South Crystal Lake

Methods

Study Area Analysis

The watershed containing South Crystal Lake was analyzed using ESRI ArcGIS 10.2. Using this software with 2016 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**[i] 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)[ii] 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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[i] 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.

[ii] 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 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 >= 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

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Study Area

South Crystal Lake is located in the Coastal Old Tampa Bay Watershed, south of Crystal Lake Road in Lutz, Florida. The Landscape Development Intensity Index of the 100 meter buffer around South Crystal Lake is dominated by Medium Density Residential (58.48%) and Natural Lands (40.88%) land uses. The resulting LDI value for the 100 meter buffer around South Crystal Lake is 4.88.
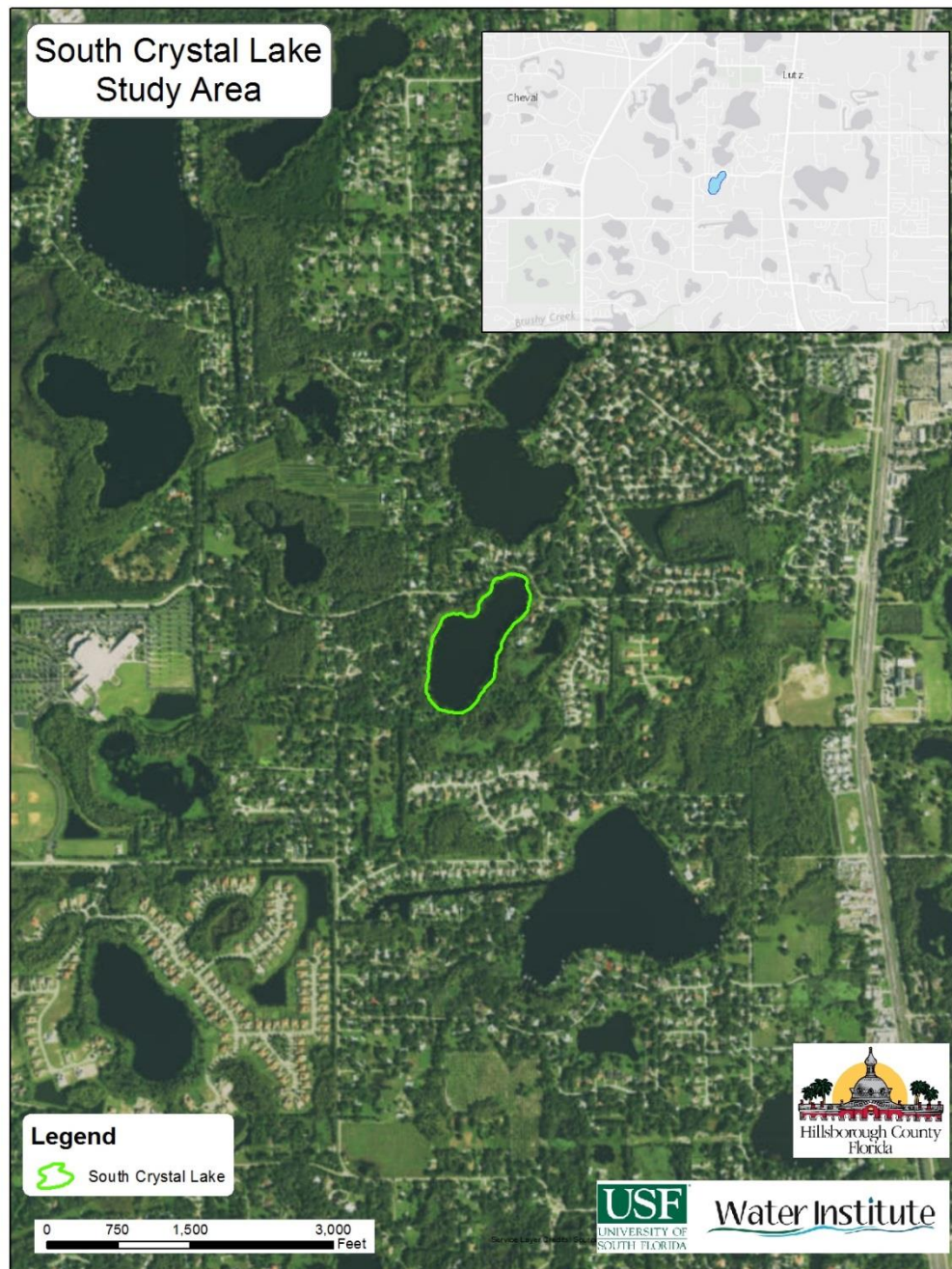

