



North Crystal Lake

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

David Eilers, A. Richardson, T. Khan | USF Water Institute | July 24, 2024

Methods

STUDY AREA ANALYSIS

The watershed containing the North Crystal Lake was analyzed using ESRI ArcGIS Pro. Using this software with 2032 ESRI Basemaps aerial, 2020 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 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 ≥ 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.

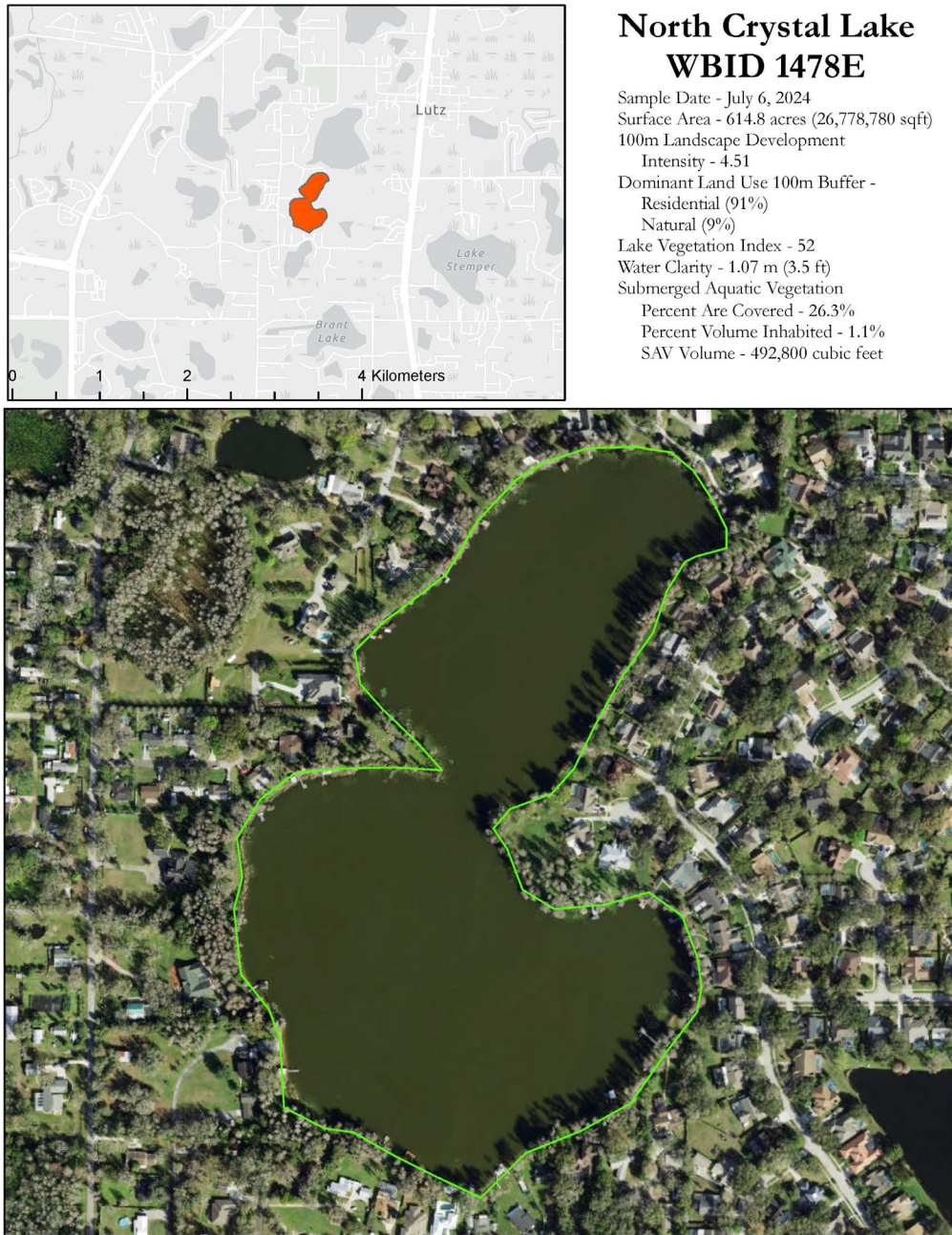
WATER QUALITY ASSESSMENT

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

North Crystal 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 North Crystal Lake is dominated by residential (91%) and natural (9%) land uses. The resulting LDI value for the 100 meter buffer around North Crystal Lake is 4.51.

