



# Alligator Creek WBID 2030 TMDL Implementation Plan

Supplemental Stormwater Management Program



October 9, 2018

## TABLE OF CONTENTS

Report Summary.....	3
Alligator Creek Basin.....	3
Sources of Nitrogen Pollution.....	6
TMDLs.....	7
Impaired Waters.....	10
Seagrass .....	11
NPDES Permit.....	11
Water Quality Monitoring.....	13
Nutrient Reduction Efforts.....	18
Community Engagement and Outreach.....	21
TMDL BMP Strategy.....	24

## FIGURES

Figure 1. 2017 Aerial View of Alligator Creek Basin .....	5
Figure 2. Land Use in the Alligator Creek Basin.....	5
Figure 3. Septic Systems in the Alligator Creek Basin (2009).....	7
Figure 4. Map of Alligator Creek WBID 2030 as of 2006.....	9
Figure 5. Map of Alligator Creek WBIDs 2030 and 2030A as of 2018.....	9
Figure 6. Map of Impaired WBIDs near the Alligator Creek Basin.....	10
Figure 7. Chart of Seagrass Acreage for the Sarasota County portion of Lemon Bay.....	11
Figure 8. Map of Water Quality Sampling Locations in Alligator Creek Basin.....	14
Figure 9. Graph of Nitrogen Concentrations in Alligator Creek Basin & Lemon Bay.....	14
Figure 10. Aerial View of green water in Venice Gardens Lakes.....	15
Figure 11. Graph of Nitrogen Concentrations in Venice Gardens Lakes.....	15
Figure 12. Naturalized Briarwood Waterway 2017.....	16
Figure 13. Graph of Nitrogen Concentrations in Briarwood Waterway.....	17
Figure 14. Graph of Nitrogen Concentrations in Siesta Waterway.....	17
Figure 15. Graph of Nitrogen Concentrations in Alligator Creek.....	18
Figure 16. Graph of Nitrogen Concentrations in Lemon Bay 2017.....	18

Alligator Creek WBID 2030 TMDL Implementation Plan

Figure 17. Location of the Briarwood Stormwater Treatment Facility.....19

Figure 18. BSTF Treatment Process.....20

Figure 19. Nitrogen Concentrations in and out of the BSTF.....20

Figure 20. Flow in and out of the BSTF in 2017.....21

Figure 21. Alligator Creek Tee Shirt with Snook Image.....22

Figure 22. Blue Not Green Fertilizer Outreach Poster.....23

Figure 23. Spread Fun Not Fertilizer Outreach Poster.....24

## EXECUTIVE SUMMARY

Although the TMDL for Alligator Creek is based on legal considerations more than rigorous scientific analysis, there is evidence that the Venice Gardens Lake System is hypereutrophic and discharges an unhealthy excess of nitrogen to Alligator Creek and Lemon Bay. Reducing nitrogen load to the TMDL waterbody is primarily being accomplished by the Briarwood Stormwater Treatment Facility (BSTF). Improvements to the operation, maintenance and monitoring of the BSTF are expected to demonstrate increased removal efficiencies. Other activities, such as fertilizer reductions, low impact design, native landscaping, wastewater management, septic system management, or other projects may also contribute valuable reductions.

## ALLIGATOR CREEK BASIN

Located in Venice Florida, the Alligator Creek Basin is a small, rectangular drainage basin of 6,800 acres with a 5-mile long creek that runs diagonally from the northeast to the southwest. The headwaters are wetlands, the middle reach is a canalized creek and the bottom third is a mangrove-lined tidal creek. Flow from the Alligator Creek Basin goes to Lemon Bay then to the Gulf of Mexico. Flushing rates that would move pollutants to the Gulf are strongly influenced by freshwater inflows from Alligator and other adjacent creeks according to the Lemon Bay Watershed Management Plan which is available at:

[http://www.sarasota.wateratlas.usf.edu/upload/documents/LemonBayWMP\\_Aug2010\\_full.pdf](http://www.sarasota.wateratlas.usf.edu/upload/documents/LemonBayWMP_Aug2010_full.pdf).



Figure 1. Aerial View of the Alligator Creek Basin.

The Alligator Creek Basin contains about 20% of the land that contributes stormwater to the Lemon Bay Watershed, which is a substantial amount. Land use is predominantly residential and commercial but green space and blue space are also noteworthy and add up to 32%.

Land Use	Acres	Percent
Residential	3,869	57
Water & Wetland	1,051	16
Commercial, Industrial, Transportation, Utilities	786	12
Forest, Open Area & Park	481	7
Pasture	360	5
Golf	252	4

Figure 2. Land Use in the Alligator Creek Basin.

## SOURCES OF NITROGEN POLLUTION

Nitrogen is a nutrient necessary for life that cycles through air, water and living things. When present in excessive amounts in water, algae blooms occur, water transparency is lost and oxygen levels are depleted, conditions that are deleterious to a healthy balance of aquatic life. The usefulness of the waterbody is impaired.

Nitrogen is an important pollutant in Alligator Creek and Lemon Bay. Major sources are wastewater, septage, reclaimed wastewater, fertilizer, plant debris and air pollution. Stormwater is not a source of pollution – it comes from rain that falls on land and picks up pollutants as it flows, eventually depositing the pollutants in waterbodies. The stormwater drainage system also receives pollutants from groundwater that seeps into the system.

Since the 1980s, stormwater treatment systems (mostly wet ponds) have been part of land development standards. In the Alligator Creek Basin, stormwater treatment is found in the eastern half of the basin. The coastal area was built before stormwater treatment Best Management Practices (BMPs) were required. Designed ponds are visible in aerial views. Published reports indicate that stormwater wet ponds remove about 30% to 40% of nitrogen from stormwater.

Wastewater Treatment in the basin follows a similar pattern as the stormwater treatment system. The upstream area is served by wastewater treatment plants and the downstream portion, nearer to Lemon Bay, is served by septic systems. Septic systems are designed to slowly discharge to underground infiltration systems (drainfields) and may contribute nitrogen to stormwater runoff and baseflow.

