Lake Wastena

LAKE HABITAT ASSESSMENT, LAKE VEGETATION IDEX, SUBMERGED VEGETATION SURVEY AND WATER QUALITY

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Methods

STUDY AREA ANALYISIS

The watershed containing the Lake Wastena was analyzed using ESRI ArcGIS 10.6. Using this software with 2020ESRI Basemaps aerial, 2017 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 FDEP (https://floridadep.gov/dear/bioassessment/content/bioassessment-ldi-hdg-bcg). "The Landscape Development Intensity index (LDI) is an estimate of how much humans have altered an area of interest around a waterbody. Various land use types (low density residential, row crops, industrial, natural) are assigned coefficients of land use intensity based on estimates of the amount of human energy that is put into those land use types. The LDI is calculated by multiplying each land use coefficient by the percentage of the area of interest occupied by that land use, and then summing the results. The Florida Department of Environmental Protection (DEP) uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. For streams and rivers, DEP typically uses a LDI calculated for the 100 m buffer of the waterbody for 10 km upstream of the point of interest. For lakes and isolated wetlands, DEP typically uses a LDI calculated for the 100 m buffer around the waterbody. LDI values less than two (≤2) can be considered minimally disturbed."

LAKE BATHYMETRY AND MORPHOLOGICAL CHARACTERISTICS ASSESSMENT

The Bathymetric Map[1] provides the lake's morphologic parameters in various units. The bottom of the lake was mapped using a Lowrance Elite 7 Ti Wide Area Augmentation System (WAAS)[2] enabled Global Positioning System (GPS) with Totalscan transducer (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.

[1] 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.

[2] 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 43.

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.

