Hendrics East Lake

Methods

Study Area Analysis

The watershed containing Hendrics East Lake 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.

[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

Hendrics East Lake is located in the Hillsborough Bay Watershed near Brandon, Hillsborough County, Florida. The surface area of Hendrics East Lake was approximately 10.65 acres at the time of the assessment. The Landscape Development Intensity Index of the 100 meter buffer around Hendrics East Lake is dominated by Residential High Density (65.6%) and Residential Medium Intensity (16.8%) land use. The resulting LDI value for the 100 meter buffer around Hendrics East Lake is 34.08.

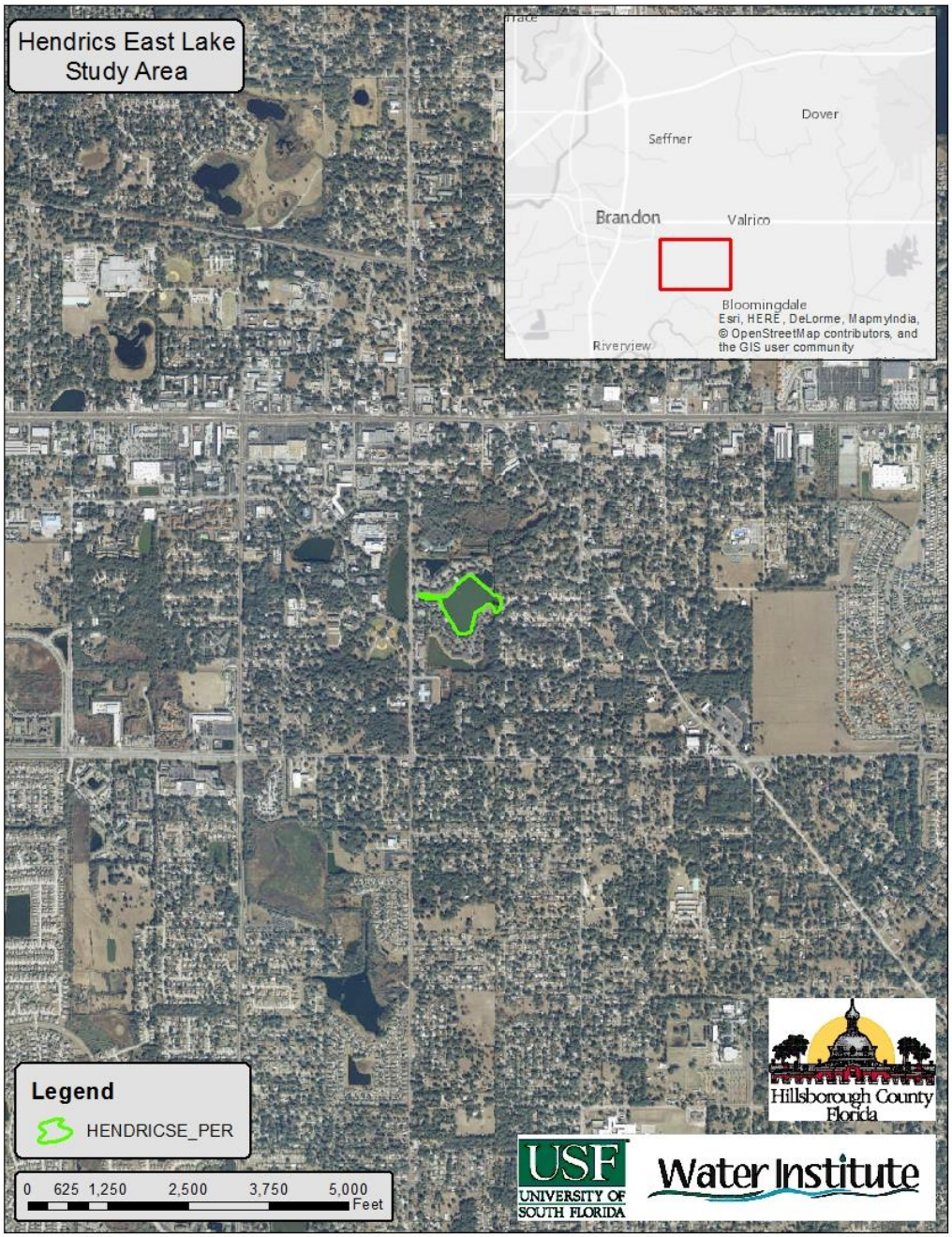

Figure 1 2015 Hendrics East Lake Assessment Study Area Map

Lake Bathymetry and Morphological Characterization

Hendrics East Lake is a shallow system with few areas of varying depth. At the time of the assessment, Hendrics East Lake was experiencing moderately high water levels resulting in a 10.7 acre water body. Hendrics East Lake at the time of the assessment had a mean water depth of 5.06 feet and a maximum observed depth of 7.9 feet. The volume at this time was approximately 17,561,743 gallons. Figure 2 shows the resulting bathymetric contour map for Hendrics East Lake from data collected on July 27, 2015. The collected data has been overlain the 2011 Hillsborough County aerials.

