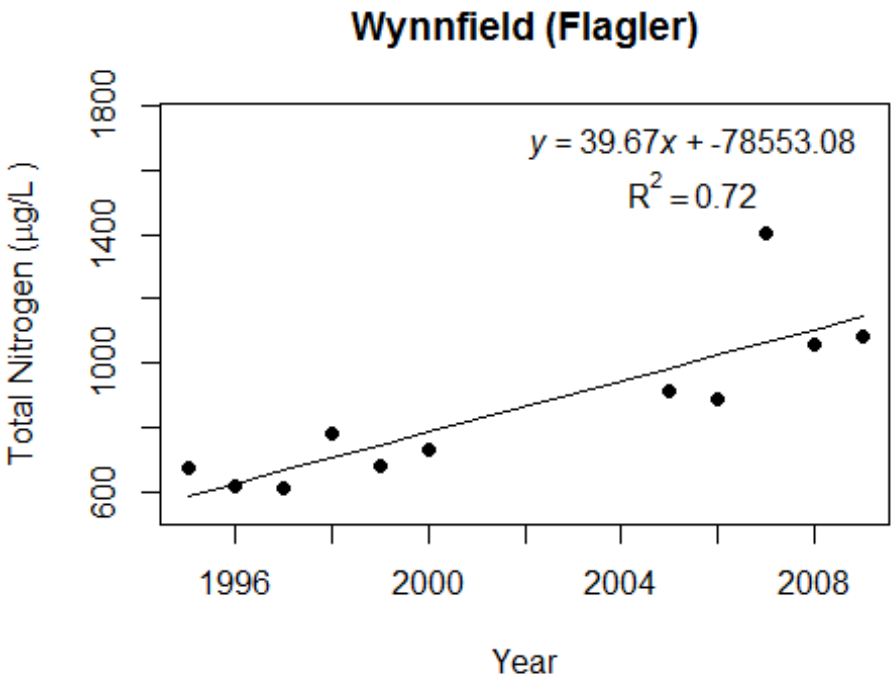
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over time. These analyses define statistics based on the best fit line drawn through the data after plotting them with year on the horizontal line (x-axis) and the data value on the vertical line (y-axis). Figure 2 shows example plots with linear regression statistic of lakes that show significant total phosphorus increases, decreases and no change over time. The statistics that are listed include the following:

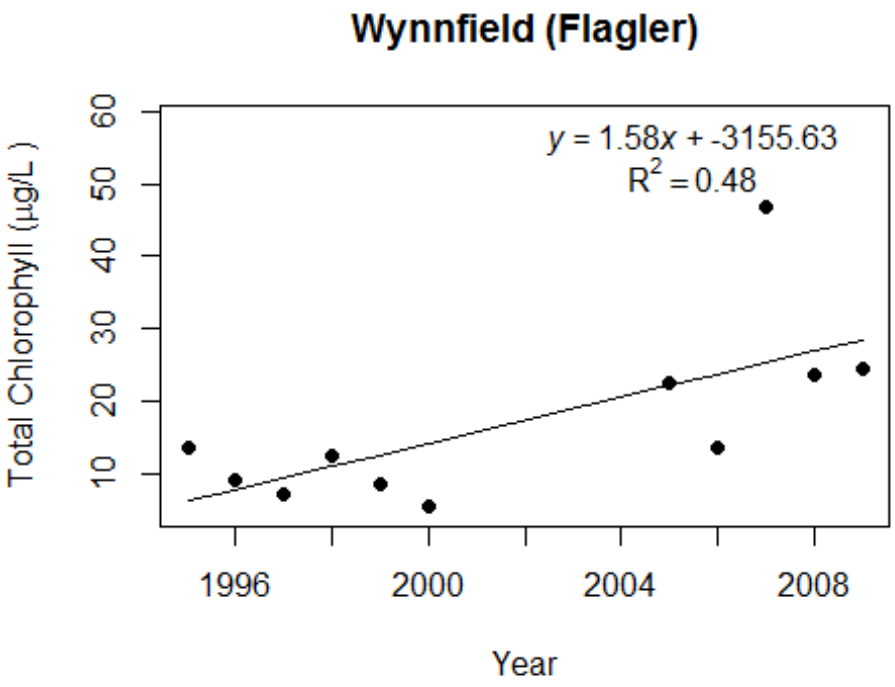
- **Number of years (n):** This is simply the number of years of data that were used to calculate annual means.
- **Intercept (a):** This is the value on the y-axis that the fitted line would cross if the x-axis where zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R^2):** This value is an indication of how much variance above and below the fitted line there is in the data. This value ranges from 0 to 1. A high value means a tight fit and a low value means a loose fit.
- **Probability of Significance (p):** For most statistical analyses a p-value of less than 0.05 means the statistic is significant and analyses with p-values greater than 0.05 are not significant.

