



# Lake Grady

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

David Eilers, Karina Gonthier | USF Water Institute | August 7, 2023

# Methods

## STUDY AREA ANALYSIS

The watershed containing the Lake Grady 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 ( $\leq 2$ ) can be considered minimally disturbed.”

## LAKE BATHYMETRY AND MORPHOLOGICAL CHARACTERISTICS ASSESSMENT

The **Bathymetric Map**<sup>1</sup> 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)<sup>2</sup> 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.

---

<sup>1</sup> 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.

<sup>2</sup> WAAS is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals from 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  $\geq 7$  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

Lake Grady is located in the Hillsborough Bay Watershed in central Hillsborough County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Lake Grady is dominated by natural (57%) and residential (42%) land uses. The resulting LDI value for the 100 meter buffer around Lake Grady is 3.73.

FIGURE 1: 2023 LAKE GRADY ASSESSMENT STUDY AREA MAP



## Lake Bathymetry and Morphological Characterization

At the time of the assessment, Lake Grady was experiencing normal water levels (35.26 feet NAVD88 on staff gauge) resulting in a 138.0 acre water body. Lake Grady at the time of the assessment had a mean water depth of 4.6 feet and a maximum observed depth of 12.66 feet. The volume at this time was approximately 207,203,163 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Grady from data collected on August 7, 2023. The collected data has been overlain the 2022 ESRI Basemap aerials.

*Table 1: Morphological Calculations for Lake Grady*

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	6,010,821	558,419	138.0		
Mean Depth	4.6	1.40			
Maximum Depth	12.66	3.86			
Volume (cubic)	27,698,842	784,336		635.9	207,203,163
Gauge (NAVD 88)	35.26	10.75			



