Saddleback Lake

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

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Methods

STUDY AREA ANALYISIS

The watershed containing the Saddleback Lake was analyzed using ESRI ArcGIS Pro. Using this software with 2022 ESRI 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.

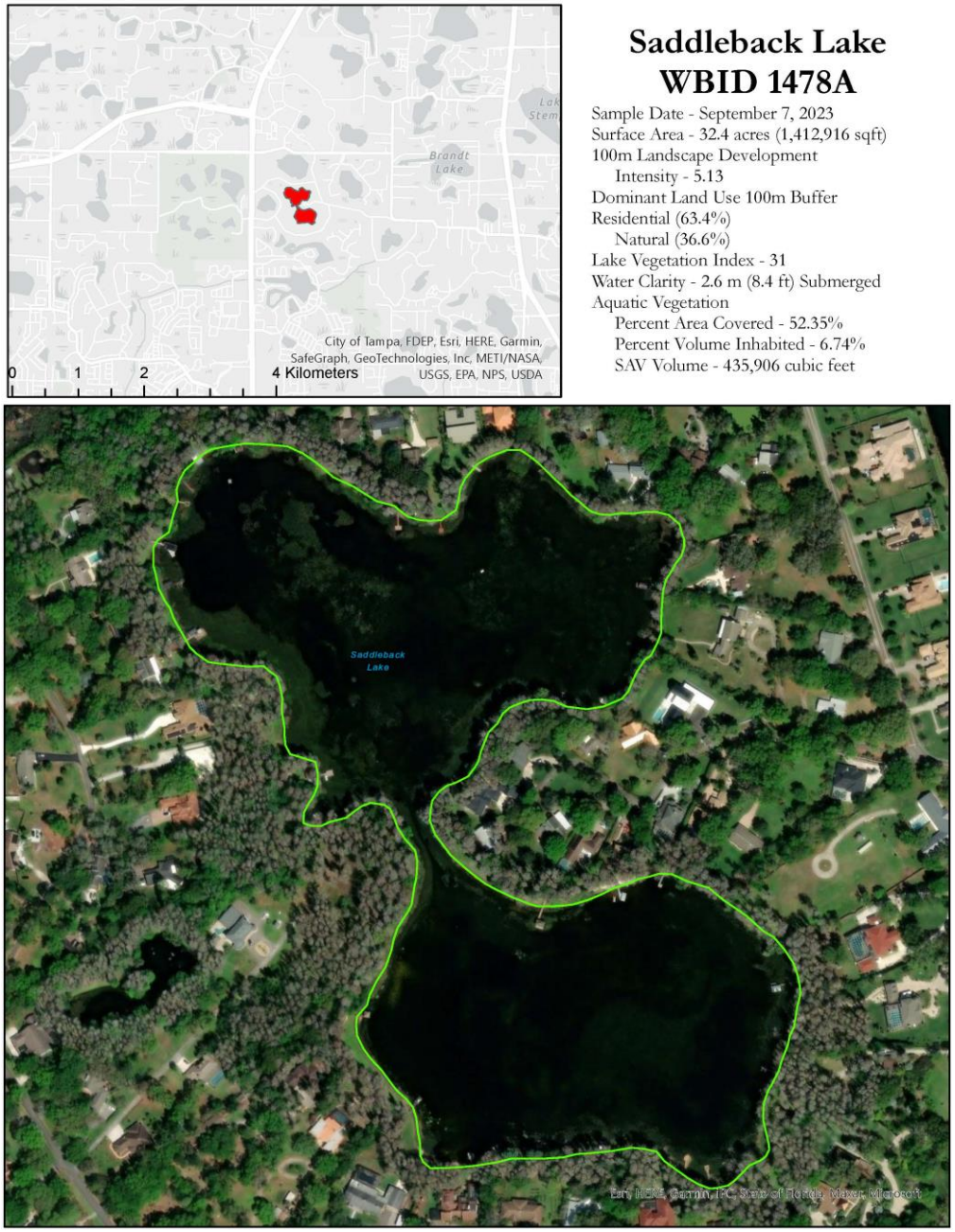
WATER QUALITY ASSESSMENT

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, 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. Due to the lack of public access to the majority of lakes in Hillsborough County, the majority of available water quality samples are from the resident volunteer LAKEWATCH program. This data is being included in the analysis of Hillsborough County lakes.

