Report on LakeWatch Water Quality Studies

at Lemon Creek Wildflower Preserve

> Note: This report covers the period from July 2011 through November 2023. In October 2024, our freshwater ponds were inundated by saltwater storm surge from Hurricane Milton, resulting in high salinity levels in the ponds that will significantly change the ecosystems in the months ahead. Future study will be needed to assess the impacts.

Introduction

In July 2011, Lemon Bay Conservancy volunteers began collecting water samples at Lemon Creek Wildflower Preserve in order to understand water conditions in the freshwater ponds and in the Lemon Creek estuary. Since then, our LBC volunteers have been collecting water samples as part of the LakeWatch citizen-science program run by the University of Florida's IFAS organization.

Early on, the LakeWatch data confirmed our concerns that some of the old golf course ponds were higher in nutrients levels than would be expected in natural ponds. Excess nutrients have negative impacts on water quality. In the years since LBC acquired this former golf course, we have worked to improve water quality in the ponds with the objective of sending lower nutrient water flows into Lemon Creek and from there into Lemon Bay.

As we will discuss in this report, we have made substantial progress in lowering the nutrient levels in three of the six ponds that we monitor, while the other three have shown limited change. Notably, we have reduced the nutrient levels in Pond 3 (Moorhen Pond), which is the pond that into which other freshwater ponds feed and is the exit point from the pond system to Lemon Creek. So, we can report we have reduced nutrient flows into the Creek.

While we can see clear changes in several ponds, the same is not true for our Lemon Creek data. The estuary data is highly variable, with few patterns of change over time.

LakeWatch Program Background

The Florida LakeWatch program began in 1986. Over the years, the scientists running the program have published numerous publications and built an extensive database of conditions for lakes and other water bodies throughout Florida. According to their website, "LakeWatch is now one of the largest lake monitoring programs in the nation with over 1800 trained citizens currently monitoring 525 lakes, 175 estuary stations, 125 river stations, 20 coastal dune lakes and 10 spring runs in 57 counties."

Our LakeWatch Water Sampling Process

Between 6 and 12 times each year, our LBC volunteers collect water samples and record data from six preserve freshwater ponds and from three locations in brackish Lemon Creek.

In most cases, the sampling is done from a kayak launched into the waterbody. Occasionally, samples are collected from shore. In the two larger ponds, we collect samples and data at three separate locations within each pond. For the four smaller ponds, we collect two sets of samples for each pond. For the creek, we collect one sample at each of the three locations.

Using supplies provided by LakeWatch, here is our process:

- Two bottles of water are collected at each sampling location.
- A Secchi disc is lowered into the water to measure the clarity of the water (based on how far below the surface the disc disappears from view) and the water depth.
- The time each sample is taken, the clarity and depth readings, and weather information, are recorded on a data sheet for each water body. For four locations, we have staff gauges to measure the water elevation. Where that information is available, it is also recorded.
- For the creek locations, we collect one additional sample that is not part of the official LakeWatch process. We use a handheld device called a refractometer with creek samples to obtain a salinity estimate for each location. (Note: post Hurricane Milton, we are now recording salinity data for all ponds, as well as the creek.)
- Later in the day, we take one of the two bottles from each sampling location and strain the water onto a paper wafer that is labelled and placed in a desiccant bottle. All of the strained wafers collected from the freshwater ponds are placed in a single desiccant container that is stored in a freezer, as discussed further in the next bullet. The creek samples are strained and placed in a separate desiccant container. These wafers will be used to analyze and report total chlorophyll from each location.
- The second bottle of water from each sampling location (labeled by waterbody and sampling location #) is frozen. These bottles, along with the desiccant bottles, are collected periodically (usually every three months) by the LakeWatch team for transport to Gainesville. The samples are analyzed to report on total phosphorous, total nitrogen, specific conductance, and color for each location.

LakeWatch Reports and Data

Each spring, the University of Florida LakeWatch data team provides summary reports on the data for each of our waterbodies. These reports aggregate our collected data by year and include trend charts to show changes over time in each waterbody. They also provide information for comparison of our water bodies to other locations.

The LakeWatch team also provides detailed spreadsheets with the data from each sample we have collected over the years that can be used for further study.

