Lake Maurine

Methods

Study Area Analysis

The watershed containing Lake Maurine was analyzed using ESRI ArcGIS 10.2. Using this software with 2011 Hillsborough County aerial, Land Use/ Land Cover (LULC), Landscape Development Intensity (LDI) Index values were calculated for the 100 meter buffer surrounding the lake following the procedures of Reiss & Brown 2012(Reiss & Brown. 2012. Landscape Development Intensity (LDI) Index User's Manual. H.T. Odum Center for Wetlands, University of Florida. March 2012). According to Reiss and Brown "The LDI represents a human disturbance gradient for wetland systems. The LDI is an integrated measure of human activity, combining the effects from air and water pollutants, physical damage, changes in the suite of environmental conditions … on the structure and processes of landscapes and ecosystems… Natural, undeveloped LU/LC classes have a LDI index value of zero. In the Florida framework, the maximum LDI index score is approximately 42."

Lake Bathymetry and Morphological Characteristics Assessment

The **Bathymetric Map**[i] provides the lake's morphologic parameters in various units. The bottom of the lake was mapped using a Lowrance HDS 5 Gen 2 Wide Area Augmentation System (WAAS)[ii] 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. 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.

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[i] 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.

[ii] 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. For more information, see end note 2.

Lake Vegetation Index Assessment

Hillsborough County requested the implementation of the Florida Department of Environmental Protection methods for Lake Vegetation Index (LVI 1000) (http://www.dep.state.fl.us/water/sas/sop/sops.htm) using forms FD 9000-03 (Physical/Chemical Characterization), FD 9000-06 (Lake Habitat Assessment) FD 9000-27 (LVI Field Sheet) and FD 9000-31 (Lake Observation Field Sheet).

The Lake Vegetation Index (LVI) is a rapid assessment protocol in which selected sections of a lake are assessed for the presence or absence of vegetation through visual observation and through the use of a submerged vegetation sampling tool called a Frodus. The assessment results provide a list of species presents and the dominant and where appropriate co-dominant species that are found in each segment. These results are then entered into a scoring table and a final LVI score is determined. LVI scores provide an estimate of the vegetative health of a lake. Our assessment team was trained and qualified by FDEP to conduct these assessment as an independent team and must prequalify each year prior to conducting additional assessments. The LVI method consists of dividing the lake into twelve pie-shaped segments (see diagram below) and selecting a set of four segments from the twelve to include in the LVI. The assessment team then travels across the segment and identifies all unique species of aquatic plant present in the segment. Additionally, a Frodus is thrown at several points on a single five-meter belt transect that is established in the center of the segment from a point along the shore to a point beyond the submerged vegetation zone. For scoring, the threshold score for impairment is 37.

Four metrics are utilized in the Lake Vegetation Index Survey; Dominant Coefficient of Conservatism (CoC), Percent Florida Exotic Pest Plant Council Type 1 (% FLEPPC), Percent Native Taxa, Percent Sensitive Taxa.

The Dominant Coefficient of Conservatism (CoC) metric for the dominant or co-dominate species in each section. The CoC applies a score of 0-10 to each species based on its ecological tolerances and fidelity to pre-settlement conditions. Species with higher scores show a high fidelity to native, undisturbed habitats and are typically sensitive to alterations. Available CoC scores can be obtained from LT 7000 from the Florida Department of Environmental Protection at: http://www.dep.state.fl.us/water/sas/sop/sops.htm.

The percent FLEPPC (Florida Exotic Pest Plant Council) Category 1 invasive exotic taxa in a single sampling unit (pie slice) by dividing the number of FLEPPC Category I taxa by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 to determine which plants are on the FLEPPC Category 1 list. Note that not all exotic taxa should be included in this metric, only those listed in Appendix LVI 1000-1 as Category 1 FLEPPC. If the FLEPPC updates their list of Category 1 exotics, those updates shall not be reflected in this calculation until they are included in Appendix LVI 1000-1.

