LAKE ASSESSMENT REPORT FOR CEDAR EAST LAKE IN HILLSBOROUGH COUNTY FLORIDA

Date Assessed: May 22, 2007
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Reviewed by: Jim Griffin, Ph.D.

INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Cedar East Lake on the Hillsborough County Watershed Atlas (**http://www.hillsborough.wateratlas.usf.edu/**). The project is a collaborative effort between the University of South Florida's Center for Community Design and Research and Hillsborough County Stormwater Management Section. The project is funded by Hillsborough County and the Southwest Florida Water Management District's Northwest Hillsborough, Hillsborough River and Alafia River Basin Boards. The project has, as its primary goal, the rapid assessing of up to 150 lakes in Hillsborough County during a five year period. The product of these investigations will provide the County, lake property owners and the general public a better understanding of the general health of Hillsborough County lakes, in terms of shoreline development, water quality, lake morphology (bottom contour, volume, area etc.) and the plant biomass and species diversity. These data are intended to assist the County and its citizens to better manage lakes and lake centered watersheds.

Figure 1. General photograph of Cedar East Lake taken on May 22, 2007.

The first section of the report provides the results of the overall morphological assessment of the lake. Primary data products include: a contour (bathymetric) map of the lake, area, volume and depth statistics, and the water level at the time of assessment. These data are useful for evaluating trends and for developing management actions such as plant management where depth and lake volume are needed.

The second section provides the results of the vegetation assessment conducted on the lake. These results can be used to better understand and manage vegetation in your lake. A list is provided with the different plant species found at various sites around the lake. Potentially invasive, exotic (non-native) species are identified in a plant list and the percent of exotics is presented in a summary table. Watershed values provide a means of reference.

The third section provides the results of the water quality sampling of the lake. Both field data and laboratory data are presented. The trophic state index (TSI) [i] is used to develop a general lake health statement, which is calculated for both the water column with vegetation and the water column if vegetation were removed. These data are derived from the water chemistry and vegetative submerged biomass assessments and are useful in understanding the results of certain lake vegetation management practices.

The intent of this assessment is to provide a starting point from which to track changes in your lake, and where previous comprehensive assessment data is available, to track changes in the lake's general health. These data can provide the information needed to determine changes and to monitor trends in physical condition and ecological health of the lake.

Section 1: Lake Morphology

Bathymetric Map[ii]. The bottom of the lake was mapped using a Lowrance LCX 26C HD Wide Area Augmentation System (WAAS)[iii] enabled Global Positioning System (GPS) with fathometer (bottom sounder) to determine the boat's position, and bottom depth in a single measurement. The result is an estimate of the lake's area, mean and maximum depths, and volume and the creation of a bottom contour map (Figure 2). Besides pointing out the deeper fishing holes in the lake, the morphologic data derived from this part of the assessment can be valuable to overall management of the lake vegetation as well as providing flood storage data for flood models. Table 1 provides the lake's morphologic parameters in various units.

Table 1. Lake Morphologic Data (Area, Depth, and Volume)

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	222,156.00	20,638.29	5.10		
Mean Depth	5.25	1.60			
Maximum Depth	11.07	3.46			
Volume (cubic)	983,342.23	27,848.83		22.58	7,356,603.00