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

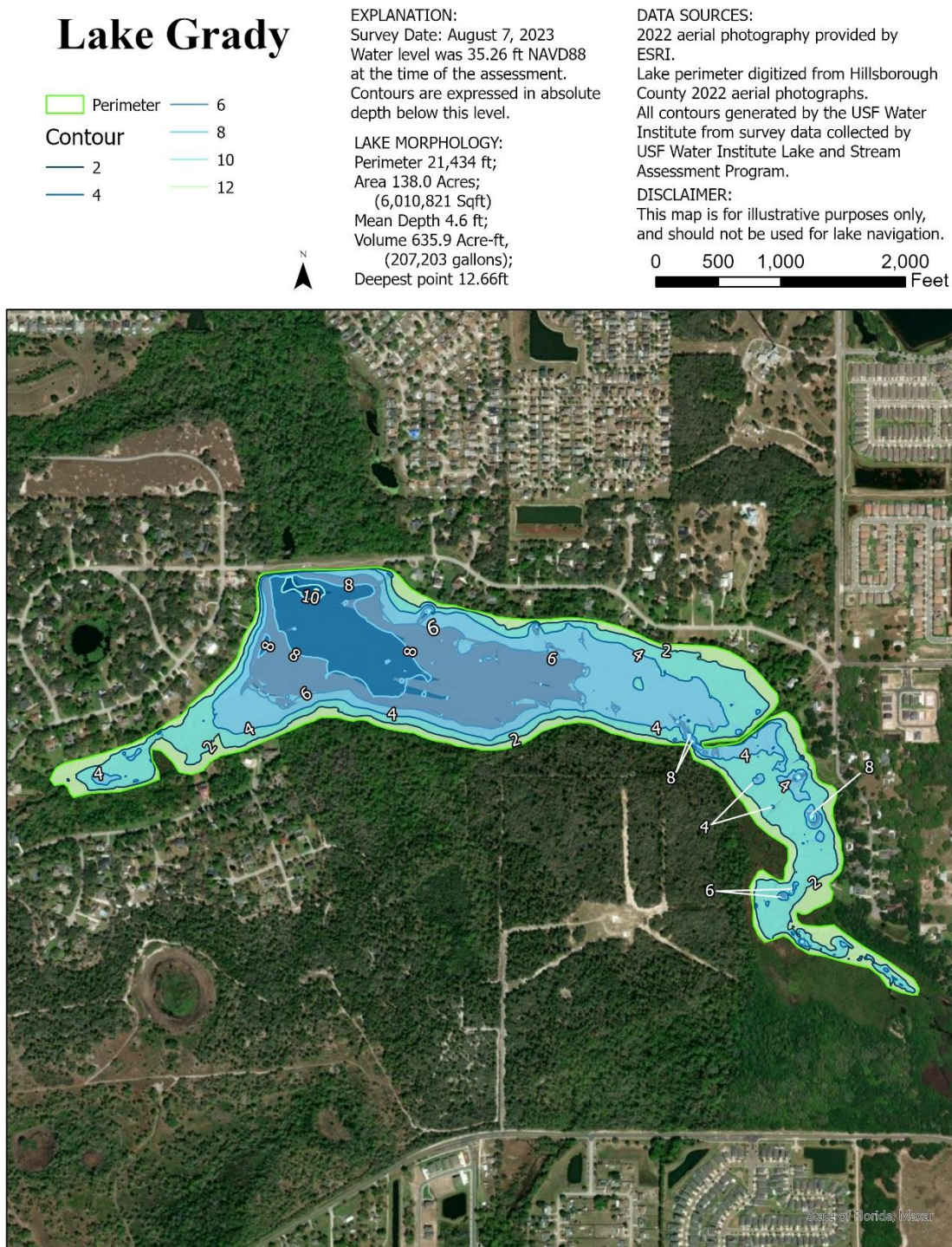




Figure 3 Overview photograph of Lake Grady showing the undeveloped portion of shoreline along region 7 of the Lake Vegetation Index.

## Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for Lake Grady was conducted on August 7, 2023. Lake Grady is an impoundment of several creeks. Pelleham Branch Creek enters Lake Grady to the west while Bell Creek enters at the eastern extent of the lake. The open water portion of Lake Grady features many relics of its prior land cover in the form of submersed trees under the water's surface. The water in Lake Grady was characterized as tannic and slightly turbid. The secchi disk depth was 0.7 meters limiting the submerged aquatic vegetation community. The vegetation quality of the plants in and buffering Lake Grady are predominantly native species with moderate growths of non-native invasive species such as *Ludwigia peruviana* and *Pistia stratiotes*. The percentage of non-native FLEPPC 1 species ranged from 17% (region 7) to 29% (region 1). Stormwater reaches the lake predominately via sheet flow from surrounding natural cover. The residential development along the northern shoreline has removed the shrub and native ground cover



communities and have largely been maintained for residential turf grasses. The bottom substrate quality was dominated by sandy/silt with coarse particulate organic matter near shore.



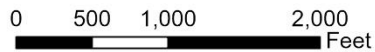
*Figure 4 Vallisneria americana, Tapegrass, was the only rooted submersed vegetation observed during the LVI. This shallow bed was observed in region 10.*

The Lake Vegetation Index identified 49 species of wetland vegetation growing in the four selected sections along Lake Grady. The majority of these species (39) are native species. The remaining 10 species (*shown in **bold** in Table 2*) are non- native or invasive to this region. The vegetation community along the shorelines of Lake Grady is predominately a nature preserve along the northern shoreline. At the time of the assessment the water transparency was 0.7 m (2.3 ft). A shallow bed in region 10 of *Vallisneria americana* was the only rooted species of submersed vegetation observed during the LVI assessment. The floating leaved vegetation community had 6 species observed with both *Pistia stratiotes* being co-dominant in all four LVI regions.

By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 0.1% of the surface area of Lake Grady. This submerged vegetation inhabits an estimated 0.01% of the water volume in Lake Grady. 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 Lake Grady was 16, below the impairment threshold of 43 indicating the vegetation community is showing evidence of being “Impaired”. Figure 6 shows the map of Lake Grady detailing the LVI regions used for the assessment (Regions 1, 4, 7, 10). Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index.