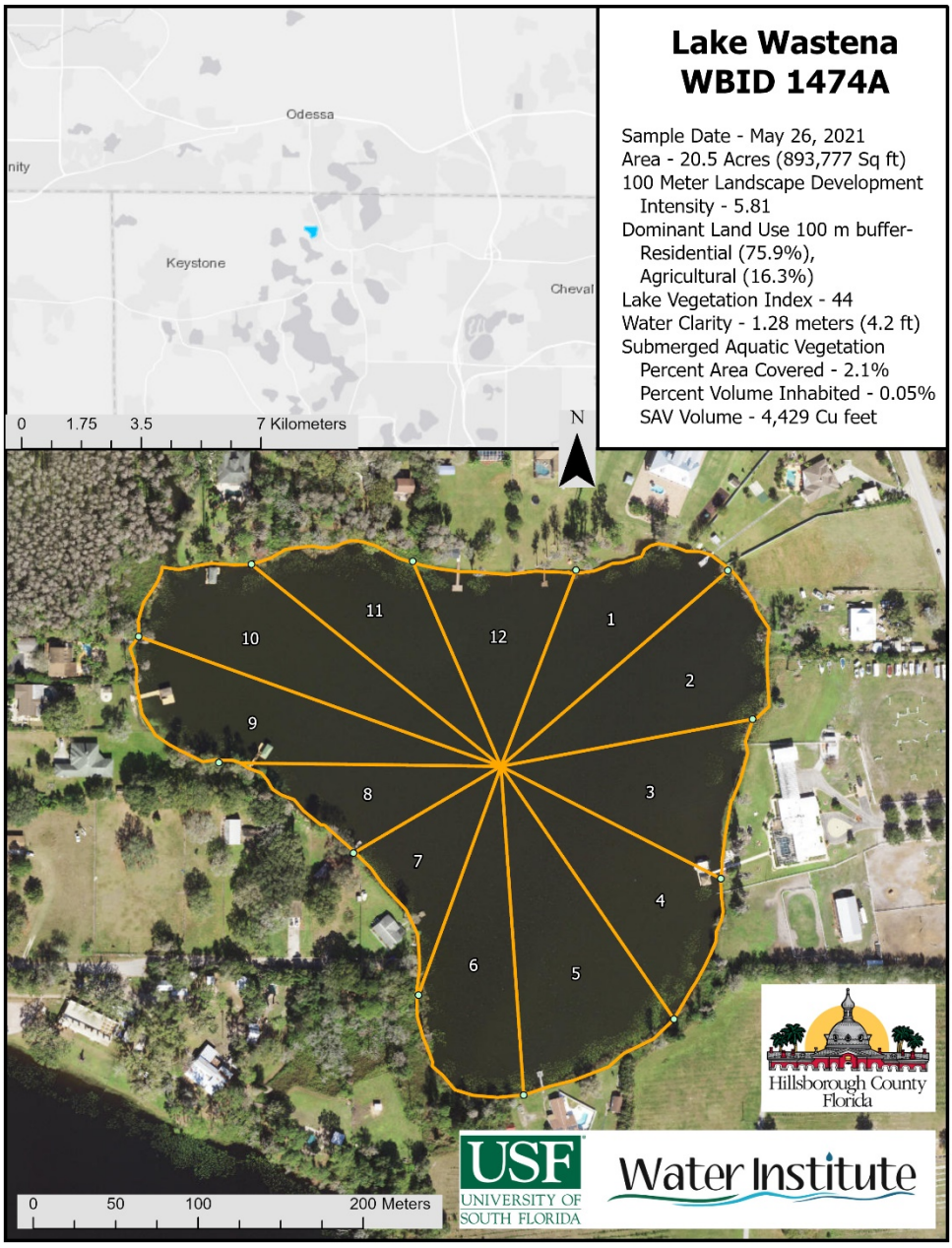
WATER QUALITY ASSESSMENT

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 Hillsborough County Public Utilities Laboratory Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, EColi, 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 Wastena is located in the Coastal Old Tampa Bay Watershed in north-western Hillsborough County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Lake Wastena is dominated by Residential (75.9%), Agricultural (16.3%) and Natural (7.9%) land uses. The resulting LDI value for the 100 meter buffer around Lake Wastena is 5.81.

FIGURE 1: 2021 LAKE WASTENA ASSESSMENT STUDY AREA MAP



Lake Bathymetry and Morphological Characterization

At the time of the assessment, Lake Wastena was experiencing normal water levels, although a staff gauge was not available, resulting in a 20.5 acre water body. Lake Wastena at the time of the assessment had a mean water depth of 9.2 feet and a maximum observed depth of 22.6 feet. The volume at this time was approximately 61,297,216 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Wastena from data collected on May 26, 2021. The collected data has been overlain the 2020 Hillsborough County aerials.

Table 1: Morphological Calculations for Lake Wastena

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	893,777	83,034	20.5		
Mean Depth	9.2	2.79			
Maximum Depth	22.6	6.88			
Volume (cubic)	8,194,189	232,031		188.1	61,297,216
Gauge (NAVD 88)	N/A	N/A			

