Lake Rogers

Methods

Study Area Analysis

The watershed containing Lake Rogers was analyzed using ESRI ArcGIS 10.2. Using this software with 2014 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 Brown & Vivas 2003, 2005 (Brown & Vivas. 2003. A Landscape Development Intensity (LDI) Index. Center for Environmental Policy, Department of Environmental Engineering Sciences, University of Florida. Technical Report Submitted to the Florida Department of Environmental Protection) and (Brown & Vivas. 2005. Landscape development intensity index. Environmental Monitoring and Assessment 101: 289-309.) According to Brown and Vivas, "The intensity and aerial extent of human activities in a landscape may adversely affect the ecological processes of natural communities…the Landscape Development Intensity Index (LDI) functions as an objective measure of how human disturbance affects biological, chemical, and physical processes of aquatic systems. By incorporating non-renewable energy input expenditures… natural systems were assigned a non-renewable empowerment density of 0. The landscape development intensity (LDI) index is calculated as the percentage area within the catchment of a particular type of land use multiplied by the coefficient of energy use associated with that land use, summed over all land use types found in the catchment."

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.

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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

Study Area

Lake Rogers is located in Lake Rogers Park, west of the Veterans Express Way between Crawley Road and highway 582 in Odessa, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Lake Rogers is dominated by Upland Mixed – Coniferous/Hardwood (58.17%) and Mixed Upland Nonforested (31.86%) land uses. The resulting LDI value for the 100 meter buffer around Lake Rogers is 1.35. The LDI value calculated for the FDEP WBID containing Lake Rogers was 4.35 with approximately 29.6% Residential, 8.6% Upland Mixed – Coniferous/Hardwood, 8% Stream and Lake Swamps (bottomland), 7.5% Cypress, and 6% Reservoirs land uses.

Figure 1 2016 Lake Rogers Assessment Study Area Map

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Lake Bathymetry and Morphological Characterization

Lake Rogers at the time of the assessment was experiencing a prolonged period of high water. Lake Rogers had a mean water depth of 11 feet and a maximum observed depth of 23.2 feet. The volume at this time was approximately 341,077,631 gallons. Figure 2 shows the resulting bathymetric contour map for Lake Rogers from data collected on August 2, 2016. The collected data has been overlain the 2014 Hillsborough County aerials.
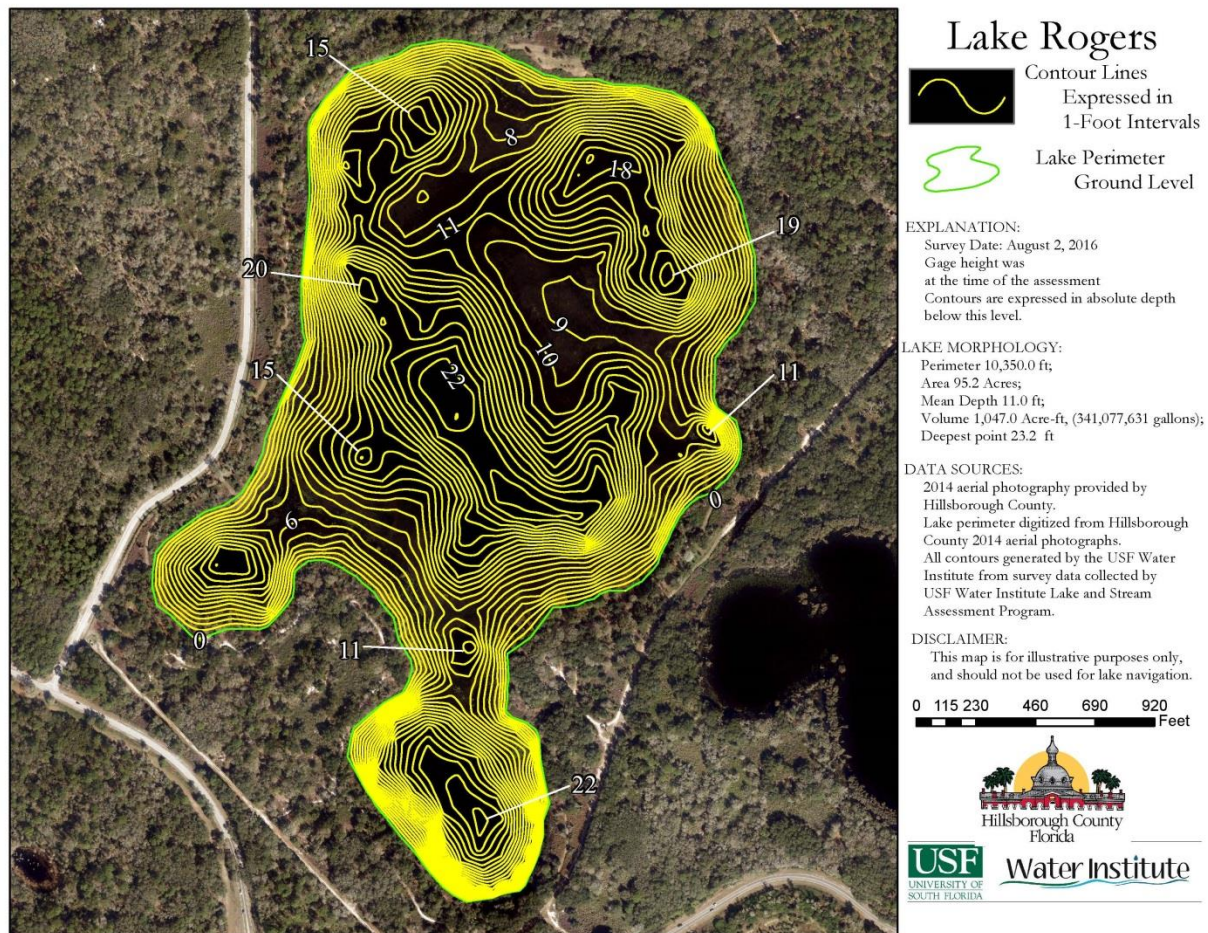