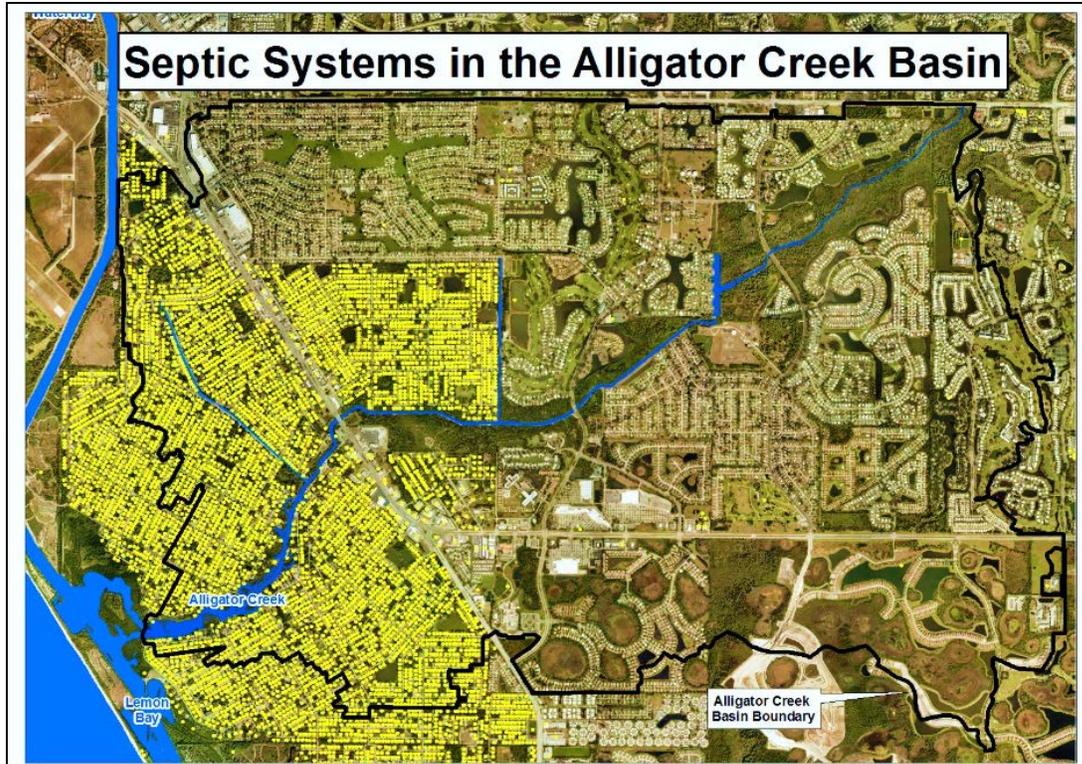


Figure 3. Septic Systems in the Alligator Creek Basin (2009)

## TMDLS

Healthy waterbodies should provide recreation, fish and shellfish for consumption, and the propagation and maintenance of a healthy, well balanced population of fish and wildlife, as defined in rule (62-302, FAC). This is called the Designated Use of a waterbody and originates in the US Clean Water Act. Florida water quality standards define how much pollutant is excessive. Waterbodies not meeting standards are verified “impaired” for a specific pollutant. Impaired waterbodies are assigned TMDLs that define how much pollutant must be removed. Implementation of the pollutant reductions are mandated through National Pollutant Discharge Elimination System (NPDES) permits.

In 2006, the Environmental Protection Agency (EPA) issued a Total Maximum Daily Load (TMDL) for nutrients for Alligator Creek WBID 2030 calling for a 28% reduction in total nitrogen. The TMDL estimated that a reduction of 3,336 pounds of nitrogen per

year would restore the creek, which would change the total load from 11,840 pounds per year to 8,504 pounds per year. The TMDL fulfills the Environmental Protection Agency's (EPA) responsibility to assess waterbodies on Florida's 1998 303(d) list as required by the 1999 Consent Decree. The TMDL document is available on the Sarasota Water Atlas website at:

<http://www.sarasota.wateratlas.usf.edu/upload/documents/TMDLNutsDOColiSaraBayCh arHrbMarch2006.pdf>. The Consent Decree is located at:

<http://www.sarasota.wateratlas.usf.edu/upload/documents/Florida-TMDL-Consent-Decree-1999.pdf>. The 1998 3030(d) list is at:

<http://www.sarasota.wateratlas.usf.edu/upload/documents/1998-303d-Listed-Water-Segments.pdf>

WBIDs are parts of a watershed that are identified by a waterbody ID number (WBID). TMDLs and verified impaired designations are assigned to WBIDs. At the time of the establishment of the TMDL, WBID 2030 encompassed most of the Alligator Creek Basin. Later, the Florida Department of Environmental Protection (FDEP) subdivided the WBID into 2030 and 2030A to separate the fresh and marine reaches.

Sarasota County typically uses the drainage basin as the management unit rather than the WBID to achieve flood protection and water quality improvements. There are differences between these two sets of boundaries. The basin boundaries are developed from flood elevation studies and the WBIDs are based on a large-scale statewide mapping system. This document will sometimes refer to the basin and other times refer to the WBID.

