Lake Williams

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

David Eilers, Ray Dominguez | USF Water Institute | May 28, 2020

Methods

STUDY AREA ANALYISIS

The watershed containing the Lake Williams was analyzed using ESRI ArcGIS 10.6. Using this software with 2020 Hillsborough County aerial, 2014 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 one. In the Florida framework, the maximum LDI index score is approximately 42."

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. 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.

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[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, E Coli, 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 Williams is located in north-western Hillsborough County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Lake Williams is dominated by Residential (64.1%) and Natural (27.5) land uses. The resulting LDI value for the 100 meter buffer around Lake Williams is 4.79.

FIGURE 1: 2020 LAKE WILLIAMS ASSESSMENT STUDY AREA MAP
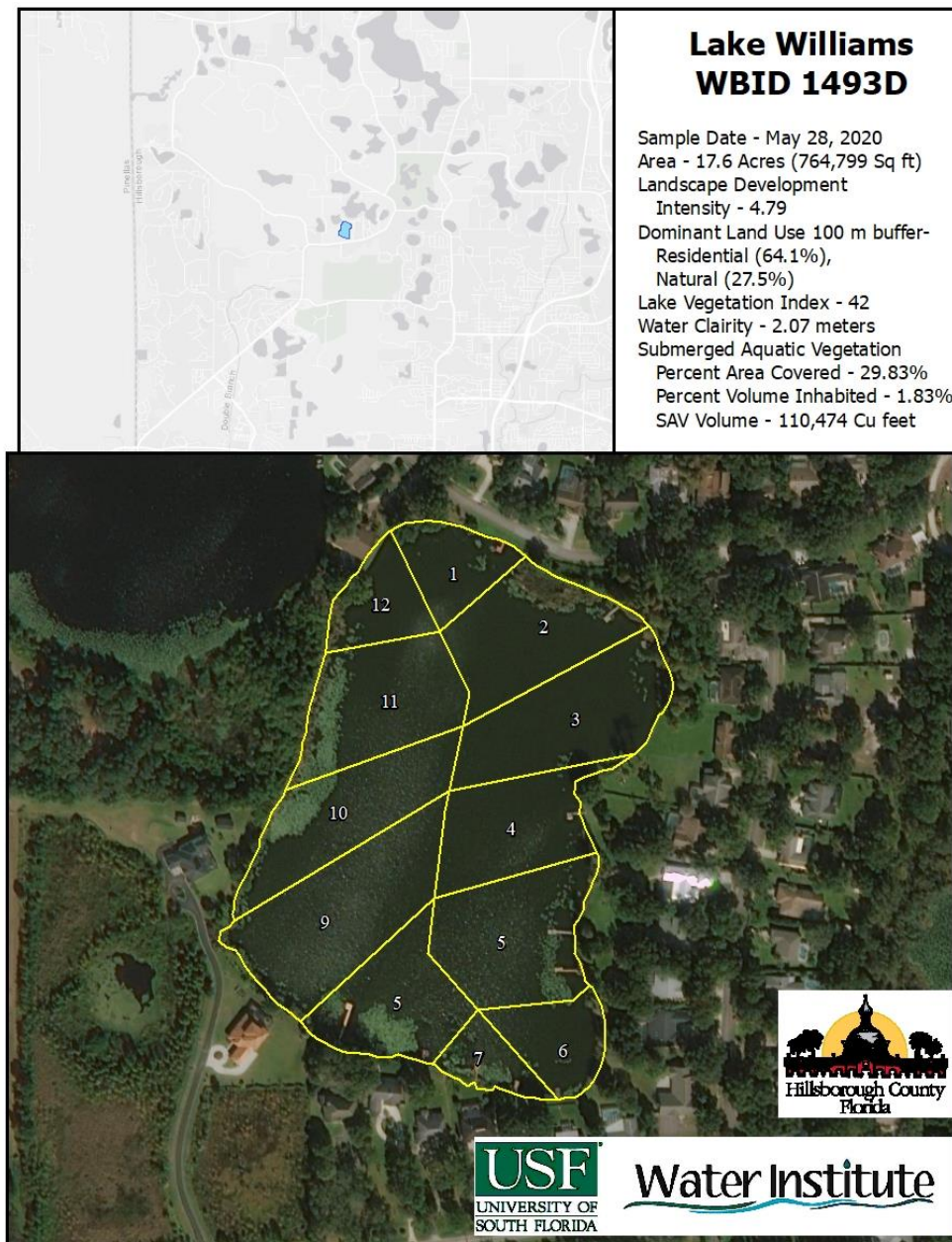
Lake Bathymetry and Morphological Characterization