The percent native taxa in a single sampling unit (pie slice) is calculated by dividing the number of native taxa by the total number of taxa in that sampling unit. Multiply result times 100. Nativity status is determined by the Plant Atlas from the Institute for Systematic Botany, and is listed in

Appendix LVI 1000-1. For informational purposes, visit the website http://www.florida.plantatlas.usf.edu/. Taxa that are native according to the Plant Atlas from the Institute for Systematic Botany but are not on the list in Appendix LVI 1000-1 may be included in this metric calculation, but inclusion of these additional taxa is not required.

The percent sensitive taxa in a single sampling unit by summing the number of taxa with a C of C (Coefficient of Conservatism) score >= 7 and then dividing by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 for a list of C of C scores.

The collected bathymetric data is analyzed for submerged aquatic vegetation (SAV) calculations including the percentage of the surface area of the lake inhabited by SAV as well as an estimate of the percent volume of the lake inhabited by SAV. SAV is an important component to a lakes nutrient cycling as well as chlorophyll concentrations due to the SAV and phytoplankton competing for available nutrients in the water column. In addition SAV serves a vital role as habitat for many species of macroinvertebrates and fish as well as substrate for epiphytic algae.

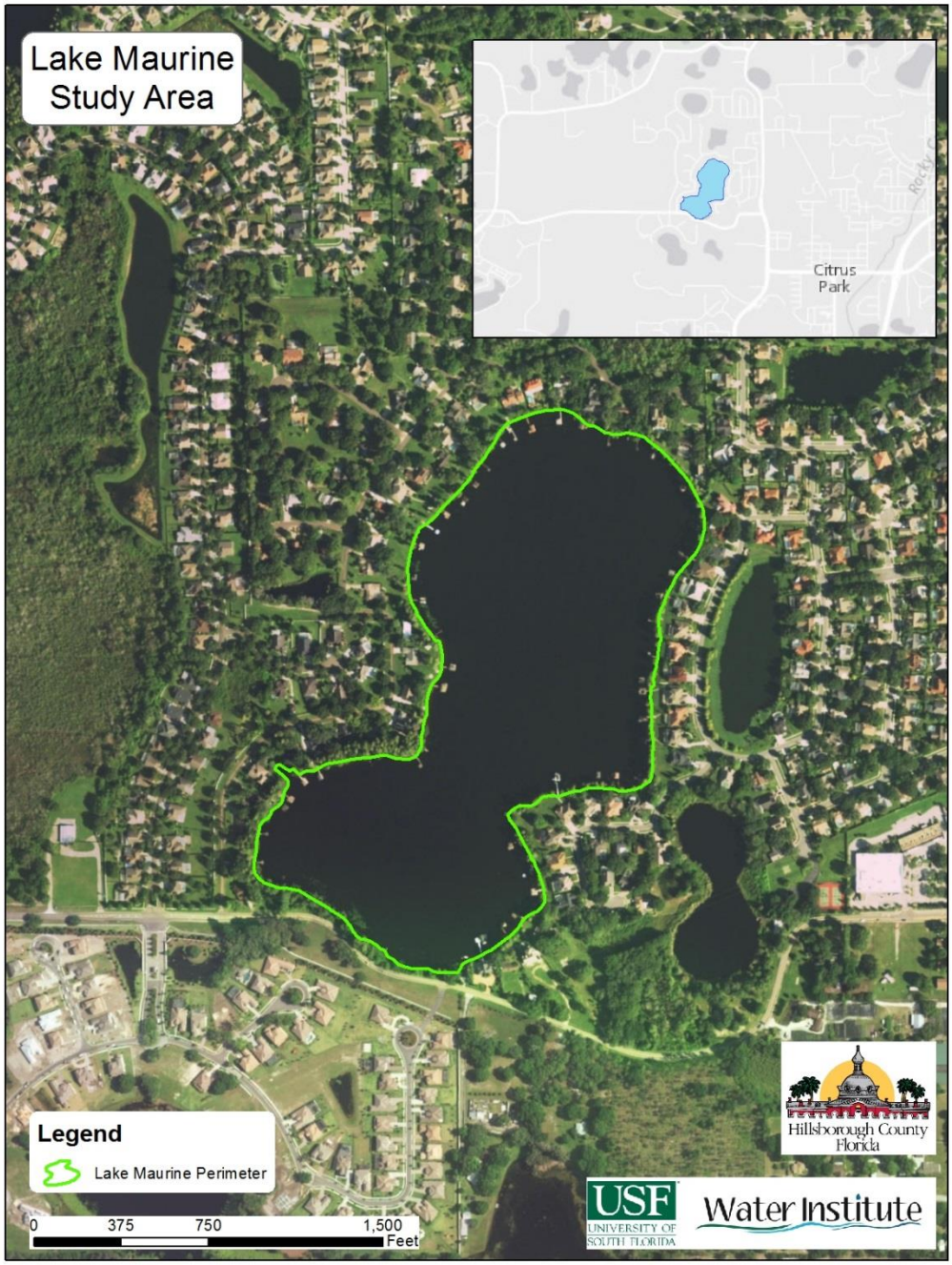
Water Quality Assessment