# Lake Grady



## EXPLANATION:

Survey Date: August 7, 2023  
 Water level was 35.26 ft NAVD88 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 0.5 foot increments.

## DATA SOURCES:

2022 aerial photography provided by ESRI.  
 Lake perimeter digitized from Hillsborough County 2022 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 6,226 square ft; 0.1 Acres;  
 (0.1% of Lake Surface Area)  
 Mean SAV Height 0.4 ft;  
 Volume 2,738 Cubic ft, (20,482 gallons);  
 (0.01% of Lakes Volume)



Water Institute



Figure 5 Lake Grady Submerged Aquatic Vegetation Assessment Results



# Lake Grady WBID 1669

- Lake Vegetation Index Points
- Lake Grady LVI Regions

0 125 250 500 Meters

Sample Date - August 7, 2023  
Regions Assessed - 1, 4, 7, 10  
Dominant Species per Region -  
1 - *Ludwigia peruviana*,  
*Pistia stratiotes*  
4 - *Ludwigia peruviana*,  
*Pistia stratiotes*  
7 - *Urochloa mutica*,  
*Pistia stratiotes*  
10 - *Alternanthera philoxeroides*,  
*Pistia stratiotes*

Lake Description  
Water Clarity - 0.7m (2.3ft)  
Color - Slightly Turbid, Tannic  
Sediment Types - Sandy/Silt, CPOM,  
Lake Vegetation Index - 16

