LAKE ECOSUMMARY

Lake Minneola, WBID 2839A, Lake County
May 12, 2016 and September 14, 2017



Figure 1. Lake Minneola in Lake County.

DEP conducted water quality and biological sampling at Lake Minneola (STORET 20020047 and G1CE0057, and SBIO Nickname MINCTREF and MINNEOLA, respectively; (Figure 1) in Lake County on May 12, 2016, and September 14, 2017, to assess attainment of designated uses. This lake was sampled as part of the DEP strategic monitoring program. Overall, the water quality data indicated that the lake met applicable State Water Quality Criteria; however, the plant community did not meet expectations for a healthy, well-balanced lake.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance 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 a specific waterbody exceeding water quality criteria (Chapter 62-302, Florida Administrative Code [F.A.C.]), 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. DEP assesses the health of plant communities in Florida lakes, as one indication of whether adverse impacts to biological communities have occurred.

Site Description

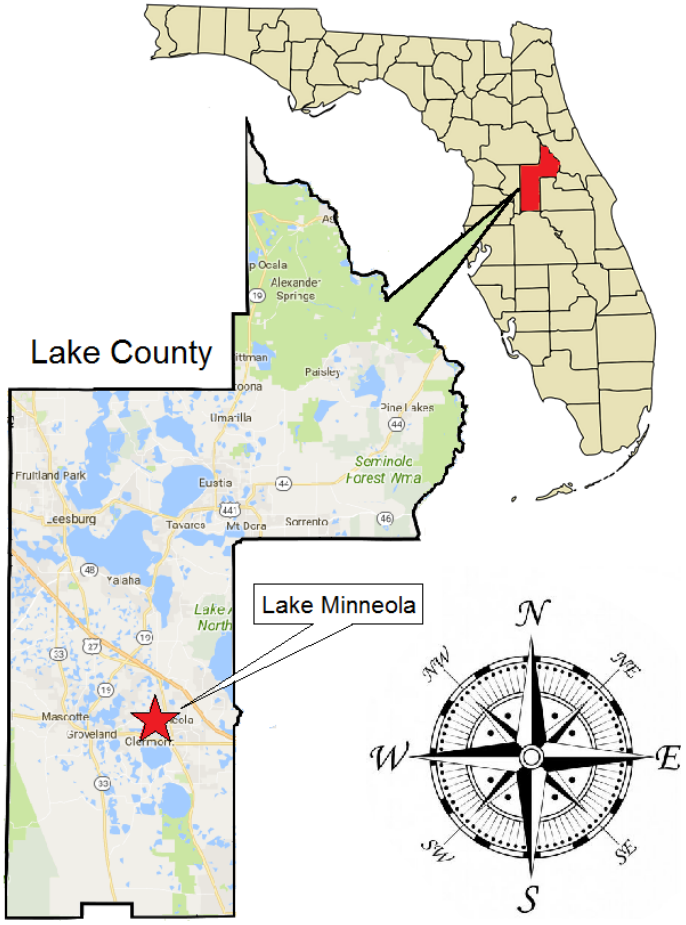


Figure 2. Location of Lake Minneola in Lake County.

Lake Minneola is located near Clermont, Florida (Figure 2) and is within the Ocklawaha River watershed. It has an approximate surface area of 1,890 acres, making it the smallest of the three main lakes comprising the Clermont

Chain of Lakes. With depths nearing 30 feet on the southern coast (Figure 3), however, it is the deepest lake in the chain. The Palatlakaha River flows out of Crystal Cove on its northwest shore.

The predominant land uses surrounding Lake Minneola are residential and business, with some forest and natural areas along the west coast. Downtown Clermont borders the south shore, and the city of Minneola borders the eastern shore, making it the most developed lake in the Clermont Chain of Lakes. There is a public boat ramp and swimming area at Waterfront Park in Clermont (Figure 4).

This lake is not currently listed for any impairments on the Impaired Waters Verified List (2/12/13). Additional information about this WBID is available in the TMDL Tracker application: (http://prodenv.dep.state.fl.us/DearTmdl/welcomehz.do).