At the time of the assessment, Lake Williams was experiencing elevated water levels however no water elevation gauge was available resulting in a 17.6 acre water body. Lake Williams at the time of the assessment had a mean water depth of 7.9 feet and a maximum observed depth of 18.03 feet. The volume at this time was approximately 45,110,867 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Williams from data collected on May 28, 2020. The collected data has been overlain the 2020 Hillsborough County aerials.

Table 1: Morphological Calculations for Lake Williams

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	766,731	71,231	17.6		
Mean Depth	7.9	2.40			
Maximum Depth	18.03	5.5			
Volume (cubic)	6,030,404	170,760		138.4	45,110,867
Gauge (NAVD 88)	Unknown				

Figure 2: 2019 1-Foot Bathymetric Contour Map for Lake Williams

Lake Williams

Depth (Feet)

18 - 19	9 - 10
17 - 18	8 - 9
16 - 17	7 - 8
15 - 16	6 - 7
14 - 15	5 - 6
13 - 14	4 - 5
12 - 13	3 - 4
11 - 12	2 - 3
10 - 11	1 - 2
	0 - 1

EXPLANATION:
Survey Date: May 28, 2020
Water level was unknown
at the time of the assessment.
Contours are expressed in absolute
depth below this level.

LAKE MORPHOLOGY:
Perimeter 3,576ft;
Area 17.6 Acres;
   (766,731 Sqft)
Mean Depth 7.9 ft;
Volume 138.4 Acre-ft,
   (45,110,867 gallons);
Deepest point 18.03ft

DATA SOURCES:
2020 aerial photography provided by
ESRI.
Lake perimeter digitized from Hillsborough
County 2020 aerial photographs.
All contours generated by the USF Water
Institute from survey data collected by
USF Water Institute Lake and Stream

