LAKE ASSESSMENT REPORT FOR DEAD LADY LAKE IN HILLSBOROUGH COUNTY, FLORIDA

Date Assessed: May 2, 2007
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Reviewed by: Jim Griffin, Ph.D.

INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Dead Lady 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.
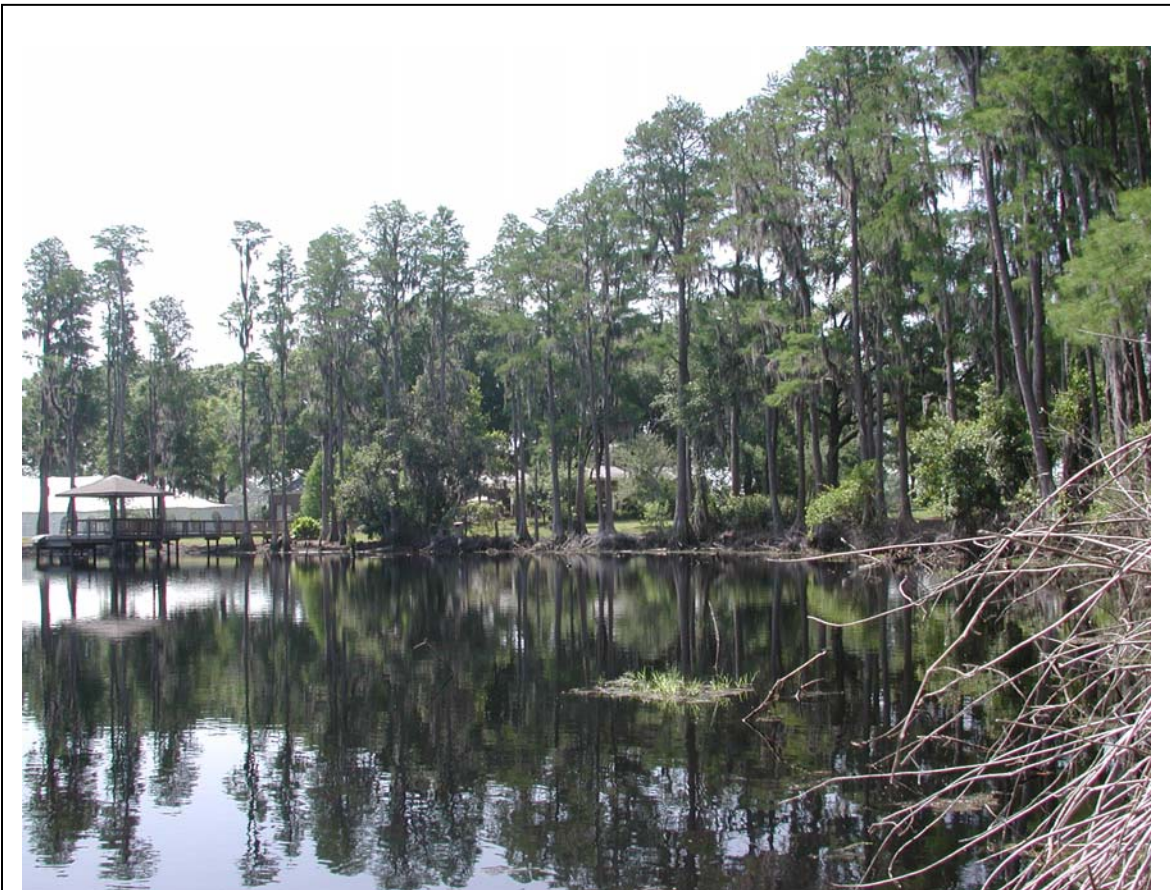
Figure 1. Photograph of Dead Lady Lake taken on May 2, 2007.

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 the 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 the 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]. Table 1 provides the lake's morphologic parameters in various units. 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.
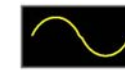
Table 1. Lake Morphologic Data (Area, Depth and Volume).

