

LAKEWATCH Report for Lover's Key-1 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Estero Bay (including Tidal Imperial River)		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Lover's Key-1
Latitude	26.3916
Longitude	-81.873
Water Body Type	Estuary
Period of Record (year)	2011 to 2016

LAKEWATCH Report for Lover's Key-1 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	30 - 44	37 (6)
Total Nitrogen ($\mu\text{g/L}$)	352 - 544	452 (6)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	2.2 - 8.8	5.6 (6)
Secchi (ft)	4.2 - 6.0	4.9 (6)
Secchi (m)	1.3 - 1.8	1.5 (6)
Color (Pt-Co Units)	10 - 19	14 (6)
Specific Conductance ($\mu\text{S/cm@25 C}$)	28017 - 46600	40236 (6)
Salinity (ppt)	23 - 29	26 (6)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

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Trend Analyses Estuary

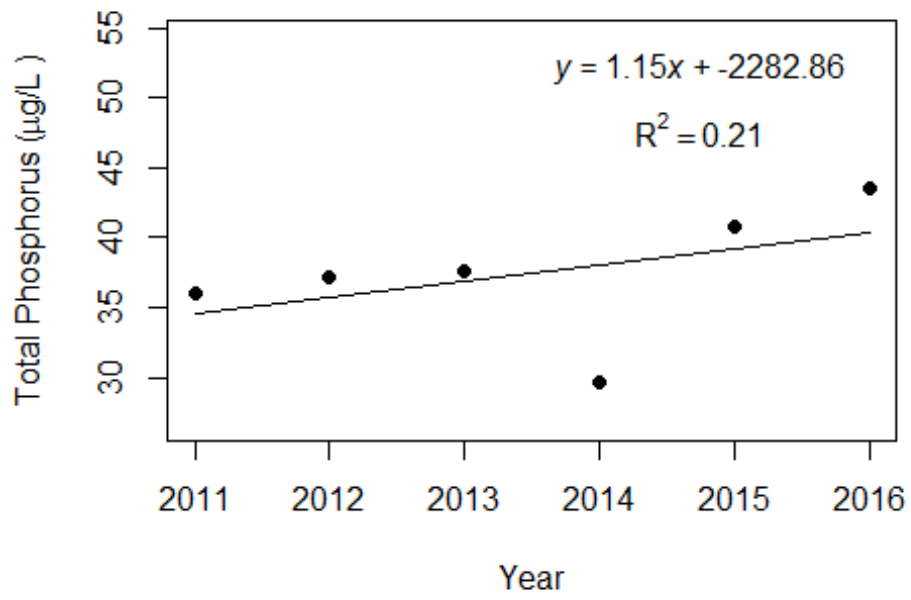
The following data are for linear regression statistics derived by plotting annual average total phosphorus, total nitrogen, chlorophyll, and Secchi data by year of data collection. Linear regression analysis is a common statistical approach used to determine if significant trends are occurring over 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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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.

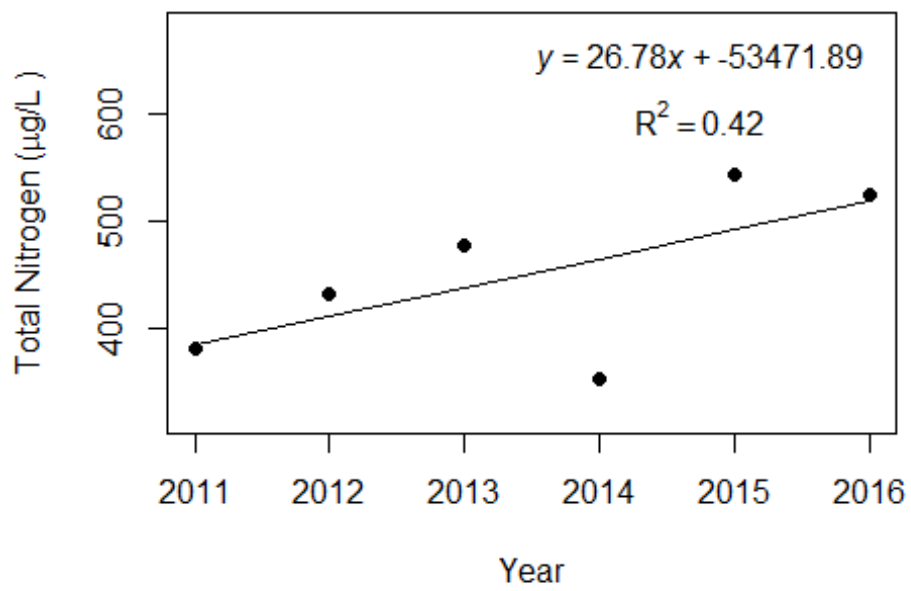
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	6	6	6	6
Intercept (a)	-2283	-53472	-1660	-73
Slope (b)	1.15	26.78	0.83	0.04
Coefficient of Determination (R ²)	0.21	0.42	0.36	0.01
Probability of Significance (p)	0.36	0.17	0.21	0.87
Potential Trend	No Trend	No Trend	No 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 Lover's Key-1 in Lee County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