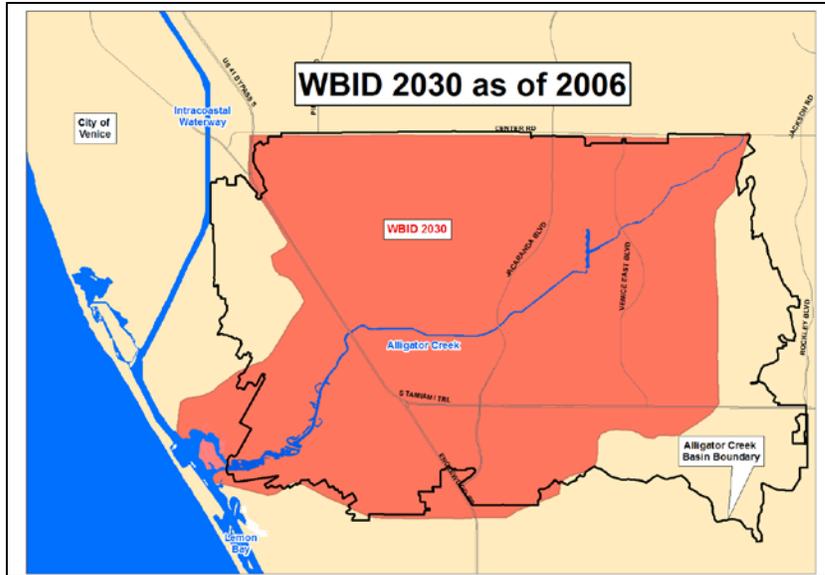


Figure 4. Map of Alligator Creek WBID 2030 as of 2006.

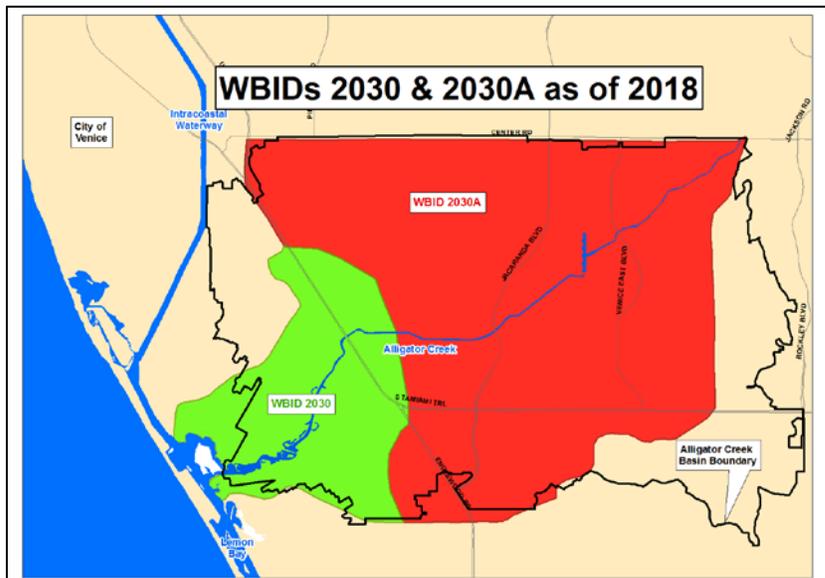


Figure 5. Map of Alligator Creek WBIDs 2030 and 2030A as of 2018.

Sometimes there is more than one TMDL in a basin, but the 2006 nitrogen TMDL is the only TMDL in the Alligator Creek Basin. The original TMDL also addressed impairment for dissolved oxygen and assigned a load reduction for biochemical oxygen demanding substances but the TMDL was withdrawn because WBID 2030 was never on

the Clean Water Act (CWA) Section 303(d) list for dissolved oxygen. The withdrawal document is available on the Sarasota Water Atlas at:

<http://www.sarasota.wateratlas.usf.edu/upload/documents/EPA%20Withdrawal%20of%20Alligator%20Creek%20DO%20TMDL%2006-16-06.pdf>

## IMPAIRED WATERS

There are several impaired WBIDs in the Alligator Creek Basin or in the downstream bays. According to the Statewide Comprehensive Verified List of Impaired Waters located at <https://floridadep.gov/dear/watershed-assessment-section/documents/statewide-comprehensive-verified-list-impaired-waters>, WBID 2030 is currently impaired for Fecal Coliform bacteria. Immediately downstream of Alligator Creek, North Lemon Bay WBID 1983A1 is impaired for Nutrients (Chlorophyll-a) and Nutrients (Total Nitrogen). Farther south, but still in Sarasota County, Lemon Bay WBID 1983A is impaired for Fecal Coliform, Bacteria (in Shellfish), Nutrients (Chlorophyll-a) and Nutrients (Total Nitrogen). To the north, Roberts Bay (WBID 2018A) and Dona Bay (WBID 2002) are also impaired for nutrients. In some cases, the source of high levels of nutrients comes from wastewater or septage and in those cases bacteria and nutrient TMDLs may be related.

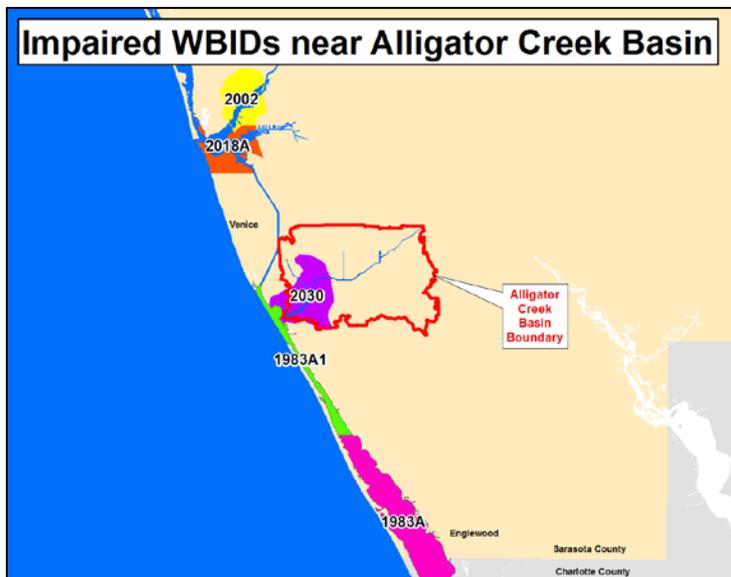


Figure 6. Map of Impaired WBIDs near the Alligator Creek Basin.