Parameter	Feet	Meters	Acres	Acre-ft	Gallons
Surface Area (sq)	153,212.43	14,233.90	3.52		
Mean Depth	6.89	2.1			
Maximum Depth	10.29	3.14			
Volume (cubic)	950,450.54	26,913.76		21.82	7,109,913
Gauge (relative)	15.14				

2
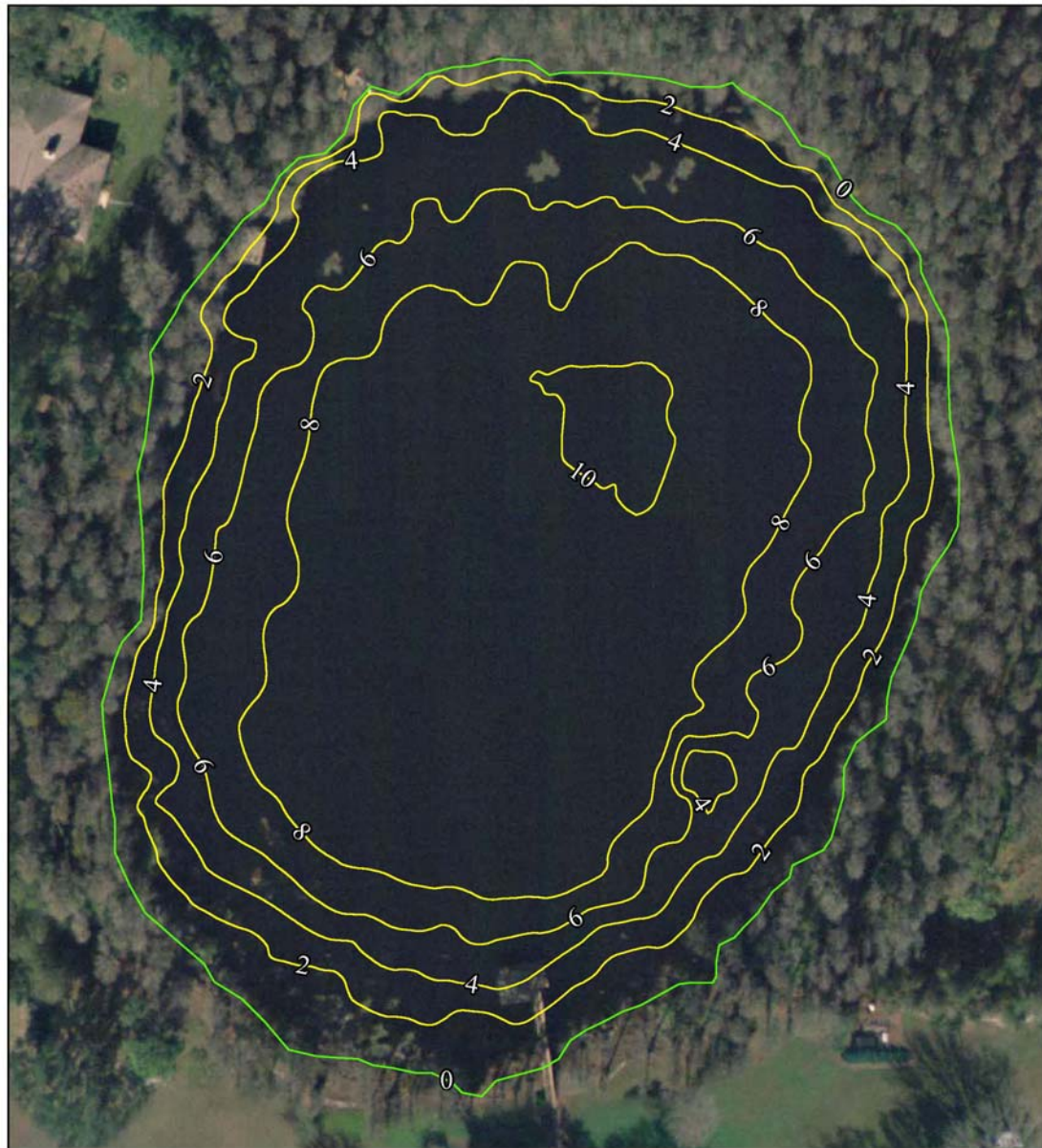
Dead Lady Lake

Section - Township - Range
11-27-17

Contour Lines
Expressed in
2-Foot Intervals

Lake Perimeter
Ground Level

EXPLANATION:
Survey Date: May 3, 2007
Lake water level was 15.14 ft
(utilizing the relative gauge on lake)
at time of assessment.
Contours are expressed in absolute depth
below this level.

LAKE MORPHOLOGY:
Perimeter 1,473 ft;
Area 3.52 Acres;
Mean Depth 6.89 ft;
Volume 21.8 Acre-ft, (7,109,913 gallons);
Deepest point 10.29 ft

DATA SOURCES:
2006 aerial photography provided by the
SWFWMD.
Lake perimeter digitized from SWFWMD
2006 aerial photographs.
All contours generated by the Florida Center
for Community Design and Research from
survey data provided by the Hillsborough
County Lake Management Program.