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

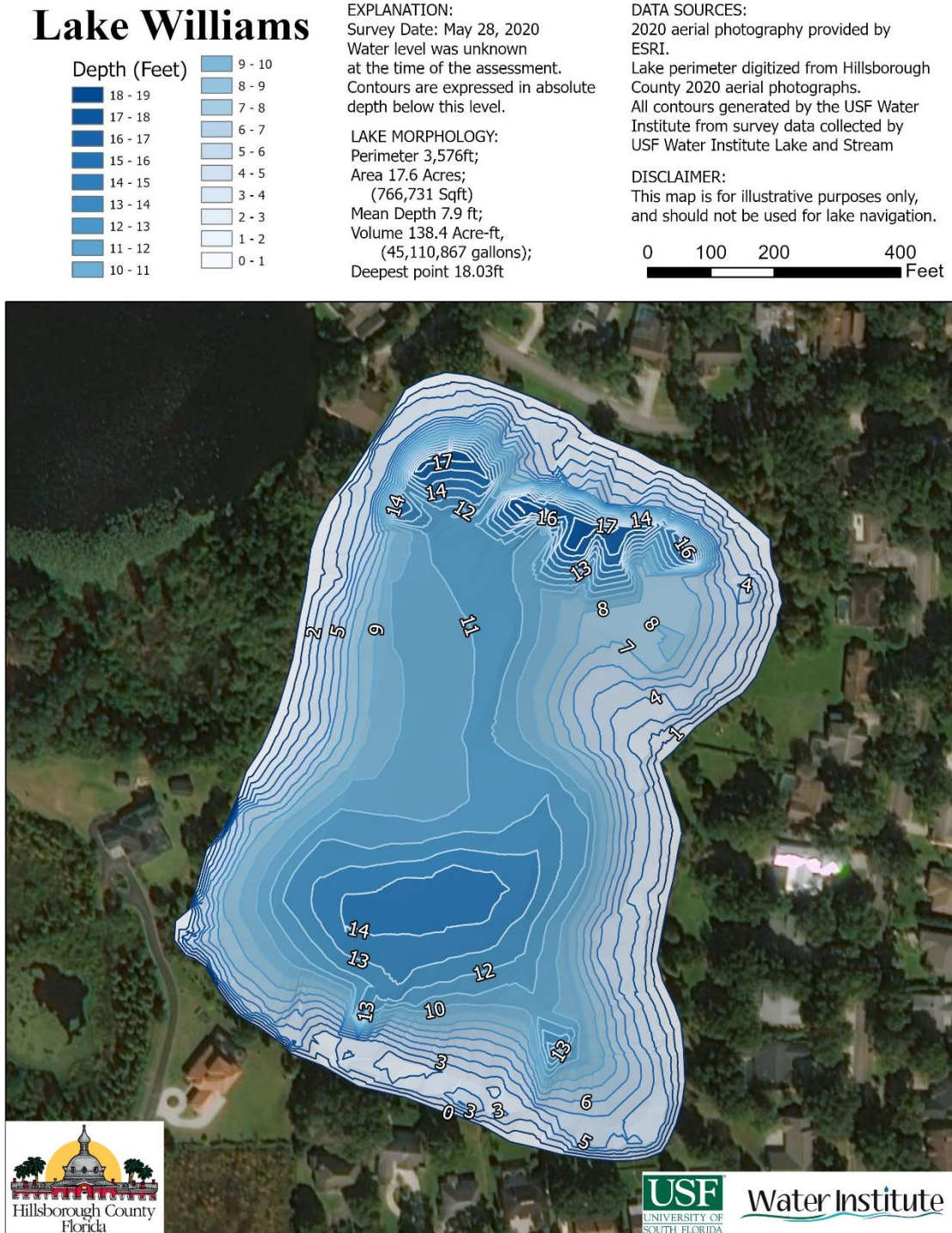0   100   200   400
Feet

Figure 3 Overview photograph of Lake Williams showing typical shoreline in the residential section of the lake.

Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for Lake Williams was conducted on May 28, 2020. The water in Lake Williams was characterized as clear and slightly turbid with a color value of 27.4 PCU. The secchi disk depth was 2.07 meters in part due to the high tannins and turbidity. The vegetation quality of the plants in and buffering Lake Williams are predominantly native species with moderate growths of non-native nuisance species such as *Schinus terebinthifolius, Panicum repens and Oxycaryum cubense*. Most stormwater reaches the lake via sheet flow. The bottom substrate quality was dominated by sand with coarse particulate organic matter near shore and some accumulation of muck. Approximately 64.1% of the surrounding land has been developed for residential housing including several docks. Some homeowners have maintained a vegetated buffer zone along the shoreline.

Figure 4 Typha, Cattails, along a vegetated section of Lake Williams shoreline.

The Lake Vegetation Index identified 33 species of wetland vegetation growing in the four selected sections along Lake Williams. The majority of these species (26) are native species. The remaining 7 species (*Panicum repens*, *Alternanthera philoxeroides, Eichhornia crassipes, Oxyaryum cubense, Schinus terebinthifolius, Sapium sebiferum* and *Ludwigia peruviana*) are non- native and invasive to this region. The vegetation community along Lake Williams is dominated by a variety of emergent species including *Panicum repens* and *Typha*. The water's surface in Lake Williams was dominated by *Nuphar* with some *Eichhornia crassipes*. A total of 7 species of submerged aquatic vegetation were observed, *Utricularia gibba, Utricularia radiata, Nitella, Potamogeteon diversifolius, Chara, Eleocharis baldwinii and Najas guadalupensis* with *Chara* being the dominant species. Submerged vegetation was abundant in the lake due to the moderate water visibility. By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 29.76% of the surface area of Lake Williams. This submerged vegetation inhabits an estimated 1.83% of the water volume in Lake Williams. 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 Williams was 42, above the impairment threshold of 43 indicating that the vegetation community is "Disturbed". Figure 6 shows the map of Lake Williams 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.

