LAKE ECOSUMMARY

Lake Francis, July 12, 2011

DEP conducted water quality and biological sampling at Francis Lake in Madison County on July 12, 2011 as part of a state-wide probabilistic monitoring program which monitors water quality statewide. Overall, the water quality and plant community data indicated that the lake met some of the expectations for a healthy, well-balanced lake.

Background

Although healthy, well-balanced lake communities may be maintained with some level of human activities, such activities may result in lake degradation. Human stressors include increased inputs of nutrients, sediments and/or pesticides from watershed runoff, undesirable removal of native shoreline and/or upland buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP has methods to evaluate if human activities have resulted in the condition where a particular waterbody has exceeded water quality criteria (Chapter 62-302, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life support), and exceedances of these standards are associated with interference with the designated use. Chlorophyll *a* is a measure of algal biomass in the water column. In clear, low alkalinity lakes (lakes where color is < 40 PCU and alkalinity is < 20 mg/L $CaCO_2$), a healthy system is expected to have $\leq$ 6 µg/L of chlorophyll *a*. In colored ($\geq$ 40 PCU) lakes or clear, high alkalinity ($\geq$20 mg/L $CaCO_2$) lakes, healthy systems are expected to have $\leq$ 20 µg/L of chlorophyll *a*. Chlorophyll *a* values greater than those shown above may result in unwanted shading of aquatic plants and/or greater potential for harmful algal blooms. The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. These tools are often used in conjunction with one another because it is possible to detect imbalance in the plant community while the algal community appears healthy (and vice versa).

Methods

The LVI was sampled on July 12, 2011, by the DEP Northeast District Office. Surface water samples were collected on July 26, 2011, by DEP Status Network staff in Tallahassee for analysis of nutrients, chlorophyll *a*, color and physical parameters following DEP Standard Operating Procedures (SOPs; see http://www.dep.state.fl.us/water/sas/qa/sops.htm). Sampling and analyses met DEP quality assurance/quality control standards (see http://www.dep.state.fl.us/water/sas/qa/index.htm).

For the LVI, species lists were developed for four of twelve sections of the lake (Figure 1), and the following information was derived from those lists: percent native species, percent invasive exotic species, percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is to disturbance) of the dominant species. According to DEP SOP LT 7000, the LVI score ranges and categories are: (78-100) Exceptional; (38-77) Healthy; and (0-37) Impaired. DEP has proposed a revised impairment threshold, in which scores of 43 and higher fully meet the expectation of a healthy, well balanced community, and scores below 43 are considered impaired.

The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000. A lake habitat assessment was performed per DEP SOP FT 3200.



Figure 1. Sampling map of Lake Francis. Sections 2, 5, 8 & 11 were sampled for the Lake Vegetation Index.

Site Information

Lake Francis is a 10 hectare eutrophic urban lake located in the city of Madison, in Madison County, FL. The entire shoreline has been converted to a recreation area and the vegetative buffer has been reduced to a width of 0-1 meter (Figure 2).


Figure 2. Photo of Lake Francis, March 25, 2013.

The landscape development intensity index (LDI), based on land use data within 100 m of the lake shoreline is 7.11. LDI scores range from 1 to 10 with a score of <2 being "minimally disturbed."

Lake Francis is not currently on the impaired waters list.

Results

Water Quality

The chlorophyll *a* sample collected on July 26, 2011, did not achieve the proposed water quality standard, which are assessed as annual geometric means, not as individual samples (Table 1). In contrast, the concentrations of total nitrogen and total phosphorus in the sample collected on July 26, 2011 did not exceed their proposed respective annual geometric mean water quality criteria, also assessed as an annual geometric mean (Table 1).

With long residence time, low flushing rates and increased nutrients from stormwater runoff, chlorophyll *a* has been trending higher over time in Lake Francis. This increase in chlorophyll may result in a shift from taxa better adapted to mesotrophic conditions to those tolerant of eutrophic conditions, which is often interpreted as biological imbalance. The cultural eutrophication process can be slowed by educating the community on Best Management Practices to minimize the use of ornamental lawn care products (i.e. fertilizer) and encouraging the growth of a lake vegetative buffer with plants native to Florida.

Table 1. Water quality results from July 26, 2011 at Lake Francis.

