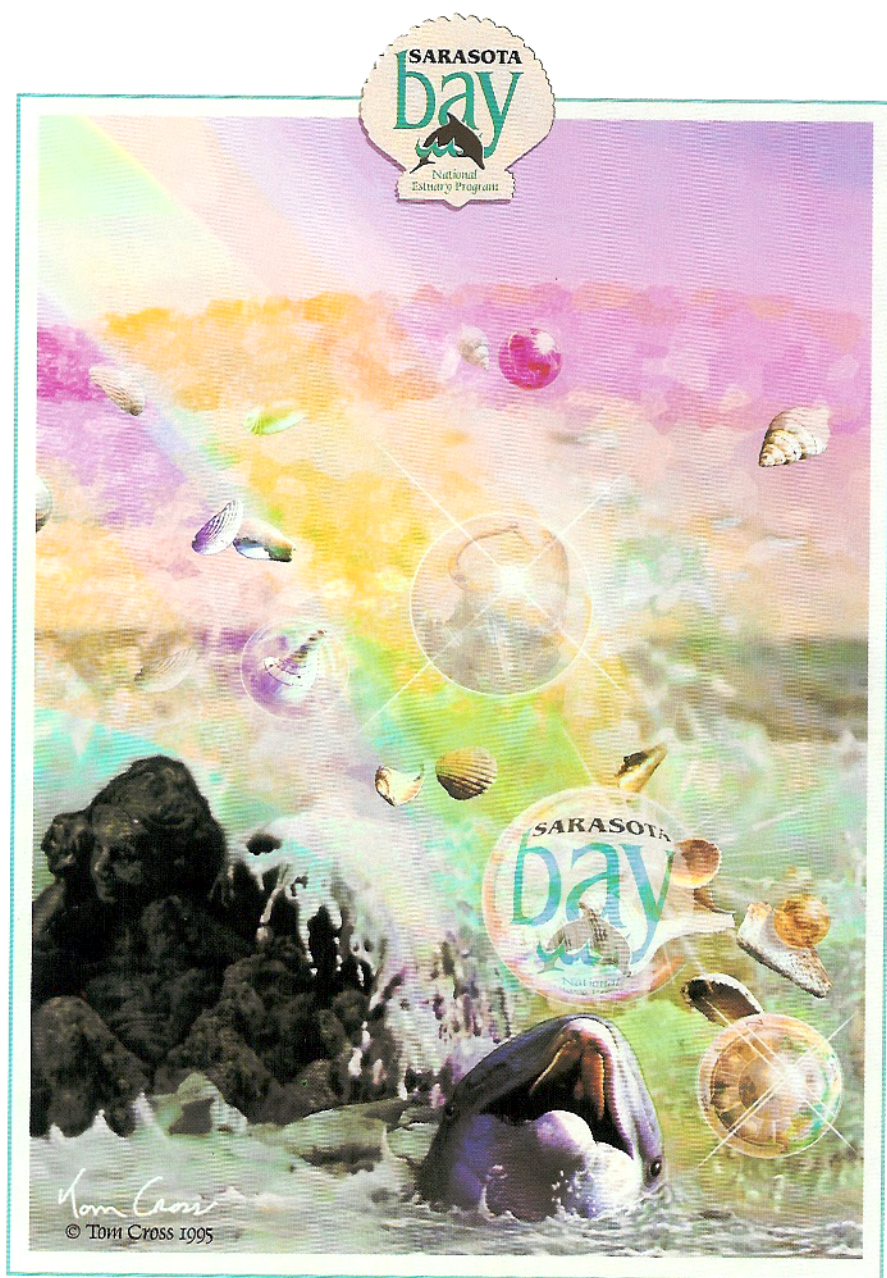


SARASOTA BAY



The VOYAGE to
PARADISE RECLAIMED
1995

Sarasota Bay
The Voyage to Paradise Reclaimed
1995



The
Comprehensive Conservation and
Management Plan for Sarasota Bay

Preface



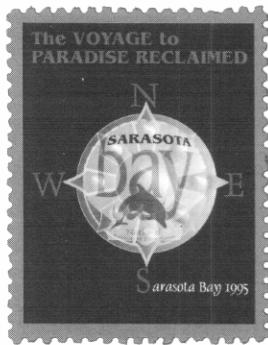
"Sarasota Bay: The Voyage to Paradise Reclaimed"
is produced by the Sarasota Bay National Estuary Program for the people of Manatee and Sarasota counties.

