LAKE ECOSUMMARY

Lake Virginia, June 4, 2012

DEP conducted water quality and biological sampling on June 4, 2012 at Lake Virginia to assess attainment of designated uses. Water quality results met all applicable limits. Plant community data and macroinvertebrate data indicated that Lake Virginia met expectations for a healthy, well-balanced lake.

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 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. The Lake Condition Index (LCI) uses benthic macroinvertebrates to determine the biological integrity of a lake. The LCI is no longer accepted as an independent tool for assessing and reporting the biological condition of Florida lakes given the lack of correlation to human disturbance and the high correlation with nutrients and water clarity, which may be due to either anthropogenic or natural sources. However, the LCI can be useful for comparison of LCI assessments at a single site over time to interpret change in the benthic macroinvertebrate community. These assessments are often used in conjunction with one another because it is possible to detect imbalances in one community while the others appear healthy.

Methods

The DEP Central District Office conducted a LVI, measured field parameters, and collected LCI and water quality samples on June 4, 2012 in Lake Virginia. 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.

For the LCI, macroinvertebrates were collected from the lake bottom using a grab sampler following DEP SOP FS 7460. Samples were taken at a depth of 2–4 m to avoid the littoral zone which is typically covered with submersed vegetation. Twelve grab samples were collected from segments equally-spaced around the lake. The 12 samples were composited and a 100-organism count subsample was identified to the lowest practical taxonomic level, typically the species level.

Site Information

Lake Virginia, located in Orange County in the city of Winter Park, is part of the Howell Branch watershed in the middle St. Johns River Basin. Lake Virginia has a surface area of approximately 225 acres, a maximum depth of 23 feet and a mean depth of 15 feet.

Surface water enters Lake Virginia through two canals connecting Lake Mizell to the east and Lake Sue to the southwest. Surface water exits Lake Virginia through a canal connecting to Lake Osceola.

Much of Lake Virginia's watershed was developed before the State of Florida's stormwater treatment rules were adopted in 1982. As a result, most of the stormwater entering Lake Virginia received no treatment. In 1990, The City of Winter Park committed itself to reducing stormwater pollution to its lakes and developed a stormwater management program to improve water quality.

Assisted by the Florida Department of Environmental Protection's Total Maximum Daily Load (TMDL) Water Quality Restoration Grants and Nonpoint Source Management Implementation Grants, the City of Winter Park nearly eliminated all of the untreated stormwater discharge from Winter Park into Lake Virginia.

In addition, alum was applied to the lake's surface three times in April, May and June of 2007, to inactivate phosphorus found in sediments. The "Lake Virginia Sediment inactivation Project Pre-Treatment Monitoring Plan", prepared for the City of Winter Park by Environmental Research and Design, had demonstrated that phosphorus in Lake Virginia's sediments was contributing to algal growth and poor water quality.

Results

Water Quality

On June 4, 2012, Lake Virginia's chlorophyll *a* concentration was 3.6 µg/L, which achieves the proposed criterion of 20 µg/L. The concentration of total nitrogen (TN) in the sample collected on June 4, 2012 (0.4 mg/L) also complied with the newly proposed water quality criterion of 1.91 mg/L. Total phosphorus (TP) concentration was 0.014 mg/L, also meeting the newly proposed water quality criterion (0.09 mg/L).All other water quality parameters met their applicable limits. (Note that compliance with nutrient criteria cannot be determined with a single sample; all concentrations are based on annual geometric means not to be surpassed more than once in a three year period) Please see Table 1 for other results. Data from a June 2010 sampling event are shown for additional information.

Table 1. Water quality results from surface water samples collected on June 4, 2012 and June 15, 2010 at Lake Virginia by FDEP. Water quality criteria from 62-302, F.A.C.

Analyte	6/4/12 Result	6/15/10 Result	Applicable Class III Water Quality Criteria
Field Temperature (°C)	28.5	32.7	
Field pH (SU)	8.0	8.0	
Field Dissolved Oxygen (mg/L)	8.16 J	8.02	≥ 5
Field Specific Conductance (µmhos/cm)	230	205	Not to exceed 50% of background or 1275 µmhos/cm
Alkalinity (mg $CaCO_3$/L)	59	51 A	
Color (PCU)	3.7	5 U	
Turbidity (NTU)	1.8	0.6	
Chlorophyll a (µg/L)	3.6	2.0	<20**
Total Phosphorus (mg/L)	0.014	0.008 I	< 0.09**
Nitrate+Nitrite (mg/L)	0.004 U	0.035 J	
Ammonia (mg/L)	0.01 U	0.012 I	
Aluminum (µg/L)	167 A	110 I	
Total Kjeldahl Nitrogen (mg/L)	0.4	0.37 J	
Total Nitrogen (mg/L)	0.4	0.41	<1.91**
Secchi disk depth (m)	2.7	>2.0	

**proposed 62-302 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.
J – Estimated Value
I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.