Figure 1: 2017 South Crystal Lake Assessment Study Area Map

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Lake Bathymetry and Morphological Characterization

South Crystal Lake is a relatively shallow natural basin that has potentially been dredged along the western shore. At the time of the assessment, South Crystal Lake was experiencing moderately high water levels resulting in a 19.5 acre water body. South Crystal Lake had a mean water depth of 7.2 feet and a maximum observed depth of 28.3 feet. The volume at this time was approximately 45,525,937 gallons. Figure 2 shows the resulting bathymetric contour map South Crystal Lake from data collected on June 15, 2017. The collected data has been overlain the 2016 Hillsborough County aerials.
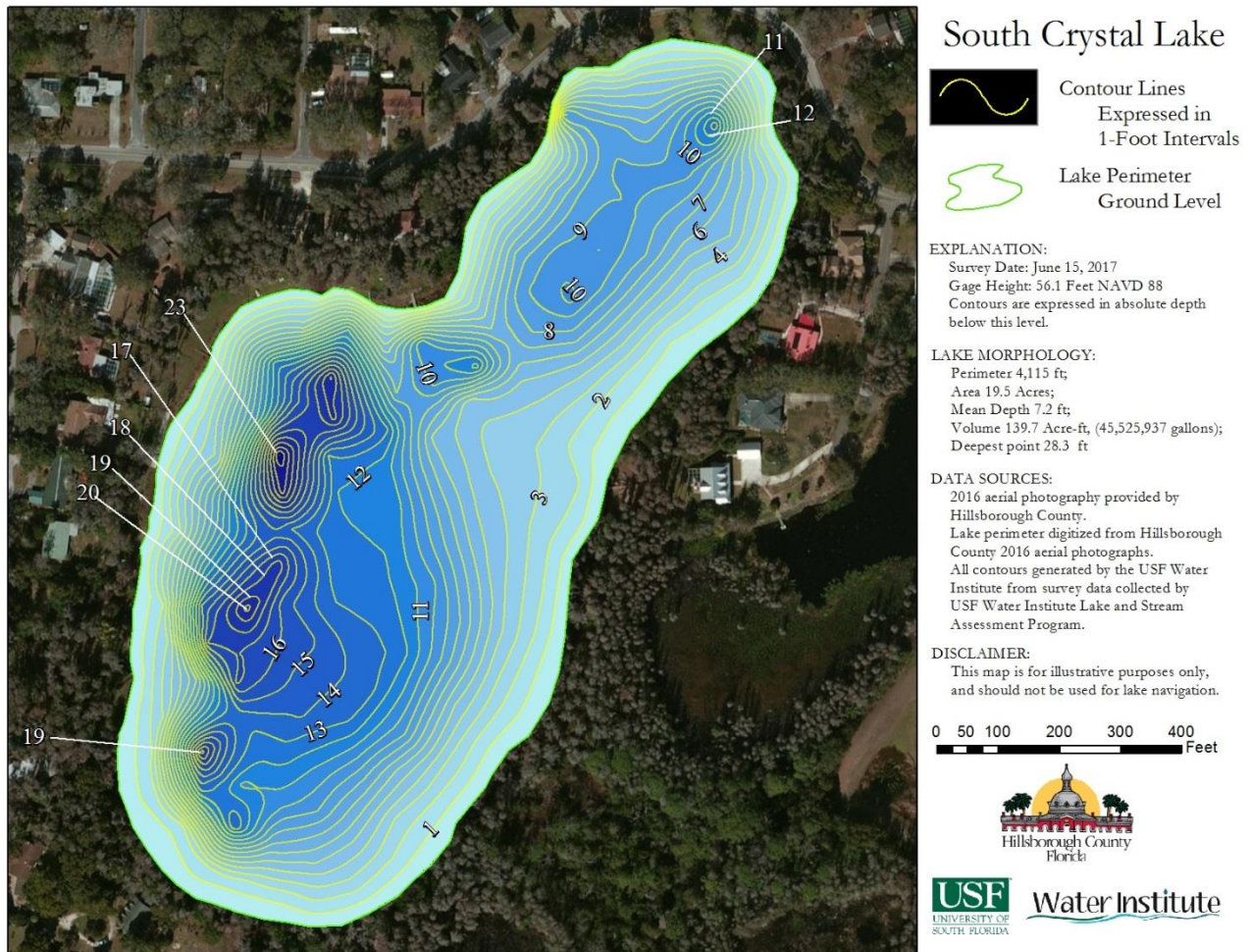

