

TECHNICAL MEMORANDUM
No. 1

JonesEdmunds

Janicki Environmental, Inc.

Blue Cypress Lake – Water Quality Study

TO: Vincent Burke, PE, Utilities Director, Indian River County

FROM: Brett Cunningham, PE, Jones Edmunds
Anthony Janicki, PhD, Janicki Environmental

XC: Bill Lynch, PE, Jones Edmunds
Jon Perry, Janicki Environmental

DATE: September 19, 2018

SUBJECT: Task 1 – Data Collection and Task 3 – Trend Analysis
Jones Edmunds Project No. 08620-002-01

1 INTRODUCTION

This Technical Memorandum is part of a Water Quality Study for Blue Cypress Lake (BCL). When complete, the Study will determine whether anthropogenic influences are a significant causative factor in water quality. More specifically, whether the application of biosolids in the tributary watershed discharging to BCL is affecting water quality will be determined.

2 OBJECTIVES

The project objective is to gather, validate, and assess the water quality data associated with BCL and its watershed, including the permitted use of land application of biosolids. This Technical Memorandum reports on the results regarding the water quality data collection completed as part of the Task 1 and Task 3 examination of temporal trends in the water quality data of the BCL Water Quality Study. Information related to land application of biosolids within the BCL watershed will be presented in Technical Memorandum No.2 following collection and review of information.

3 DATA SOURCES

To address the changes occurring in BCL, available data were extracted from the Florida Department of Environmental Protection (FDEP) Impaired Waters Rule (IWR) Run 55 dataset for the Waterbody Identification (WBID) containing BCL and the surrounding WBIDs. A WBID is the spatial unit used by FDEP for assessing a waterbody's ability to meet its designated use.

These WBIDs included the following:

- Blue Cypress Lake (2893V)
- Padgett Branch (Class I) (3152C)
- Blue Cypress Lake Drain (2893V1)
- Blue Cypress Marsh (28938)
- Blue Cypress Creek (3133)
- Padgett Branch (3152B)

Each of these waterbodies are designated as Class I – Potable Water Supplies, except Padgett Creek (3152B) which is a Class III – Fish Consumption, Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife.

The IWR Run 55 dataset included data collected from the late 1960s until mid-2017. To extend that record to the most recent samples, the web-based St. Johns River Water Management District’s (SJRWMD) Environmental Data Retrieval Tool (<http://webapub.sjrwmd.com/agws10/edqt/>) was used to query all of the surface water collected in the SJRWMD Blue Cypress Creek planning unit, which were further reduced to the selected WBIDs based on station location. These queries resulted in additional locations and data not in the IWR Run 55 dataset.

Figure 1 shows the location of the WBIDs in relation to BCL and the density of the stations extracted from the two data sources.

4 TASK 1 – DATA COLLECTION

4.1 DATA COMPILATION AND VALIDATION

Several actions were required to produce a single dataset for analysis:

1. Format the SJRWMD dataset to be compatible with the IWR dataset. This included altering the field name and converting analytes listed to those used by FDEP.
2. Combine the two datasets. This action required checking for duplicate records since the extraction from the SJRWMD database included data already in the IWR dataset and data not reported to FDEP.

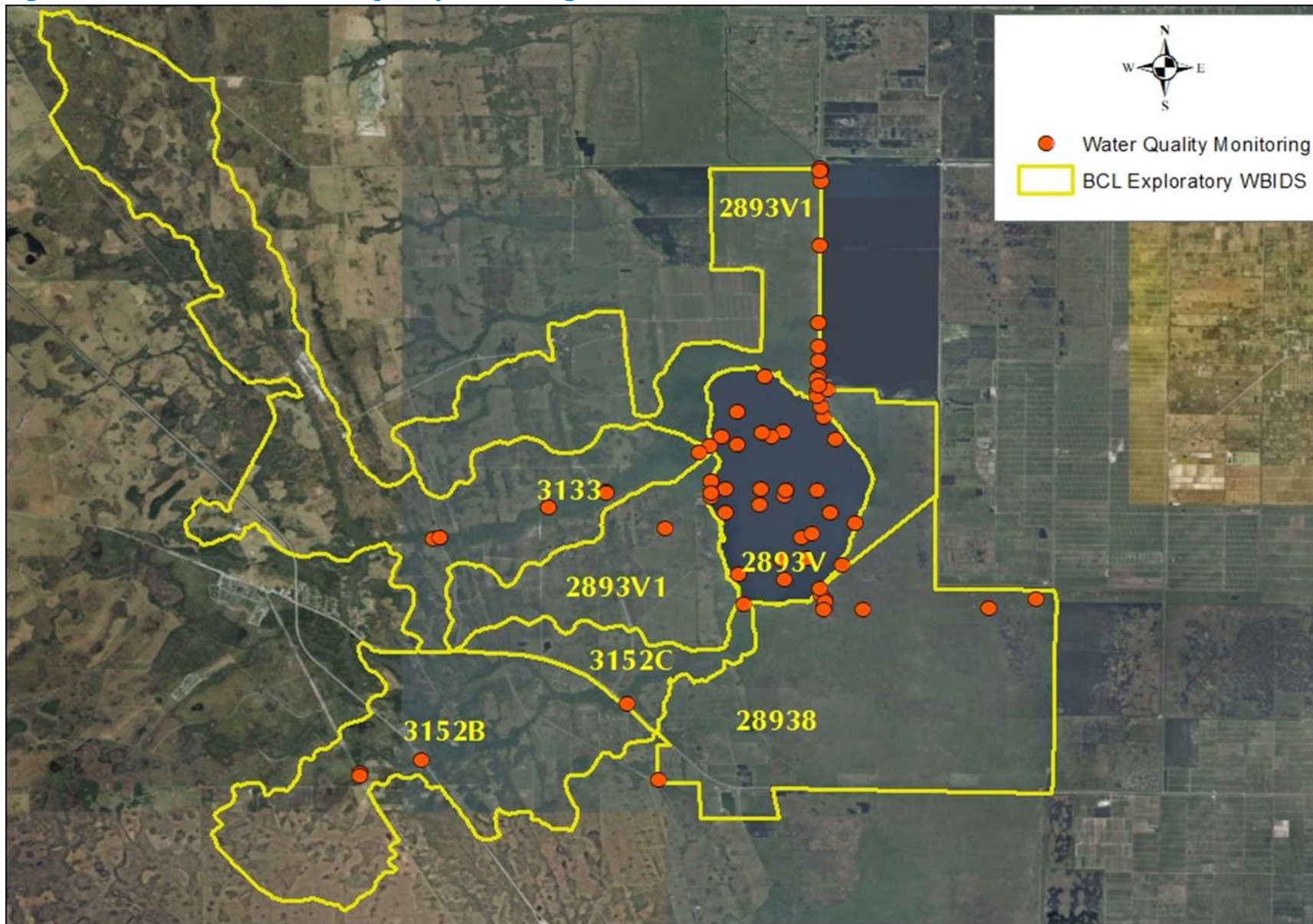
Remove the data qualified with the any of the following data quality codes: V, F, N, O, Y, H, J, K, Q, ?. Also, data qualified with a U or T signifying their values are less than the method detection limit had their values changed to one-half of the reported detection limit in accordance with FDEP convention.

3. Outliers may also be omitted from further analysis at the Users’ discretion.

4.2 DATA SUMMARY

Appendix A summarizes the available water quality data. The data are organized by WBID, collecting agency, and station. Additional information regarding the period of record and the number of sampling days are also provided. Although there are numerous stations, many lack long-term records and are likely associated with special studies.

Figure 1 WBIDs and Water Quality Monitoring Stations from the FDEP IWR and SJRWMD Databases



4.3 RESULTS

Both the FDEP IWR Run 55 dataset and the SJRWMD data were queried and combined into a single dataset to be used for analysis.

5 TASK 3 – TREND ANALYSIS

5.1 METHODS

The validated data gathered under Task 1 for the WBIDs surrounding BCL provided the source data for the trends analysis. The WBIDs included:

- Blue Cypress Lake (2893V)
- Padgett Branch (Class I) (3152C)
- Blue Cypress Lake Drain (2893V1)
- Blue Cypress Marsh (28938)
- Blue Cypress Creek (3133)
- Padgett Branch (3152B)

Within each of these WBIDs several agencies sampled numerous sites at different times over the period of record. SJRWMD has been sampling several sites continually for long enough that trends could be determined at those sites. Figure 2 shows the locations of the WBIDs and the stations selected for trend analysis.

5.2 ANALYTICAL METHODS

The seasonal Kendall-Tau trend test was used to determine whether significant temporal trends were detected in the data. The seasonal Kendall Tau is a nonparametric test that is useful for detecting trends in environmental and water quality data when the underlying distribution is not known (Gilbert, 1987; Loftis *et al.*, 1989; Helsel and Hirsch, 1992). This test has also been applied to trend detection for water quality variables in numerous studies.

This first step of the seasonal Kendall Tau test is to develop a time series plot of the raw data for the period of record being analyzed (Figure 3). The time series is plotted with the predicted values to give a sense of the overall trend of the data. As can be seen in the example plot in Figure 3, an increasing trend is apparent in the data being evaluated during the period of record.

In the second step of the analysis, the intra-annual variability in the data is explored by plotting the monthly univariate statistics in the form of a box-and-whisker plot (Figure 4 provides an example). The box represents the inter-quartile range, while the top and bottom of the whiskers represent the maximum and minimum values, respectively. Also included in the plot is the mean represented by a red dot. The notches in the boxes represent the 95 percent confidence interval of the medians. If the confidence limits around the medians for any pair do not overlap, the medians of that pair are significantly different at the $\alpha = 0.05$ level.