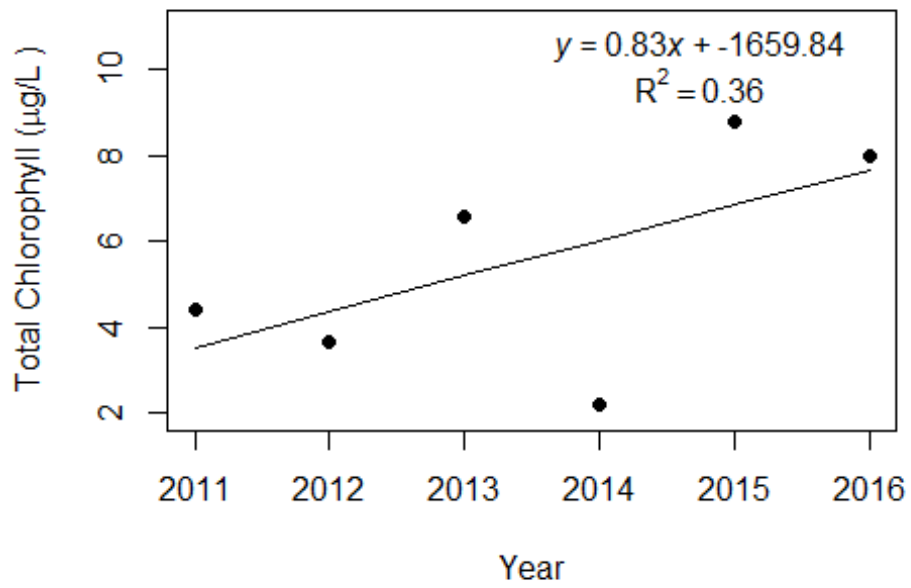
Lover's Key-1 (Lee)



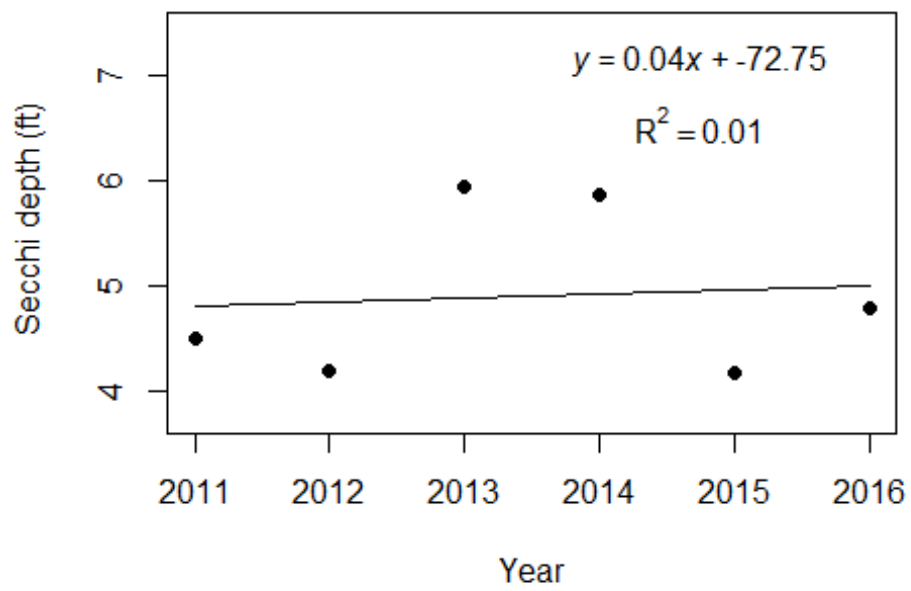
Lover's Key-1 (Lee)



Lover's Key-1 (Lee)



Lover's Key-1 (Lee)



LAKEWATCH Report for Lover's Key-2 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

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The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Estero Bay (including Tidal Imperial River)		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Lover's Key-2
Latitude	26.4002
Longitude	-81.8705
Water Body Type	Estuary
Period of Record (year)	2011 to 2016

