CITY OF ST. PETERSBURG
WATER QUALITY REPORT CARD
2019

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INTRODUCTION

The City of St. Petersburg is currently meeting the requirements of a Consent Order (OGC No. 16-1280) from the Florida Department of Environmental Protection (DEP). The Consent Order is a result of unpermitted discharges of wastewater and effluent from several of the City's Facilities and Systems into waters of the State and/or into adjacent canals, ditches and ponds that are connected to waters of the State. As part of the Consent Order, the City is required to develop a detailed Water Quality Monitoring Assessment Report and create a Water Quality Report Card.

The following presents the 2019 Water Quality Report Card. The Report Card presents information for two central themes related to water quality – Environmental Health and Human Health. The City has implemented a series of water quality monitoring programs that provide critical insights to the status and trends in water quality as they pertain to these two themes. Each of these monitoring programs are presented, including a description of the program (i.e., the what, where, why and how) and a summary of the data collected by that program.

2019 Water Quality Report Card
ENVIRONMENTAL HEALTH

WHY IS WATER QUALITY IMPORTANT?

To residents of the Tampa Bay area it is obvious that the health of the Tampa Bay ecosystem, specifically its water quality, is important in terms of regional environmental values. What is less commonly considered is the importance of the Bay's healthy ecosystem in terms of the region's economic health and residents' well-being and quality of life.

Economic Value

The Tampa Bay Estuary Program (TBEP) and its partners, including the City of St. Petersburg, established ecosystem goals and developed methods for achieving the goals, as defined in the Comprehensive Conservation and Management Plan (CCMP) originally published in 1996. The goals were related to improving the health of the Tampa Bay ecosystem, with quantifiable targets established for living resources based on bay conditions found in the 1950s, when the bay area population was ~25% of that currently. As noted by the TBEP, the CCMP "...reflected broad-based input from citizens, groups and communities with a common interest in a healthy bay as the cornerstone of a prosperous economy" (see the Program description on the TBEP website, TBEP.org). As a result of management decisions made and implemented by the TBEP partners and other participating entities, the CCMP's primary goal of restoring bay seagrass acreage to 1950-era extents was met and surpassed in the last three years.

The importance of a healthy Tampa Bay as an economic resource has only been recently quantified, however. The Tampa Bay area includes parts or all of six counties with a population of approximately 3 million, and employment of approximately 1.4 million. The TBEP and the Tampa Bay Regional Planning Council (TBRPC) recently completed a study which quantified the Bay's economic value (TBEP and TBRPC, 2014). This valuation identified bay-area business categories as either "Bay Influenced" or "Non-Bay Influenced", with a portion of the "Bay Influenced" category sub-classified as "Healthy Bay Dependent". Those business categories determined to be "Healthy Bay Dependent" include tourism-related ventures as well as real estate and shopping businesses, as examples.

The study found that "Bay-Influenced" businesses accounted for 47% of the total within the Tampa Bay watershed, and that "Healthy Bay Dependent" businesses accounted for 21% of the total. The job totals for "Bay-Influenced" businesses were 660,000, while the subset of these which were "Healthy Bay Dependent" totaled about 300,000.

These findings indicate that the "Healthy Bay Dependent" businesses and associated jobs account for about 1 in every 5 businesses and jobs in the Tampa Bay watershed. The monetary value associated with these jobs was estimated as representing $22 billion (13% of total six-county GDP), and that have the jobs in the Bay watershed, corresponding to $51 billion, are associated with "Bay Influenced" positions.

The study also provided an estimate of the monetary benefits of ecosystem services provided by Bay habitats, including seagrasses. It was estimated that Bay area residents would have to pay additional fees of $20-$100 million/year for stormwater and wastewater treatment without the treatment provided by seagrasses. Additional modeling of the impacts of saving $24 million/year in treatment indicated an estimated economic impact (due to spending on other purchases) of almost 500 jobs and $223 million in personal income within Hillsborough, Pinellas, and Pasco counties. Additional study results quantified the premiums associated with housing, hotels, and food service associated with Bay and non-Bay locations.

Quality of Life

Another recent study quantified the Tampa Bay area's Human Well-being Index (HWBI), related to health, quality of life, clean water and air, and availability of food and recreational opportunities. The HWBI was developed by the USEPA's Office of Research and Development as a means of quantifying the influence of social, economic, and environmental service flows on human well-being (Smith et al., 2012).

The HWBI includes 8 components (domains) of human well-being that can be linked to ecosystem services via their relationship to economic, environmental and societal well-being. The 8 domains (Education, Health, Leisure Time, Living Standards, Cultural Fulfillment, Safety and Security, Social Cohesion, and Connection to Nature), along with 25 indicators and 80 metrics used to calculate the scores for each domain. The HWBI methodology can be applied to any size population. Applied to the Tampa Bay area, the HWBI indicates a slightly higher well-being in the Bay area than in Florida as a whole, but below the national average. Individual domain scores are also provided for each of the five main counties of the Bay area (Hillsborough, Manatee, Pasco, Pinellas, and Polk).

AMBIENT WATER QUALITY MONITORING PROGRAM

The City's Ambient Water Quality Monitoring Program collects data to allow assessment of the quality of the City's surface waters. Data collected assist the City in its environmental stewardship efforts, aiding the City in accomplishing the following:

- determination of overall effectiveness of the City's Stormwater Management Program (SWMP);
- identification and prioritization of portions of the City's stormwater system requiring pollution reduction additional controls;
- evaluation of load reductions due to in-ground projects and other management actions implemented in the City's drainage area;
- identification of local sources where urban stormwater is adversely affecting surface water resources; and
- meeting the requirements of the City's MS4 (Municipal Separate Storm Sewer Systems) permit No. FLS000007. The MS4 permit is the means by which the Florida Department of Environmental Protection and Environmental Protection Agency regulate stormwater discharges to surface waters, and directs the permit holder (the City) to "...reduce the discharge of pollutants...to the Maximum Extent Practicable".

Since 2001, the City's stormwater monitoring requirements were accomplished utilizing data collected by the Southwest Florida Water Management District from Lake Maggiore and Pinellas County data for the inland and coastal sites. Monitoring of the coastal sites and some of the inland sites originally sampled by Pinellas County from 1991 through 2012 within City boundaries were taken over by the City in 2013. In the summer of that year, the City began water quality sampling at a number of sites within its boundaries that had been sampled by the County, and in several additional water bodies (Table 1 and Figure 1). The City's sampling routine follows that implemented by the County.

The City's monitoring program includes streams and ditches, two lakes, and coastal waters in Tampa Bay adjacent to the City shoreline (Table 1 and Figure 1). Fixed monitoring sites in streams and ditches upstream of tidal influences are sampled for water quality and flow measurements, with four freshwater sampling sites combined in Booker Creek and the Clam Bayou drainage system. Additional water quality samples are collected from marine portions of streams, creeks, and channels (those classified as "Estuary" in Table 1). Fixed monitoring sites include lake monitoring sites in Lake Maggiore and Crescent Lake.

Coastal water sites are also sampled by the City within nearshore regions of Tampa Bay off the City's coastline. The City monitors four sites in each coastal segment in Tampa Bay (E-6 north of the former Pier location and E-7 south of the former Pier location, see Figure 1). The city

collects samples from these sites and from all fixed sites approximately every six weeks in the wet season and every seven weeks in the dry season, or a total of eight times per year. The City's accredited water quality laboratory performs all analyses in-house. All monitoring sites are sampled for a full suite of water quality constituents, including the following:

- Physical constituents (salinity, specific conductance, pH, and temperature)
- Nutrients (nitrogen and phosphorus)
- Chlorophyll *a* (phytoplankton biomass)
- Dissolved oxygen and oxygen demanding materials
- Water clarity (Secchi disc)
- Enteric bacteria (fecal coliforms, *Enterococci*, *E. coli*)
- Constituents affecting water clarity (TSS and Turbidity)

Table 1. City water quality sampling stations.				
WBID	**WBID Name**	**Sample Station**	**Water Type**	**Sampling Period**
		BOCA CIEGA BAY		
1716A	34th Street Basin	45-03	Stream	2008-2018
1716B	Clam Bayou Drain	46-03	Stream	2008-2018
1716A	34th Street Basin	578	Stream	2016-2018
1709F	Frenchmans Creek - Basin U	48-03	Estuary	2008-2018
1716C	Clam Bayou (East Drainage)	CB-01	Estuary	2014-2018
1716C	Clam Bayou (East Drainage)	North Canal	Estuary	2016-2018
1716C	Clam Bayou (East Drainage)	South Canal	Estuary	2016-2018
1716C	Clam Bayou (East Drainage)	Central Canal	Estuary	2016-2018
1701	Bear Creek	39-02	Estuary	2008-2018
1716D	Clam Bayou Drain (Tidal)	580	Estuary	2016-2018
1716D	Clam Bayou Drain (Tidal)	CBD-01	Estuary	2016-2018
		MIDDLE TAMPA BAY		
1696	Booker Creek	40-02	Stream	2008-2018
1731A	Lake Maggiore	LM-1	Lake	2013-2018
1731A	Lake Maggiore	LM-2	Lake	2013-2018
1731A	Lake Maggiore	LM-3	Lake	2013-2018
1700A	Crescent Lake	CL-01	Lake	2013-2018
1700A	Crescent Lake	CL-02	Lake	2013-2018
1709D	Little Bayou - Basin Q	51-02	Estuary	2008-2018
1683	Smacks Bayou	32-03	Estuary	2008-2018
1700	Coffeepot Bayou	44-02	Estuary	2008-2018
1558B	Tampa Bay (Middle Segment)	E6-1	Estuary	2003-2018
1558C	Tampa Bay (Middle Segment)	E6-2	Estuary	2003-2018
1558C	Tampa Bay (Middle Segment)	E6-3	Estuary	2003-2018
1558C	Tampa Bay (Middle Segment)	E6-4	Estuary	2003-2018
1558B	Tampa Bay (Middle Segment)	E7-1	Estuary	2003-2018
1558B	Tampa Bay (Middle Segment)	E7-2	Estuary	2003-2018
1558B	Tampa Bay (Middle Segment)	E7-3	Estuary	2003-2018
1558B	Tampa Bay (Middle Segment)	E7-4	Estuary	2003-2018

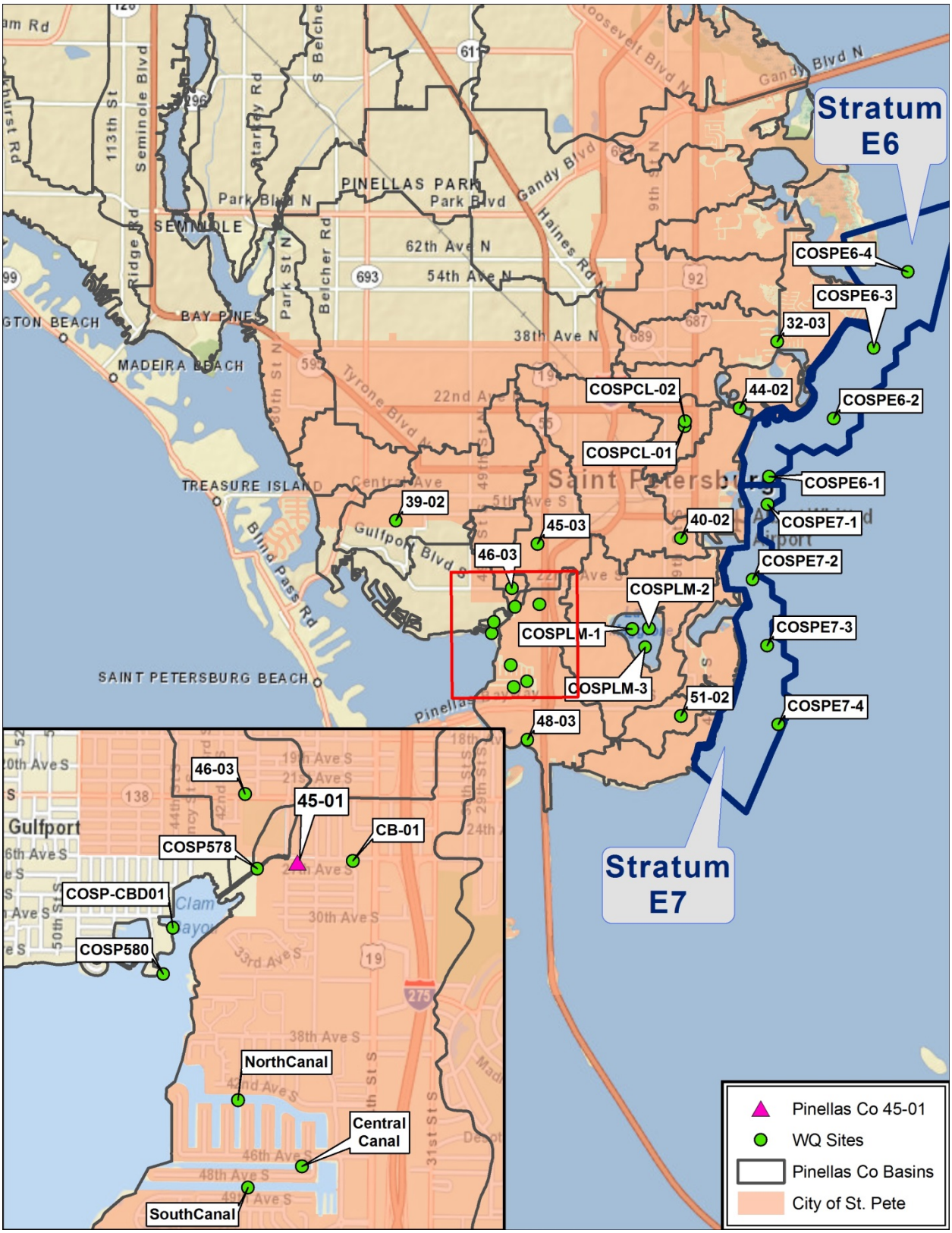

Figure 1. **City of St. Petersburg Ambient Water Quality Monitoring Program sampling sites.**

REGULATORY STATUS

The FDEP assesses water bodies against a series of regulatory criteria as defined by the Impaired Water Rule (FAC 62-303) on a five-year schedule. If a water body is confirmed to exceed Impaired Water Rule thresholds for a given parameter, the water body is determined to be impaired for that parameter. Currently, there are several waterbodies within the boundaries of the City that are listed as impaired (Figure 2), though not every impaired WBID is regularly monitored by the City as part of its Ambient Monitoring Program. These include impairments for dissolved oxygen (Bear Creek, Little Bayou – Basin Q), chlorophyll *a* (Little Bayou – Basin Q), as well as for nutrients (Crescent Lake) Additionally, multiple WBIDs within the City's boundaries are currently listed as verified impaired, or proposed to be listed with finalization expected imminently (Group 5 WBIDs Cycle 4; those noted with "*" in Figure 2), for various bacteria (Coffepot Bayou, Little Bayou – Basin Q, Frenchman's Creek, and Clam Bayou (East Drainage)). .

Smacks Bayou and Coffee Pot Bayou were the subjects of State and Federal Total Maximum Daily Load (TMDL) development, with proposed TMDLs calling for reductions in loadings of TN, TP, and BOD to address perceived DO problems. Working closely with FDEP to review the data used in the data evaluation led FDEP staff to agreed that FDEP was justified in no longer pursuing development of nutrient or DO TMDLs for Smacks Bayou or Coffee Pot Bayou. Both water bodies were delisted from the 1998 303(d) list and the State's Verified List (a listing of impaired water bodies).