For context on our report results, it is useful to first provide background on the preserve ponds and creek and their relationships to one another.

The Golf Course Pond and Creek System

When the Wildflower Golf Course was built in the early 1970s, a series of interconnected ponds were created to serve as water hazards and to provide irrigation sources for the greens and fairways. With the exception of one pond, which was dug at a later date, the major ponds were all interconnected by underground pipes and designed to drain to the west into Lemon Creek when the ponds reached higher levels during the rainy season.

Stormwater from neighboring communities to the north of the golf course, built on land originally owned by the same developer, was allowed to feed into the pond system at several locations. An arrangement was also established with a local water treatment firm, Sandalhaven Utilities, to pump treated sewage effluent into one of the ponds for use in irrigation of the golf course.

Please refer to the map for a depiction of the golf course pond and creek system prior to restoration. In LakeWatch reporting, our Ponds are designated WF1 through WF6. We'll refer to them as Ponds 1 through 6 in these discussions.

Starting on the east side, Pond 1 (Duckweed Pond) received treated sewage effluent through underground pipes from the Sandalhaven sewage treatment plant located to the south of the preserve. It was connected to Pond 2 (Long Pond) via an underground culvert (depicted in turquoise on the map).

Pond 6 (Turtle Pond) received intermittent stormwater inflows through an open ditch and connecting culverts from communities to the north. (During the dry season, the inflow ditch dried up.) Pond 6 connected via culverts to Pond 2 (Long Pond).

Pond 2 (Long Pond) connected to Pond 3 (Moorhen Pond).

Pond 5 (Verna's Pond) received stormwater inflows from neighborhoods to the north through culverts under Gasparilla Pines Boulevard and from two additional culverts that flow out of the Village at Wildflower condominium community to its east. Verna's Pond connected via culvert to Pond 3 (Moorhen Pond).

Pond 3 (Moorhen Pond) was the recipient of inflows from Long Pond and Verna's Pond. It also received stormwater via a culvert from a pond in the Sandalhaven community on the north side of Gasparilla Pines Boulevard. When Pond 3 began to fill, it overflowed to an open ditch system running to the west and eventually into the northern end of Lemon Creek.

Pond 4 (Hosman Pond) was dug sometime after the course was initially built, most likely to provide fill dirt elsewhere. It is disconnected from the other ponds.

"Fresh" water flowed into brackish Lemon Creek from several sources. At the north end, the Creek received direct stormwater inflows via a culvert from the north side of Gasparilla Road. When Moorhen Pond was high enough (water level greater than approximately 2.5' NAVD), the drainage creek from Moorhen Pond drained into the Creek a little further south. Drainage swales from Placida Road (just west of the diagram) dumped into the Creek near the tidal interchange point. Lemon Lake, to the south of the preserve in Charlotte County's Amberjack Preserve, connected to the southern end of the creek after it first passed through the Fiddlers' Green condominium complex and other properties. Lemon Creek had a tidal connection near the southwest corner of the preserve to Lemon Bay through culverts that run under Placida Road.

Actions Taken to Improve Water Quality in the Ponds

Over the years, we have not changed the overall pattern of water flows through the preserve, but we have worked to improve the quality of the freshwater ponds and their interconnections, and to expand and enhance the estuarine creek system.

<u>Initial Focus on Duckweed Pond</u>

The first water quality improvement step that LBC took after acquiring the old golf course property was to halt the inflow of treated sewage effluent into Pond 1 (Duckweed Pond).

The early LakeWatch data confirmed that Duckweed Pond was extremely high in nutrients, and we focused our initial water quality improvement efforts on that pond. The photo depicts the dense growth of Duckweed covering the pond during LakeWatch sampling in August 2011.