FIGURE 1: 2024 NORTH CRYSTAL LAKE ASSESSMENT STUDY AREA MAP



Lake Bathymetry and Morphological Characterization

At the time of the assessment, North Crystal Lake was experiencing normal water levels (50.58 feet NAVD88 on staff gauge) resulting in a 43 acre water body. North Crystal Lake at the time of the assessment had a mean water depth of 7.8 feet and a maximum observed depth of 19.08 feet. The volume at this time was approximately 109,450,074 gallons. Figure 2 shows the resulting bathymetric contour map for North Crystal Lake from data collected on July 24, 2024. The collected data has been overlain the 2023 ESRI Basemap aerials.

Table 1: Morphological Calculations for North Crystal Lake

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	1,874,399	174,136	43		
Mean Depth	7.8	2.38			
Maximum Depth	19.08	5.82			
Volume (cubic)	14,631,245	414,307		335.9	109,450,074
Gauge (NAVD 88)	50.58	15.42			

Figure 2: 2024 2-Foot Bathymetric Contour Map for North Crystal Lake

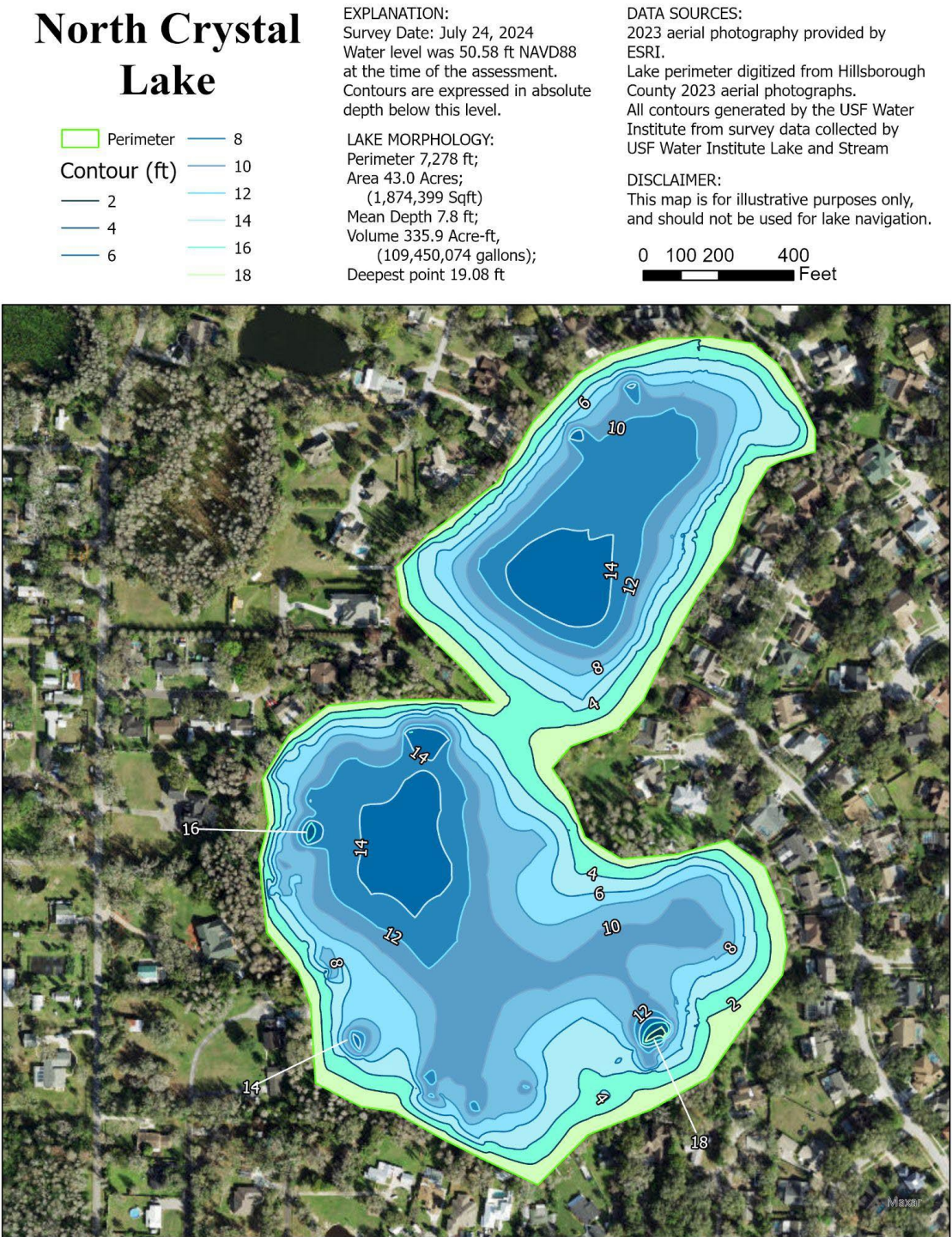




Figure 3 Overview photograph of North Crystal Lake showing Nuphar which was co-dominant in all regions

Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for North Crystal Lake was conducted on July 24, 2024. The water in North Crystal Lake was characterized as tannic, green, and turbid. The secchi disk depth was 1.07 meters allowing for some growth of submersed aquatic vegetation. The vegetation quality of the plants in and buffering North Crystal Lake are predominantly native species with moderate growth of the non-native invasive species *Panicum repens* as it was present in all regions. The percentage of non-native FLEPPC 1 species ranged from 7.69% (region 1) to 20% (region 4). Stormwater reaches the lake predominately via ditches, pipes, and cultivated vegetation and has a few BMPs. 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.