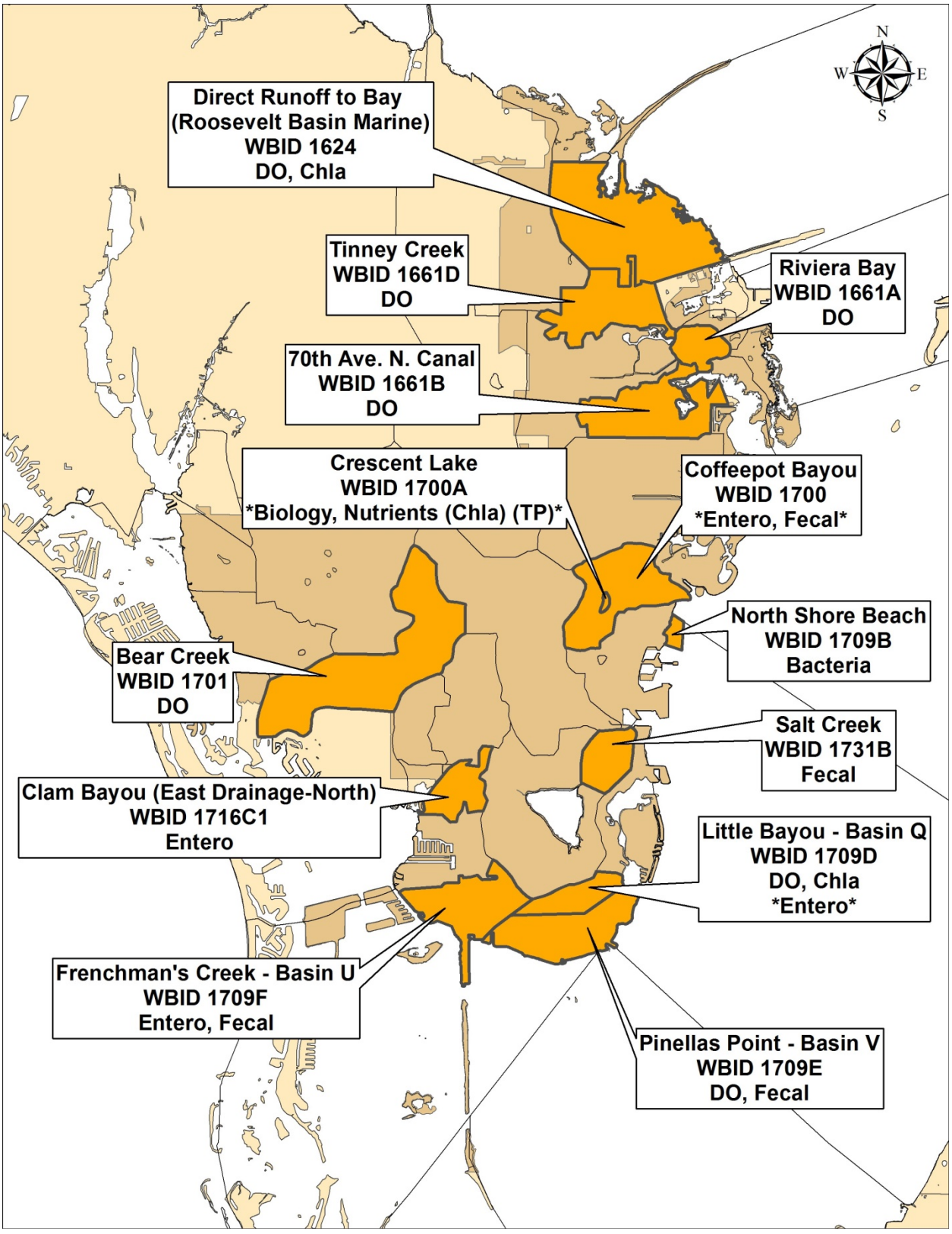

Figure 2. FDEP Impaired WBIDs within the City of St. Petersburg.

TAMPA BAY REASONABLE ASSURANCE PLAN

Through the process of developing the Reasonable Assurance Plan (RAP), nitrogen loading allocations for the City were developed. Allocations were developed for both point source and non-point source nitrogen loads. Ongoing or planned/proposed City projects to reduce nitrogen loading to Tampa Bay include expanding and improving its reclaimed water system, street sweeping programs, stormwater system enhancements, Clean Marina Program, central sewer expansion, support for the Florida Yards and Neighborhoods Program, etc. ***The City has met its allocated nitrogen loads from both point sources and its MS4 since establishment of allocations as part of the 2009 Reasonable Assurance Update.***

Several of the impaired City water bodies are linked to nutrient pollution, in many cases nitrogen more so than phosphorus. These key nutrients can be added to a water body through both point source (direct discharge) and non-point source (e.g., surface runoff) loadings. A key focus of the TBEP has been to establish nitrogen loading targets for Tampa Bay to encourage seagrass recovery. In 1996, local government (including the City) and agency partners in the TBEP approved a long-term goal to restore 95% of the seagrass coverage observed in 1950 (38,000 acres). Also in 1996, the Tampa Bay Nitrogen Management Consortium (NMC) was formed. The NMC includes local governments (including the City) and agencies participating in the TBEP, as well as industrial, utility and agricultural interests in the Tampa Bay watershed. These entities have pledged to work cooperatively in a voluntary framework to assist with the maintenance of nitrogen loads to support seagrass restoration in Tampa Bay. Combined efforts of the TBEP and its partners (including the City) to reduce nitrogen loading are resulting in more than sufficient water quality for the expansion of seagrasses (Tampa Bay NMC, 2017). Seagrass coverage in Tampa Bay increased between 2012 and 2016 by 7,013 acres. As of 2016, Tampa Bay seagrass acreage exceeds both the TBEP's initial recovery goal, as well as the 1950 benchmark estimate.

CITY AMBIENT WATER QUALITY REPORT CARD

A report card scoring system was developed by Janicki Environmental (2017), using a color-coded scoring system that could be used to evaluate each monitoring station or group of stations (stratum) on an annual basis. As part of the development of the reporting tool, the City was divided into 2 major basins – those sites that drain to either Middle Tampa Bay or Boca Ciega Bay. These major basins correspond to existing delineations of areas used by the City, Pinellas County or by other local intergovernmental agencies including the Tampa Bay Estuary Program to report on watershed management actions and the FDEP to evaluate water quality with respect to established standards. The major basins are depicted in Figure 3. Four water quality parameters are evaluated for the water quality report card:

- Dissolved Oxygen % Saturation (DO %sat),
- Chlorophyll *a* (µg/L) (Chla),
- Total Nitrogen (mg/L) (TN), and
- Total Phosphorus (mg/L) (TP).

A short description of each of these parameters and the justification for their inclusion in the City's monitoring and reporting is described below. Where possible, the thresholds chosen to evaluate City water quality data for the reporting tool are consistent with numeric criteria and standards promulgated by FDEP to evaluate compliance with these standards.

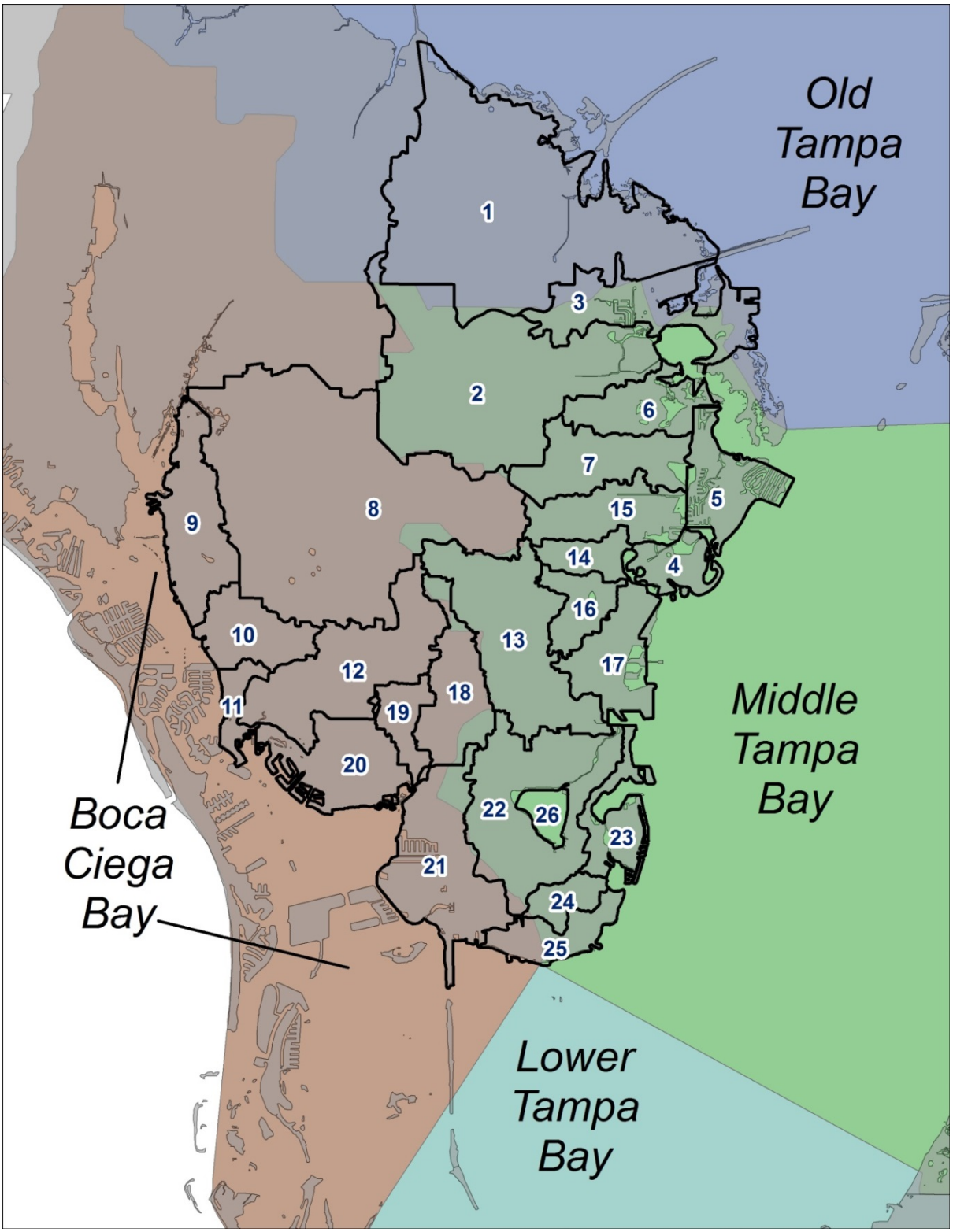

Figure 3. **Bay segments and the basins that drain to them. Basin labels coincide with those reported in Table 1.**

Dissolved Oxygen Saturation

Dissolved oxygen is a measure of the amount of oxygen available in the water to living creatures. The amount available depends upon the amount of algae and decomposing organic matter and determines habitats for fish and bottom-dwelling organisms. Additionally, oxygen levels are influenced by water temperature, with colder water able to "hold" more oxygen than warmer water and salinity.

To establish thresholds for the reporting tool, established Florida Administrative Code rules (FAC 62-303.530 and 62-303.533) were used for City streams, lakes and estuaries. The thresholds differ depending upon the water body type and its designated use according to Florida rules. For predominantly freshwaters that are designated as potable water supply, fish consumption, recreation, or the propagation and maintenance of a healthy well-balanced population of fish and wildlife, no more than 10% of the daily average percent dissolved oxygen saturation values shall be below 38%. For predominantly marine waters, no more than 10% of the daily average percent dissolved oxygen saturation values shall be below 42%.

Chlorophyll a

Chlorophyll *a* is the pigment that makes plants and algae green. This pigment is what allows plants and algae to use energy from sunlight to produce organic carbon. Chlorophyll *a* concentrations provide a measure of the amount of algae in the water. Algae occur at the base of the food chain and provide a food source for the organisms higher in the aquatic food changes. Additionally, algae add oxygen to the water as a by-product of photosynthesis. However, too much chlorophyll *a* is indicative of an algal bloom which decreases available light and lowers dissolved oxygen values (via decomposition of dead algae).

For the report card tool, the threshold values for chlorophyll *a* concentrations varied. In general, for freshwaters including lakes and streams an annual geometric mean concentration of 20 (µg/L) was used. The estuary strata in Middle Tampa Bay were evaluated against an arithmetic annual mean of 8.5 (µg/L) (Janicki Environmental, 2011a). There are samples collected by the City in tidal streams for which Chlorophyll *a* concentration criteria have not currently been established by FDEP. In these cases an annual geometric mean of 11 (µg/L) was used to evaluate threshold exceedances.

Total Nitrogen and Total Phosphorus

Total nitrogen and total phosphorus are essential nutrients for plants and animals, but in excessive amounts can cause algal blooms which decrease available light and dissolved oxygen levels. As a result, excess nutrients can cause changes in shifts in algal and plant species

communities, diebacks of seagrass, reduced populations of fish and shellfish, and losses of acceptable aquatic habitats. Sources of nitrogen include wastewater treatment plants, runoff from fertilized lawns and croplands, and failing septic systems. The Tampa Bay region has extensive phosphate deposits and both fresh and estuarine waters of the region can be enriched with phosphate. Compared to other estuaries, the levels of nitrogen relative to phosphorus in Tampa Bay are relatively low, and algae are therefore suggested to be limited by nitrogen (the addition of nitrogen can fuel algal growth). While naturally occurring in Florida soils, increased levels of phosphorus can also cause algal blooms in excessive amounts. In addition to naturally occurring concentrations, phosphorus may enter a water body via wastewater discharges, or drainage from the surrounding watershed.

The FDEP and the Environmental Protection Agency (EPA) have recently developed water quality standards for nutrients. These are typically expressed as annual geometric mean concentrations. However, for the estuarine waters of Boca Ciega Bay and Middle Tampa Bay, geometric mean concentrations reported as management level thresholds for total nitrogen and total phosphorus in technical support documents used in the development of the criteria (Janicki Environmental 2011a, b) were used for the report card tool. Therefore, for freshwater the nutrient criteria used for the report card was:

- TP = a geometric annual mean of 0.12 (mg/L)
- TN = a geometric annual mean of 1.54 (mg/L).

For the open bay estuarine segments, the nutrient thresholds used for the report card are reported as annual geometric means:

- TP = 0.29 (mg/L)
- TN = 0.87 (mg/L)

There are samples collected by the City in tidal streams for which numeric nutrient criteria have not currently been established by FDEP. In these cases, for the report card tool, are assumed to be in compliance.

The thresholds described above for each monitored water quality parameter were used to establish a color-coded scoring system that could be used to evaluate each monitored station or stratum on an annual basis. The scoring system is defined below:

- If the annual data for a particular station or stratum were in compliance with (i.e. did not exceed) the established threshold then that station/stratum was assigned a color code of Green.
- If the annual data for a particular station or stratum were in exceedance of the established threshold then that station/stratum was assigned a color code of Yellow.

- If more than one in a rolling three-year period (the evaluation year and the two previous years), annual data for a particular station or stratum were in exceedance of the established threshold then that station/stratum was assigned a color code of Red.

Report card evaluations for the most recent year of water quality sampling (2018) are shown in Figure 4 for Boca Ciega Bay and Middle Tampa Bay stations/strata. Report cards for each individual station or stratum, showing annual results for 2003-2018, are shown in Figure 5 through Figure 26.

All stations/strata (Figure 4) for Boca Ciega Bay were in compliance (scored as "Green") for total nitrogen and total phosphorus in 2018. Report card results for all years between 2003-2017 for total nitrogen and total phosphorus were also listed as "Green" for all stations, with the exception of one marginal value ("Yellow") in 2011, indicating compliance with established thresholds. For Middle Tampa Bay, total phosphorus values were in compliance ("Green") at all stations in 2018. However, for total nitrogen, values in Lake Maggiore were marginal ("Yellow"). Remaining stations in Middle Tampa Bay were all in compliance for both total nitrogen and total phosphorus in 2018 and all stations were in compliance for these parameters for all years between 2003 and 2017.

Report card results for dissolved oxygen were largely "Green" indicating compliance with established thresholds in 2018, with the exception of 1 station in Boca Ciega Bay (Clam Bayou CB-01) which was scored as "Red" and 1 station in Middle Tampa Bay (Little Bayou 51-02) which was scored as "Yellow". These two stations have been scored in the "Red" in years prior to 2018 (Figure 11 and Figure 19). A "Red" score indicates more than one exceedance in the three-year period including the year of evaluation and the two years prior to the year of evaluation.