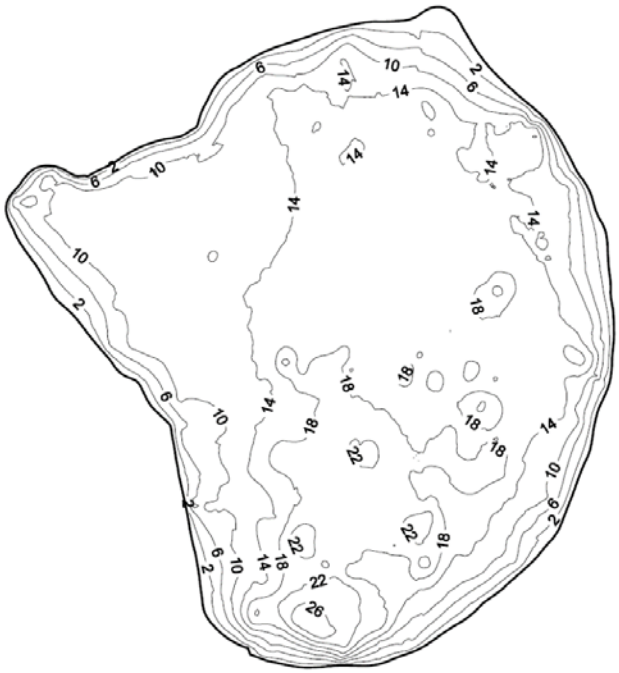


Figure 3. Bathymetry of Lake Minneola in Lake County. (Source: Florida LAKEWATCH)



Figure 4. Lake Mineola Waterfront Park in Clermont.

Methods

Water Quality

This lake was sampled on May 12, 2016, and September 14, 2017, by members of the DEP Central Regional Operations Center. Surface water samples were collected from the center of the lake for analysis of metals, chlorophyll *a*, color, alkalinity, fluoride, ammonia, nitrogen, phosphorus, bromide, chloride, and sulfate following DEP Standard Operating Procedures (SOPs; see https://floridadep.gov/dear/quality-assurance/content/dep-sops). Sampling and analyses met DEP quality assurance/quality control standards. Results were compared with applicable Class III water quality criteria contained in 62-302, F.A.C., including nutrients, dissolved oxygen, and other indicators.

Chlorophyll *a* is a measure of algal biomass in the water column. Chapter 62-302.531, F.A.C., provides numeric criteria for chlorophyll *a*, total nitrogen (TN), and total phosphorus (TP) in lakes, and is dependent upon the long term mean color and alkalinity of the lake (Table 1). If the annual geometric mean chlorophyll *a* (calculated with at least four samples, representing seasonal variability) does not exceed the chlorophyll *a* value for the lake type in Table 1, then the TN and TP criteria for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in Table 1. If there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in Table 1 for the lake type, then the applicable numeric interpretations for TN and TP shall be

the minimum values in Table 1. Based on the color and alkalinity results presented in this report, Lake Minneola is a high color, low alkalinity lake.

Table 1. Numeric nutrient criteria in lakes, 62-302.531 (2)(b)(1), F.A.C. AGM = annual geometric mean

Long Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a*	AGM TP Range[1]	AGM TN Range
> 40 Platinum Cobalt Units	20 µg/L	0.05 to 0.16[1] mg/L	1.27 to 2.23 mg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$	20 µg/L	0.03 to 0.09 mg/L	1.05 to 1.91 mg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$	6 µg/L	0.01 to 0.03 mg/L	0.51 to 0.93 mg/L

[1] For lakes with color > 40 PCU in the West Central Region, the maximum TP limit is 0.49 mg/L

Dissolved Oxygen

Rule 62-302.533 (1), F.A.C., states that no more than 10 percent of the daily average percent dissolved oxygen (DO) saturation values shall be below 67 percent in the Panhandle West bioregion, 38 percent in the Peninsula and Everglades bioregions, or 34 percent in the Northeast and Big Bend bioregions. This site is in the Peninsula region for DO criteria assessment. Percent saturation considers factors such as temperature, atmospheric pressure, and salinity. For lakes, the daily average DO level shall be calculated as the average of measurements collected in the upper two meters of the water column at the same location on the same day.