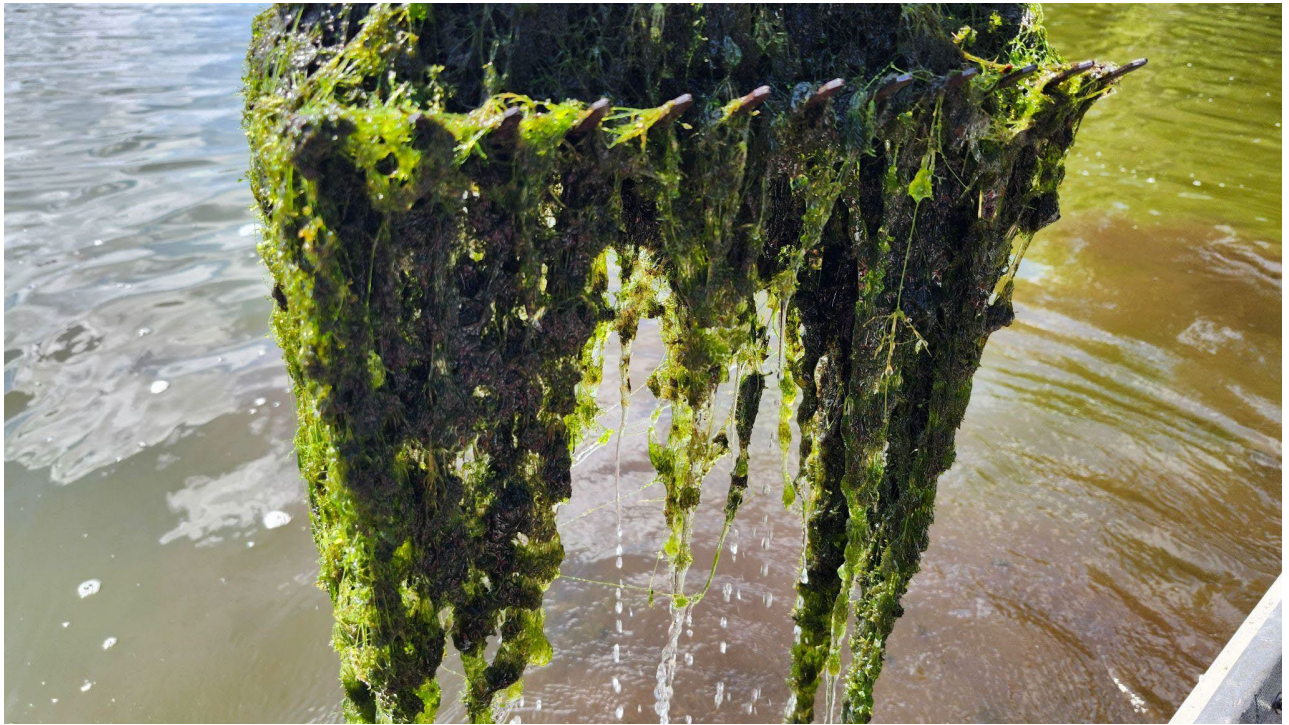


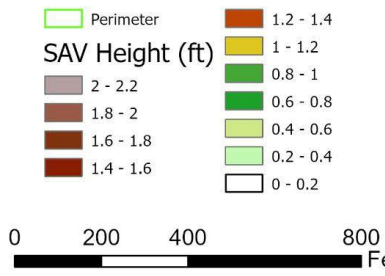
Figure 4 Nitella collected on Frotus rake, found in segments 5, 8, and 11 of North Crystal Lake but was co-dominant in segments 8 and 11

The Lake Vegetation Index identified 41 species of wetland vegetation growing in the four selected sections along North Crystal Lake. The majority of these species (33) 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 North Crystal 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 1.07 m (3.5 ft). Low annual average secchi disk depths lead to a littoral zone being dominated by floating leaved vegetation. Six species of submersed aquatic vegetation were observed during the lake vegetation index, species found to be co-dominant was *najas guadalupensis* and *Nitella*. The floating leaved vegetation community had three species observed, two of which were found in all regions viewed being *Hydrocotyle* and *Nuphar*.

By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 26.29% of the surface area of North Crystal Lake. This submerged vegetation inhabits an estimated 1.10% of the water volume in North Crystal Lake. 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 North Crystal lake was 52, above the impairment threshold of 43 indicating the vegetation community is not showing evidence of being “Impaired”. Figure 6 shows the map of North Crystal 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.

North Crystal Lake



EXPLANATION:

Survey Date: July 24, 2024
 Water level was 50.58 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 1 foot increments.

DATA SOURCES:

2023 aerial photography provided by ESRI.
 Lake perimeter digitized from Hillsborough County 2023 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 492,800 square ft; 11.3 Acres;
 (26.29% of Lake Surface Area)
 Mean SAV Height 0.3 ft;
 Volume 161,051 Cubic ft, (1,204,751 gallons);
 (1.10% of Lakes Volume)