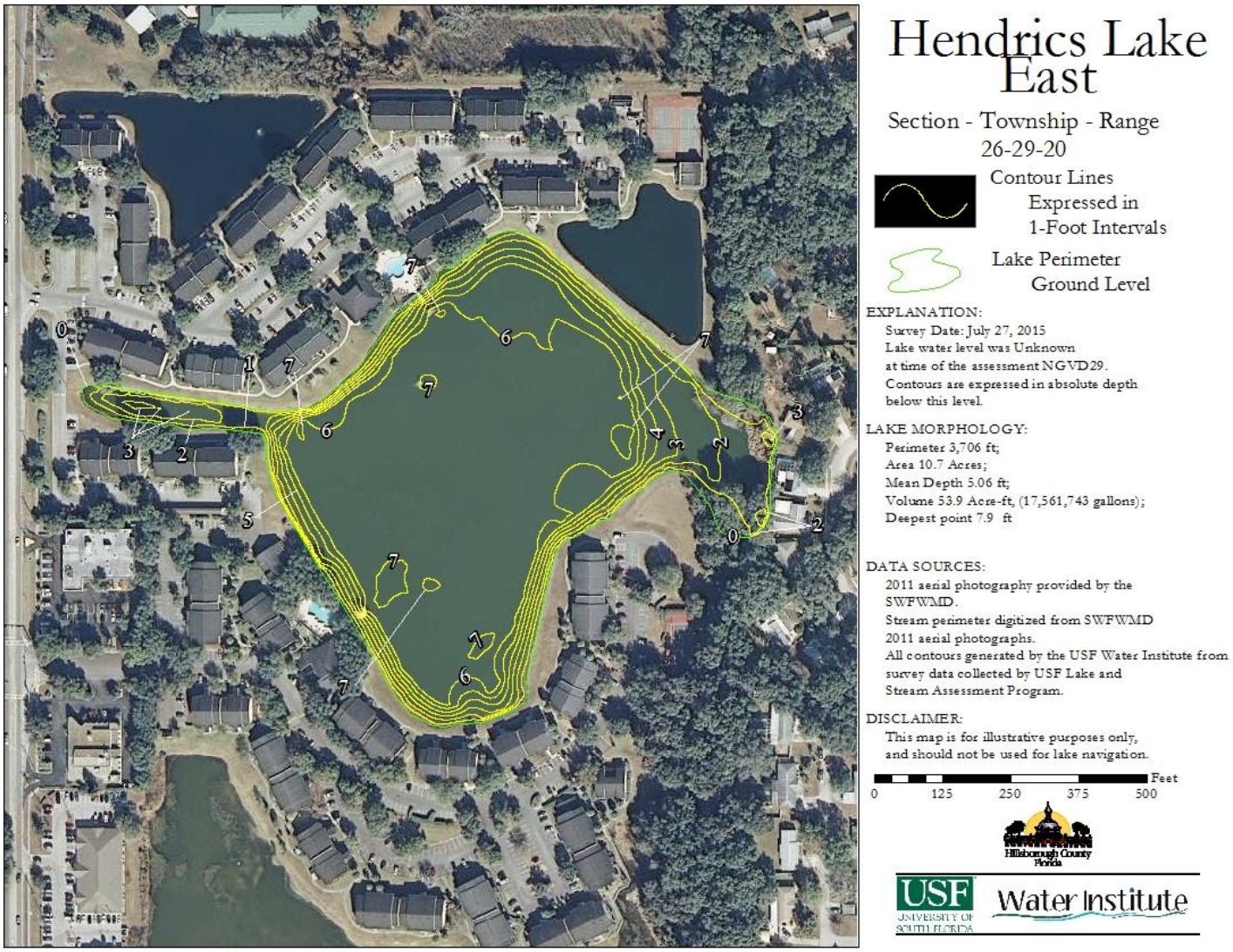

Figure 2 2015 Bathymetric Contour Map for Hendrics East Lake

Table 1 Morphological Calculations for Hendrics East Lake

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	463,965	43,104	10.65	0	0
Mean Depth	5.06	1.54	0	0	0
Maximum Depth	7.9	2.41	0	0	0
Volume (cubic)	2,347,647	66,478	0	53.9	17,561,743
Gauge (relative)	NA	NA	0	0	0

Lake Vegetation Index Assessment

Figure 3 Overview photograph of Hendrics East Lake

The lake assessment for Hendrics East Lake was conducted on July 27, 2015. Hendrics East Lake received a lake habitat assessment (FEDP form FD 9000-6) score of 35 due to Poor scores for Stormwater Inputs, Vegetation Quality, Adverse Watershed Land Use, Lakeside Adverse Human Alterations, Upland Buffer Zone and Bottom Substrate Quality. Marginal scores were given for the Secchi Depth.

Figure 4 the emergent vegetation community surrounding Hendrics East Lake was heavily disturbed by frequent mowing.

The Lake Vegetation Index identified 25 species of wetland vegetation growing in the four selected sections along George Lake. The majority of these species (18) are native species. The remaining 7 species in bold in Table 2 are non-native and invasive to this region. The emergent vegetation community along Hendrics East Lake is heavily disturbed from frequent mowing leaving very few species of wetland vegetation (Figure 4). The majority of species that are present are small diminutive species. Only region 3 had a dominant species out of the regions used in the analysis. The dominant species in region 3 was *salix caroliniana* shown in Figure 5. The water's surface in Hendrics East Lake was dominated by *pistia stratiotes* (Figure 6).The water column of the lake did not have any observed submerged vegetation species. Hendrics East Lake obtained a LVI score of 5 at the time of the assessment. By analyzing the collected sonar chart, submerged aquatic vegetation covered approximately 9% of the surface area of Hendrics East Lake. This submerged vegetation inhabits an estimated 1.93% of the water volume in Hendrics East Lake. Figure7 shows the map of Hendrics East Lake 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 Salix caroliniana *on Hendrics East* Lake

Figure 6 *Pistia stratiotes* and *alternanthera philoxeroides* on Hendrics East Lake