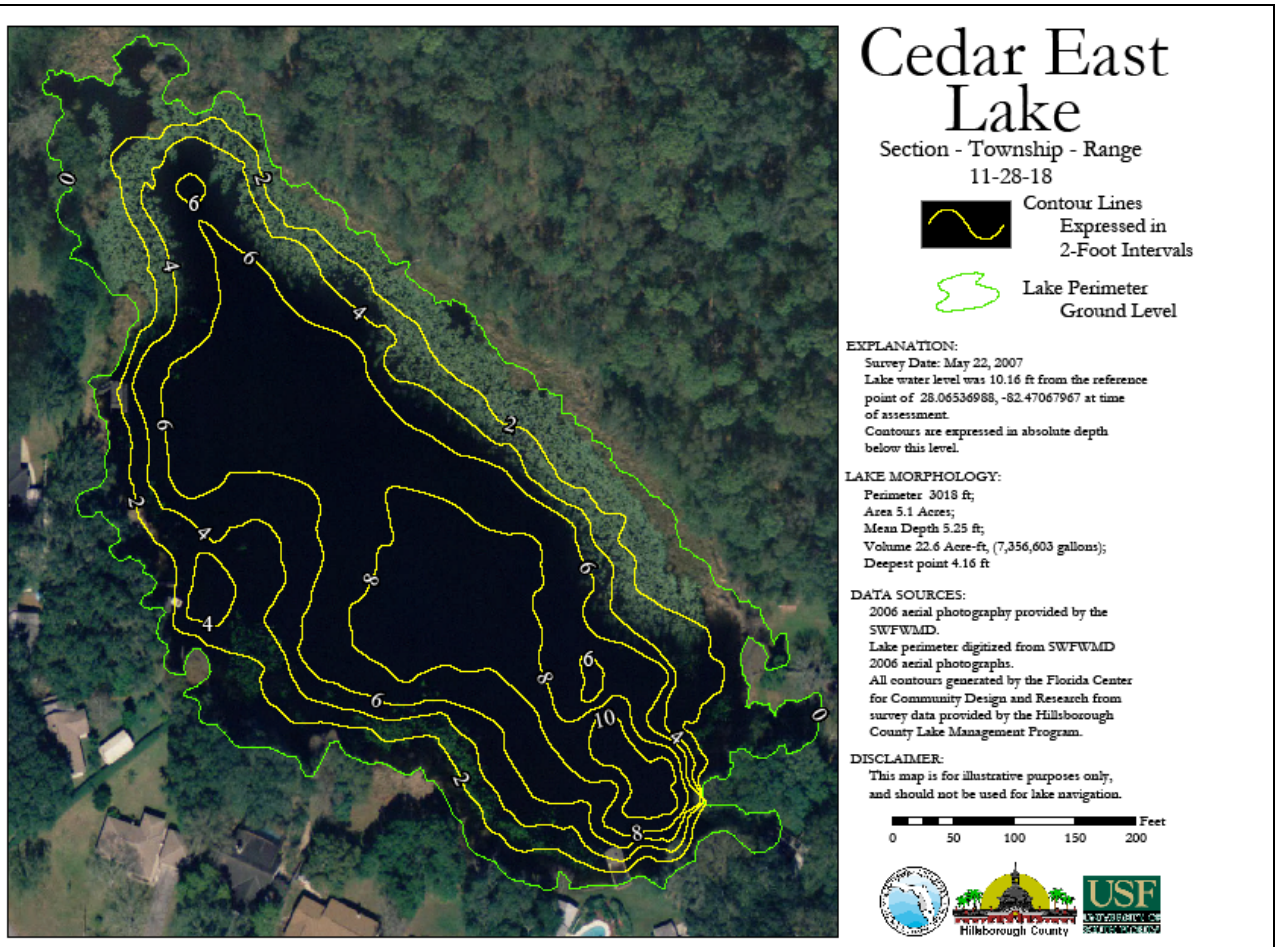


Figure 2. Contour map for Cedar East Lake. The mapping technique used in 2006 employs a standard DGPS for horizontal position and a fathometer for depth.

Section 2: Lake Ecology (vegetation)

The lake's apparent vegetative cover and shoreline detail are evaluated using the latest lake aerial photograph as shown in Figure 3 and by use of WAAS enabled GPS. Submerged vegetation is determined from the analysis of bottom returns from the Lowrance 26c HD combined GPS/fathometer described earlier. As depicted in Figure 3, six vegetation assessment sites were chosen for intensive sampling based on the *Lake Assessment Protocol* (copy available on request) for a lake of this size. The site positions are set using GPS and then loaded into a GIS mapping program (ArcGIS) for display. Each site is sampled in the three primary vegetative zones (emergent, submerged and floating)[iv]. The latest aerials high resolution aerial photos are used to provide shore details (docks, structures, vegetation zones) and to calculate the extent of surface vegetation coverage. The primary indices of submerged vegetation cover and biomass for the lake, percent area coverage (PAC) and percent volume infestation (PVI), are determined by transiting the lake by boat and employing a fathometer to collect "hard and soft return" data. These data are later analyzed for presence and absence of vegetation and to determine the

height of vegetation if present. The PAC is determined from the presence and absence analysis of 100 sites in the lake and the PVI is determined by measuring the difference between hard returns (lake bottom) and soft returns (top of vegetation) for sites (within the 100 analyzed sites) where plants are determined present.