Figure 2: 2021 2-Foot Bathymetric Contour Map for Lake Wastena

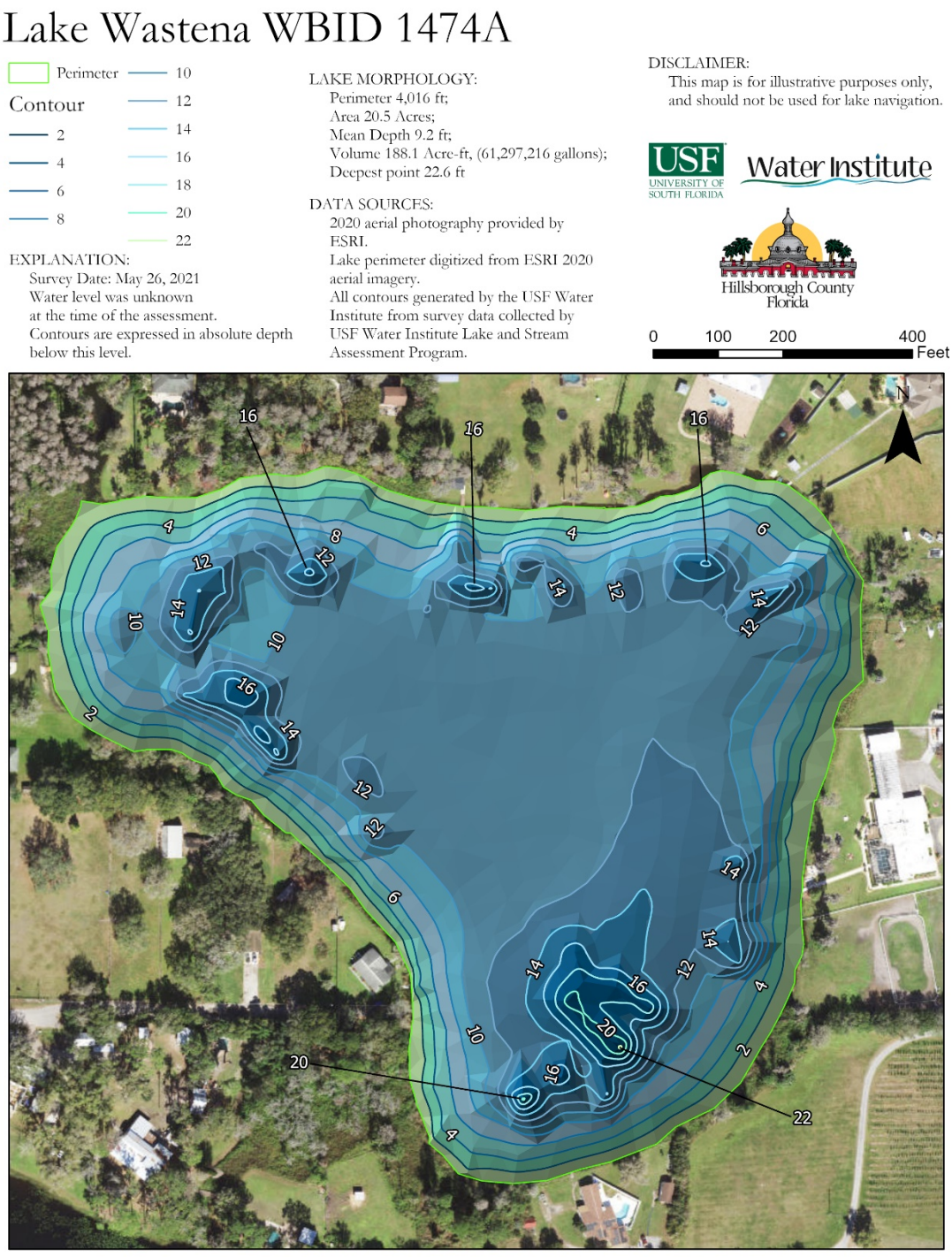


Figure 3 Overview photograph of Lake Wastena showing typical shoreline vegetation

Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for Lake Wastena was conducted on May 26, 2021. The water in Lake Wastena was characterized as clear with a color value of 33.95 PCU. The secchi disk depth was 1.28 meters in part due to the moderate tannins and turbidity. The vegetation quality of the plants in and buffering Lake Wastena are predominantly native species with minor growths of non-native nuisance species such as *Ludwigia peruviana, Panicum repens and Myriophyllum aquaticum*. Stormwater reaches the lake via sheet flow from surrounding residential land cover. The bottom substrate quality was dominated by sand/silt with coarse particulate organic matter near shore. The development along the shoreline has removed or greatly reduced the emergent vegetation community along several residential properties. This alteration has also allowed for several non-native invasive species to become established.

Figure 4 Pontederia cordata was common along the shorelines of Lake Wastena

The Lake Vegetation Index identified 38 species of wetland vegetation growing in the four selected sections along Lake Wastena. The majority of these species (31) are native species. The remaining 7 species (*Panicum repens*, *Schinus terebinthifolius, Myriophyllum aquaticum, Alternanthera philoxeroides, Oxycaryum cubense, Sapium sbiferum* and *Ludwigia peruviana*) are non- native and invasive to this region. The vegetation community along Lake Wastena is dominated by a variety of emergent species including *Ludwigia peruviana, Panicum repens* and *Pontederia cordata.* The water's surface in Lake Wastena was dominated by *Nuphar*. A total of four species of submerged aquatic vegetation were observed, *Eleocharis (submersed viviparous), Myriophyllum aquaticum, Chara,* and *Nitella* with *Eleocharis* being the dominant species. Submerged vegetation was somewhat sparse in Lake Wastena in part due to available light and suitable bottom substrates. By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 2.1% of the surface area of Lake Wastena. This submerged vegetation inhabits an estimated 0.05% of the water volume in Lake Wastena. Figure 5 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 Wastena was 44, above the impairment threshold of 43 indicating that the vegetation community is "Healthy". Figure 6 shows the map of Lake Wastena detailing the LVI regions used for the assessment (Regions 3, 6, 9, 12). Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index.