LAKEWATCH Report for Lover's Key-2 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	40 - 47	43 (6)
Total Nitrogen ($\mu\text{g/L}$)	348 - 482	411 (6)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	2.2 - 8.0	4.2 (6)
Secchi (ft)	3.3 - 4.7	4.0 (6)
Secchi (m)	1.0 - 1.4	1.2 (6)
Color (Pt-Co Units)	8 -23	14 (6)
Specific Conductance ($\mu\text{S/cm@25 C}$)	28517 - 47400	42303 (6)
Salinity (ppt)	26 - 30	28 (6)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Lover's Key-2 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

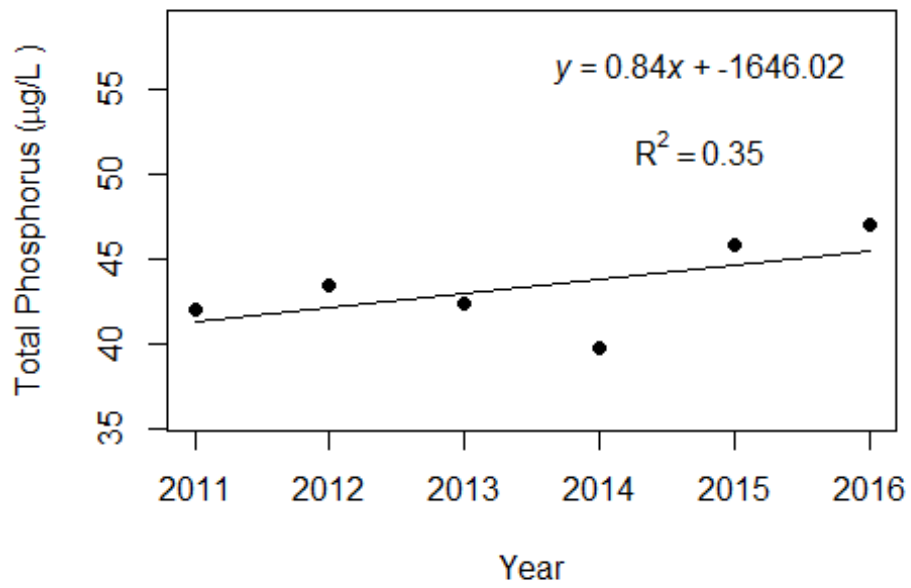
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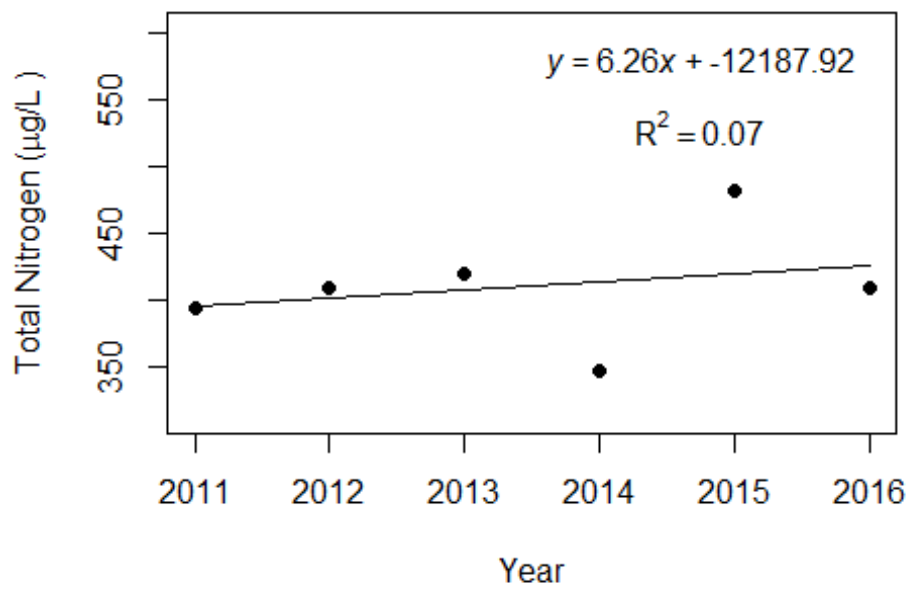
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	6	6	6	6
Intercept (a)	-1646	-12188	-925	-255
Slope (b)	0.84	6.26	0.46	0.13
Coefficient of Determination (R ²)	0.35	0.07	0.18	0.21
Probability of Significance (p)	0.21	0.60	0.40	0.36
Potential Trend	No Trend	No Trend	No Trend	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 Lover's Key-2 in Lee County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