The data collected during the site vegetation sampling include vegetation type, exotic vegetation, predominant plant species and submerged vegetation biomass. The total number of species from all sites is used to approximate the total diversity of aquatic plants and the percent of invasive-exotic plants on the lake (Table 2). The Watershed value in Table 2 only includes lakes sampled during the lake assessment project begun in May of 2006. These data will change as additional lakes are sampled. Tables 3 through 6 detail the results from the 2007 aquatic plant assessment for you lake. These data are determined from the 6 sites used for intensive vegetation surveys. The tables are divided into Floating Leaf, Emergent and Submerged plants and contain the plant code, species, common name and presence (indicated by a 1) or absence (indicated by a blank space) of species and the calculated percent occurrence (number sites species is found/number of sites) and type of plant (Native, Non-Native, Invasive, Pest). In the "Type" category, the term invasive indicates the plant is commonly considered invasive in this region of Florida and the term "Pest" indicates that the plant has a greater than 55% occurrence in your lake and is also considered a problem plant for this region of Florida, or in a non-native invasive that is or has the potential to be a problem plant in your lake and has at least 40% occurrence. These two terms are somewhat subjective; however, they are provided to give lake property owners some guidance in the management of plants on their property. Please remember that to remove or control plants in a wetland (lake shoreline) in Hillsborough County the property owner must secure an Application To Perform Miscellaneous Activities In Wetlands (http://www.epchc.org/forms_documents.htm) permit from the Environmental Protection Commission of Hillsborough and for management of in-lake vegetation outside the wetland fringe (for lakes with an area greater than 10 acres), the property owner must secure a Florida Department of Environmental Protection permit (http://www.dep.state.fl.us/lands/invaspec/).

Table 2 Total diversity, percent exotics, and number of EPPC pest plants

Parameter	Lake	Watershed
Total Plant Diversity (# of Taxa)	54	105
% Non-Native Plants	14.82%	17.14%
Total Pest Plant Species	5	11

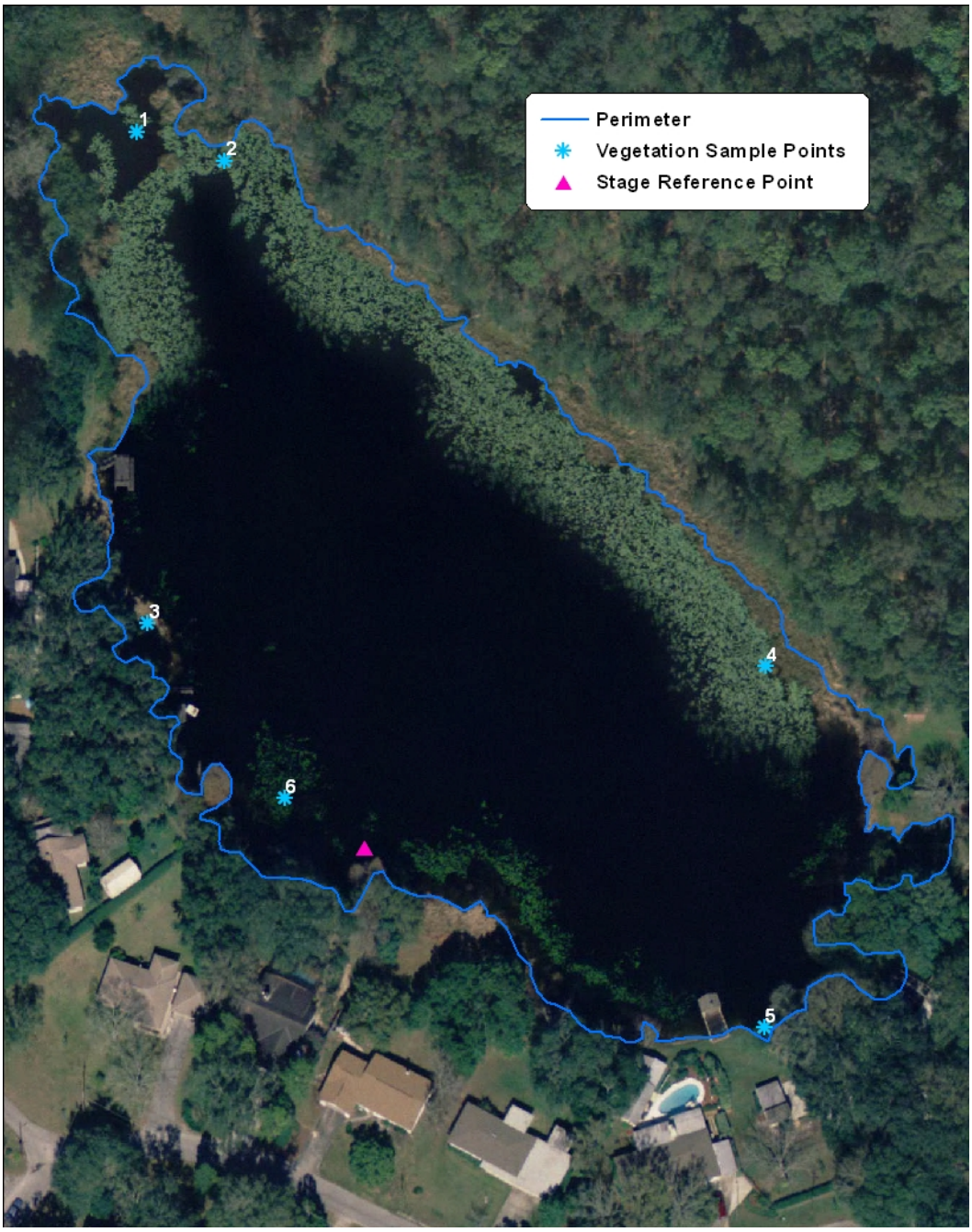


Figure 3. 2006 six-inch resolution aerial photograph depicting location of vegetation assessment sites and stage reference point for Cedar East Lake. Major emergent and floating vegetation zones as well as structures such as docks are also observable in this aerial.