## SEAGRASS

Seagrass is used as an indicator of healthy water quality by the Tampa Bay, Sarasota Bay and Charlotte Harbor National Estuary Programs. Using aerial maps produced by the SW Florida Water Management District, seagrass acreage goals were set for bays. Near Alligator Creek, Lemon Bay is meeting its seagrass target and Dona/Roberts Bay is not. Seagrass targets were the foundation of the FDEP Numeric Nutrient Criteria for bays in SW Florida. These criteria are the formal regulatory standards for nitrogen and phosphorus in bays (62-302 FAC). More can be learned about seagrass targets on the Sarasota Water Atlas Bay Conditions pages at <http://www.sarasota.wateratlas.usf.edu/bay-conditions/>. The premise of seagrass targets is that increased nitrogen will cause an increase in chlorophyll, that shades out the seagrass resulting in a decrease in seagrass acreage.

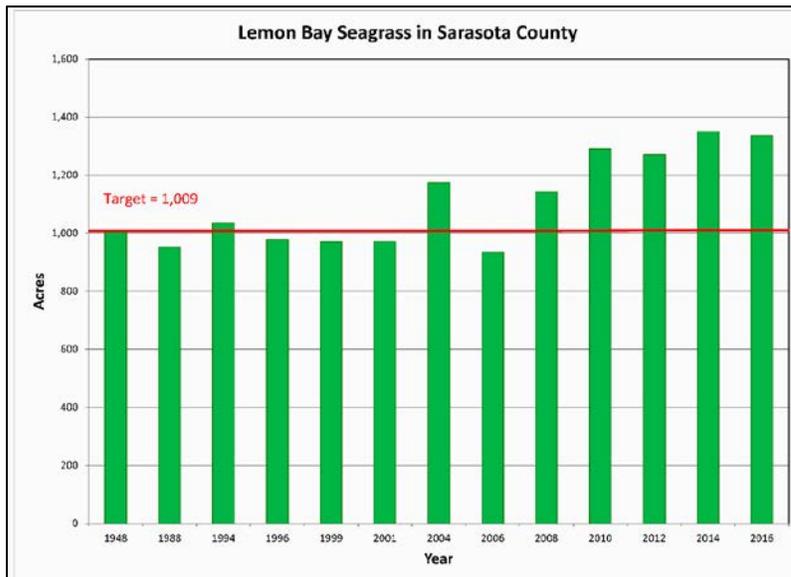


Figure 7. Chart of Seagrass Acreage for the Sarasota County portion of Lemon Bay.

## NPDES PERMIT

NPDES permits allow discharges of pollutants to the waters of the United States if certain conditions are met. NPDES covers stormwater, municipal wastewater, industrial wastewater and other discharges. In Florida, the NPDES program is delegated from EPA

to the FDEP. Sarasota County has a stormwater permit issued by FDEP for the discharge of polluted stormwater and is called a MS4 permit which stands for Municipal Separate Storm Sewer System. Partners to this permit include the Cities of Sarasota, North Port, Venice and Longboat Key and the Florida Department of Transportation. The permit has a single objective - to reduce stormwater pollution to the Maximum Extent Practicable (MEP). The permit is available here:

<http://www.sarasota.wateratlas.usf.edu/upload/documents/Sarasota-County-2014-MS4-Permit.pdf>.

TMDLs are implemented through the NPDES MS4 permit. Conditions for EPA-established TMDLs include the following tasks and due dates from the date of permit issuance:

- a. TMDL Prioritization Report (1-6 months)
  - b. TMDL Monitoring and Assessment Plan (6-12 months)
  - c. TMDL Monitoring (12-36 months)
  - d. TMDL Implementation Plan (24-48 months)
  - e. Evaluation of Results (each annual report)
- 
- a. The prioritization (revised version) was approved by FDEP in 2016 and the letter is available here:  
<http://www.sarasota.wateratlas.usf.edu/upload/documents/FDEP-Approval-of-Sarasota-County-Revised-TMDL-Schedule-8-29-16.pdf>.
  - b. The TMDL Monitoring and Assessment Plan is available here:  
<http://www.sarasota.wateratlas.usf.edu/upload/documents/Letter-County-to-FDEP-TMDL-Monitoring-Plan-Alligator-Creek-10-14-15.pdf>.
  - c. TMDL Monitoring has been conducted for several years and will be described in this report.
  - d. This report is the TMDL Implementation Plan.

The permit requires a TMDL Implementation Plan (also known as a Supplemental SWMP) to reduce pollutants to be submitted to the FDEP for approval. The plan should include:

1. Structural and non-structural BMPs and program activities to be implemented, a schedule, and estimated load reductions.
2. A monitoring strategy to document progress in meeting the load reductions with updates in each annual report.

## WATER QUALITY MONITORING

Monthly, ambient samples are taken from 3 locations in the Venice Gardens Lake System, 6 locations in the BSTF, three locations in Alligator Creek, 3 locations in Briarwood Waterway, and 3 locations in Siesta Waterway. Flow is measured in and out of the BSTF. Water depth is measured continuously at the weir from Venice Gardens Lakes to the Briarwood Waterway. Water depth and rainfall are measured at the Automated Rainfall Monitoring Station located in Alligator Creek at Jacaranda Boulevard. Ambient monitoring is also conducted downstream in Lemon Bay. All water quality data is available to be downloaded from the Sarasota Water Atlas. Alligator Creek and Lemon Bay are depicted on the Creek Conditions pages and the Bay Conditions pages, respectively.