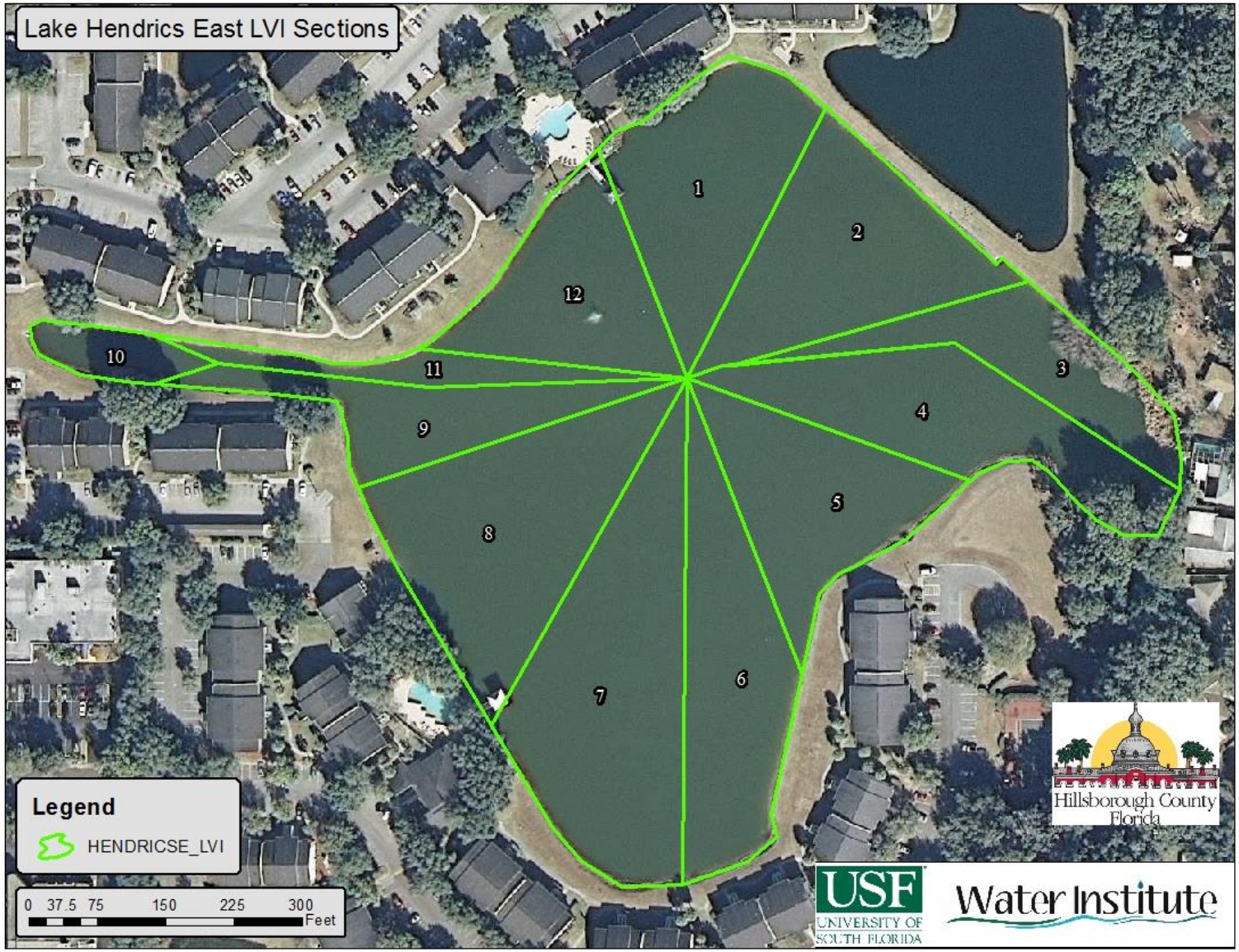

Figure 7 Lake Vegetation Index region map for Hendrics East Lake

Table 2 Lake Vegetation Index results for Hendrics East Lake 7/27/2015

SPECIES		Region			
	CofC	3	6	9	12
Alternanthera philoxeroides	0.00	1	1	1	1
Panicum repens	0.00	1	1	1	1
Boehmeria cylindrica	5.00		1	1	1
Diodia virginiana	3.00		1	1	1
Hydrocotyle	2.00		1	1	1
Pistia stratiotes	0.00	1	1	1	
Commelina virginica	4.67		1	1	
Cyperus odoratus	3.00	1			1
Eclipta prostrata	2.00	1	1		
Ludwigia peruviana	0.00	1			1
Urochloa mutica	0.00	1			1
Acer rubrum	4.65	1			
Centella asiatica	1.92			1	
Eupatorium capillifolium	0.83		1		
Galium tinctorium	5.08				1
Landoltia punctata	0.00	1			
Lemna	1.00	1			
Ludwigia octovalvis	2.00				1
Lygodium japonicum	0.00			1	
Mikania scandens	1.95	1			
Myrica cerifera	2.00	1			
Nephrolepis exaltata	3.00			1	
Quercus laurifolia	4.00	1			
Salix caroliniana	2.95	D			
Woodwardia areolata	6.50	1			