In terms of chlorophyll *a*, the report card indicates that all stations in Boca Ciega Bay, with the exception of a marginal value ("Yellow") in Central Canal, during 2018 were in compliance with the evaluated thresholds. However, 5 of the 11 stations in Middle Tampa Bay were graded as "Red" during 2018 (Figure 4), indicating there has been more than one exceedance in the three-year period 2016-2018. These 5 stations were Little Bayou, 1 Crescent Lake station, and 3 Lake Maggiore stations; the majority of the failing stations in 2018 were lake stations. The Lake Maggiore (Figure 24 through Figure 26) and Crescent Lake (Figure 21) stations did not have data available prior to 2013. However, each annual report card for these stations has displayed a score other than green (initial year yellow with one year of failing to meet the threshold, remainder red indicating continued failing to meet the threshold). Data for Little Bayou (Figure 19) extend back to 2008, but only one year during this period (2012) has been scored with a passing "Green" in that period.

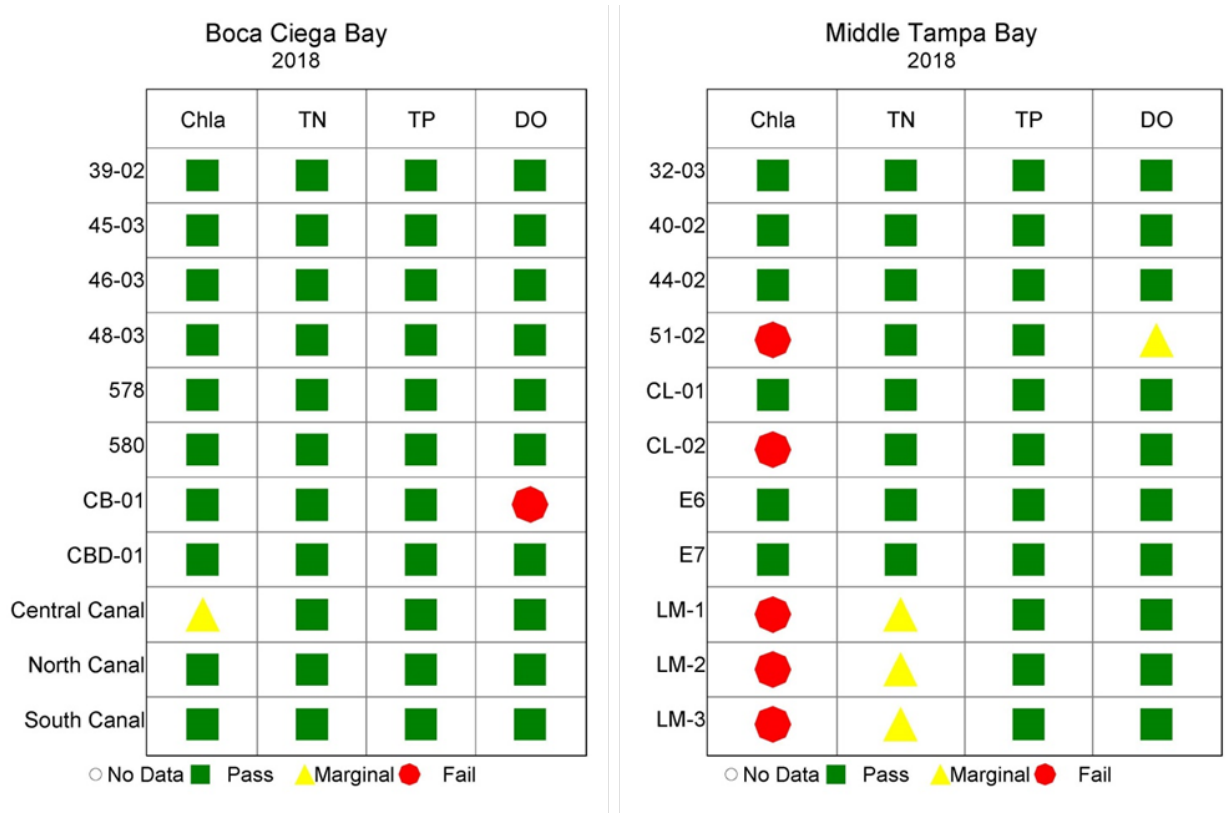

Figure 4. Report Card outcomes for year 2018 in Boca Ciega Bay and Middle Tampa Bay.

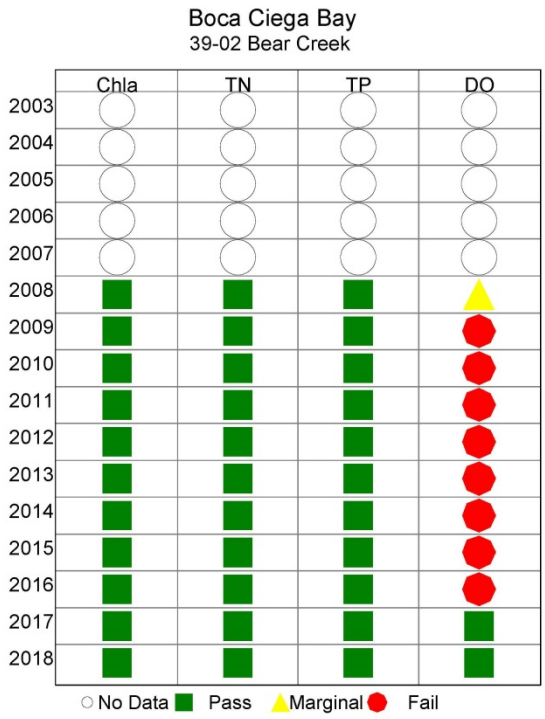

Figure 5. Station 39-02 Report Card.

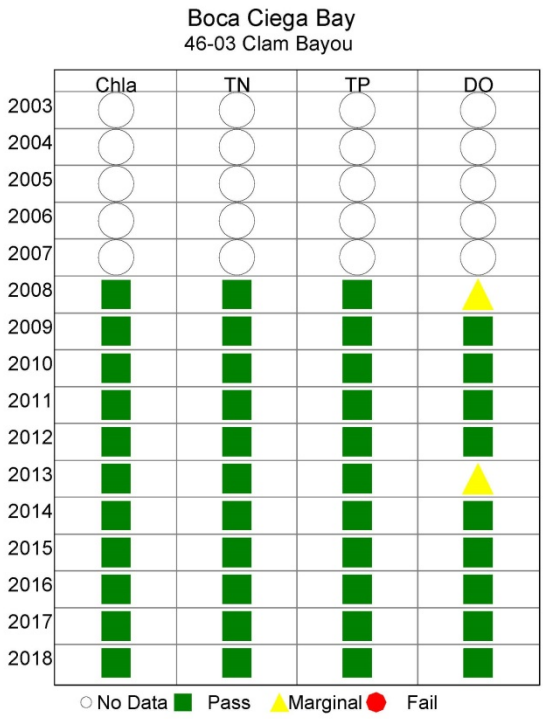

Figure 7. Station 46-03 Report Card.

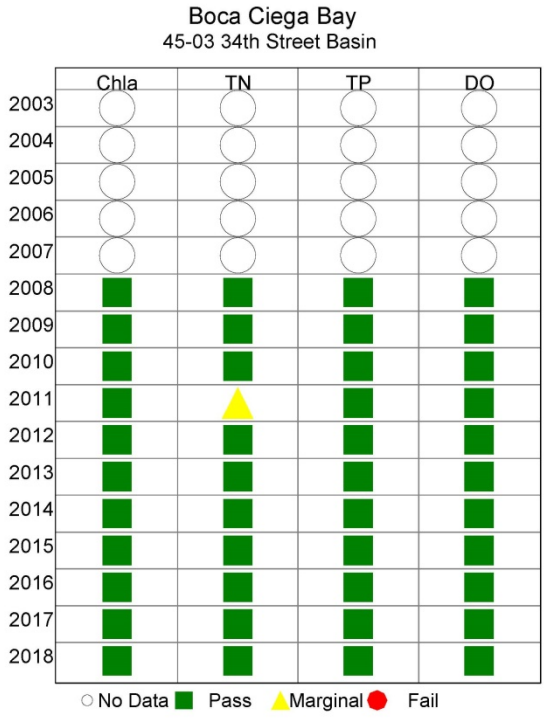

Figure 6. Station 45-03 Report Card.

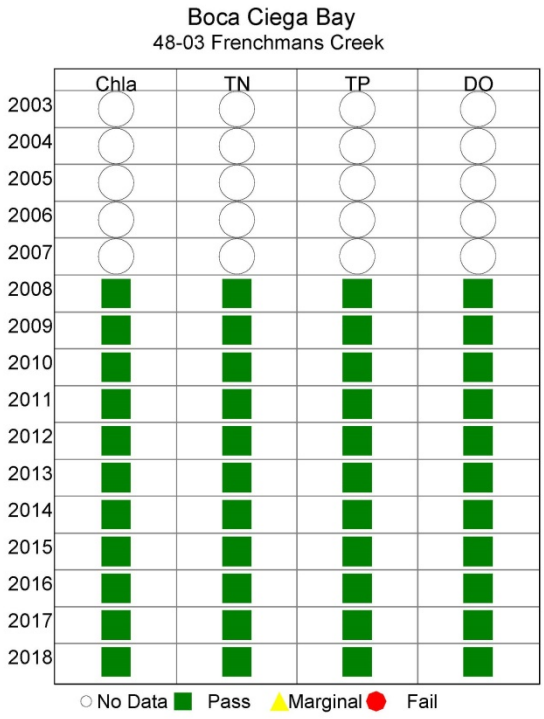

Figure 8. Station 48-03 Report Card.

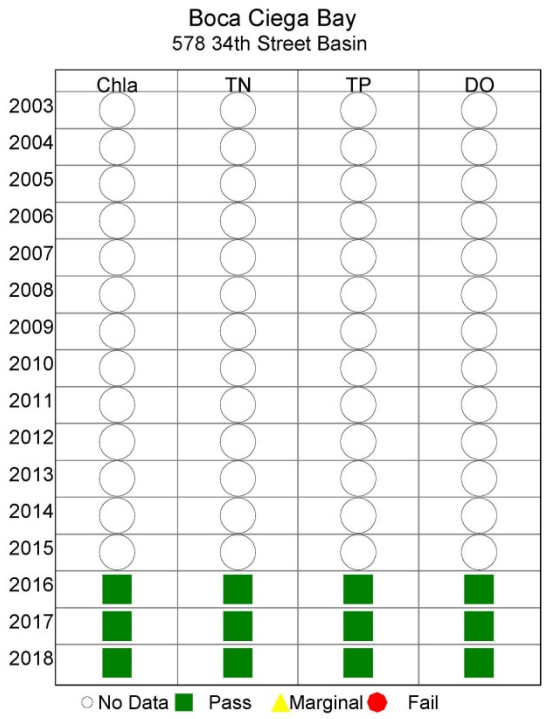

Figure 9. Station 578 Report Card.

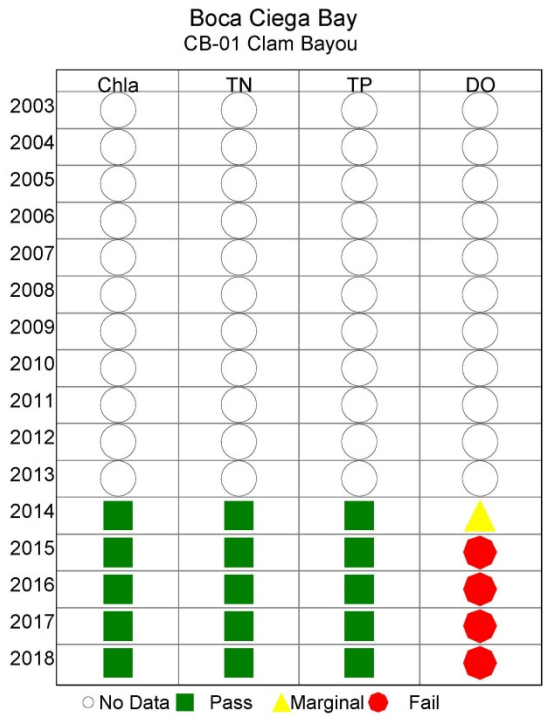

Figure 11. Station CB-01 Report Card.

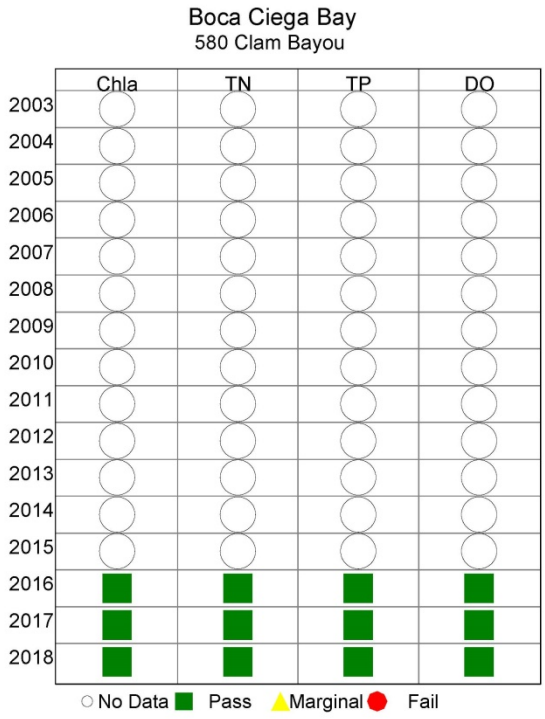

Figure 10. Station 580 Report Card.

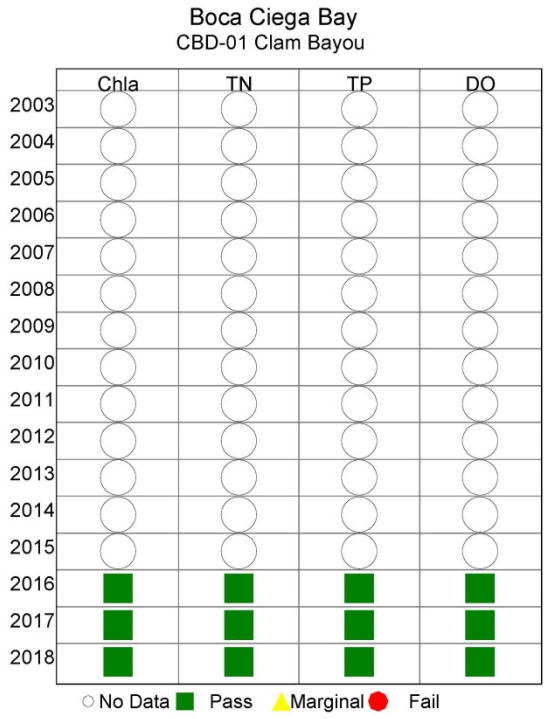

Figure 12. Station CBD-01 Report Card.

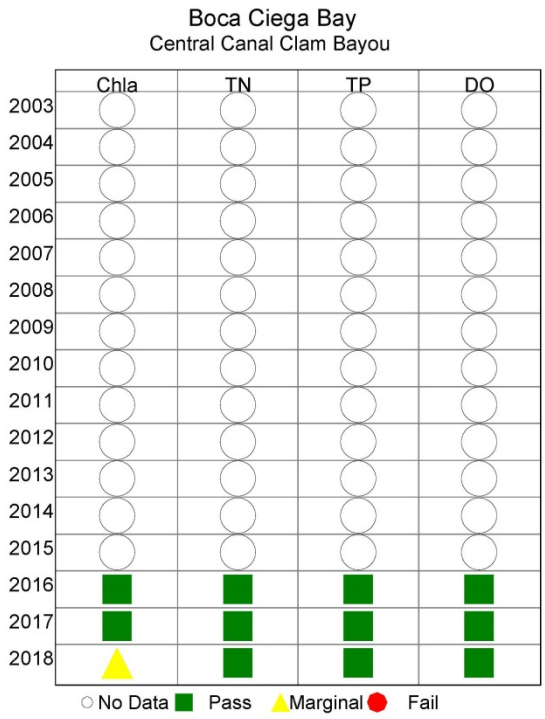

Figure 13. Central Canal Report Card.