Figure 2 WBIDs and Stations Identified for Trend Analysis

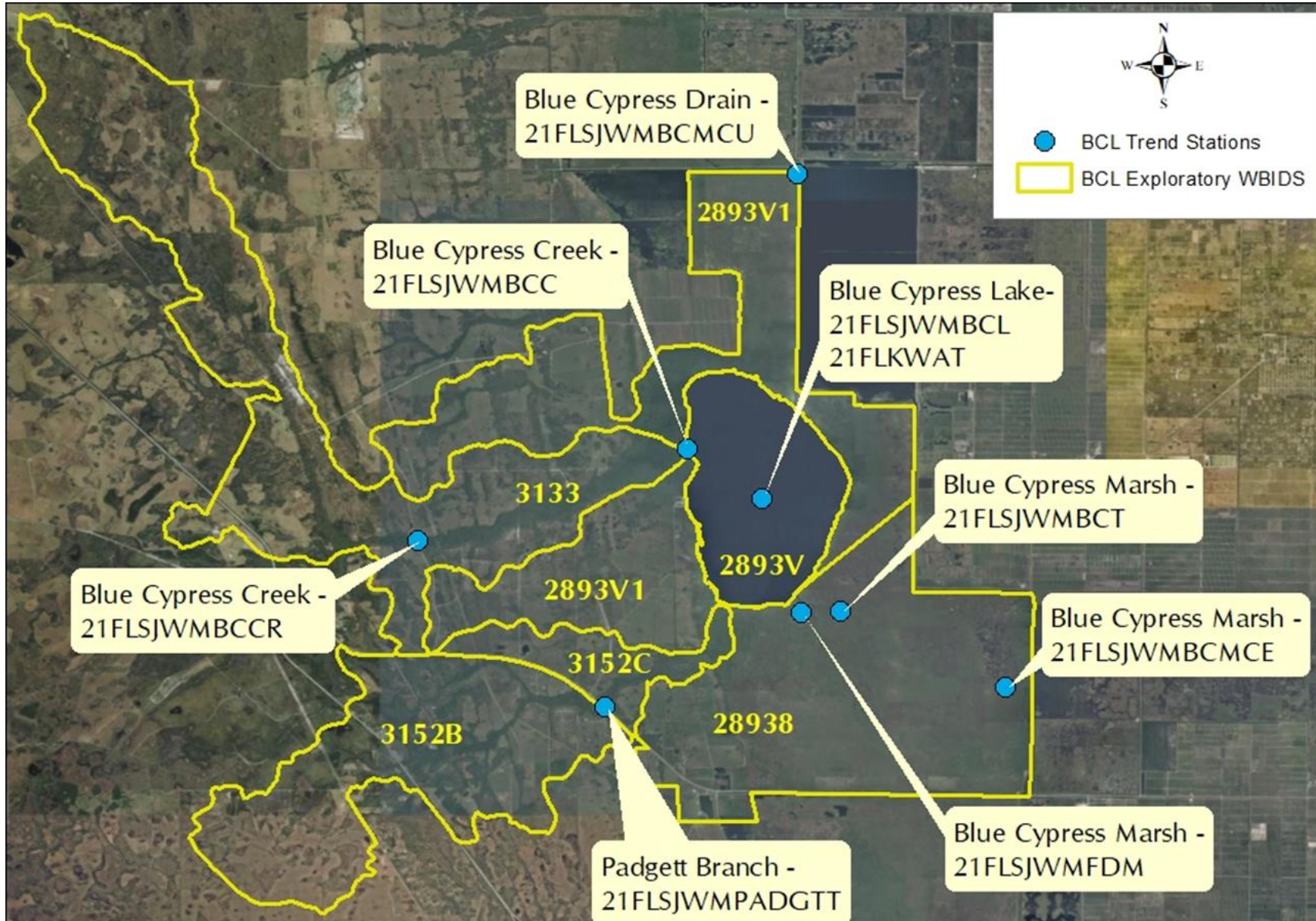


Figure 3 Sample Trend Results for the Water Quality Index Data

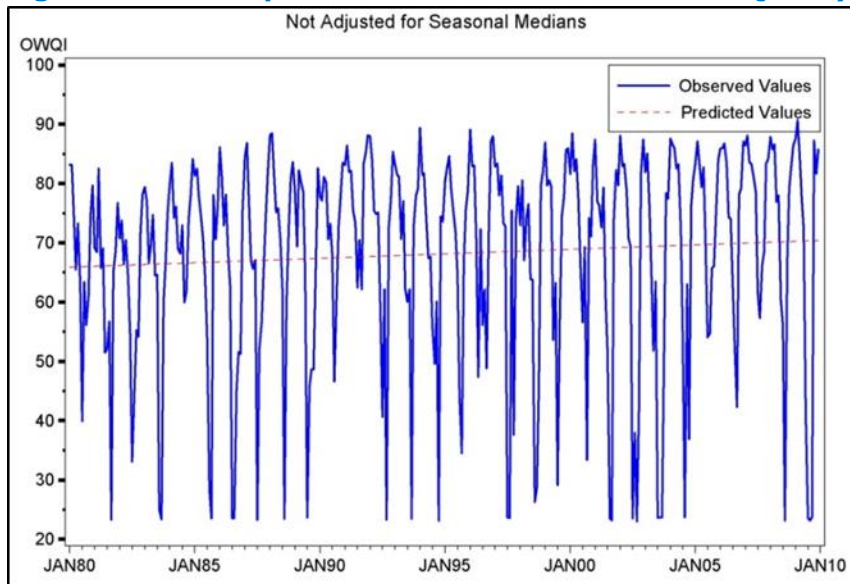
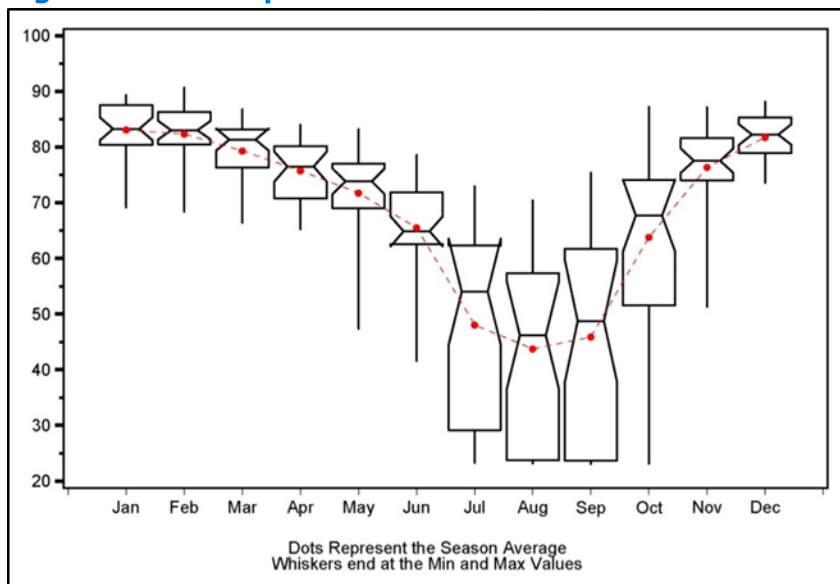
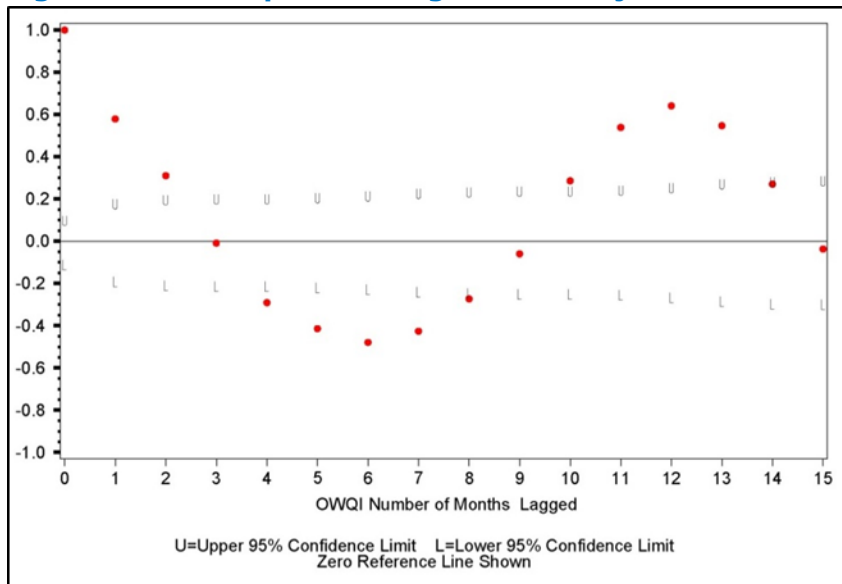


Figure 4 Sample of Seasonal Univariate Results



In the next step, correlations are calculated for each monthly value, the previous month's value, two months prior, and continuing up to 15 months prior. The values in Figure 5 summarizes the values and plots in an autocorrelation plot (correlogram) to investigate whether or not seasonality exists. Statistically significant correlation values fall outside the confidence limits (U=upper confidence limit, L=lower confidence limit). If seasonality exists in the data, the 6-month lag value is expected to be negatively correlated, while the 12-month lag values will be positively correlated.

Figure 5 Sample Correlogram Not Adjusted for Seasonal Median

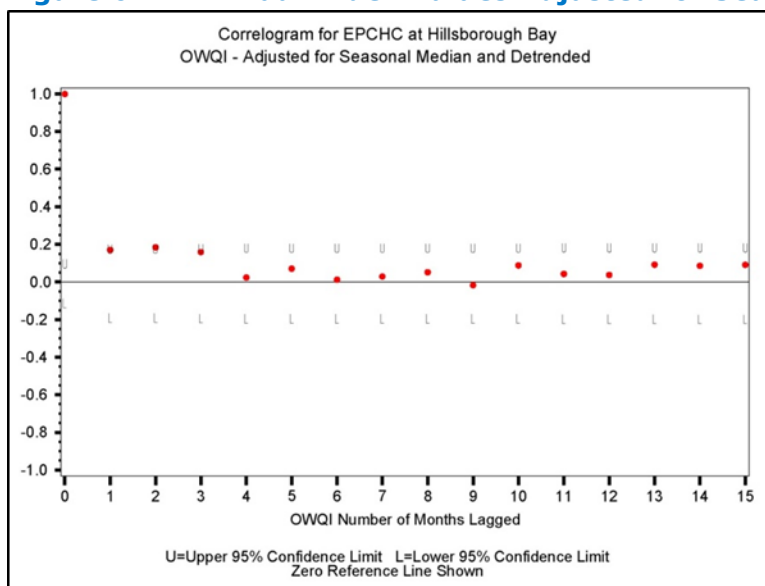


An objective test is applied to determine if seasonality exists in the data of interest. The test measures the proportional distance between the zero line and the correlation value at 6 months (0.48) and the distance between the zero line and the correlation value at 12 months (0.64). If the sum of these values is greater than one, or if the distance between the zero line and the correlation value at 12 months is greater than one, then seasonality exists.

If the data are found to be seasonal, the data are adjusted for season by subtracting the calendar monthly median from each data point. The Kendall Tau test is then applied to the seasonally adjusted data. The test determines the slope of the time-series data and the p-value. The p-value represents the probability of obtaining a value.

The next step is to test for autocorrelation in a similar manner to that used for testing for seasonality. The trend is taken out of the seasonally-adjusted data by removing the effect of the slope. The seasonally-adjusted, detrended data are then plotted in an autocorrelation plot (correlogram) to test for the presence of autocorrelation in the time series data (Figure 6). If the 1-month lag and the 2-month lag are significantly correlated with the present value, the data are autocorrelated. The final step of the analysis is to calculate the tau statistic and summarize the output of the test (p-value, slope, significance, autocorrelation, and seasonality).

Figure 6 Annual Index Values Adjusted for Seasonal Median and Detrended



5.3 RESULTS

The following parameters were tested for trends:

- Total nitrogen
- Total phosphorus (TP)
- Chlorophyll *a*
- Total Kjeldahl nitrogen
- Nitrate-nitrite
- Total orthophosphate
- Dissolved orthophosphate
- Ammonia
- Color
- Secchi disk depth

Appendix B shows time-series plots for each of these parameters at each of the trend sites. Table 1 identifies the statistically significant trends. The results of all of the other tests were either insignificant or had insufficient data (less than 60 monthly data points) to conduct the analysis.

Table 1 Statistically Significant Results from the Trends Analyses

WBID	Station	Parameter	First Year	Last Year	n	Trend	Magnitude
Blue Cypress Lake (2893V)	21FLKWAT	TP	2003	2014	107	Increasing	Large
	21FLKWAT	Chlorophyll <i>a</i>	2003	2014	106	Increasing	Small
	21FLSJWMBCL	Secchi Disk Depth	1991	2018	275	Decreasing	Small
	21FLSJWMBCL	Dissolved Orthophosphate	2006	2018	133	Increasing	Large
Blue Cypress Creek (3133)	21FLSJWMBCL	TP	1991	2018	280	Increasing	Small
	21FLSJWMBCC	Secchi Disk Depth	1992	2006	129	Decreasing	Small
	21FLSJWMBCC	Color	1991	2006	134	Increasing	Small
	21FLSJWMBCC	TP	1991	2006	142	Increasing	Small
	21FLSJWMBCCR	TP	2006	2018	146	Decreasing	Small

WBID	Station	Parameter	First Year	Last Year	n	Trend	Magnitude
Blue Cypress Drain (2893V1)	21FLSJWMBCMCU	Secchi Disk Depth	1996	2018	233	Decreasing	Small
	21FLSJWMBCMCU	TP	2006	2018	140	Increasing	Small
	21FLSJWMBCMCU	Dissolved Orthophosphate	2006	2018	132	Increasing	Large
	21FLSJWMBCMCE	Secchi Disk Depth	1992	2018	150	Decreasing	Small
	21FLSJWMBCMCE	TP	1992	2018	158	Increasing	Small
Blue Cypress Marsh (28938)	21FLSJWMBCT	Secchi Disk Depth	1983	2018	178	Decreasing	Small
	21FLSJWMBCT	Dissolved Orthophosphate	2006	2018	74	Increasing	Large
	21FLSJWMBCT	TP	1983	2018	197	Increasing	Small
	21FLSJWMFDM	NO ₃ -NO ₂	1980	2002	91	Decreasing	Large
	21FLSJWMFDM	NO ₃ -NO ₂	1980	2002	91	Decreasing	Large

In terms of nutrient concentrations, significant increasing trends were detected in TP concentrations at stations in each of the WBIDs tested, including BCL. Significant increasing trends were also detected in dissolved orthophosphate data collected in BCL, Blue Cypress Drain, and Blue Cypress Marsh. The only significant trend in nitrogen concentrations was found in the NO₂-NO₃ in Blue Cypress Marsh during 1980 to 2002.

With the increase in nutrients, a corresponding increase chlorophyll *a* could be expected, particularly in BCL. An increase was detected from the monthly mean of Lakewatch data collected from 2003 to 2014. The data collected at 21FLSJWMBCL (center of the lake) was tested for the same period, but no increase in chlorophyll *a* was detected. Decreasing trends in Secchi disk depth were detected in all sampling stations indicative of decreased water clarity.

6 CONCLUSIONS

An increasing trend in TP has been identified in BCL and at stations in the surrounding WBIDs. This makes identifying the source of the increasing trend more difficult. Inflection points identified in the time series plots, loosely associated with known drought/rehydration periods, could aid in the identification for the changes in the concentrations.

Additional data will need to be gathered to further the investigation, including:

- Rainfall
- Land use changes
- Hydrologic changes
- Biosolids application periods (both local and surrounding areas)
- Groundwater data

7 REFERENCES

- Gilbert, R.O., 1987. *Statistical Methods in Environmental Pollution Monitoring*. Van Nostrand Reinhold, New York. 320 pp.
- Helsel, D.R., Hirsch, R.M., 1992. *Statistical Methods in Water Resources*. US Geological Survey, Reston, VA.
- Loftis, J.C., R.C. Ward, R.D. Phillips, and C.H. Taylor. 1989. *An Evaluation of Trend Detection Techniques for Use in Water Quality Monitoring Programs*. United States Environmental Protection Agency, Environmental Research Laboratory, Corvallis, Oregon. EPA/600/S3-89/037.

Appendix A
Summary of Available Water Quality Data

**Appendix A, Pages 12 - 213 can be viewed
at the Indian River County Department of
Utility Services office. Please call (772)
226-1835 to set up a time.**

**TECHNICAL MEMORANDUM
NO. 2**

JonesEdmunds

Janicki Environmental, Inc.

Blue Cypress Lake – Water Quality Study

TO: Vincent Burke, PE, Utilities Director, Indian River County

FROM: Bill Lynch, PE, Jones Edmunds

XC: Brett Cunningham, PE, Jones Edmunds
Anthony Janicki, PhD, Janicki Environmental
Jon Perry, Janicki Environmental

DATE: December 4, 2018

SUBJECT: **Task 1 - Data Collection - Biosolids**
Jones Edmunds Project No. 08620-002-02
IRC Account No. 111-28138-033190

1. INTRODUCTION

This technical memorandum is prepared as part of the Blue Cypress Lake (BCL) Water Quality Study. The study when complete is to determine if anthropogenic influences are a significant causative factor in water quality. More specifically, are the application of biosolids in the tributary watershed discharging to BCL affecting water quality?

This memorandum provides a summary of the biosolids data for land application sites tributary to BCL. More specifically, this memorandum presents information on the permits, permit applications, nutrient management plans, and most recent Florida Department of Environmental Protection (FDEP) compliance inspection reports.

2. OBJECTIVES

The overall project objective is to gather, validate, and assess the water quality data associated with Blue Cypress Lake and its watershed, including the permitted use of land application of biosolids.

The objective of this technical memorandum is to provide an overview of biosolids land application within the BCL watershed and to summarize findings from evaluating the biosolids-related information associated with the permitted use of biosolids land application within the BCL watershed. The water quality impacts of biosolids land application are addressed in Technical Memorandums 1, 3 and 4 prepared as part of this Water Quality Study.