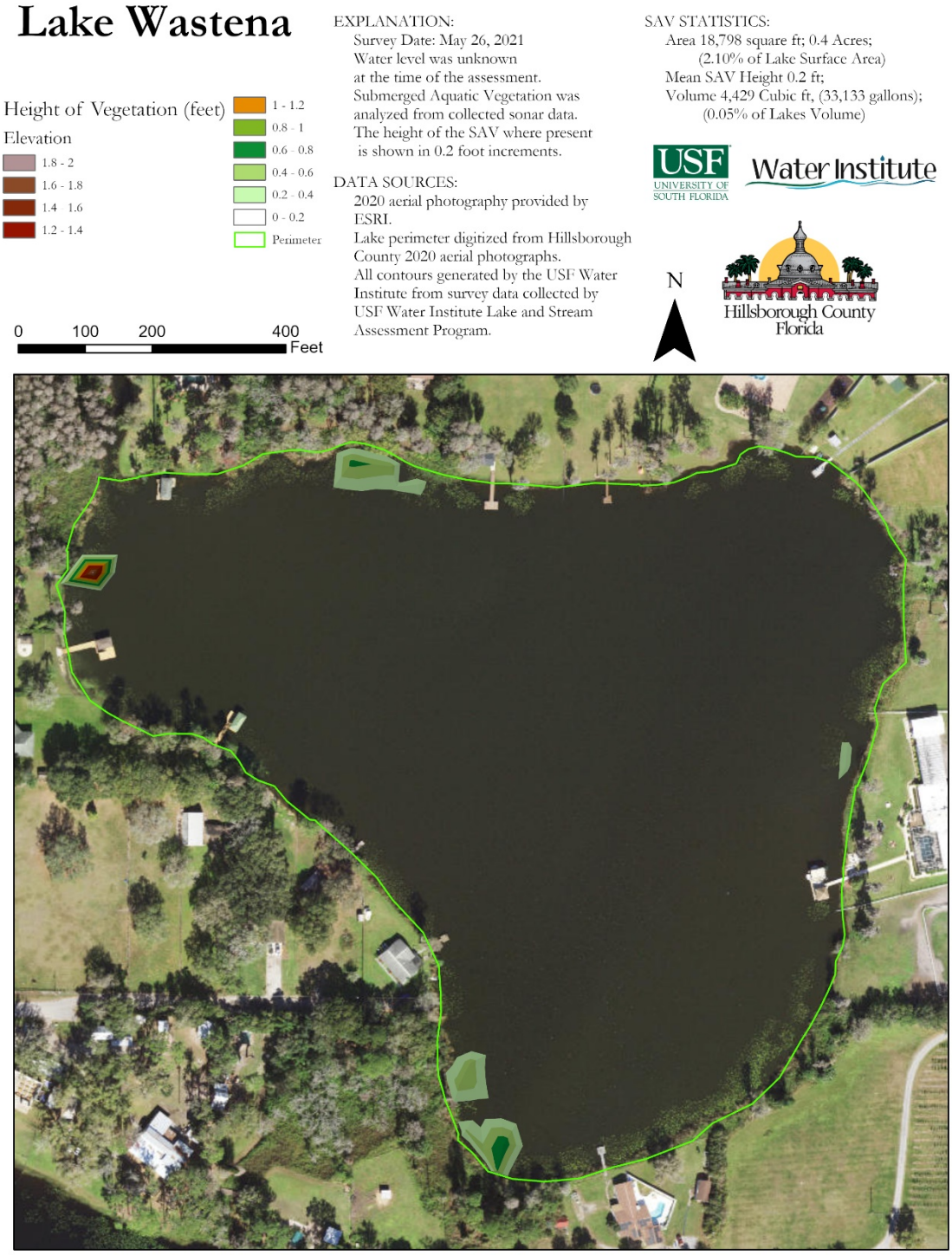


Figure 5 Lake Wastena Submerged Aquatic Vegetation Assessment Results

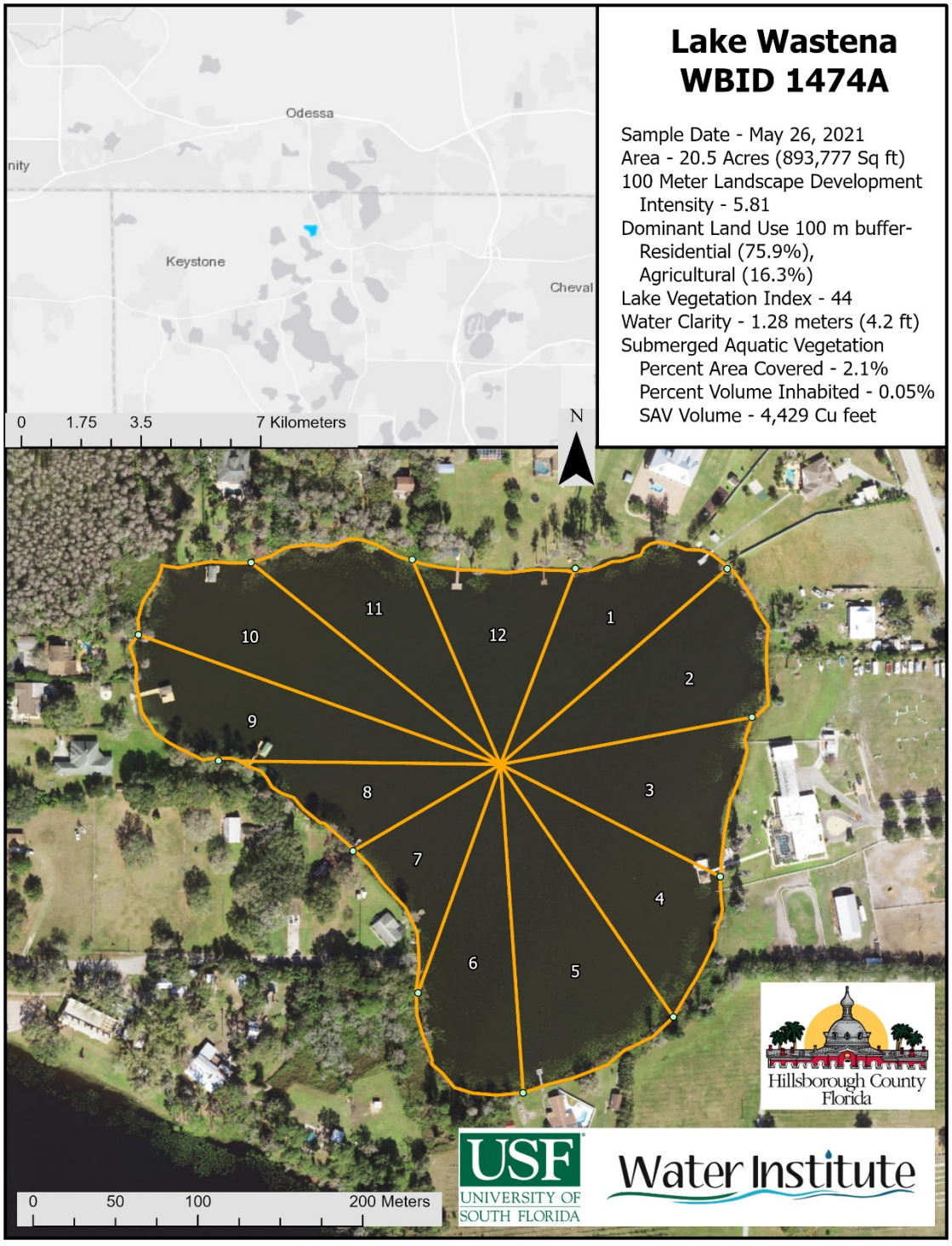


Figure 6: Lake Vegetation Index region map for Lake Wastena

Table 2: Lake Vegetation Index results for Lake Wastena May 26, 2021

SPECIES	CofC	3	6	9	12
Eleocharis (submersed viviparous but unable to ID to species)	3.00	1	1	1	1
Hydrocotyle	2.00	1	1	1	1
Ludwigia peruviana	0.00	1	C	1	1
Nuphar	3.50	C	C	D	C
Panicum repens	0.00	C	1	1	1
Bacopa monnieri	3.50	1		1	1
Blechnum serrulatum	5.50		1	1	1
Eleocharis baldwinii	2.82		1	1	1
Myriophyllum aquaticum	0.98	1		1	1
Pontederia cordata	5.38	1		1	C
Taxodium	7.00		1	1	1
Alternanthera philoxeroides	0.00	1		1	
Andropogon virginicus	3.00		1		1
Cyperus polystachyos	1.56			1	1
Diodia virginiana	3.00	1			1
Ilex cassine	6.00		1	1	
Ptilimnium capillaceum	2.73	1			1
Thelypteris interrupta	6.74		1		1
Typha	1.00	1			1
Centella asiatica	1.92				1
Cephalanthus occidentalis	5.00			1	
Chara	3.90	1			
Cyperus surinamensis	2.03				1
Gordonia lasianthus	7.00		1		
Iris virginica	5.50			1	
Ludwigia arcuata	3.50				1
Ludwigia suffruticosa	6.23			1	
Magnolia virginiana	7.00		1		
Mikania scandens	1.95	1			
Myrica cerifera	2.00		1		
Nitella	6.00	1			
Oxycaryum cubense	0.50		1		
Persea palustris	7.00		1		
Phyla nodiflora	1.92				1
Salix caroliniana	2.95		1		
Sapium sebiferum	0.00			1	