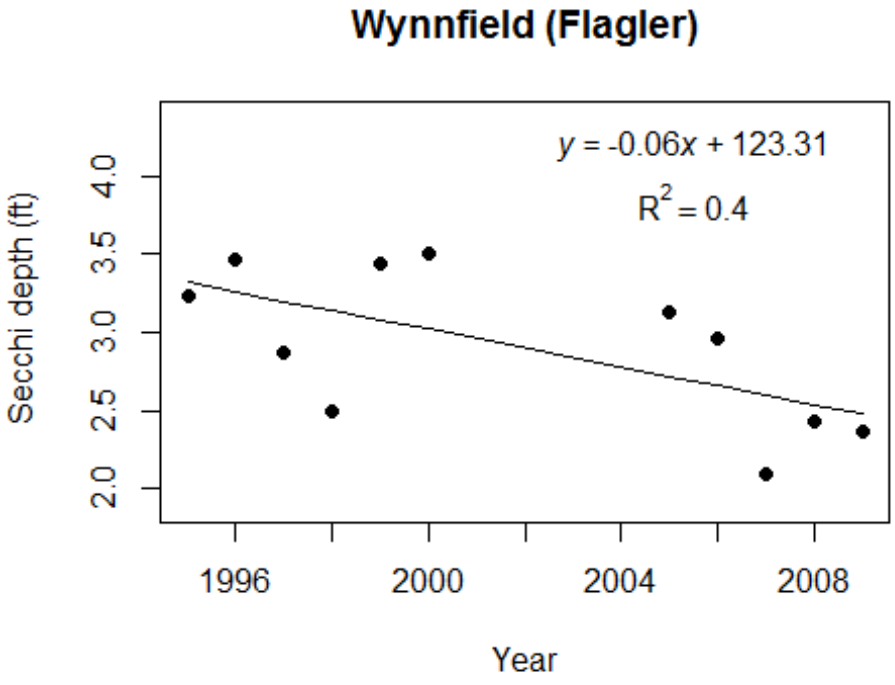
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	11	11	11	11
Intercept (a)	-8391	-78553	-3156	123
Slope (b)	4.22	39.67	1.58	-0.06
Coefficient of Determination (R^2)	0.65	0.72	0.48	0.40
Probability of Significance (p)	0.00	0.00	0.02	0.04
Potential Trend	Increasing	Increasing	Increasing	Decreasing

The following graphs on the next two pages are trend analyses examining regression between year and annual means of total phosphorus, total nitrogen, chlorophyll, and Secchi depth for Wynnfield in Flagler County. If there are no plots then there is less than five years of data, which is not enough for the analysis.


Wynnfield (Flagler)
y = 4.22x + -8391.34
R2 = 0.65
Total Phosphorus (µg/L)
40
60
80
120
1996
2000
2004
2008
Year


Wynnfield (Flagler)
y = 39.67x + -78553.08
R2 = 0.72
Total Nitrogen (µg/L)
600
1000
1400
1800
1996
2000
2004
2008
Year


Wynnfield (Flagler)
y = 1.58x + -3155.63
R2 = 0.48
Total Chlorophyll (µg/L)
10
20
30
40
50
60
1996
2000
2004
2008
Year


Wynnfield (Flagler)
y = -0.06x + 123.31
R2 = 0.4
Secchi depth (ft)
2.0
2.5
3.0
3.5
4.0
1996
2000
2004
2008
Year

City of Palm Coast, Florida
Agenda Item

Agenda Date: October 25, 2018

Department	PLANNING	**Amount**	
Item Key	4624	**Account #**	

Subject BEAUTIFICATION AND ENVIRONMENTAL ENHANCEMENTS

Background :

Recommended Action :
Presentation only

11.01.03. Measurement of Trees

For the purposes of this Chapter, the size of existing trees shall be calculated by the measurement of the diameter of the trunk in caliper inches, taken at breast height (four feet six inches). The size of new landscape trees shall be calculated by measurement of the diameter of the trunk at six (6) inches above grade, up to and including trees four (4) inches in diameter. The size of new trees over four (4) inches in diameter shall be calculated by measurement of the diameter of the trunk at twelve (12) inches above grade.

11.01.04. Classification of Developments

For the purpose of applying landscaping and irrigation requirements, developments are classified as follows:

A. MFR/COM: Townhouse, condominium, and multifamily residential development and institutional, office and commercial uses;

B. IND: Industrial and warehousing development;

C. SUBD: Subdivisions in any zoning district; and

D. SFR/DPX: Single-family detached and duplex development on individual lots.

Section 11.02. Tree Preservation, Protection, and Replacement

11.02.01. Protected Trees Defined

All trees that meet the following criteria are protected, with the exception of invasive species (see Subsection 11.02.05.C.1) and/or species not suited to this area per the United States Department of Agriculture hardiness list:

A. The trunk is six (6) inches or greater diameter.

B. Trees with a trunk four (4) inches or greater diameter, if surveyed for credit.

C. Specimen trees, which are any protected trees with a trunk of twenty-four (24) inches or greater diameter except for sand pines; however the following species are considered specimen trees when they reach one of the following:

1. Twelve (12) inches or greater diameter: Cypress, Magnolia, Loblolly Bay, Red Bay, Scrub Oak, and Red Cedar;
2. Eighteen (18) inches or greater diameter: Elm, Hickory, Oak, Green Ash, Sycamore, Date Palm, and Maple.