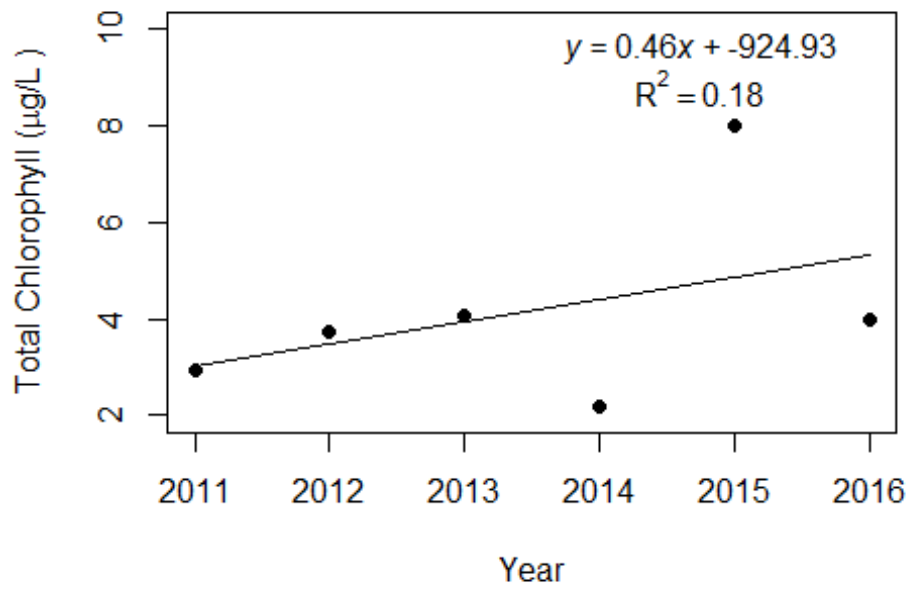
Lover's Key-2 (Lee)



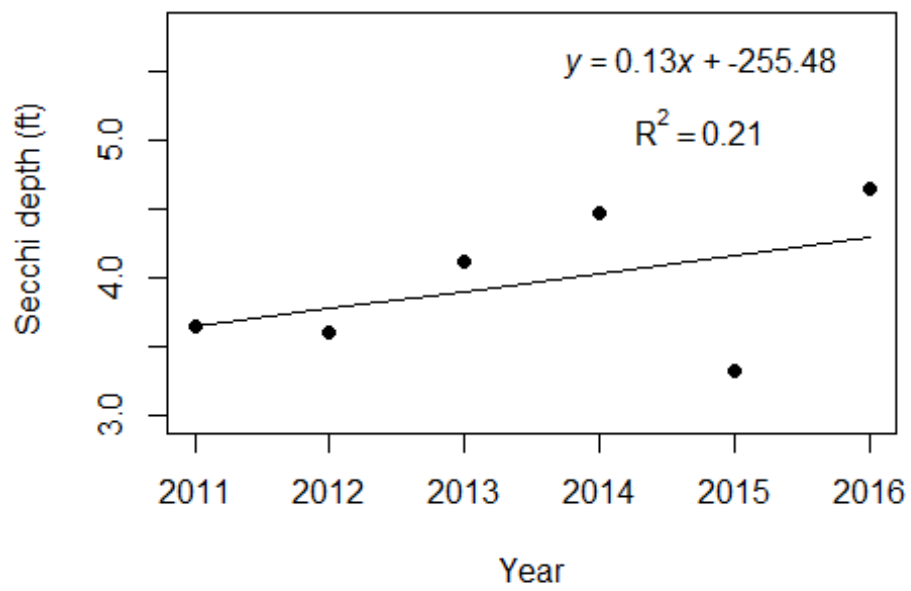
Lover's Key-2 (Lee)



Lover's Key-2 (Lee)



Lover's Key-2 (Lee)



LAKEWATCH Report for Lover's Key-3 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

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The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Estero Bay (including Tidal Imperial River)		

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- **Water Body Type:** Four different types of systems; lakes, estuaries, streams and springs.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Lover's Key-3
Latitude	26.3831
Longitude	-81.8667
Water Body Type	Estuary
Period of Record (year)	2011 to 2016

LAKEWATCH Report for Lover's Key-3 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: Definitions

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Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	32 - 57	42 (6)
Total Nitrogen ($\mu\text{g/L}$)	288 - 456	355 (6)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	2.4 - 7.0	4.1 (6)
Secchi (ft)	0.5 - 4.3	2.7 (6)
Secchi (m)	0.2 - 1.3	0.8 (6)
Color (Pt-Co Units)	4 -11	8 (6)
Specific Conductance ($\mu\text{S/cm@25 C}$)	31017 - 48500	42920 (6)
Salinity (ppt)	24 - 30	28 (6)

