Sarasota Bay–Peace–Myakka Basin
Lakes, Rivers, Streams, and Aquifers

Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Bureau of Assessment and Restoration Support, Watershed Monitoring Section

Good science is the foundation of the Florida Department of Environmental Protection's (FDEP) programs to assess and protect water quality. FDEP is committed to characterizing the environmental conditions of Florida's freshwater resources through several monitoring programs. The Watershed Monitoring Section administers the Status Monitoring Network, which oversees the statewide sampling of surface and ground water. This report summarizes the 2006 Status Monitoring Network results for the Sarasota Bay–Peace–Myakka Basin.

Sarasota Bay–Peace–Myakka Basin

The Sarasota Bay–Peace–Myakka Basin is located in the west-central portion of the Florida peninsula. The basin covers approximately 3,385 square miles. It is situated in Charlotte, DeSoto, Hardee, Manatee, Polk, and Sarasota Counties, with small portions in Glades, Highlands, Hillsborough, and Lee Counties.

The Sarasota Bay–Peace–Myakka Basin is made up of three distinct watersheds: the Sarasota Bay watershed; the Peace River watershed; and the Myakka River watershed. The Sarasota Bay watershed is the most urbanized area of the basin. Its major metropolitan areas are Bradenton, Sarasota, and Venice, and the island communities of Longboat Key, Bradenton Beach, Holmes Beach, and Anna Maria. The Peace River watershed's major urban areas are Lakeland, Winter Haven, Auburndale, Haines City, and Bartow. The Myakka River watershed is primarily rural, with the most urbanized portions concentrated in the North Port and Port Charlotte areas. The entire basin contains approximately 1 million people.

Natural areas are abundant throughout the Sarasota Bay–Peace–Myakka Basin. Some of Florida's most beautiful and productive estuaries, including Sarasota Bay, Little Sarasota Bay, Dryman Bay, and Blackburn Bay, are found in the Sarasota Bay watershed. The basin has a diverse landscape, with expanses of scrub habitat, dry prairie, riverine floodplains, freshwater wetlands, and extensive tidal wetlands. In addition to providing important habitat for wildlife, these areas provide ground water recharge, flood protection through the natural storage and detention of floodwaters, and the maintenance and enhancement of water quality. Both the Peace and Myakka Rivers discharge into Charlotte Harbor, Florida's second largest estuary. These natural areas lessen negative impacts to ecological health and water quality in the basin.

The following table summarizes land use statistics calculated for the Sarasota Bay–Peace–Myakka Basin from 2004 satellite imagery.

Land Use	Agriculture	Forest	Urban	Wetlands	Other
Percentage	21.6	6.1	51.8	9.7	11.1

The percentage reported as "Other" consists of water, rangeland, barren land, transportation, communication, and utilities.

Monitoring Design of the Status Monitoring Network

FDEP has worked with the water management districts, local governments, and other entities to establish an Integrated Water Resource Monitoring (IWRM) Program. This program combines surface and ground water monitoring efforts, consisting of water chemistry, biology, and sediment analyses. It is fiscally and logistically prohibitive to sample every river, stream, lake, or individual well in the state on a regular basis. A probabilistic monitoring design is a cost-effective approach to produce a statistically valid estimate of the condition of water resources. The IWRM Program is made up of three levels of monitoring designs: (1) the Status Monitoring Network designed to allow statistical inferences about all state waters; (2) more intensive basin monitoring used to identify and confirm impaired waterbodies that do not meet Florida's water quality standards; and (3) site-specific regulatory compliance monitoring.

The Status Monitoring Network uses a random site monitoring design to assess the state's surface and ground water quality. The objective of this design is to broadly characterize aquatic resources with a known statistical confidence. Samples are collected from randomly selected points, which is a cost-effective way to provide a geographic snapshot of the condition of all waters in a basin. This monitoring program is not designed to answer site-specific questions about individual lakes, rivers, streams, or wells.

The Status Monitoring Network categorizes Florida's fresh waters into 6 different resource types. Four of these are surface water: small lakes, large lakes, rivers, and streams. The other 2 resources are ground water: unconfined and confined aquifers. The 2004–2009 Status Monitoring Network design divides the state into 29 basins, with 5 or 6 basins sampled each year. Approximately 30 samples are collected annually from each resource in the selected basins. Thus, in each basin, approximately 120 samples are collected for surface water resources, and 60 samples for ground water resources, in addition to quality assurance samples.