DISCLAIMER:
This map is for illustrative purposes only,
and should not be used for lake navigation.

Feet
0   40   80   120   160

Hillsborough County   USF UNIVERSITY OF SOUTH FLORIDA

Figure 1. Contour map for Dead Lady Lake. The mapping technique used in 2007 employs a standard DGPS for horizontal position and a fathometer for depth.

3

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 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 (Figure 6).

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 5 detail the results from the 2007 aquatic plant assessment for the lake. These data are determined from the six 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 the 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 the 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 County and for management of in-lake vegetation outside the wetland fringe (for lakes with an area greater than ten 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 Exotic Pests Plants Council pest plants.

Parameter	Lake	Watershed
Total Plant Diversity (# of Taxa)	27	139
% Non-Native Plants	11.11%	15.11%
Total Pest Plant Species	4	13
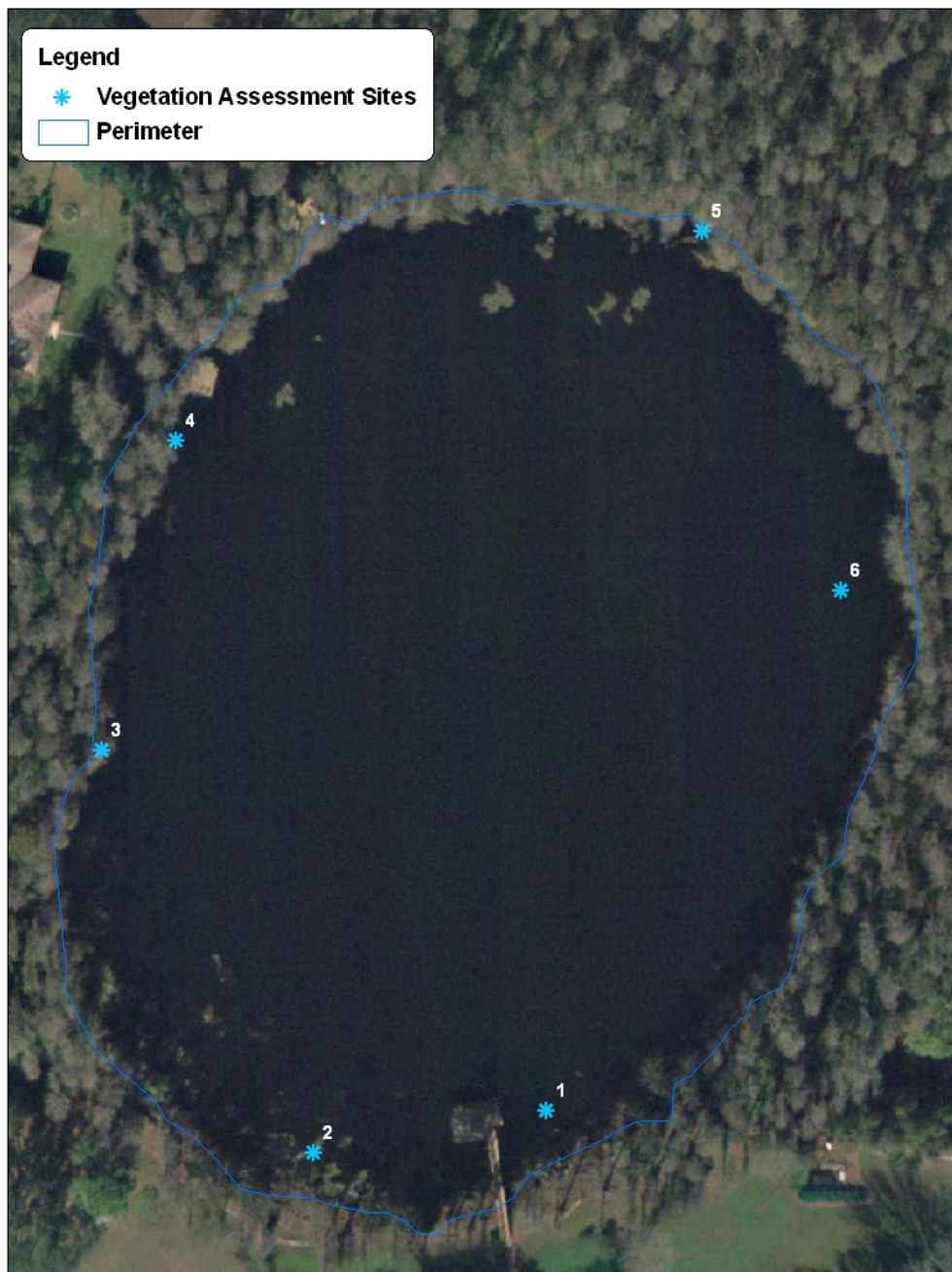
Figure 3. 2006 six-inch resolution aerial photograph showing location of vegetation assessment sites on Dead Lady Lake. Major emergent and floating vegetation zones as well as structures such as docks are also observable in this aerial.