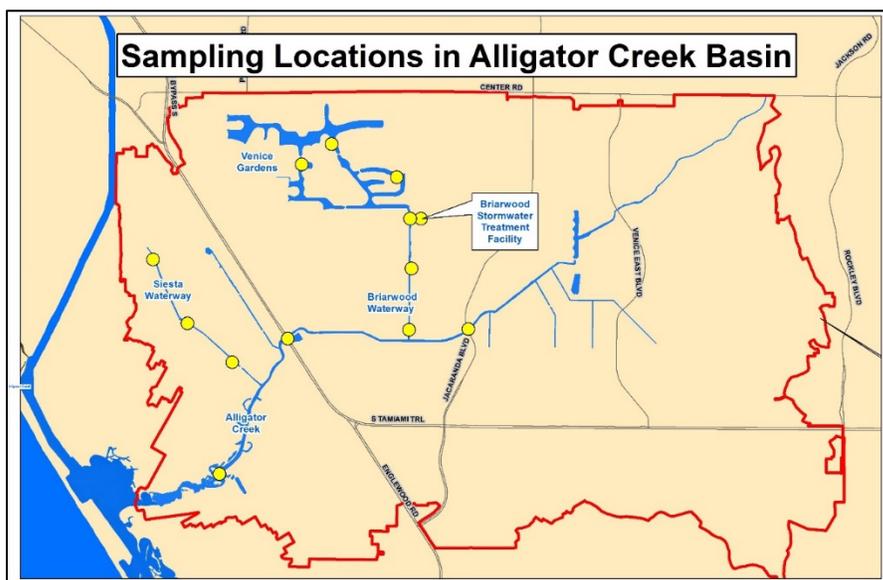


Figure 8. Map of Water Quality Sampling Locations in Alligator Creek Basin.

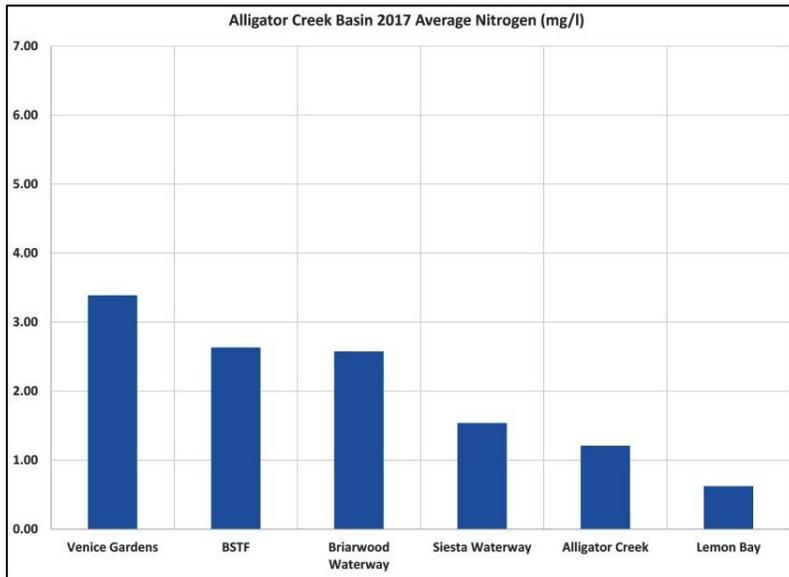


Figure 9. Graph of Nitrogen Concentrations in Alligator Creek Basin & Lemon Bay.

The Venice Gardens Lake System is composed of three lakes that are interconnected by culverts. When water levels are high, flow from the lake travels over a broad weir into Briarwood Waterway then to Alligator Creek. In the lakes, elevated levels of nitrogen, phosphorus and chlorophyll exceed water quality standards. The lakes are very green with low transparency.



Figure 10. Aerial View of green water in Venice Gardens Lakes.

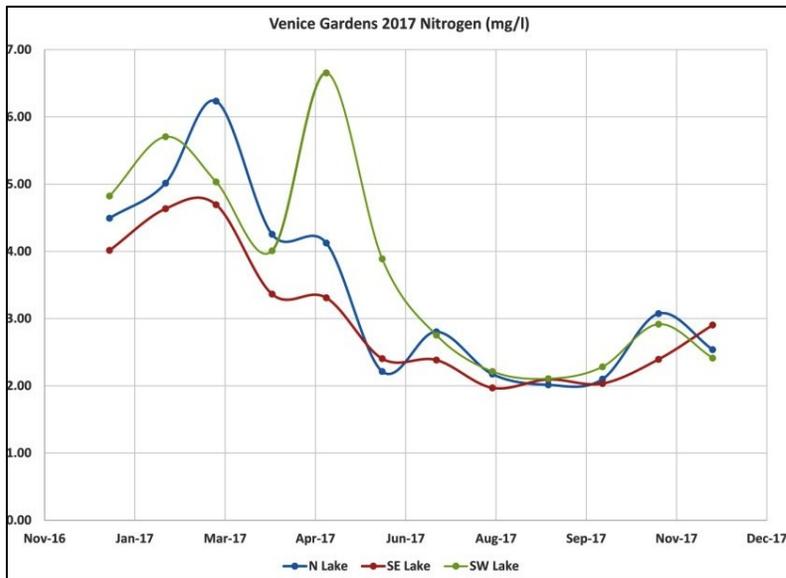


Figure 11. Graph of Nitrogen Concentrations in Venice Gardens Lakes.

It is unclear why the lakes are so eutrophic because the contributing land use is served by sanitary sewer and is not a heavy user of fertilizer. Historic wet weather leaks of wastewater may have enriched the lakes with nutrients. Another hypothesis is that little or no discharge from the lakes in dry season may result in accumulated nutrients, or accumulated nutrients in sediments are a source of nutrients in the water.

In 2017, a project to naturalize the Briarwood and Siesta Waterways was completed. The project was not built to remove pollutants but similar installations such as filter marshes are known to remove nutrients.



Figure 12. Naturalized Briarwood Waterway 2017.