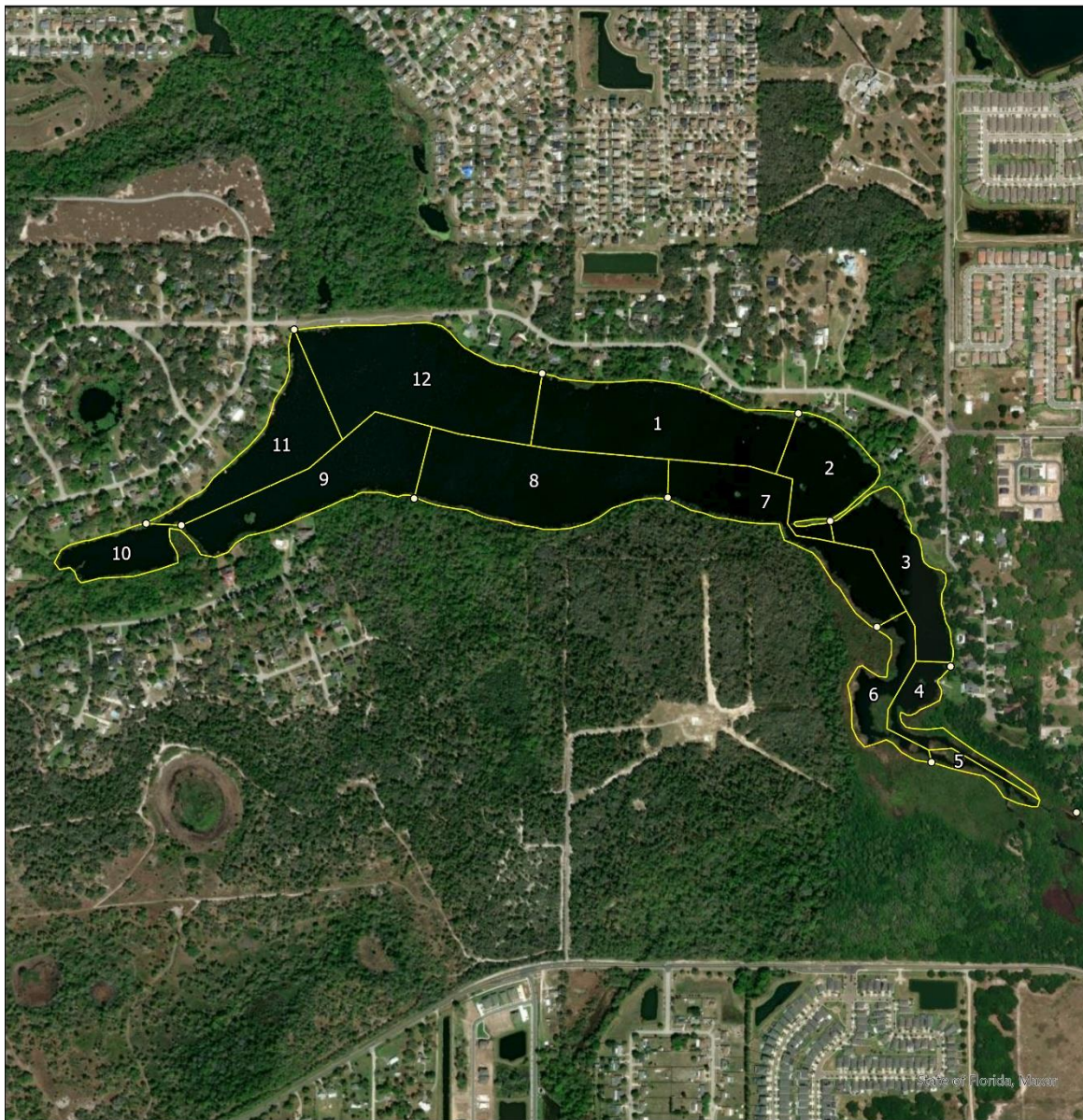


Figure 6: Lake Vegetation Index region map for Lake Grady

Table 2: Lake Vegetation Index results for Lake Grady August 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
					1	4	7	10	
<i>Acer rubrum</i>	4.65	-	FACW	Native	p	p	p	p	4
<b><i>Alternanthera philoxeroides</i></b>	0.00	Category 2	OBL	Exotic	p	p	p	c	4
<b><i>Cyperus blepharoleptos</i></b>	0.00	-	OBL	Exotic	p	p	p	p	4
<b><i>Eichhornia crassipes</i></b>	0.00	Category 1	OBL	Exotic	p	p	p	p	4
<i>Lemna</i>	1.00	-	OBL	Native	p	p	p	p	4
<i>Ludwigia leptocarpa</i>	3.00	-	OBL	Native	p	p	p	p	4
<b><i>Ludwigia peruviana</i></b>	0.00	Category 1	OBL	Exotic	c	c	p	p	4
<i>Myrica cerifera</i>	2.00	-	FAC	Native	p	p	p	p	4
<b><i>Pistia stratiotes</i></b>	0.00	Category 1	OBL	Exotic	c	c	c	c	4
<i>Salix caroliniana</i>	2.95	-	OBL	Native	p	p	p	p	4
<i>Typha</i>	1.00	-	OBL	Native	p	p	p	p	4
<b><i>Urochloa mutica</i></b>	0.00	Category 1	FACW	Exotic	p	p	c	p	4
<i>Azolla filiculoides</i>	1.81	-	OBL	Native	-	p	p	p	3
<i>Cephalanthus occidentalis</i>	5.00	-	OBL	Native	p	-	p	p	3
<b><i>Colocasia esculenta</i></b>	0.00	Category 1	OBL	Exotic	p	-	p	p	3
<i>Hydrocotyle</i>	2.00	-	FACW	Native	-	p	p	p	3
<i>Persicaria hydropiperoides</i>	2.50	-	OBL	Native	p	-	p	p	3
<i>Quercus nigra</i>	2.50	-	FACW	Native	p	-	p	p	3
<b><i>Salvinia minima</i></b>	0.00	Category 1	OBL	Exotic	p	p	-	p	3
<i>Vitis rotundifolia</i>	1.18	-	-	Native	p	-	p	p	3
<i>Baccharis</i>		-	-	Native	p	-	p	-	2
<i>Bacopa monnieri</i>	3.50	-	OBL	Native	-	p	p	-	2
<i>Gordonia lasianthus</i>	7.00	-	FACW	Native	-	p	p	-	2
<i>Ludwigia octovalvis</i>	2.00	-	OBL	Native	-	p	-	p	2