Lake Williams

EXPLANATION:
Survey Date: May 28, 2020
Water level was unknown
at the time of the assessment.
Submerged Aquatic Vegetation was
analyzed from collected sonar data.
The height of the SAV where present
is shown in 0.25 foot increments.

DATA SOURCES:
2020 aerial photography provided by
ESRI.
Lake perimeter digitized from Hillsborough
County 2020 aerial photographs.
All contours generated by the USF Water
Institute from survey data collected by
USF Water Institute Lake and Stream
Assessment Program

SAV STATISTICS:
Area 228,153 square ft; 5.2 Acres;
(29.8% of Lake Surface Area)
Mean SAV Height 0.5 ft;
Volume 110,474 Cubic ft, (826,410 gallons);
(1.83 % of Lakes Volume)

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Figure 5 Lake Williams Submerged Aquatic Vegetation Assessment Results
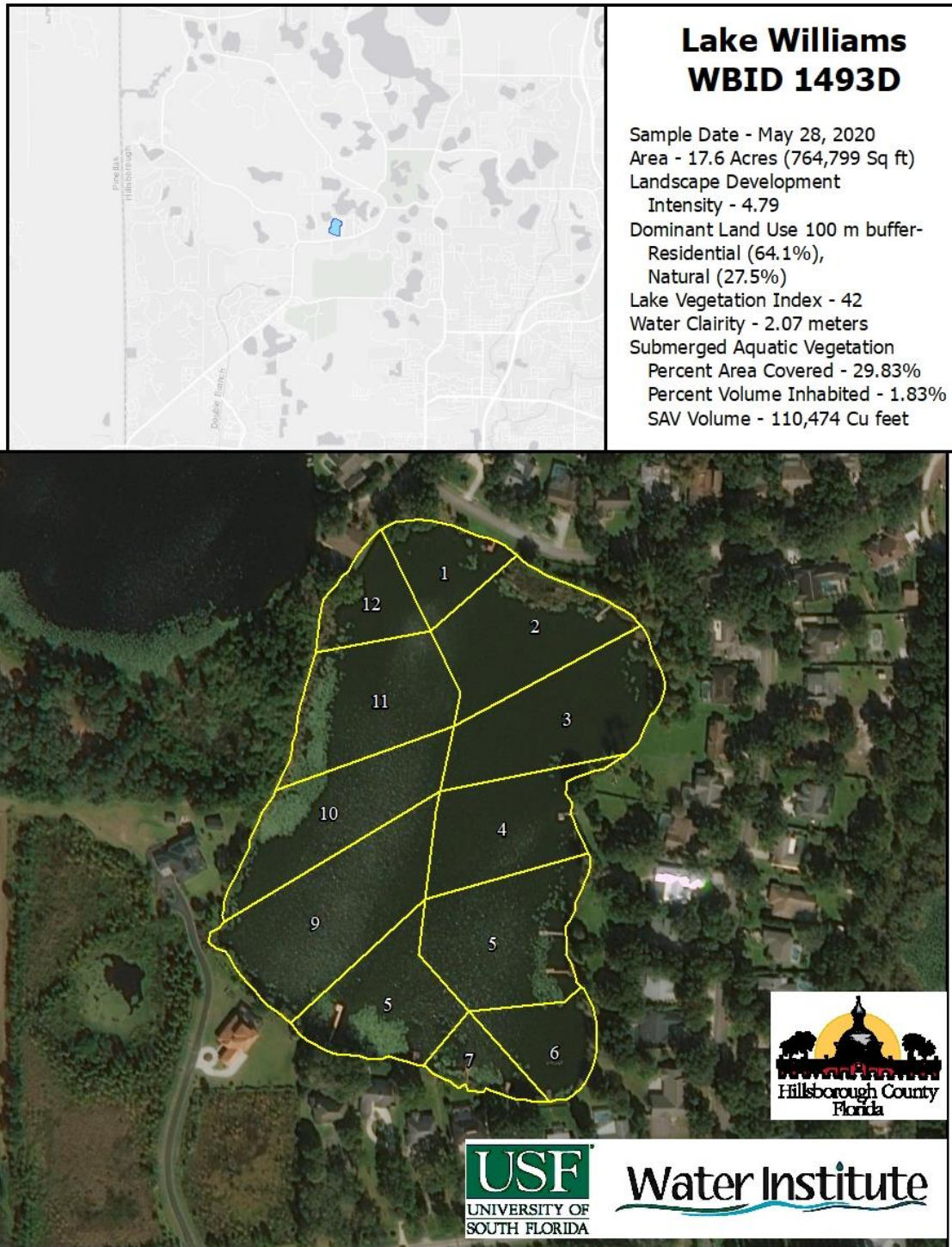
Figure 6: Lake Vegetation Index region map for Lake Williams

