LAKE ECOSUMMARY

Lake Dora

May 15, 2012

DEP conducted biological sampling on May 15, 2012 at Lake Dora as part of the Status Networks' ambient monitoring program. Some of the water quality samples collected during this assessment indicate that nutrient standards, which are expressed as annual geometric means, may not be achieved. Plant community data indicated that the lake met expectations for a healthy, well-balanced lake, but phytoplankton data indicated a potential imbalance in the algal community.

Background

Although a healthy, well-balanced lake may be maintained with some level of human disturbance, human 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 DEP Central District Office conducted a LVI and collected water chemistry and field parameter data on Lake Dora on May 15, 2012. Samples were collected 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's new draft F.A.C. Chapter 62.302 requires at least two temporally independent LVIs with an average score of 43 or above in order to meet the expectation of a healthy, well balanced community. The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000.

Site Information

Lake Dora, located in central Florida approximately 30 miles northwest of Orlando, is part of the Upper Ocklawaha River Basin. It has a drainage basin of approximately 11,418 acres. At a lake surface elevation of 63 ft National Geodetic Vertical Datum (NGVD), the lake has a surface area of approximately 1,774 ha (4,384 acres) and an average depth of 3.0 m (9.8 ft). Surface water enters Lake Dora through the Beauclair Dora Canal. Surface water outflow from the lake travels to Lake Eustis through the Dora Canal, which has been verified as impaired for dissolved oxygen (DO). Surface elevations in Lakes Eustis, Harris, Dora, and Beauclair are controlled by the Burrel Lock and Dam located on Haines Creek that is operated by the St. Johns River Water Management District.

Using the methodology to identify and verify water quality impairments described in Chapter 62-303, Florida Administrative Code (Identification of Impaired Surface Waters or IWR), Lake Dora was verified as impaired by un-ionized ammonia and nutrients, and was included on the verified list of impaired waters for the Ocklawaha Basin that was adopted by Secretarial Order on August 28, 2002.

To reduce pollutants and improve the water body, the Total Maximum Daily Load (TMDL) for total phosphorus (TP) was developed and adopted on September 19, 2003 for Lake Dora and Dora Canal. The TP target concentration of 0.031 mg/L listed in the TMDL report was based on the data analysis conducted by the SJRWMD. The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-situ water quality conditions.

The TMDL for Lake Dora estimated that discharge from Lake Beauclair contributes nearly 91 percent of the total annual phosphorus load for Lake Dora. Reductions in phosphorus loading to and from Lake Beauclair as a result of Beauclair's TMDL will be a large factor in how the TMDL for Lake Dora is met. The reductions in TP needed to meet the TMDL for Lake Dora are expected to address the DO impairment in Dora Canal.

To meet the restoration targets specified in the TMDL report, Lake Dora was included in the Upper Ocklawaha Basin Management Action Plan (BMAP). The action plan was developed in partnership with cities, counties, the St. Johns River Water Management District, Lake County Water Authority, Florida Department of Transportation, Florida Department of Agriculture and Consumer Services, Florida Fish and Wildlife Conservation Commission and other local stakeholders. The BMAP was adopted on August 14, 2007 and calls for biannual meetings to follow up on implementation activities.

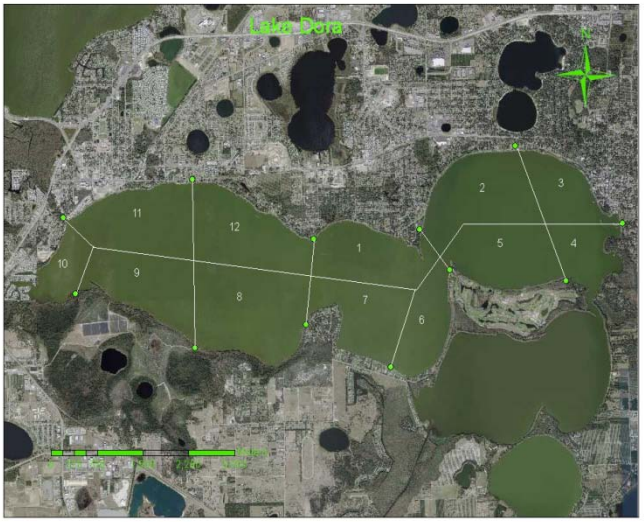

Figure 1. Sampling map of Lake Dora. Sections 3,12,6,9 were sampled for the Lake Vegetation Index. The water quality sample was collected from the middle of the east lobe.