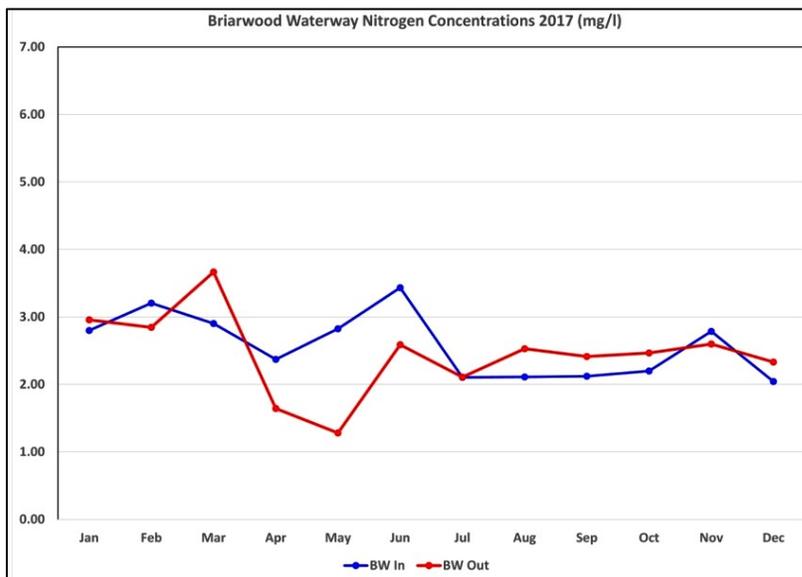


Figure 13. Graph of Nitrogen Concentrations in Briarwood Waterway.

On average, there is a slight reduction (5%) in the average nitrogen concentration of the water as it flows through the Briarwood Waterway but is inconsistent. Additional monitoring and analysis may provide valuable information about this process and how to maximize nutrient removal.

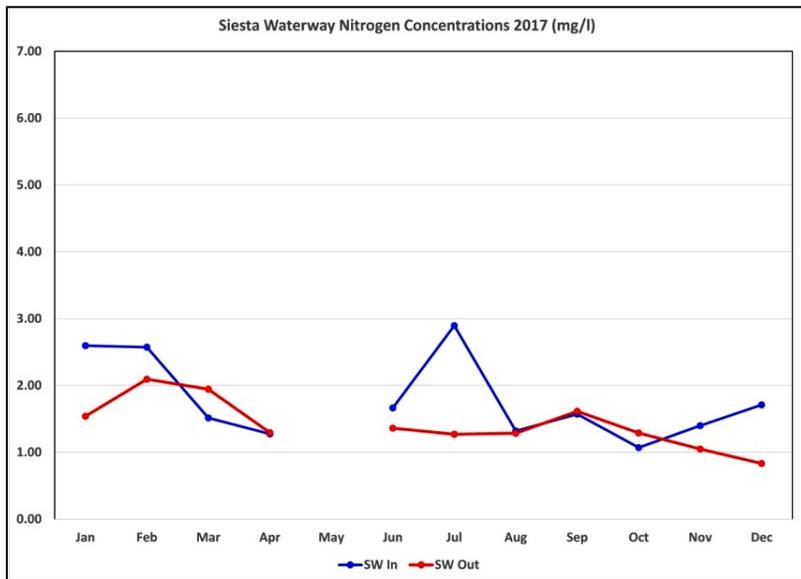


Figure 14. Graph of Nitrogen Concentrations in Siesta Waterway.

On average there was a 37% reduction of nitrogen concentration in the water flowing through the Siesta Waterway, but the process is inconsistent over the course of the year. Continued monitoring will inform about whether this is a reliable process for nutrient removal.

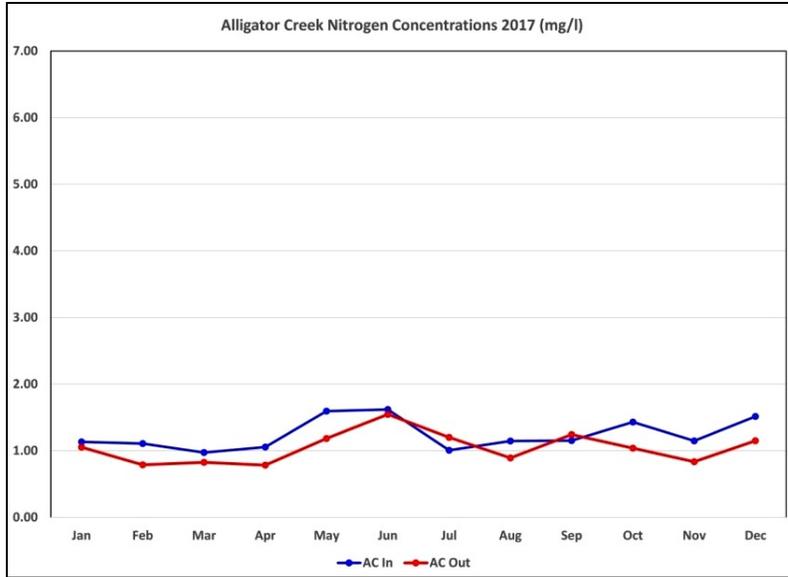


Figure 15. Graph of Nitrogen Concentrations in Alligator Creek.

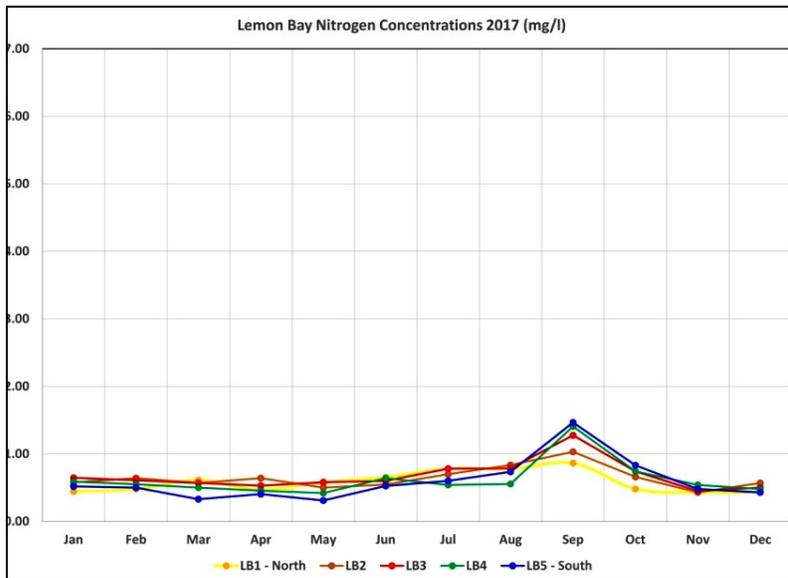


Figure 16. Graph of Nitrogen Concentrations in Lemon Bay 2017.