This document presents a Comprehensive Conservation and Management Plan to restore Sarasota Bay, and provides specific actions to be implemented by the community. The recommendations for improved Bay management were developed following an intensive technical analysis to determine the condition of Sarasota Bay and sources of pollution. The actions recommended in this Plan have received extensive review by citizen and technical advisors, local governments and state and federal agencies.

The technical information supporting this Plan has been reviewed for accuracy by national experts in related fields. Additional detail is available at the Sarasota Bay Program, 5333 North Tamiami Trail, Sarasota, FL 34234.



Vision for the future



Sarasota Bay's future depends on each of us, as tremendous opportunities exist for improving our damaged Bay. Through the Sarasota Bay Program, the community is creating a new vision for Sarasota Bay.

In this brighter future, water quality improves throughout the Bay, with a resurgence of submerged seagrasses and related marine life. Catches of fish increase for both recreational and commercial fishermen.

Wetlands, both freshwater and tidal, are restored. Existing wetlands, viewed as vital links between people and the Bay, are protected from harm. Canals in residential communities become dramatically more productive habitats for marine life.

The community aggressively pursues stormwater management and treatment. Residents naturalize their yards, planting native habitats for birds and wildlife, and wildlife returns.

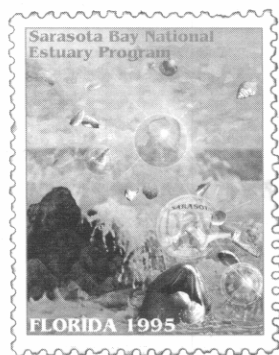
Direct discharges of wastewater to Sarasota Bay are minimized. Septic tanks and ineffective package treatment plants are replaced with environmentally appropriate treatment systems with effluent reuse. Treated wastewater is perceived by residents as a source of water to be used for irrigation, rather than a by-product for disposal.

Inlets and passes are managed and monitored as mechanisms for improving the Bay.

Recreational opportunities increase as the Bay improves and conflicts between user groups are resolved.

Management and protection of the Bay are central to the decisions of government and the practices of citizens. Citizens and government share a common goal: to implement a comprehensive Bay restoration plan.

How to use this book



Please begin with the Introduction on page 1-2 for an overview of the Sarasota Bay Program, the state of Sarasota Bay-1995, its problems and the solutions that are recommended to restore the Bay. A chart on pages 2-12 and 2-13 summarizes the most immediate action in each issue area presented in the plan.

Following the summary, a series of Action Plans recommend specific solutions to Sarasota Bay's problems. The Action Plans address wastewater, stormwater, freshwater and saltwater wetlands, fisheries and other living resources, and governance. The plans are not presented in priority order, nor are the actions presented by priority ranking. Timing of actions – which could be considered a type of priority setting – is recommended under "Timetable and Status" after each action or set of related actions.

Each Action Plan also includes cost estimates and financing strategies, measurements of success and anticipated benefits relevant to the particular issue and associated Bay resources. For readers who want to take part as private citizens in the Bay's recovery, we provide ideas on "What You Can Do" in each Action Plan. Finally, an "Action Update" is provided for each issue area, encapsulating (as of press time) the status of actions recommended in each section.

A summary and evaluation of Environmental Programs related to Sarasota Bay restoration is presented, in keeping with the requirements of the U.S. Environmental Protection Agency. The critique provides constructive suggestions on ways to improve policies, regulations and intergovernmental coordination related to Bay management.

For technical detail, refer to the Summary of Technical Investigations. A description of recommendations for long-term Bay monitoring and research needs is also provided. Additional detail on technical work completed by the program can be found in *Sarasota Bay: Framework for Action (1992)*, available from the Sarasota Bay Program.

Sarasota Bay *The Voyage to Paradise Reclaimed* *1995*

The *Comprehensive Conservation* *Management Plan for Sarasota Bay*

Written by the Sarasota Bay community

Published by the Sarasota Bay National Estuary Program

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The Voyage to Paradise Reclaimed



The Comprehensive Conservation & Management Plan for Sarasota Bay, Florida

During the past 50 years, human activities have caused a slow but steady decline in the general health of Sarasota Bay (*Fig. 1*).

The people of Manatee and Sarasota counties are now realizing the extent of damage that began with massive dredge-and-fill projects from 1950-60, and continued with the community's rapid growth and associated pollution.