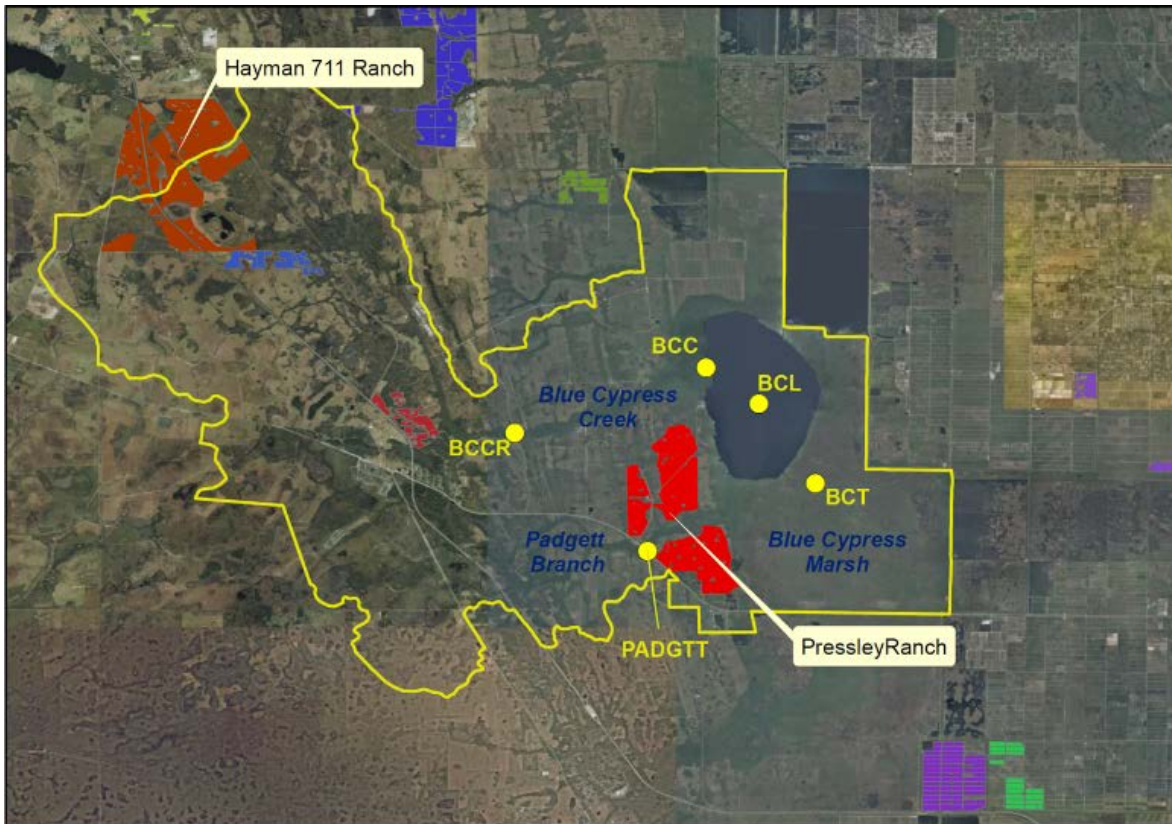


Figure 1 – Biosolids land application sites within the BCL Watershed

3. DATA SOURCES

The primary documents reviewed for this technical memorandum are associated with The Pressley Ranch and Hayman 711 Ranch biosolids land application sites shown above in Figure 1. More specifically, the documents listed below each site description were reviewed to develop an understanding and overview of the land application practices.

Pressley Ranch

According to the FDEP Permit Fact sheet included with the Permit, "The Pressley Ranch is a biosolids land application site consisting of approximately 3059 acres that are used for biosolids application. The application site is divided into 22 application zones as shown in Condition I.2 of the permit. The site is utilized for cattle farming and the crop is Bahia grass." The Pressley Ranch land application site is completely within the BCL watershed.

- Biosolids Site Permit No. FLA801097-002 issued to H&H Liquid Sludge Disposal Inc. as Permittee; Effective March 1, 2018
- Biosolids Site Permit Application; signed November 26, 2018 by the Site Permittee (date may be incorrect given permit effective date of March 1, 2018)
- Nutrient Management Plan; dated January 12, 2018
- Compliance Evaluation Inspection; dated July 6, 2018

Hayman 711 Ranch

According to the FDEP Permit Fact sheet included with the Permit, "Hayman's 711 Ranch is a biosolids land application site consisting of approximately 3,738.7 acres that are used for biosolids application. The application site is divided into 41 application zones as shown in Condition I.2 of the permit. Bahia and Floralta grasses are grown on the site for grazing cattle." As shown above in Figure one a portion of the Hayman 711 Ranch is within the BCL watershed.

- Biosolids Site Permit No. FLA617903 issued to H&H Liquid Sludge Disposal Inc. as Permittee; Effective December 17, 2017
- Biosolids Site Permit Application; signed August 24, 2017 by the Site Permittee
- Nutrient Management Plan; dated August 2017
- Compliance Evaluation Inspection; dated June 15, 2017

These documents have not been appended to this technical memorandum with the exception of the recent Compliance Evaluation Inspection reports. Documents are available from the writer upon request.

4. SUMMARY OF FINDINGS

4.1 Compliance Inspection Evaluations

The Compliance Inspection Evaluations reviewed for both facilities indicate that FDEP found the permitted biosolids management facilities to be in compliance with the Department's rules and regulations (see Appendix for inspection reports).

For the Pressley Ranch Biosolids Management Facility, FDEP noted "In-Compliance", for Section 3. Nutrient Management Plan of the Biosolids Compliance Inspection Report. FDEP also presented observations regarding phosphorus (3.3) and water table (3.4) as follows:

3.3 Observation: The soils testing shows the application fields have increased Phosphorus concentrations when compared to the initial testing 5 years ago. This indicates the Phosphorus is being stored on the fields. This data also confirms compliance with the Department's rules and regulations.

3.4 Observation: At the time of the inspection, the site water table was too high to allow spreading. It is anticipated that the site will not receive any further biosolids application until the dry season. The site was wet, and some of the application sites had some minimal ponding from recent spring rains.

Although in compliance, Observation 3.3 regarding increased phosphorus concentration in the soils and Observation 3.4 regarding site water table are characteristics that support the possible water quality effects of biosolids in the BCL watershed.

For the Hayman 711 Ranch Biosolids Management Facility, the Biosolids Compliance Inspection Report provides minimal observations and concludes the facility was determined to be in compliance, as noted above.

4.2 Biosolids Permits

Below are findings from a review the permit conditions as they pertain to the objectives of the BCL Water Quality Study.

Land application of biosolids is authorized on specific application zones listed in each permit in accordance with the associated Nutrient Management Plan (NMP) which establishes specific application rates and procedures for each application zone. Further, land application of biosolids shall not result in a violation of Florida water quality standards pursuant to Chapter 62-302, F.A.C., and Chapter 62-520, F.A.C.

Monitoring is specified for soils, but neither surface water nor ground water quality monitoring are required by the permits with the exception that ground water monitoring is required for the Hayman 711 land application site when the application rate in the approved NMP exceeds 400 pounds of plant available nitrogen per acre per year. The permit does address water table level monitoring which is to be determined in one or more representative locations in the application zone before each application of biosolids by measuring the water level in a monitoring well or piezometer. No record of either monitoring wells or piezometers was found in the documents reviewed for this technical memorandum.

Application of biosolids shall meet the requirements of Class B biosolids as defined in Rule 62-640.200, F.A.C. Cumulative Application Limits (pounds/acre) are listed for metals, but not for nitrogen or phosphorus. Nutrient loading is presented in the NMPs.

4.3 Nutrient Management Plans

Below are findings from a review the NMPs as they pertain to the objectives of the BCL Water Quality Study.

Pressley Ranch

As presented, the intent of the NMP is to document the actions that the operators of Pressley Ranch land application site will continue to undertake to reduce the potential for impairment of surface and groundwater resources from applied nutrients. The ultimate goal of this NMP is to apply biosolids to obtain maximum nutrient benefit while minimizing runoff and leaching of nutrients and to operate the site in a socially and environmentally acceptable manner. The biosolids NMP as presented is to minimize the transport of N and P to surface and groundwater.

The Hauler H&H Liquid Sludge Disposal, Inc. (H&H) transports and applies treated, Class B biosolids from various Wastewater Treatment Facilities (WWTFs) to the Pressley Ranch in accordance with State and Federal regulations. The site is owned by Mr. Gary Pressley and is an ongoing hay and cattle operation. H&H has an agreement to provide Class B Biosolids to the landowner for fertilizer and soil conditioning.

The nutrient input sources for Pressley Ranch are biosolids and manure from beef cattle. The amount of nutrients to be applied on the site is described in the NMP and considered soil test results, agronomic crop demand, expected crop yield, cattle operation and biosolids analysis results. The nutrient sources for the site include biosolids, cow manure and existing

soil. The P Index Value calculations included in NMP for all application zones is between 75 and 150 indicating medium potential for P movement from the site. Therefore the NMP concludes, Nitrogen-based nutrient management is satisfactory for this site when conservation measures are taken to lessen the probability of P loss.

Hayman 711 Ranch

The Hayman 711 Ranch NMP presents a plan which complies with applicable regulations and is prepared in accordance with the USDA | NRCs Florida Field Office Technical Guide – Nutrient Management, Code 590, November 2012. The NMP is for the entire land application site including application areas within and outside the BCL watershed. The NMP notes that site is not in a designated sensitive geographic area subject to phosphorous restrictions as defined in 62-640.500 (7) FAC.

The assessment of potential for phosphorus movement was prepared utilizing the method presented in *UF/IFAS Nutrient Management Series: Computational Tools for Field Implementation of the Florida Phosphorus Index – Osceola County, Florida, August 2013* (IFAS Tools). According to IFAS Tools Table 3, the P Movement Potential Interpretation for all zones on the Site falls within the Medium range of 75-150. Therefore, the nutrient application for each zone can be based on nitrogen loading.

5. CONCLUSIONS

The following conclusions were developed from a review of the biosolids data for the two land application sites tributary to BCL.

1. The permitted biosolids management facilities appear to be compliant with the Department's rules and regulations.
2. The permits lack surface water and ground water monitoring requirements although they require that the land application of biosolids not result in a violation of Florida water quality standards.
3. Depth to ground-water is a concern. The permits require water table level monitoring in monitoring wells or piezometer in one or more representative locations in the application zones before each application of biosolids and Biosolids Application Site Logs include a depth to ground water column. Reviewed reports showed uniformed values and no location of monitoring.
4. NMPs appear to be complete. Both note nitrogen-based nutrient management is satisfactory for this site.
5. Nitrogen-based nutrient management appears to result in phosphorous loading that exceeds crop needs; therefore excess phosphorous within the BCL watershed.

Appendix
Compliance Inspection Evaluations
Reports



Florida Department of Environmental Protection

Southeast District Office
3301 Gun Club Road, MSC 7210-1
West Palm Beach, Florida 33406
561-681-6600

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

July 6, 2018

Mr. Rick D. Hacht., President
H&H Liquid Sludge Disposal, Inc.
P.O. Box 390
Branford, FL 32008
biosolidsolutions@hhlsc.com

RE: 2018 Compliance Evaluation Inspection
Pressley Ranch Biosolids Application Site
DW Facility ID# FLA801097
Indian River County

Dear Mr. Hacht:

Department personnel conducted a Compliance Evaluation Inspection at the above-referenced facility on June 22, 2018. Based on the information provided during the inspection the facility was determined to be in compliance. A copy of the report is attached for your records. The Permittee shall contact the Department 7-days prior to any future land application of biosolids.

The Department appreciates your efforts to maintain this facility in compliance with state and federal rules. Should you have any questions or comments, please contact Denise K. Watts at (561) 681-6701, or via e-mail at denise.watts@floridadep.gov.

Sincerely,

A handwritten signature in black ink that reads "John Renfranz". The signature is written in a cursive, flowing style.

John Renfranz
Environmental Manager
Southeast District

JR/dkw

Blake Hacht, H&H Compliance Manager
Donnie Yates, H&H, L.S.D. Supervisor
Shiv Shani, P.E., AEC Build
Gary Pressley, Owner of Pressley Ranch
Denise K. Watts, FDEP/SED
John Renfranz, FDEP/SED
Mike Bechtold, FDEP/SED

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Denise.Watts@floridadep.gov
John.Renfranz@floridadep.gov
Mike.Bechtold@floridadep.gov

**FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BIOSOLIDS COMPLIANCE INSPECTION REPORT**

Facility Name and Physical Address Pressley Ranch BMF 4505 Blue Cypress Road Vero Beach, FL 32996	WAFR ID FLA801097	County Indian River	Entry Date 6/22/2018	Entry Time 10:00 a.m.
	Facility Phone # (772) 473-8901		Exit Date 6/22/2018	Exit Time 12:30 p.m.