Lemon Bay experienced elevated levels of nitrogen in summer, especially September, in 2017. The least elevated segment of Lemon Bay was at the north, near Alligator Creek, suggesting that Alligator Creek was not the source of this condition.

## NUTRIENT REDUCTION EFFORTS

In 2012, the construction of the Briarwood Stormwater Treatment Facility (BSTF) was completed. It is located at the juncture of the Venice Gardens Lakes and the Briarwood Waterway. The treatment goal is to reduce nutrient and suspended solids pollution to Alligator Creek and Lemon Bay through a treatment train consisting of stormwater harvesting, engineered wetlands and biologically active upflow media filters. Lake water is pumped through the facility then discharged back to the lake or the the Briarwood Waterway, depending on lake levels. More can be learned about the BSTF at:

[http://www.sarasota.wateratlas.usf.edu/upload/documents/AlligatorCreek-FDEP319h-WQ-Monitoring-Program-Report\\_2016-01-08.pdf](http://www.sarasota.wateratlas.usf.edu/upload/documents/AlligatorCreek-FDEP319h-WQ-Monitoring-Program-Report_2016-01-08.pdf).



Figure 17. Location of the Briarwood Stormwater Treatment Facility.

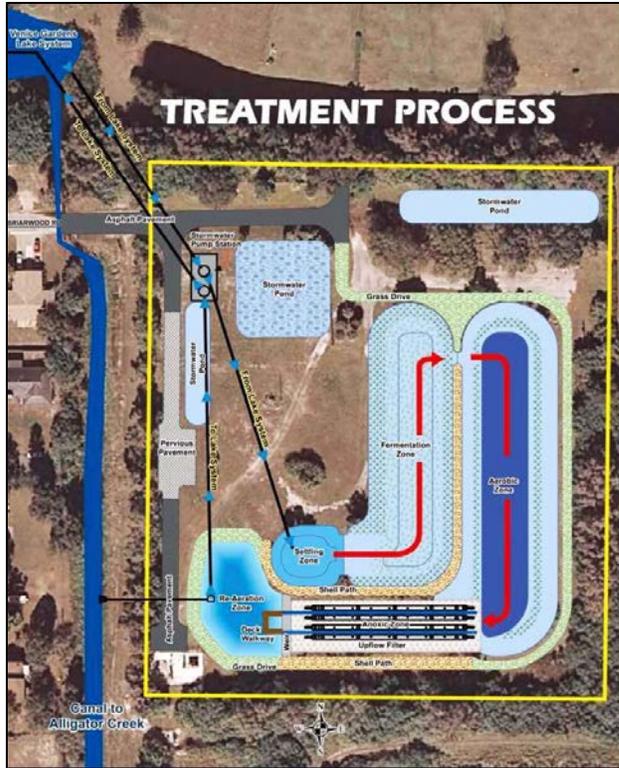


Figure 18. BSTF Treatment Process.

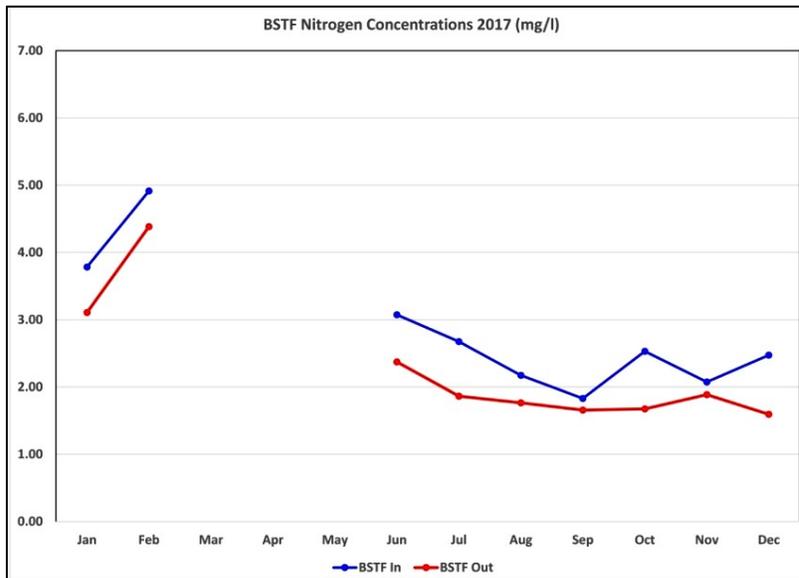


Figure 19. Nitrogen Concentrations in and out of the BSTF.

In 2017, the nitrogen concentration of the water leaving the BSTF was lower than the water entering the facility for every month with data. During very dry weather the BSTF

is turned off to prevent dewatering of the Venice Gardens Lakes. It is also turned off for annual maintenance. Samples are not taken when there is no flow.

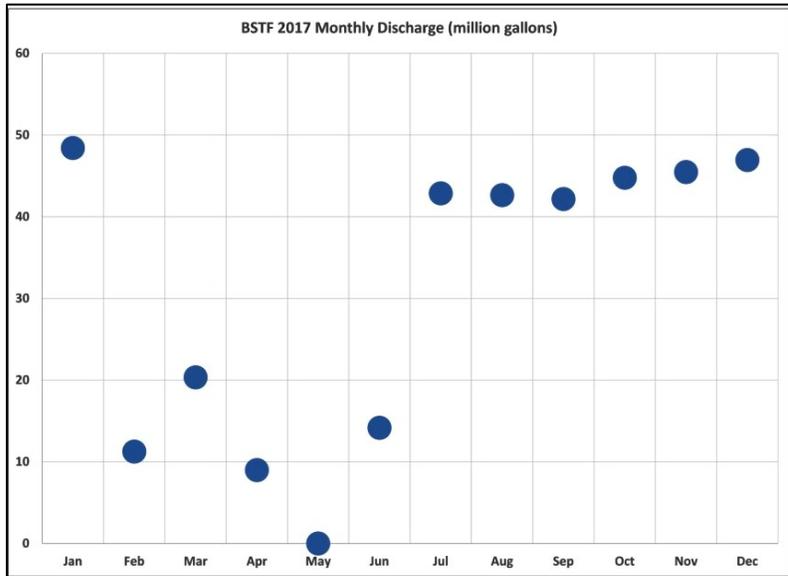


Figure 20. Graph of Monthly Discharge from the BSTF.