Only recently has the community noticed improvements in the Bay, largely resulting from concerted government action to improve habitat and water quality. Nitrogen pollutant loads into Sarasota Bay have been reduced by approximately 25 percent since 1989, 43 percent in the central Bay. Significant improvements in water quality and bottom habitat have been measured as a result of pollutant reduction due to improvements at the City of Sarasota and Manatee County wastewater treatment operations. The comprehensive restoration strategy proposed in this document suggests that an additional 23-percent reduction in nitrogen loads — or more — can be achieved through coordinated action by the community.

The plan proposes to continue initiatives begun during the past five years to **increase** available wetland habitat, and to improve the quality and **reduce** the quantity of stormwater runoff. It includes **recommendations** for constructing a wastewater treatment system in northern Sarasota County, reclaiming wastewater on a large scale and **altering landscaping** to reduce pollution to meet the challenges of the future.

Still, past destruction of seagrasses and mangroves, and continuing pollution from wastewater and stormwater, present a major challenge for the stewards of Sarasota Bay.

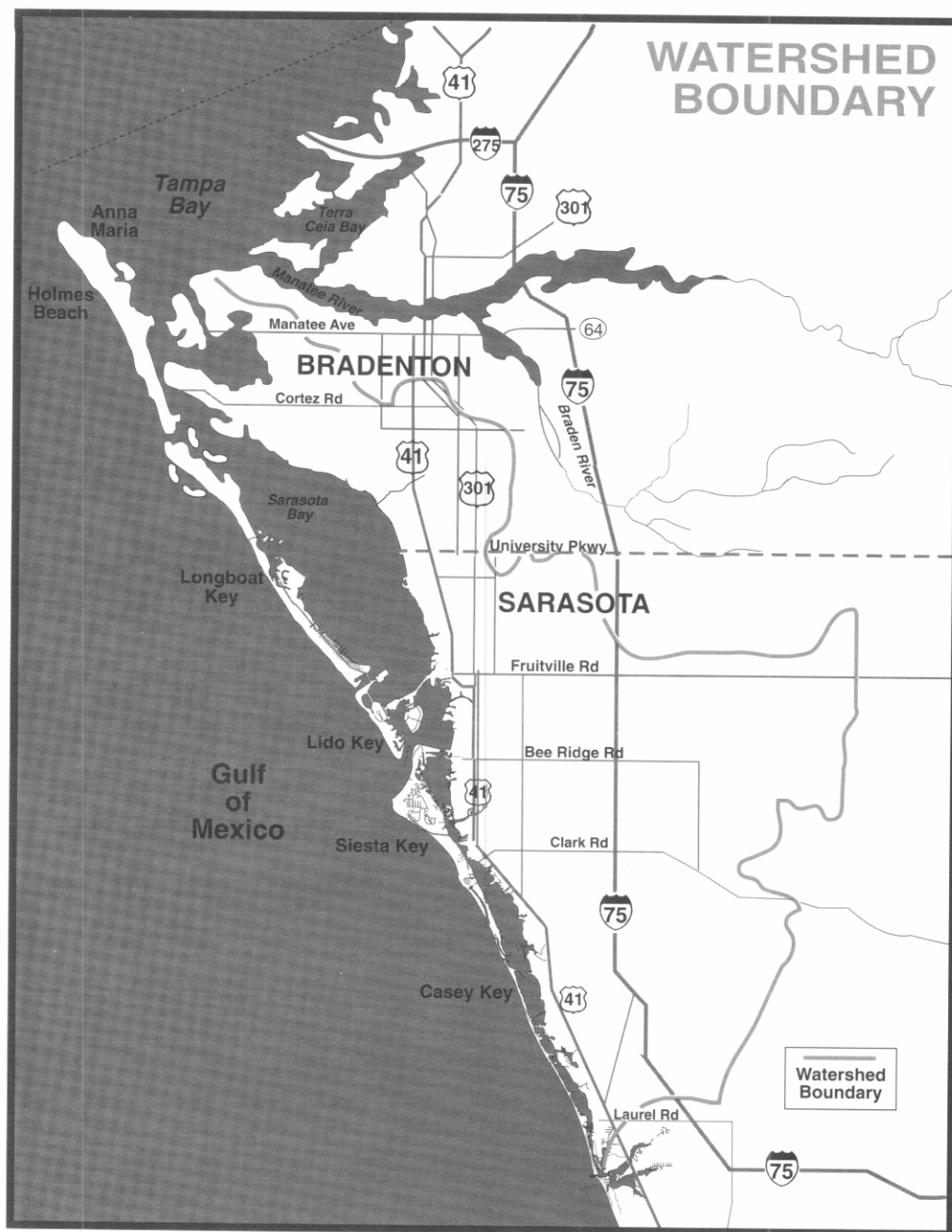


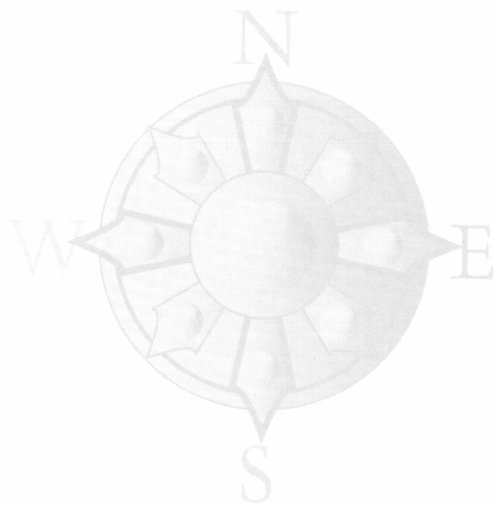
Figure 1.

This challenge can be met through concerted effort by the community. In this spirit, the Sarasota Bay Program recommends specific actions to restore and protect Sarasota Bay.

In 1993, the Sarasota Bay Program completed the most comprehensive analysis of any estuary in Florida, documenting problems related to pollution by wastewater and stormwater, loss of wetlands and seagrasses, and conflicts in recreational use of the Bay. Results of these investigations by top estuarine scientists were presented in the "Framework for Action 1993" report and are summarized in this report.