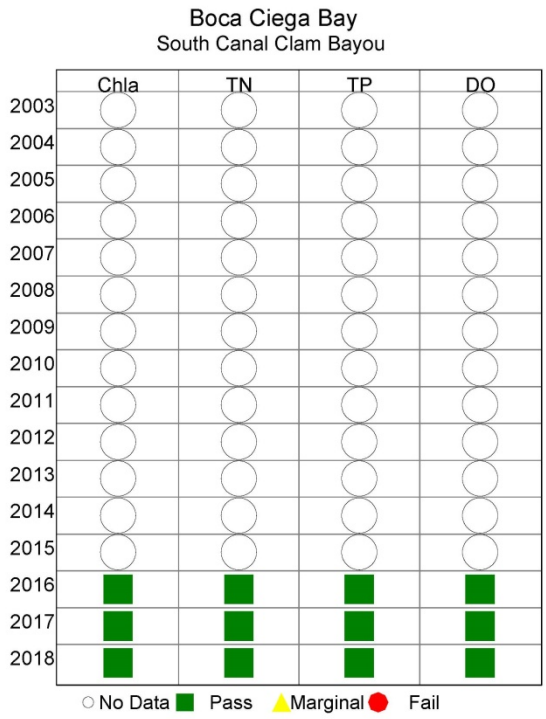

Figure 15. South Canal Report Card.

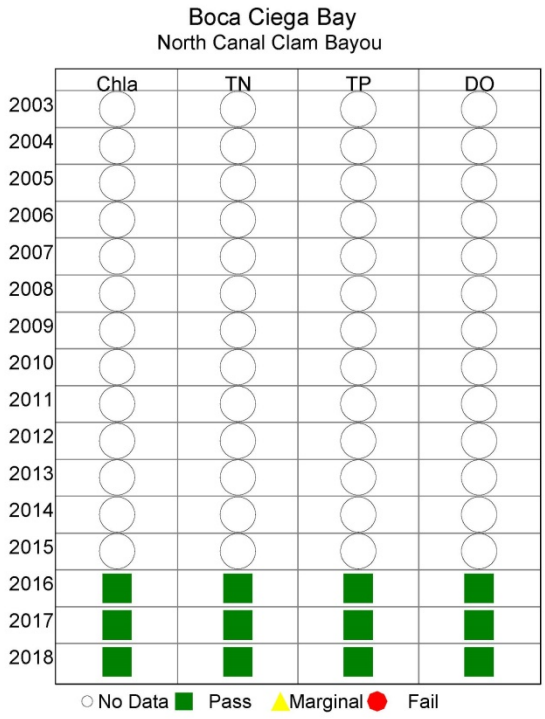

Figure 14. North Canal Report Card.

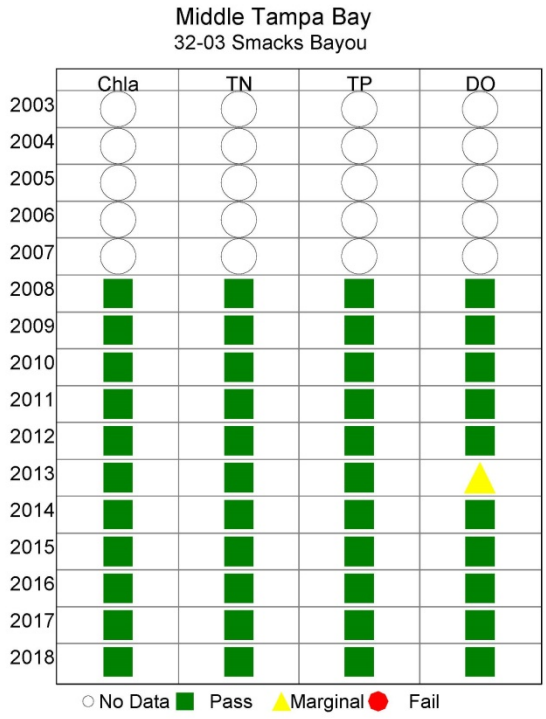

Figure 16. Station 32-03 Report Card.

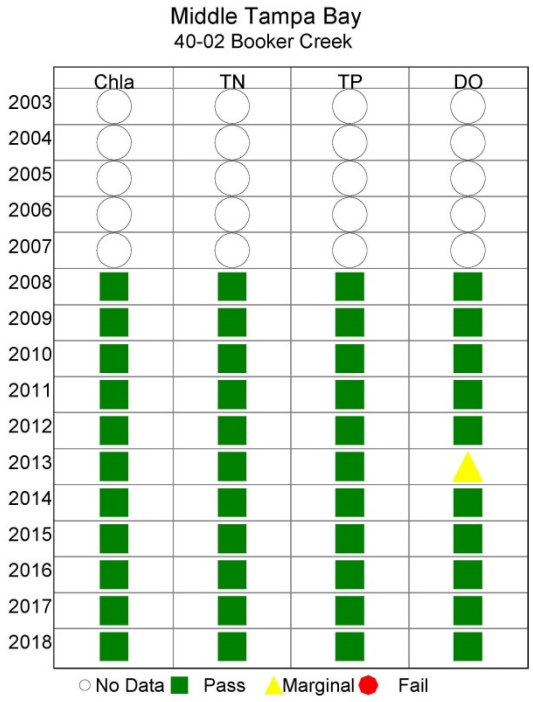

Figure 17. Station 40-02 Report Card

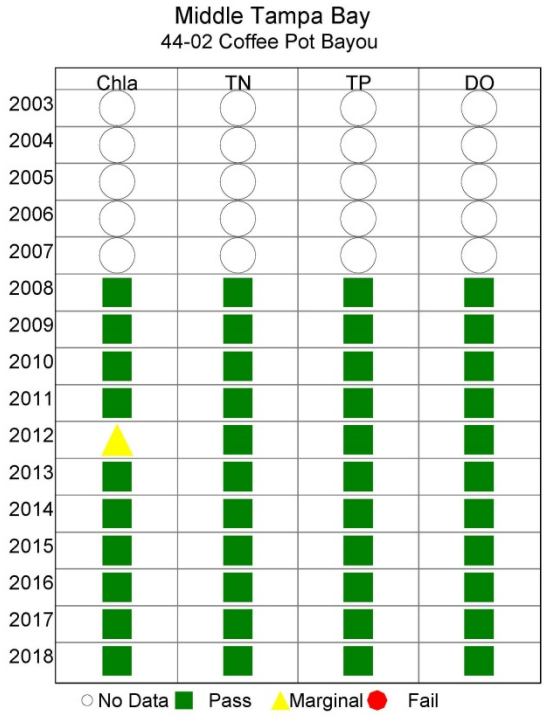

Figure 18. Station 44-02 Report Card

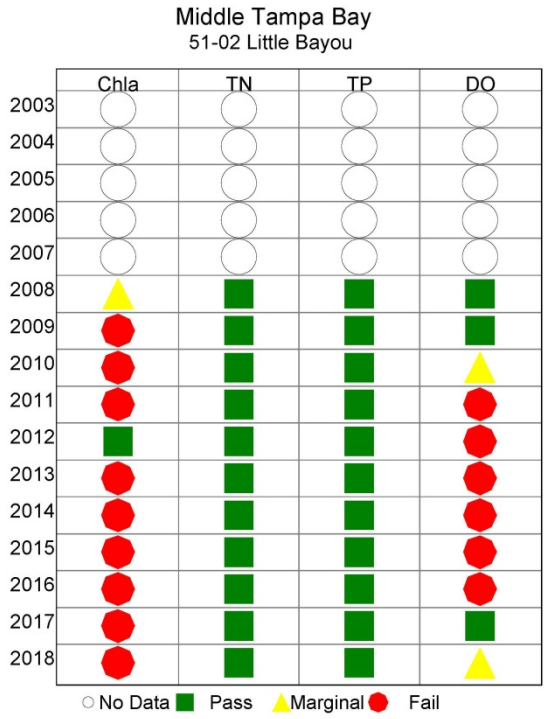

Figure 19. Station 51-02 Report Card

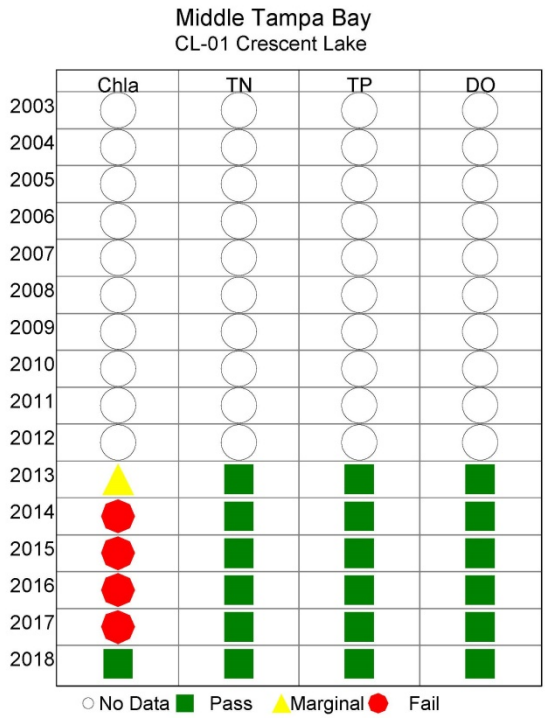

Figure 20. Station CL-01 Report Card

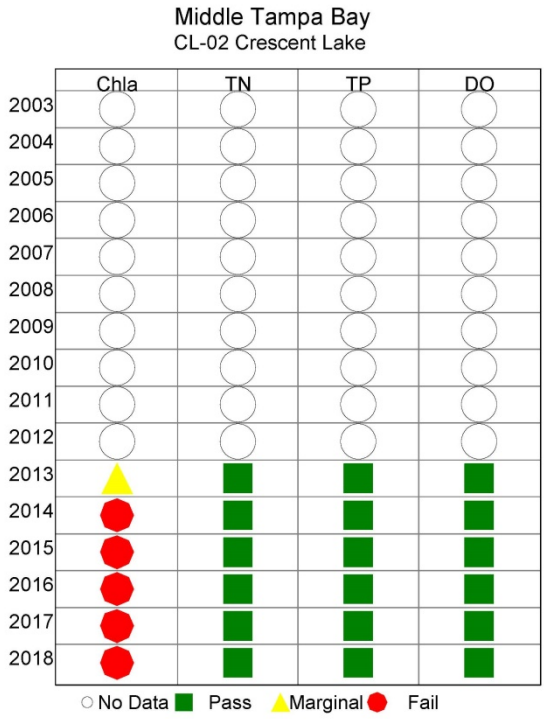

Figure 21. Station CL-02 Report Card.

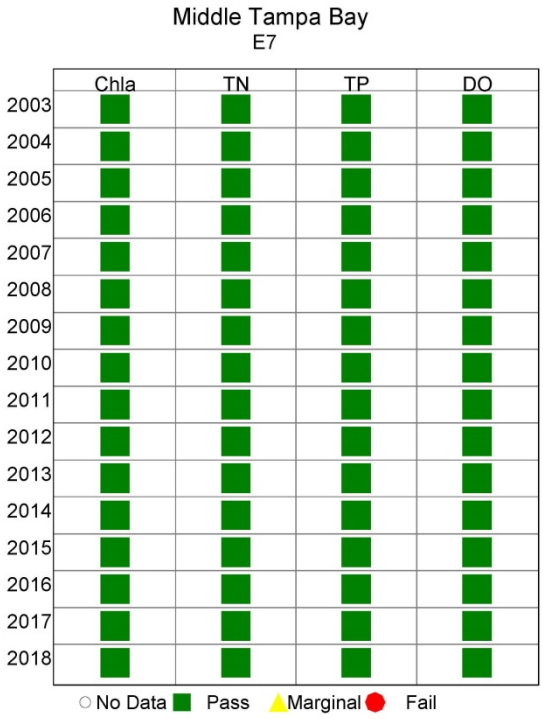

Figure 23. E7 Stations Report Card.

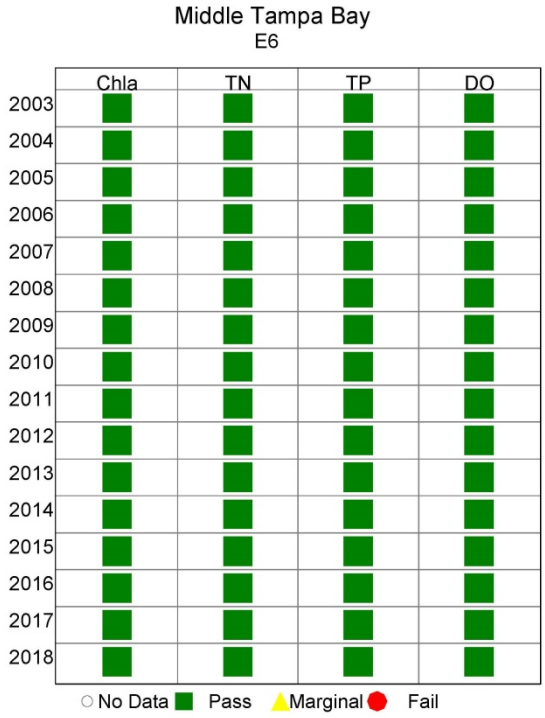

Figure 22. E6 Stations Report Card.

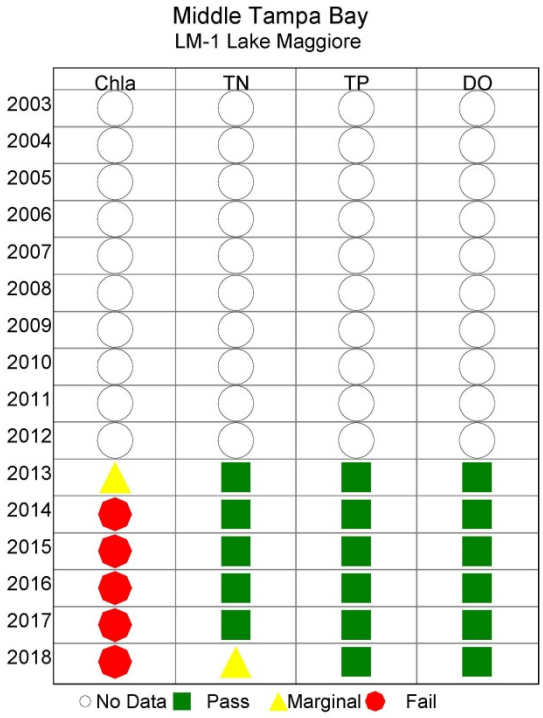

Figure 24. Station LM-1 Report Card.

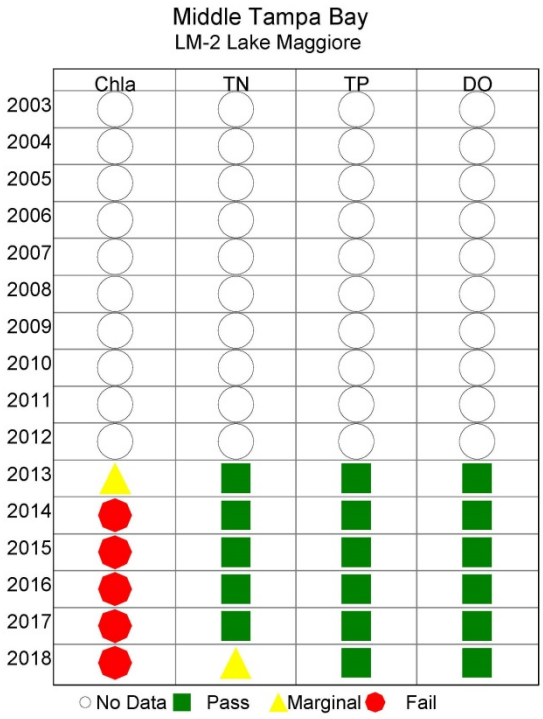

Figure 25. Station LM-2 Report Card.