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

Plant Species Code	Plant Species	Common Name	Sample Site						Percent Occurrence	Native, Non-Native (NN), Invasive (I), Pest (P)
			1	2	3	4	5	6		
ACA	Azolla caroliniana (Fig. 4)	Carolina Mosquito Fern		1	1	1	1	1	83.33%	Native, P
HYE	Hydrocotyl umbellata	Manyflower Marshpennywort, Water Pennywort	1	1		1			50%	Native

Figure 4. *Azolla caroliniana*, Carolina Mosquito Fern, is a common native floating vegetation. These plants are very small, less than 1" in diameter. Photographer: John Kohout .

Table 4. List of Aquatic Zone Emergent Plants Found.

Plant Species Code	Plant Species	Common Name	Sample Site						Percent Occurrence	Native, Non-Native (NN), Invasive (I), Pest (P)
			1	2	3	4	5	6		
BLS	*Blechnum serrulatum*	Swamp Fern	1	1	1	1	1	1	100%	Native
EBI	*Eleocharis baldwinii*	Baldwin's Spikerush, Roadgrass	1	1	1	1	1	1	100%	Native
TAS	*Taxodium ascendens*	Pond Cypress	1	1	1	1	1	1	100%	Native
WAX	*Myrica cerifera*	Wax Myrtle	1	1	1	1	1	1	100%	Native
BOC	*Boehmeria cylindrica*	Bog Hemp, False Nettle	1	1	1	1	1	1	100%	Native
PRS	*Panicum repens (Fig. 5)*	Torpedo Grass	1	1	1		1	1		NN, I, P
PBA	*Persea borbonia*	Redbay	1	1	1		1	1	83.33%	Native
QLO	*Quercus laurifolia*	Laurel oak	1	1	1		1	1	83.33%	Native
LOP	*Ludwigia spp.*	Water Primroses, Primrosewillow	1	1			1	1	83.33%	Native, P
OCA	*Osmunda cinnamomea*	Cinnamon Fern	1		1			1	50%	Native
COS	*Cephalanthus occidentalis*	Common Buttonbush			1		1	1	50%	Native
RF	*Osmunda regalis*	Royal Fern					1	1	33.33%	Native
CER	*Ceratopteris thalictroides*	Water Sprite		1				1	33.33%	NN, I
SCI	*Scirpus spp.*	Sedge		1		1			33.33%	Native
CAA	*Centella asiatica*	Asian Pennywort, Coinwort, Spadeleaf				1			16.67%	Native
COM	*Commelina spp.*	Dayflower				1			16.67%	Native
FSC	*Fuirena spp.*	Rush Fuirena				1			16.67%	Native
AST	*Aster spp.*	Aster spp., Elliot's Aster				1			16.67%	Native
SAL	*Salix spp.*	Willow	1						16.67%	Native
SAM	*Sambucus canadensis*	Elderberry			1				16.67%	Native
CCA	*Cinnamomum camphora*	Camphor-tree		1					16.67%	NN, I
MSS	*Mikania scandens*	Climbing Hempvine						1	16.67%	Native

Table 5. List of Submerged Zone Aquatic Plants Found.

Plant Species Code	Plant Species	Common Name	Sample Site						Percent Occurrence	Native, Non-Native (NN), Invasive (I), Pest (P)
			1	2	3	4	5	6		
ALG	*Algal Spp.*	Algal Mats, Floating	1	1	1	1	1	1	100%	Native, P
MUM	*Micranthemum umbrosum*	Shade Mudflower, Baby's Tears	1	1	1	1	1	1	100%	Native
POT	*Potamogeton spp.*	Pond Weed				1			16.67%	Native

Figure 5. Algal species such as those pictured here, although native, can be a pest species covering much of the surface of the waterbody. Presence of this species may be an indication of increased nutrient loading from sources such as fertilizer runoff from lawns. The grass pictured here is *Panicum repens*, Torpedo Grass. This grass is a non-native invasive species which dominates native vegetation communities in disturbed areas along Florida lakes.