Physical water quality samples were taken using a Eureka Manta Sub-2 multiprobe pre and post calibrated on the day of the assessment. Measurements taken with this device include: depth, conductivity, pH, Dissolved Oxygen (mg/l and % Saturation) and salinity. Chemical water parameters were collected and preserved on ice by USF Water Institute staff and analyzed at the Environmental Protection Commission of Hillsborough County Laboratory. Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, Fecal Coliform, Enterococci, Ammonia, Nitrates/Nitrites, Total Phosphorous, Kjeldahl Nitrogen and Total Nitrogen. The results of the water quality sampling effort will be discussed in the framework of the FDEP Numeric Nutrient Criteria

Study Area

Lake Maurine is located north of N. Mobly Road in the Citrus Park area of Hillsborough County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Lake Maurine is dominated by Residential land use (77.9%). The remaining areas within this buffer include Natural Lands (6.8%) and Open Urban Land (13.1%) land uses. The resulting LDI value for the 100 meter buffer around Lake Maurine is 6.27.

Figure 1: 2017 Lake Maurine Assessment Study Area Map



Lake Bathymetry and Morphological Characterization

Lake Maurine is a 2 lobed lake with isolated deeper holes in each lobe. At the time of the assessment, Lake Maurine was experiencing moderately high water levels (31.29' NAVD88) resulting in a 54.1 acre water body. Lake Maurine at the time of the assessment had a mean water depth of 7.31 feet and a maximum observed depth of 19.5 feet. The volume at this time was approximately 128,784,212 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Maurine from data collected on July 10, 2017. The collected data has been overlain the 2016 Hillsborough County aerials.