Figure 2 2016 1-Foot Bathymetric Contour Map for Lake Rogers.

Table 1 Morphological Calculations for Lake Rogers.

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	4,145,278	385,106	95.2	0	0
Mean Depth	11	3.35	0	0	0
Maximum Depth	23.2	7.07	0	0	0
Volume (cubic)	45,595,131	1,291,098	0	1,046.7	341,077,631
Gauge (relative)	40.1	12.22	0	0	0

Lake Vegetation Index Assessment

Figure 3 Overview photograph of Lake Rogers.

The lake assessment for Lake Rogers was conducted on August 2, 2016. Lake Rogers received a lake habitat assessment (FEDP form FD 9000-6) score of 120 due to optimal scores for Vegetation Quality, Stormwater Inputs, Lakeside Adverse Human Alteration, Upland Buffer Zone and Adverse Watershed Land Use as well as suboptimal scores for Secchi and Bottom Substrate Quality.

Figure 4 Lake Rogers had a buffering zone of emergent vegetation surrounding the lake containing a mixture of native and invasive species. High water levels are evident

The Lake Vegetation Index identified 41 species of wetland vegetation growing in the four selected sections along Lake Rogers. The majority of these species (38) are native species. The remaining 3 species (*Panicum repens*, *Melaleuca quinquenervia* and *Ludwigia peruviana*) are non-native and invasive to this region. The vegetation community along Lake Rogers is dominated by a variety of emergent species including *Quercus laurifolia, Fuirena scirpoidea* and *Panicum hemitomon* (Figure 5). The water's surface in Lake Rogers was dominated by *Nymphaea odorata* (Figure 6). The calculated LVI score for Lake Rogers was 63, above the impairment threshold of 37. Figure 7 shows the map of Lake Rogers 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 observed during the assessment. By analyzing the collected sonar chart, submerged aquatic vegetation covered approximately 6% of the surface area of Lake Rogers. This submerged vegetation inhabits an estimated 0.95% of the water volume in Lake Rogers.

It is important to note that the prolonged high water has shown changes in the vegetation community. Many stressed and dead trees were observed along the shoreline. Compared to the LVI scores from our previous sampling in 2011, during a period of low water, both the overall LVI score (73 in 2011) and total number of species observed has decreased.