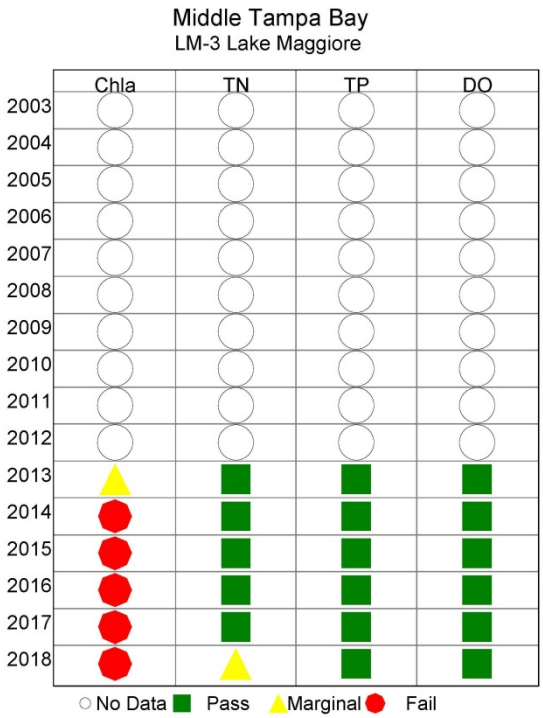

Figure 26. Station LM-3 Report Card.

TRENDS IN WATER QUALITY

Trend analysis of a time-series of data is the practice of collecting information and attempting to spot a pattern over time. In terms of the City's water quality monitoring program, the use of trend tests allows managers to identify degradation in water quality conditions preferably prior to an actual exceedance of a regulatory standard, or before significant harm occurs to aquatic habitats. Thus, the results of analyses of trends in water quality provide the City with an "early warning system" and should best be used with the results of the report card analyses of compliance with water quality standards and criteria. A significant increasing trend in a pollutant need not imply non-compliance, rather the City should respond to such a result before such trends lead to an eventual non-compliance.

For the sake of a simple interpretation of the results of the trend tests, several points should be considered. First, the water quality parameters include parameters such as nitrogen and phosphorus and those parameters that are indicative of the status of the water bodies "health" including chlorophyll *a* and dissolved oxygen. Secondly, the direction of any significant trends is important to note. For most parameters investigated, increasing trends can be considered to be negative or undesirable. These particularly include the nutrients and chlorophyll *a*. In contrast, increasing dissolved oxygen is a positive result as low dissolved oxygen conditions are undesirable as the support of most aquatic fauna require adequate dissolved oxygen conditions.

Results of trend tests performed for each monitored station (see Figure 1and Table 1) are shown in Figure 27 to Figure 30. Summary information for each parameter analyzed is also provided below each Figure. For the purposes of this report, "small trends" are defined as statistically significant trends with a rate of change less than 10% of the median value per year, and "large trends" are defined as statistically significant trends with a rate of change greater than or equal to 10% of the median value per year. Thus, "small trends" represent water quality conditions that are changing (either increasing or decreasing) at a lesser rate of change than for "large trends." The terms "large" and "small" do not imply either ecological significance or the lack of ecological significance.

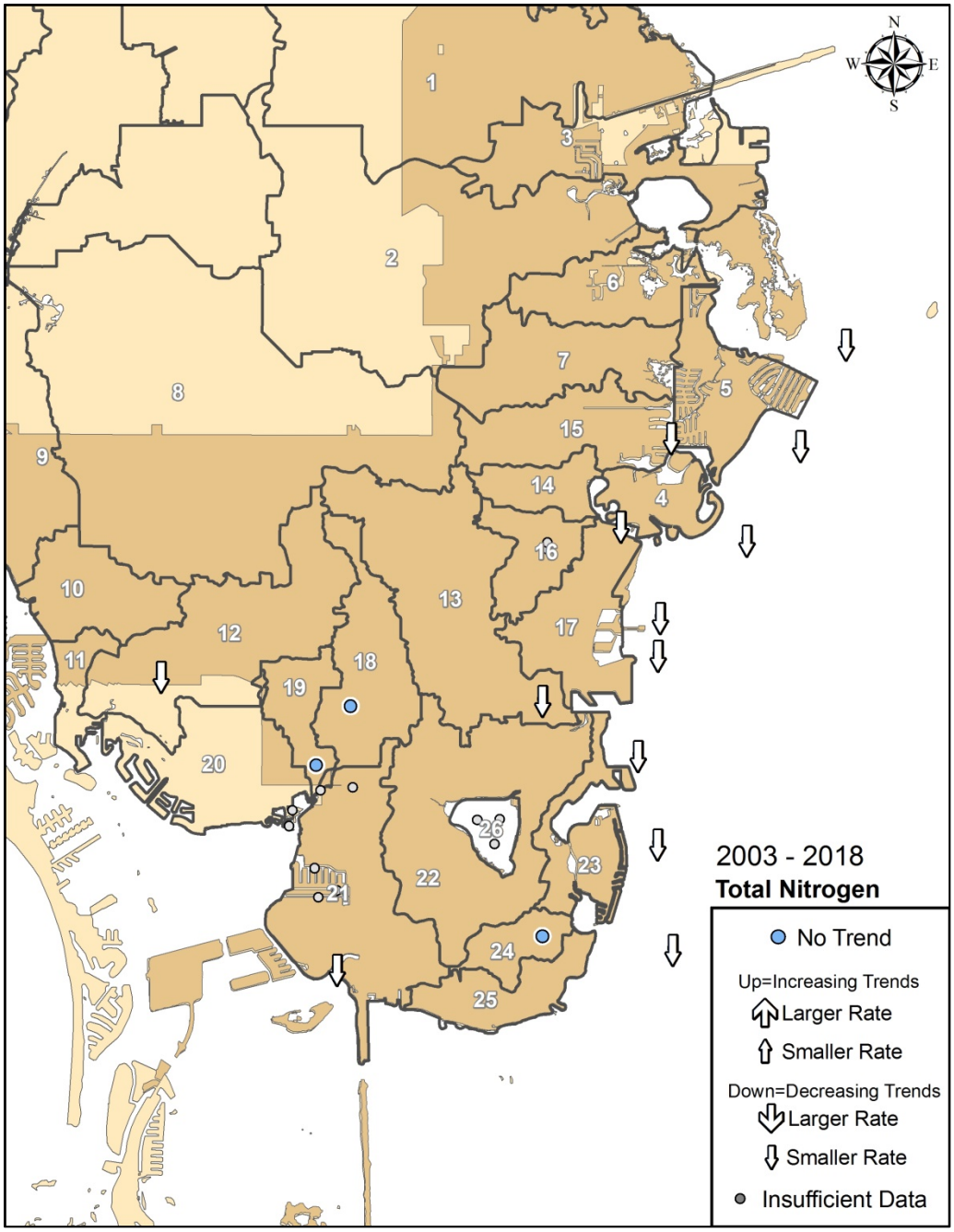

Figure 27. Trend test results for Total Nitrogen.

- Nearly all stations in Middle Tampa Bay were characterized by significant decreasing trends in total nitrogen.
- The only station in Middle Tampa Bay that did not have a significant decrease was Little Bayou, where no apparent trend was evident.
- For Boca Ciega Bay, two sites had no apparent trend (34th Street Station 45-03 and Clam Bayou Drain) while two others (Bear Creek and Frenchmans had decreasing trends for total nitrogen.

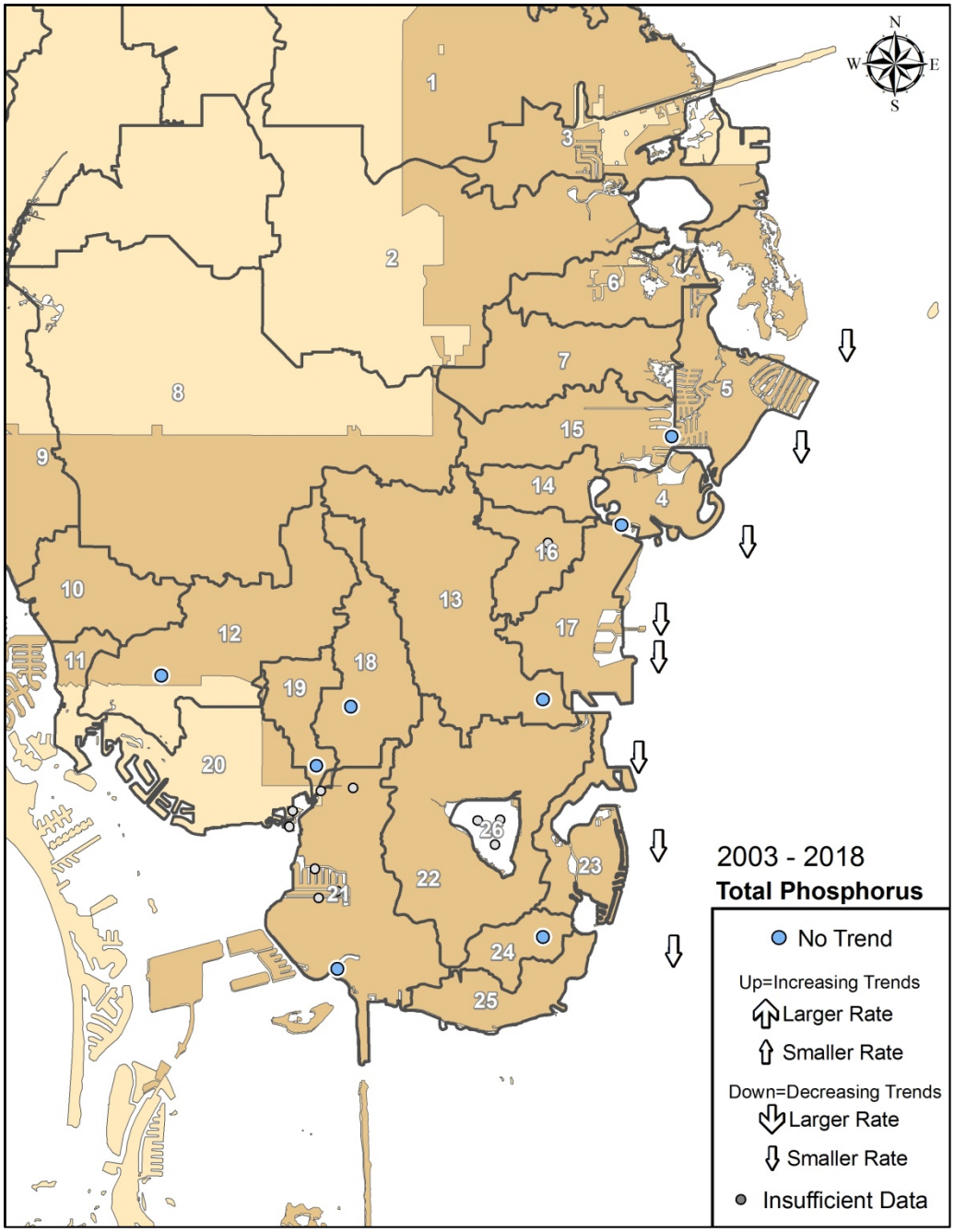

Figure 28. Trend test results for Total Phosphorus.

- None of the 4 stations in Boca Ciega Bay exhibited significant trends in total phosphorus
- 4 of the 12 stations in Middle Tampa Bay also exhibited no significant trends in total phosphorus
- The remaining 8 stations in Middle Tampa Bay displayed decreasing trends in total phosphorus
- Those stations that displayed decreasing trends in total phosphorus tended to be found in estuarine waters

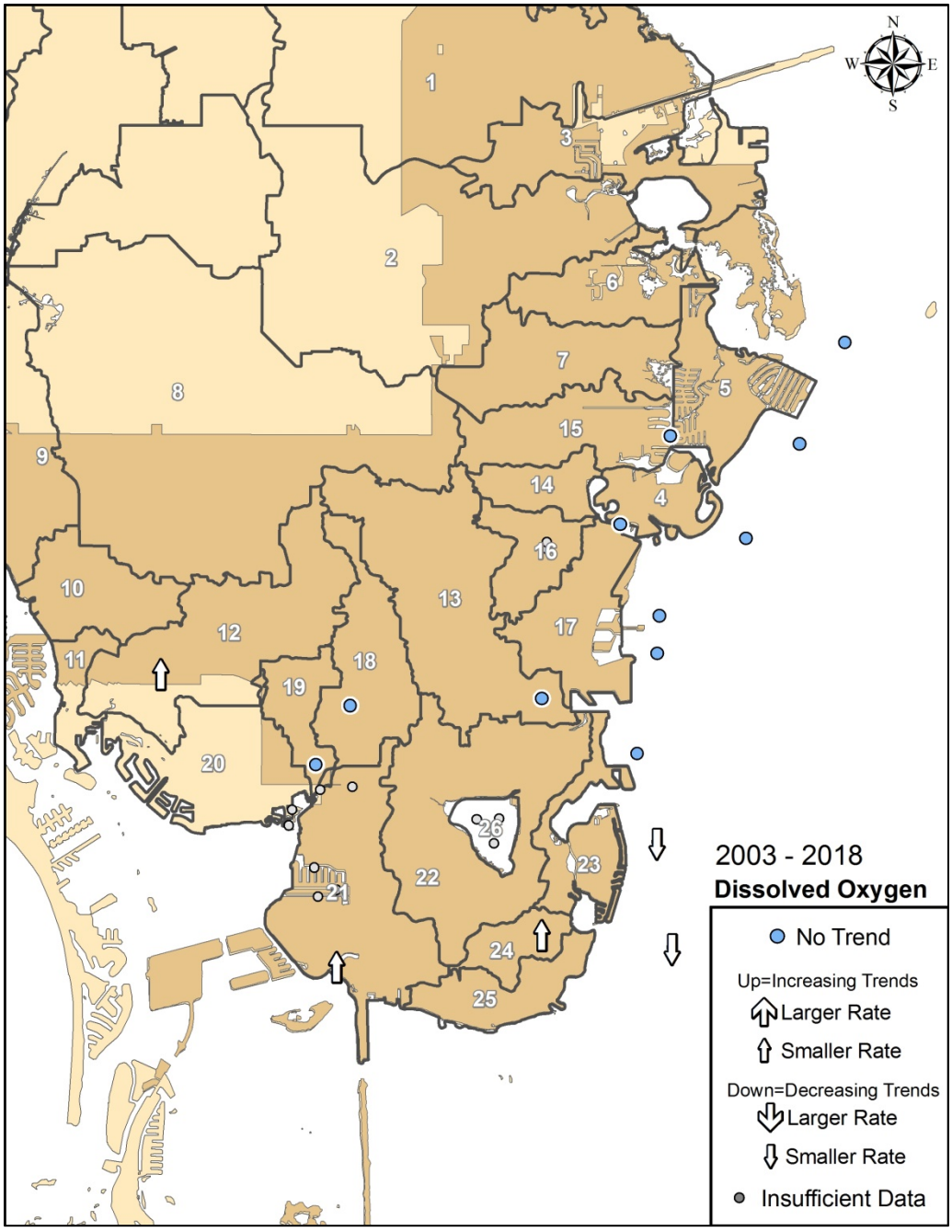

Figure 29. Trend test results for Dissolved Oxygen.

- A significant, increasing trend in dissolved oxygen was observed for Bear Creek and Frenchmans Creek, in the Boca Ciega Bay Basin.
- Neither of the two remaining stations in the Boca Ciega Bay Basin displayed any significant trend in dissolved oxygen
- One station (Little Bayou) in Middle Tampa Bay exhibited a significant increasing trend in dissolved oxygen while two stations in the E7 segment exhibited decreasing. The remaining stations had no significant trends for dissolved oxygen.