LAT	27	°	42	'	21.38N	''
LONG	80	°	46	'	55.46W	''

Name(s) of Field Representatives(s) and Title	Email	Phone
Donnie Yates, Supervisor	d.yates@hhlsd.com	(386) 935-0941
Blake Hacht, Compliance Manager	b.hacht@hhlsd.com	(800) 653-0386

Name & Address of Permittee / Designated Rep.	Title	Email	Phone
Rick Hacht, H&H Liquid Sludge Disposal, Inc. P.O. Box 390 Branford, FL 32088	President	hhlsd@windstream.net	(386) 935-0941

Inspection Type	C	E	I	Samples Taken(Y/N): N	Sample ID#:	Samples Split (Y/N) :
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BIOSOLIDS SITE COMPLIANCE AREAS EVALUATED


IC = In Compliance; MC = Minor Out of Compliance; NC = Out of Compliance; SC = Significant out of Compliance; NA = Not Applicable; NE = Not Evaluated
Significant Non-Compliance Criteria Should be Reviewed when Out of Compliance Ratings Are Given in Areas Marked by a "♦"

	PERMITS/ORDERS		SITE OPERATIONS				SELF-MONITORING PROGRAM
IC	1. ♦ Permit	IC	4. ♦ Access Control	IC	7. Odor/Nuisance	IC	8. ♦ Records & Reports
NA	2. ♦ Compliance Schedules	IC	5. ♦ Site Restrictions and Setbacks			IC	9. Site Monitoring
IC	3. Nutrient Management Plan	IC	6. ♦ Operation and Maintenance				
NA	10. Other						

Facility and/or Order Compliance Status:	<input checked="" type="checkbox"/> In-Compliance	<input type="checkbox"/> Out-Of-Compliance	<input type="checkbox"/> Significant-Out-Of-Compliance
-------------------------------------------------	---------------------------------------------------	--------------------------------------------	--------------------------------------------------------

Recommended Actions: N/A

Name(s) and Signature(s) of Inspector(s)	District Office/Phone Number	Date
Denise K. Watts 	Michael W. Bechtold 	(561) 681-6701 6/25/2018

Name and Signature of Reviewer	District Office/Phone Number	Date
John Renfranz 	(561) 681-6645	7/6/2018

Single Event Violations				
Check for Yes	Evaluation Area	Description	Finding Description	Finding ID
<input type="checkbox"/>	Biosolids Disposal	General	Operation of unpermitted disposal system at a permitted facility.	EDUN
<input type="checkbox"/>	Laboratory	General	The laboratory is not certified by the Department of Health.	LNCE
<input type="checkbox"/>	Permit	General	Unauthorized discharge from the collection system with a high potential for water quality or health impacts	UNBP
<input type="checkbox"/>	Permit	General	The facility is operating without a wastewater permit.	UPHI
<input type="checkbox"/>	Records and Reports	General	Falsification of any record or report	FARR
<input type="checkbox"/>	Records and Reports	General	The Permittee failed to report noncompliance to the Department within 24 hours as required by 62-620.610(20), F.A.C.	RSWP

Facility Summary:

1. ♦ Permit: In-Compliance

Current Permit available on-site?	Yes
Date Permit issued	03/01/2018
Date Permit Expires If expired, please check SEV code list.	02/28/2028
Permit Renewal Application due by	09/01/2017
Administrative or Judicial Orders?	N/A

- 1.1 Observation: The 3,760-acre site, owned by Mr. Gary Pressley, is distributed into 22 applications zones where 1,000 head of cattle graze on Bahia grass and are rotated to a different zone every 30-days. The nutrient sources for the site include Class B biosolids from various wastewater treatment plants, 11,320 tons of cattle manure/year, and the nutrient found in the existing soil. This site is not located in geographic areas subject to restrictions on phosphorus as required by 62-640.500(7), Florida Administrative Code.
- 1.2 Additional Comments: The Department was recently informed that Pressley Ranch will no longer be cutting and bailing Bahia Grass. The Nutrient Management Plan will be updated and the permit may need to be modified.
- 1.3 Additional Comments: The permittee shall contact the Department 7-days prior to any future land application of biosolids.

2. ♦ Compliance Schedules: Not Applicable

Compliance Schedule in Permit met?	Not Applicable
Compliance Schedules in Order are being met?	Not Applicable

3. Nutrient Management Plan: In-Compliance

NMP available on-site?	Yes
Are there any NMP revisions? If so, please explain below.	See Observation

- 3.1 Observation: The Nutrient Management Plant (NMP) was issued on January 13, 2018. Its goal is to effectively and efficiently use the nutrient resources to supply plants and animals with enough food, forage, fiber and/or cover while minimizing the transport of nutrients to ground or surface water in order to prevent environmental degradation. In the NMP, the soil pH was evaluated for each zone based on the soil test results. Rule 62-640.700(9), F.A.C. indicates that the pH of the biosolids-soil mixture shall be 5.0 or greater at the time the biosolids are applied.
- 3.2 Observation: During the inspection, DEP personnel requested H&H submit additional soil fertility testing. H&H explained that they had additional testing performed in March 2017. The March 2017 soil testing results were submitted to DEP on the same day of the inspection. When the newly submitted soil fertility

results were compared to the Phosphorus index, all zones passed the P-index. The NMP will be updated to incorporate the March 2017 test results.

- 3.3 Observation: The soils testing shows the application fields have increased Phosphorus concentrations when compared to the initial testing 5 years ago. This indicates the Phosphorus is being stored on the fields. This data also confirms compliance with the Department’s rules and regulations.
- 3.4 Observation: At the time of the inspection, the site water table was too high to allow spreading. It is anticipated that the site will not receive any further biosolids application until the dry season. The site was wet, and some of the application sites had some minimal ponding from recent spring rains.
- 3.5 Observation: The drainage features within the ranch were designed to limit runoff from the fields. At the setbacks boundaries, which have not received biosolids application, there was a distinctive break in the appearance of the vegetation. The vegetation within the biosolids application areas appeared much denser/healthier when compared to the vegetation in the setback area. This evidence appears to support that the setbacks are working to keep the nutrients within the application sites.

4. ♦ Access Control: In-Compliance

Application Zones Inspected	3a, 3b, 3c, 8, 10, 11, 13, 15 and 16
How is access controlled?	Fences & gates
Advisory signage satisfactory?	Yes
Are any biosolids tracked off-site?	No
Do any biosolids run-off from the site?	No

5. ♦ Site Restrictions and Setbacks: In-Compliance

Are site restriction requirements met?	Yes
Are grazing, harvesting and public access restrictions followed?	Yes
Are grazing restrictions followed?	Yes
Are harvesting restrictions followed, if applicable?	Yes
Are setback distances maintained?	Yes
How are setbacks marked or otherwise followed?	Orange ribbons mark setbacks. Setbacks from waterways are vegetated.

6. ♦ Operation and Maintenance: In-Compliance

Site being operated/maintained as per permit (includes NMP)?	Yes
Agricultural operations and crops match the NMP?	Yes

All biosolids applied meet the requirements for Class B, Class A, or Class AA standards?	Yes
Do biosolids application exceed the allowed loading rates in the NMP and permit application?	No
Method of application observed?	N/A *site not active at time of inspection. When active & spreading, incorporation is used.
Does the method of application match the NMP?	Yes
If incorporation is conducted for the purpose of vector attraction reduction, is this recorded?	Yes
Additional sources of nutrients applied. (e.g. commercial fertilizer, etc.)	No
Biosolids storage observed?	No
Does the storage match the NMP and are storage provisions followed?	Not Applicable

6.1 Observation: At the time of this inspection, the last land application was on May 12, 2018. No storage or land application of biosolids was observed.

7. Odor/Nuisance: In-Compliance

Were odors observed off-site?	No
Were vectors observed?	No
Any known complaints? If yes, explain below.	No

8. ♦ Records and Reports: In-Compliance

Biosolids Site Logs available on-site?	Yes
Current activities reflected on the log?	Yes
Date of most recent application	05/12/2018
Were running totals of the restricted nutrient completed?	Yes
Hauling Records available on-site?	Yes
Annual Summary reports submitted?	Yes
Annual Summary review period	02/10/2014 ----- 02/16/2017
Was the facility within allowed nutrient loading limits?	Yes
Are all zones above minimum pH?	Yes
Harvest records available on-site, if applicable?	Not Applicable
Date and quantity of most recent harvest, if applicable?	N/A N/A Not Applicable

9. Site Monitoring: In-Compliance

Is the water table level measured and recorded, if required?	Yes
--------------------------------------------------------------	-----

Water table level at time of inspection (if required)	Not Evaluated	See Observation
Is ground water quality monitoring conducted, if required?	Not Required in Permit	
Is annual soil pH testing conducted?	Yes	
Is soil fertility testing conducted at the frequency specified in the NMP and site permit?	Yes Annually	

- 9.1 Observation: The pH of soil shall be 5.0 or greater at the time biosolids are land applied. At a minimum, soil pH testing shall be conducted annually. The pH for the land application zones land applied between March and May ranged between 5.0 to 5.6. The water table at the time of land application was at 36.”
- 9.2 Observation: The water table was above the limit to land apply at the time of this inspection. The measurement could not be taken due to field saturation.

10. Other: Not Evaluated

Photos of site visit



Class B Biosolids signs are properly posted on the site and each zone is separated by gates and fences.



Bahia grass grown on site for cattle grazing.





The ranch contains of a series of drainage ditches that keeps some of the runoff contained onsite.



There was standing water present on the day of this inspection due to recent rains.





Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

June 15, 2017

Rick Hacht, President
H & H Liquid Sludge Disposal, Inc.
P.O. Box 390
Branford, FL 32008
biosolidsolutions@hhlsd.com

Re: Hayman 711 Ranch Biosolids Management Facility
DW Facility ID #FLA617903
Osceola County

Dear Mr. Hacht:

Department personnel conducted an inspection of the above-referenced 5/10/2017 on May 10, 2017. Based on the information provided during and following the inspection, the facility was determined to be in compliance with the Department's rules and regulations. A copy of the inspection report is attached for your records, and any non-compliance items which may have been identified at the time of the inspection have been corrected.

The Department appreciates your efforts to maintain this facility in compliance with state and federal rules. Should you have any questions or comments, please contact Nikki Belian at 407-897-2907 or via e-mail at Nicole.Belian@dep.state.fl.us.

Sincerely,

A handwritten signature in cursive script that reads "Christianne C. Ferraro".

Christianne C. Ferraro, P.E., Manager
Central District
Florida Department of Environmental Protection

Enclosures: Inspection Report

cc: Martin Buerk; mbuerk@hhlsd.com

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION WASTEWATER COMPLIANCE INSPECTION REPORT

Facility Name and Physical Address Hayman 711 Ranch Biosolids Management Facility (BMF) P.O. Box 390 Hayman Ranch Road Kenansville, FL 32739	WAFR ID FLA617903	County Osceola	Entry Date 5/10/2017	Entry Time 10:40 am
	Facility Phone # (800) 653-0386		Exit Date 5/10/2017	Exit Time 11:45 am

LAT	27	°	50	′	11.57	″N
LONG	80	°	57	′	58.95	″W

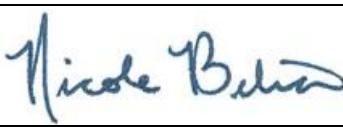

Name(s) of Field Representatives(s) and Title Terry Blount Martin Buerk – H & H Liquid Sludge Disposal	Operator Certification # Ranch Manager Vice President	Email mbuerk2hhlsd.com	Phone (561) 722-0046 (561) 441-5875
---------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------	----------------------------------	--------------------------------------------------

Name & Address of Permittee / Designated Rep. Rick Hacht H & H Liquid Sludge Disposal Inc P.O. Box 390 Branford, FL 32008	Title President	Email biosolidsolutions@hhlsd.com	Phone (800) 653-0386
--------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------	---------------------------------------------	--------------------------------

Inspection Type	R	S	I	Samples Taken(Y/N): N	Sample ID#:	Samples Split (Y/N) :
<input checked="" type="checkbox"/> Domestic <input type="checkbox"/> Industrial						

FACILITY COMPLIANCE AREAS EVALUATED							
IC = In Compliance; MC = Minor Out of Compliance; NC = Out of Compliance; SC = Significant out of Compliance; NA = Not Applicable; NE = Not Evaluated Significant Non-Compliance Criteria Should be Reviewed when Out of Compliance Ratings Are Given in Areas Marked by a "♦"							
	PERMITS/ORDERS		SELF MONITORING PROGRAM		FACILITY OPERATIONS		EFFLUENT/DISPOSAL
IC	1. ♦ Permit	NA	3. Laboratory	IC	6. Facility Site Review	NA	9. ♦ Effluent Quality
NA	2. ♦ Compliance Schedules	NA	4. Sampling	NA	7. Flow Measurement	NA	10. ♦ Effluent Disposal
		IC	5. ♦ Records & Reports	IC	8. ♦ Operation & Maintenance	IC	11. Biosolids
						NA	12. Groundwater
NA	14. Other					NA	13. ♦ SSO Survey

Facility and/or Order Compliance Status:	<input checked="" type="checkbox"/> In-Compliance	<input type="checkbox"/> Out-Of-Compliance	<input type="checkbox"/> Significant-Out-Of-Compliance
-------------------------------------------------	---------------------------------------------------	--------------------------------------------	--------------------------------------------------------

Recommended Actions: Compliance Letter			
Name(s) and Signature(s) of Inspector(s) Nikki Belian		District Office/Phone Number (407) 897-2907	Date 6/14/2017
Name and Signature of Reviewer Christianne C. Ferraro, P.E.		District Office/Phone Number 407-897-4114	Date 6/14/2017

Single Event Violations				
Check for Yes	Evaluation Area	Description	Finding Description	Finding ID
<input type="checkbox"/>	Effluent Disposal	General	Operation of unpermitted disposal system at a permitted facility.	EDUN
<input type="checkbox"/>	Laboratory	General	The laboratory is not certified by the Department of Health.	LNCE
<input type="checkbox"/>	Permit	General	Unauthorized discharge from the collection system with a high potential for water quality or health impacts	UNBP
<input type="checkbox"/>	Permit	General	The facility is operating without a wastewater permit.	UPHI
<input type="checkbox"/>	Records and Reports	General	Falsification of any record or report	FARR
<input type="checkbox"/>	Records and Reports	General	The Permittee failed to report noncompliance to the Department within 24 hours as required by 62-620.610(20), F.A.C.	RSWP

Facility Treatment Summary: Biosolids Management Facility (land application site)

1. Permit: In-Compliance

Current Permit available on-site?	Yes
Date Permit issued	12/17/2012
Date Permit Expires	12/16/2017
Permit Renewal Application due by	06/19/2017
Administrative or Judicial Orders?	N/A

1.1 Observation: A copy of the permit was available onsite. Permit renewal application due by June 19, 2017.

2. Compliance Schedules: Not Applicable

3. Laboratory: Not Applicable

4. Sampling: Not Applicable

5. Records and Reports: In-Compliance

Documents/Records reviewed	Timeframe
Discharge Monitoring Reports (DMRs)	Not applicable

5.1 Observation: The required records were available on site and no deficiencies were noted.

6. Facility Site Review: In-Compliance

6.1 Observations: Land application was happening at time of inspection.

6.2 Observations: Appropriate grass crops were being cultivated.

6.3 Observations: The fields were uniformly applied.

6.4 Observations: There was no evidence of runoff.

6.5 Observations: Setbacks were correctly maintained.

6.6 Observations: The facility grounds were secured properly.

6.7 Observations: The site was adequately fenced.

6.8 Observations: Proper signage was prominently visible.

6.9 Observations: Water table monitoring wells are adequately installed throughout the site as needed.

7 Flow Measurement: Not Applicable

8 Operation and Maintenance: In-Compliance

Facility being operated as per permit?	Yes
----------------------------------------	-----

8.1 Observation: The site was well maintained.

9 Effluent Quality: Not Applicable

10 Effluent Disposal: Not Applicable

11 Biosolids: In-Compliance

11.1 Observation: Class B biosolids have been applied to the site. They are spread uniformly as liquid and cake, and not excessively.