D. Historic trees, which are any protected trees with a trunk of thirty-six (36) inches or larger diameter.

E. For SFR/DPX development, any tree one and one-half (1½) to six (6) inches in diameter that was planted to meet the minimum tree density requirements or an existing tree that was previously credited towards meeting the requirements of this Chapter.

11.02.02. Tree Survey Requirements

A. Tree Survey

The required survey shall be accomplished within the last twenty-four (24) months and shall identify all protected trees by species name and the size of the trunk measured at the diameter at breast height.

B. Monument Signs

Where monument signs are proposed to be located on an existing development, all protected trees that are located within fifty (50) feet of the proposed sign shall be shown on the tree survey.

C. Protected, Specimen, and Historic Trees

1. MFR/COM and IND Developments

a. The tree survey shall show all protected trees six (6) inches in diameter and greater from the property lines to five (5) feet past the required buffer area width, except as provided in Section 11.02.02.D. Protected trees within any adjacent rights-of-way extending to the nearest street pavement shall be included in the survey.

b. All specimen and historic trees shall be individually located and identified over the entire site as to species and size except as provided in Section 11.02.02.D.

2. SUBD Developments

All specimen and historic trees shall be individually located and identified over the entire site as to its species and size except as provided in Section 11.02.02.D.

3. SFR/DPX Developments

a. Protected trees six (6) inches or greater diameter within all front, rear, and street side building setback areas shall be surveyed and shown on the tree survey if the trees are going to be used for credit.

b. Specimen and historic trees shall be surveyed over the entire lot except as provided in Section 11.02.02.D.

D. Survey of Individual Trees Not Required

Under the following circumstances, the Land Use Administrator may determine that a survey identifying each individual protected tree is not warranted and a count of all protected trees including species and diameter size is acceptable:

1. When existing vegetated areas are to remain undisturbed; or
2. Where some or all of a development site or a proposed subdivision must be filled to such an extent, in order for permitted development to occur, that there is no feasible means to save protected trees.
3. When the trees are located in wetland preservation or conservation areas that will not be impacted.

11.02.03. Tree Preservation

A. Specimen and Historic Tree Preservation Requirements

Specimen and historic trees are select protected trees that due to their size and contribution to the overall tree canopy of the City are granted an extra level of significance and protection. Building footprints, drives, stormwater management facilities, and similar activities on all sites shall be designed to save the maximum practicable number of specimen and historic trees. During the subdivision platting process, lot lines shall be shifted for the same purpose. Table 11-1 shows the minimum percentage of specimen and historic trees that shall be preserved on a site. Owners of lots assigned the SFR, DPX, and EST zoning districts may remove any specimen or historic tree

that is within the buildable area of the lot with no mitigation, if all reasonable efforts to shift or flip the building footprint cannot save the tree(s).

Table 11 - 1: Minimum Specimen and Historic Trees to be Preserved

Number of Specimen/ Historic Trees on a Site	Percentage of trees to be Preserved MFR/COM, SUBD	IND
Less than 3 per acre, or a portion thereof	75%	50%
3.0 to 5.0 per acre	67%	40%
5.1 to 8.0 per acre	50%	25%
More than 8.0 per acre	4 per acre	2 per acre

B. Tree Preservation Credits

The following credits apply only within the COM, IND, MFR, OFC, P&G, and PSP zoning districts:

1. Trees saved in wetlands or their associated upland buffers are eligible for preservation credits; however, preservation of trees in wetlands for preservation credits may not also be used as criteria for preserved wetlands and imperiled upland habitats density bonuses established in Chapter 3.
2. A stormwater retention/detention area may be credited toward meeting the tree density requirement provided the area contains tree species that will survive periodic flooding.
3. The total diameter of preserved protected, specimen, and historic trees on the site may be applied to satisfy the tree density requirements. A preserved palm tree shall be credited on a one-to-one basis for any palm tree removed.
4. Existing pine trees (other than sand pine) in good health may be used as buffer shade tree credits if they are a minimum of six (6) inches diameter and comprise no more than fifty (50) percent of the buffer tree requirement. If pines meeting these criteria are of good quality and spacing such that planting of new shade trees for some or all of the remaining required buffer shade trees is impractical, then existing pines may count for more than the fifty (50) percent maximum requirement.