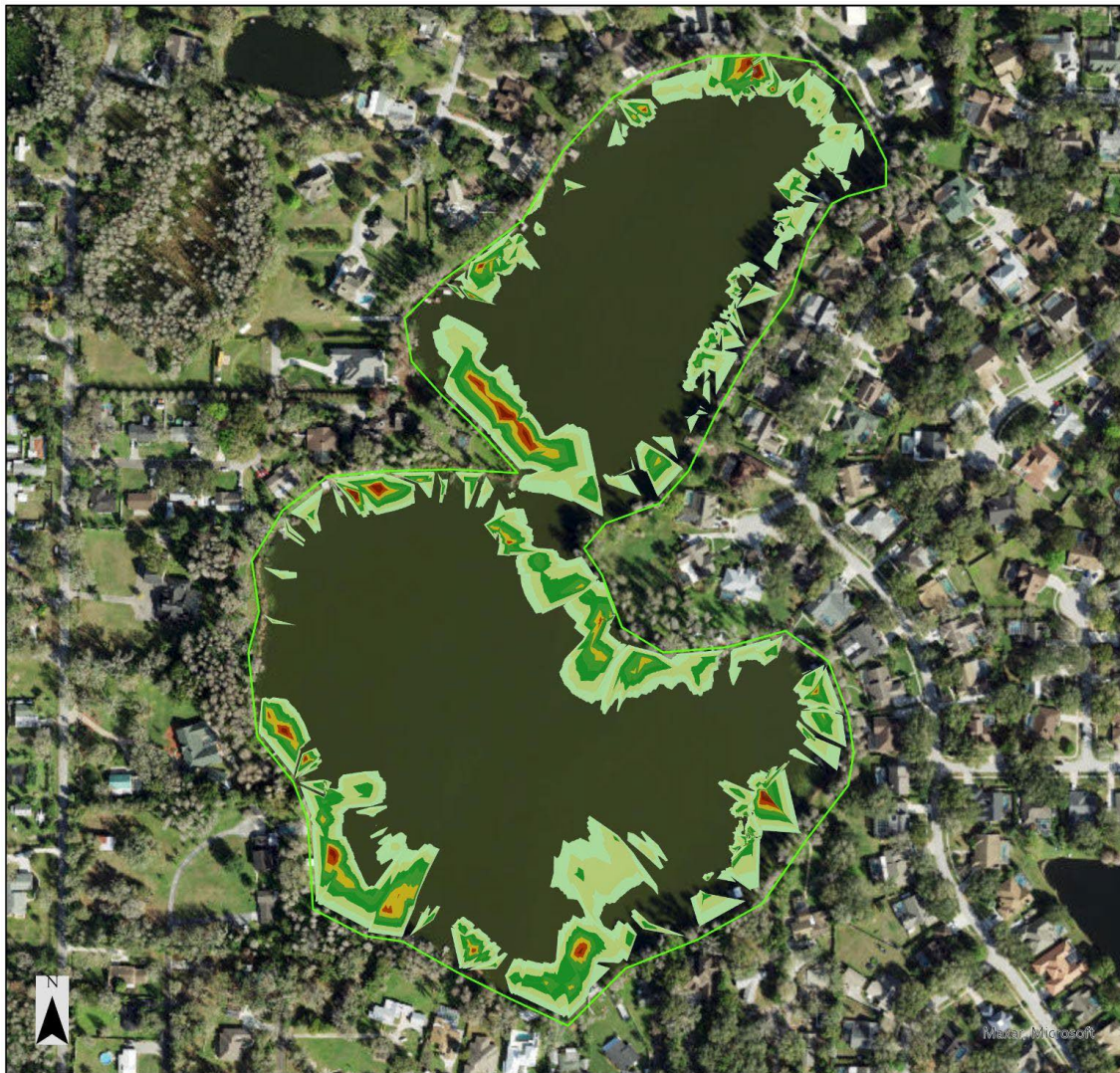


Figure 5 North Crystal Lake Submerged Aquatic Vegetation Assessment Results

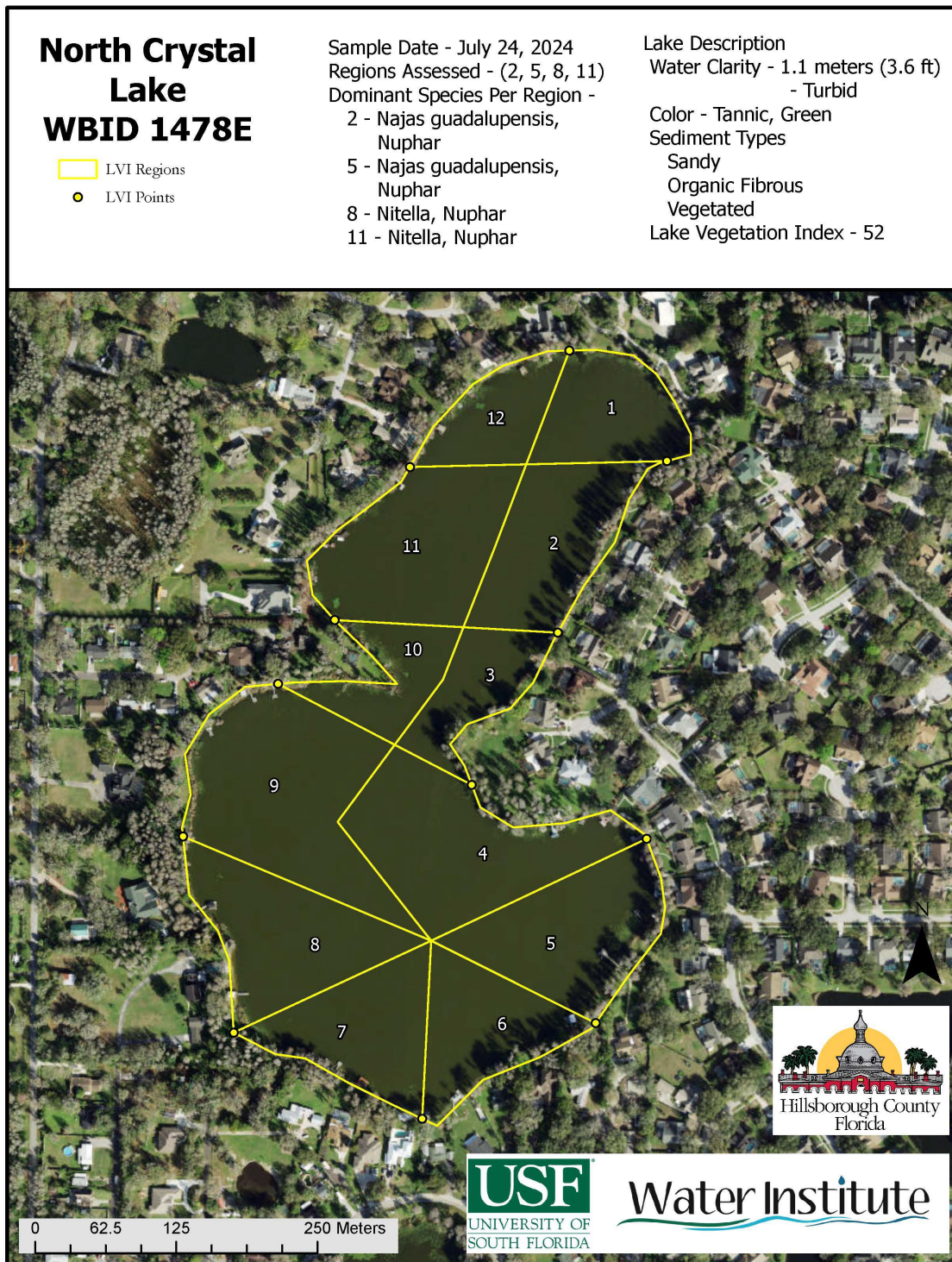


Figure 6: Lake Vegetation Index region map for North Crystal Lake

Table 2: Lake Vegetation Index results for North Crystal Lake July 24, 2024. 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	C of C Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					2	5	8	11	
<i>Acer rubrum</i>	4.65	Not Listed	FACW	Native	p	p	p		3
<i>Alternanthera philoxeroides</i>	0.00	Category 2	OBL	Exotic	p	p	p	p	4
<i>Bacopa monnieri</i>	3.50	Not Listed	OBL	Native		p			1
<i>Blechnum serrulatum</i>	5.50	Not Listed	FACW	Native	p		p		2
<i>Boehmeria cylindrica</i>	5.00	Not Listed	OBL	Native	p		p	p	3
<i>Cephalanthus occidentalis</i>	5.00	Not Listed	OBL	Native			p	p	2
<i>Chara</i>	3.90	Not Listed	OBL	Native		p			1
<i>Colocasia esculenta</i>	0.00	Category 1	OBL	Exotic			p		1
<i>Cyperus odoratus</i>	3.00	Not Listed	FACW	Native	p	p			2
<i>Cyperus polystachyos</i>	1.56	Not Listed	FACW	Native	p	p	p	p	4
<i>Eleocharis baldwinii</i>	2.82	Not Listed	OBL	Native		p	p		2
<i>Eleocharis submersa</i> <i>viviparous (species unknown)</i>	3.00	Not Listed	OBL	Native		p	p	p	3