12 Groundwater Quality: Not Applicable

13 SSO Survey: Not Applicable

14 Other: Not Applicable

TECHNICAL MEMORANDUM
No. 3

JonesEdmunds

Janicki Environmental, Inc.

Blue Cypress Lake – Water Quality Study

TO: Vincent Burke, PE, Utilities Director, Indian River County

FROM: Anthony Janicki, PhD, Janicki Environmental
Brett Cunningham, PE, Jones Edmunds
Jon Perry, Janicki Environmental
Bill Lynch, PE, Jones Edmunds

DATE: November 13, 2018

SUBJECT: Phosphorus Budget
Jones Edmunds Project No. 08620-002-01

1 INTRODUCTION

This Technical Memorandum No. 3 is part of a Water Quality Study for Blue Cypress Lake (BCL). When complete, the Study will determine whether anthropogenic influences are a significant causative factor in water quality. More specifically, the Study will determine whether the application of biosolids in the tributary watershed discharging to BCL is affecting water quality.

2 OBJECTIVES

The project objective is to gather, validate, and assess the water quality data associated with BCL and its watershed, including the permitted use of land application of biosolids. This Technical Memorandum reports on the results of the phosphorus budget.

3 PHOSPHORUS BUDGET

The approach to the phosphorus budget uses measured concentrations in the three major tributaries and BCL, flow estimates from the Hydrologic Simulation Program – Fortran (HSPF) model developed by the St. Johns River Water Management District (SJRWMD) for 2000 through 2012, and flow estimates for 2013 through 2017 based on relationships of flow versus rainfall from the HSPF model. Figure 1 shows the watershed boundaries from the HSPF model and the polygons representing areas permitted to receive applications of biosolids. As Figure 1 shows, the Blue Cypress Creek water quality station is downstream of a portion of the biosolids application sites, but the others are not. Therefore, this approach is not accounting for a large portion of the biosolids contribution, which is important to the findings.

Figure 1 WBIDs and Water Quality Monitoring Stations from the FDEP IWR and SJRWMD Databases

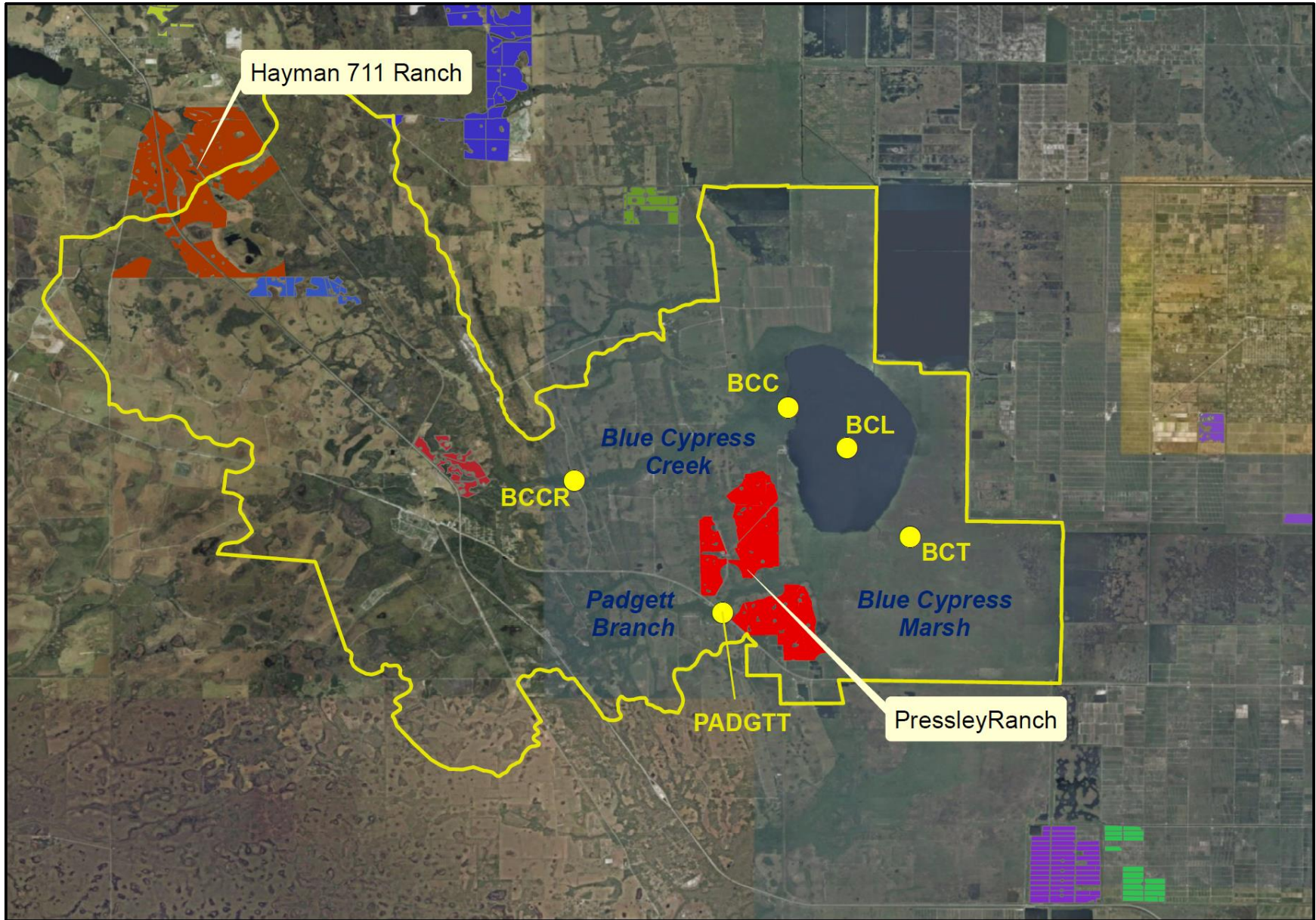


Figure 2 shows an annual summary of the total phosphorus (TP) from biosolids applied at each location within the BCL watershed since 2006. As Figure 2 shows, the largest applications were at Hayman 711 Ranch and Pressley Ranch.

Figure 2 Biosolids Applications in the Blue Cypress Lake Watershed by Location

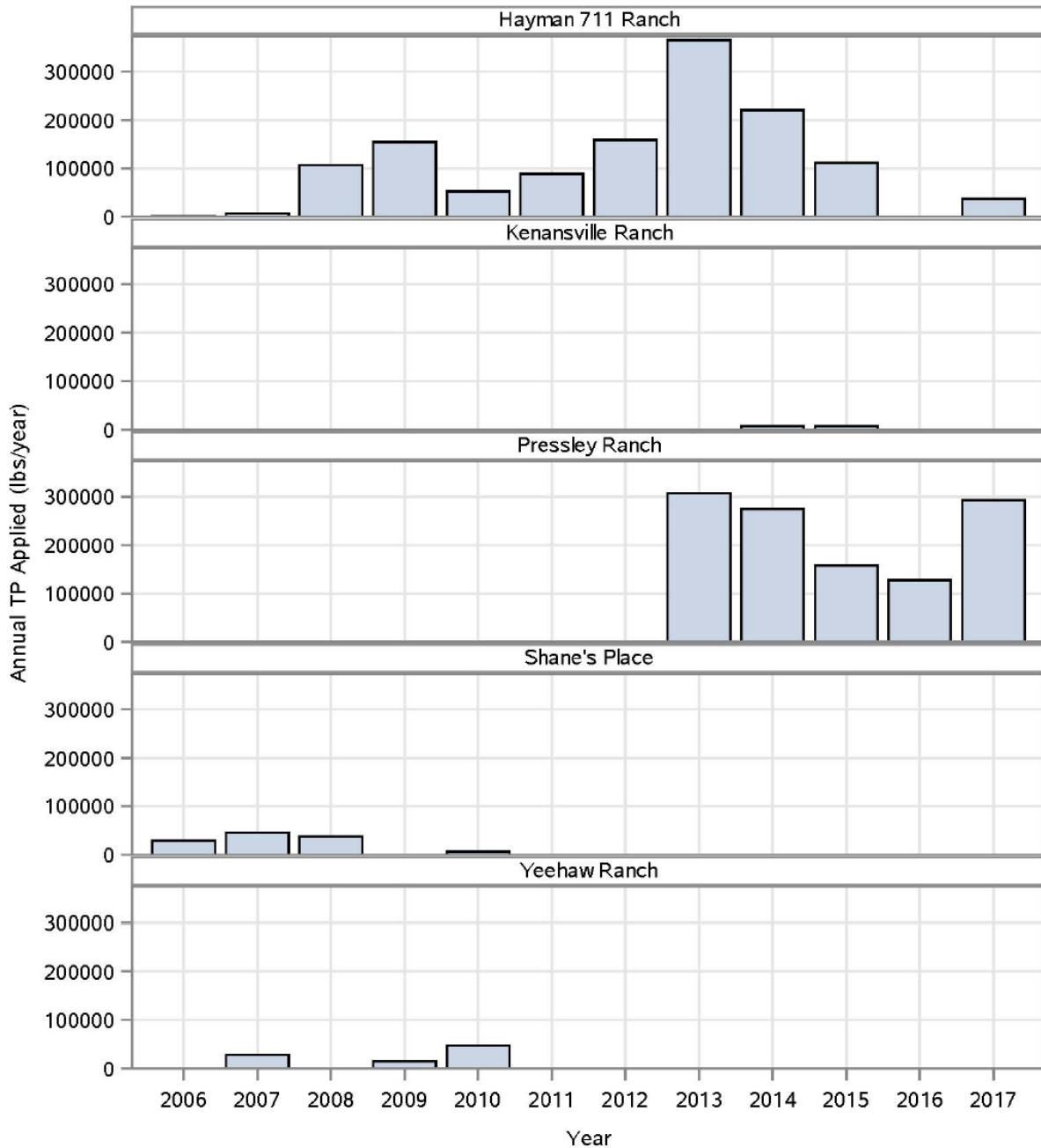


Figure 3 shows an annual summary of the TP from biosolids applied within the BCL watershed since 2006.

Figure 3 Total Biosolids Applications in the Blue Cypress Lake Watershed

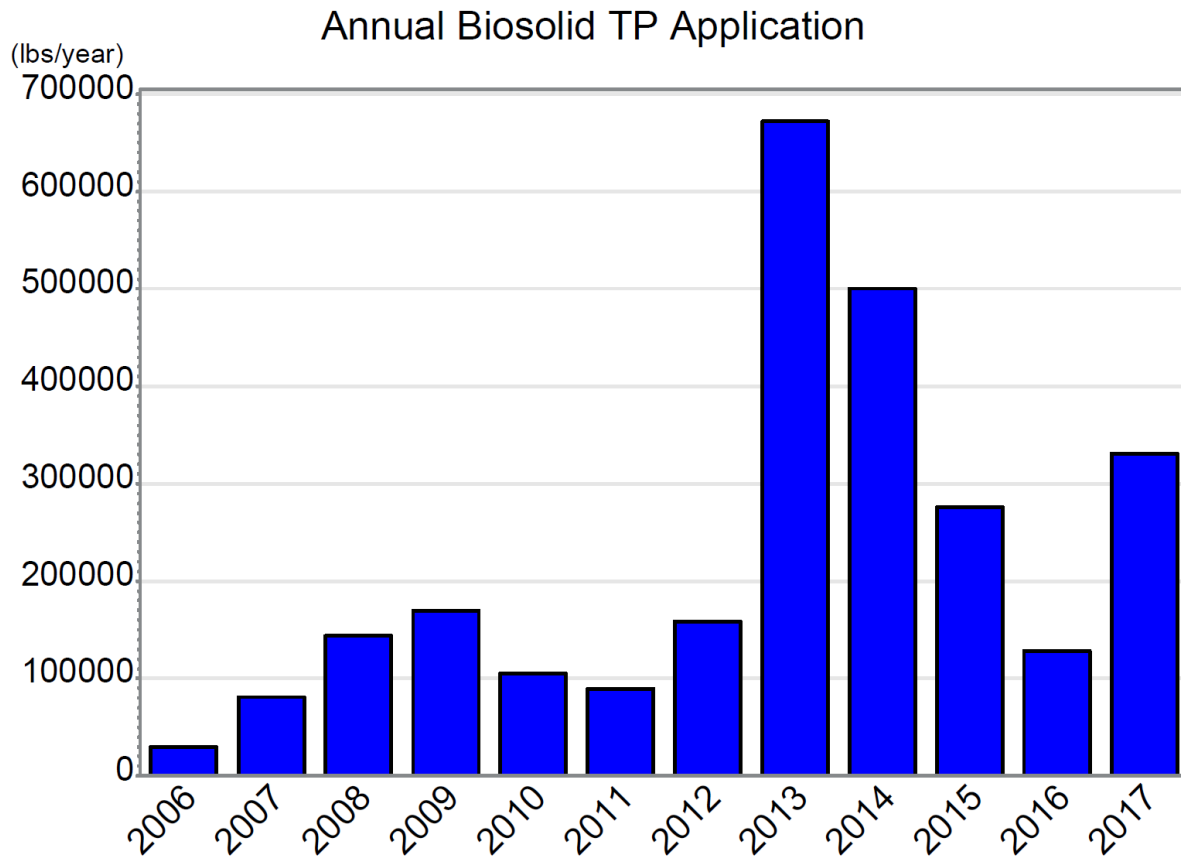


Figure 4 shows the fluxes or masses of phosphorus entering (blue line) and leaving (green) the lake. The Mass In is calculated from the total modeled/estimated annual volume entering the lake multiplied by the mean annual measured TP concentration from the three water quality stations, which do not capture a large portion of the biosolids application areas. The Mass Out is calculated from the total modeled/estimated annual volume leaving the lake multiplied by the mean annual measured TP concentration from a representative site in the middle of the lake. Clearly, the mass of phosphorus entering the lake exceeded the mass leaving the lake through 2005. From 2006 until 2012, the Mass In and Mass Out were similar. From 2013 to 2017, the mass of phosphorus leaving the lake exceeds that entering the lake. Since the water chemistry – in particular the pH and dissolved oxygen – are relatively constant during this time, the net difference between discharge of incoming phosphorus and release of bound phosphorus in the lake sediments is unlikely to have changed significantly. That means that an unaccounted-for phosphorus source likely exists.