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 6 for Dead Lady 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 fair terms of the trophic state index. This lake is a dark water lake and as such it must maintain a TSI of below 60 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.
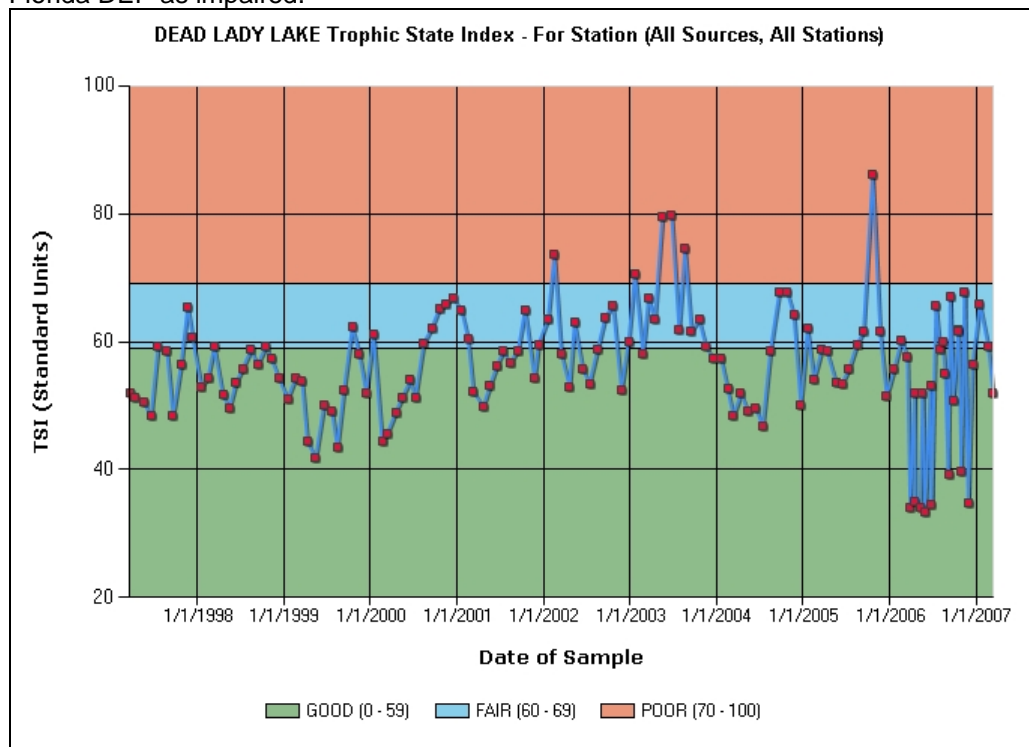
Figure 6. Recent Trophic State Index (TSI) graph from Hillsborough Watershed Atlas. For the latest date go to:
(http://www.hillsborough.wateratlas.usf.edu/lake/waterquality.asp?wbodyid=5632&wbodyatlas=lake)
Note: The graph above includes benchmarks for using verbal descriptors of "good", "fair" and "poor". 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 chemical 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 othe sources. Table 6 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 compare reasonably well with the mean data from the LAKEWATCH data set for the lake. The trophic state index (TSI) calculated from the sample data (53.64) is within the values shown in the figure above.

Table 7 contains the field data taken in the center of the lake using a multi-probe (we use eithe a YSI 6000 or a Eureka Manta) 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.

Table 6. Water Quality Parameters (Laboratory)

Summary Table for Water Quality		
Parameter	Value	Comment
TP ug/L	50.00	
TN mg/L	0.94	
Chla ug/L	11.40	
Chla TSI	51.84	
TP TSI	54.36	
TN TSI	54.71	
Secchi Disk (SD)	5.79	
TSI	53.64	Balanced
PAC	34%	
PVI	13%	
Adj TP	0.74	P from Veg Added
Adj TSI	60.36	With additional P

Table 7. Water Quality Parameters (Field-YSI)