Coastal Trophic State

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Trend Analyses Estuary

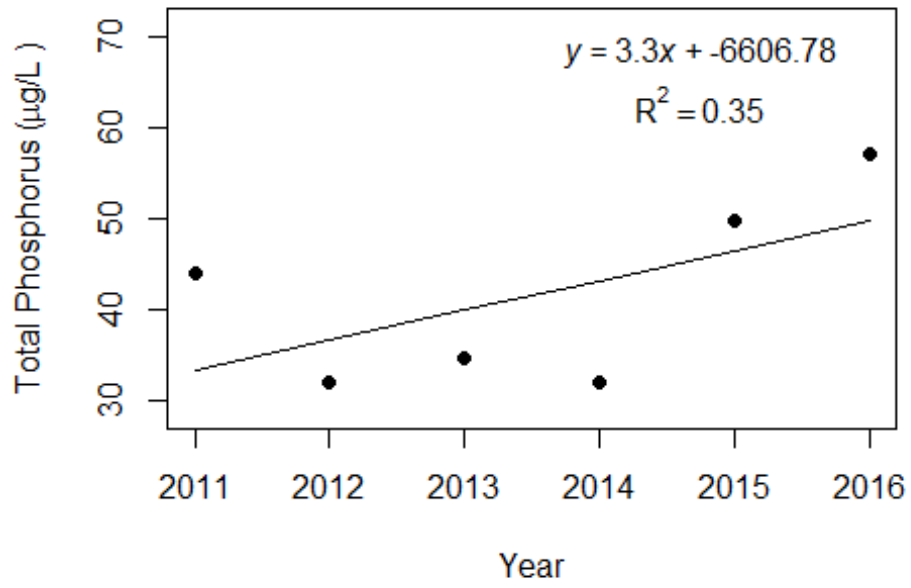
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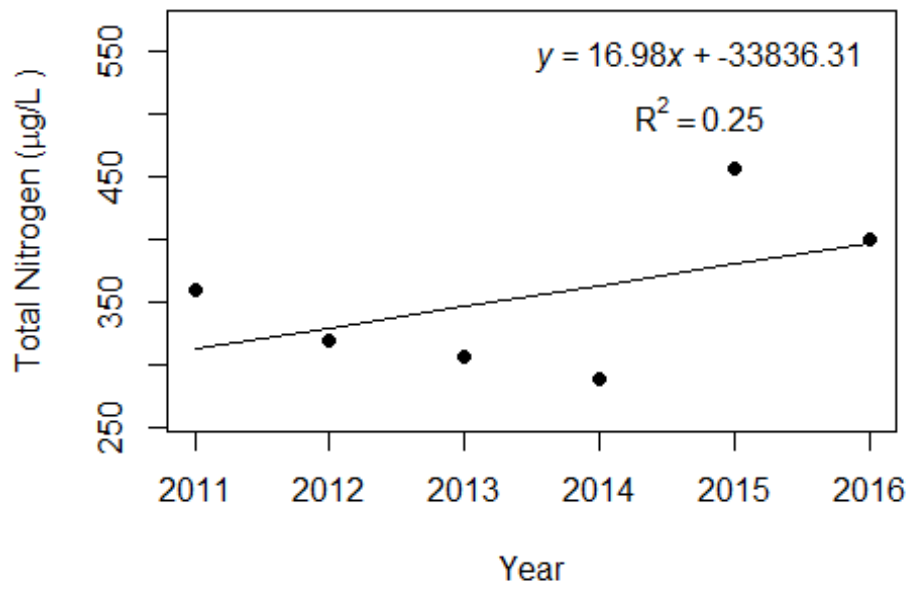
Statistic	Total Phosphorus	Total Nitrogen	Chlorophyll	Secchi
Number of Years (n)	6	6	6	6
Intercept (a)	-6607	-33836	-1687	969
Slope (b)	3.30	16.98	0.84	-0.48
Coefficient of Determination (R ²)	0.35	0.25	0.59	0.23
Probability of Significance (p)	0.21	0.32	0.08	0.41
Potential Trend	No Trend	No Trend	No 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 Lover's Key-3 in Lee County. If there are no plots then there is less than five years of data, which is not enough for the analysis.