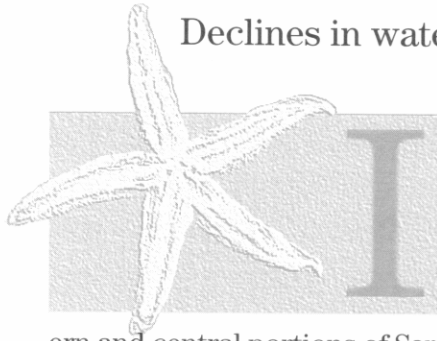
State of Sarasota Bay: 1995

The Comprehensive
Conservation & Management Plan
for Sarasota Bay, Florida



State of the Bay, 1995

Discussion of priority problems



Declines in water and sediment quality

In general, water quality in the northern and central portions of Sarasota Bay is improving, although similar improvements have not been detected in the southern Bay. Sediment quality is degraded in tributaries Baywide, but the main Bay is relatively free of contaminants.

A principal pollutant affecting Bay water quality is nitrogen. An overabundance of nitrogen harms the Bay by increasing algal growth. Excessive algae reduce light penetration to submerged seagrasses and, through biological and chemical processes, deplete oxygen from the water. Nitrogen loading into Sarasota Bay has tripled since intensive development began. Without remedial action, nitrogen loadings are projected to increase another eight percent during the next 20 years, and 16 percent when the area is fully developed according to existing plans (*Fig. 1*). By implementing the restoration strategy for Sarasota Bay, however, nitrogen loadings in the year 2012 can be at least 18 percent lower than today. Further reductions may be possible by modifying residential landscapes throughout the region.

Human-induced sources of nitrogen are wastewater (including small and large wastewater treatment plants), groundwater (from septic systems and small treatment plants) and stormwater (including fertilizers from lawn care and agriculture). Nitrogen

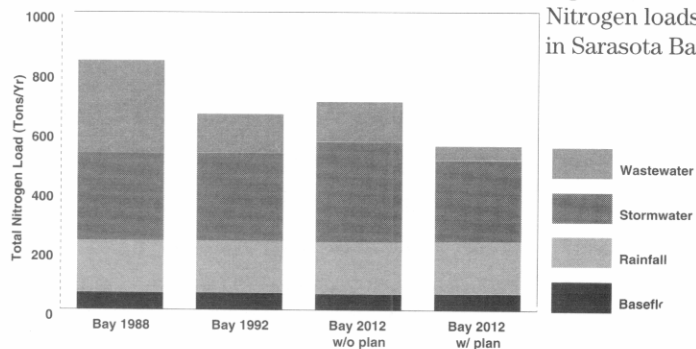


Figure 1.
Nitrogen loads
in Sarasota Bay.

also gets into Sarasota Bay via rainfall. Nitrogen in rainfall (NO_x) is associated with acid rain. (Measuring rates of atmospheric deposition of nitrogen in the Bay is a recommended research priority.) Baseflow is uncontaminated groundwater.