Table 3. **List of Floating Leaf Zone Aquatic Plants Found**

Floating Vegetation

Code	**Native, Non-Native (NN), Invasive (I), Pest (P)**	Plant Species	Common Name	1	2	3	4	5	6	% Occurrence
NOA	N,P	*Nymphaea odorata*	American White Water lily, Fragrant Water Lily	1	1	1	1		1	83%
HYE	N	*Hydrocotyl umbellata*	Manyflower Marshpennywort, Water Pennywort	1		1		1	1	66.6%
NLM	N	*Nuphar lutea var. advena*	Spatterdock, Yellow Pondlily		1				1	33.3%
SMA	NN,I	*Salvinia minima*	Water Spangles, Water Fern	1	1					33.3%

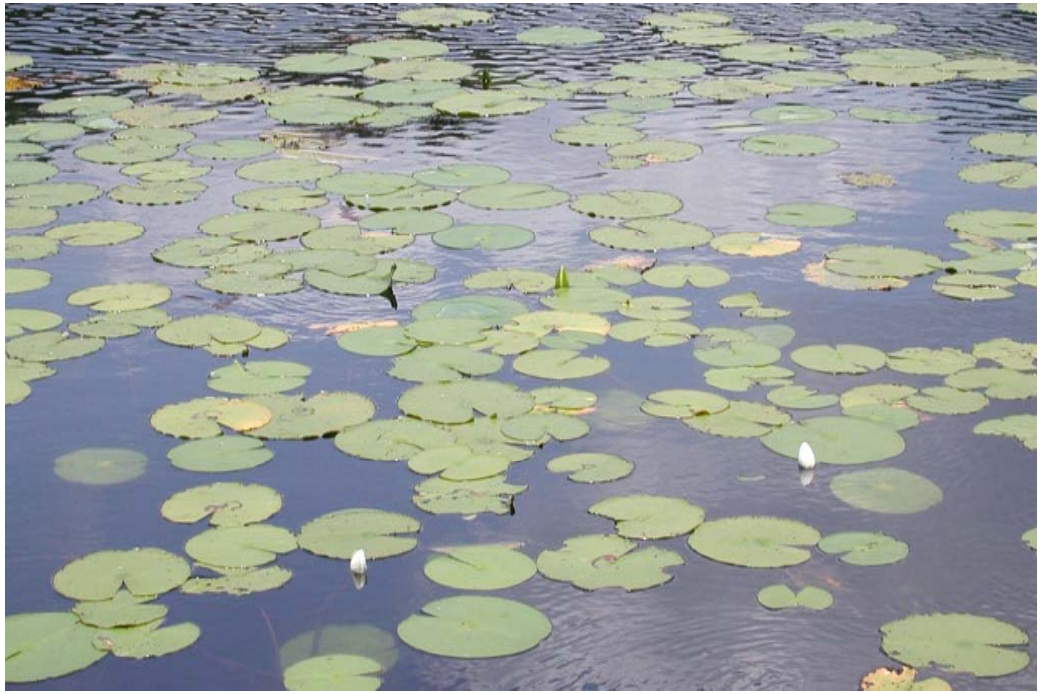


Figure 4. *Nymphea odorata,* American White Water Lily, is a common floating leaved plant in Lake Cedar East. Although native, this species can become a pest plant species when populations cover much of the surface of the water making navigation difficult and shading submerged vegetation species.