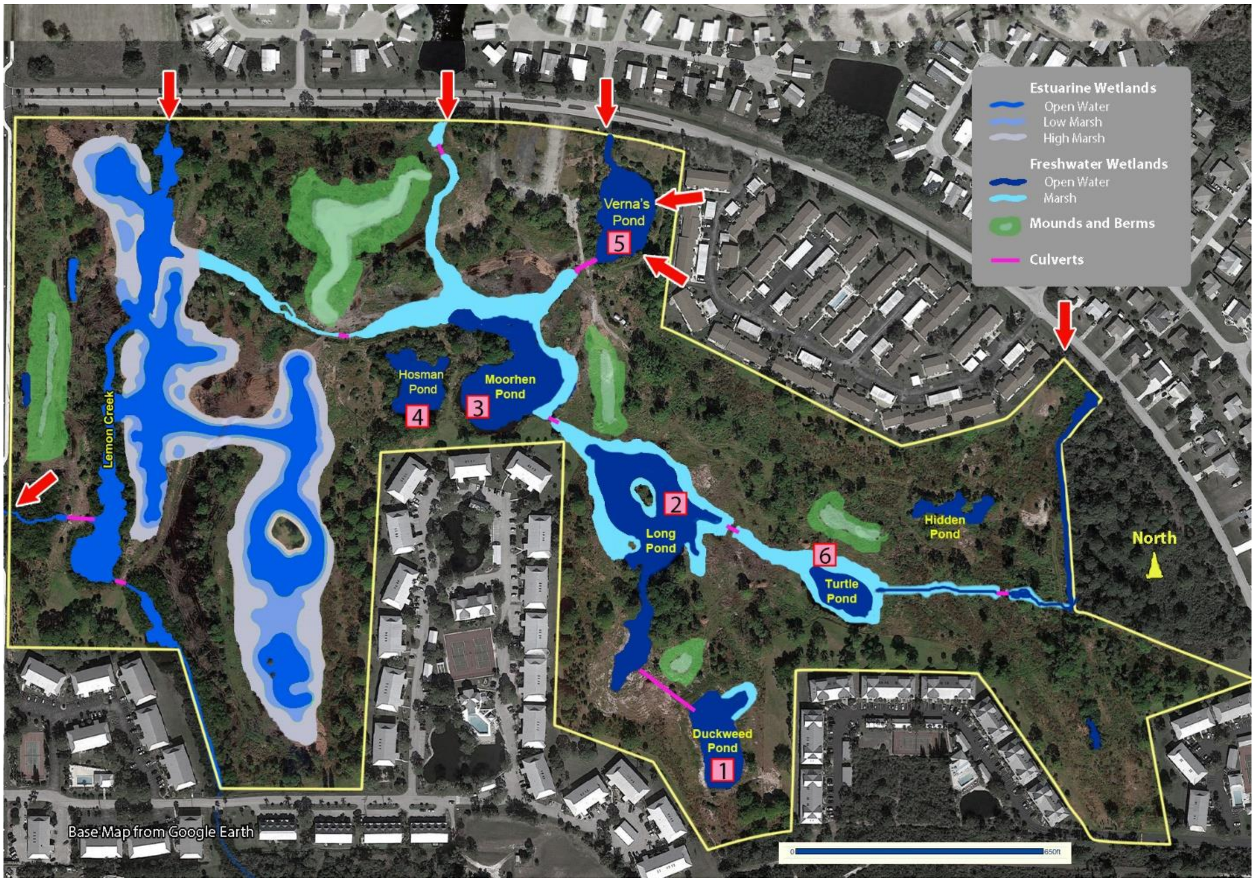
We added a riser standpipe to the pond to stop the flow of high nutrient water from Duckweed into Long Pond unless water levels in the pond rose to elevated levels (approximately 4.0' NAVD). We installed floating islands in the pond with plants designed to absorb excess nutrients. We used a net and pump system to periodically harvest duckweed from the pond and thereby remove nutrients contained within the plants. And, we installed a solar pond aerator to increase oxygen levels in the water.

The first visible result of these changes was in Pond 3 (Moorhen Pond). Duckweed had often been present covering much of the pond surface. Not long after cutting off water flow out of Duckweed Pond, the duckweed at Moorhen largely disappeared as nutrient levels dropped. Shortly thereafter, the same reduction in duckweed coverage occurred in Long Pond.

The Preserve Restoration Project

On a much larger scale, we started discussions with the Southwest Florida Water Management District's Surface Water Improvement and Management (SWIM) Team, to improve water quality within the preserve and to return the property to native habitats. Through the District's cooperative funding initiative, we were able to obtain matching funds that were used to develop a preserve restoration redesign and provide construction funding. The District also provided project management leadership. When it became apparent that additional funds were needed, in 2015, we successfully applied for and received a NOAA Ecosystem Resiliency grant. Together, the District and NOAA committed over $1.2 million in funding to the preserve restoration project.