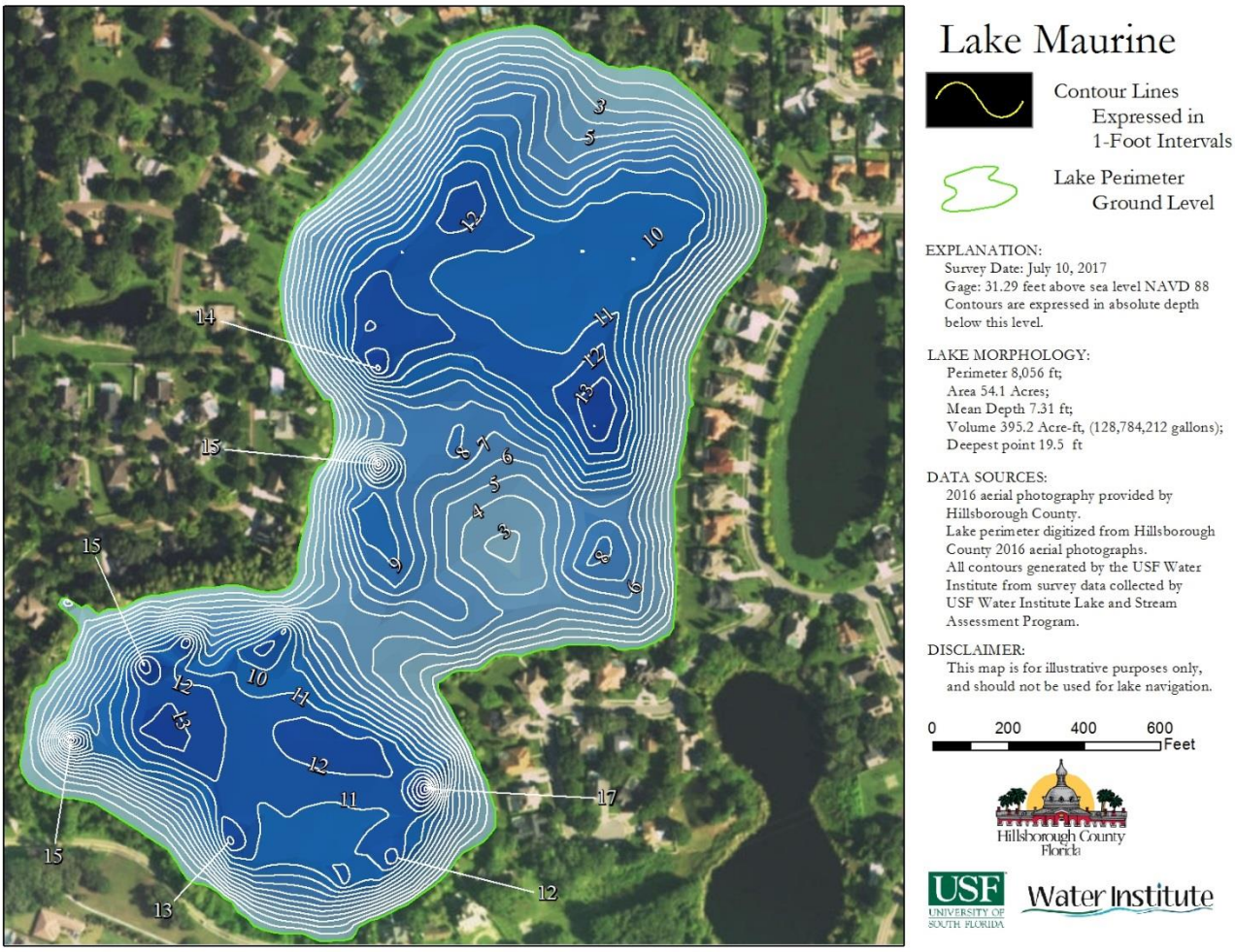


Figure 2: 2017 1-Foot Bathymetric Contour Map for Lake Maurine

Table 1: Morphological Calculations for Lake Maurine

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	2,355,004	218,785	54.1	0	0
Mean Depth	7.31	2.23	0	0	0
Maximum Depth	19.5	5.95	0	0	0
Volume (cubic)	17,215,826	487,493	0	395.2	128,784,212
Gauge (NAVD 88)	31.29	9.54	0	0	0

Lake Vegetation Index Assessment

Figure 3 Overview photograph of Lake Maurine showing the less developed south shore

The lake assessment for Lake Maurine was conducted on July 10, 2017. Lake Maurine received a lake habitat assessment (FEDP form FD 9000-6) score of 63 due to suboptimal scores for Secchi, Vegetation Quality, Bottom Substrate Quality and Adverse Watershed Land Use. Marginal scores were achieved for Lakeside Adverse Human Alterations and Upland Buffer Zone. Stormwater Inputs received poor scores.