Taxon	CofC Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					1	4	7	10	
<i>Nuphar</i>	3.50	-	OBL	Native	p	-	-	p	2
<b><i>Panicum repens</i></b>	0.00	Category 1	FACW	Exotic	p	-	-	p	2
<i>Persea</i>		-	-	Native	p	-	p	-	2
<i>Sacciolepis striata</i>	5.35	-	OBL	Native	-	-	p	p	2
<i>Thelypteris palustris pubescens</i>	5.31	-	FACW	Native	-	p	p	-	2
<i>Woodwardia virginica</i>	3.50	-	FACW	Native	-	-	p	p	2
<i>Cyperus odoratus</i>	3.00	-	FACW	Native	-	-	-	p	1
<i>Diodia virginiana</i>	3.00	-	FACW	Native	-	-	p	-	1
<b><i>Echinochloa crusgalli</i></b>	0.22	-	FACW	Exotic	-	-	-	p	1
<i>Eclipta prostrata</i>	2.00	-	FACW	Native	-	p	-	-	1
<i>Eleocharis baldwinii</i>	2.82	-	OBL	Native	-	-	-	p	1
<i>Ilex cassine</i>	6.00	-	OBL	Native	-	-	p	-	1
<i>Liquidambar styraciflua</i>	2.50	-	FACW	Native	-	-	p	-	1
<b><i>Ludwigia grandiflora</i></b>	0.00	-	OBL	Exotic	-	p	-	-	1
<i>Magnolia virginiana</i>	7.00	-	OBL	Native	-	-	-	p	1
<i>Mikania scandens</i>	1.95	-	-	Native	-	p	-	-	1
<i>Najas guadalupensis</i>	5.07	-	OBL	Native	-	-	-	p	1
<i>Panicum hemitomon</i>	5.82	-	OBL	Native	-	p	-	-	1
<i>Pontederia cordata</i>	5.38	-	OBL	Native	-	p	-	-	1
<i>Sabal palmetto</i>	2.85	-	FAC	Native	p	-	-	-	1
<i>Sesbania herbacea</i>	1.00	-	FAC	Native	-	-	-	p	1
<i>Symphyotrichum carolinianum</i>	3.93	-	OBL	Native	-	-	p	-	1
<i>Taxodium</i>	7.00	-	OBL	Native	p	-	-	-	1
<i>Utricularia gibba</i>	6.37	-	OBL	Native	-	p	-	-	1
<i>Vallisneria americana</i>	7.00	-	OBL	Native	-	-	-	p	1



Table 3: Scoring Summary for the Lake Vegetation Index

<b>LVI Sample Result: 16</b>				
<b>Region</b>		<b>South</b>		
<b>Metric / Section</b>	<b>1</b>	<b>4</b>	<b>7</b>	<b>10</b>
<b>Total # Taxa</b>	24	25	30	32
<b>% Native Taxa</b>	63%	68%	77%	69%
<b>% FLEPPC 1 Taxa</b>	29%	20%	17%	22%
<b>% Sensitive Taxa</b>	4%	4%	3%	6%
<b>Dom Taxa Count</b>	2	2	2	2
<b>CofC Dom Taxa</b>	0.00	0.00	0.00	0.00
<b>Section LVI</b>	6	15	25	17

## Water Quality Assessment

Limited long-term water quality data is available for Lake Grady. The available data was collected by Lakewatch, Florida Department of Environmental Protection and Hillsborough County Environmental Services. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of the Lake Grady during the assessment in 2023.