Table 4 List of Emergent Zone Aquatic Plants Found

Emergent Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	% Occurrence
PRS	NN,I,P	*Panicum repens*	Torpedo Grass	1	1	1	1	1	1	100%
SCS	N,P	*Scirpus cubensis*	Burhead Sedge,Cuban Scirpus	1	1	1	1	1	1	100%
LPA	N,P	*Ludwigia peruviana*	Peruvian Primrosewillow	1	1	1	1		1	83%
ACE	N	*Acer rubrum var. trilobum*	Southern Red Maple	1	1		1	1	1	83%
OCA	N	*Osmunda cinnamomea*	Cinnamon Fern	1	1	1		1		66.6%
APS	NN,I,P	*Alternanthera philoxeroides*	Alligator Weed	1	1	1		1		66.6%
SAL	N	*Salix spp.*	Willow	1	1	1		1		66.6%
BID	N	*Bidens spp.*	Bur Marigold			1		1	1	50%
PHN	N	*Panicum hemitomon*	Maidencane	1	1	1				50%
EBI	N	*Eleocharis baldwinii*	Baldwin's Spikerush, Roadgrass	1	1			1		50%
FSC	N	*Fuirena spp.*	Rush Fuirena	1		1			1	50%
WAX	N	*Myrica cerifera*	Wax Myrtle	1	1		1			50%
MSS	N	*Mikania scandens*	Climbing Hempvine	1	1	1				50%
QNA	N	*Quercus nigra*	Water Oak		1	1	1			50%
BMI	N	*Bacopa monnieri*	Common Bacopa, Herb-Of-Grace	1					1	33.3%
CAA	N	*Centella asiatica*	Asian Pennywort, Coinwort, Spadeleaf			1			1	33.3%
DVA	N	*Diodia virginiana*	Buttonweed			1			1	33.3%
PCA	N	*Pontederia cordata*	Pickerel Weed	1			1			33.3%
SLA	N	*Sagittaria lancifolia*	Bulltongue Arrowhead, Duck Potato	1	1					33.3%
BLS	N	*Blechnum serrulatum*	Swamp Fern			1	1			33.3%
CEA	NN,I	*Colocasia esculenta*	Wild Taro, Dasheen, Coco Yam	1				1		33.3%
TYP	N	*Typha spp.*	Cattails	1	1					33.3%
LOS	N	*Ludwigia octovalvis*	Mexican Primrosewillow, Long-stalked Ludwigia				1		1	33.3%
QLO	N	*Quercus laurifolia*	Laurel oak			1	1			33.3%
TAS	N	*Taxodium ascendens*	Pond Cypress			1			1	33.3%
MEL	NN,I	*Melaleuca quinquenervia*	Punk Tree, Melaleuca		1		1			33.3%
SSM	NN,I	*Sapium sebiferum*	Popcorn Tree, Chinese Tallow Tree	1	1					33.3%

Table 5. List of Emergent Zone Aquatic Plants Found

Emergent Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	% Occurrence
GTM	N	*Galium tinctorium*	Stiff Marsh Bedstraw			1			1	33.3%
DCA	N	*Dichondra carolinensis*	Pony-foot			1		1		33.3%
EVM	NN	*Ensata ventricosum*	Banana Plam	1				1		33.3%
COM	N	*Commelina spp.*	Dayflower		1					16.6%
CAM	N	*Crinum americanum*	Swamp lily					1		16.6%
EAA	N	*Eclipta alba (prostrata)*	False Daisy, Yerba De Tajo						1	16.6%
HRS	N	*Habenaria repens*	Waterspider False Reinorchid	1						16.6%
PNA	N	*Phyla nodiflora*	Frog-fruit, Carpetweed, Turkey Tangle Frogfruit			1				16.6%
PLU	N	*Pluchea spp.*	Marsh Fleabane,Camphorweed	1						16.6%
IRI	N	*Iris spp.*	Flag					1		16.6%
NSS	N	*Nephrolepsis spp.*	Sword Fern			1				16.6%
RF	N	*Osmunda regalis*	Royal Fern		1					16.6%
POL	N	*Polygonum spp.*	Smartweed, Knotweed	1						16.6%
CER	NN,I	*Ceratopteris thalictroides*	Water Sprite	1						16.6%
CYP	N	*Cyperus spp.*	Sedge			1				16.6%
LRS	N	*Ludwigia repens*	Creeping Primrosewillow, Red Ludwigia						1	16.6%
PIN	N	*Pinus spp.*	Pine Tree				1			16.6%
SAM	N	*Sambucus canadensis*	Elderberry	1						16.6%
TDM	N	*Taxodium distichum*	Bald Cypress						1	16.6%
CCA	NN,I	*Cinnamomum camphora*	Camphor-tree					1		16.6%
CSS	N	*Cyperus surinamensis*	Flat Sedge			1				16.6%
HCC	N	*Hibiscus coccineus*	Marsh Hibiscus	1						16.6%

Figure 5.

Figure 6.

Figure 5. *Colocasia esculenta*, Wild Taro, is a non-native invasive species in Florida. This species can dominate native shoreline vegetation and disrupt native plant communities.

Figure 6. *Scirpus cubensis,* Burhead Sedge,Cuban Scirpus, is a native sedge which can become a pest plant species when found in high abundance. This species can form floating mats of vegetation which can cover the waters surface, shading out submerged vegetation and producing large amounts of organic debris.