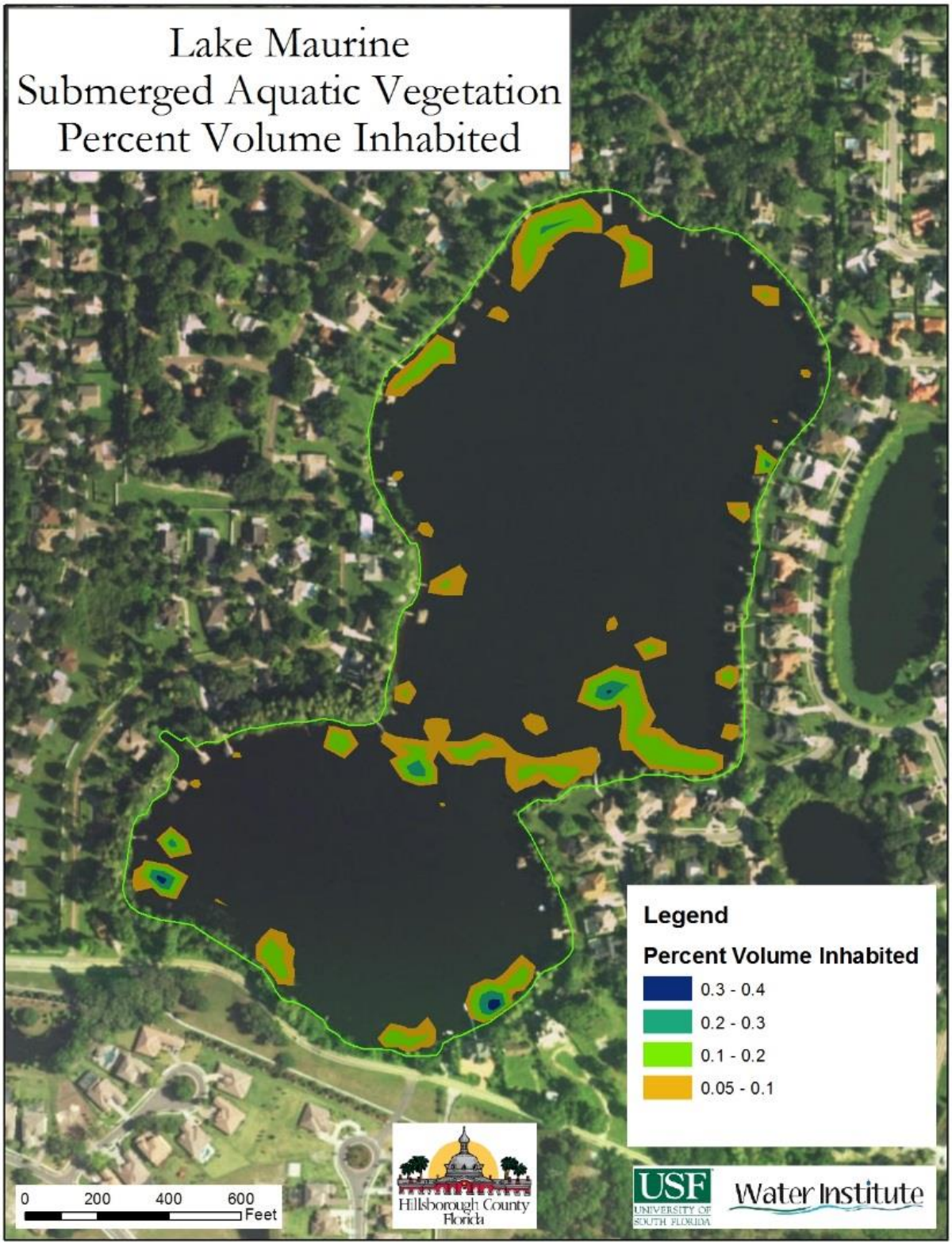
Figure 4 Lake Maurine was dominated by cultivated vegetation and seawalls with few areas of natural buffer.

The Lake Vegetation Index identified 31 species of wetland vegetation growing in the four selected sections along Lake Maurine. The majority of these species (25) are native species. The remaining 6 species (*Panicum repens*, Alternanthera philoxeroides, *Sphagneticola trilobata, Schinus terebinthifolius, Cyperus alternifolius,* and *Ludwigia peruviana*) are non-native and invasive to this region. The vegetation community along Lake Maurine is dominated by a variety of emergent species including *Panicum repens, Taxodium,* and *Ludwigia peruviana.* The water's surface in Lake Maurine was dominated by *Nuphar* (Figure 5). No species submerged aquatic vegetation was observed during the assessment visually or through the frodus sampling. Further SAV study came from analyzing the collected sonar chart, submerged aquatic vegetation covered approximately 10.5% of the surface area Lake Maurine. This submerged vegetation inhabits an estimated 0.2% of the water volume in Lake Maurine. It cannot be confirmed if the sonar derived data is SAV or if it is the result of young *Nuphar* beginning to grow. Figure 6 shows the results of the SAV analysis indicating the location and percent of the water column inhabited by SAV.