Study Area

Saddleback Lake 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 Saddleback Lake is dominated by residential (63.4%) and natural (36.6%) land uses. The resulting LDI value for the 100 meter buffer around Saddleback Lake is 5.13.

FIGURE 1: 2023 SADDLEBACK LAKE ASSESSMENT STUDY AREA MAP



Lake Bathymetry and Morphological Characterization

At the time of the assessment, Saddleback Lake was experiencing low water levels (51.35 feet NAVD88 on staff gauge) resulting in a 32.4 acre water body. Saddleback Lake at the time of the assessment had a mean water depth of 4.6 feet and a maximum observed depth of 18.61 feet. The volume at this time was approximately 48,352,308 gallons. Figure 2 shows the resulting bathymetric contour map for Saddleback Lake from data collected on September 7, 2023. The collected data has been overlain the 2022 ESRI Basemap aerials.

Table 1: Morphological Calculations for Saddleback Lake

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	1,412,916	131,263	32.4		
Mean Depth	4.6	1.39			
Maximum Depth	18.61	5.67			
Volume (cubic)	6,463,719	183,030		148.4	48,352,308
Gauge (NAVD 88)	51.35	15.65			

Figure 2: 2023 2-Foot Bathymetric Contour Map for Saddleback Lake

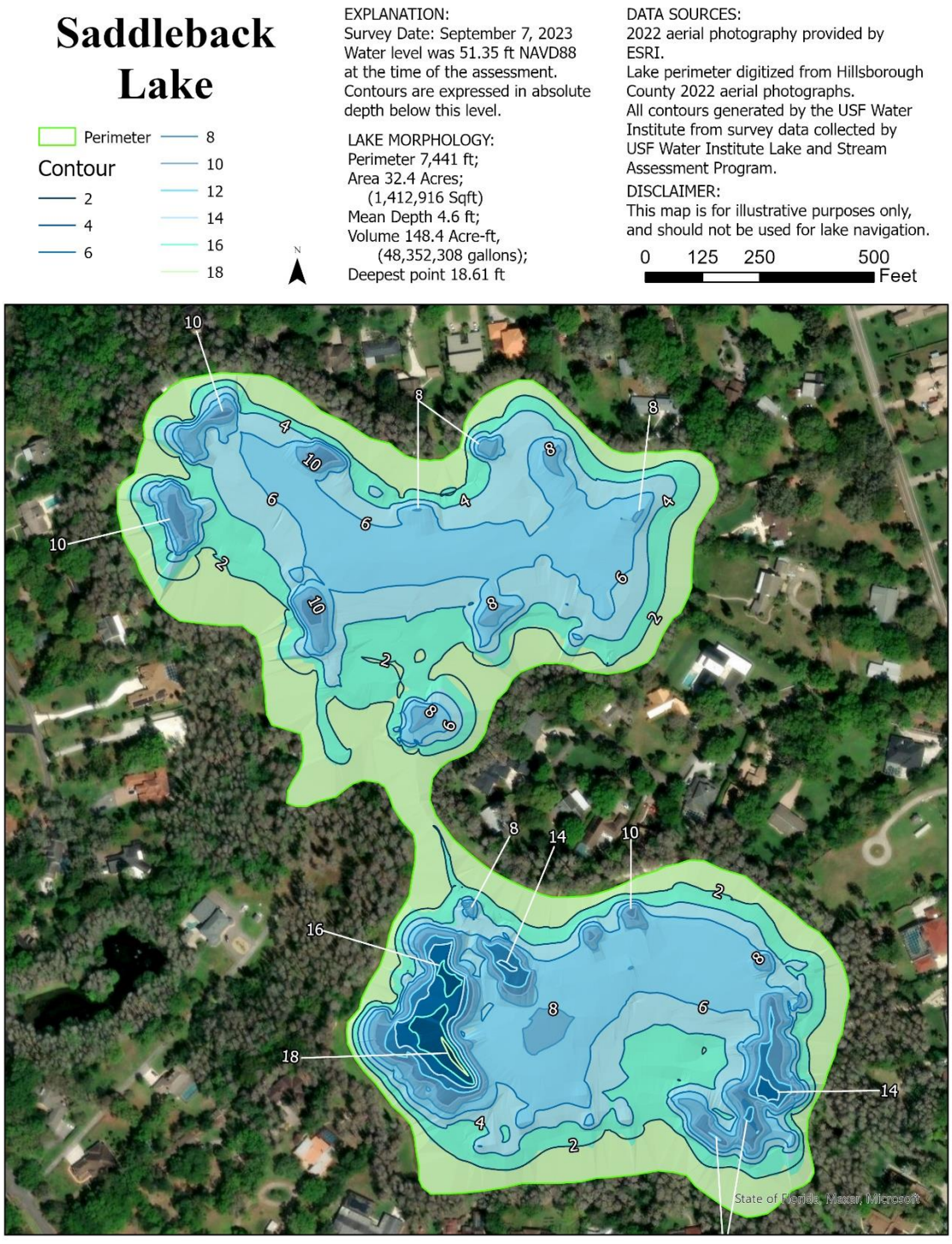


Figure 3 Overview photograph of Saddleback Lake showing the residentially developed portion of shoreline featuring a canopy of Taxodium.

Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for Saddleback Lake was conducted on September 7, 2023. The water in Saddleback Lake was characterized as tannic with moderate turbidity. The secchi disk depth was 2.56 meters allowing for an abundant submerged aquatic vegetation community. The vegetation quality of the plants in and buffering Saddleback Lake are predominantly native species with extensive growths of non-native invasive species such as *Hydrilla verticillata* and *Panicum repens.*. The percentage of non-native FLEPPC 1 species ranged from 15% (region 5) to 19% (regions 2 & 8). Stormwater reaches the lake predominately via sheet flow from surrounding residential land cover. The development along the shoreline has maintained the nearshore *Taxodium* however the shrub and native ground cover communities have largely been maintained for residential turf grasses. The bottom substrate quality was dominated by sandy/silt with coarse particulate organic matter near shore and submersed vegetation.