Table 6. List of Submerged Zone Aquatic Plants Found

Submerged Vegetation

Code	**Native, Non-Native (NN), Invasive (I), Pest (P)**	Plant Species	Common Name	1	2	3	4	5	6	% Occurrence
UTA	N	*Utricularia spp.*	Bladderwort	1	1					33.3%
MUM	N	*Micranthemum umbrosum*	Shade Mudflower, Baby's Tears						1	16.6%

Section 3: Lake Water Chemistry

A critical element in any lake assessment is the long-term water chemistry data set. The primary source of water quality trend data for Florida lakes is the Florida LAKEWATCH volunteer and the Florida LAKEWATCH water chemistry data. Hillsborough County is fortunate to have a large cadre of volunteers who have collected lake water samples for significant time period. These data are displayed and analyzed on the Water Atlas as shown in Figure 7 for Cedar East Lake. Additional data, when available, is also included on the Water Atlas; however, the LAKEWATCH data remains the primary source. By the trend data shown in the figure, the lake may be considered good health in terms of the trophic state index (TSI). This lake is a clear water lake and as such it must maintain a TSI of at or below 40 to not be considered impaired by the State of Florida guidelines[v]. The lake's long term water quality data indicates enough violations of these criteria to be classified by Florida DEP as impaired. The more recent trends indicate an improving (downward) trend in TSI, indicating reduced algal biomass and nutrients. However, as discussed below, these data differ from the water chemistry results from the recent lake assessment.

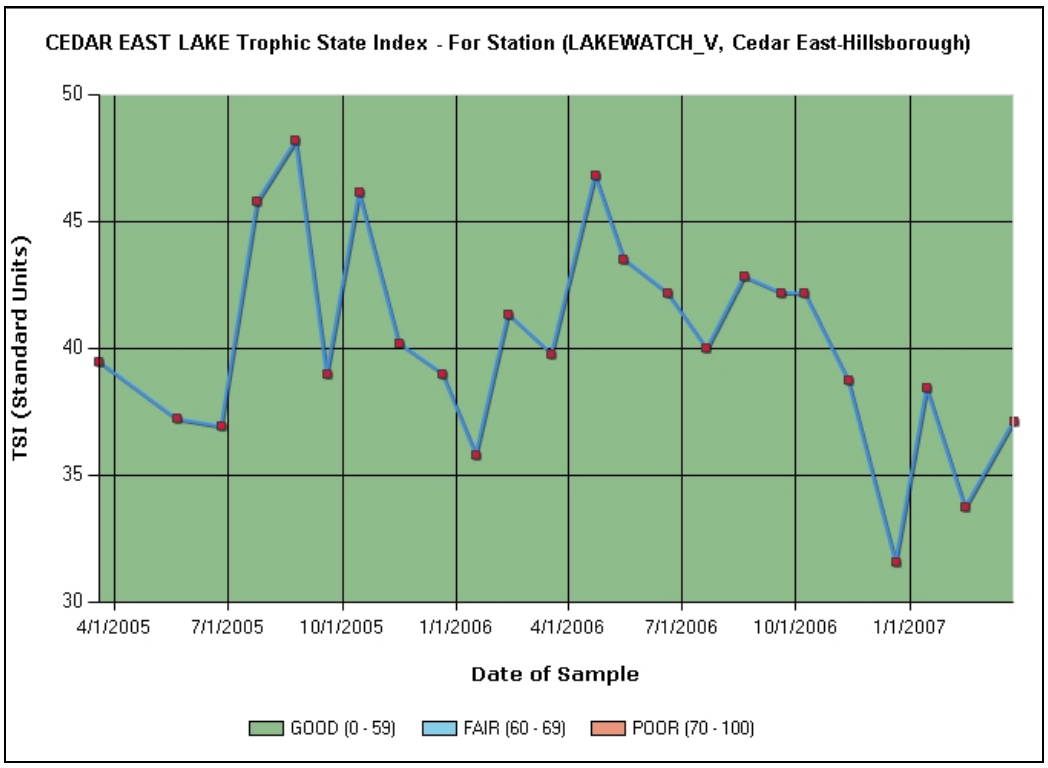


Figure 7. Recent Trophic State Index (TSI) graph from Hillsborough Watershed Atlas. For the latest date go to:
(http://www.hillsborough.wateratlas.usf.edu/lake/waterquality.asp?wbodyid=5836&wbodyatlas=lake **)**

Note: The graph above includes benchmarks for using verbal descriptors of "good", "fair" and "poor". The verbal descriptors for these benchmarks are based on an early determination by stakeholders of the generally acceptable and understood terms for describing the state of lakes. The same benchmarks are used for nutrient graphs (Nitrogen and Phosphorus), chlorophyll graphs and trophic state index (TSI) graphs. The TSI is a calculated index of lake condition based on nutrient and chlorophyll (a) concentrations (please see "Learn more about Trophic State Index"). The benchmarks are established based on the TSI range that relates to a specific descriptor. The source for the TSI concentration relationships is the Florida Water Quality Assessment, 1996, 305(b) (Table 2-8).