Figure 5 Emergent vegetation community on Lake Rogers.
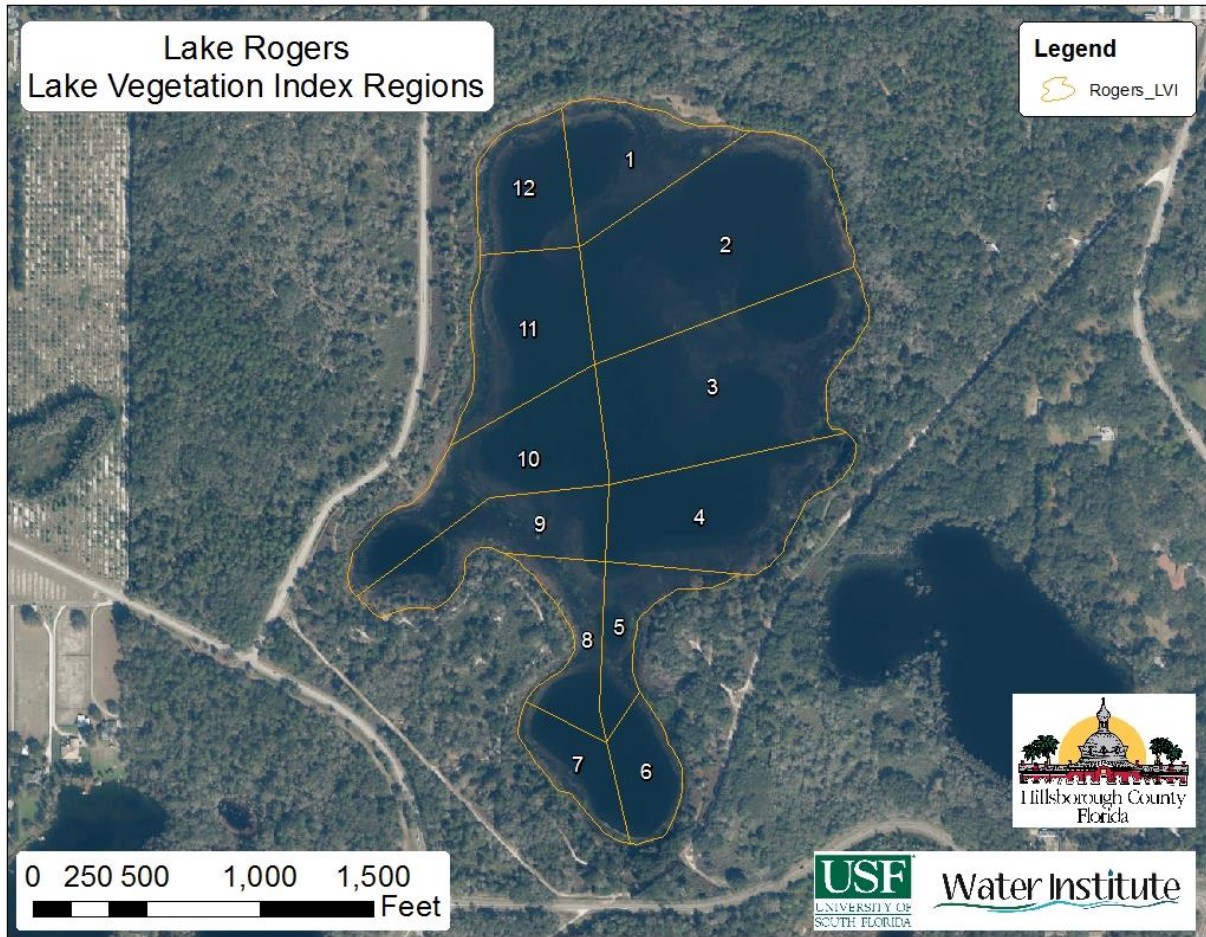

Figure 6 *Nymphaea odorata* on Lake Rogers.

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Figure 7 Lake Vegetation Index region map for Lake Rogers.

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Table 2 Lake Vegetation Index results for Lake Rogers 8/2/2016.

SPECIES	CofC	Region 2	5	8	11
Andropogon glomeratus	3.00		1		
Bacopa monnieri	3.50	1	1	1	1
Blechnum serrulatum	5.50	1	1	1	1
Cephalanthus occidentalis	5.00	1	1	1	1
Cladium jamaicense	8.00	1		1	
Cyperus odoratus	3.00	1	1	1	1
Cyperus polystachyos	1.56	1	1		
Eleocharis baldwinii	2.82	1	1	1	1
Eupatorium capillifolium	0.83	1	1	1	1
Fuirena scirpoidea	5.50	c	c	c	c
Hydrocotyle	2.00	1	1		
Hypericum fasciculatum	8.00		1	1	1
Ilex cassine	6.00	1			
Lachnanthes caroliniana	3.76		1		
Leersia hexandra	5.61	1	1	1	1
Ludwigia arcuate	3.50	1	1	1	1
Ludwigia octovalvis	2.00		1	1	
Ludwigia peruviana	0.00	1	1	1	1
Melaleuca quinquenervia	0.00	1	1	1	1
Micranthemum glomeratum	5.85	1			
Mikania scandens	1.95	1	1	1	1
Myrica cerifera	2.00			1	1
Nuphar	3.50	1			
Nymphaea odorata	5.00	C	C	C	C
Nymphoides aquatica	6.09		1		
Panicum hemitomon	5.82	1	1	1	1
Panicum repens	0.00	1	1	1	1
Pluchea foetida	6.65				1
Pontederia cordata	5.38				1
Potamogeton diversifolius	6.00	1	1	1	1
Quercus laurifolia	4.00	1	1	1	1
Quercus nigra	2.50	1	1	1	
Rhynchospora corniculata	4.00	1			
Sacciolepis striata	5.35	1	1	1	1
Sagittaria graminea	5.53		1		
Salix caroliniana	2.95		1		1
Sesbania herbacea	1.00		1		
Taxodium	7.00			1	
Utricularia gibba	6.37	1	1	1	1
Utricularia purpurea	6.50	1		1	
Xyris				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	28	30	27	24
% Native taxa in sampling unit	89.29	90.00	88.89	87.50
% FLEPPC CAT 1 taxa in sampling unit	10.71	10.00	11.11	12.50
% Sensitive taxa in sample unit	3.57	3.33	11.11	4.17
Dominant CoC in sample unit	5.25	5.25	5.25	5.25

Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.874	0.901	0.858	0.805
Invasive FLEPPC 1 Score (1 - (x/30))=	0.643	0.667	0.630	0.583
Sensitive Score (x/(27.78 or 20)) =	0.179	0.167	0.556	0.208
Dominant CoC Score (x/(7.91 or 7)) =	0.750	0.750	0.750	0.750
Raw Score Total = N+I+S+D =	2.445	2.484	2.793	2.346
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.611	0.621	0.698	0.587
South				
LVI Score for sampling unit =	61	62	70	59
Total LVI SCORE =	63			

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Water Quality Assessment

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

Table 4 Lake Rogers Water Quality (Field)

Depth (m)	Temp (c)	pH	DO (mg/L)	DO (% Sat)	Cond (umho/cm)	Salinity (ppt)	TDS (mg/L)	Secchi Depth (m)
0.08	32.34	6.32	6.81	91.9	72.2	0.04	46.2	2.32
0.1	32.47	6.11	6.69	90.5	72.4	0.04	46.3	
2.06	31.45	5.99	6.45	85.7	72	0.04	46.1	
4.55	28.01	5.5	0	0	83.9	0.04	53.7	

The chemical water quality analysis for Lake Rogers is shown in Table 5 for the sample taken on August 3, 2016. 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 acidic lakes with insufficient data developed by FDEP of 0.01 mg/l with a value of 0.021 mg/l. Total Nitrogen values were above the nutrient threshold for clear acidic lakes with insufficient data developed by FDEP of 0.51 mg/l with a value of 0.766 mg/l. Chlorophyll-a values are above the nutrient threshold for clear acidic lakes developed by FDEP of 6.0 µg/l with a value of 7.1 µg/l.

Bacteria testing showed trace levels of Fecal Coliform (<4 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 Rogers Water Quality Results from 8/3/2016 (Laboratory)

Parameter	Value	Units
Alkalinity	7.0	mg/LCaCO3
Nitrates/Nitrites	0.003	mg/L
Fecal Coliform	<4	#/100 ml
Enterococci	<10	#/100 ml
Chlorophyll a	8.5	ug/L
Chlorophyll b	2.6	ug/L
Chlorophyll c	1.4	ug/L
Chlorophyll t	11.3	ug/L
Chlorophylla Corr	7.1	ug/L
Chlorophyll-pheo	6.6	ug/L
Ammonia	0.006	mg/L
Kjeldahl Nitrogen	0.763	mg/L
Total Nitrogen	0.766	mg/L
Total Phosphorus	0.021	mg/L
Color(345)F.45	12.9	Pt/Co

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Table 6 Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean (Geomean) Color (pcu)	12.96
Number of Samples	1
Geometric Mean Alkalinity (mg/L CACO3)	7.0
Number of Samples	1
Lake Type	Clear Acidic
Chlorophyll a Criteria (ug/L)	6.0
Insufficient for Geomean Criteria then P mg/L	0.01
Insuffcient for Geomean Criteria then N mg/L	0.93
Geomean Chla ug/L	7.1
Geomean TP mg/L	0.021
Geomean TN mg/L	0.766
Number of Samples	1
Potential Impaired Chlorophyll a	Impaired
Potential Impaired TP	Impaired
Potential Impaired TN	Impaired