Table 2: Lake Vegetation Index results for Lake Williams May 28, 2020

SPECIES	CofC	Region 3	Region 6	Region 9	Region 12
Chara	3.90	D	D	1	D
Mikania scandens	1.95	1	1	1	1
Panicum repens	0.00	1	1	1	1
Typha	1.00	1	1	D	1
Alternanthera philoxeroides	0.00	1	1	1	
Eleocharis baldwinii	2.82	1		1	1
Hydrocotyle	2.00	1	1	1	
Ludwigia octovalvis	2.00		1	1	1
Najas guadalupensis	5.07	1	1	1	
Nuphar	3.50	1	1	1	
Pontederia cordata	5.38	1	1	1	
Ludwigia arcuata	3.50	1		1	
Ludwigia peruviana	0.00		1	1	
Myrica cerifera	2.00			1	1
Nitella	6.00	1			1
Oxycaryum cubense	0.50		1	1	
Taxodium	7.00	1	1		
Acer rubrum	4.65			1	
Bacopa monnieri	3.50			1	
Blechnum serrulatum	5.50	1			
Diodia virginiana	3.00	1			
Eichhornia crassipes	0.00			1	
Habenaria repens	3.50			1	
Ludwigia peploides	4.00			1	
Magnolia virginiana	7.00	1			
Persea palustris	7.00			1	
Persicaria hydropiperoides	2.50			1	
Potamogeton diversifolius	6.00	1			
Sapium sebiferum	0.00				1
Schinus terebinthifolius	0.00		1		
Thalia geniculata	6.00		1		
Utricularia gibba	6.37		1		
Utricularia radiata	6.01		1		

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Score Summary	Region			
	3	6	9	12
Total # of taxa in sampling unit	17	17	22	9
% Native taxa in sampling unit	88.23529	70.58824	77.27273	77.77778
% FLEPPC CAT 1 taxa in sampling unit	5.882353	17.64706	13.63636	22.22222
% Sensitive taxa in sample unit	11.76471	5.882353	4.545455	0
Dominant CoC in sample unit	3.9	3.9	1	3.9
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.832958	0.151342	0.40953	0.429037
Invasive FLEPPC 1 Score (1 - (x/30))=	0.803922	0.411765	0.545455	0.259259
Sensitive Score (x/(27.78 or 20)) =	0.588235	0.294118	0.227273	0
Dominant CoC Score (x/(7.91 or 7)) =	0.557143	0.557143	0.142857	0.557143
Raw Score Total = N+I+S+D =	2.782258	1.414367	1.325114	1.245439
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.695565	0.353592	0.331279	0.31136
South				
LVI Score for sampling unit =	69.55645	35.35917	33.12786	31.13599

Water Quality Assessment

Long-term water quality data is available for Lake Williams. The available data was collected by Southwest Florida Water Management District, Florida Department of Environmental Protection and Hillsborough County (1996-2020). Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of the Lake Williams.