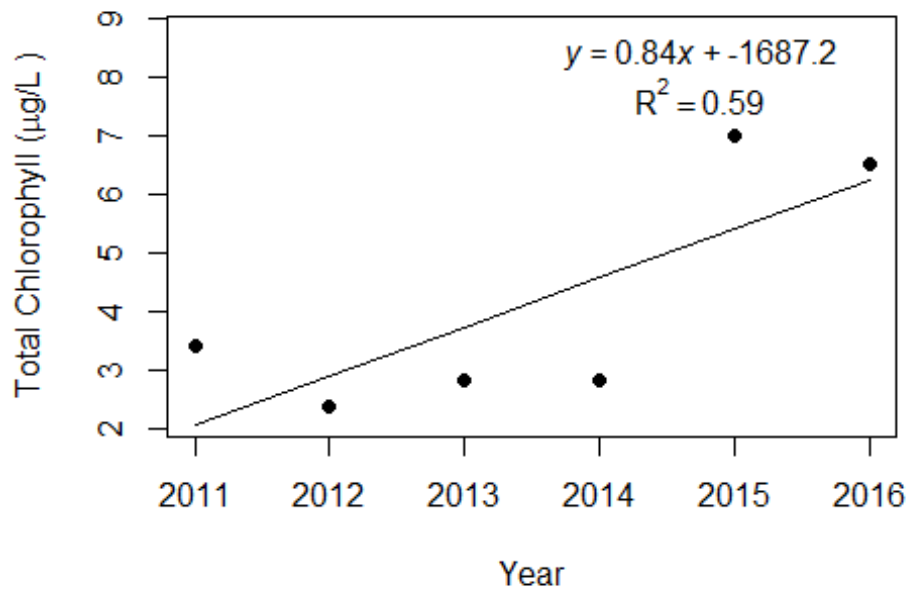
Lover's Key-3 (Lee)



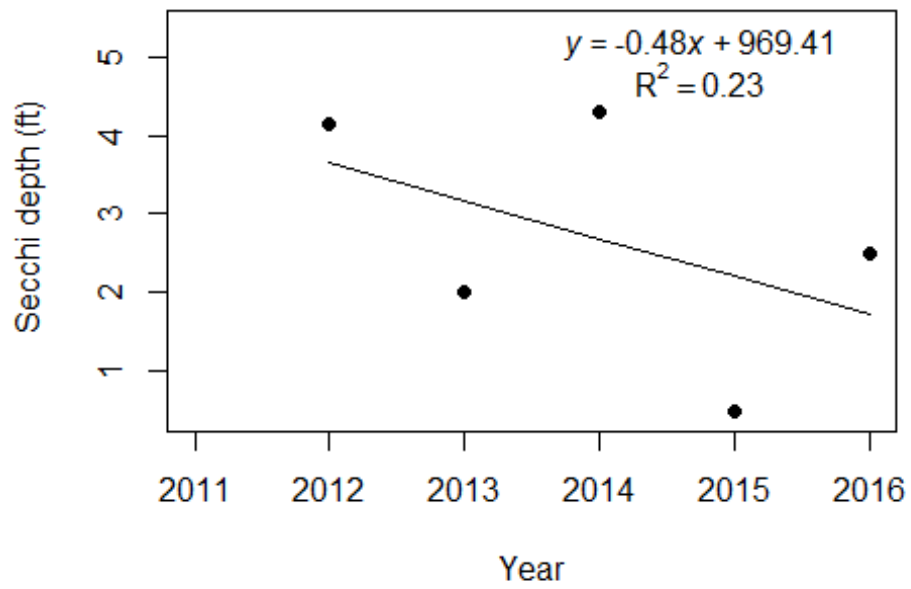
Lover's Key-3 (Lee)



Lover's Key-3 (Lee)



Lover's Key-3 (Lee)



LAKEWATCH Report for Pine Island Sound-1 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

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The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Pine Island Sound		

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- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Pine Island Sound-1
Latitude	26.4794
Longitude	-82.11
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for Pine Island Sound-1 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: Definitions