The daily average freshwater DO criteria is preferentially assessed using daily average values calculated from full days of diel (collected over a 24 hour period) monitoring data. If diel monitoring data are not available as was the case for this report, instantaneous samples are used to assess the DO criterion by comparing the instantaeous value with a time-of-day-specific translation of the daily average criterion (62-303.420(9), F.A.C.), and a spreadsheet calculator for this purpose is available at: https://floridadep.gov/dear/water-quality-standards-program/documents/do-saturation-calculator%C2%A0.

Lake Vegetation Index

The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. The LVI was sampled per DEP SOP LVI 1000 and calculated per DEP SOP LVI 2000. Species lists were developed for four of twelve sections of the lake (Figure 5), and the following information was derived from those lists: percent native species, percent Category 1 invasive exotic species as identified by the Florida Exotic Pest Plant Council, percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is of disturbance) of the dominant or co-dominant species. Chapter 62-303.330 and 62-303.430, F.A.C., provide that a LVI score of 43 or greater meets the expectation of a healthy, well balanced community, and scores below 43 are considered impaired.

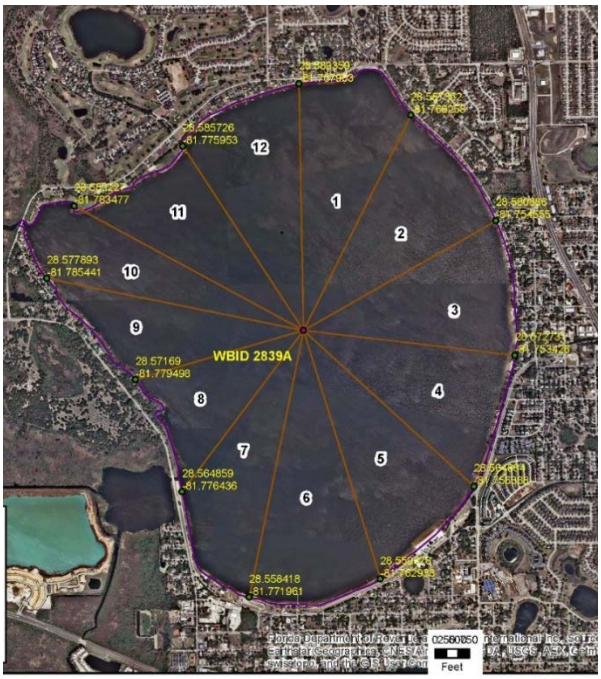


Figure 5. LVI sampling map of Lake Minneola. Sections 3, 6, 9, 12 were sampled on May 12, 2016 and sections 2, 5, 8, 11 were sampled on September 14, 2017. The water quality samples were collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2.

Based on these two sampling events, the lake met the nutrient thresholds for high color, low alkalinity lakes; however, the thresholds represent annual geometric mean concentrations (minimum of four samples) not to

be exceeded more than once in any three-calendar year period. DEP's Watershed Assessment Section will evaluate the complete dataset for this lake to assess compliance with nutrient criteria.

Lake Vegetation Index

The LVI score for this lake was 36 out of a possible 100 points on May 12, 2016, and was 40 out of a possible 100 points on September 14, 2017. Both scores correspond with a "Not Healthy" designation. Tables 3 and 4 contain the species list and occurrence information for these sampling events. A total of 9 invasive exotic plants were observed in the lake on May 12, 2016, and 8 were observed on September 14, 2017.

Conclusions

Sampling at Lake Minneola indicates that the lake met applicable State Water Quality Criteria. Water quality results were well within acceptable limits for chlorophyll *a*, total nitrogen and total phosphorus on May 12, 2016, and September 14, 2017. The Lake Vegetation Index score, however, was less than expected for a healthy lake on both occasions.

To help make sense of the passing water quality results but a failing LVI score, we can look at the Landscape Development Intensity Index (LDI) score for Lake Minneola. The Landscape Development Intensity Index (LDI) (Brown and Vivas, 2007) functions as an objective measure of how human disturbance affects biological, chemical, and physical processes of aquatic systems. To calculate an LDI score for lakes, a 100-meter buffer of land around the waterbody is used, and an LDI score of 1 indicates minimal human disturbance while a score of 10 indicates extreme disturbance. Lake Minneola has an LDI score of 5.88, indicating that human disturbance is moderate and likely plays a role in the reduced quality of the plant community within the lake and in its littoral zone, leading to a failing LVI score.