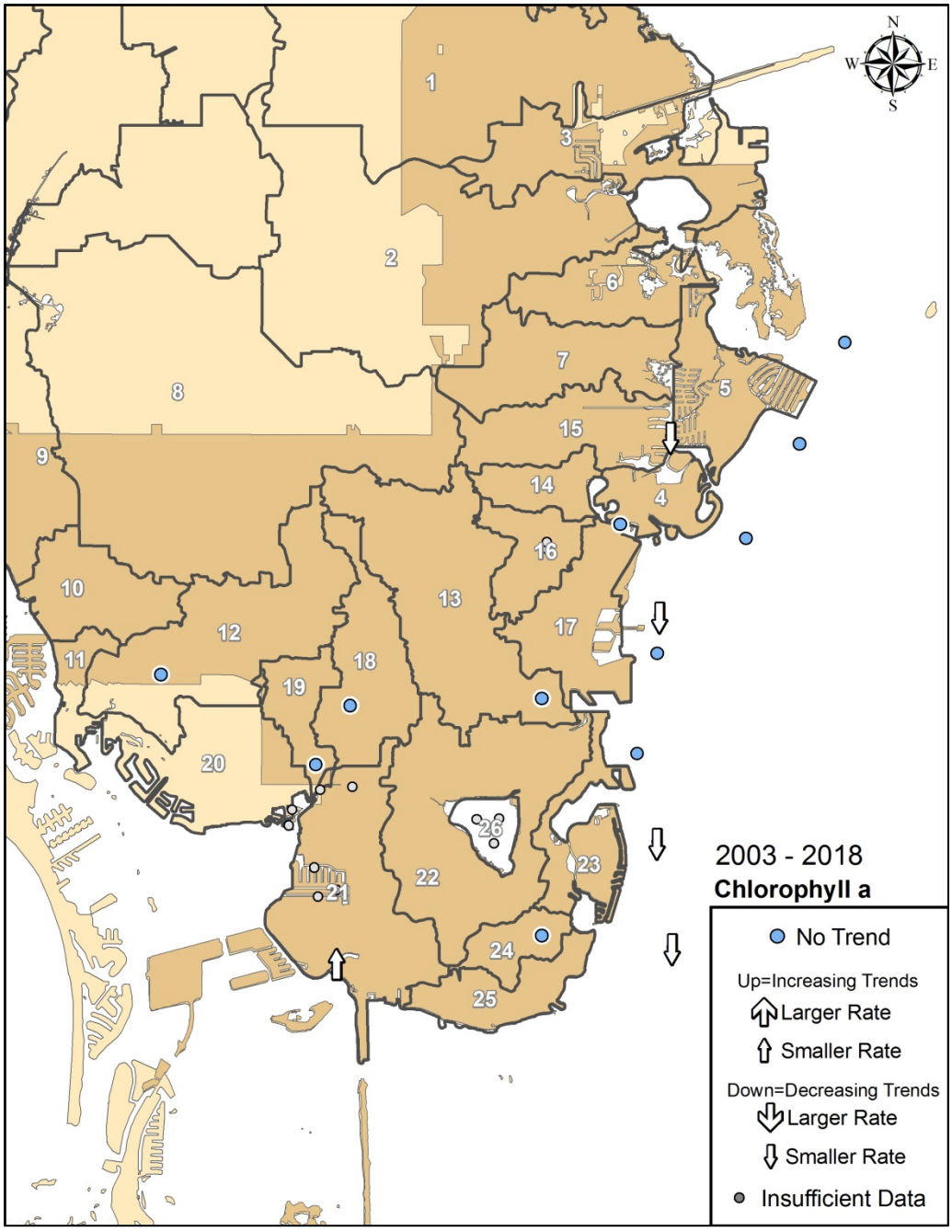

Figure 30. Trend test results for chlorophyll *a*.

- One station (Frenchmans Creek) in Boca Ciega Bay displayed an increasing significant trend in chlorophyll *a*
- The remaining stations in Boca Ciega Bay exhibited no significant trends
- Four estuarine stations in Middle Tampa Bay (Smacks Bayou, Middle Tampa Bay E6-1, E7-3 and E7-4) displayed significant declining trends in chlorophyll *a*
- The remaining stations in Middle Tampa Bay exhibited no significant trends

CONCLUSIONS

The following summarizes the status of the City's monitoring stations in regards to environmental health as represented by nutrients, dissolved oxygen and chlorophyll *a*. Recommendations are provided based on our evaluation of the data collected by the environmental health ambient monitoring program.

- With the exception of a marginal TN value for 2018 in Lake Maggiore, all stations examined on the Boca Ciega and Middle Tampa Bay report cards indicated nutrient (total nitrogen and total phosphorus) concentrations have met the established thresholds during all years of examination. Trend tests indicate that this status for nutrients may be expected to continue in the near-term, as the only observable significant trends for nutrients were declines in concentrations; only increases in concentrations might be expected to trigger a change on the report card.
- Most stations met the established thresholds for dissolved oxygen on the report card. However, 1 station in Boca Ciega Bay was scored as having failed to meet established criteria for more than 1 year in the rolling-three year period. Trend tests indicate that dissolved oxygen levels at two stations in Boca Ciega Bay are statistically significantly increasing so in years to come, it is possible the report card status will improve for the station currently scored as "Red". Trend tests for all other stations indicated no statistically significant change over time in dissolved oxygen. Thus, dissolved oxygen levels do not appear to have significantly decreased over time. One station in Middle Tampa Bay exhibited a significant increasing trend in dissolved oxygen while two stations in the E7 segment exhibited decreasing trends. The remaining stations had no significant trends for dissolved oxygen.
- With the exception of one marginal value, stations in Boca Ciega Bay had a chlorophyll *a* grade of "green" for the report card in 2018. The trend tests indicated that one station (Frenchmans Creek) in Boca Ciega Bay has a statistically increasing trend for chlorophyll *a*, which could impact future report card years. Five of 11 stations in Middle Tampa Bay scored as "red" indicating a failure to meet established thresholds in more than 1 of the current and previous 2 year period. Four of the five failing stations were in lakes, and the 5th was a bayou. The only significant trends in chlorophyll *a* in Middle Tampa Bay were decreasing trends at four sites. Thus, it is anticipated that, for the near-future, the more estuarine/open water sites are expected to maintain a passing status on the report card. This highlights the efforts of the TBEP and its partners (including the City) to implement nutrient reduction programs, resulting in increasing water clarity and vastly improved seagrass coverages.
- It is recommended that the City continue the Ambient Water Quality Monitoring Program as currently designed and implemented.

2019 Water Quality Report Card
HUMAN HEALTH

The monitoring most relevant to human health issues is what is known as enteric bacteria monitoring. Enteric bacteria are those that normally inhabit the intestinal tract of humans and animals and can be indicative of stormwater runoff, sewage flows, pets and wildlife. The City of St Petersburg collects three forms of bacteria samples: fecal coliforms, *Escherichia coli (E. coli)* in fresh waters and *Enterococci* in marine waters. Until February 2016, fecal coliforms were the primary indicator bacteria but the fact that fecal coliforms reside in all warm blooded animals made it difficult to distinguish between human (pet waste, farms, sewage) or natural (nesting areas, bat colonies) sources. While no longer the accepted standard, many organizations continue to monitor fecal coliforms since they have long historical records.

The US EPA issued guidance regarding the use of *E. coli* and *Enterococci* for fresh and saline waters, respectively. The Florida Department of Health and the Florida Department of Environmental Protection both adopted the new USEPA guidance as criteria and began assessing surface waters with the new standards (Table 2).

The Florida Department of Health takes the assessment a step further when looking at bathing areas such as beaches through the Healthy Beaches Program whose protocols are followed by the City. Beaches are sampled for Enterococci; waters that don't meet the standard are considered moderate. When samples exceed 70 colony forming units (cfu)/100 mL, they are considered poor and an advisory will be posted when a confirming value is collected the following day. The City does not wait for a confirming value but posts an advisory when the results exceed 70 cfu/100 mL. The results from the City's monitoring can be found on the Recreational Water Quality Map app on the City's website at http://www.stpete.org/water/waterquality.php.

Table 2. FDEP bacteriological criteria for various class waters from 62-302.530 F.A.C.		
(6)(a) Bacteriological Quality (Fecal Coliform Bacteria) (Class II Waters)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a median value of 14 with not more than 10% of the samples exceeding 43 (for MPN) or 31 (for MF), nor exceed 800 on any one day. To determine the percentage of samples exceeding the criteria when there are both MPN and MF samples for a waterbody, the percent shall be calculated as $100*(n_{mpn}+n_{mf})/N$, where n_{mpn} is the number of MPN samples greater than 43, n_{mf} is the number of MF samples greater than 31, and N is the total number of MPN and MF samples.
(6)(b) Bacteriological Quality (*Escherichia coli* Bacteria) (Class I and Class I-Treated Waters)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly geometric mean of 126 nor exceed the Ten Percent Threshold Value (TPTV) of 410 in 10% or more of the samples during any 30-day period. Monthly geometric means shall be based on a minimum of 5 samples taken over a 30-day period.
(6)(b) Bacteriological Quality (*Escherichia coli* Bacteria) (Class III Predominantly Fresh Waters)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly geometric mean of 126 nor exceed the Ten Percent Threshold Value (TPTV) of 410 in 10% or more of the samples during any 30-day period. Monthly geometric means shall be based on a minimum of 10 samples taken over a 30-day period.
(16)(c) Bacteriological Quality (*Enterococci* Bacteria) (Class III Predominantly Marine Waters)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly geometric mean of 35 nor exceed the Ten Percent Threshold Value (TPTV) of 130 in 10% or more of the samples during any 30-day period. Monthly geometric means shall be based on a minimum of 10 samples taken over a 30-day period.

The City of St. Petersburg has implemented a series of monitoring programs whose primary focus is on water quality as it relates to human health. These are described in the subsections below.

BEACHES MONITORING PROGRAM

The City has several beach areas with relatively heavy recreational use, including primary contact activities such as swimming. Monitoring bacterial concentrations in these waters provides for identification of potential threats to human health, with the City able to provide public warnings at the beaches when unsafe bacterial levels exist based on the monitoring data.
The objective of the Beach Monitoring Program is to monitor water quality where the public engages in activities classified as primary contact such as swimming. The City of St. Petersburg has been monitoring beach water quality for bacterial contamination since at least the mid-1970s, when monitoring included North Shore Beach, Spa Beach, and Maximo Beach. These sites were selected to include the most utilized beaches within the City limits and along with Lassing Park and Treasure Island Beach (Figure 31), are currently monitored by the City. Data collected since 2010 are included in the City's electronic database, and are available for evaluation. Monitoring at the Spa Beach site ceased after mid-August 2017 when construction on the new Pier began, and the City picked up the Treasure Island Beach site at that time, with City monitoring there beginning in September 2017. Spa Beach sampling is scheduled to return once Pier construction is complete and access to the sampling site is again available.

The Beaches Monitoring Program sampling and laboratory analytical methodologies follow those of the Florida Healthy Beaches Program. Samples are collected on a weekly basis every Wednesday. As part of the initial implementation of the Beaches Monitoring Program fecal coliform concentrations were measured. Measurement of *Enterococci* concentrations was implemented in 2010. The State standard for enteric bacteria changed from fecal coliforms to *Enterococci* in marine waters in 2016.

The City has established a classification system for *Enterococci* concentrations as follows:

- Good conditions - 0-35 cfu/100 mL
- Moderate conditions - 36-70 cfu/100 mL
- Poor conditions >70 cfu/100 mL.

The City issues a beach advisory when the concentrations of *Enterococci* exceed 70 cfu/100 mL. The City continues sampling on a daily basis until the *Enterococci* concentration drops to 70 cfu/100 mL or less.

Tables 3 through 6 present the frequency of exceedances of *Enterococci* concentrations of 70 cfu/100 mL and fecal coliform concentrations of 800 cfu/100 mL in each of the beaches in the Beaches Monitoring Program for the period 2010 through 2018. Figure 32 through Figure 35 present the number of samples that were classified as Good, Moderate or Poor at the same beaches and years.

The preponderance of samples was classified as Good in each of the beaches. There is no apparent temporal trend in the frequency of occurrence of Poor samples, with the exception of North Shore Beach where the number of poor samples has increased since 2014. Additionally, larger numbers of Poor samples were found in 2015 and 2016 at multiple sites, two years in which rainfall was extremely high.

Figure 31. Beach Monitoring Program sampling sites.

Table 3. Enteric bacterial monitoring results from Maximo Beach.				
	Enterococci (Exceedance > 70 (cfu/100ml))		Fecal Coliform (Exceedance > 800 (cfu/100ml))	
Year	**Number of Samples**	**Number of Exceedances**	**Number of Samples**	**Number of Exceedances**
2010	42	3	41	1
2011	48	6	47	1
2012	52	1	52	0
2013	53	2	53	0
2014	55	5	54	2
2015	62	9	59	4
2016	58	7	41	1
2017	56	4	0	0
2018	57	6	0	0
All	483	43	347	9

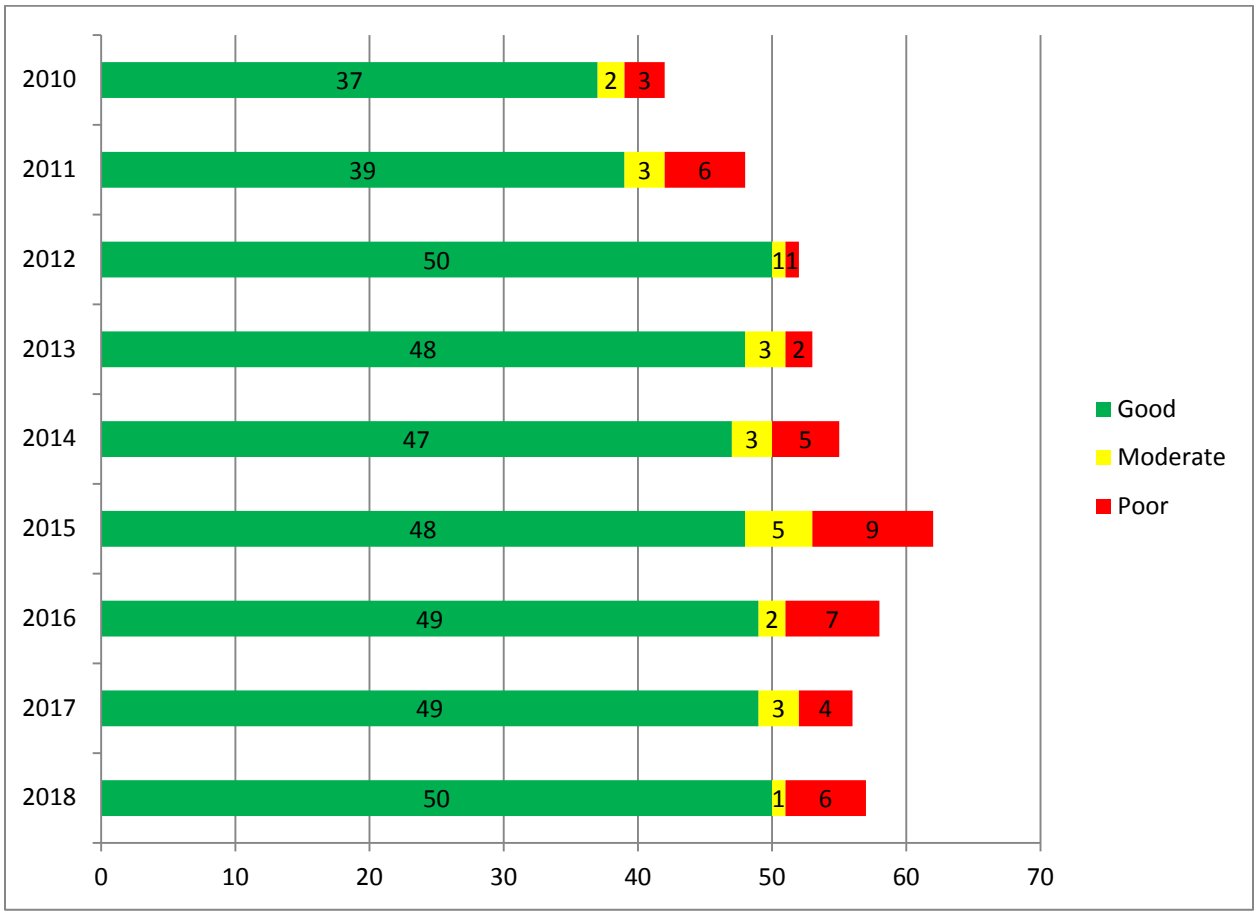

Figure 32. **Number of Good, Moderate, and Poor conditions in relation to *Enterococci* concentrations in Maximo Beach.**