<i>Eupatorium capillifolium</i>	0.83	Not Listed	FAC	Native	p	p	p	p	4
<i>Eupatorium compositifolium</i>	2.72	Not Listed	FAC	Native	p				1
<i>Hydrocotyle</i>	2.00	Not Listed	FACW	Native	p	p	p		3
<i>Ilex cassine</i>	6.00	Not Listed	OBL	Native			p		1
<i>Ludwigia octovalvis</i>	2.00	Not Listed	OBL	Native	p	p	p	p	4
<i>Ludwigia peruviana</i>	0.00	Category 1	OBL	Exotic	p	p	p	p	4
<i>Magnolia virginiana</i>	7.00	Not Listed	OBL	Native			p		1
<i>Melaleuca quinquenervia</i>	0.00	Category 1	FAC	Exotic			p		1
<i>Micranthemum glomeratum</i>	5.85	Not Listed	OBL	Native	p		p		2
<i>Mikania scandens</i>	1.95	Not Listed		Native	p	p	p		3
<i>Najas guadalupensis</i>	5.07	Not Listed	OBL	Native	c	c	p	p	4
<i>Nitella</i>	6.00	Not Listed	OBL	Native		p	c	c	3
<i>Nuphar</i>	3.50	Not Listed	OBL	Native	c	c	c	c	4
<i>Nymphaea odorata</i>	5.00	Not Listed	OBL	Native				p	1
<i>Panicum hemitomon</i>	5.82	Not Listed	OBL	Native		p	p		2
<i>Panicum repens</i>	0.00	Category 1	FACW	Exotic	p	p	p	p	4
<i>Persicaria hydropiperoides</i>	2.50	Not Listed	OBL	Native				p	1
<i>Pontederia cordata</i>	5.38	Not Listed	OBL	Native	p	p	p	p	4