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- **Total Phosphorus ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	57 - 70	63 (2)
Total Nitrogen ($\mu\text{g/L}$)	414 - 485	449 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	7.9 - 12.1	10.0 (2)
Secchi (ft)	2.6 - 3.0	2.8 (2)
Secchi (m)	0.8 - 0.9	0.9 (2)
Color (Pt-Co Units)	12 - 13	13 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	39750 - 47857	43804 (2)
Salinity (ppt)	25 - 30	27 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Pine Island Sound-1 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 Pine Island Sound-1 in Lee 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 Pine Island Sound-2 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Pine Island Sound		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Pine Island Sound-2
Latitude	26.4833
Longitude	-82.1828
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for Pine Island Sound-2 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	87 - 114	100 (2)
Total Nitrogen ($\mu\text{g/L}$)	599 - 607	603 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	11.1 - 13.9	12.5 (2)
Secchi (ft)	2.8 - 2.8	2.8 (2)
Secchi (m)	0.9 - 0.9	0.9 (2)
Color (Pt-Co Units)	12 -13	12 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	45000 - 47429	46214 (2)
Salinity (ppt)	28 - 30	29 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Pine Island Sound-2 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 Pine Island Sound-2 in Lee 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 San Carlos Bay-1 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	Lower Caloosahatchee River Estuary		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-1
Latitude	26.5264
Longitude	-82.0031
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-1 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus (µg/L)	68 - 147	107 (2)
Total Nitrogen (µg/L)	505 - 1556	1031 (2)
Chlorophyll- uncorrected (µg/L)	5.5 - 9.4	7.4 (2)
Secchi (ft)	2.9 - 3.7	3.3 (2)
Secchi (m)	0.9 - 1.1	1.0 (2)
Color (Pt-Co Units)	22 -46	34 (2)
Specific Conductance (µS/cm@25 C)	29750 - 37488	33619 (2)
Salinity (ppt)	18 - 23	21 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll (µg/L) (Forsberg and Ryding 1980)	Coastal Chlorophyll (µg/L) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-1 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-1 in Lee 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 San Carlos Bay-2 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-2
Latitude	26.5153
Longitude	-82.055
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-2 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	62 - 70	66 (2)
Total Nitrogen ($\mu\text{g/L}$)	518 - 560	539 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	6.3 - 10.1	8.2 (2)
Secchi (ft)	2.3 - 2.3	2.3 (2)
Secchi (m)	0.7 - 0.7	0.7 (2)
Color (Pt-Co Units)	20 -32	26 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	33000 - 44000	38500 (2)
Salinity (ppt)	20 - 27	24 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-2 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-2 in Lee 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 San Carlos Bay-3 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-3
Latitude	26.4897
Longitude	-82.0481
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-3 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	58 - 64	61 (2)
Total Nitrogen ($\mu\text{g/L}$)	483 - 500	491 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	8.9 - 9.4	9.1 (2)
Secchi (ft)	2.2 - 3.6	2.9 (2)
Secchi (m)	0.7 - 1.1	0.9 (2)
Color (Pt-Co Units)	16 -24	20 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	37250 - 45286	41268 (2)
Salinity (ppt)	23 - 28	26 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-3 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-3 in Lee 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 San Carlos Bay-4 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-4
Latitude	26.4806
Longitude	-82.0064
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-4 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	50 - 54	52 (2)
Total Nitrogen ($\mu\text{g/L}$)	421 - 429	425 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	8.2 - 9.3	8.7 (2)
Secchi (ft)	2.6 - 2.6	2.6 (2)
Secchi (m)	0.8 - 0.8	0.8 (2)
Color (Pt-Co Units)	16 -21	18 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	41000 - 46286	43643 (2)
Salinity (ppt)	25 - 29	27 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-4 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-4 in Lee 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 San Carlos Bay-5 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-5
Latitude	26.455
Longitude	-82.0156
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-5 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	38 - 45	42 (2)
Total Nitrogen ($\mu\text{g/L}$)	364 - 374	369 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	5.9 - 8.8	7.4 (2)
Secchi (ft)	5.1 - 5.7	5.4 (2)
Secchi (m)	1.6 - 1.8	1.7 (2)
Color (Pt-Co Units)	9 -12	10 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	40000 - 48625	44313 (2)
Salinity (ppt)	25 - 30	28 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-5 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-5 in Lee 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 San Carlos Bay-6 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	San Carlos Bay-6
Latitude	26.5003
Longitude	-82.0146
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for San Carlos Bay-6 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	59 - 69	64 (2)
Total Nitrogen ($\mu\text{g/L}$)	469 - 483	476 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	3.5 - 7.0	5.3 (2)
Secchi (ft)	5.3 - 6.1	5.7 (2)
Secchi (m)	1.6 - 1.8	1.7 (2)
Color (Pt-Co Units)	26 -129	78 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	8000 - 34750	21375 (2)
Salinity (ppt)	5 - 22	13 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for San Carlos Bay-6 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 San Carlos Bay-6 in Lee 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 Tarpon Bay-1 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Tarpon Bay-1
Latitude	26.4442
Longitude	-82.0853
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for Tarpon Bay-1 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	51 - 55	53 (2)
Total Nitrogen ($\mu\text{g/L}$)	433 - 501	467 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	7.5 - 8.8	8.2 (2)
Secchi (ft)	2.6 - 3.1	2.8 (2)
Secchi (m)	0.8 - 0.9	0.9 (2)
Color (Pt-Co Units)	14 - 14	14 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	41500 - 47750	44625 (2)
Salinity (ppt)	26 - 30	28 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tarpon Bay-1 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 Tarpon Bay-1 in Lee 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 Tarpon Bay-2 in Lee County Using Data Downloaded 10/17/2016

Introduction Estuary

For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Florida Department of Environmental Protection (FDEP) initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards (see for Florida Department of Environmental Regulation Nutrient Criteria's for: Estuaries and coastal segments: <http://www.dep.state.fl.us/water/wqssp/nutrients/index.htm>).