Redesigning the preserve ponds and the creek system were fundamental elements of the plan. The map below depicts the greatly expanded wetlands within the preserve today. The restoration project was completed in January 2021.



For the freshwater system, the work involved expanding several ponds, adding gradual sloping sides, and planting more than 60,000 wetland plants to help filter the water. With a few exceptions, for trail crossings and at the Duckweed Pond outflow, the underground culverts between the various ponds were removed and open flow ways were created.

As depicted by the red arrows on the map, the preserve continues to receive stormwater from neighboring areas. As stormwater often contains high nutrient levels, our goal was to reduce the nutrients in the freshwater before it reaches Lemon Bay. The three ponds that received major restoration efforts were the three in the central, interconnected pond system, namely Pond 6 (Turtle Pond), Pond 2 (Long Pond), and Pond 3 (Moorhen Pond).

For the creek, the existing estuarine area was greatly expanded, almost tripling the surface area, and providing important increases in habitat for juvenile tarpon and the many other species that use that habitat.

LakeWatch Water Quality Reports – The Freshwater Ponds

We receive reports from the LakeWatch team annually for each of our preserve ponds and for our three sampling locations in Lemon Creek. The most recent set of reports cover our water sampling work from July 2011 through November 2023.

The freshwater reports are divided into three parts as explained in the report introduction:

- "Part one allows the comparison of data with Florida Department of Environmental Protection's Numerical Nutrient Criteria. "
- "Part two allows a comparison of the long-term mean nutrient concentrations with nutrient zone concentrations published by LakeWatch staff…"
- Part 3 "examines data for long-term trends that may be occurring in individual systems…"

Attachment A contains an example of the full seven-page report for WF-1 (Pond 1/Duckweed Pond).

Attachment B includes the Trend Plot Charts contained in the last two pages of the LakeWatch reports for each of our six ponds. The charts graphically depict the annual geometric means, standard deviations, and trend lines for Total Phosphorous, Total Nitrogen, Total Chlorophyll, and Secchi Depth. They also identify statistically significant trends.

It should be noted that the number of months of data available to produce these charts varies from six to twelve months per year depending on the number of times volunteers sampled the ponds. This can have some impacts on the data as months that were "missed" could be months that might typically be seasonally higher or lower than the months sampled.

When looking at the individual pond trend reports in Appendix B, you will note that the scale used varies from pond to pond, making it somewhat difficult to compare findings between the different ponds.

Figure 1 below allows us to look at all six preserve ponds in relation to one another. (You may want to print Figure 1 for reference in the discussions that follow.)

Figure 1: Data Comparisons Across Ponds

Freshwater Ponds	WF-1 (Duckweed)	WF-2 (Long)	WF-3 (Moorhen)	WF-4 (Hosman)	WF-5 (Verna's)	WF-6 (Turtle)
Total Phosphorous						
Min Annual Mean	126	94	96	51	45	102
Max Annual Mean	1753	727	524	96	72	216
Grand Mean	348	230	199	71	55	148
FDEP Target (Mean <50)	impaired?	impaired?	impaired?	impaired?	impaired?	impaired?
TP Zone 5 (background 252)	above	within	within	within	within	within
Trend	decreasing	decreasing	decreasing	increasing	none	none
Total Nitrogen						
Min Annual Mean	2366	1386	1443	1330	899	1072
Max Annual Mean	9895	3815	3318	2112	1427	1740
Grand Mean	3816	1956	1945	1687	1079	1361
FDEP Target (Mean <1270)	impaired?	impaired?	impaired?	impaired?		impaired?
TN Zone 5 (background 2701)	above	within	within	within	within	within
Trend	decreasing	decreasing	decreasing	none	none	none
Chlorophyll						
Min Annual Mean	43	34	29	16	14	27
Max Annual Mean	216	153	211	51	55	47
Grand Mean (>20, use targets above)	92	67	55	25	24	35
Trend	decreasing	decreasing	decreasing	none	none	none
Secchi (ft)						
Min Annual Mean	1	1	1	2	2	2
Max Annual Mean	2	2	2	5	5	2
Grand Mean	1	2	2	3	3	2
Trend	increasing	none	none	none	none	none
Color						
Min Annual Mean	68	54	54	40	53	59
Max Annual Mean	215	165	141	55	77	123
Grand Mean	123	86	82	47	67	84
Specific Conductance (µS_cm@25C)						
Min Annual Mean	443	612	495	648	215	480
Max Annual Mean	805	1022	656	862	351	942
Grand Mean	622	766	578	731	255	688
Lake Classification	Colored	Colored	Colored	Colored	Colored	Colored
Trophic State	Hypereutrophic	Hypereutrophic	Hypereutrophic	Eutrophic	Eutrophic	Eutrophic