Table 4. Enteric bacterial monitoring results from North Shore Beach.				
	Enterococci (Exceedance > 70 (cfu/100ml))		Fecal Coliform (Exceedance > 800 (cfu/100ml))	
Year	**Number of Samples**	**Number of Exceedances**	**Number of Samples**	**Number of Exceedances**
2010	46	7	46	2
2011	50	15	50	7
2012	55	8	61	7
2013	56	9	58	3
2014	57	7	59	3
2015	61	11	62	2
2016	65	15	44	2
2017	69	17	0	0
2018	71	22	0	0
All	530	111	380	26

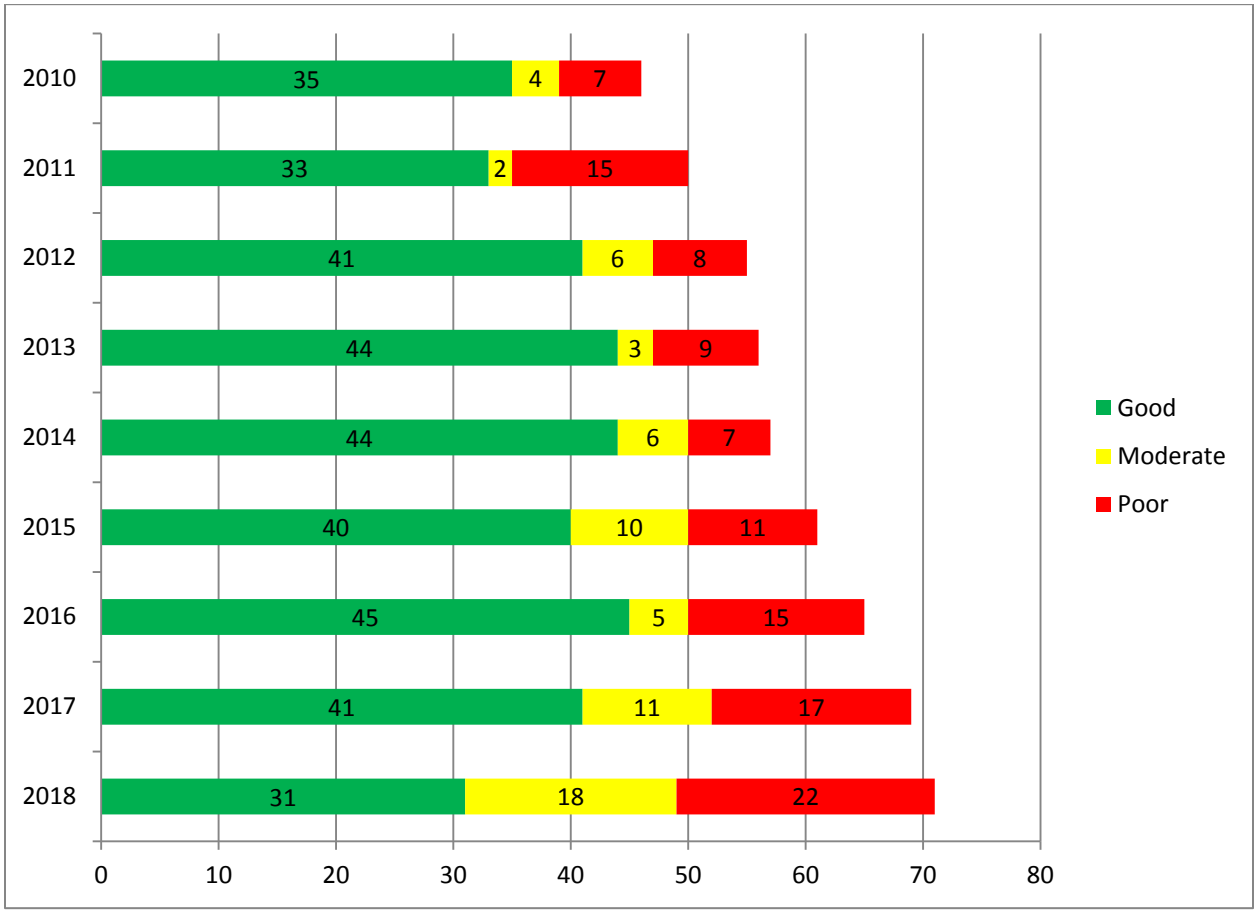

Figure 33. **Number of Good, Moderate, and Poor conditions in relation to *Enterococci* concentrations in North Shore Beach.**

Table 5. Enteric bacterial monitoring results from Treasure Island Beach.				
	Enterococci (Exceedance > 70 (cfu/100ml))		Fecal Coliform (Exceedance > 800 (cfu/100ml))	
Year	Number of Samples	Number of Exceedances	Number of Samples	Number of Exceedances
2010	53	4	53	0
2011	45	2	26	0
2012	25	1	0	0
2013	27	1	0	0
2014	27	2	0	0
2015	31	6	0	0
2016	27	1	0	0
2017	39	5	0	0
2018	55	3	0	0
All	329	25	79	0

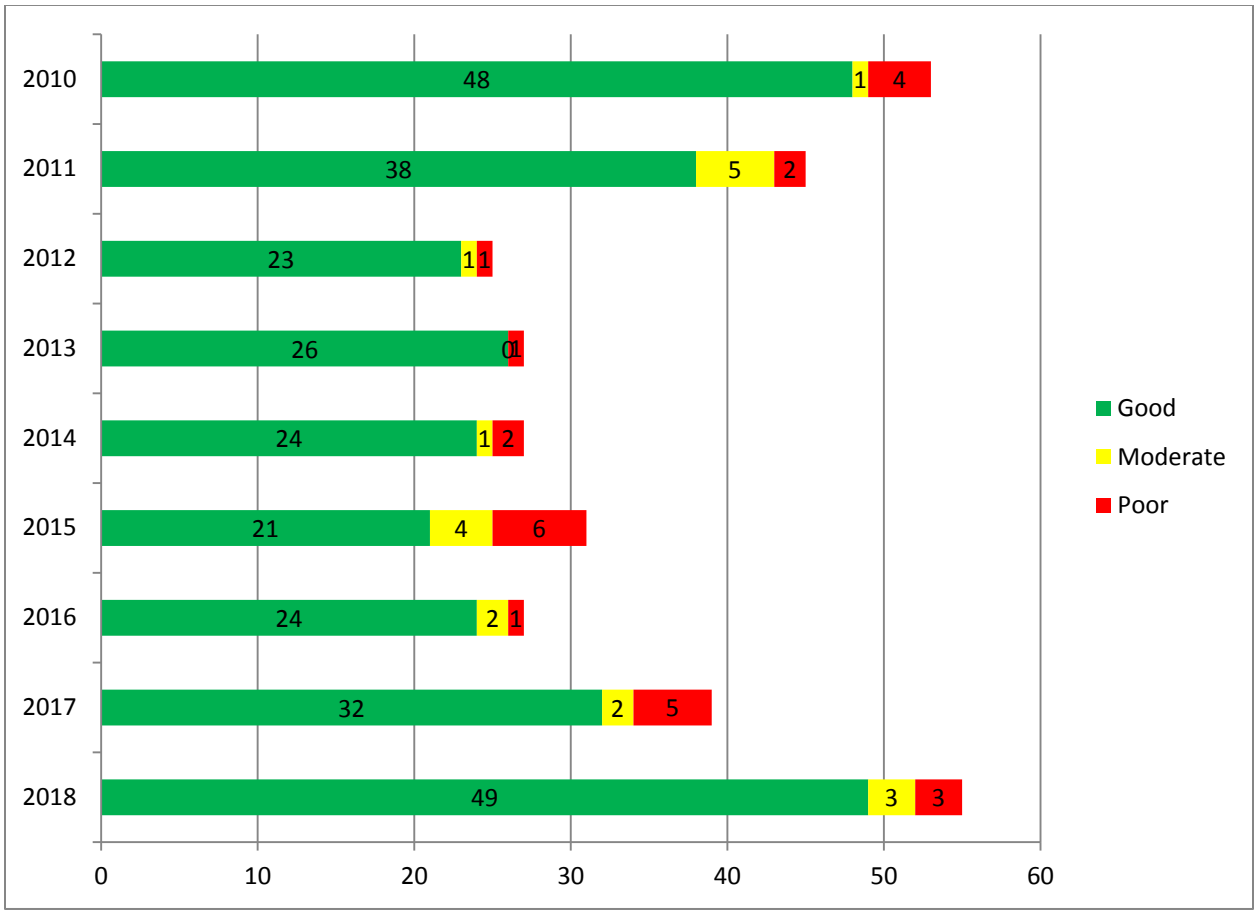

Figure 34. **Number of Good, Moderate, and Poor conditions in relation to *Enterococci* concentrations in Treasure Island Beach.**

Table 6. Enteric bacterial monitoring results from Spa Beach and Lassing Park.				
	Enterococci (Exceedance > 70 (cfu/100ml))		Fecal Coliform (Exceedance > 800 (cfu/100ml))	
	Number of Samples	Number of Exceedances	Number of Samples	Number of Exceedances
Spa Beach				
2016	14	0	1	0
2017	38	5	0	0
All	52	5	1	0
Lassing Park				
2016	1	0	0	0
2017	33	6	0	0
2018	59	8	0	0
All	93	14	0	0

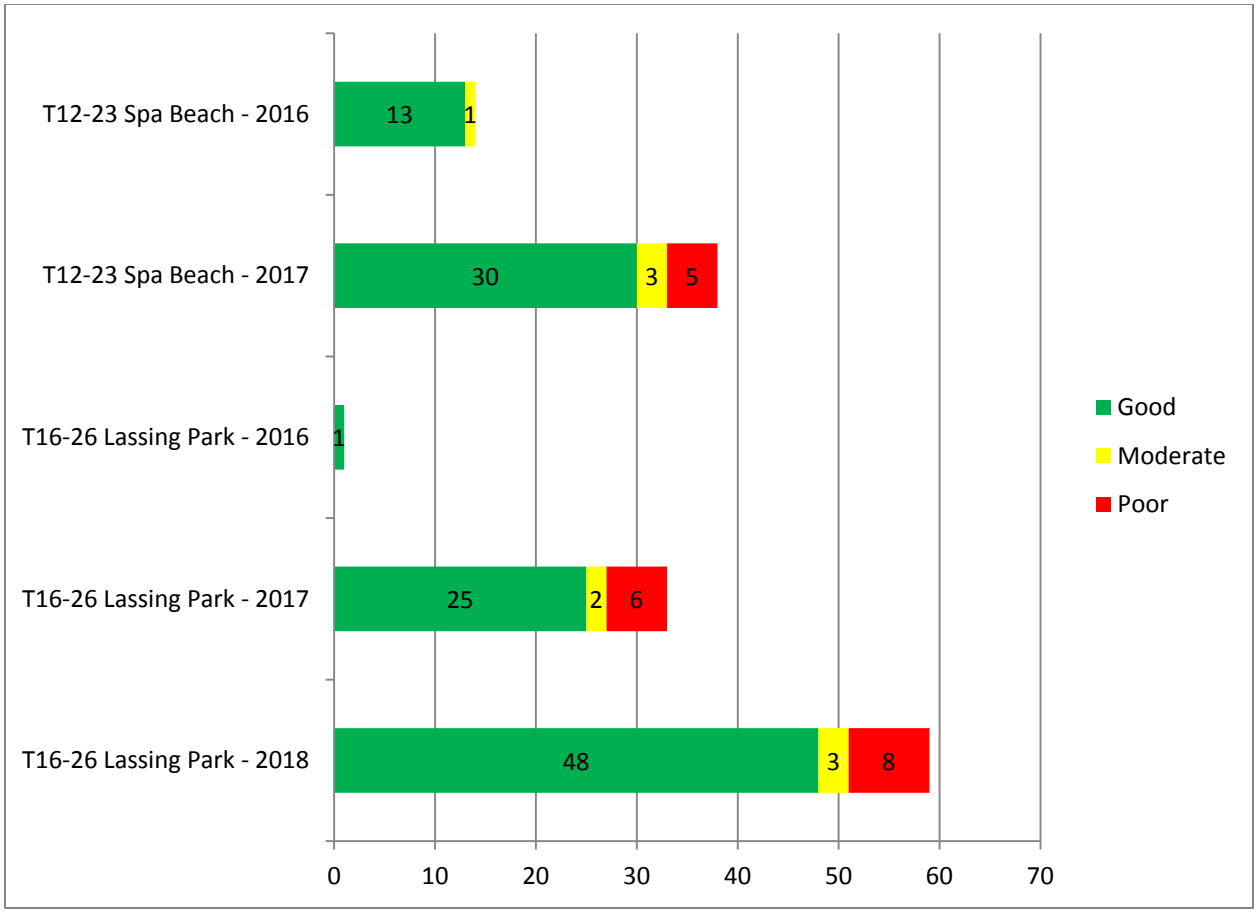

Figure 35. **Number of Good, Moderate, and Poor conditions in relation to *Enterococci* concentrations in Spa Beach and Lassing Park.**

RECREATIONAL AREA MONITORING PROGRAM

Many city parks are adjacent to or contain water bodies used for recreation other than swimming. These parks support secondary (non-submersive) contact with water during recreational activities, such as fishing, kayaking, boating, and paddle boarding. The objective of the Recreational Area Monitoring Program is to increase public awareness about the water quality conditions as they relate to human health within the City's recreational areas.

Monitoring of enteric bacteria in the recreational areas shown in Figure 36 was initiated in April 2017 stemming from public concerns following unplanned wastewater releases of 2015 and 2016. Prior to this time, several recreation sites were sampled as part of the City's Sanitary Sewer Overflows Monitoring Program and therefore data prior to April 2017 exist for selected sites.

Samples are collected monthly and *Enterococci* concentrations estimated. The results are compared to the City's classification system described above.

Table 7 presents the 2017 and 2018 sampling results from the Recreational Area Monitoring Program. The greatest numbers of *Enterococci* exceedances were found in Fossil Park Lake and Salt Creek, where all samples taken except for one indicated exceedances. Given these results, it would be prudent to investigate the sources of *Enterococci* in these two systems.

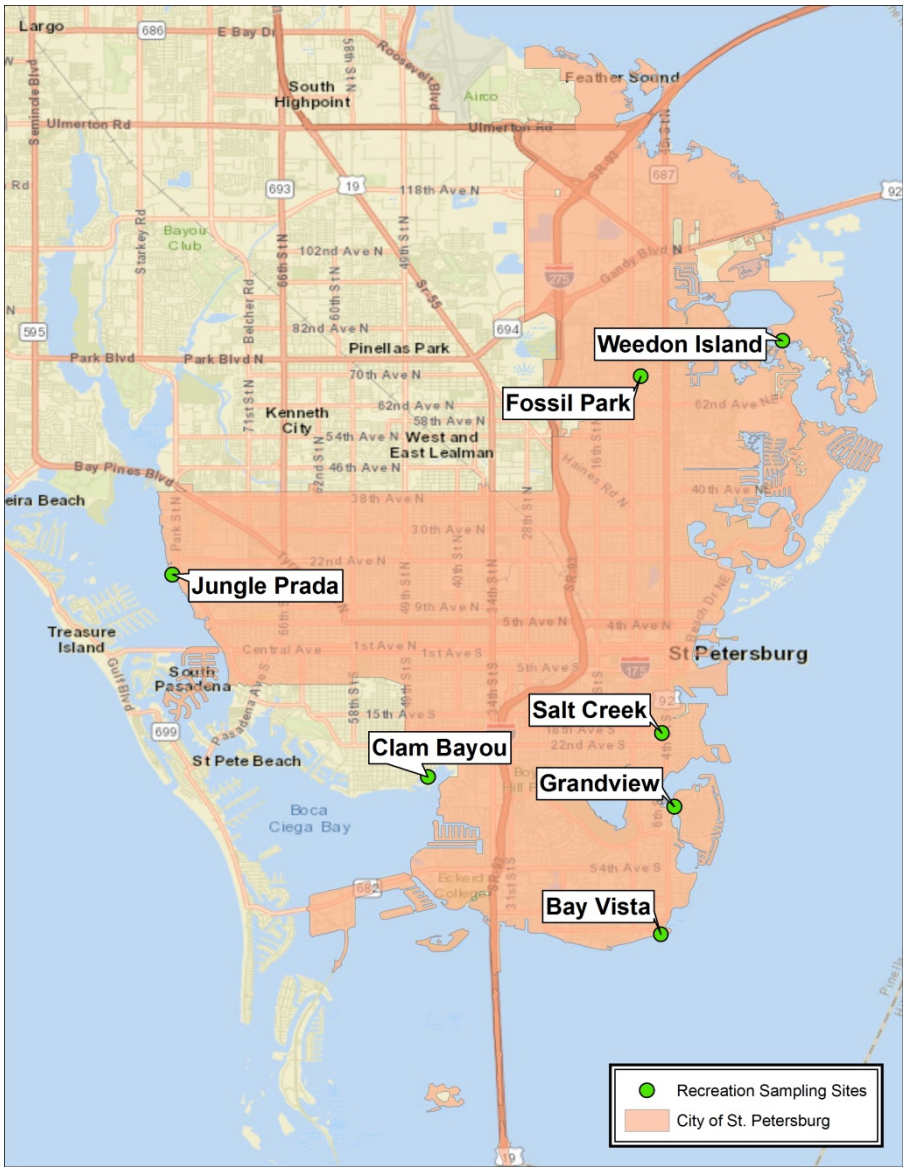

Figure 36. Recreational Area Monitoring Program sampling sites.