Figure 4 Total Annual Phosphorus Fluxes Calculated for Blue Cypress Lake

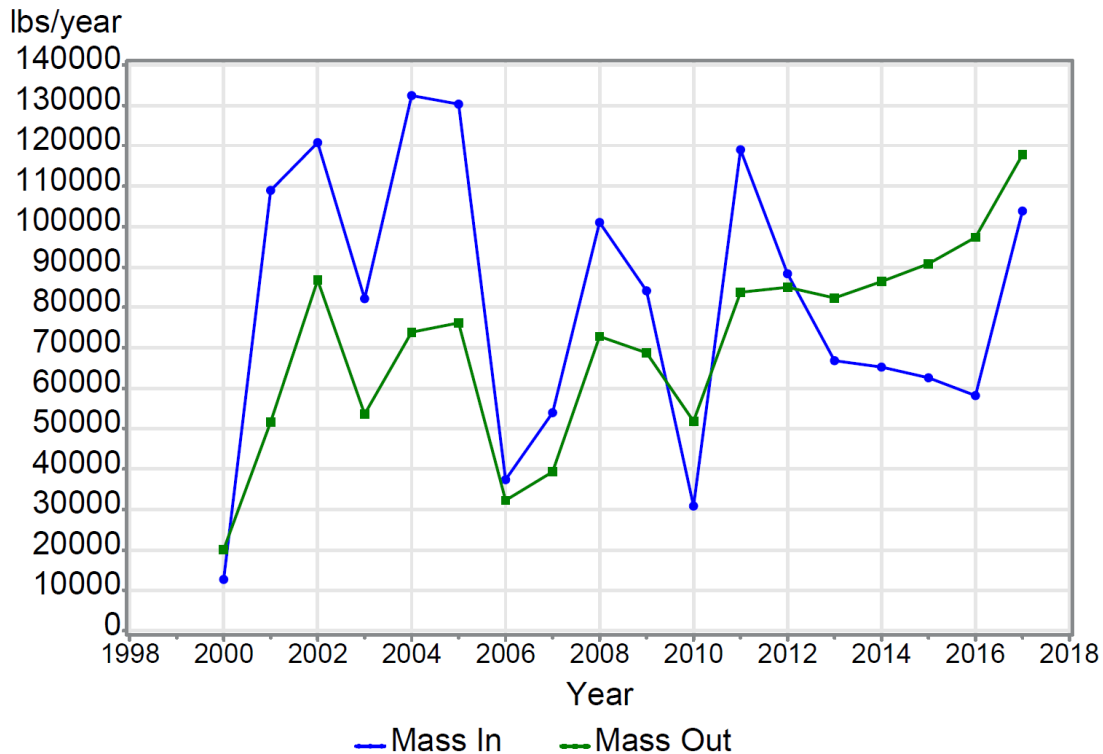


Figure 5 shows the differences in the calculated fluxes. Given the results shown in Figures 4 and 5, it would follow that the lake mass would decrease if more mass leaves the lake than enters. In fact, Figure 6 shows that the mass within BCL continues to increase, which corroborates the hypothesis that there is another phosphorus source to the lake.

Figure 5 Total Annual Differences in Calculated Phosphorus Fluxes

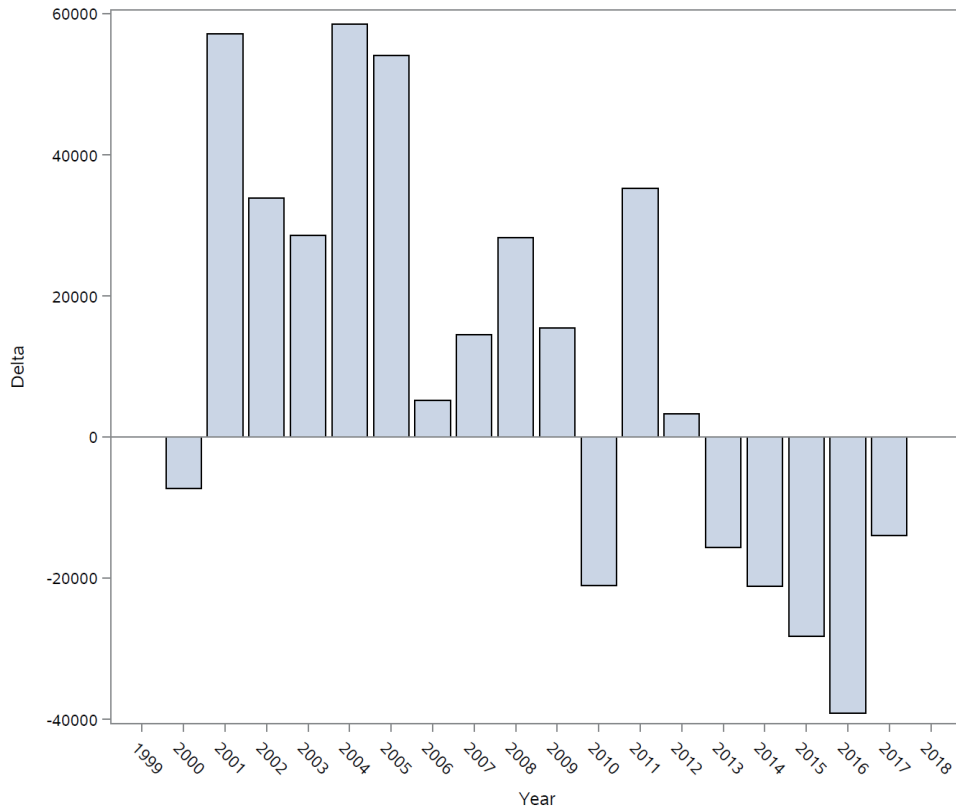
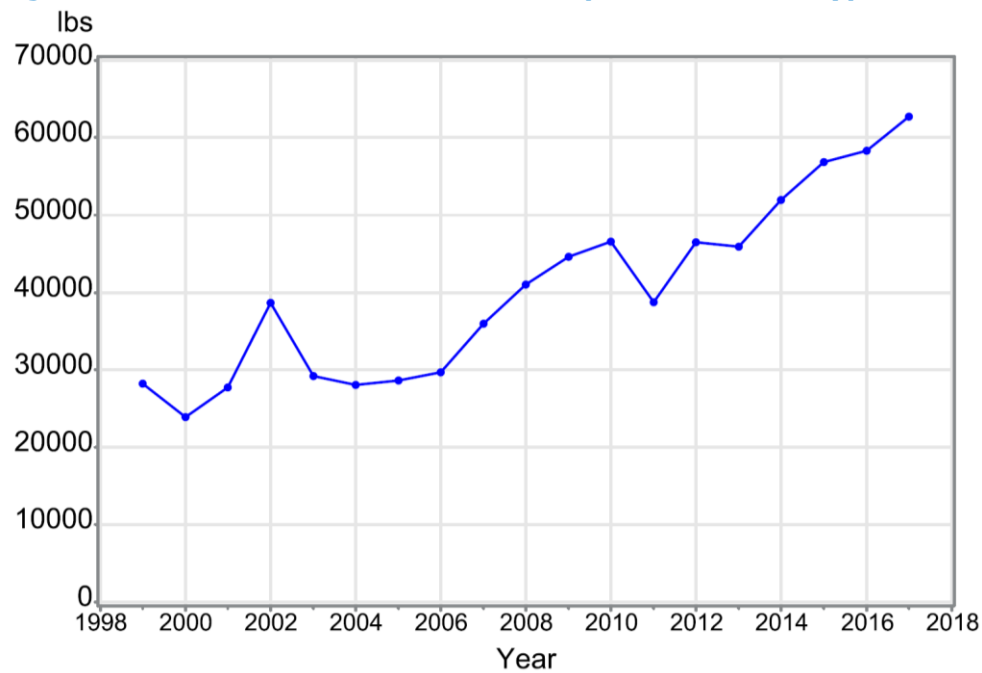


Figure 6 Total Annual Mass of Phosphorus in Blue Cypress Lake



4 FINDINGS AND CONCLUSIONS

The larger applications of biosolids that are downstream of the water quality stations, i.e., not accounted for in these calculations, began in 2013 – the same year that a continuous annual flux of unaccounted-for phosphorus begins as determined through the approach presented. Beginning in 2013, the annual TP application rate downstream of the water quality sampling stations averages approximately 200,000 pound per year (lb/year) and the unaccounted-for TP averages approximately 20,000 lb/year. That difference means that if only 10 percent of the phosphorus in those biosolids reaches the lake, it would account for all of the unaccounted-for phosphorus. Given that the application rates far exceed the agronomic needs of the crop and that residual phosphorus in the fields that were tested in the area for renewing the application permit were relatively low (i.e., much of the phosphorus applied appears to have migrated from the fields), biosolids likely account for a significant amount of the upward trend in phosphorus concentrations in BCL.

Appendix A presents the information supporting the phosphorus data that we used for the model and this Technical Memorandum.

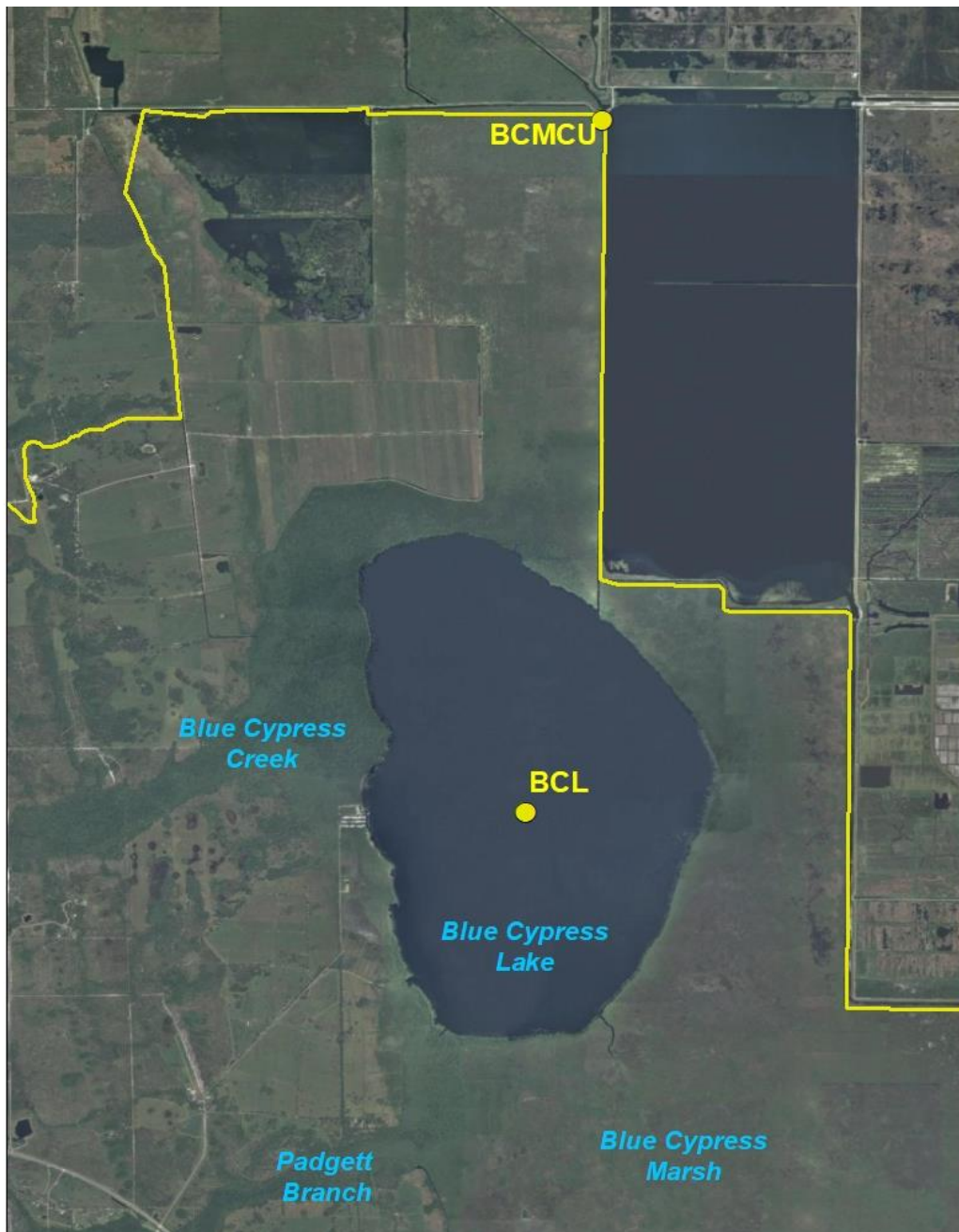
Appendix A
Supporting Information for
Phosphorus Data

APPENDIX A

SUPPORTING INFORMATION FOR PHOSPHORUS DATA

A question arose regarding the use of phosphorus data from the SJRWMD station in Blue Cypress Lake (Station BCL) (period of record 1991 to present) as the concentration used to calculate the mass of phosphorus leaving the lake. Of the other potential candidates, the only other possible choice would be to use the SJRWMD site BCMCU due to its relatively long period of record (2006 to present). Figure 1 shows the two sites.

Figure 1 SJRWMD Sites BCL and BCMCU



We examined the mean annual concentrations (Figure 2) and time-series plots (Figure 3) from both sites to compare the data. Figure 2 shows relatively good agreement between the two sites regarding the annual mean concentrations. The time-series plots support this observation. The water quality at the BCMCU site may be affected by additional inputs along the canal as well as in-stream biogeochemical processes occurring along the canal that likely account for the observed differences.