Conclusion

The results of the assessment should be considered as an extreme circumstance due to the increased lake stage present on Lake Rogers at the time See Figure 8 below. Lake Rogers resides in an active well field, and has recently been connected to other nearby lakes, some of which are characterized by colored, acidic water. The resulting increase in stage level and decrease in light penetration has eliminated the vast majority of the submerged vegetation community and disrupted the emergent vegetation community. The results of the assessment of Lake Rogers shows impairment based on Total Nitrogen, Total Phosphorous and Chlorophyll-a 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 not show impairment in the vegetation

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communities according to the Lake Vegetation Index with moderate overall species, low occurrences of non-native, invasive species and several sensitive plant species with an overall LVI score of 63. The Current LVI score does show degradation in the vegetation communities compared to previous LVI scores taken during times of low and average lake stages. Bacteria sampling revealed very low biomass of Fecal Coliform bacteria present at the time of the assessment.
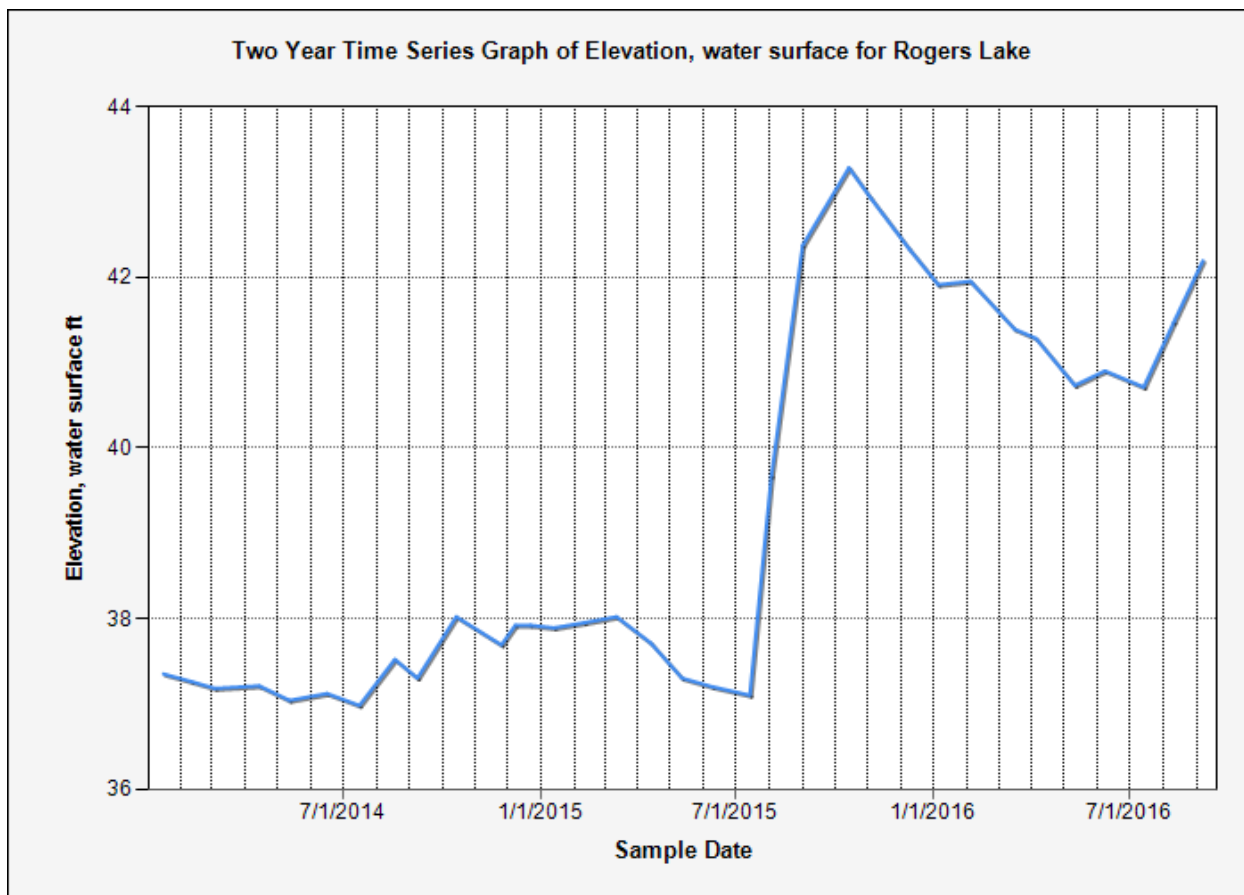

Figure 8 Two Year Graph of Lake Stage for Lake Rogers.