11.02.04. Tree Protection Measures

A. Canopy Road, Specimen, and Historic Tree Protection

In order to protect the existing tree canopy over portions of roadways within the City, the following roadway segments have an extra level of significance and protection: Colbert Lane (from the south right-of-way line of Palm Coast Parkway SE to 2,200 feet to the south), Palm Coast Parkway east of I-95, and Palm Harbor Parkway south of the Hammock Dunes Bridge.

Roadway projects and modifications to these roadway systems necessitated by development shall preserve and protect any specimen or historic tree within the right-of-way and within thirty-five (35) feet of the right-of-way line along Colbert Lane (from the south right-of-way line of Palm Coast Parkway SE to 2,200 feet to the south), Palm Coast Parkway east of I-95, and along Palm Harbor Parkway south of the Hammock Dunes Bridge. The applicant may meet this requirement by utilizing an average protected width of thirty-five and a minimum width of twenty-five (25) feet and maximum width of forty-five (45) feet. Within these protected tree areas, the specimen

and historic trees shall not be removed except for the minimal number necessary to allow for site access, sidewalks, necessary utilities, and signage. Preservation methods are to include, but are not limited to, the following:

1. Reduction of the length of turn, deceleration, or acceleration lanes subject to public safety needs and the approval of the Land Use Administrator.
2. Consideration of alternatives to widening such as alternate service roads.
3. Root protection/aeration construction methods such as retaining walls with guardrails.
4. Where no practical alternative for preservation is possible, such as traffic safety conflicts, the total diameter of the protected tree being removed shall be replaced with replacement trees having no less than four (4) inch caliper.

B. Tree Protection During Clearing or Tree Trimming Activities

Protected trees, including their tree protection zones, in front buffer areas shall be preserved if trees are in good condition and do not impede access or visibility into or out of the site.

C. Tree Protection During Construction

1. During any development activity, appropriate protective measures, per City standards, shall be taken to prevent the destruction or damage of all trees to be retained on the site. The preservation of existing vegetation within the tree protection zones of all trees to be retained is required, unless the vegetation is hand cleared.
2. Protection methods, including trimming/pruning of trees and tree barricades, shall conform to ANSI A-300 standards.

11.02.05. Tree Removal

A. Prohibitions

Unless exempted herein, it is prohibited and unlawful for a person or entity, agent, or representative thereof, directly or indirectly, to perform or authorize the following:

1. Cut down, remove, damage, or destroy any protected tree as defined in Section 11.02.01 on any parcel without first obtaining a tree removal permit (for required mitigation standards on MFR/COM and IND properties refer to Section 11.04.02 and on SFR/DPX properties refer to Table 11-4);
2. Commit any act or authorize the commission of any act that physically or effectively removes a protected tree or causes a tree to die, such as damage inflicted upon the root system by heavy machinery, chemicals, or paving, any pruning or tree work inconsistent with ANSI A-300 standards, or changing the natural grade above the root system (removal or effective removal of any protected, specimen or historic tree on MFR/COM and IND properties shall be mitigated per Section 11.04.02 and on SFR/DPX properties refer to Table 11-4);
3. Root raking the area within the tree protection zone or adding fill over the tree protection zone, which may cause damage and permit infection or pest infestation to a protected tree; or
4. Perform tree removal, land clearing, grubbing, grading, excavation, construction, or make or install any improvement upon any site or parcel, regardless of the existence of valid permits or approvals for the given activity, unless all protected trees and protected vegetative areas established pursuant to this chapter have been surrounded by a protective barrier.

B. Land Clearing

During the subdivision infrastructure construction stage, clearing of trees and existing vegetation shall be limited to the minimum necessary to construct roadway and utility rights-of-way and stormwater facilities. Trees may only be cleared from individual lots upon review and approval of the tree survey and/or fire hazard considerations at the time of building permit application. However, in order to accommodate development within a subdivision where fill is required to such a depth that it would preclude the survival of existing trees, lots may also be cleared provided:

1. A clearing and grading plan shall be submitted showing vegetation and tree areas to be preserved, the amount of fill needed for lot development based on existing grades, proposed roadway and building elevations, and drainage plans.
2. Replacement of these trees may be allowed in common areas of the subdivision (i.e., street trees, detention or retention ponds, buffer areas, etc.).