As part of the lake assessment the physical water quality and water chemistry of a lake are measured. These data only indicate a snap shot of the lakes water quality; however they are useful when compared to the trend data available from LAKEWATCH or other sources. Table 7 contains the summary water quality data and index values and adjusted values calculated from these data. The total phosphorus (TP), total nitrogen (TN) and chlorophyll (a) water chemistry sample data are the results of chemical analysis of samples taken during the assessment and analyzed by the Hillsborough County Environmental Protection Commission laboratory. These data indicate a nutrient concentration and algal biomass significantly greater than the mean values determined from the LAKEWATCH dataset for the lake. As a result, the trophic state index (TSI) calculated from the sample data (52.07) is significantly higher than the TSI based on the LAKEWATCH data (40.3).

Table 8 contains the field data taken in the center of the lake using a multi-probe (YSI 6000) which has the ability to directly measure the temperature, pH, dissolve oxygen (DO), percent DO (calculated from DO, temperature and conductivity) and Turbidity. These data are listed for three levels in the lake and twice for the surface measurement. The duplicate surface measurement was taken as a quality assurance check on measured data. These data indicate a relatively well mixed system with low productivity (lower than normal surface DO and relatively low pH) and a lake bottom that may contain anoxic muck.

Table 7. Water Quality Parameters (Laboratory)

Summary Table for Water Quality		
Parameter	***Value***	***Comment***
TP ug/L	33.00	
TN mg/L	0.61	
Chla ug/L	7.30	
Chla TSI	45.43	
TP TSI	58.72	
TN TSI	49.01	
Secchi Disk (SD)	7'4.5"	
TSI	52.07	P limited
PAC	8%	
PVI	5%	
Adj TP	0.05	P from Veg Added
Adj TSI	52.09	With additional P

Table 8. Water Quality Parameters (Field-YSI)

Sample Location	Time	Temp (°C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	DO (mg/L)	PH (SU)	ORP (ORP)	Turbidity (NTU)	Secchi Depth (ft)
Surface	15:05	28.58	0.211	73.4	5.68	7.04	132.7	0.5	
Mid	15:08	27.02	0.21	58.5	4.63	6.85	135	0.6	
Bottom	15:12	26.79	0.209	51.3	4.1	6.77	118	1.2	
Surface	15:15	28.53	0.21	74.4	5.77	6.93	115.4	0.3	
Mean Value		**27.73**	**0.21**	**64.4**	**5.045**	**6.8975**	**125.275**	**0.65**	**7'4.5"**

Table 7 also provides data derived from the vegetation assessment which is used to determine an adjusted TSI. This is accomplished by calculating the amount of phosphorus that could be released by existing submerged vegetation if this vegetation were treated with an herbicide or

managed by the addition of Triploid Grass Carp (*Ctenopharyngodon idella*). Cedar East has very little submerged vegetation with only 8% of the lake area covered with submerged aquatic vegetation. Grass carp were introduced to the lake in 1992 and 1994. The per acre carp stocking rate was relatively high (about 10 carp per acre in 1994) and since carp can live for 12 to 20 years it is probable that an adequate number still exist in the lake to make it difficult to grow submerged vegetation. The water clarity (Secchi Disk Depth) indicates adequate sun penetration to grow these types of vegetation; however, floating leaf plants could shade growing areas also limiting growth. The management goal for the lake should be to increase bottom vegetation with a Florida Native such as Tape grass (*Vallisneria Americana).*

To better understand many of the terms used in this report, we recommend that you visit the Hillsborough Watershed Atlas (http://www.hillsborough.wateratlas.usf.edu) and explore the "Learn More" areas which are found on the resource pages. Additional information can also be found using the Digital Library on the website.