Results

Water Quality

The concentration of total phosphorus (0.050 mg/L) in the sample collected on May 15, 2012 was above the TMDL limit of 0.031 mg/L. The concentrations of total nitrogen (3.0 mg/L) exceeded the proposed minimum water quality criterion of 1.05 mg/L. The chlorophyll *a* value (88 µg/L) was over three times the proposed Class III water quality criterion. Note that compliance with nutrient criteria cannot be determined with a single sample; all concentrations are based on annual geometric means not to be exceeded more than once in

a three year period. Please see **Table 1** for other results.

Phytoplankton
The algal community in the water column consisted of 91% cyanobacteria (blue-green algae), 4% green algae, 2% diatoms, 1% cryptomonads and 2% dinoflagellates. Dominance in algal groups varies naturally throughout the year, but prolonged dominance of cyanobacteria may be associated with a higher risk for harmful algal blooms. During the May 15, 2012 sample event, Lake Dora's algal community was dominated by cyanobacteria.

Lake Vegetation Index
The LVI score for this lake was 53 out of a possible 100 points, corresponding with a Category II "Healthy" designation. **Table 2** contains the species list and occurrence information for this sampling event. A total of 8 invasive exotic plants were observed in the lake. Although one section was dominated by *Typha* (cattails), another section was codominated by two beneficial plants *Paspalidium geminatum* (Kissimmee grass) and *Vallisneria americana* (eel grass). *Paspalidium geminatum* also codominated a section with *Typha*. No dominant was chosen for section 10. On August 24, 2010, FDEP conducted an LVI that also scored 53, indicating stability in the plant community.

Summary

Water quality results indicate that Lake Dora may not achieve nutrient standards, which are expressed as annual geometrics means, not single samples. Total phosphorus during the May 15, 2012 sample event (0.050 mg/L) was higher than the adopted TMDL threshold of 0.031 mg/L. Total nitrogen (3.0 mg/L) was higher than proposed 62-302 Florida Administrative Code (FAC) thresholds for Annual Geometric Mean Total.

Elevated nutrient levels in Lake Dora may contribute to imbalances in the lake's algal community. Chlorophyll *a* measured in Lake Dora (88 µg/L) during the May 15, 2012 sampling event and (53 µg/L) during the August 24, 2010 sample event indicate that phytoplankton biomass is high due to Lake Dora's elevated nutrient levels. The dominance of cyanobacteria may be associated with a higher risk for harmful algal blooms.

The plant community appears stable from the August 24, 2010 to the May 15, 2012 sample event. Both events scored 53, which are considered "Healthy". Successful plant management by Lake County Water Authority may be why the plant community has not reacted unfavorably to Lake Dora's excess nutrients.

Lake Dora would benefit from a management plan to further reduce nutrient loads from its watershed, promote native submersed and littoral vegetation and upland buffers, and control submersed and emergent exotic vegetation.

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

David Scharr david.scharr@dep.state.fl.us

Lake Dora TMDL document:
http://www.dep.state.fl.us/water/tmdl/docs/tmdls/final/gp1/dora_canal-tp-tmdl.pdf

Technical Publication SJ2004-5, Pollutant Load Reduction Goals for Seven Major Lakes in the Upper Ocklawaha River Basin
http://www.sjrwmd.com/technicalreports/pdfs/TP/SJ2004-5.pdf

Best Management Action Plan for the implementation of TMDL's adopted by FDEP in the Upper Ocklawaha River Basin
http://www.dep.state.fl.us/water/watersheds/docs/bmap/AdoptedUpOcklawahaBMAP.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

Table 1. Water quality results from surface water samples collected on May 15, 2012 and August 24, 2010 at Lake Dora by the Florida Department of Environmental Protection

Analyte	5/15/2012 Result	8/24/2010 Result	Applicable Class III Water Quality Criteria
Field Temperature (°C)	26.3	30.3	
Field pH (SU)	7.6	7.0	
Field Dissolved Oxygen (mg/L)	6.2	4.5	≥ 5
Field Specific Conductance (µmhos/cm)	510	431	"Not to exceed 50% of background or 1275 µmhos/cm"
Alkalinity (mg $CaCO_3$/L)	118	-	
Color (PCU)	21 A	15 A	
Turbidity (NTU)	11	-	
Chlorophyll a (µg/L)	88	53	<20**
Total Phosphorus (mg/L)	0.050	0.031	0.031*
Nitrate+Nitrite (mg/L)	0.004 U	0.017	
Ammonia (mg/L)	0.087	0.010 I	
Total Kjeldahl Nitrogen (mg/L)	3.0	2.1	
Total Nitrogen (mg/L)	3.0	2.117	1.05**
Secchi disk depth (m)	0.4	0.4	

*Total Maximum Daily Load for Total Phosphorus for Lake Dora and Dora canal, Lake County, Florida, September 19, 2003

**proposed 62-302 FAC thresholds for Annual Geometric Mean Total

A - Value reported is the mean of two or more determinations

U - Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed.