C. Tree Removal Activities Exempt from Permit/Replacement Requirements

The following activities shall be lawful without application or issuance of a tree permit and do not require tree replacement:

1. The removal of any invasive plant species as determined by the Florida Department of Agriculture and Consumer Services' "Noxious Weeds" rule set forth in the Florida Administrative Code.
2. The removal or alteration of any tree or vegetation in or about an existing City or utility easement or right-of-way provided such work is done by, or under the control of, the operating utility company, and said company has received all necessary licenses or permits to provide utility service within the easement.
3. Removal or effective removal of trees severely cut by a utility company on SFR and DPX zoned platted lots.
4. Any activity conducted by a lawfully operating and bona fide commercial nursery, tree farm, agricultural operation, silvicultural operation, ranch, or similar operation when the activity occurs on property owned or lawfully occupied by the person conducting said activity and is done in pursuit of said activity. This exemption shall include the purposeful removal of a tree or trees for their permanent relocation at another site undergoing development.
5. Trees located within a City drainage easement, City drainage rights-of-way, or City access rights-of-way that need to be removed to allow for access to or maintenance or clearing and construction of the City's drainage ditches and drainage related facilities.

D. Permit Requirements

1. A permit is required for land clearing/filling. It is prohibited and unlawful to clear trees, fill land, excavate, or dredge any parcel of land prior to the issuance of a single-family building permit or a site development permit, unless otherwise stated in this LDC, or authorized by the Land Use Administrator. The building permit shall act as the tree removal permit.
   a. Vacant properties may be partially cleared to enable the construction of seawalls prior to a permit being issued for a principal structure. Refer to Section 4.01 for requirements.
   b. Vacant properties may be partially cleared for the purpose of removal of unsuitable debris or muck within the buildable area of a site. Refer to Chapter 9 for permitting requirements.

c. Vacant single-family residential properties that are under common ownership with any developed adjacent residential lot may be cleared of all pines, vegetation, and any trees less than six (6) inches in diameter if the minimum tree densities are maintained or replaced. Refer to Chapter 9 for permitting requirements.

2. Prior to the removal of any protected tree, an application for tree removal shall be submitted to the City. If the requested removal is in conjunction with an approved building permit, grade and fill permit, or a site development permit, a separate permit need not be obtained, but tree removal shall be addressed during the development order review process. The following types of tree removals require a permit but mitigation is not required.

a. Trees within clusters if there is a need to relieve thinning or overcrowding of trees, as part of an approved fire mitigation plan.

b. Protected trees, exclusive of specimen and historic trees, that would not drop the lot below the minimum tree density requirements on SFR/DPX platted lots, as outlined in Section 11.03.01.A.

E. Removal of Protected Trees

Protected trees removed under this section shall require replacement on MFR/COM and IND properties per Table 11-2 and on SFR/DPX properties per Table 11-4 if the tree was originally preserved or planted to meet a requirement of this Chapter or the tree removal would cause the property to no longer meet the minimum tree density standards outlined in Section 11.03.01.A. Upon receipt of a completed application and verification on-site by a certified arborist or the Land Use Administrator, the Land Use Administrator may permit the removal of the following protected trees:

1. Dead, severely diseased, or severely injured trees, as determined by a certified arborist or the Land Use Administrator.
2. Trees that pose imminent danger to the health, safety, and welfare of the public and cannot be corrected through standard arboricultural procedures, as determined by a certified arborist.
3. Trees that pose a sight distance visibility problem along any public right-of-way.
4. Any pine tree within thirty (30) feet of a structure or within a distance from a structure less than the tree's height may be removed as a safety precaution provided the property owner where the tree is located agrees to the removal and applies for the permit.
5. Trees causing structural damage to a foundation, driveway, parking lot, patio, wall, water or sewer line, or which interfere with the construction or repair of public infrastructure or facilities that cannot be corrected by standard arboricultural means.

F. Tree Removal on Developed Residential Lots

On developed lots zoned SFR, DPX, or EST all provisions of Subsection 11.02.05.D.2 and Subsection 11.02.05.E would apply as well as the requirements to maintain the minimum tree density as outlined in Subsection 11.03.01.A. The following additional requirements also apply:

1. Protected trees, exclusive of specimen and historic trees that are in excess of the minimum tree density for the lot, can be removed without mitigation, but those not in excess of the minimum tree density require replacement per Table 11-4.
2. Removal of a specimen or a historic tree shall be mitigated as follows:

a. A specimen tree - One (1) shade tree per Table 11-4.
b. A historic tree - Two (2) trees meeting the standards of Table 11-4 with at least one (1) tree being a shade tree.

G. Tree Thinning on MFR/COM and IND Developments

On properties where the landscaping has been planted for a minimum of ten (10) years or where the property owner has retained or planted more trees than required by this Chapter and meets all of the standards of this Chapter; tree thinning of overcrowded trees may be requested by the property owner or designated agent upon submittal of a report by a certified arborist to the City. After review, the Land Use Administrator may approve or conditionally approve a thinning of the overcrowded trees when the intent of the original landscape plan and this Chapter would still be met by the removal of such trees, and where:

1. Required trees have matured and grown to such a size and density that tree thinning would be the most prudent methodology for maintaining the health and vibrancy of the trees; or
2. Trees in excess of the required minimum have matured and grown to such a size and density that tree thinning would only have an insignificant impact on the overall landscaping of the site.