Figure 2 Mean Annual TP concentrations from Site BCL versus BCMCU

Mean Annual Lake TP (mg/L) vs. Mean Annual Outgoing Canal TP (mg/L)

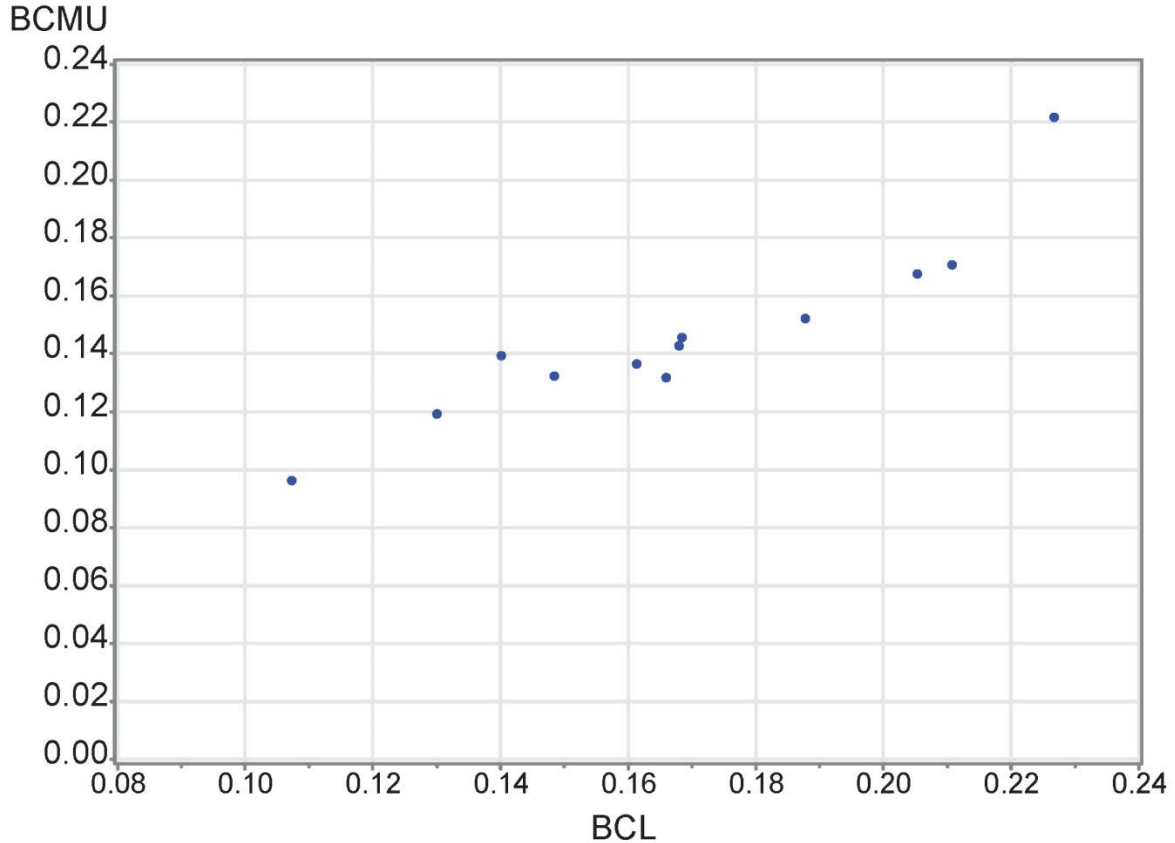
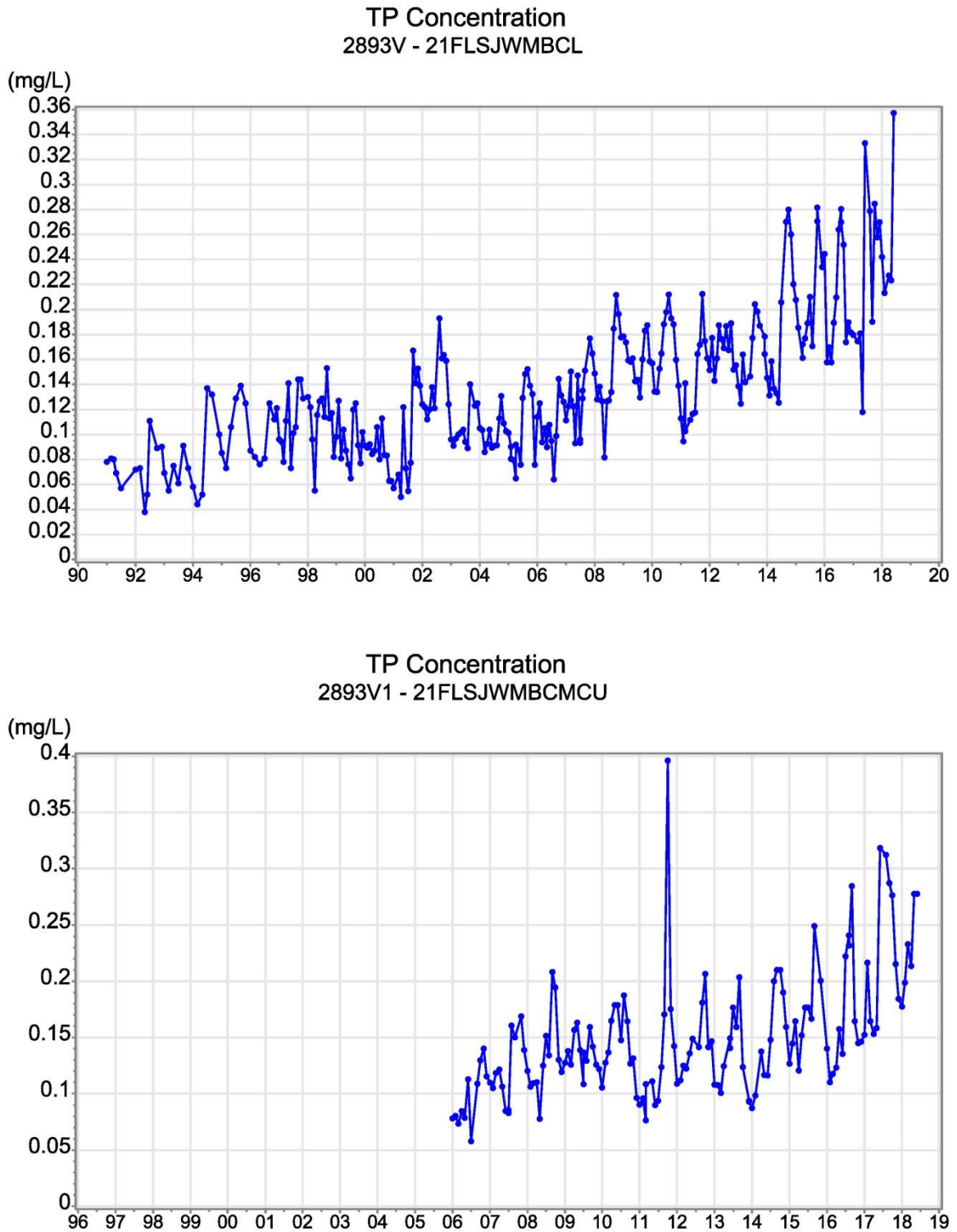


Figure 3 Time series plots of TP concentrations for site BCL (top) and BCMCU (bottom)



We used site BCL to represent the concentration of water leaving the lake because site BCL has a longer period of record, is more representative of the water quality in the lake, and is the only station within the lake with an extended period of record.

TECHNICAL MEMORANDUM
No. 4

JonesEdmunds

Janicki Environmental, Inc.

Blue Cypress Lake – Water Quality Study

TO: Vincent Burke, PE, Utilities Director, Indian River County

FROM: Anthony Janicki, PhD, Janicki Environmental
Jon Perry, Janicki Environmental
Brett Cunningham, PE, Jones Edmunds

XC: Bill Lynch, PE, Jones Edmunds

DATE: November 21, 2018

SUBJECT: Draft Waterbody Identification (WBID) Assessment
Jones Edmunds Project No. 08620-002-01

1 INTRODUCTION

This Technical Memorandum No. 4 is part of a Water Quality Study for Blue Cypress Lake. When complete, the Study will determine whether anthropogenic influences are a significant causative factor in water quality. More specifically, the Study will determine whether the application of biosolids in the tributary watershed discharging to Blue Cypress Lake is affecting water quality.

2 OBJECTIVES

The project objective is to gather, validate, and assess the water quality data associated with BCL and its watershed, including the permitted use of land application of biosolids. The objective of this Technical Memorandum is to report the results of the WBID Assessment completed as part of Task 3 of CCNA2018 Work Order 1.

3 BACKGROUND

The State of Florida is charged with regularly assessing the State’s waterbodies against State-adopted water quality criteria. Florida Department of Environmental Protection (FDEP) is responsible for the assessment under Rule 62-303, Florida Administrative Code (FAC), also known as the Impaired Waters Rule (IWR).

To conduct the assessment, FDEP maintains a database known as the IWR Run, which is a compilation of many data sources including STORage and RETrieval (STORET), United States Geological Survey (USGS), Florida Department of Agriculture and Consumer

Services, and the water management districts. Local governments and agencies also contribute data to the FDEP database. Recently, FDEP has migrated the data to its replacement, the Florida Watershed Information Network (WIN).

These data are assigned to waterbodies based on their geographic coordinates. The waterbodies are assigned unique WBIDs, which are used to track a waterbody through the Watershed Management Cycle. The five steps of the Watershed Management Cycle are the following:

- Set water quality standards.
- Waterbody monitoring.
- Waterbody assessment.
- Total maximum daily load development.
- Basin management action plans.

Figure 1 shows the WBIDs and the distribution of monitoring sites for this analysis. These waterbodies, including and surrounding Blue Cypress Lake, were last assessed by FDEP in 2016 for January 1, 2007, to June 30, 2014, which does not include much of the more recent upward trend in total phosphorus (TP) observed in some of the waterbodies. Following FDEP protocol of assessing 7.5 years, the analyses in this Technical Memorandum include data from July 1, 2010, to December 31, 2017.

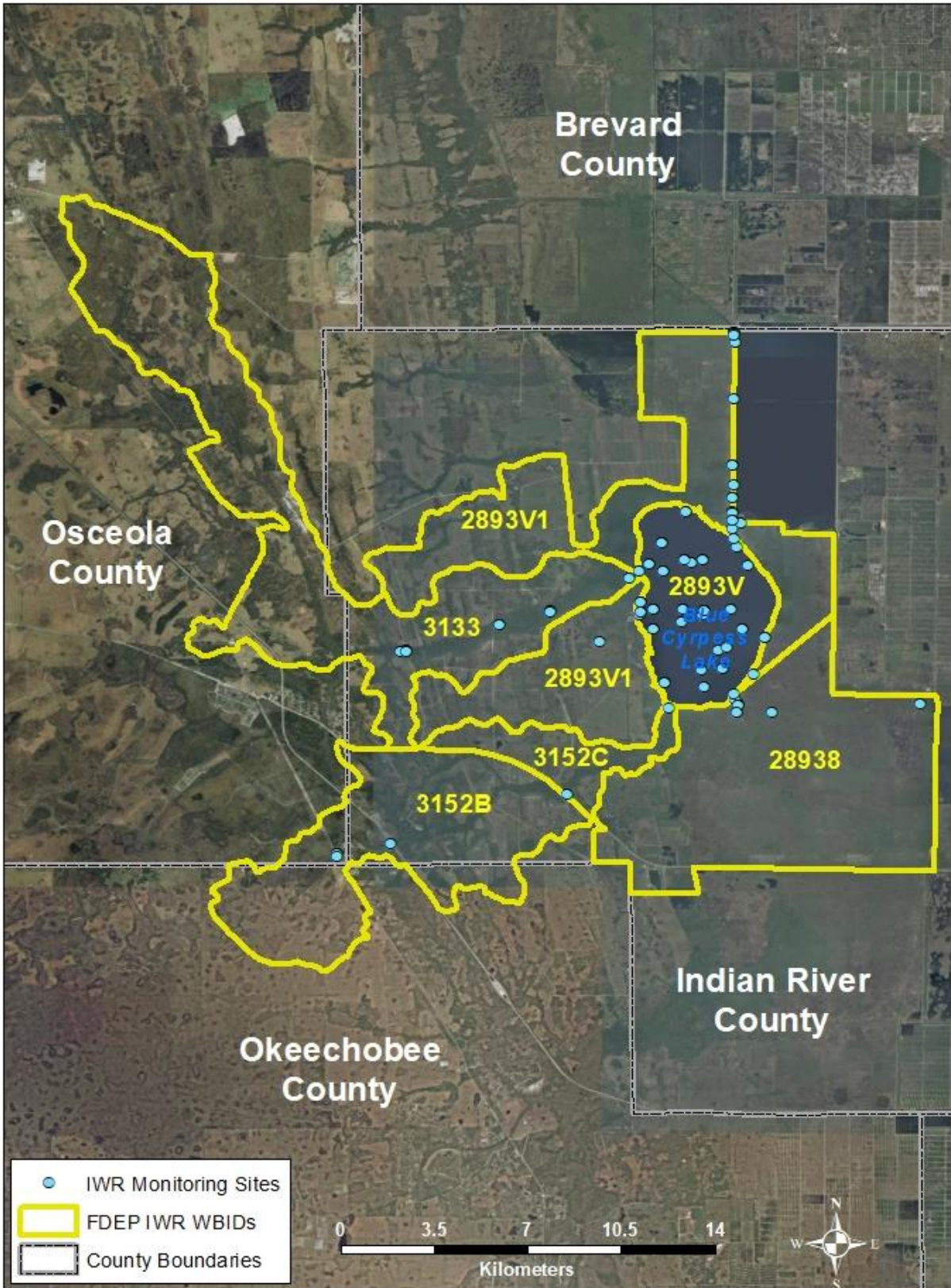
Table 1 shows the WBIDs used for this analysis with their classes and types.