Lakes

The Sarasota Bay–Peace–Myakka Basin has approximately 400 lakes. FDEP has divided these lakes by size into 2 categories: small lakes of 2.5 to 25 acres and large lakes over 25 acres. This division allows a better characterization of the status of the basin's lake resources. The basin contains numerous brackish lakes and wetlands that were excluded from this resource category.

Rivers and Streams

The Peace and Myakka Rivers, totaling 136 miles, represent the river resource. The remaining streams and tributaries are designated as the stream resource. These total about 2,887 miles, although some may be dry during drought. Many of these stream resources have been artificially channelized, impounded, or otherwise altered, minimizing the streams' natural ability to filter pollutants. The 2 resources can have different habitats and uses.

Aquifers

Aquifers are permeable layers of sand, gravel, or rock that contain water. Unconfined aquifers are near the land surface and are easily affected by human activities. Confined aquifers lie below a layer of material, such as fine-grained clay, that limits the downward flow of water. Water in confined aquifers usually filters slowly through sediment and rock layers, and is older and less affected by human activities. FDEP's Watershed Monitoring Section samples ground water in the Sarasota Bay–Peace–Myakka Basin through wells in unconfined and confined aquifers.

The unconfined aquifer in the basin is an important source of water, especially for agriculture and mining. In terms of the region's water use, about 85 to 90% of all ground water is derived from the upper Floridan, a confined aquifer. Currently, no water supply comes from the lower Floridan aquifer due to its high salinity. Over the last few decades, massive development and extended drought in the Sarasota Bay–Peace–Myakka Basin have caused excess discharge and insufficient recharge of the aquifer. The resulting ground water drawdown precipitates saltwater intrusion and

the upconing of sulfate-enriched mineralized water into coastal wells, rendering them unfit for drinking water and sometimes agricultural use.

Summary and Results

The tables below show the sampling carried out for each resource in the Sarasota Bay–Peace–Myakka Basin, in terms of acres of large lakes, number of small lakes, miles of rivers and streams, and number of wells for confined and unconfined aquifers. Not all randomly selected stations can be sampled for various reasons. Those that can be sampled are termed accessible. Those stations that cannot be sampled are considered either dry or inaccessible. Reduced rainfall or periods of drought occur on a cyclical basis in many areas of Florida. Prolonged or intense periods of drought can adversely affect water chemistry. During the sampling period, precipitation was reduced by 10% compared with the 30-year annual average.

Surface Water Resource	**Large Lakes** (≥ 25 acres)	**Small Lakes** (2.5–25 acres)	**Rivers** (2 rivers/canals)	**Streams** (all other streams/ canals)
Resource Size (area, number, length)	14,944 acres	252 lakes	136 miles	2,887 miles
Accessible	86%	46%	70%	22%
Dry	0%	3%	0%	11%
Inaccessible	14%	51%	30%	67%
Number of Samples	30	27	30	30

Ground Water Resource	**Unconfined Aquifers**	**Confined Aquifers**
Number of Wells	279	460
Accessible	34%	39%
Inaccessible	66%	61%
Samples	30	30

Basin Precipitation	Average Annual (1971–2000)	Annual (2006)
Sarasota Bay–Peace–Myakka Basin	50.7 inches	45.5 inches

Rainfall data were obtained from the National Climatic Data Center database for the Arcadia, Mountain Lake, Myakka River State Park, Punta Gorda, Venice, Wauchula, and Winter Haven Stations.

The discussion and figures below provide results for the basin's surface and ground water resources for a number of important indicators (see the *Definitions and Criteria* pages for explanations of the indicators used). As discussed in *Definitions and Criteria*, natural conditions such as higher water temperatures, freshwater and stormwater inflows, and different soils can affect the results shown below. The exceedance of a standard or threshold is not necessarily caused by a pollutant.

Lakes: Dissolved oxygen (DO) is within the standard for large lakes and below the standard in 19% of the small lakes. Low DO can be harmful to aquatic life. Fecal coliform bacteria levels are within the standard for large lakes and high for 22% of the small lakes sampled. pH is outside the standard range for 37% of the large lakes and 11% of the small lakes. Un-ionized ammonia levels are within the standard for both large and small lakes. The Trophic State Index, a combined measure of nutrients and chlorophyll that indicates lake health, shows that 40% of the large lakes and 22% of the small lakes have excess nutrients and chlorophyll.