Figure 4 Hydrilla verticillata was dominant in all regions of the Lake Vegetation Index on Saddleback Lake

The Lake Vegetation Index identified 43 species of wetland vegetation growing in the four selected sections along Saddleback Lake. The majority of these species (35) are native species. The remaining 8 species (*shown in **bold** in Table 2*) are non- native or invasive to this region. The vegetation community along the shorelines of Saddleback Lake has been altered by lawn maintenance activities leaving a *Taxodium* canopy with a sparse shrub and ground cover community. The edges of the lake are dominated by species able to rapidly colonize following the frequent disturbance of mowing, such as *Panicum repens*. At the time of the assessment the water transparency was 2.56 m (8.4 ft). High annual average secchi disk depths allow for an extensive littoral zone with establishment of floating leaved and submerged aquatic vegetation. Six species of submersed aquatic vegetation were observed during the lake vegetation index. *Hydrilla verticillata* was the dominant species in all LVI regions. The floating leaved vegetation community had 4 species observed with both *Hydrocotyle* and *Salvinia minima* being the most commonly occurring species in the LVI regions.

By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 52.35% of the surface area of Saddleback Lake. This submerged vegetation inhabits an estimated 6.74% of the water volume in Saddleback Lake. These values are likely an underestimate of true values due to the shallow water limits of sonar for identifying and measuring the submersed vegetation community. Figure 5 shows the results of the SAV analysis indicating the location and height of SAV estimated from collected sonar readings.

The calculated LVI score for Saddleback Lake was 31, below the impairment threshold of 43 indicating the vegetation community is showing evidence of being “Impaired”. Figure 6 shows the map of Saddleback Lake detailing the LVI regions used for the assessment (Regions 2, 5, 8, 11). Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index.