Table 1 **WBIDs, FDEP Waterbody Names, Classes, and Types Used in This Assessment**

WBID	FDEP Name	Class	Type
2893V	Blue Cypress Lake	1	Lake
3152C	Padgett Branch (Class I)	1	Stream
2893V1	Blue Cypress Lake Drain	1	Stream
28938	Blue Cypress Marsh	1	Stream
3133	Blue Cypress Creek	1	Stream

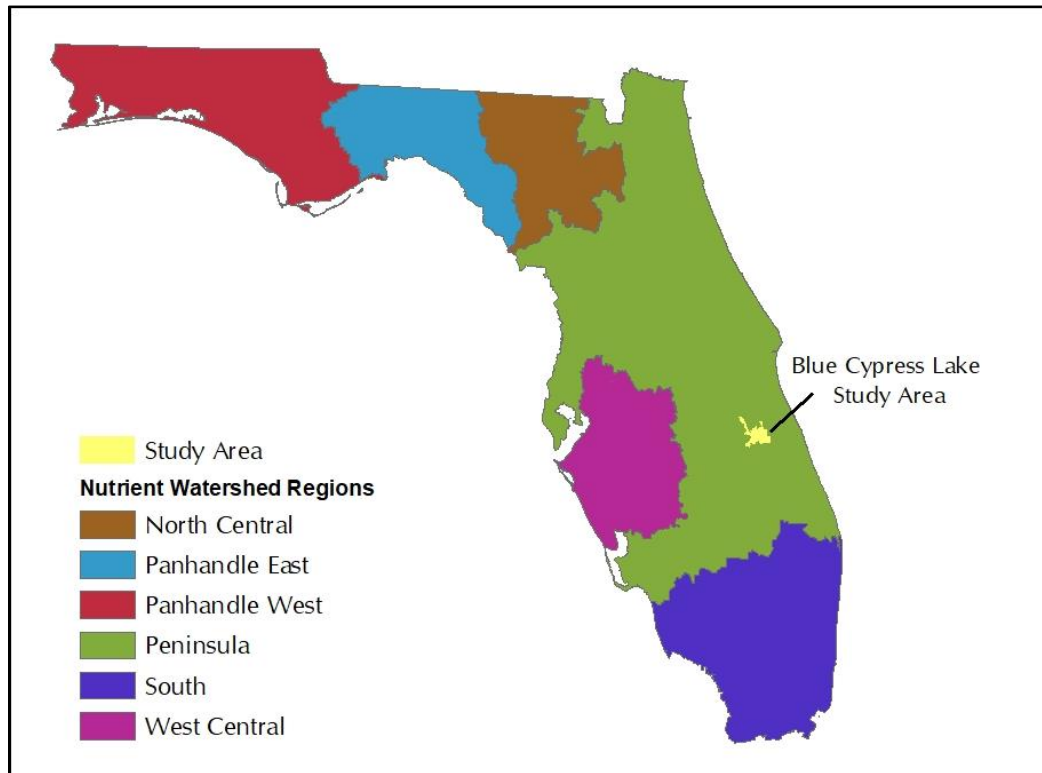
The water quality standards used in the assessment are dependent on the class of waterbody, i.e., Class 1: Drinking water supply or Class 3F: Fish Consumption, Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. All the waterbodies in this assessment are Class 1.

Figure 1 Location of WBIDs and Water Quality Monitoring Sites in Relation to Blue Cypress Lake



The Numeric Nutrient Criteria (NNC) for total nitrogen (TN), TP, and chlorophyll *a* also take into account the waterbody type, i.e., lakes, streams, or estuaries. The location within the State is also significant since the same type of waterbody has different NNC depending on the nutrient region (Figure 2). All of the waterbodies referenced in this Technical Memorandum are in the Peninsula Nutrient Region.

Figure 2 Location of the Blue Cypress Lake Study Area Within the Peninsula Nutrient Watershed Region



The expression used for the State dissolved oxygen (DO) criterion was recently changed from a concentration to a percent saturation criterion. This criterion also is dependent on the class of waterbody and whether the waterbody is freshwater or marine. For a waterbody to be placed on the Verified Impaired List due exceedance of the DO criterion, the causative pollutant must be identified. In the absence of a causative pollutant, the WBID is placed on the Study List for further monitoring or on the Natural Background List. The typical causative pollutants are nutrients expressed as excessive chlorophyll *a* or an elevated biochemical oxygen demand.

4 WATER QUALITY CRITERIA

FDEP uses all the available data within a WBID to compare the ambient water quality in a waterbody with the appropriate water quality criteria. For this assessment, we looked at the following parameters:

- TN
- TP
- Corrected Chlorophyll *a* (CHLAC)
- DO (DOSAT)

The first three are the NNC. As mentioned previously, the waterbody type and geographic location determine the appropriate NNC. Table 2 shows the criteria used in this assessment. All of the NNC are assessed as annual geometric means (AGMs) and should not be exceeded more than once in 3 years. The AGMs are used to limit the effect of extreme low or high values that would skew an arithmetic mean. For lakes, the TN and TP have two values that are dependent on the chlorophyll *a* value. If the CHLAC AGM is less than 20 micrograms per liter ($\mu\text{g/L}$), the higher criteria are used for TN and TP. If the CHLAC AGM is greater than 20 $\mu\text{g/L}$, the lower criteria are used.

Table 2 Applicable NNC and DO Standards for Blue Cypress Watershed

Waterbody Type	Chlorophyll <i>a</i> ($\mu\text{g/L}$)	TN ($\mu\text{g/L}$)	TP ($\mu\text{g/L}$)	DO (%)
Lake	≤ 20	≤ 1.27 ≤ 2.23	≤ 0.05 ≤ 0.16	≥ 38
Stream	—	≤ 1.54	≤ 0.12	≥ 38

While many other water quality criteria can be assessed, data requirements need to be met for an assessment to be made and sufficient data for many of these criteria were not available.

Exceedance of any NNC is not sufficient to deem a WBID as being impaired. As promulgated by FDEP, NNC in freshwater WBIDs require biological confirmation of any impairment. For lakes, the key parameter is the Lake Vegetation Index (LVI); for streams, the Stream Condition Index (SCI). Currently, Blue Cypress Marsh is verified impaired for the presence of macrophytes.

If a waterbody fails an NNC criterion and no corresponding biological data are available, that waterbody is placed on the Study List for additional monitoring. If a waterbody fails to meet the NNC and passes the biological criterion, that waterbody is not impaired. If a waterbody fails the NNC and fails the biological assessment, that waterbody is placed on the Verified Impaired List.

As previously mentioned, the DO standard is dependent on whether a waterbody is fresh or marine. In this case, all the waterbodies are freshwater. The DO criterion should not be exceeded in more than 10 percent of the samples.

5 WATER QUALITY DATA

The dataset developed under Task 1 was used for this assessment and was derived from the FDEP IWR Run 55 database appended with more recent data from the St. Johns River Water Management District (SJRWMD) for the WBIDs surrounding Blue Cypress Lake. This dataset includes data from various agencies but predominantly from the SJRWMD.

6 ASSESSMENT

Following FDEP protocol, data for 7.5 years were used in the assessment, namely July 1, 2010, to December 31, 2017. Table 3 shows the results of the assessment. Green cells represent waterbodies that meet or pass the criterion; red cells represent waterbodies that fail a criterion. Open cells indicate lack of sufficient data to complete the assessment.

Table 3 Results of the Assessment for NNC and Dissolved Oxygen.

Waterbody	TN	TP	Chlorophyll <i>a</i>	DO
Blue Cypress Lake	Green	Red	Green	Red
Padgett Branch	Green	Red	White	Red
Blue Cypress Lake Drain	Green	Red	White	Red
Blue Cypress Marsh	White	Green	White	Red
Blue Cypress Creek	Green	Red	White	Red

The first notable result is that none of the assessed WBIDs fail to meet the TN criterion. Conversely, four of the five WBIDs fail to meet the TP and DOSAT criteria. Four of the five WBIDs did not have sufficient data to assess for chlorophyll *a*. The fifth WBID, Blue Cypress Lake, met the chlorophyll *a* criterion.

As discussed above, a WBID is deemed impaired if both an exceedance of an NNC and a biological confirmation indicate an impairment. For information regarding biological parameters used to confirm an impairment, we referred to the IWR Run 55 database. Three of the waterbodies have biological data available for assessment: Blue Cypress Lake, Blue Cypress Marsh, and Blue Cypress Creek. Blue Cypress Lake and Blue Cypress Marsh failed to meet the biological criteria, LVI, and excessive macrophytes, respectively. Blue Cypress Creek did meet the SCI criterion.

Table 4 shows the results of combining the water quality and biological assessments. Expecting that Blue Cypress Lake will be deemed Verified Impaired is reasonable because the TP and LVI criteria were not met. The remainder of the WBIDs that failed either the TP or biological assessments will be placed on the Study List.

Table 4 Expected Impairment Status

Waterbody	Total Nitrogen	Total Phosphorus	Chlorophyll <i>a</i>	Dissolved Oxygen
Blue Cypress Lake	Not Impaired	Impaired	Not Impaired	Not Impaired
Padgett Branch	Not Impaired	Study List	White	Study List
Blue Cypress Lake Drain	Not Impaired	Study List	White	Study List
Blue Cypress Marsh	White	Not Impaired	White	Study List
Blue Cypress Creek	Not Impaired	Study List	White	Study List

The above are the expected results of the next assessment to be conducted by FDEP scheduled for late 2020 using data from January 1, 2013, to June 30, 2020. However, with the development of WIN and streamlining of the assessment, FDEP is considering conducting a state-wide assessment every 2 years instead of the current 5-year rotation.

According to Rule 62-303, FAC, a waterbody shall be included on the Planning List for nutrients if *there is a statistically significant increasing trend in the annual geometric means at the 95 percent confidence level in TN, TP, or chlorophyll a over the planning period using a Mann's one-sided, upper-tail test for trend.* Figures 3 and 4, respectively, show that the

recent increasing trend in TP in Blue Cypress Lake and Blue Cypress Lake Drain meets the stated criterion.

Figure 3 Total Phosphorus AGM in Blue Cypress Lake

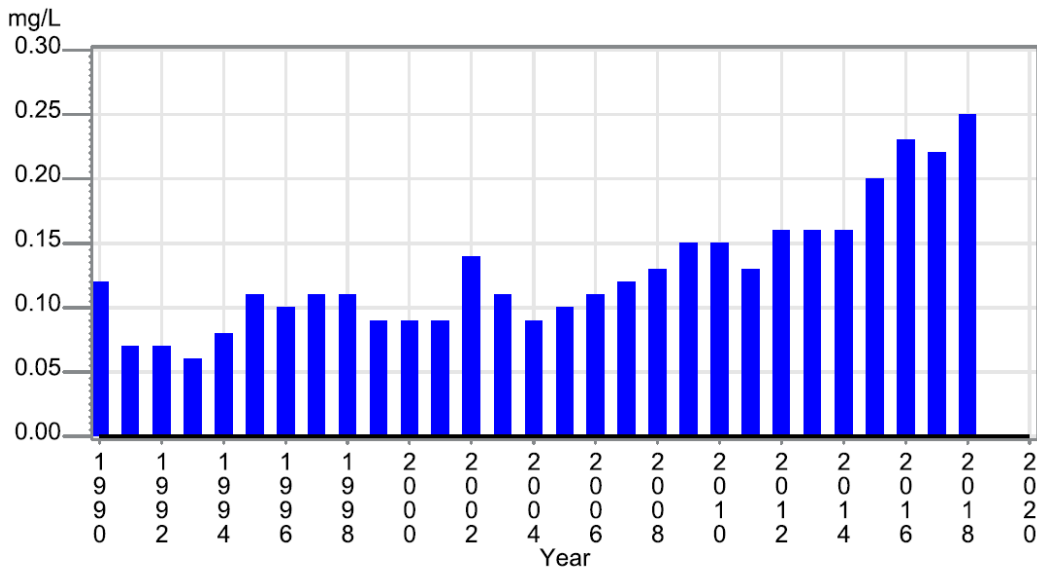
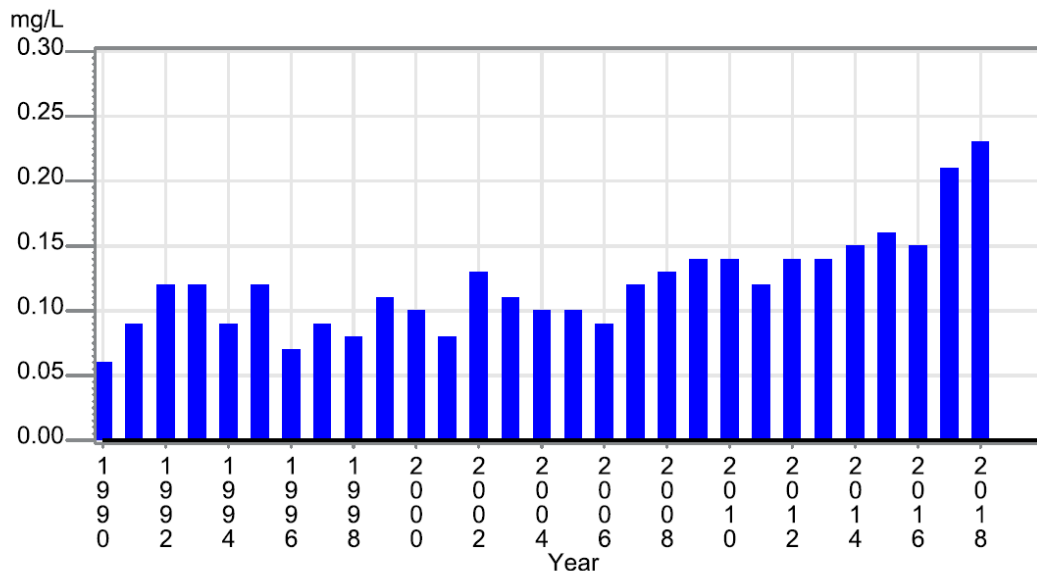


Figure 4 Total Phosphorus AGM in Blue Cypress Lake Drain



7 CONCLUSIONS

Each of the identified WBIDs were assessed using all the available data against FDEP Water Quality Standards for TN, TP, chlorophyll *a*, and DO. Section 6 shows the expected results of the next FDEP assessment. The recent increasing trend in TP in Blue Cypress Lake would have placed it on the Planning List. However, with the higher AGMs coupled with available biological confirmation, placement on the Verified Impaired list is highly likely. This likely change in impairment status results from the recent higher TP concentrations in Blue Cypress Lake.