Rivers and Streams: DO is below the standard in 37% of the rivers and 58% of the streams sampled. Canal/ditch construction and ground water inflows can contribute to low DO concentrations. Low DO can be harmful to aquatic life. Fecal coliform bacteria is above the standard in 10% of the rivers and 29% of the streams sampled. pH levels are within the standard for rivers and outside the standard range in 6% of streams. Un-ionized ammonia is above the standard for rivers (10%) and streams (4%). Chlorophyll exceeds the standard in 17% of the rivers and 21% of the streams sampled.

Aquifers: Exceedances of arsenic (10%) and sodium (3%) are found in a small percentage of the unconfined wells sampled. Sodium is above the standard in 12% of the confined wells. Total coliform bacteria exceed the standard in 45% of the unconfined wells and 21% of the confined wells. These bacteria are indicators of possible human health effects if the water is used for drinking. Other analytes are within standards.

Surface Water Resource	Dissolved Oxygen	Fecal Coliform	pH	Un-ionized Ammonia	Trophic State Index
Large Lakes					
Small Lakes					
Surface Water Resource	**Dissolved Oxygen**	**Fecal Coliform**	**pH**	**Un-ionized Ammonia**	**Chlorophyll**
Rivers					
Streams					

Ground Water Resource	Arsenic	Cadmium	Chromium	Lead	Nitrate–Nitrite	Sodium	Fluoride	Total Coliform
Unconfined Wells								
Confined Wells								

Note: The gray segments of the pie charts represent the percentage of water resources that meets water quality standards. Blue segments represent the percentage that does not meet the standards. See the *Definitions and Criteria* pages for more information.

This survey does not represent a comprehensive analysis of any individual waterbody.

The Watershed Monitoring Section would like to thank the Southwest Florida Water Management District for its contributions to this report.

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Surface Water Definitions and Criteria

Each indicator listed below was chosen because it has an applicable state criterion, found in *Criteria for Surface Water Quality Classifications, Rules 62-302 and 62-303, Florida Administrative Code.*

Indicators	Criterion/Threshold[1]	Designated Use
Fecal Coliform Bacteria	< 400 counts/100mL	Recreation
Dissolved Oxygen	≥ 5 mg/L	Aquatic Life
pH	≥ 6 and ≤ 8.5 SU	Aquatic Life
Un-ionized Ammonia	≤ 0.02 mg/L	Aquatic Life
Chlorophyll *a*	≤ 20 µg/L	Aquatic Life
Trophic State Index (TSI)	Color ≤ 40 PCUs, then TSI ≤ 40 Color > 40 PCUs, then TSI ≤ 60	Aquatic Life

[1] mL – milliliters; mg/L – milligrams per liter; SU – standard units; µg/L – micrograms per liter; PCUs – platinum cobalt units

Fecal coliform bacteria: The single-sample threshold for fecal coliform is 400 counts per 100 milliliters of water. These bacteria can enter water through the discharge of waste from mammals and birds, agricultural and stormwater runoff, and untreated human sewage. The presence of fecal coliform bacteria may indicate that the water is contaminated by other disease-causing organisms.

Dissolved oxygen (DO): The state criterion for DO is a minimum of 5 milligrams per liter to maintain healthy conditions for aquatic life. Lower levels do not affect human recreation. Algae and plants produce oxygen through photosynthesis. Oxygen is also dissolved in water by wind and wave action. Respiration by aquatic animals, decomposition, wastewater, stormwater runoff from urban streets or farmland, and failing septic tanks consume oxygen. Natural conditions—such as ground water from springs, water from swamps/wetlands, higher water temperatures, and calm and cloudy weather—can also decrease DO levels in waterbodies.

pH: The surface water criterion for pH is between 6 and 8.5 standard units. The pH scale, which ranges from 0 to 14, is a measure of the degree of acidity or alkalinity of a solution. Numbers below 7.0 indicate acidity; numbers above 7.0 indicate alkalinity. The midpoint of 7.0 on the pH scale represents neutrality—that is, a neutral solution is neither acidic nor alkaline. pH affects many chemical and biological processes in water, and aquatic organisms are adapted to a certain range of pH. When pH levels are outside this range, it stresses these organisms' physiological systems and can reduce reproduction. Atmospheric deposition (acid rain), geology, vegetation, and pollution can cause changes in pH.