Examples of human disturbance in Lake Minneola would be the introduction and transfer of exotic plant species from boat ramps and recreation, and the removal of native shoreline and/or upland buffer vegetation from homeowners, waterfront businesses, and/or waterfront parks. Once exotic plant taxa become established, they can persist even if the water quality is meeting its designated uses. Lake Minneola is currently being treated for one such exotic invasive plant, Ludwigia grandiflora/hexapetala, which was noted to be present during both LVI events (on the May 12, 2016 LVI it is noted as "Ludwigia (unknown nativity)".

Table 2. Water quality results from May 12, 2016, and September 14, 2017, at Lake Minneola.

Analyte	Result 5/12/16	Result 9/14/17	Applicable Class III Water Quality Criteria
Field Dissolved Oxygen (% saturation)	104	111	*Peninsula Criteria: > 37.23% (5/12/16), > 35.80% (9/14/17)
Field Specific Conductance (µmhos/cm)	118	90	50% above background or 1275 µmhos/cm, whichever is greater
Alkalinity (mg $CaCO_3$/L)	4.8	5.5	Shall not be depressed below 20 [or reduced by more than 25%]
Color (PCU)	190	150	N/A
Chlorophyll *a* (µg/L)	12	7.2	≤ 20 µg/L for colored lakes
Total Phosphorus (mg/L) as P	0.028	0.023	< 0.16 mg/L
Nitrate+Nitrite (mg/L) as N	0.077	0.007	N/A
Ammonia (mg/L) as N	0.005	0.008	**< 3.53 mg/L (5/12/17), < 2.57 mg/L (9/14/17)
Total Kjeldahl Nitrogen (mg/L) as N	1.2	1.0	N/A
Total Nitrogen (mg/L) as N	1.277	1.007	< 2.23 mg/L

* DO criterion calculated per DO Saturation Calculator.

** Total Ammonia Nitrogen Calculator

*** pH value from 5/12/16 sampling event was qualified and could not be used, pH value of 7.0 is from sampling event one week later, on 5/19/16.

Table 3. Species list for the May 12, 2016, LVI at Lake Minneola. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Minneola, May 12, 2016		Sections			
Scientific Name	Common Name	1	2	3	4
Acer rubrum	RED MAPLE	P		P	P
Alternanthera philoxeroides*	ALLIGATORWEED	P			
Bacopa caroliniana	LEMON BACOPA			P	
Blechnum serrulatum	SWAMP FERN			P	
Canna	BANDANNA-OF-THE-EVERGLADES			P	
Centella asiatica	SPADELEAF			P	
Cephalanthus occidentalis	BUTTONBUSH		P	P	P
Colocasia esculenta*	WILD TARO	P		P	
Cyperus odoratus	FRAGRANT FLATSEDGE			P	
Cyperus polystachyos	MANYSPIKE FLATSEDGE			P	
Cyperus surinamensis	TROPICAL FLATSEDGE			P	
Diodia virginiana	VIRGINIA BUTTONWEED			P	
Eupatorium capillifolium	DOGFENNEL		P		P
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE	P	P	P	P
Hibiscus grandiflorus	SWAMP ROSEMALLOW	P			
Hydrocotyle sp.	PENNYWORT	P	P	P	P
Hypericum fasciculatum	PEELBARK ST. JOHN'S WORT			P	
Juncus marginatus	SHORE RUSH			P	
Liquidamber styraciflua	SWEETGUM			P	
Ludwigia arcuata	PIEDMONT PRIMROSEWILLOW	P	P		
Ludwigia leptocarpa	ANGLESTEM PRIMROSEWILLOW		P	P	
Ludwigia octovalvis	MEXICAN PRIMROSEWILLOW			P	
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW			P	
Ludwigia (unknown nativity)	PRIMROSEWILLOW	P			
Luziola fluitans	SOUTHERN WATERGRASS		P		
Magnolia grandiflora	SOUTHERN MAGNOLIA			P	
Melaleuca viminalis	BOTTLEBRUSH				P
Mikania scandens	CLIMBING HEMPVINE			P	
Myrica cerifera	WAX MYRTLE	P		P	P
Nuphar	SPATTERDOCK		P	P	P
Nymphaea odorata	FRAGRANT WATERLILY		P	P	P
Nymphoides aquatica	BIG FLOATINGHEART		P		
Panicum hemitomon	MAIDENCANE	P	P	C	C
Panicum repens*	TORPEDO GRASS	D	D	C	C
Paspalidium geminatum	EGYPTIAN PASPALIDIUM		P		
Paspalum urvillei	VASEYGRASS	P			
Polygonum hirsutum	HAIRY SMARTWEED		P	P	
Pontederia cordata	PICKERELWEED	P	P	P	P
Potamogeton diversifolius	WATERTHREAD PONDWEED		P	P	
Sagittaria lancifolia	DUCK POTATO	P	P	P	P
Salix caroliniana	CAROLINA WILLOW	P		P	P
Salvinia minima*	WATER SPANGLES			P	
Sambucus canadensis	ELDERBERRY				P
Sapium sebiferum*	CHINESE TALLOW	P			
Schinus terebinthifolius*	BRAZILIAN PEPPER	P	P		
Taxodium	CYPRESS		P	P	P
Typha	CATTAIL			P	P
Urena lobata*	CAESARWEED			P	P
Utricularia gibba	HUMPED BLADDERWORT		P		
Vitis	MUSCADINE	P			P
Wedelia trilobata*	CREEPING OXEYE	P			