Table 7. Occurrence of Enterococci counts in excess of 35 (cfu/100 mL) depicted as "Red". "Green" indicates non-exceedances and blank cells depict no samples. Data collected by the Recreational Area Monitoring Program.

Sample Date	Bay Vista Park	Fossil Park Lake	Grandview Park	Jungle Prada Recreational Park	Salt Creek	Weedon Island	Clam Bayou Kayak Launch
19APR17	NO	YES	NO		YES	NO	
10MAY17	NO	YES	NO	NO	YES	NO	
07JUN17	YES	YES	YES	YES	YES	YES	
05JUL17	NO	YES	NO	NO	YES	NO	
10JUL17	YES						
23AUG17	NO	YES	NO	NO	YES	NO	
26SEP17	YES	YES	NO	YES	YES	NO	
27SEP17	NO						
25OCT17	YES	YES	NO	YES	YES	NO	
08NOV17	NO	YES	YES	NO	YES	YES	
11DEC17	NO	YES	NO	NO	YES	NO	
10JAN18	NO	YES	YES	NO	YES	YES	
11JAN18			NO				
14FEB18	NO	YES	YES	NO	YES	NO	
14MAR18	NO	YES	NO	NO	YES	NO	
15MAR18							YES
16MAR18							YES
25APR18	NO	YES	NO	NO	YES	NO	NO
03MAY18							
04MAY18							
07MAY18							
23MAY18	NO	YES	NO	NO	YES	NO	YES
24MAY18							YES
13JUN18	NO	YES	NO	NO	YES	NO	NO
25JUL18	NO	YES	YES	YES	YES	NO	YES
26JUL18			YES	YES			NO
22AUG18	YES	YES	NO	NO	YES	NO	NO
23AUG18	NO						
12SEP18	NO	YES	YES	NO	YES	NO	YES
13SEP18							YES
10OCT18	YES	YES	YES	YES	YES	YES	YES
12OCT18	NO		YES	YES			YES
06NOV18	NO			NO			

SANITARY SEWER OVERFLOWS MONITORING PROGRAM

Many urban areas with aging drainage and sanitary sewer infrastructure experience occasional Sanitary Sewer Overflow (SSO) events, commonly due to heavy rainfall and resultant runoff, conveyance pipe breakage, and flooding. The City has been responding to reports of SSOs since at least the mid-1970s, and has been collecting bacterial data associated with these overflows (based on paper copies of reports within City archives).

The objective of the Sanitary Sewer Overflow Monitoring Program is to quantify and minimize the impacts to the environment and the public from SSO events. Monitoring provides information that assists the City in determining appropriate courses of action for mitigation or remediation (if needed). Monitoring sites are selected based on reported SSO events, with samples collected in response to the event. Each SSO location is sampled, if possible, at the immediate point of impact of the SSO on the receiving water body (stream, canal, lake/pond). If possible, samples are also collected upstream and downstream of the impact point. SSO monitoring sites visited since 2010 are shown in Figure 37. Data are available in the City's electronic database back through 2010.

Monitoring at a given sampling site continues daily until the enteric bacterial counts drop below background levels as defined by the Background Monitoring Program (described below) associated with that site, or until a level is reached deemed acceptable based on professional judgment.

The locations of all SSO sampling sites are provided in Figure 37. For this report card, an event is defined as one reported SSO at one location. In total, the City SSO database contains data for sampling during 105 events. Of all the SSOs, seven general locations were associated with locations where SSOs were sampled during multiple events. The fecal coliform concentrations observed at these locations are provided in Table 8 and described below.

- 54th Ave. N. Discharge - There were three events during which samples were collected at this location, with samples at the point of discharge, upstream of the discharge, and downstream of the discharge. Nearly 100% of the samples collected were in exceedance of State standards for fecal coliforms (Table 8).
- Albert Whitted Emergency Overflow – The discharges due to these overflows entered Tampa Bay in the near vicinity of the plant. Sampling was implemented at multiple locations associated with the City's beaches in the vicinity of these discharges. Few of the samples showed fecal coliform concentrations in exceedance of State standards (Table 8).
- Clam Bayou Discharge - Sampling at multiple sites associated with discharges to Clam Bayou occurred during multiple events. The fecal coliform results from these sites show that at about half the sites, a very high proportion (80%-90%) of the samples had fecal

coliform concentrations in excess of the State standard. For most of the remaining sites, fecal coliform exceedances were found in approximately 40%-70% of the samples. At only one site were the fecal coliform exceedances found in less than 5% of samples (Table 8).

- Lake Maggiore SSO – Samples were taken from Lake Maggiore during two events at three different locations. The site designated as the stormwater drain to the lake likely reflects the most direct influence expected from the SSO and all samples collected at this site had fecal coliform concentrations exceedance of the State standard. Given that this was likely associated with a relatively high rainfall event, and thus it is likely that the lake was discharging into Salt Creek north of the SSO inflow, it is reasonable that the site north of the inflow also had all samples in exceedance. The site south of the inflow, however, only had one of four samples in exceedance of the State standard for fecal coliform. This appears to be reasonable given the likely flow path of the SSO discharge through Lake Maggiore.

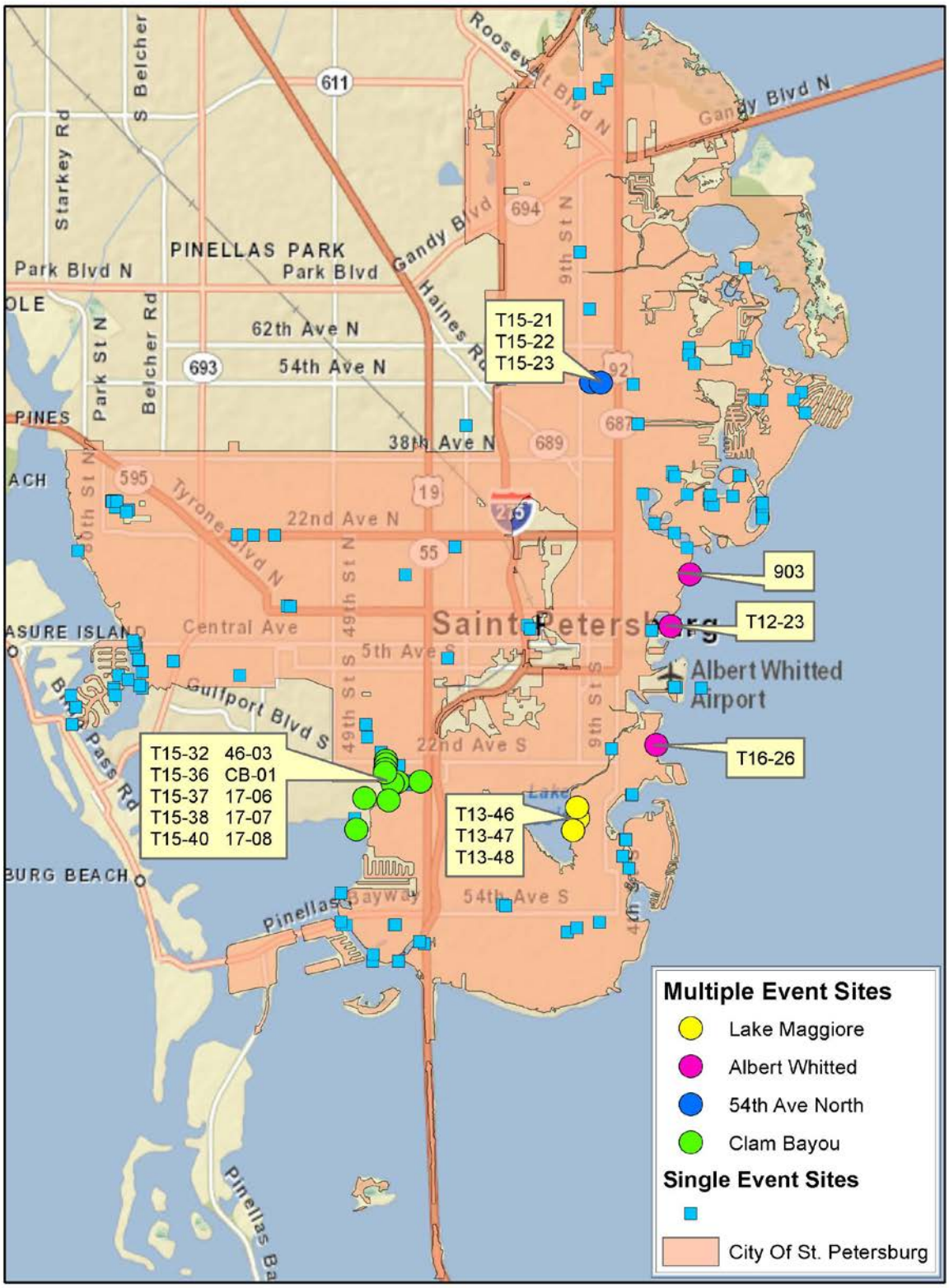

Figure 37. **Sanitary Sewer Overflow (SSO) Monitoring Program sampling sites.**

Table 8. Sampling associated with SSOs occurring at same locations over multiple events.			
Site Name	**Fecal Coliform>800 cfu/100 mL**	**Number of samples**	**Number of events**
54TH AVE. N. DISCHARGE			
T15-21 (Point of Discharge)	28	28	3
T15-22	23	27	3
T15-23	25	27	3
ALBERT WHITTED EMERGENCY OVERFLOW			
Northshore Beach (903)	0	5	2
T12-23 Spa Beach	1	5	2
T16-26 Lassing Park	2	15	3
CLAM BAYOU – DISCHARGE			
T15-32	3	77	1
T15-36 (Point of Discharge)	70	97	2
T15-37	58	97	2
T15-38	39	96	2
T15-40	20	77	1
46-03	7	8	1
CB-01	9	10	1
T17-06 Upstream	4	5	2
T17-07 Point of Impact	5	5	2
T17-08 Downstream	4	5	2
SANITARY SEWER OVERFLOW - LAKE MAGGIORE			
T13-46 Stormwater Drain Entry to L. Maggiore	4	4	2
T13-47 South of L. Maggiore Entry	1	4	2
T13-48 North of L. Maggiore Entry	4	4	2

BACKGROUND CONDITION MONITORING PROGRAM

City staff identified that in order to meaningfully interpret the data collected by its Sanitary Sewer Overflows Monitoring Program that additional data collected in the same areas but in the absence of an overflow event could provide the appropriate baseline or background data. The objective, therefore, of the Background Monitoring Program is to provide location-specific "normal" bacterial levels in the absence of conditions influenced by an SSO.

Monitoring began in February 2017 at these sites for background conditions. Sampling frequency is approximately every six weeks to two months, often coinciding with Ambient Monitoring sample collection. Concentrations of *Enterococci*, *E. coli*, and total fecal coliforms were estimated in each sample. It is important to note that the State's bacterial standard has recently been redefined by *Enterococci* and *E. coli* concentrations. Fecal coliform data continue to be monitored given the longer data record for this parameter.

Background monitoring sites were selected to coincide with locations where known SSO events occurred in the past and were, therefore, more likely to occur in the future (Figure 38). The selected sites include both marine and freshwater locations. For each site, background enteric bacterial concentrations are defined by the geometric mean of background concentrations observed in the absence of an SSO event.

Table 9 presents the calculated geometric mean of the enteric bacteria concentrations, i.e., the background concentrations, for each of the background monitoring sites. The highest geometric mean fecal coliform concentrations were found in the following sampling sites:

- T16-25 1st St. N. + 45th Ave
- T15-23 54th Ave N. + 1st St.
- T16-49 Joe's Creek 38th Ave N + 66th St.
- T16-51 Booker Creek 11th Ave S

The geometric mean *E. coli* concentrations were generally similar across the majority of the sampling sites ranging from 20 - 418 mpn/100mL. However two sites had order of magnitude higher geometric means for *E. coli*: T16-25 1st St. N. + 45th Ave (3080 mpn/100mL) and T15-23 54th Ave N. + 1st St. (1105 mpn/100mL). Similar to the fecal coliform results, the *Enterococci* geometric means were highest at the T16-25 1st St. N. + 45th Ave and T15-23 54th Ave N. + 1st St. These results suggest that investigation into the potential sources of bacterial contamination at these two sites should be conducted.

Figure 38. **Background Monitoring Program sampling sites.**

Table 9. Geometric mean concentrations of *Enterococci* , *E. coli*, and total fecal coliform from the Background Monitoring Program.

Sampling Site	Number of Samples	Fecal Coliform (cfu/100ml)	*E. coli* (mpn/100ml)	*Enterococci* (cfu/100ml)
T15-23 54th Ave N. + 1st St.	19	1887	1105	713
T16-19 2201 61st St. N. Canal	20	974	217	290
T16-25 1st St. N. + 45th Ave	19	3038	3080	771
T16-43 WFP Outfall	19	592	172	160
T16-45 Sunset Dr. N. & Central	19	42	20	47
T16-46 Sunset Dr. S. & 3rd Ave	19	48	173	33
T16-49 Joe's Creek 38th Ave N + 66th St.	19	1329	302	390
T16-50 Joe's Creek 45th Ave N + 28th St.	20	628	282	226
T16-51 Booker Creek 11th Ave S	19	1291	418	191

CONCLUSIONS

The following summarizes the status of the City's monitoring in regards to human health as represented by enteric bacteria. Recommendations are provided based on our evaluation of the four human health monitoring programs.

- With the exception of the Beaches Monitoring Program, the remaining three human health programs (recreational, SSO and background conditions) were all instituted relatively recently. While the results from these three monitoring programs provide an overview of existing conditions, the limited period of record does not allow evaluation of temporal trends, i.e., whether human health conditions are improving or declining. It is recommended that the City continue implementation of all four programs which will allow analysis of long-term changes in human health conditions.
- The Sanitary Sewer Overflows monitoring program identified specific areas where elevated bacterial concentrations have been observed most frequently. These locations include the 54th Ave. N. and 1st St. location, Clam Bayou, and Lake Maggiore. It is recommended that the City implement investigations into the potential sources of bacterial contamination. It is also recommended that the City institute a sampling protocol similar to that used in the Background Conditions Program in these areas, where multiple SSO events have been observed. The 54th Ave. N. and 1st St. location is already part of the Background Condition Monitoring Program but the other locations are not, so it is recommended that Clam Bayou and Lake Maggiore be added to the Background Program, with sampling under this program allowing establishment of "normal" conditions and development of a long-term database for these locations.
- For sites monitored as part of the Sanitary Sewer Overflows Monitoring Program, it is recommended that the focus be on obtaining samples from downstream receiving waterbodies where impacts are likely to be most important.
- With respect to the Recreational Areas Monitoring Program, the greatest numbers of *Enterococci* exceedances were found in Fossil Park Lake and Salt Creek, where all samples taken except for one indicated exceedances. Given these results, it would be prudent to investigate the sources of *Enterococci* in these two systems.

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