Analyte	Result	Remark	Applicable Class III Water Quality Criteria
Field Temperature (°C)	29.3		
Field pH (SU)	8.6		
Field Dissolved Oxygen (mg/L)	6.87		≥ 5
Field Specific Conductance (µmhos/cm)	118		
Alkalinity (mg $CaCO_3$/L)	57		
Color (PCU)	12		
Chlorophyll a (µg/L)	**50**		*≤ 20 µg/L**
Total Phosphorus (mg/L)	0.076		*≤ 0.09 mg/L**
Nitrate+Nitrite (mg/L)	0.004	U	
Ammonia (mg/L)	0.016	I	
Total Kejldahl Nitrogen (mg/L)	1.1		
Total Nitrogen (mg/L)	1.104		*≤ 1.91 mg/L**

*Federally promulgated numeric nutrient criteria for Florida lakes

**Annual geometric mean

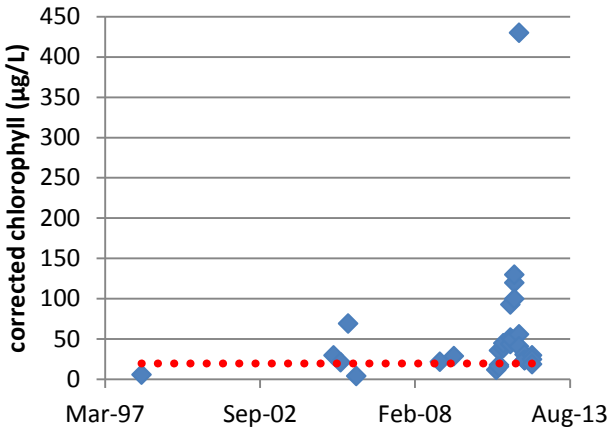


Figure 3. Chlorophyll *a* trend data for Lake Francis (dotted red line indicates the proposed limit).

Lake Vegetation Index

The LVI score for this lake was 59 out of a possible 100 points, corresponding with a "Healthy" designation. Table 2 contains the species list and occurrence information for this sampling event. A total of 6 (21% of the total taxa) invasive exotic plants were observed in the lake. Without active management, desirable native species may be displaced.

Based on the lake habitat assessment (which scores the water clarity, vegetation quality, stormwater inputs, substrate quality and adverse anthropological alterations in the lake footprint and surrounding uplands), Francis Lake scored 9 out of a potential 140 points.

Based on the increasing chlorophyll trend towards eutrophy, Lake Francis may be more susceptible to harmful algal blooms, low dissolved oxygen levels and fish kills, especially during the warm summer months.

Table 2. Species list for the July 12, 2011 LVI at Lake Francis. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Francis, July, 12, 2011		Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
Alternanthera philoxeroides	ALLIGATOR WEED*	P	P	P	P
Bidens laevis	BURRMARIGOLD; SMOOTH BEGGARTICKS	P	P	P	P
Boehmeria cylindrica	FALSE NETTLE; BOG HEMP	P	P	P	P
Cyperus odoratus	FRAGRANT FLATSEDGE	P			P
Cyperus surinamensis	TROPICAL FLATSEDGE				P
Dichondra carolinensis	CAROLINA PONYSFOOT	P	P		
Diodia virginiana	VIRGINIA BUTTONWEED	P			
Eupatorium capillifolium	DOGFENNEL	P			
Galium tinctorium	STIFF MARSH BEDSTRAW				P
Habenaria repens	WATERSPIDER FALSE REINORCHID	P			
Hydrocotyle	MARSHPENNYWORT	P	P	P	P
Liquidambar styraciflua	SWEETGUM				P
Ludwigia leptocarpa	ANGLESTEM PRIMROSEWILLOW	P		P	
Mikania scandens	CLIMBING HEMPVINE	P			P
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE				P
Myriophyllum aquaticum	PARROT FEATHER WATERMILFOIL*	P			P
Panicum hemitomon	MAIDENCANE	D	D	D	D
Panicum repens	TORPEDO GRASS*	P			
Paspalum urvillei	VASEYGRASS*	P			P
Phyla nodiflora	TURKEY TANGLE FOGFRUIT; CAPEWEED	P	P	P	P
Polygonum densiflorum	DENSEFLOWER KNOTWEED	P			P
Polygonum hydropiperoides	MILD WATERPEPPER; SWAMP SMARTWEED	P		P	
Sabal palmetto	CABBAGE PALM				P
Sacciolepis striata	AMERICAN CUPSCALE	P		P	P
Salix caroliniana	CAROLINA WILLOW; COASTALPLAIN WILLOW	P		P	P
Sapium sebiferum	CHINESE TALLOW*				P
Sesbania punicea	PURPLE SESBAN*				P
Typha sp.	CAT TAIL	P			P

Thank you for your interest in maintaining the water quality of Florida's lakes. Please feel free to contact us if you have any questions.

Contact and resources for more information

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A guide for Waterside Living
http://www.currentproblems.org/links/lotis.pdf

DEP publications on Best Management Practices and Environmental Stewardship and Education:
http://www.dep.state.fl.us/water/nonpoint/pubs.htm
DEP biological assessment resources:
http://www.dep.state.fl.us/water/bioassess/index.htm
FWCC Aquatic Plant Management:
http://myfwc.com/wildlifehabitats/habitat/invasive-plants/aquatic-plant/
Freshwater Algal Bloom information:
http://www.dep.state.fl.us/labs/biology/hab/index.htm