Figure 1. Sampling map of Lake Virginia. Sections 2,5,8,11 were sampled for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Lake Vegetation Index

The LVI score for this lake was 55 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 ten invasive exotic plants were observed in the lake. Besides one observation of *Hydrilla verticillata*, the exotics observed were located along the margin of the lake and occurred with relatively low abundance. The sections observed were primarily codominated by the beneficial submerged species *Potamogeton illinoensis* (Illinois pondweed) and *Vallisneria americana* (eel grass) with one section codominated with *Najas guadalupensis* (southern niad) and *Potamogeton illinoensis*. A previous LVI was conducted on June 15, 2010 and scored a 51 "Healthy" designation indicating stability in the plant community.

Lake Condition Index

The LCI score on June 4, 2012, for Lake Virginia was 47, corresponding with a "very good" designation. LCI samples collected in March of 2006 and June of 2010 corresponded with a "good" designation. Two species, generally accepted as good indicators of lake quality, (the caddisfly *Cernotina* and the shrimp *Palaemonetes*), were found in the 2012 sample and not the 2010 sample. This difference could be due to sample variability and may not necessarily reflect a change in the benthic community. Overall, the benthic community appears to be balanced and stable.

Table 2. Species list for the June 4, 2012 LVI at Lake Virginia. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Species	Common Name	Sections:	2	5	8	11
Acer rubrum	RED MAPLE			P		P
Alternanthera philoxeroides*	ALIGATOR WEED			P		
Blechnum serrulatum	SWAMP FERN			P		
Cephalanthus occidentalis	BOTTON BUSH			P		P
Ceratophyllum demersum	COON TAIL			P		
Cinnamomum camphora*	CAMPHOR TREE					P
Cladium jamaicense	SAW GRASS			P		
Colocasia esculenta*	WILD TARO		P		P	P
Cyperus alternifolius*	UMBRELLA SEDGE					P
Cyperus odoratus	RUSTY FLAT SEDGE					P
Cyperus papyrus*	PAPYRUS		P		P	
Echinochloa	BARNYARD GRASS		P		P	
Eupatorium capillifolium	DOG FENNEL		P		P	P
Hydrilla verticillata*	HYRDILLA			P		
Hydrocotyle	PENNY WORT		P	P	P	P
Ilex cassine	DAHOON HOLLY			P		
Iris hexagona	BLUE FLAG IRIS					P
Ludwigia peruviana*	PRIMROSE WILLOW		P		P	P
Myrica cerifera	WAX MYRTLE			P		
Najas guadalupensis	SOUTHERN NIAD		P	C	P	P
Nitella	NITELLA		P	P		
Nuphar	COW LILY		P	P		P
Nymphaea odorata	FRAGRENT WATER LILY		P	P	P	P
Panicum hemitomon	MAIDENCANE			P		
Panicum repens*	TORPEDO GRASS		P	P		P
Parthenocissus quinquefolia	VIRGINIA CREEPER				P	
Peltandra	ARROW ARUM				P	
Pluchea	FLEABANE					P
Pontederia cordata	PICKEREL WEED		P	P	P	P
Potamogeton illinoensis	ILLINIOS PONDWEED		C	C	C	C
Ruellia simplex*	WILD PETUNIA					P
Rumex	RUMEX					P
Sabal palmetto	SABAL PALM		P	P		
Sagittaria isoetiformis	QUILWORT ARROWHEAD				P	
Sagittaria lancifolia	DUCK POTATO		P	P	P	P
Salix caroliniana	CAROLINA WILLOW		P	P		P
Salvinia minima	WATER SPANGLES		P	P	P	P
Sambucus canadensis	ELDERBERRY				P	
Schoenoplectus	BULL RUSH			P		
Schoenoplectus californicus	GIANT BULL RUSH					P
Taxodium	CYPRESS TREE		P	P	P	P
Thalia geniculata	FIRE FLAG			P	P	
Typha	CAT TAIL		P	P	P	P
Utricularia inflata	BLADDER WORT		P	P	P	
Vallisneria americana	EEL GRASS; TAPE GRASS		C	P	C	C
Vigna luteola	COW PEA		P			P
Wedelia trilobata*	CREEPING OX EYE					P

Summary

Lake Virginia has benefited from a management plan to reduce nutrient loads from its watershed, promote native submersed and littoral vegetation, and control submersed and emergent exotic vegetation.

Water quality results were well within acceptable limits for chlorophyll *a,* total nitrogen and total phosphorus on June 4, 2012. Lake Vegetation Index scores have corresponded with a "Healthy" designation in 2010 and 2012. The 2012 LCI score (47 "Very Good") indicates stability in the composition of the benthic community and possible improvement from the past two macroinvertebrate assessments in 2006 and 2010.

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.

Thanks to Dana Denson with Reedy Creek Improvement District for providing interpretation of Lake Virginia's macroinvertebrate community.

Contact and resources for more information

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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