Schinus terebinthifolius	0.00			1	
Vitis rotundifolia	1.18		1		

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Score Summary	3	6	9	12
Total # of taxa in sampling unit	15	18	19	21
% Native taxa in sampling unit	73.33333	83.33333	68.42105	85.71429
% FLEPPC CAT 1 taxa in sampling unit	13.33333	11.11111	21.05263	9.52381
% Sensitive taxa in sample unit	0	22.22222	5.263158	4.761905
Dominant CoC in sample unit	1.75	1.75	3.5	4.44
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.257371	0.64362	0.067634	0.735585
Invasive FLEPPC 1 Score (1 - (x/30))=	0.555556	0.62963	0.298246	0.68254
Sensitive Score (x/(27.78 or 20)) =	0	1	0.263158	0.238095
Dominant CoC Score (x/(7.91 or 7)) =	0.25	0.25	0.5	0.634286
Raw Score Total = N+I+S+D =	1.062926	2.52325	1.129038	2.290505
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.265732	0.630813	0.282259	0.572626
South				
LVI Score for sampling unit =	26.57316	63.08125	28.22595	57.26263

Total LVI SCORE = 44

Water Quality Assessment

Limited long-term water quality data is available for Lake Wastena. The available data was collected by USGS, FDEP, Southwest Florida Water Management District, Hillsborough County and University of Florida LAKEWATCH program (1991-2021), however this dataset is incomplete with 2019 having no samples. As part of this assessment four samples were taken during May, June, July and August of 2021. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of the Lake Wastena during the assessment in 2021.