Un-ionized ammonia: The threshold for un-ionized ammonia is less than or equal to 0.02 milligrams per liter. This is calculated from total ammonia and adjusted for temperature, salinity, and pH. Ammonia occurs in different forms; water temperature and pH affect which form predominates at any given time in an aquatic system. Un-ionized ammonia can be toxic to fish and invertebrates.

Chlorophyll a*: The threshold for chlorophyll is less than or equal to 20 micrograms per liter. Chlorophyll is the pigment that allows algae and plants to convert sunlight into organic compounds during the process of photosynthesis. Excess nutrients, such as nitrogen and phosphorus, can stimulate algal blooms. Excess algae sink to the bottom and decay, using up the oxygen that other plants and organisms require to survive. High concentrations of chlorophyll reduce water clarity and limit the light available to shallow-water ecosystems.

Trophic State Index (TSI)*: TSI and chlorophyll are the primary measures used to assess nutrient impairment in a waterbody. There are two thresholds for TSI, based on the color of a lake. Dark-water lakes with a mean color greater than 40 platinum cobalt units (PCUs) are impaired when their annual mean TSI exceeds 60. Clear and low-color lakes with a mean color less than or equal to 40 PCUs are impaired when their annual mean TSI exceeds 40. TSI is measured using chlorophyll, nitrogen, and phosphorus concentrations. A 10-unit increase or decrease in the index represents a doubling or halving, respectively, of the number of algal cells present.

***** Both TSI and chlorophyll *a* are not standards, but thresholds used to estimate the impairment of state waters. These thresholds are used in the analysis of Status Network data, based on single samples in a basin at a predetermined time of year. The analysis and representation of these data are not intended to infer the verification of impairment, as defined in Rule 62-303, Florida Administrative Code, in these waters.

Aquifer Definitions and Criteria

The table below shows the thresholds for eight indicators regulated under drinking water standards.

Indicators	Criterion/Threshold[1]	Designated Use
Arsenic	≤ 10 µg/L	Potable Water(drinking water)
Cadmium	≤ 5 µg/L	Potable Water(drinking water)
Chromium	≤ 100 µg/L	Potable Water(drinking water)
Lead	≤ 15 µg/L	Potable Water(drinking water)
Nitrate–Nitrite	≤ 10 mg/L	Potable Water(drinking water)
Sodium	≤ 160 mg/L	Potable Water(drinking water)
Fluoride	≤ 4 mg/L	Potable Water(drinking water)
Total Coliform Bacteria (counts per 100 milliliters)	≤ 4 (sample maximum)	Potable Water(drinking water)

[1] µg/L – micrograms per liter; mg/L – milligrams per liter

Arsenic, cadmium, chromium, and lead are all naturally occurring metals in the earth's crust. These and other metals are used in manufacturing and can be produced and used in pesticides, preservatives, and industrial operations. They may enter water as a pollutant. Florida has primary standards (criteria) for these metals to protect human health. Excess levels in drinking water can cause adverse health effects.

Nitrate–nitrite is used in fertilizer and is found in sewage and wastes from human and/or farm animals. Florida's drinking water standard is 10 milligrams per liter (mg/L) for nitrate and 1 mg/L for nitrite. In addition, to allow for the fact that the toxicity of nitrate and nitrite is additive, the standard for the sum of nitrate and nitrite is 10 mg/L. In the long term, nitrates and nitrites have the potential to cause serious adverse effects in humans.

Sodium (salt) has a drinking water standard to protect individuals who are susceptible to sodium-sensitive hypertension or diseases that cause difficulty in regulating body fluid volume. Sodium is monitored so that individuals on sodium-restricted diets may take the sodium in their water into account. Drinking water contributes only a small fraction (less than 10%) of an individual's overall sodium intake.

Fluoride, a natural element, is added to drinking water systems to reduce dental cavities. Prolonged exposure to levels above 4 milligrams per liter may result in crippling skeletal fluorosis, a serious bone disorder. Lower levels may cause dental fluorosis when children are developing teeth. In its moderate and severe forms, dental fluorosis is a brown staining and/or pitting of the permanent teeth.

Total coliform bacteria are common in the environment and are generally not harmful. The presence of these bacteria in drinking water, however, is an indicator that disease-causing organisms may be present. The U.S. Environmental Protection Agency and Florida have set an enforceable drinking water standard for total coliform of 4 counts per 100 milliliters to reduce the risk of adverse health effects. Drinking water that meets this standard is usually not associated with a health risk from disease-causing bacteria and is considered safe.