The near shore Florida coastline is separated into estuary and estuary segments within the estuary. Deeper coastal waters are separated into coastal nutrient regions and coastal nutrient segments within the regions. Numeric nutrient criteria are established for all estuary segments, including criteria for total nitrogen, total phosphorus, and chlorophyll a. For open ocean coastal waters, numeric criteria are established for chlorophyll a, that is derived from satellite remote sensing techniques. For those locations without defined segments there are narrative nutrient criteria (e.g., Florida Keys Halo Zone).

The maps defining individual estuaries and coastal segments can be found at: <https://www.flrules.org/Gateway/reference.asp?No=Ref-05420>.

The individual nutrient criteria can be found at: <https://www.flrules.org/gateway/ruleNo.asp?id=62-302.532>

Estuary lies in the following location:

Estuary	Estuary Segment	Coastal Nutrient Region	Coastal Nutrient Segment
Charlotte Harbor/Estero Bay	San Carlos Bay		

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 estuary resides.
- **Name:** Estuary 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.
- **Period of Record (year):** Years an estuary has been in the LAKEWATCH program.

County	Lee
Name	Tarpon Bay-2
Latitude	26.4636
Longitude	-82.0667
Water Body Type	Estuary
Period of Record (year)	2001 to 2002

LAKEWATCH Report for Tarpon Bay-2 in Lee County Using Data Downloaded 10/17/2016

Long-Term Data Summary Estuary: 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 ($\mu\text{g/L}$):** The nutrient most often limiting growth of plant/algae in Florida's fresh and saltwater environments.
- **Total Nitrogen ($\mu\text{g/L}$):** Another nutrient needed for aquatic plant/algae growth but only limiting when nitrogen to phosphorus ratios are generally less than 10.
- **Chlorophyll-uncorrected ($\mu\text{g/L}$):** 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 ($\mu\text{S/cm@25}^\circ\text{C}$), Salinity (ppt):** Measurement of the ability of water to conduct electricity and can be used to estimate the amount of dissolve materials in water.

Long-Term Data Summary Estuary: Data

Parameter	Minimum and Maximum Annual Means	Mean of Annual Means (Sampling years)
Total Phosphorus ($\mu\text{g/L}$)	46 - 51	48 (2)
Total Nitrogen ($\mu\text{g/L}$)	400 - 423	412 (2)
Chlorophyll- uncorrected ($\mu\text{g/L}$)	6.4 - 9.4	7.9 (2)
Secchi (ft)	4.6 - 4.9	4.7 (2)
Secchi (m)	1.4 - 1.5	1.4 (2)
Color (Pt-Co Units)	12 -19	15 (2)
Specific Conductance ($\mu\text{S/cm@25 C}$)	40250 - 46750	43500 (2)
Salinity (ppt)	25 - 29	27 (2)

Coastal Trophic State

Trophic status is a measure of a systems biological productivity and LAKEWATCH uses total chlorophyll averages as a trophic state measure. Since the total chlorophyll measurement indicates how much algae is actually present in a water body, it is the most direct indicator of biological productivity. For freshwater lakes, LAKEWATCH uses the trophic state classification criteria proposed by Forsberg and Ryding (1980). LAKEWATCH staff sampled coastal systems around all of Florida (Hoyer et al. 2002) and discovered that chlorophyll concentrations are significantly less for the same amount of algae than freshwater lakes. Thus, to classify trophic status of coastal waters using similar classification terminology LAKEWATCH provided the table below accounting for the chlorophyll differences reported by Hoyer et al. (2002).

Trophic Status	Freshwater Chlorophyll ($\mu\text{g/L}$) (Forsberg and Ryding 1980)	Coastal Chlorophyll ($\mu\text{g/L}$) (Hoyer et al. 2002)
Oligotrophic	< 3.0	< 0.5
Mesotrophic	3.0 - 7.0	0.5 - 1.8
Eutrophic	7.0 - 40.0	1.8 - 12.4
Hypereutrophic	> 40.0	> 12.4

Hoyer, M. V., T. K. Frazer, S. K. Notestein and D. E. Canfield, Jr. 2002. Nutrient, chlorophyll, and water clarity relationships in Florida's nearshore coastal waters with comparisons to freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1-8.

LAKEWATCH Report for Tarpon Bay-2 in Lee County Using Data Downloaded 10/17/2016

Trend Analyses Estuary

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 were zero.
- **Slope (b):** This is the rate at which the fitted line increases (positive number) or decreases (negative number).
- **Coefficient of determination (R²):** 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 Tarpon Bay-2 in Lee County. If there are no plots then there is less than five years of data, which is not enough for the analysis.