Table 4: Lake Wastena Water Quality (Field)

Date	Depth (m)	Temp °C	pH	DO (mg/L)	DO (%sat)	Cond (unho/cm)	Salinity (ppt)	Secchi Depth (m)
5/26/21	0.25	26.75	7.64	6.91	86.4	152	0.07	1.28
5/26/21	3.2	26.45	7.47	6.82	84.8	152	0.07	
6/10/21	0.5	30.5	8.10	8.06	108	186	0.09	
7/28/21	0.5	31.8	6.90	7.19	98.1	166	0.08	
8/10/21	0.5	31.0	6.84	9.53	128	177	0.08	

The chemical water quality analysis for Lake Wastena is shown in Table 5 for the samples taken on 5/26/21, 6/10/21, 7/28/21 and 8/10/21. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment as well as the available geometric mean values for the period of record since complete data for the past three years for available parameters is not available. Color values for the period of record data have a geometric mean value of 33.95 PCU, classifying it as a clear water lake (less than or equal to 40 PCU). Total Alkalinity period of record geometric mean value is 21.77 mg/L classifying the lake as alkaline (greater than or equal to 20 mg/L). The NNC thresholds for a clear, alkaline lake with insufficient data to calculate NNC (Previous three years with at least 3 samples per year in separate seasons) are 20 µg/L for Chlorophyll-a Corrected for Phaeophytin, 0.03 mg/L for Total Phosphorous and 1.05 mg/L for Total Nitrogen.