In 2017, the BSTF removed 2,391 pounds of nitrogen. The TMDL calls for the removal of 3,336 pounds per year of nitrogen so the BSTF achieved 72% of the TMDL goal. Much of the time the discharge was to the lake though, so it is not a direct reduction to Alligator Creek.

## COMMUNITY ENGAGEMENT AND OUTREACH

Sarasota County conducted a concerted effort to engage and support groups on the Alligator Creek Basin who were involved in activities to improve water quality or natural systems.

The Venice Gardens Lakes Group, conducted paddle cleanups in the lakes, installed a vegetated floating island with a grant from the Charlotte Harbor National Estuary Program, planted shorelines with aquatic vegetation, held a well-publicized open house, built a relationship with the local newspaper, the Venice Gondolier, and more. Sarasota County’s Neighborhood Environmental Stewardship Coordinator, Mollie Holland, built 4

demonstration shorelines in Venice Gardens Park and held an outreach event to teach about the water quality benefits of aquatic plants and Florida-Friendly plants that need little fertilization or irrigation once established.

The South Venice Civic Association formed a Water Quality Task Force that initiated the project to naturalize the Briarwood and Siesta Waterways. This project changed local thinking about canals as forsaken drainage features and replaced it with the idea that they could be assets to neighborhoods if they were living streams. This group continues looking for other improvements to implement. They have spoken to numerous other associations around the County to encourage grass roots initiatives.

To raise consciousness about Alligator Creek, Sarasota County is supporting paddle cleanups on the creek and are exploring other project opportunities, that may include naturalizing the middle reach of the creek that has been canalized. Tee shirts were printed to support such volunteers and included the outline of the iconic and prized snook sport fish that lives in coastal creeks of SW Florida.



Figure 21. Alligator Creek Tee Shirt with Snook Image.

A fertilizer outreach program was publicized in the Alligator Creek Watershed (and throughout the County) to educate people about minimizing the use of fertilizers to prevent nutrient-enriched stormwater from entering waterbodies. Methods included social media, attendance at public events, and ads in movie theaters. Sarasota County continues to implement a fertilizer ordinance that restricts usage during the summer rainy season. These innovative outreach programs were created under a contract with the Science and Environment Council of SW Florida and included distribution to their 29 member organizations.



Figure 22. Blue Not Green Fertilizer Outreach Poster.



Figure 23. Spread Fun Not Fertilizer Outreach Poster.

A story map was created on the Sarasota Water Atlas to inform the community about the activities and 20 interesting features in the basin. The Alligator Creek Watershed Tour is available at: <http://www.sarasota.wateratlas.usf.edu/watershedtours/alligatorcreek/#>.

## TMDL BMP STRATEGY

The activities in this strategy shall be accomplished in the next NPDES MS4 5-year permit term. All progress and results will be included in each annual report.

1. A proposed budget for fiscal year 2019 includes funding for further study of causes of the eutrophic condition of the lakes and how to optimize performance of the BSTF. Performance improvements might include more hours of operation annually, discharging treated water preferentially to the Briarwood Waterway rather than back go the lake.
2. An effort shall be made to more accurately monitor volumes discharged over the weir from the lakes to Briarwood Waterway and discharges from the BSTF to the Briarwood Waterway.

3. A study of the lakes system shall be conducted to measure bathymetry (water depth), submerged aquatic vegetation and sediment characterization. This information will inform about possible nutrients coming from organic sediments, identify possible macrophyte planting options, and provide information on total water volume of the lake system.
4. An effort will be made to develop a contract for fish harvesting from the lake system. This technique has been used in eutrophic lakes to remove nutrients in the form of fish, which are about 2.5% nitrogen by weight.
5. Monitoring of the BSTF, Venice Gardens Lakes, Alligator Creek, Siesta Waterway, Briarwood Waterway, and Lemon Bay will be continued to better understand improving or declining trends in water quality and to assess waterbodies for impaired status. Data will be uploaded to the Sarasota Water Atlas website and into the FDEP WIN database. Creeks and Bays will continue to be characterized in Creek Conditions and Bay Conditions pages on the Water Atlas.
6. Outreach and community engagement will continue in the Alligator Creek watershed to support activities that will reduce excessive nutrient pollution.
7. Screening samples will be taken from other waterbodies in the watershed to identify excessive concentrations. This data will be used to identify possible nutrient reduction projects.
8. An effort will be made to change the Venice Gardens Lakes System from an algae-dominated lake to a large-plant-dominated lake by planting of shorelines or other similar initiatives. This effort will be made in cooperation with the Venice Gardens Lakes Group.
9. Data about the volume, quality and location of accidental spills of sewage, septage or reclaimed water will be tabulated and reported in each annual report. This data will make pollutant load modeling more accurate and illustrate trends in spill management.
10. Data about the number and location of septic systems shall be tabulated and reported in each annual report. This data will help with pollutant load modeling

and inform about the expansion of septic system usage or the transition of septic systems to sewage treatment services.

11. The NEST program will continue to conduct outreach, education and project support in the Alligator Creek basin with a focus on nutrient reductions. Activities may include paddle cleanups of Alligator Creek to reduce plastic and other pollution and as a consciousness-raising activity about the Creek itself.