Preference for removal shall be given to trees having poor structure, root issues, or in declining health. Tree replacement and mitigation are not required after tree thinning.

H. Requirements Suspended

During a declared emergency, the Land Use Administrator may suspend the requirements of this subsection.

11.02.06. Tree Mitigation Standards

Applicants are strongly encouraged to preserve as much of the existing vegetation as possible. Therefore, existing protected trees are counted toward meeting the landscaping requirements for a site. By saving protected trees, rather than planting new ones, applicants can achieve the minimum planting requirements in a more efficient and economical manner.

Tree mitigation for all protected, specimen, and historic trees for MFR/COM and IND developments shall be provided as shown in Table 11-2 and for SFR/DPX properties shall be provided per Table 11-4. The property owner shall be responsible for the cost of mitigating the trees removed from the property.

Table 11 - 2: Tree Mitigation Requirements for New MFR/COM and IND Development

Protected Trees	Specimen Trees	Historic Trees	Palm Trees
70% of the predevelopment tree inches removed from the required perimeter buffer areas of the site. Minimum replacement tree size shall be 2-1/2" caliper.	70% of the tree inches removed from the site. Minimum replacement tree size shall be 3" caliper.	100% of the tree inches removed from the site. Minimum replacement tree size shall be 3-1/2" caliper.	40% of palms removed from the site. Minimum replacement shall be 8' clear trunk palms (preferably Sabal Palms).

b. For screening of mechanical equipment, utilities and storage areas, see Section 13.04.07.A.

11.03.05. Landscape Buffer Requirements

A. Buffer Type Determination

Determining perimeter buffer requirements for a site consists of a two (2) -step process:

1. Use Table 11- 5 to determine the type of buffer required.
2. Use Table 11- 6 to find the design standards for the particular buffer required.

B. Perimeter Buffer Requirements

Table 11-5 shows the perimeter buffer types required based on the zoning of the subject property and the adjoining zoning/use. The zoning of the subject property is shown on the second row with the black background and the adjoining zoning/use is shown on the left-hand column. To use Table 11-5, go along the second row to find the subject property's zoning and then go down that column to where it aligns with the same row as the adjoining zoning/use. For example, if the proposed development is located on land zoned "IND-1" and the abutting land is zoned "MFR-1" then use the "IND" column at the right-hand side of the table and follow it down to the row labeled "MFR", which would require a perimeter buffer type "D", "E", or "F".

Table 11 – 5: Perimeter Buffer Requirements

	Zoning of Proposed Development				
	AGR, PRS, P & G	SFR, DPX, EST	MFR, MHD	OFC, COM, MPD[1], PSP[2]	IND
Adjoining Zoning/Use (shown below):					
AGR, PRS, P&G	None	None	None	None	None
SFR, DPX, EST	None	None	D, E or F	D, E or F	D, E or F
MFR, MHD	None	None	C	D, E or F	D, E or F
OFC, COM, MPD[1], PSP[2]	None	None	C	C	D, E, or F
IND	None	None	C	C	C
Non Specially Designated Roads	None	A	A	A	A
Specially Designated Segments Palm Coast Parkway, Palm Harbor Parkway and Colbert Lane[3]	None	B	B	B	B
Other Specially Designated Roads or Segments Thereof[4]	None	G	G	G	G
Retention Pond, Lake, or Canal	None	None	None	C	D, E or F

[1] In the MPD zoning district the requirements shall revert to the underlying zoning district or use for the subject property, as described within the MPD Agreement.

[2] Requirements in the PSP zoning district shall revert to the existing or proposed use on the property, as determined by the Land Use Administrator.

[3] Segments are limited to Palm Coast Parkway east of I-95, Palm Harbor Parkway south of the Hammock Dunes Bridge, and Colbert Lane from the south right-of-way line of Palm Coast Parkway SE to 2,200 feet to the south.

[4] Other specially designated roads or segments thereof, include the following: Belle Terre Parkway, Belle Terre Boulevard, Colbert Lane (segment north of Palm Coast Parkway SE and segment more than 2200 feet south of Palm Coast Parkway SE), Cypress Point Parkway, I-95, Matanzas Woods Parkway, Old Kings Road, Palm Coast Parkway

(segment west of I-95), Palm Harbor Parkway (segment north of the Hammock Dunes Bridge), Pine Lakes Parkway, Royal Palms Parkway, S.R. 100, Seminole Woods Parkway, U.S. 1, and White View Parkway.

1. For nonresidential uses, a perimeter buffer will not be required between two (2) or more newly created adjoining lot lines when subdividing a parcel of land that has an existing development or an approved site plan. (For example, two outparcels in front of a shopping center with an anchor tenant building.) In order to qualify, the existing or approved project and future developments on the proposed lots must have approval for a unified or master site plan that incorporates shared facilities including: access, stormwater facilities, and connectivity.
2. The double-frontage lots fronting along Palm Coast Parkway SE or Palm Coast Parkway NE and fronting along the City un-named right-of-way, located about 350 feet south of Palm Coast Parkway NE and extending east from Florida Park Drive to the Intracoastal Waterway, do not have to provide any buffers along the City un-named right-of-way.