Geometric mean Chloropyll-a corrected values for the most recent data (2020 through 2021 since no samples were taken in 2019) is 6.25 µg/L. Period of record Chlorophyll-a corrected geometric mean was 6.62 µg/L. Total Phosphorous mean values for the most recent data were inconclusive of the nutrient threshold for clear alkaline lakes in the west central region with insufficient data with a value of 0.041 mg/l due to the four 2021 samples carrying QA qualifiers indicating a value below the minimum detection limit for the method used. The geometric mean value for the period of record is 0.021 mg/L. Total Nitrogen values were below the nutrient threshold for clear, alkaline lakes with insufficient data developed by FDEP of 1.05 mg/l with a value of 1.016 mg/l for the most recent data. The geometric mean for the period of record was 0.805 mg/L.

Bacteria testing showed low levels of E. Coli (2.0 colonies/100ml) and Enterococci (18.5

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 Wastena 2021 Water Quality Results (Laboratory)

Parameter	5/26/2021	6/10/2021	7/28/2021	8/10/2021	POR Mean Value	Units
Alkalinity	25.7	23.6	21.4	21.0	21.77	**mg/LCaCO3**
E Coli	2.0	13.4	6.30	8.50	33.26	**#/100ml**
Enterococci	18.5	30.9	184	81.3	N/A	**#/100 ml**
Chlorophyll a	10.2	12.2	14.7	16.0	8.27	**ug/L**
Chlorophyll b	1.0	1.3	1.3	1	1.07	**ug/L**
Chlorophyll c	1.0	1.3	1.8	1	1.25	**ug/L**
Chlorophyll t	10.2	12.2	16.5	16.0	N/A	**ug/L**
Chlorophyll a Corrected	1.0	1.3	1.3	1.0	6.62	**ug/L**
Ammonia	< 0.073	< 0.073	< 0.073	< 0.073	0.011	**mg/L**
Nitrates/Nitrites	0.053	< 0.043	< 0.043	< 0.043	0.010	**mg/L**
Kjeldahl Nitrogen	1.09	0.926	0.913	1.10	0.875	**mg/L**
Total Nitrogen	1.150	0.930	0.910	1.100	0.805	**mg/L**
Total Phosphorus	0.077	< 0.068	< 0.068	< 0.068	0.021	**mg/L**

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	33.95
Number of Samples	47
Geometric Mean Alkalinity (mg/L $CACO_3$)	21.77
Number of Samples	19
Lake Type	Clear Alkaline
Chlorophyll a Criteria (ug/L)	20
Insufficient for Geomean Criteria then P mg/L	0.03
Insuffcient for Geomean Criteria then N mg/L	1.05
Geomean Chla Corrected ug/L (3-year)	6.25
Geomean TP mg/L (3-year)	0.041
Geomean TN mg/L (3-year)	1.016
Number of Samples (3-year)	10
Potential Impaired Chlorophyll a	Not Impaired
Potential Impaired TP	Impaired/ Inconclusive
Potential Impaired TN	Not Impaired

Conclusion

The results of the assessment of Lake Wastena shows an impaired lake based on Total Phosphorous concentrations according to the FDEP numeric nutrient criteria using the 10 available samples taken during 2020-2021. The sampling data was insufficient to calculate proper FDEP Numeric Nutrient Criteria values since no data was available in 2019 and the 2021 data were only collected in May-August.

Consistent Long term sampling would be necessary to determine actual NNC values with a minimum of three samples per year for the previous three years with each year having samples split among seasons. The most recent 3 samples for Total Phosphorous is inconclusive for the nutrient threshold as the minimum detection limit of the method used was not suitable. The system also shows inconclusive health in the vegetation communities according to the Lake Vegetation Index with moderate overall species (38), moderate occurrences of non-native, invasive species and few sensitive plant species with an overall LVI score of 44. The assessment also revealed sparse submerged aquatic vegetation community comprising four species occupying 2.10% of the surface area and 0.05% of the volume of Lake Wastena.