Section 4: Conclusion

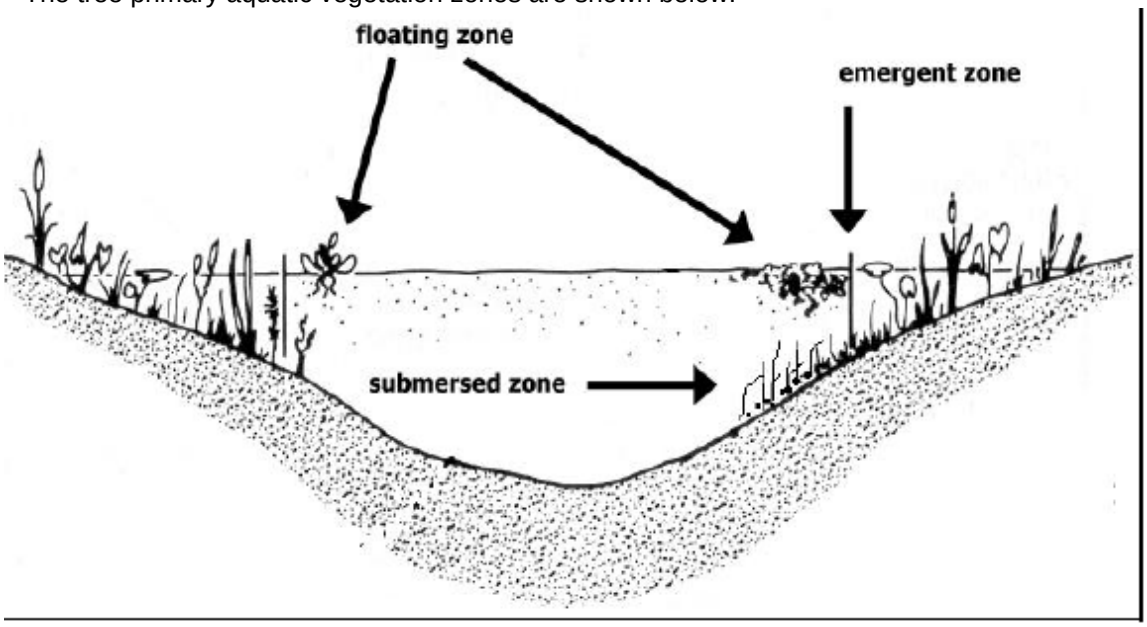
Cedar East is a small area (5.1 acre) lake that would be considered in the high mesotrophc (fair to good) category of lakes based on water chemistry. It has a lower than normal concentration of aquatic vegetation with only about 8% of the open water areas containing submerged vegetation. Submerged vegetation helps to maintain the nutrient balance in the lake as well as provide good fish habitat. The lake needs additional submerged vegetation and possibly the control of floating leaf vegetation (*Nymphaea odorata*) that may crowd out the lake bottom areas where submerged vegetation can grow. The primary Pest plants in the lake include *Nymphaea odorata, Panicum repens, Scirpus cubensis, Ludwigia peruviana* and *Alternanthera philoxeroides* . For more information and recent updates please see the Hillsborough Watershed Atlas (water atlas) website at: http://www.hillsborough.wateratlas.usf.edu .

[i] "Trophic" means "relating to nutrition." The Trophic State Index (TSI) takes into account chlorophyll, nitrogen, and phosphorus, which are nutrients required by plant life. For more information please see *learn more* at:
http://www.hillsborough.wateratlas.usf.edu/lake/default.asp?wbodyid=5836&wbodyatlas=lake

[ii] A bathymetric map is a map that accurately depicts all of the various depths of a water body. An accurate bathymetric map is important for effective herbicide application and can be an important tool when deciding which form of management is most appropriate for a water body. Lake volumes, hydraulic retention time and carrying capacity are important parts of lake management that require the use of a bathymetric map.

[iii] WAAS is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals form GPS satellites in view and retransmit these data to a master control site and then to geostationary satellites. The geostationary satellites broadcast the information to all WAAS-capable GPS receivers. The receiver decodes the signal to provide real time correction of raw GPS satellite signals also received by the unit. WAAS enabled GPS is not as accurate as standard DGPS which employs close by ground stations for correction, however; it was shown to be a good substitute when used for this type of mapping application. Data comparisons were conducted with both types of DGPS employed simultaneously and the positional difference was determined to be well within the tolerance established for the project.

[iv] The tree primary aquatic vegetation zones are shown below:



[v] A lake is impaired if " (2) For lakes with a mean color less than or equal to 40 platinum cobalt units, the annual mean TSI for the lake exceeds 40, unless paleolimnological information indicates the lake was naturally greater than 40, or
For any lake, data indicate that annual mean TSIs have increased over the assessment period, as indicated by a positive slope in the means plotted versus time, or the annual mean TSI has increased by more than10 units over historical values. When evaluating the slope of mean TSIs over time, the Department shall use a Mann's one-sided, upper-tail test for trend, as described in

Nonparametric Statistical Methods by M. Hollander and D. Wolfe (1999 ed.), pages 376 and 724 (which are incorporated by reference), with a 95% confidence
level."
Excerpt from Impaired Water Rule (IWR). Please see:
http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf