

# Lake Sinclair

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## Methods

### Study Area Analysis

The watershed containing Lake Sinclair was analyzed using ESRI ArcGIS 10.2. Using this software with 2011 Hillsborough County aerial, 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 zero. In the Florida framework, the maximum LDI index score is approximately 42."

### Lake Bathymetry and Morphological Characteristics Assessment

The **Bathymetric Map**<sup>i</sup> provides the lake's morphologic parameters in various units. The bottom of the lake was mapped using a Lowrance HDS 5 Gen 2 Wide Area Augmentation System (WAAS)<sup>ii</sup> enabled Global Positioning System (GPS) with fathometer (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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<sup>i</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>ii</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 37.

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 Environmental Protection Commission of Hillsborough County Laboratory. Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, Fecal Coliform, 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 Sinclair is located northeast of Bearss Ave and Interstate 275 near Lutz, Florida in the Hillsborough Bay Watershed. The Landscape Development Intensity Index of the 100 meter buffer around Lake Sinclair is dominated by Medium Density Single Family Residential (69.3%), Natural Land (24.02%) and Low Density Single Family Residential (6.67%) land uses. The resulting LDI value for the 100 meter buffer around Lake Sinclair is 26.35.



Figure 1 2015 Lake Sinclair Assessment Study Area Map



## Lake Bathymetry and Morphological Characterization

Lake Sinclair is a shallow, heavily vegetated system c. At the time of the assessment, Lake Sinclair was experiencing moderately high water levels resulting in a 21.85 acre water body. Lake Sinclair at the time of the assessment had a mean water depth of 6.88 feet and a maximum observed depth of 14.0 feet. The volume at this time was approximately 49,001,925 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Sinclair from data collected on August 11, 2015. The collected data has been overlain the 2011 Hillsborough County aeriels.



Figure 2 2015 1-Foot Bathymetric Contour Map for Lake Sinclair

Table 1 Morphological Calculations for Lake Sinclair

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	951,789	88,424	21.85	0	0
Mean Depth	6.88	2.1	0	0	0
Maximum Depth	14.0	4.27	0	0	0
Volume (cubic)	6,550,559	185,491	0	150.38	49,001,925
Gauge (relative)	unknown	unknown	0	0	0

## Lake Vegetation Index Assessment



Figure 3 Overview photograph of Lake Sinclair

The lake assessment for Lake Sinclair was conducted on August 11, 2015. Lake Sinclair received a lake habitat assessment (FEDP form FD 9000-6) score of 52 due to optimal scores for Secchi Depth. Suboptimal scores were achieved for Stormwater Inputs. Marginal scores were achieved for Lakeside Adverse Human Alterations and Adverse Watershed Land Use. Bottom Substrate Quality, Upland Buffer Zone and Vegetation Quality received poor scores.





**Figure 4 Lake Sinclair had a narrow buffering zone of emergent vegetation surrounding the lake containing a mixture of native and invasive species.**

The Lake Vegetation Index identified 31 species of wetland vegetation growing in the four selected sections along Lake Sinclair. The majority of these species (22) are native species. The remaining 9 species (*Hydrilla verticillata*, *Panicum repens*, *Alternanthera philoxeroides*, *Sphagneticola trilobata*, *Salvinia minima*, *Schinus terebinthifolius*, *Pistia stratiotes*, *Landoltia punctata* and *Ludwigia peruviana*) are non-native and invasive to this region. The vegetation community along Lake Sinclair is dominated by a variety of emergent species including *Quercus laurifolia*, *Alternanthera philoxeroides* and *Ludwigia peruviana*. The water's surface in Lake Sinclair was dominated by *Salvinia minima*. The submerged vegetation community of Lake Sinclair was dominated by *Hydrilla verticillata* (Figures 5 & 6). The calculated LVI score for Lake Sinclair was 13, below the impairment threshold of 37. Figure 7 shows the map of Lake Sinclair detailing the LVI regions used for the assessment. Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index. Submerged vegetation was abundant during the assessment. By analyzing the collected sonar chart, submerged aquatic vegetation covered approximately 96% of the surface area of Lake Sinclair. This submerged vegetation inhabits an estimated 64.98% of the water volume in Lake Sinclair.



Figure 5 *Hydrilla verticillata* on Lake Sinclair

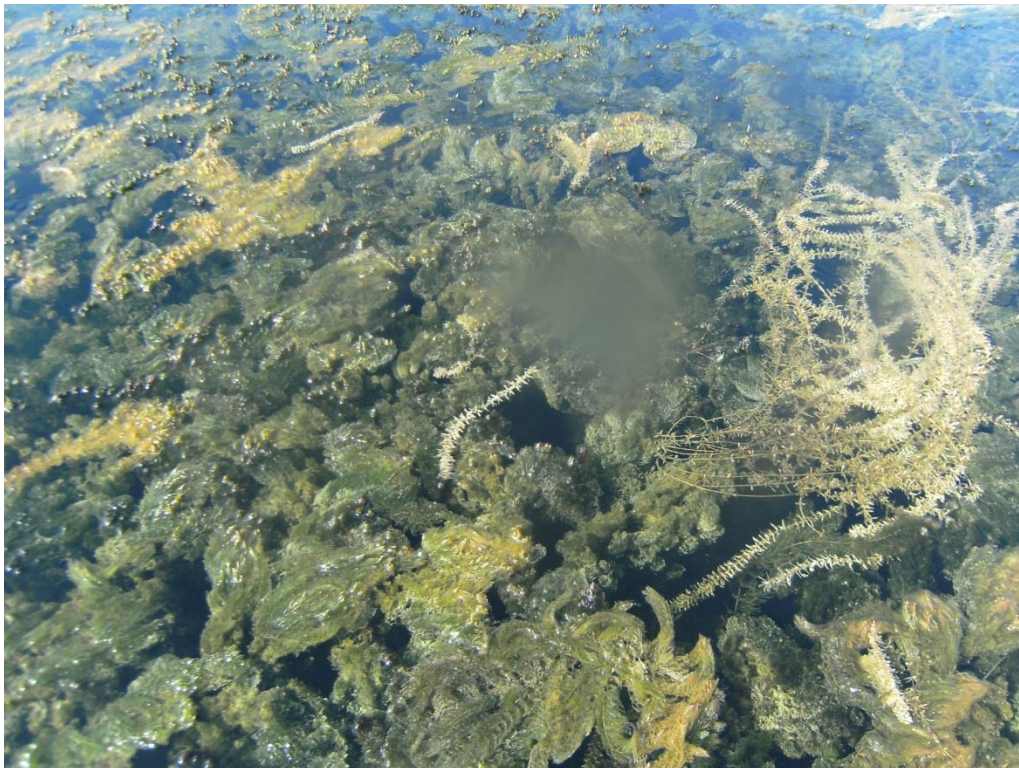


Figure 6 *Hydrilla verticillata* was topped out on much of Lake Sinclair



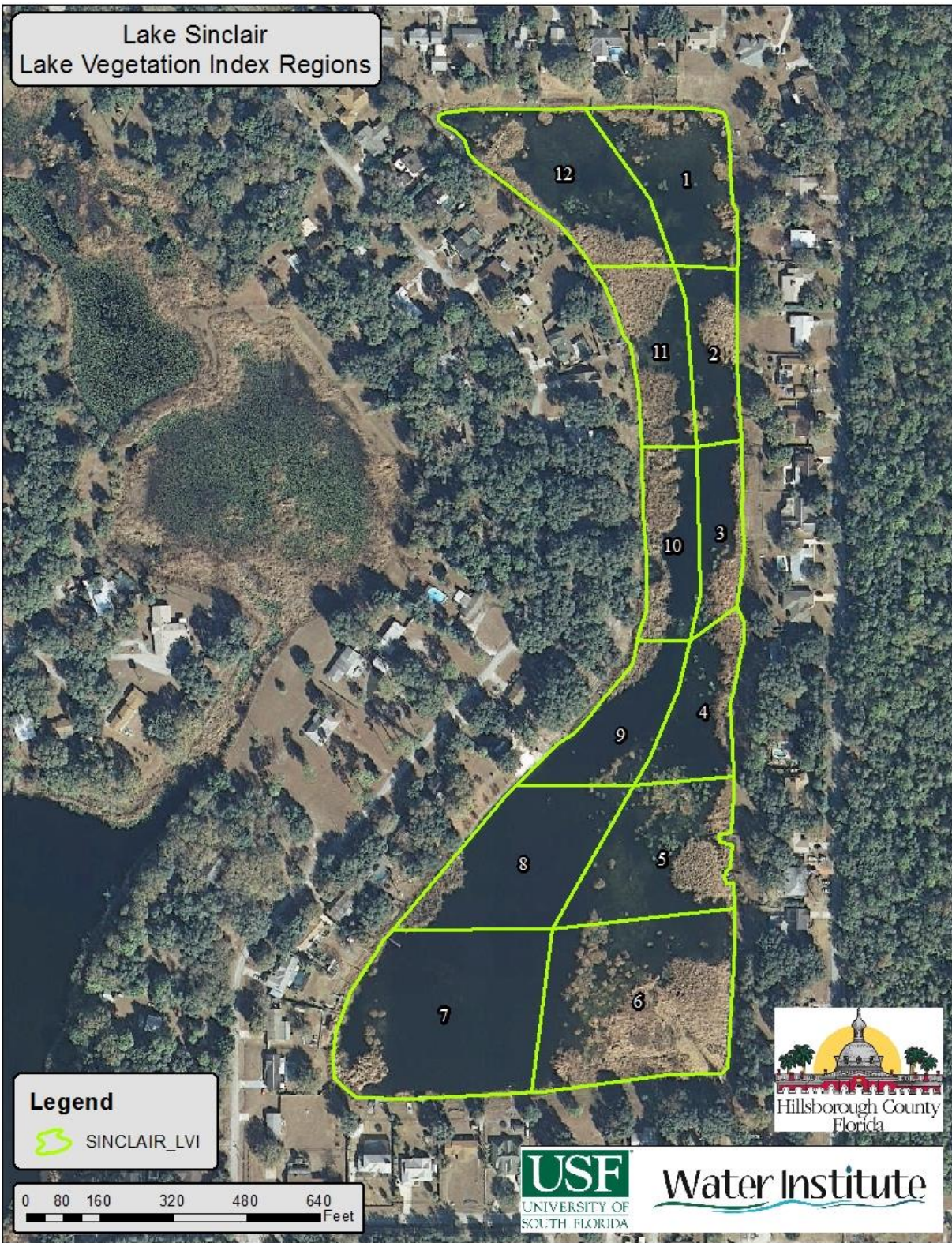


Figure 7 Lake Vegetation Index region map for Lake Sinclair

Table 2 Lake Vegetation Index results for Lake Sinclair 8/11/2015

SPECIES	Region				
	CofC	3	6	9	12
<b>Alternanthera philoxeroides</b>	0.00	1	1	1	1
Ceratophyllum demersum	4.16	1	1	1	1
<b>Hydrilla verticillata</b>	0.00	D	D	D	D
<b>Ludwigia peruviana</b>	0.00	1	1	1	1
Mikania scandens	1.95	1	1	1	1
<b>Landoltia punctata</b>	0.00	1		1	1
Lemna	1.00	1		1	1
Myrica cerifera	2.00	1	1		1
Panicum hemitomon	5.82	1	1	1	
<b>Panicum repens</b>	0.00	1	1		1
<b>Salvinia minima</b>	0.00	1		1	1
Taxodium	7.00		1	1	1
Azolla caroliniana	1.81	1			1
Bacopa monnieri	3.50	1	1		
<b>Commelina diffusa</b>	2.02	1			1
Cyperus odoratus	3.00	1			1
Diodia virginiana	3.00	1			1
Eupatorium capillifolium	0.83	1			1
Quercus laurifolia	4.00		1		1
Sambucus nigra	1.48		1		1
<b>Schinus terebinthifolius</b>	0.00		1		1
<b>Sphagneticola trilobata</b>	0.00			1	1
Acer rubrum	4.65				1
Hydrocotyle	2.00		1		
Ilex cassine	6.00				1
Liquidambar styraciflua	2.50				1
Najas guadalupensis	5.07		1		
Potamogeton illinoensis	6.64		1		
Sagittaria lancifolia	3.00				1
Salix caroliniana	2.95		1		
Typha	1.00		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	18	11	24
% Native taxa in sampling unit	58.82353	72.22222	45.45455	62.5
% FLEPPC CAT 1 taxa in sampling unit	23.52941	22.22222	27.27273	20.83333
% Sensitive taxa in sample unit	0	5.555556	9.090909	4.16667
Dominant CoC in sample unit	0	0	0	0
Native Score $((x-62.5)/37.5)$ or $((x-66.67)/25.89)=$	0	0.214454	0	0
Invasive FLEPPC 1 Score $(1 - (x/30))=$	0.215686	0.259259	0.090909	0.305556
Sensitive Score $(x/(27.78 \text{ or } 20)) =$	0	0.277778	0.454545	0.208333
Dominant CoC Score $(x/(7.91 \text{ or } 7)) =$	0	0	0	0
Raw Score Total = $N+I+S+D =$	0.215686	0.751491	0.545455	0.513889
Division Factor = $(3 \text{ D}=0 \text{ or } 4) =$	4	4	4	4
Average LVI dividend = $\text{Raw} / \text{DF}$	0.053922	0.187873	0.136364	0.128472
South				
LVI Score for sampling unit =	5.392157	18.78728	13.63636	12.84722
Total LVI SCORE =	13			



## Water Quality Assessment

Long-term water quality data is not available for Lake Sinclair. The available data was collected as part of this lake assessment. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of Lake Sinclair.

Table 4 Lake Sinclair Water Quality (Field)

Depth (m)	Temp ( C)	pH	DO (mg/L)	DO (%Sat)	Cond (umho/cm)	Salinity (ppt)	TDS (mg/L)	Secchi Depth (m)
0.1	29.37	7.98	6.9	89.2	214.8	0.1	137.5	3.79
1.54	28.63	7.58	3.88	49.6	226.2	0.1	144.7	
3.59	27.35	7.09	0.43	5.3	237.1	0.11	151.7	

The chemical water quality analysis for Lake Sinclair is shown in Table 5 for the sample taken on August 11, 2015. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment since geometric mean values for the past three years for available parameters are not available. Total Phosphorous values were below the nutrient threshold for clear alkaline lakes with insufficient data developed by FDEP of 0.03 mg/l with a value of 0.023 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 0.539 mg/l. Chlorophyll-a values are below the nutrient threshold for clear alkaline lakes developed by FDEP of 20.0 µg/l with a value of 1.3 µg/l.

Bacteria testing showed low levels of Fecal Coliform (< 10 colonies/100ml) above 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 Sinclair Water Quality Results from 8/11/2015(Laboratory)

Parameter	Value	Units
Alkalinity	62	mg/LCaCO <sub>3</sub>
Nitrates/Nitrites	0.014	mg/L
Fecal Coliform	<10	#/100 ml
Enterococci	40	#/100 ml
Chlorophyll a	2.1	ug/L
Chlorophyll b	2.6	ug/L
Chlorophyll c	1.8	ug/L
Chlorophyll t	5.1	ug/L
Chlorophylla Corr	1.3	ug/L
Chlorophyll-pheo	1.8	ug/L
Ammonia	0.035	mg/L
Kjeldahl Nitrogen	0.525	mg/L
Total Nitrogen	0.539	mg/L
Total Phosphorus	0.023	mg/L
Color(345)F.45	10.6	Pt/Co

Table 6 Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	10.6
Number of Samples	1
Geometric Mean Alkalinity (mg/L CaCO <sub>3</sub> )	62
Number of Samples	1
Lake Type	Clear Alkaline
Chlorophyll a Criteria (ug/L)	20
Insufficient for Geomean Criteria then P mg/L	0.03
Insufficient for Geomean Criteria then N mg/L	1.05
Geomean Chla ug/L	1.3
Geomean TP mg/L	0.023
Geomean TN mg/L	0.539
Number of Samples	1
Potential Impaired Chlorophyll a	Not Impaired
Potential Impaired TP	Not Impaired
Potential Impaired TN	Not Impaired

## Conclusion

The results of the assessment of Lake Sinclair does not show impairment based on Total Nitrogen, Total Phosphorous and Chlorophyll concentrations according to the FDEP numeric nutrient criteria using the single sample taken during this assessment. Long term sampling would be necessary to determine actual NNC values. The system does show impairment in the vegetation communities according to the Lake Vegetation Index with moderate overall species, high occurrences of non-native, invasive species, a single sensitive plant species and dominance by a non-native invasive species with an overall LVI score of 13. Bacteria sampling revealed low biomass of Fecal Coliform bacteria present at the time of the assessment.