The calculated LVI score for Lake Maurine was 42, above the impairment threshold of 37. Figure 7 shows the map of Lake Maurine detailing the LVI regions used for the assessment. Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index.

Figure 5 *Nuphar* dominated the water surface in Lake Maurine

Figure 6 Lake Maurine Submerged Aquatic Vegetation Assessment Results



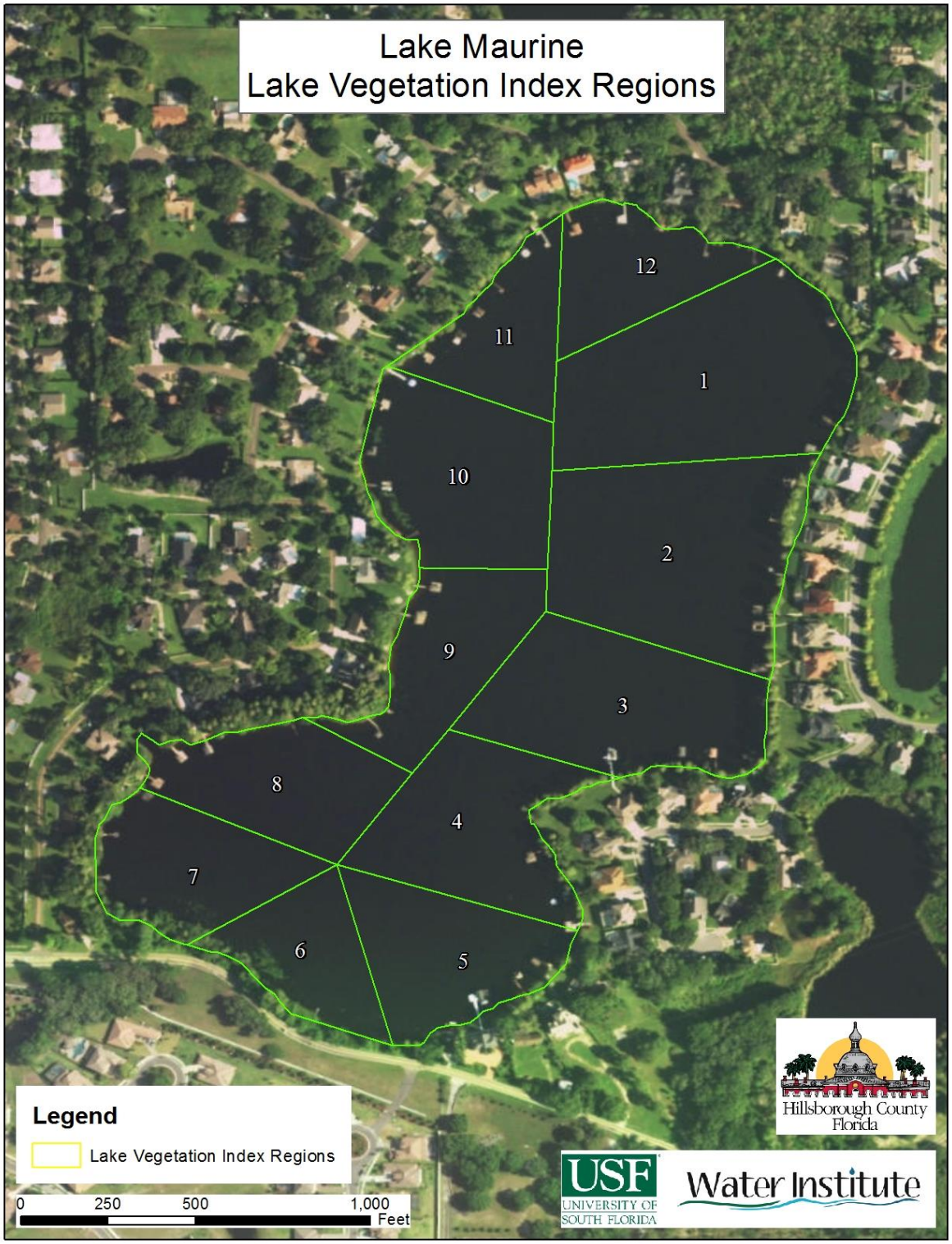


Figure 7: Lake Vegetation Index region map for Lake Maurine

Table 2: Lake Vegetation Index results for Lake Maurine 7/10/17

SPECIES	CofC	Region			
		2	5	8	11
Alternanthera philoxeroides	0	1	1	1	1
Blechnum serrulatum	5.5	1	1	1	1
Boehmeria cylindrica	5	1	1	1	1
Eupatorium capillifolium	0.83	1	1	1	1
Hydrocotyle	2	1	1	1	1
Nuphar	3.5	C	D	1	1
Panicum repens	0	1	1	D	D
Sagittaria lancifolia	3	1	1	1	1
Sphagneticola trilobata	0	1	1	1	1
Taxodium	7	C	1	1	1
Cyperus odoratus	3	1	1		1
Cyperus polystachyos	1.56	1		1	1
Ludwigia peruviana	0		1	1	1
Mikania scandens	1.95	1		1	1
Myrica cerifera	2	1	1		1
Typha	1		1	1	1
Acer rubrum	4.65		1	1	
Cephalanthus occidentalis	5	1	1		
Eclipta prostrata	2	1	1		
Schinus terebinthifolius	0	1	1		
Baccharis					1
Cyperus alternifolius	0	1			
Cyperus surinamensis	2.03			1	
Echinochloa walteri	2.5				1
Erechtites hieracifolia	1		1		
Ilex cassine	6		1		
Juncus effusus	2		1		
Magnolia virginiana	7				1
Osmunda regalis	7.6				1
Pluchea		1			
Salix caroliniana	2.95		1		

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Score Summary	Region			