Findings from the Pond Reports

Figure 1 Layout

Figure 1 shows the minimum and maximum annual geometric means, the grand geometric mean, and trend information for various criteria, beginning with Total Phosphorous (TP).

The Trend information for TP, TN, Chlorophyl, and Secchi link to the charts included in Appendix B and indicate whether a statistically significant trend is present.

For Total Phosphorous (TP) and Total Nitrogen (TN), Figure 1 also includes information on how each pond's levels compare to FDEP Numeric Nutrient Criteria and to LakeWatch Regional TP/TN zones.

FDEP Numeric Nutrient Criteria and Color

In part 1 of the lake watch annual reports (example in Appendix A), there is information on which FDEP Numeric Nutrient Criteria apply for distinct types of lakes. All of our preserve ponds are considered "Colored Lakes," which have different nutrient criteria than lakes classified as "clear soft water lakes" or "clear hard water" lakes.

Color data (Pt-Co units) in the LakeWatch reports, and shown in Figure 1, is "true color, which is the color of the water after particles have been filtered out." A lake falls into the category of Colored when the mean Pt-Co units are greater than 40.

Based on the nutrient target information provided in the reports for colored lakes, the annual geometric means for our ponds should be 50 ug/L or lower for TP and 1270 ug/l or lower for TN. As you look at the data in Figure 1, you can see that none of our ponds meet these criteria. That suggests they all may be considered potentially "impaired."

The LakeWatch reports note: "If your lake's concentrations ... are greater than FDEP's NNC values from Table 1, your lake may be considered impaired." In discussions with LakeWatch staff, they caution that further review of FDEP calculations and protocols is needed to fully assess these preliminary findings.

An additional note on Color: Other LakeWatch documents suggest that 79% of lakes studied have a Color value less than 50. Also, that a color value greater than 50 may limit algae growth. With the exception of Pond 4 (Hosman) all of our ponds have Color grand means higher than 50.

Florida LakeWatch Nutrient Zones and "Natural Background"

Part 2 of the full LakeWatch reports (example in Appendix A) provides more favorable comparison information for the nutrient levels in our ponds as compared to other Florida lakes in our area.

Based on research findings, LakeWatch divides Florida lakes into six Total Phosphorous zones and five Total Nitrogen zones. For each zone, there are quantified "natural background conditions," defined as "the condition of waters in the absence of man-induced alterations."

The detail reports list "the nutrient concentrations for the upper 90% of lakes with each zone." For our part of the state, the TP criteria is 252 ug/L and the TN criteria is 2,701 ug/L. Comparing the grand geometric means for our six ponds to these levels, we can see that all of our ponds except

Pond 1 (Duckweed Pond) have lower nutrient levels and are considered “within natural background”.

Looking back to the FDEP nutrient criteria previously discussed, we can see that the “natural” nutrient levels provided in this analysis are remarkably different from the FDEP nutrient criteria. The reports do not address reasons for the differing numbers.

<u>Total Phosphorous</u>

Looking at the TP grand means in Figure 1 for our six preserve ponds, we can see that the lowest grand mean is for Pond 5 (Verna’s Pond) at 55, while the highest grand mean is for Pond 1 (Duckweed) at 348. We can also see which ponds are showing statistically significant changes in this criterion. Ponds 1, 2, and 3 are all showing decreases in TP, while Pond 4 (Hosman) is showing an increase.