*Table 4: Lake Grady Water Quality 8/7/2023 (Field)*

<b>Meter</b>	Depth	Temp	pH	D.O	D.O Sat.	Cond.	Salinity
<b>Readings:</b>	(M)	(°C)	(SU)	(MG/L)	(%)	(UMHO/CM)	(PPT)
Top:	0.26	30.8	6.7	5.34	67	120	0.06
Mid-Depth:	1.99	30.7	6.56	5.17	64.8	120	0.06
Bottom:	3.68	30.4	6.48	0.24	3	250	0.12

The chemical water quality analysis for Lake Grady is shown in Table 5 for the samples taken on 6/22/23 and 7/19/23. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment. The long term color data have a geometric mean value of 108.7 PCU, classifying it as a colored water lake (greater than or equal to 40 PCU). Total Alkalinity period of record geometric mean value is 23.5 mg/L. The NNC thresholds for a colored lake with insufficient data to calculate NNC (Previous three years with at least 4 samples per year in separate seasons) in the west central nutrient region are 20 µg/L for Chlorophyll-a Corrected for Phaeophytin, 0.49 mg/L for Total Phosphorous and 1.65 mg/L for Total Nitrogen.

Geometric mean Chlorophyll-a corrected values are only available for 2023 with a value of 22.6 µg/L, above the threshold of 20 µg/L. Similarly, only 2023 data was available for Total Phosphorous (0.143 mg/L) and Total Nitrogen (0.799 mg/L). Both of these values are below the thresholds

Bacteria testing showed low levels of E. Coli (2.68 colonies/100ml) and Enterococci (22.2 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 Grady 2023 Hillsborough County Environmental Services Water Quality Results (Laboratory)*

<b>Parameter</b>	<b>6/22/2023</b>	<b>7/19/2023</b>	<b>POR Mean Value</b>	<b>Units</b>
<b>Alkalinity</b>	24.8	27.4	23.5	<b>mg/LCaCO<sub>3</sub></b>
<b>Color</b>			108.7	<b>PCU</b>
<b>E Coli</b>	7.2	1.0	18.1	<b>#/100ml</b>
<b>Enterococci</b>	41.4	11.9	20.0	<b>#/100 ml</b>
<b>Chlorophyll a</b>	27	57	24.7	<b>ug/L</b>
<b>Chlorophyll b</b>	3	2.5	2.36	<b>ug/L</b>
<b>Chlorophyll c</b>	3.5	2.5	1.0	<b>ug/L</b>
<b>Chlorophyll a Corrected</b>	26	48	21.1	<b>ug/L</b>
<b>Ammonia</b>	0.073	0.073	0.014	<b>mg/L</b>
<b>Nitrates/Nitrites</b>	0.043	0.043	0.019	<b>mg/L</b>
<b>Kjeldahl Nitrogen</b>	1.180	1.140	0.859	<b>mg/L</b>
<b>Total Nitrogen</b>	1.180	1.140	0.778	<b>mg/L</b>
<b>Total Phosphorus</b>	0.18	0.15	0.268	<b>mg/L</b>



Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean Color (pcu)	108.7
Number of Samples	10
Geometric Mean Alkalinity (mg/L CaCO <sub>3</sub> )	23.5
Number of Samples	4
Lake Type	Colored

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)		< 20		< 0.49		< 1.65
2022 (0)		< 20		< 0.49		< 1.65
2023 (8)	22.6	< 20	0.268	< 0.49	0.799	< 1.65

## Conclusion

Lake Grady is impounded lake in the Hillsborough Bay Watershed of Hillsborough County, Florida. The results of the assessment of Lake Grady shows impairment based on Chlorophyll-a concentrations according to the FDEP numeric nutrient criteria using a combination of Lakewatch and Hillsborough County Environmental Services datasets for 2023. Data insufficiencies eliminate the ability to calculate numeric nutrient criteria for Lake Grady.

The system also shows impairment in the vegetation communities according to the Lake Vegetation Index with abundant invasive species (10) and a low overall LVI score of 16. The assessment also revealed a very small submerged aquatic vegetation community comprising 2 species occupying 0.1% of the surface area and 0.01% of the volume of Lake Grady.