	2	5	8	11
Total # of taxa in sampling unit	19	22	16	20
% Native taxa in sampling unit	73.68421	77.27273	75	80
% FLEPPC CAT 1 taxa in sampling unit	10.52632	13.63636	12.5	10
% Sensitive taxa in sample unit	5.263158	4.545455	6.25	15
Dominant CoC in sample unit	5.25	3.5	0	0
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.270924	0.40953	0.321746	0.514871
Invasive FLEPPC 1 Score (1 - (x/30))=	0.649123	0.545455	0.583333	0.666667
Sensitive Score (x/(27.78 or 20)) =	0.263158	0.227273	0.3125	0.75
Dominant CoC Score (x/(7.91 or 7)) =	0.75	0.5	0	0
Raw Score Total = N+I+S+D =	1.933204	1.682257	1.217579	1.931537
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.483301	0.420564	0.304395	0.482884
South				
LVI Score for sampling unit =	48.33011	42.05643	30.43948	48.28843

Total LVI SCORE = **42**

Water Quality Assessment

Long-term water quality data is available for Lake Maurine thanks to dedicated volunteers. The majority of the available data was collected as part of the University of Florida LAKEWATCH program and the US Geological Survey. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of Lake Maurine.

Table 4: Lake Maurine Water Quality (Field)

Depth (m)	Temp °C	pH	DO (mg/L)	DO (%sat)	Cond (unho/cm)	Salinity (ppt)	TDS (mg/L)	Secchi Depth (m)
0.29	32.36	8.01	7.94	106	288.3	0.13	184.5	1.4
0.42	32.28	8.16	8.01	106.8	288.4	0.13	184.6	
1.09	32.05	7.88	7.98	106	288	0.13	184.3	
2.27	31.79	7.62	7.25	95.8	287.4	0.13	183.9	
POR	21.3	7.08			256.1		110	1.7