<u>Total Nitrogen</u>

Looking at the grand means for TN, WF-5 (Verna’s Pond) again shows the lowest level of TN and Pond1 (Duckweed) the highest level. Ponds 1, 2, and 3 are showing decreases over time while ponds 4, 5, and 6 do not have a statistical trend.

<u>Chlorophyll and Trophic State</u>

Trophic State shown in Figure 1 is a measure of how productive a lake may be. In these reports, the rating is assigned based on chlorophyll. Lakes with mean chlorophyll greater than 40 are rated as hypereutrophic (highly productive). Lakes with mean chlorophyll between 8 and 40 are rated as eutrophic (productive). There are other factors that can be used when establishing this rating. (LakeWatch circular 102, available from their website, provides more information.)

Based on the overall grand means for total chlorophyll, three of our ponds (Ponds 1, 2, and 3) are classified as hypereutrophic, while three are categorized as eutrophic. If we were to look only at the means for the three years since the preserve restoration, rather than all years, five of our six ponds would fall in the eutrophic category.

<u>Specific Conductance</u>

The LakeWatch reports define Specific Conductance as a “measurement of the ability of water to conduct electricity and can be used to estimate the dissolved materials in the water.” It Is only used in LakeWatch reports for establishing whether some lakes are considered hard water or soft water lakes for the FDEP Numeric Nutrient Criteria.

Other LakeWatch documents state that 75% of studied lakes have a grand mean less than 190, suggesting our ponds are high on this measurement.

Specific conductance is also sometimes used for estimating salinity. So, this measurement is likely to change dramatically in analysis done after Hurricane Milton when highly saline water surged into our preserve ponds.

<u>Secchi</u>

Secchi is a measure of water clarity. During our water sampling work, our volunteers lower a disc into the pond and measure the point at which the disc disappears. The level is recorded to the nearest quarter foot. For some reason, the LakeWatch reports only show the results in whole numbers. Pond 4 (Hosman) and Pond (Verna's) have better mean clarity than our other ponds. Pond 1 (Duckweed) is the only pond showing a statistically significant improvement in clarity.

Trend Data for our Ponds

Significant Nutrient Reductions in Ponds 1, 2, and 3

The LakeWatch reports use analysis of annual geometric means to calculate whether there are significant water quality changes over time. For our preserve ponds, the data shows that Ponds 1, 2, and 3, have statistically significant decreases in total phosphorous, total nitrogen, and chlorophyll.

As these ponds were the three ponds through which treated sewage effluent had previously flowed, and the three ponds that had the highest nutrient loads when we first began collecting data, it is logical that we would see improvement in those ponds over time. The charts in Appendix B visually depict the sharp drops in nutrient levels from 2012 to 2014.

As part of the preserve restoration work, all three of these ponds were modified. The major restoration work initially planned for Pond 1 was limited by funding constraints to the addition of a shallow dogleg area with plantings in the new zone. Ponds 2 and 3 were both significantly expanded, and thousands of wetland plantings were placed in the new littoral zones in each pond.

The reductions in nutrients in Pond 3 are particularly valuable because the drainage creek out of Pond 3 is the single outflow from all the freshwater ponds into the Lemon Creek estuary.

All three of these ponds were initially classified by LakeWatch Trophic State criteria as hypereutrophic, but now fall in the eutrophic category.

Limited Changes in Ponds 4, 5, and 6

In contrast to the dramatic improvements in Ponds 1 through 3, Ponds 4 through 6 show limited change over time. One likely reason for this is that these ponds were lower in nutrients to start with and, according to data provided in the LakeWatch reports, they are within expected background levels for natural lakes in our area of Florida.

Pond 4 (Hosman Pond) is isolated from the rest of the ponds in the preserve, and it does not receive surface level stormwater inflows. It has steep sides and an average water depth of six feet, making it deeper than most of our other ponds. Because of its location and its relatively good water quality, it was not modified during our restoration work. It is the only pond showing a trend of increasing Total Phosphorous in our LakeWatch reports. The reason behind that is not clear, but could, perhaps, be due to natural eutrophication over time.