Sarasota Bay - Peace - Myakka Basin 2006 Ground Water Sample Sites

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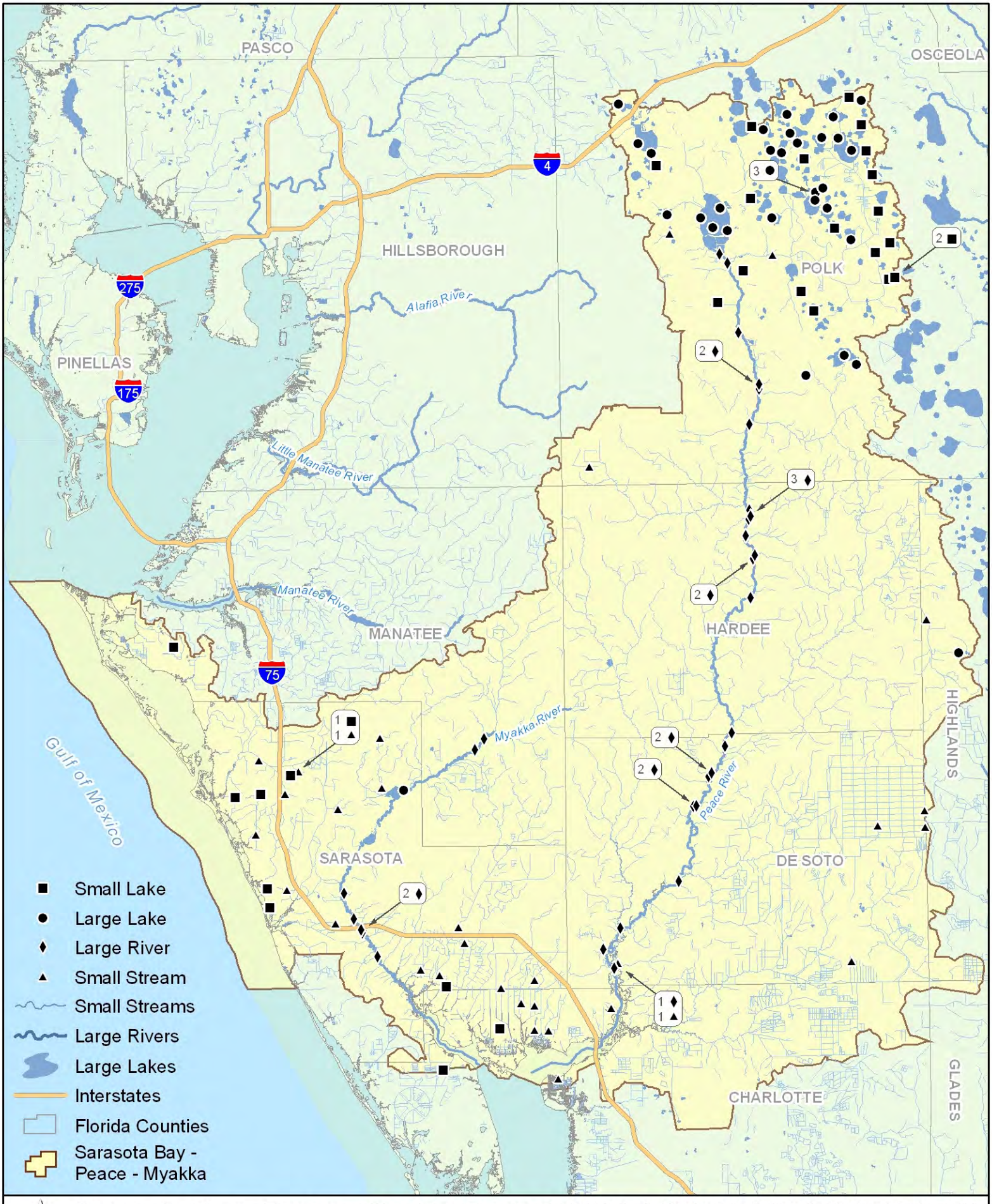
0 4 8 16 24 32 Miles

Created March 13, 2009 by Justin Berke in the Division of Environmental Assessment and Restoration, Watershed Monitoring Section. This map is for display purposes only and is not intended for further analysis. For more information contact Justin.Berke@dep.state.fl.us or (850) 245-8551. Basin reports located at http://www.dep.state.fl.us/water/monitoring/basins.htm



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