Table 3 Scoring Summary for the Lake Vegetation Index

LVI Score Summary	Region			
	3	6	9	12
Total # of taxa in sampling unit	15	9	10	10
% Native taxa in sampling unit	60	66.66667	60	60
% FLEPPC CAT 1 taxa in sampling unit	26.6667	22.22222	30	30
% Sensitive taxa in sample unit	0	0	0	0
Dominant CoC in sample unit	2.95	NULL	NULL	NULL
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0	0	0	0
Invasive FLEPPC 1 Score (1 - (x/30))=	0.111111	0.259259	0	0
Sensitive Score (x/(27.78 or 20)) =	0	0	0	0
Dominant CoC Score (x/(7.91 or 7)) =	0.421429	0	0	0
Raw Score Total = N+I+S+D =	0.53254	0.259259	0	0
Division Factor = (3 D=0 or 4) =	4	3	3	3
Average LVI dividend = Raw /DF	0.133135	0.08642	0	0
South				
LVI Score for sampling unit =	13.31349	8.641975	0	0
Total LVI SCORE =	5			

Water Quality Assessment

Long-term water quality data is available for Hendrics East Lake is not available. Table 4 provides a summary of the Physical/Chemical conditions recorded at the center of the lake at the time of the assessment.

Table 4 Hendrics East Lake Water Quality (Field)

Depth (m)	Temp ©	pH	DO (mg/L)	DO (% Sat)	Cond (umho/cm)	Salinity (ppt)	TDS (mg/L)	Secchi Depth (m)
0.34	28.54	8.7	8.2	104.5	148.7	0.07	95.2	0.58
1.25	28.36	8.15	6.86	87.2	147.9	0.07	94.6	
2.02	28.22	7.2	4.67	59.2	282	0.13	180.5	

The chemical water quality analysis for Hendrics East Lake is shown in Table 5 for the sample taken on July 27, 2015. Table 6 includes this data in the numeric nutrient criteria framework using the available data for available parameters. Total Phosphorous values were above the nutrient threshold for clear alkaline lakes with insufficient data available developed by FDEP of 0.03 mg/l with a sample value of 0.252 mg/l. Total Nitrogen values were above the nutrient threshold for clear alkaline lakes with insufficient data available developed by FDEP of 1.05 mg/l with a sample value of 1.24 mg/l. Chlorophyll-a values fall above the nutrient threshold for clear alkaline lakes developed by FDEP of 20.0 µg/l with a sample value of 48.8 µg/l.

Bacteria testing showed low levels of Fecal Coliform (60 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 Hendrics East Lake Water Quality Results from 7/27/2015(Laboratory)

Parameter	Value	Units
Alkalinity	58	mg/LCaCO3
Nitrates/Nitrites	0.003	mg/L
Fecal Coliform	60	#/100 ml
Enterococci	110	#/100 ml
Chlorophyll a	60.7	ug/L
Chlorophyll b	8.5	ug/L
Chlorophyll c	4	ug/L
Chlorophyll t	73.2	ug/L
Chlorophylla Corr	48.8	ug/L
Chlorophyll-pheo	17.6	ug/L
Ammonia	0.011	mg/L
Kjeldahl Nitrogen	1.237	mg/L
Total Nitrogen	1.24	mg/L
Total Phosphorus	0.252	mg/L
Color(345)F.45	19.5	Pt/Co

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	19.5
Number of Samples	1
Geometric Mean Alkalinity (mg/L CACO3)	58
Number of Samples	1
Lake Type	Clear Alkaline
Chlorophyll a Criteria (ug/L)	20
Insufficient for Geomean Criteria then P mg/L	0.03
Insufficient for Geomean Criteria then N mg/L	1.05
Geomean Chla ug/L	48.8
Geomean TP mg/L	0.252
Geomean TN mg/L	1.24
Number of Samples	1
Potential Impaired Chlorophyll a	Impaired
Potential Impaired TP	Impaired
Potential Impaired TN	Impaired

Conclusion

The results of the assessment of Hendrics East Lake shows impairment based on Total Nitrogen, Total Phosphorous and Chlorophyll-a concentrations according to the FDEP numeric nutrient criteria. The system also shows impaired conditions in the vegetation communities according to the Lake Vegetation Index with high occurrence of invasive species and overall very little spatial coverage of wetland vegetation with an overall LVI score of 5.