C. Buffer Design Standards

The required buffers shall meet the following landscape standards:

Table 11 – 6: Buffer Design Standards

Type	Width[1]	Shade Trees per Linear Feet	Maximum Shade Tree Spacing per Linear Feet	Understory Trees per Linear Feet	Short Screen or Tall Screen	Accent Planting per Linear Feet	Decorative Wall / Fence
A	10'	1/50'	75'	1/50'	Short Screen	N/A	N/A
B	35'	1/50'	75'	1/50'	Short Screen	30/100'	N/A
C[2]	10'	1/50'	75'	Optional	Short Screen[3]	N/A	N/A
D[2]	10'	1/50'	75'	Optional	Not Required	30/100'	Decorative Wall
E[2]	20'	1/50'	75'	Optional	Tall Screen	N/A	Optional
F[2]	15'	1/50'	75'	Optional	Not Required	30/100'	Fence
G	25'	1/50'	75'	1/50'	Short Screen	30/100'	N/A

[1] A 35' Buffer B may be averaged with a minimum width of 25 feet and maximum width of 45 feet, and a 25' Buffer G may be averaged with a minimum width of 20 feet and a maximum width of 30 feet.

[2] Where an adjoining lot is undeveloped, shade tree spacing in the subject lot's adjoining buffer shall be increased to one (1) per seventy-five linear feet and maximum spacing increased to ninety (90) feet. Where an adjoining lot has been developed with an adjoining buffer having shade trees, the subject lot shall have understory trees planted that are staggered between the shade trees.

[3] Not required if the adjoining property has already been developed with the shrubs already planted, or where multi-family, office, or commercial uses are adjacent to any pond, lake, canal or waterway and the view would be an enhancement for the proposed project while not negatively impacting neighboring properties, as determined by the Land Use Administrator. Also, not required when industrial properties are adjacent to each other, except where a parking area is unscreened and adjacent to the buffer.

1. Landscape buffer areas shall be located at the perimeter of the site. Plantings shall not be located in any portion of a public or private right-of-way or drainage easement, unless permitted by a landscape easement. Short, medium and tall screen plantings may be located between the minimum landscape buffer area and the parking lot, building, structure or equipment they are intended to buffer. If not screening parking areas or other areas required to be screened, these screen plantings can be incorporated into the required foundation plantings.

2. At least fifty (50) percent of the existing native vegetation shall be preserved within the landscape buffer area. Preserved native vegetation within the buffer shall be hand cleared of vines, debris, and dead branches to present an attractive transition from maintained to natural. If native vegetation is not present, is insufficient to meet the screening required by this Section, or the Land Use Administrator has determined that it must be removed due to required site grading or existing utilities, then plant material shall be installed to meet the buffer requirement.
3. When calculating the required number of trees and shrubs within a buffer, the width of access ways or easements running perpendicular to the buffer shall be subtracted from the property length.
4. Understory trees may be used in lieu of shade trees where noted in Table 11-6 as "Optional"; however, no more than twenty-five (25) percent of the required trees may be understory trees.
5. Where accent plants are required, no more than thirty (30) percent of the planting bed area shall be comprised of groundcover plants.
6. Uses within buffers:
   a. Buffer yards shall be limited to passive recreation and may contain pedestrian or bicycle trails and public amenities such as decorative fountains, artwork, and similar structures.
   b. Mechanical equipment or structures, directional signs, and backflow preventers may be allowed in perimeter buffer areas pursuant to approval by the Land Use Administrator.
   c. In a buffer ten (10) feet or less in width, none of the required buffer area may be used for stormwater retention/detention. In a buffer fifteen (15) feet in width, no more than thirty-three (33) percent of the required buffer area may be used for stormwater retention/detention. In a buffer twenty (20) feet or more in width, no more than fifty (50) percent of the required buffer area may be used for stormwater retention/detention. These ratios shall be reduced if insufficient room is left for plantings.
   d. A required buffer shall be at least fifteen (15) feet wide before it can be encumbered by the partial overlap of a sidewalk or utility easement running parallel to the buffer, and the overlap shall not exceed one-third of the required buffer width. This ratio may be reduced if stormwater retention/detention areas are also in the buffer or if there is insufficient room for plantings.
7. Decorative walls and fences, when required, shall be six (6) feet in height and comply with the material and design requirements (see Section 4.01 for material and design requirements for walls and fences).