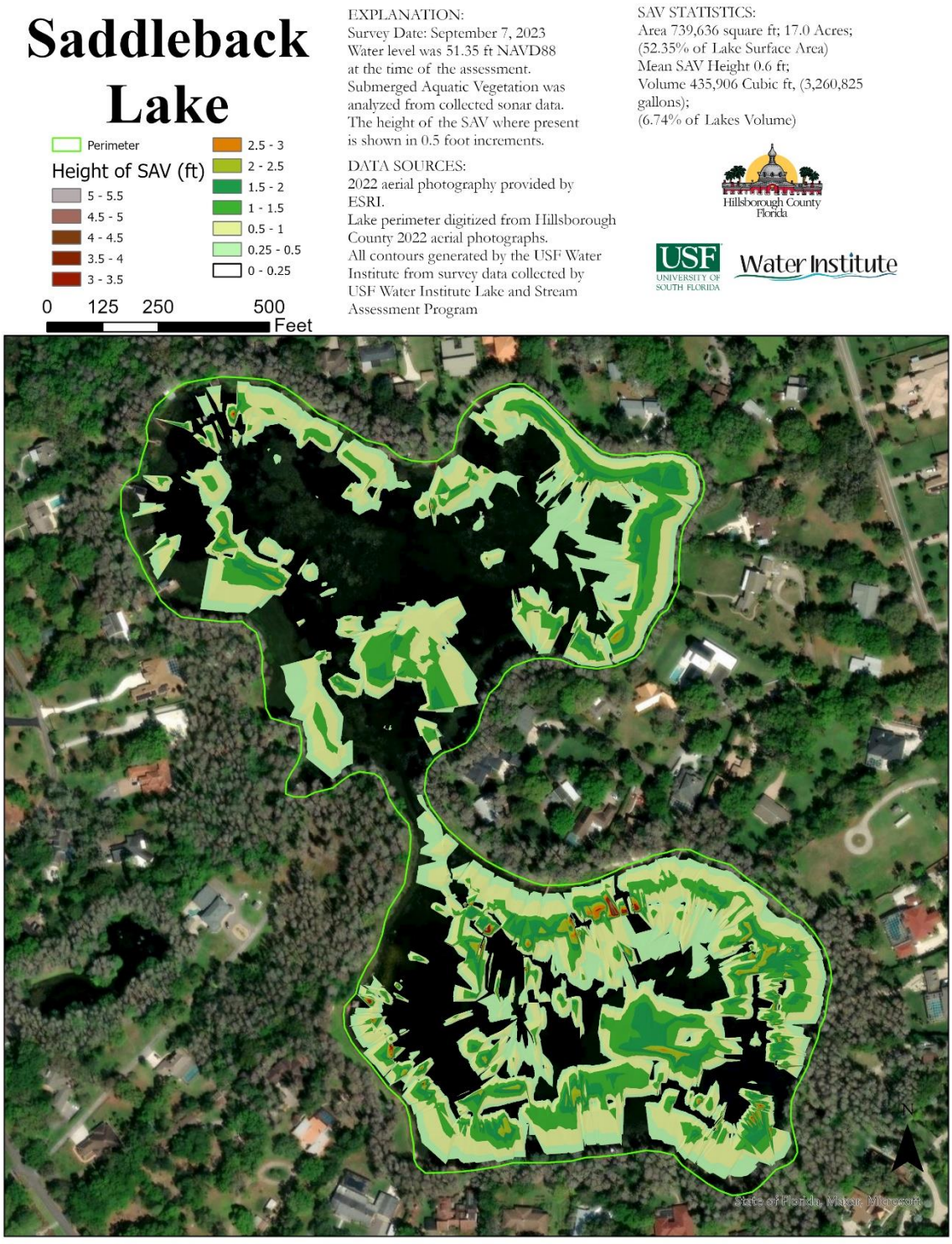


Figure 5 Saddleback Lake Submerged Aquatic Vegetation Assessment Results

Figure 6: Lake Vegetation Index region map for Saddleback Lake

Table 2: Lake Vegetation Index results for Saddleback Lake September 7, 2023. In this table, "p" represents the taxa was present in the region while "c" and "d" denotes the taxa as being co-dominant or dominant in the vegetation region.