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

Table 2. Species list for the May 15, 2012 LVI at Lake Dora. An asterisk (*) indicates an invasive exotic plant species. P = present D = dominant, C = codominant.

Species	Common Name	Sections:	4	1	7	10
Acer rubrum	RED MAPLE		P			P
Amaranthus australis	SOUTHERN AMARANTHUS		P	P	P	P
Aster	CLIMBING ASTOR		P			P
Baccharis	SALT BUSH			P		P
Bidens alba	BIDENS			P		
Canna flaccida	GOLDEN CANNA		P	P		
Casuarina equisetifolia*	AUSTRALIAN PINE			P		
Cephalanthus occidentalis	COMMON BUTTONBUSH					P
Cicuta maculata	SPOTTED WATER HEMLOCK		P	P	P	P
Cladium jamaicense	SAWGRASS		P	P		P
Colocasia esculenta*	TARO; WILD TARO			P	P	P
Cornus foemina	SWAMP DOGWOOD		P			
Cyperus alternifolius*	UMBRELLA SEDGE					P
Cyperus odoratus	FRAGRANT FLATSEDGE				P	P
Cyperus polystachyos	MANYSPIKE FLATSSEDGE			P		
Echinochloa	BARNYARD GRASS				P	
Eichhornia crassipes*	WATER HYACINTH		P			
Eleocharis cellulosa	GULF COAST SPIKERUSH			P	P	P
Eleocharis interstincta	KNOTTED SPIKERUSH			P		
Erechtites hieraciifolia	AMERICAN BURNWEED			P	P	
Eupatorium capillifolium	DOGFENNEL		P	P	P	P
Fraxinus	FRAXINUS					P
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE		P			
Habenaria repens	WATERSPIDER FALSE REINORCHID			P		
Hibiscus coccineus	SCARLET ROSEMALLOW		P			
Hydrocotyle	MARSHPENNYWORT		P	P	P	P
Ilex cassine	DAHOON		P			P
Ipomoea	MORNING GLORY		P	P		
Ludwigia	PRIMROSE WILLOW		P		P	
Ludwigia leptocarpa	ANGLESTEM PRIMROSEWILLOW			P		
Ludwigia octovalvis	MEXICAN PRIMROSEWILLOW			P		P
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW		P	P	P	P
Magnolia virginiana	SWEETBAY		P			
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE		P			P
Nuphar	COW LILY		P			
Nymphaea odorata	AMERICAN WHITE WATERLILY		P			
Nyssa sylvatica biflora	SWAMP TUPELO		P			
Panicum hemitomon	MAIDENCANE		P	P	P	
Panicum repens*	TORPEDO GRASS		P	P	P	P
Parthenocissus quinquefolia	VIRGINIA CREEPER; WOODBINE			P		P
Paspalidium geminatum	EGYPTIAN PASPALIDIUM; KISSIMMEEGRASS		C	P	C	P
Pluchea camphorata	CAMPHORWEED			P		
Polygonum punctatum	DOTTED SMARTWEED			P	P	
Pontederia cordata	PICKERELWEED		P	P	P	P
Sabal palmetto	CABBAGE PALM		P	P	P	P
Sagittaria lancifolia	BULLTONGUE ARROWHEAD		P	P	P	P
Salix caroliniana	CAROLINA WILLOW		P	P	P	P
Sambucus canadensis	ELDERBERRY		P	P	P	P
Schinus terebinthifolius*	BRAZILIAN PEPPER			P		P
Schoenoplectus	BULL RUSH				P	
Schoenoplectus californicus	GIANT BULL RUSH					P
Schoenoplectus pungens	SWORD GRASS			P	P	P
Schoenoplectus tabernaemonta	SOFT STEM BULL RUSH		P	P	P	
Taxodium	CYPRESS TREE		P	P	P	P
Typha	CAT TAIL		P	D	C	P
Urochloa mutica*	PARA GRASS				P	
Utricularia foliosa	LEAFY BLADDERWORT		P	P		
Vallisneria americana	TAPEGRASS; AMERICAN EELGRASS		C	P	P	P
Vigna luteola	HAIRYPOD COWPEA			P	P	P
Vitis	GRAPE VINE		P	P		P