<i>Sagittaria lancifolia</i>	3.00	Not Listed	OBL	Native	p	p	p	p	4
<i>Salix caroliniana</i>	2.95	Not Listed	OBL	Native		p			1
<i>Sapium sebiferum</i>	0.00	Category 1	FAC	Exotic			p		1
<i>Schinus terebinthifolius</i>	0.00	Category 1	FAC	Exotic			p		1
<i>Sphagneticola trilobata</i>	0.00	Category 2	FACW	Exotic	p	p		p	3

<i>Symphyotrichum carolinianum</i>	3.93	Not Listed	OBL	Native	p				1
<i>Taxodium</i>	7.00	Not Listed	OBL	Native	p	p	p	p	4
<i>Typha</i>	1.00	Not Listed	OBL	Native	p	p	p	p	4
<i>Utricularia gibba</i>	6.37	Not Listed	OBL	Native	p	p		p	3
<i>Utricularia inflata</i>	5.85	Not Listed	OBL	Native	p	p		p	3
<i>Vitis rotundifolia</i>	1.18	Not Listed		Native	p		p		2

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Sample Result: 52				
Region		South		
Metric / Section	2	5	8	11
Total # Taxa	25	26	30	21
% Native Taxa	84%	84.6%	76.7%	81%
% FLEPPC 1 Taxa	8%	7.7%	20%	9.5%
% Sensitive Taxa	4%	3.9%	6.7%	4.8%
Dom Taxa Count	2	2	2	2
CofC Dom Taxa	4.29	4.29	4.75	4.75
Section LVI	55.4	56	43.3	53.8

Water Quality Assessment

Long-term water quality data is available for North Crystal Lake. 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 North Crystal Lake during the assessment in 2024.

Table 4: North Crystal Lake Water Quality 7/24/2024 (Field)

Meter Readings:	Depth m	Temp (°C)	pH (SU)	D.O (mg/L)	D.O Sat. (%)	Cond. (µMho/cm)	Salinity (ppt)
Top:	0.5	31.6	7.1	7.7	97.9	174	0.08
Mid-Depth:	2.34	31.2	7	3.74	47.3	172.4	0.08
Bottom:	5	25.6	6.9	1.06	12.2	302.9	0.14

The chemical water quality analysis for North Crystal Lake is shown in Table 5. These values are the geometric mean value of available data for each annual period as well as the period of record. The FDEP Numeric Nutrient Criteria splits lakes into separate types based on color at 40 PCU. The “clear” water lakes below this value are further split into alkaline and acidic based on an alkalinity value of 20mg/L CaCO₃. The long term color data has a geometric mean value of 31.7 PCU, classifying it as a clear water lake (greater than or equal to 40 PCU). Total Alkalinity period of record geometric mean value is 23.4 mg/L. The NNC thresholds for a clear-alkaline lake with sufficient data to calculate NNC (Previous three years with at least 4 samples per year in separate seasons) are 20 µg/L for Chlorophyll-a Corrected for Phaeophytin, 0.03 – 0.09 mg/L for Total Phosphorous and 1.05 – 1.91 mg/L for Total Nitrogen.

Geometric mean Chlorophyll-a corrected values are below the threshold for two of the past three years with annual geometric means of 19.6 µg/L (2022), 21.8 µg/L (2023) and 17.1 µg/L (2024). The period of record geometric mean for chlorophyll-a corrected is 13.2 µg/L. Total Phosphorous geometric mean values for the most recent data were below the nutrient threshold for clear-alkaline lakes in the peninsula region with sufficient data with a value of 0.023 mg/l (2022), 0.023 mg/L (2023) and 0.041 mg/L (2024). Total Nitrogen values were below the nutrient threshold for clear-alkaline lakes with sufficient data with a value of 1.298 mg/l (2022), 1.283 mg/L (2023) and 1.135 mg/L (2024). Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment and the previous 3 years of data collected by Hillsborough County and Lakewatch.

Bacteria testing showed low levels of E. Coli (13.4 colonies/100ml) and elevated levels of Enterococci (8.2 colonies/100ml) exceeding 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: North Crystal Lake, Lakewatch and Hillsborough County Environmental Services Water Quality Results Laboratory Results

Parameter	2022	2023	2024	POR Mean Value	Units
Alkalinity	No Data	No Data	23.9	23.4	mg/LCaCO3
Color	34.9	No Data	26	31.7	PCU
E Coli	No Data	No Data	13.4	13.4	#/100ml
Enterococci	No Data	No Data	8.2	10.2	#/100 ml
Chlorophyll a	26.1	25.1	20.1	14.2	ug/L
Chlorophyll b	No Data	No Data	2.9	2.1	ug/L
Chlorophyll c	No Data	No Data	3.4	1.6	ug/L
Chlorophyll a Corrected	19.6	21.8	17.1	13.2	ug/L
Ammonia	No Data	No Data	0.073	0.073	mg/L
Nitrates/Nitrites	No Data	No Data	0.043	0.043	mg/L
Kjeldahl Nitrogen	No Data	No Data	1.283	1.283	mg/L
Total Nitrogen	1.298	1.283	1.135	1.189	mg/L
Total Phosphorus	0.023	0.023	0.041	0.024	mg/L

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean Color (pcu)	31.7
Number of Samples	33
Geometric Mean Alkalinity (mg/L CaCO ₃)	23.4
Number of Samples	9
Lake Type	Clear-Alkaline

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)
2022 (8)	19.6	< 20	0.023	< 0.09	1.298	< 1.91
2023 (9)	21.8	< 20	0.023	< 0.09	1.283	< 1.91
2024 (11)	17.1	< 20	0.041	< 0.09	1.135	< 1.91

Conclusion

North Crystal Lake is a predominately residential lake in the Coastal Old Tampa Bay Watershed of Hillsborough County, Florida. The results of the assessment of North Crystal Lake shows healthy 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.

The system doesn't show impairment in the vegetation communities according to the Lake Vegetation Index with a moderate amount of invasive species (6) and an overall LVI score of 52. The assessment also revealed a submerged aquatic vegetation community comprising 6 species occupying 26.29% of the surface area and 1.10% of the volume of North Crystal Lake.