Sample Location	Time	Temp (^{o}C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	DO (mg/L)	PH (SU)	ORP (ORP)	Turbidity (NTU)	Secchi Depth (ft)
Surface	12:24	28.6	0.162	81	6.26	7.1	166.2	0.5	
Mid	12:28	25.66	0.158	19.6	1.6	6.75	169.7	0.3	
Bottom	12:30	20.57	0.163	0.4	0.03	6.27	139.2	11.7	
Surface	12:32	28.09	0.162	74.4	5.87	7	121.5	0.4	
Mean Value		25.73	0.16125	43.85	3.44	6.78	149.15	3.225	5.79

Table 6 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*). While it would not be expected that all the vegetation would be turned into available phosphorus by these management methods, the data is useful when planning various management activities. Approximately 34 % of the lake has submerged vegetation present and this vegetation represents about 13 % of the available lake volume. The vegetation holds enough phosphorus to add about 0.74μg/L of the

11

nutrient to the water column. The lake is balanced in terms of limiting nutrient and eithe increases of phosphorus or nitrogen could change the TSI and increase of decrease the potential for algal growth. The small estimated nutrient retained in submerged vegetation would not have a significant affect on the TSI or water clarity. The Secchi Disk depth of 5.79 feet would not be changed by the loss of vegetation.

To better understand many of the terms used in this report, we recommend that the 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

Dead Lady Lake is a (small) area (3.5 acre) lake that would be considered in the (<mark>mesotrophic (good)/eutrophic (fair)/hypereutrophic (poor))</mark> category of lakes based on water chemistry. It has a (higher than normal/lower than normal/normal) concentration of aquatic vegetation. About 34% of the open water areas contain submerged vegetation. Vegetation helps to maintain the nutrient balance in the lake as well as provide good fish habitat. The lake has many open water areas that support various types of recreation and has a good diversity of plant species. The primary Pest plants in the lake include *Azolla caroliniana*, *Panicum repens* and *Algal Spp*. For more information and recent updates please see the Hillsborough Watershed Atlas (water atlas) website at: http://www.hillsborough.wateratlas.usf.edu .

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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=5632&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:

14
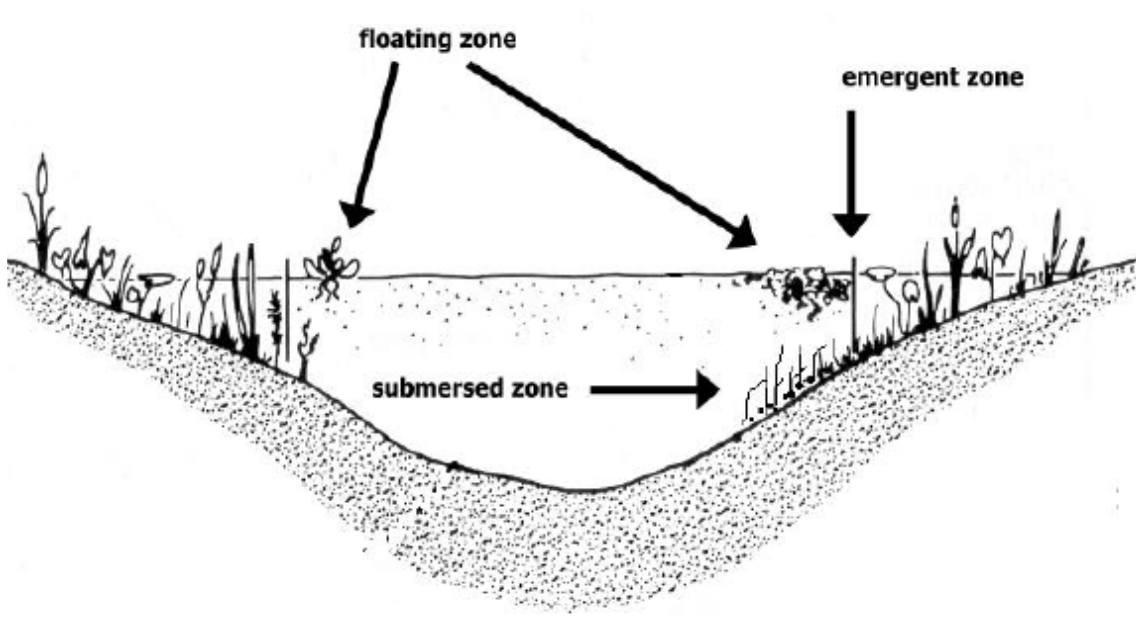
[v] A lake is impaired if " (2) For lakes with a mean color less than or equal to 40 platinum cobalt units, the annual mean TSI for the lake exceeds 40, unless paleolimnological information indicates the lake was naturally greater than 40, or

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