Figure 2: 2017 1-Foot Bathymetric Contour Map for South Crystal Lake

Table 1: Morphological Calculations for South Crystal Lake

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	848,428	78,821	19.5	0	0
Mean Depth	7.2	2.19	0	0	0
Maximum Depth	28.3	8.6	0	0	0
Volume (cubic)	6,085,890	172,332	0	139.7	45,525,937
Gauge (NAVD 88)	56.1	17.1	0	0	0

Lake Vegetation Index Assessment

Figure 3: Overview photograph of South Crystal Lake

The lake assessment for South Crystal Lake was conducted on June 15, 2017. South Crystal Lake received a lake habitat assessment (FEDP form FD 9000-6) score of 72 due to suboptimal scores for Vegetation Quality, Stormwater Inputs and Adverse Watershed Land Use. Marginal scores were achieved for Bottom Substrate Quality, Lakeside Adverse Human Alterations and Upland Buffer Zone. Secchi received poor scores.

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Figure 4: South Crystal Lake had a buffering zone of emergent vegetation surrounding the south eastern portion of the lake containing a mixture of native and invasive species.

The Lake Vegetation Index identified 22 species of wetland vegetation growing in the four selected sections along South Crystal Lake. The majority of these species (17) are native species. The remaining 5 species (*Panicum repens, Sphagneticola trilobata, Schinus terebinthifolius, Urochloa mutica,* and *Ludwigia peruviana*) are non-native and invasive to this region. The vegetation community along South Crystal Lake is dominated by a variety of emergent species including *Quercus laurifolia, Taxoidum,* and *Cephalanthus occidentalis.*(Figure 4). The water's surface in South Crystal Lake was dominated by *Nuphar* (Figure 5). The calculated LVI score South Crystal Lake was 37, meeting the impairment threshold of 37. Figure 6 shows the map of South Crystal Lake 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.

By analyzing the collected sonar chart, submerged aquatic vegetation covered approximately 5.6% of the surface area of South Crystal Lake. This submerged vegetation inhabits an estimated 0.1% of the water volume in South Crystal Lake as shown in Figure 7. It should be noted that submerged aquatic vegetation was not observed visually or with the frodus sampling. While we cannot rule out the sonar returns as being SAV, it is likely to be the developing stages of *Nuphar*.

Figure 5: *Nuphar* on South Crystal Lake

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

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Table 2: Lake Vegetation Index results for South Crystal Lake 6/15/17

SPECIES	Region				
	CofC	2	5	8	11
Acer rubrum	4.65	1	1	1	
Aster carolinianus	3.93		1		
Blechnum serrulatum	5.5		1	1	
Cephalanthus occidentalis	5	1	1	1	
Cyperus odoratus	3	1	1	1	
Eclipta prostrata	2			1	
Eleocharis baldwinii	2.82		1		
Eupatorium capillifolium	0.83	1	1	1	
Hydrocotyle	2	1		1	C
Ludwigia peruviana	0			1	1
Mikania scandens	1.95	1	1	1	
Myrica cerifera	2			1	
Nuphar	3.5	D	D	D	1
Panicum repens	0	1	1	1	C
Pontederia cordata	5.38	1	1	1	1
Quercus laurifolia	4	1	1	1	
Quercus nigra	2.5		1		
Schinus terebinthifolius	0		1	1	
Sphagneticola trilobata	0	1			1
Taxodium	7	1	1	1	
Typha	1	1	1	1	1
Urochloa mutica	0	1			1

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Table 3: Scoring Summary for the Lake Vegetation Index

LVI Score Summary	Region			
	2	**5**	**8**	**11**
Total # of taxa in sampling unit	14	16	17	8
% Native taxa in sampling unit	78.57143	87.5	82.35	50
% FLEPPC CAT 1 taxa in sampling unit	14.28571	12.5	17.65	37.5
% Sensitive taxa in sample unit	7.142857	6.25	5.88	0
Dominant CoC in sample unit	3.5	3.5	3.5	1

	2	5	8	11
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.459692	0.804558	0.605753	0
Invasive FLEPPC 1 Score (1 - (x/30))=	0.52381	0.583333	0.411765	0
Sensitive Score (x/(27.78 or 20)) =	0.357143	0.3125	0.294118	0
Dominant CoC Score (x/(7.91 or 7)) =	0.5	0.5	0.5	0.142857
Raw Score Total = N+I+S+D =	1.840644	2.200391	1.811635	0.142857
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.460161	0.550098	0.452909	0.035714
South				
LVI Score for sampling unit =	46.01611	55.00978	45.29088	3.571429
Total LVI SCORE = 37				

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Figure 7 South Crystal Lake Submerged Aquatic Vegetation

Water Quality Assessment

Long-term water quality data is not available for South Crystal Lake. 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 South Crystal Lake.