Table 4: Lake Williams Water Quality (Field)

Depth (m)	Temp °C	pH	DO (mg/L)	DO (%sat)	Cond (unho/cm)	Salinity (ppt)	Secchi Depth (m)
0.16	30.81	7.88	8.38	111.3	176	0.08	2.07
1.46	30.58	7.02	7.53	99.6	175.5	0.08	
2.88	28.75	6.35	2.7	34.6	173.5	0.08	
POR			4.96	53.96	188.4		

The chemical water quality analysis for Lake Williams is shown in Table 5 for the sample taken on June 2, 2019. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment as well as the available FDEP data for the previous three years. Total Phosphorous values were below the nutrient threshold for clear-acidic lakes in the west central region with sufficient data developed by FDEP of 0.03 mg/l with a value of 0.021 mg/l for the POR and below the threshold for the most recent 3 years of samples with a value of 0.024 mg/l.

Total Nitrogen values were below the nutrient threshold for clear-acidic lakes with sufficient data developed by FDEP of 0.93 mg/l with a value of 0.679 mg/l for the POR data. The Total Nitrogen value for the most recent 3 years of data was 0.716 mg/l. Chlorophyll-a corrected values are above the nutrient threshold for clear-acidic lakes developed by FDEP of 6.0 µg/l with a value of 7.9 µg/l for the period of record and 7.56 µg/l for the previous three years of data (2018 8.58 µg/l, 2019 8.69 µg/l and 2020 5.78 µg/l).

Bacteria testing showed low levels of E. Coli (1 colonies/100ml) and Enterococci (1 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 Williams Water Quality Results from 6/2/20 (Laboratory)

Parameter	Lake Williams (Center)	POR Mean Value	Units
Alkalinity		16.21	mg/LCaCO3
E Coli	1	3.1	#/100ml
Nitrates/Nitrites	0.008	0.005	mg/L
Enterococci	1	8.7	#/100 ml
Chlorophyll a	7.6	7.90	ug/L
Chlorophyll b	1	1.25	ug/L
Chlorophyll c	1	1.15	ug/L
Chlorophyll t	8.6	8.09	ug/L
Chlorophylla Corr	6.0	7.96	ug/L
Chlorophyll-pheo	2.3	3.55	ug/L
Ammonia	0.0160	0.010	mg/L
Kjeldahl Nitrogen	0.820	0.729	mg/L
Total Nitrogen	0.820	0.679	mg/L
Total Phosphorus	0.050	0.021	mg/L
Color(345)F.45		27.44	Pt/Co

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	27.4
Number of Samples	35
Geometric Mean Alkalinity (mg/L CACO3)	16.2
Number of Samples	33
Lake Type	Clear-acidic
Chlorophyll a Criteria (ug/L)	6
Sufficient for Geomean Criteria then P mg/L	0.03
Suffcient for Geomean Criteria then N mg/L	0.93
Geomean Chla Corrected ug/L	7.56
Geomean TP mg/L	0.024
Geomean TN mg/L	0.715
Number of Samples	24
Potential Impaired Chlorophyll a	Impaired
Potential Impaired TP	Not Impaired
Potential Impaired TN	Not Impaired

Conclusion

The results of the assessment of Lake Williams shows a healthy lake based on Total Nitrogen and Total Phosphorous concentrations according to the FDEP numeric nutrient criteria using the most recent three years of water quality record. Chlorophyll-a corrected values exceeded the threshold of 6 µg/l for the previous three year data (2020 data was below the threshold with a value of 5.78 µg/l).

The system also shows some impairment in the vegetation communities according to the Lake Vegetation Index with low overall species (33), moderate occurrences of non-native, invasive species and few sensitive plant species with an overall LVI score of 42. The assessment also revealed the submerged aquatic vegetation community comprising 7 species occupying 29.76% of the surface area and 1.83% of the volume of Lake Williams.