The relatively good water quality in Pond 5 (Verna's Pond) when compared to our other ponds is somewhat surprising because it receives direct stormwater inflows from three locations. Like Pond 4, it is a relatively deep pond with steep sides. In the restoration work, the only change that we made to this pond was to expand the outflow culverts that flow to Pond 3 (Moorhen Pond) to allow it to drain more quickly following high water inflow events.

One interesting difference in this pond from all the others is that, to the best of our knowledge, it is the only pond that has clams in the pond. It would be interesting in the future to study whether the water filtration capabilities of the clams may be helping water quality in this pond.

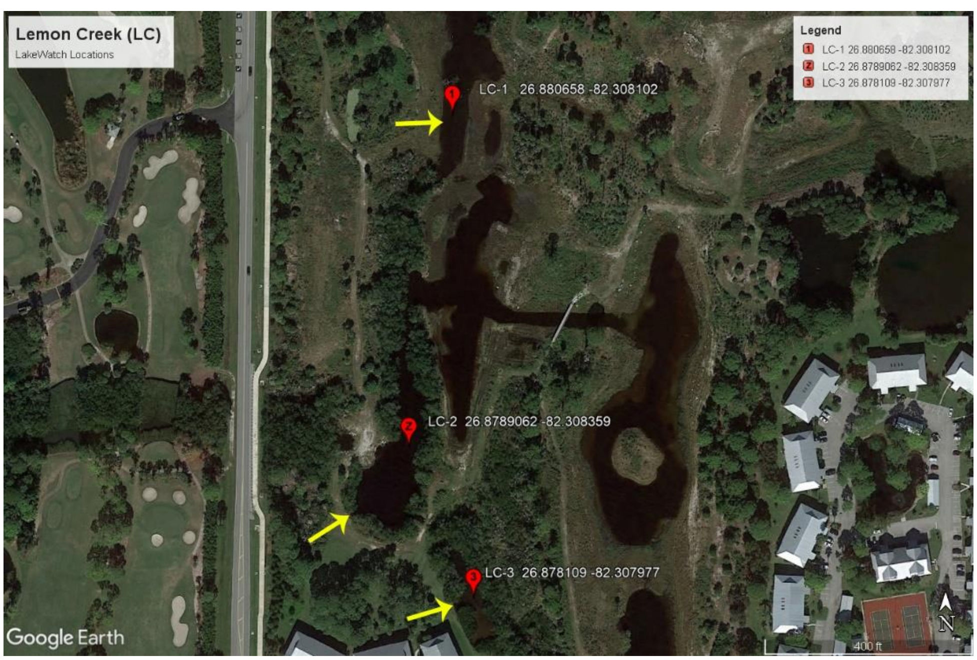
Pond 6 (Turtle Pond) was one of the three ponds that was the target of major changes during our restoration work. The pond receives intermittent stormwater inflows from the north through a long drainage ditch that runs south from Gasparilla Pines Boulevard and then turns east to flow into Turtle Pond. The inflowing drainage creek levels only get high enough to reach the pond in rainy periods. During the restoration, parts of the inflow creek that had been in culverts were opened-up and wetland plantings were added. The pond itself was also significantly modified during the restoration. Gradual sloping edges were created, and thousands of wetland plants were added. The connection to Pond 2 (Long Pond) was also modified, removing old culverts, and opening up the flow way between the two ponds.

With the restoration work completed in January 2021, we had anticipated that we would see lowering of nutrient levels in Pond 6 during the past three years. So far, that has not been the case. However, as previously noted, Pond 6, like all of our ponds except Pond 1 (Duckweed) now falls within the range of nutrient levels found in other ponds in our part of the state.

LakeWatch Water Quality Reports – Lemon Creek

The map below shows the three locations in Lemon Creek where we collect water samples. In the LakeWatch reports, the creek locations are referred to as LC1, LC2, and LC3.

All three locations are in the “old” part of the creek, this is in areas that existed prior to our restoration work expanding the creek system.



LC1(Lemon Creek North) is the closest location to the point where freshwater flows into the creek from Pond 3 when water levels are high. The north end of the creek also receives stormwater inflows from a drainage pipe running under Gasparilla Pines Boulevard. The creek area around LC1 was expanded as part of the restoration work, so there are fewer mature mangroves in this part of the creek than at the other two monitoring locations.