Taxon	CofC Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					2	5	8	11	
Acer rubrum	4.65	-	FACW	Native	p	p	p	p	4
Bacopa caroliniana	4.50	-	OBL	Native	p	p	p	p	4
Chara	3.90	-	OBL	Native	p	p	p	p	4
Eleocharis baldwinii	2.82	-	OBL	Native	p	p	p	p	4
Hydrilla verticillata	0.00	Category 1	OBL	Exotic	d	d	d	d	4
Hydrocotyle	2.00	-	FACW	Native	p	p	p	p	4
Ludwigia leptocarpa	3.00	-	OBL	Native	p	p	p	p	4
Ludwigia octovalvis	2.00	-	OBL	Native	p	p	p	p	4
Micranthemum glomeratum	5.85	-	OBL	Native	p	p	p	p	4
Najas guadalupensis	5.07	-	OBL	Native	p	p	p	p	4
Sagittaria lancifolia	3.00	-	OBL	Native	p	p	p	p	4
Salvinia minima	0.00	Category 1	OBL	Exotic	p	p	p	p	4
Crinum americanum	9.00	-	OBL	Native	p	p	-	p	3
Cyperus odoratus	3.00	-	FACW	Native	p	-	p	p	3
Panicum repens	0.00	Category 1	FACW	Exotic	-	p	p	p	3
Taxodium	7.00	-	OBL	Native	p	p	p	-	3
Alternanthera philoxeroides	0.00	Category 2	OBL	Exotic	p	-	-	p	2
Canna flaccida	5.50	-	OBL	Native	p	p	-	-	2
Colocasia esculenta	0.00	Category 1	OBL	Exotic	p	-	-	p	2
Eupatorium capillifolium	0.83	-	FAC	Native	p	-	p	-	2
Nuphar	3.50	-	OBL	Native	p	-	-	p	2
Persicaria hydropiperoides	2.50	-	OBL	Native	-	-	p	p	2
Pluchea		-	FACW	Native	p	-	-	p	2
Pontederia cordata	5.38	-	OBL	Native	p	-	-	p	2
Urochloa mutica	0.00	Category 1	FACW	Exotic	p	-	-	p	2
Andropogon		-	-	Native	-	p	-	-	1
Blechnum serrulatum	5.50	-	FACW	Native	-	-	-	p	1
Boehmeria cylindrica	5.00	-	OBL	Native	p	-	-	-	1
Ceratophyllum demersum	4.16	-	OBL	Native	-	-	p	-	1
Cyperus blepharoleptos	0.00	-	OBL	Exotic	p	-	-	-	1
Cyperus polystachyos	1.56	-	FACW	Native	-	p	-	-	1
Cyperus surinamensis	2.03	-	FACW	Native	-	p	-	-	1
Eclipta prostrata	2.00	-	FACW	Native	-	-	-	p	1

Taxon	CofC Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					2	5	8	11	
Iris virginica	5.50	-	OBL	Native	-	p	-	-	1
Ludwigia arcuata	3.50	-	OBL	Native	-	-	p	-	1
Ludwigia peruviana	0.00	Category 1	OBL	Exotic	-	-	p	-	1
Melaleuca quinquenervia	0.00	Category 1	FAC	Exotic	p	-	-	-	1
Mikania scandens	1.95	-	-	Native	p	-	-	-	1
Myrica cerifera	2.00	-	FAC	Native	-	-	-	p	1
Nelumbo lutea	5.50	-	OBL	Native	-	-	-	p	1
Salix caroliniana	2.95	-	OBL	Native	-	-	-	p	1
Schoenoplectus tabernaemontani	5.55	-	OBL	Native	-	-	p	-	1
Typha	1.00	-	OBL	Native	-	-	-	p	1

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Sample Result:				31
Region	South			
Metric / Section	2	5	8	11
Total # Taxa	27	20	21	28
% Native Taxa	74%	85%	81%	79%
% FLEPPC 1 Taxa	19%	15%	19%	18%
% Sensitive Taxa	7%	10%	5%	4%
Dom Taxa Count	1	1	1	1
CofC Dom Taxa	0.00	0.00	0.00	0.00
Section LVI	26	43	29	26

Water Quality Assessment

Limited long-term water quality data is available for Saddleback Lake. The available data was collected by Lakewatch, Southwest Florida Water Management District, Florida Department of Environmental Protection and Hillsborough County Environmental Services. The available dataset has several large datagaps with no samples between 2017 and 2022. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of the Saddleback during the assessment in 2023.