Table 4: South Crystal Lake Water Quality (Field)

Depth (m)	Temp	pH	DO (mg/L)	DO (% Sat)	Cond (umho/cm)	Salinity (ppt)	TDS (mg/L)	Secchi Depth (m)
0.3	29.09	9.84	10.34	130.5	191.5	0.09	122.6	N/A
0.31	29.48	9.74	10.15	128.9	191.2	0.09	122.3	N/A
1.8	27.79	7.97	7.2	88.8	190.7	0.09	122.1	N/A
3.43	25.55	7.75	0	0	210.3	0.1	134.6	0.46
POR	25.5	6.96	4.79	59.04	192.5	0.08		

The chemical water quality analysis South Crystal Lake is shown in Table 5 for the sample taken on June 15, 2017. 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 above the nutrient threshold for clear alkaline lakes with insufficient data developed by FDEP of 0.03 mg/l with a value of 0.044 mg/l for the most recent sample and below the threshold with 0.016 mg/l for the period of record. Total Nitrogen values were above the nutrient threshold for clear alkaline lakes with insufficient data developed by FDEP of 1.05 mg/l with a value of 1.51 mg/l for the most recent sample and below the threshold with a concentration of 0.834 mg/l for the period of record. Chlorophyll-a values are above the nutrient threshold for clear alkaline lakes developed by FDEP of 20.0 µg/l with a value of 47 µg/l for the most recent sample, but below the threshold for the period of record with a concentration of 16.39 µg/l.

Bacteria testing showed low levels of Fecal Coliform (27 colonies/100ml) and Enterococci (7 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."

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Table 5: South Crystal Lake Water Quality Results from 6/15/2017(Laboratory)

Parameter	South Crystal Lake (Center)	POR Mean Value	Units
Alkalinity	30	18.97	mg/LCaCO3
Nitrates/Nitrites	0.003		mg/L
Fecal Coliform	27		#/100 ml
Enterococci	7		#/100 ml
Chlorophyll a	47.8	5.80	ug/L
Chlorophyll b	2.6		ug/L
Chlorophyll c	4.2		ug/L
Chlorophyll t	52		ug/L
Chlorophylla Corr	47	16.39	ug/L
Chlorophyll-pheo	6.6		ug/L
Ammonia	0.006	0.004	mg/L
Kjeldahl Nitrogen	1.51	0.966	mg/L
Total Nitrogen	1.51	0.834	mg/L
Total Phosphorus	0.044	0.016	mg/L
Color(345)F.45	25.4	33.39	Pt/Co

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Table 6 Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	33.4
Number of Samples	26
Geometric Mean Alkalinity (mg/L CACO3)	30
Number of Samples	1
Lake Type	Clear Alkaline
Chlorophyll a Criteria (ug/L)	20
Insufficient for Geomean Criteria then P mg/L	0.03
Insuffcient for Geomean Criteria then N mg/L	1.05
Geomean Chla ug/L	16.39
Geomean TP mg/L	0.016
Geomean TN mg/L	0.834
Number of Samples	88
Potential Impaired Chlorophyll a	Not Impaired
Potential Impaired TP	Not Impaired
Potential Impaired TN	Not Impaired

Conclusion

The results of the assessment of South Crystal Lake shows 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 indicates that the sample from this assessment contains higher concentrations of these parameters than average for the lake. Consistent quarterly sampling would be necessary to determine actual NNC values. The system also shows impairment in the vegetation communities according to the Lake Vegetation Index with low overall species, moderate occurrences of non-native, invasive species and few sensitive plant species with an overall LVI score of 37.The vegetation community was enhanced by the natural wetland buffer on the south eastern section of the lake, however some sections of the LVI consisted of primarily cleared

turfgrass with few species overall. Submerged aquatic vegetation was not observed visually or by the frodus sampling, however low quantities were potentially identified by analysis of the sonar data.

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