D. Miscellaneous Buffer Requirements

1. Vehicle Display Areas

For automotive, recreational vehicles, motorcycles, motorized watercrafts, and other similar displays, a maximum of thirty-three (33) percent of the frontage short screen plantings may be reduced to a height of twelve (12) inches at time of planting if a minimum height of sixteen (16) inches shall be achieved within two (2) years and maintained at such height. The balance of the short screen planting shall be installed and maintained per the height standards in Table 11-4.

City of Palm Coast, Florida
Agenda Item

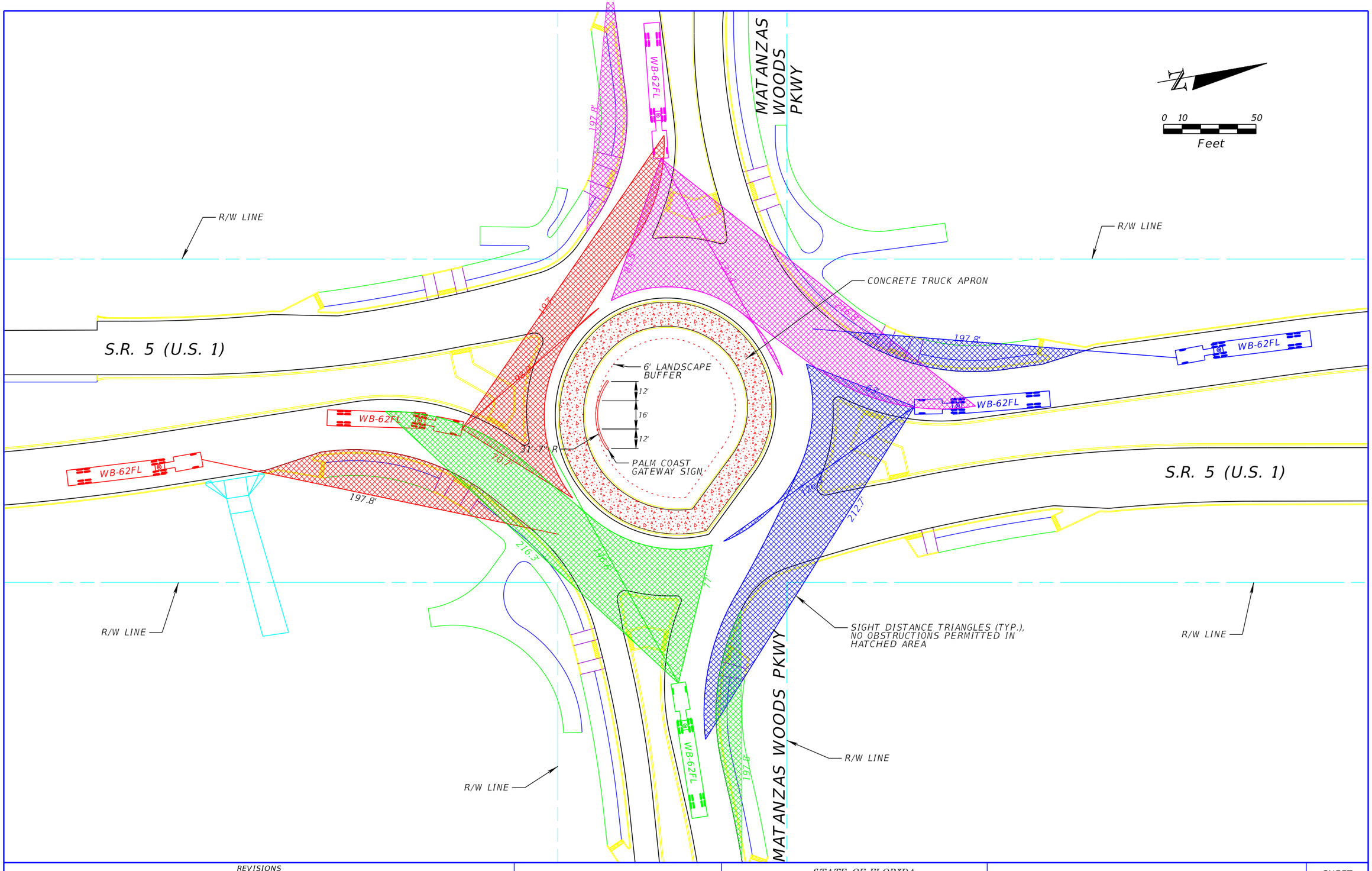
Agenda Date: October 25, 2018

Department	PLANNING	**Amount**	
Item Key	4625	**Account #**	

Subject MATANZAS WOODS PARKWAY/US 1 ROUNDABOUT SIGNAGE AND LIGHTING ENHANCEMENTS

Background :

Recommended Action :
Presentation only



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 5	FLAGLER	437595-1-52-01

PALM COAST GATEWAY SIGN DETAIL

SHEET NO. 223

$USER$ $DATE$ $TIME$ $FILE$