The chemical water quality analysis for Lake Maurine is shown in Table 5 for the sample taken on July 10, 2017. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment as well as the available LAKEWATCH geometric mean values for the period of record and past two years since complete data for the past three years for available parameters is not available. Determining proper NNC thresholds for Lake Maurine is complicated as the most recent Color sample taken with this assessment was 21.9 Pt/Co whereas the period of record geomean value was 46.15 Pt/Co and the previous two year geomean was 58.35 Pt/Co. The determining value for color is 40 Pt/Co to separate “colored” water systems and “clear” water systems. For the discussion we will assume that the normal conditions for Lake Maurine is a “colored” water system. Total Phosphorous values were below the nutrient threshold for colored lakes with insufficient data developed by FDEP of 0.05 mg/l with a value of 0.022 mg/l for the POR (0.024 mg/l for the most recent two years) and below the threshold for the single sample with a value of 0.044 mg/l. Total Nitrogen values were below the nutrient threshold for colored lakes with insufficient data developed by FDEP of 1.27 mg/l with a value of 0.747 mg/l for the POR data (0.712 mg/l for the most recent two years). The Total Nitrogen value associated with the sample for this assessment was 0.513 mg/l. Chlorophyll-a corrected values are below the nutrient threshold for colored lakes developed by FDEP of 20.0 µg/l with a value of 8.1 µg/l. LAKEWATCH sampling only measures chlorophyll-a, and not chlorophyll-a corrected. The POR data for chlorophyll-a has a geomean of 6.35 µg/l and a two year geomean of 8.33 µg/l.

Bacteria testing showed low levels of Fecal Coliform (20 colonies/100ml) and Enterococci (8 colonies/100ml) below the rules set forth in FDEP 62-302.530 (https://www.flrules.org/gateway/RuleNo.asp?title=SURFACE%20WATER%20QUALITY%20STANDARDS&ID=62-302.500) “Most Probable Number (MPN) or Membrane Filter (MF) counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day.

Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period."

Table 5: Lake Maurine Water Quality Results from 7/10/2017 (Laboratory)

Parameter	Lake Maurine (Center)	POR Mean Value	Two Year Geomean	Units
Alkalinity	27.0	14.1		mg/LCaCO3
Nitrates/Nitrites	0.003			mg/L
Fecal Coliform	20			#/100 ml
Enterococci	8			#/100 ml
Chlorophyll a	8.9	6.35	8.33	ug/L
Chlorophyll b	5.1			ug/L
Chlorophyll c	0.7			ug/L
Chlorophyll t	9.6			ug/L
Chlorophylla Corr	8.1			ug/L
Chlorophyll-pheo	3.2			ug/L
Ammonia	0.007	0.02		mg/L
Kjeldahl Nitrogen	0.513	0.750		mg/L
Total Nitrogen	0.513	0.747	0.712	mg/L
Total Phosphorus	0.044	0.022	0.024	mg/L
Color(345)F.45	21.9	46.15	58.35	Pt/Co

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	46.15
Number of Samples	29
Geometric Mean Alkalinity (mg/L CACO3)	14.07
Number of Samples	5
Lake Type	Colored
Chlorophyll a Criteria (ug/L)	20
Insufficient for Geomean Criteria then P mg/L	0.05
Insuffcient for Geomean Criteria then N mg/L	1.27
Geomean Chla ug/L	6.35
Geomean TP mg/L	0.022
Geomean TN mg/L	0.747
Number of Samples	85
Potential Impaired Chlorophyll a	Not Impaired
Potential Impaired TP	Not Impaired
Potential Impaired TN	Not Impaired

Conclusion

The results of the assessment of Lake Maurine shows a healthy lake based on Total Nitrogen, Total Phosphorous and Chlorophyll concentrations according to the approximated FDEP numeric nutrient criteria using the single sample taken during this assessment and limited long term water quality record. The sampling data was insufficient to calculate proper FDEP Numeric Nutrient Criteria values. Consistent Long term sampling would be necessary to determine actual NNC values. The system also shows moderate health in the vegetation communities according to the Lake Vegetation Index with moderate overall species (31), high occurrences of non-native, invasive species and several sensitive plant species with an overall LVI score of 42. The LVI score was hindered by the lack of a natural vegetative buffer between cultivated turf grasses and the lake. The assessment also revealed a limited submerged aquatic vegetation community comprising 6 species occupying 10.5% of the surface area and

0.2% of the volume of Lake Maurine. It should be noted that this data was analyzed from the collected sonar data and no SAV was observed visually or with the frodus sampling. It is likely that these values represent new growth of *Nuphar.*