LC2 (Lemon Creek Central) is close to the point where tidal exchange occurs between Lemon Creek and Lemon Bay. Culverts run under our preserve trail west of the sampling location, through the mangroves, and through additional culverts under Placida Road. Water quality here is also influenced by drainage swales that run along the east side of Placida Road and dump stormwater into the creek. Mature mangroves cover most of the creek banks in this area. Hurricane Ian caused considerable damage, particularly to the red and black mangroves that are in the immediate tidal flow zone closest to Placida Road.

LC3 (Lemon Creek South) is in the southern portion of our property in a narrower section of the creek surrounded by mangroves. This portion of the creek flows through the Fiddlers' Green condominium community and connects to Lemon Lake in the County's Amberjack Preserve.

Figure 2 below shows summary data for our three Lemon Creek water quality sampling locations. The trend plots for the creek locations are included in Attachment C. Because the LakeWatch team focuses primarily on freshwater systems, their annual reports provide less information for estuarine sampling locations than they do for lakes. No FDEP criteria or regional data are provided. The LakeWatch staff suggest checking with FDEP on criteria appropriate for our specific estuary. To date, that effort has not been undertaken.

Figure 2: Data Comparisons for Creek Locations

Lemon Creek Estuary	LC-1 (North)	LC-2 (Central)	LC-3 (South)
Total Phosphorous			
Min Annual Mean	74	77	83
Max Annual Mean	520	750	841
Grand Mean	231	182	253
Trend	none	none	none
Total Nitrogen			
Min Annual Mean	490	470	460
Max Annual Mean	4090	4060	4780
Grand Mean	698	1172	1521
Trend	none	none	none
Chlorophyll			
Min Annual Mean	11	5	10
Max Annual Mean	698	445	727
Grand Mean (>20, use targets above)	62	37	62
Trend	decreasing	decreasing	none
Secchi (ft)			
Min Annual Mean	0.5	0.24	0.5
Max Annual Mean	3	1.65	4.8
Grand Mean	1.6	0.8	1.6
Trend	none	none	none
Color			
Min Annual Mean	20	14	14
Max Annual Mean	187	237	357
Grand Mean	69	60	76

There are no statistically identifiable trends for TP, TN, or Secchi at any of our creek sampling locations. LC1 (Lemon Creek North) and LC2 (Lemon Creek Central) show decreasing chlorophyll levels. The reasons for this change are not clear. It's also not clear why the numbers vary so dramatically over time. The many sources of freshwater inflow into Lemon Creek likely contribute to the high variability in nutrient measurements across samples.

The specific conductance data in the detailed reports we received from LakeWatch did not correctly reflect all the available data, so that data is omitted from Figure 2.

Interestingly, while Secchi is only shown in whole numbers in the Pond data, it is reported to one decimal point in the Creek data.

We have recently begun collecting salinity data using a refractometer as part of our sampling work (in addition to standard LakeWatch procedures). That will allow us to look at salinity changes over time. From the recent salinity data, we know that the salinity in the estuary varies a great deal depending on the strength of incoming tides and on the amount of rainfall. Significant variations are to be expected in an estuarine environment.

It should be noted that for many years, the LakeWatch protocol was to only sample estuarine environments every other month. So, our base of samples for these reports is more limited than for the Ponds.

In comparison to the Ponds, the Creek samples show TP grand means that are in the range of two of our higher-nutrient ponds, Ponds 2 and 3.

For Total Nitrogen, LC1 (Lemon Creek North), has a lower TN grand mean than any of our ponds, while LC2 and LC3 show grand means that are also relatively low.

Further discussions with FDEP might provide additional insights on the information in the Creek reports.

Closing Note

The spreadsheet with monthly sampling data by location is available on the LBC website.

Appendix A: Example of Full LakeWatch Report

“Florida LAKEWATCH Report for WF-1 in Charlotte 2024”

Appendix B: LakeWatch Trend Plots for Six Ponds at Lemon Creek Wildflower Preserve

WF-1 thru WF-6

July 2011 – November 2023

Appendix C: LakeWatch Trend Plots for Lemon Creek

Three Locations

LC-1 thru LC-3

July 2011 – November 2023