Table 4. Species list for the September 14, 2017, LVI at Lake Minneola. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Minneola, September 14, 2017		Sections			
Scientific Name	Common Name	1	2	3	4
Acer Rubrum	RED MAPLE	P		P	P
Cephalanthus occidentalis	BUTTONBUSH	P		P	
Cinnamomum camphora*	CAMPHOR TREE	P			
Cladium jamaicense	SAWGRASS			P	
Colocasia esculenta*	WILD TARO			P	
Eicchornia crassipes*	WATER HYACINTH			P	
Eleocharis elongata	SLIM SPIKERUSH			P	
Eleocharis submersed viviparous					P
Fuirena scirpoides	SOUTHERN UMBRELLASEDGE		P		P
Ludwigia grandiflora*	LARGE-FLOWER PRIMROSEWILLOW				P
Ludwigia octovalvis	MEXICAN PRIMROSEWILLOW	P	P		P
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW			P	P
Luziola fluitans	SOUTHERN WATERGRASS			P	P
Magnolia virginiana	SWEETBAY			P	
Melaleuca viminalis	BOTTLEBRUSH	P			
Myrica cerifera	WAX MYRTLE	P	P	P	
Nuphar sp.	SPATTERDOCK		P	P	P
Nymphaea odorata	FRAGRANT WATERLILY			P	P
Nymphoides aquatica	BIG FLOATINGHEART			P	
Nyssa sylvatic var. biflora	SWAMP TUPELO	P		P	P
Oxycaryon cubense*	CUBAN BULRUSH			P	
Panicum hemitomon	MAIDENCANE	P	P	D	C
Panicum repens*	TORPEDO GRASS	D	D	P	C
Paspalidium geminatum	EGYPTIAN PASPALIDIUM			P	
Pontederia cordata	PICKERELWEED	P	P	P	P
Sagittaria lancifolia	DUCK POTATO	P	P	P	P
Saururus cernuus	LIZARD'S TAIL			P	
Schinus terebinthifolius*	BRAZILIAN PEPPER	P	P	P	
Sesbania sp.	RIVERHEMP				P
Taxodium	CYPRESS	P	P		P
Typha	CATTAIL		P	P	P
Utricularia foliosa	LEAFY BLADDERWORT			P	

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

Contact and resources for more information:

Kathryn March -Kathryn.W.March@dep.state.fl.us

DEP Division of Environmental Assessment and Restoration homepage: https://floridadep.gov/dear
DEP biological assessment resources: https://floridadep.gov/dear/bioassessment
FWCC Aquatic Plant Management: http://myfwc.com/wildlifehabitats/invasive-plants/
Freshwater Algal Bloom information: https://floridadep.gov/dear/algal-bloom