Table 4: Saddleback Lake Water Quality 9/7/2023 (Field)

Meter Readings:	Depth (M)	Temp (°C)	pH (SU)	D.O (MG/L)	D.O Sat. (%)	Cond. (UMHO/CM)	Salinity (PPT)
Top:	**0.5**	**32.2**	**9.08**	**6.35**	**86.6**	**167**	**0.08**
Mid-Depth:	**1.2**	**31.8**	**9.06**	**6.22**	**84.3**	**158**	**0.08**
Bottom:	**2.4**	**31.2**	**8.78**	**5.13**	**63.2**	**158**	**0.08**

The chemical water quality analysis for Saddleback Lake is shown in Table 5 for the samples taken on 6/27/23 and 7/18/23. Table 6 includes this data in the numeric nutrient criteria framework using the limited data from this assessment and the long term dataset. The long term color data is insufficient to classify Saddleback Lake as a colored water lake (greater than or equal to 40 PCU) or a clear water lake. Total Alkalinity is also insufficient to classify the lake as soft or hard. The conductivity data indicates that the lake is likely hard with a long term conductivity mean value of 157 µmho/cm. The applicable NNC thresholds could not be calculated due to insufficient classification data (color, alkalinity).

Geometric mean Chlorophyll-a corrected, Total Nitrogen and Total Phosphorous values for the past three years could not be calculated with 0 samples in 2021, 3 samples in 2022 and 2 samples in 2023

Bacteria testing showed low levels of E. Coli (6.4 colonies/100ml) and Enterococci (3 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: Saddleback Lake 2023 Hillsborough County Environmental Services Water Quality Results (Laboratory)

Parameter	6/27/2023	7/18/2023	POR Mean Value	Units
Alkalinity	38	40.8	30.7	**mg/LCaCO3**
Color			28.5	**PCU**
E Coli	7.5	5.2	6.4	**#/100ml**
Enterococci	2.0	4.0	2.8	**#/100 ml**
Chlorophyll a	2.5	6.2	3.9	**ug/L**
Chlorophyll b	2.5	2.5	2.5	**ug/L**
Chlorophyll c	2.5	2.5	2.5	**ug/L**
Chlorophyll a Corrected	3.2	6.0	2.9	**ug/L**
Ammonia	<0.073	<0.073	0.019	**mg/L**
Nitrates/Nitrites	<0.043	<0.043	0.064	**mg/L**
Kjeldahl Nitrogen	0.756	0.532	0.543	**mg/L**
Total Nitrogen	0.760	0.530	0.533	**mg/L**
Total Phosphorus	<0.068	0.150	0.024	**mg/L**

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean Color (pcu)	insufficient
Number of Samples	6
Geometric Mean Alkalinity (mg/L $CACO_3$)	insufficient
Number of Samples	11
Lake Type	insufficient

Year (# of Samples)	Geomean Chla Corrected (µg/L)	Chlorophyll a Criteria (µg/L)	Geomean Total Phosphorous (mg/L)	Total Phosphorous Criteria (mg/L)	Geomean Total Nitrogen (mg/L)	Total Nitrogen Criteria (mg/L)
2021 (0)		Insufficient		Insufficient		Insufficient
2022 (3)	2.7	Insufficient	0.020	Insufficient	0.666	Insufficient
2023 (2)	4.4	Insufficient	0.101	Insufficient	0.635	Insufficient

Conclusion

Saddleback Lake is a predominately residential lake in the Coastal Old Tampa Bay Watershed of Hillsborough County, Florida. The results of the assessment of Saddleback Lake shows inconclusive results lake based on Chlorophyll-a, Total Nitrogen and Total Phosphorous concentrations according to the FDEP numeric nutrient criteria using a combination of Lakewatch, Southwest Florida Water Management District and Hillsborough County Environmental Services datasets due to insufficient data.

The system does show impairment in the vegetation communities according to the Lake Vegetation Index with abundant invasive species (8) and an overall LVI score of 31. The primary issues in the Lake Vegetation Index is the dominance by *Hydrilla verticillata*. The assessment also revealed a submerged aquatic vegetation community comprising 6 species occupying 52.35% of the surface area and 6.74% of the volume of Saddleback Lake.