The major sources of nitrogen vary among regions of the

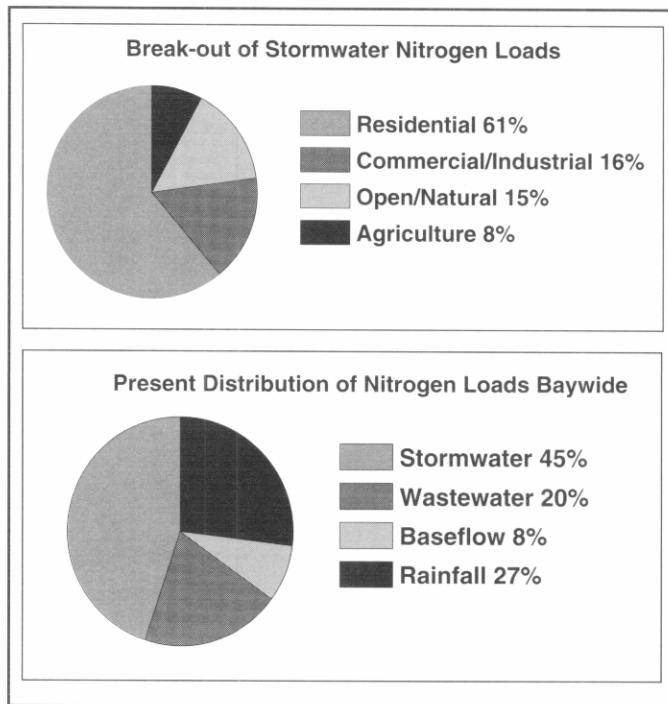


Figure 2.

ment are possible for wastewater, which means that a major source of pollution in the lower Bay can be effectively eliminated. Sarasota County is planning to centralize sewer systems, and opportunities exist to reduce costs by using existing infrastructure and capacity at the city of Sarasota's wastewater treatment plant. Solving wastewater treatment problems will also help the community address water supply problems as the treated wastewater is reclaimed for irrigation or other uses.

Unfortunately, nitrogen loadings from stormwater runoff are not as readily addressed by technology as wastewater. Baywide, stormwater contributes 45 percent of nitrogen loads, and the largest single source is residential land uses — our yards and neighborhoods. Conventional treatment technologies, such as detention ponds, are only partially effective in removing nitrogen from stormwater. Therefore, pollution prevention will be the key to reducing stormwater's contribution of nitrogen to the Bay. An excellent

Bay (*Fig. 2*). Baywide, stormwater contributes nearly half the Bay's nitrogen loads. In the Sarasota County portion of the watershed, wastewater is a regionally significant source of nitrogen. Wastewater from septic systems and small treatment plants in Sarasota County contribute up to 41 percent of nitrogen loadings in Whitaker Bayou, 32 percent in Phillippi Creek and 27 percent in Roberts Bay. High levels of treat-

place to begin is in our yards, where each resident has control over the solutions to stormwater runoff.

Information on Bay-friendly landscape design and maintenance is available through the Florida Yards & Neighborhoods Program of the Cooperative Extension Service. The program provides information and on-site advice from knowledgeable volunteers who help property owners plan changes in plant selection and/or maintenance practices. Information also is provided on shoreline management, mangrove conservation and earth-shaping to reduce runoff. The potential for this program to reduce nitrogen loads is still being assessed, but research in the Chesapeake Bay area suggests that nitrogen loads could be significantly reduced by landscaping with low-maintenance trees, shrubs and ground cover.

In addition to nitrogen, stormwater is the major contributor of sediment and toxic substances, such as heavy metals and pesticides, which are carried by particles of sediment to the Bay. These contaminants can be deadly to marine life, or may interfere with reproduction or larval development in fish and shellfish. Heavy metals include elements such as lead, cadmium, copper and zinc. Lead and cadmium come from vehicle emissions and deterioration of brakes and tires; these metals collect on pavement and, when it rains, run into Sarasota Bay. Copper, often found near marinas, is thought to be associated with antifouling bottom paints used on boats; copper-containing herbicides may be another source. Zinc is mainly contributed to the open Bay by rainfall; the source of atmospheric zinc is undetermined.

While few toxic substances were found in central Sarasota Bay, heavy metals were found in elevated levels in several creeks and bayous flowing into the Bay (*Fig. 3*). Concentrations of heavy metals in some sediments were found to be at levels of ecological, but not human, health risk. Pesticides were also found in trace amounts

Lead Levels in Oysters from Five Sites in Sarasota Bay
micrograms / g dry wt.

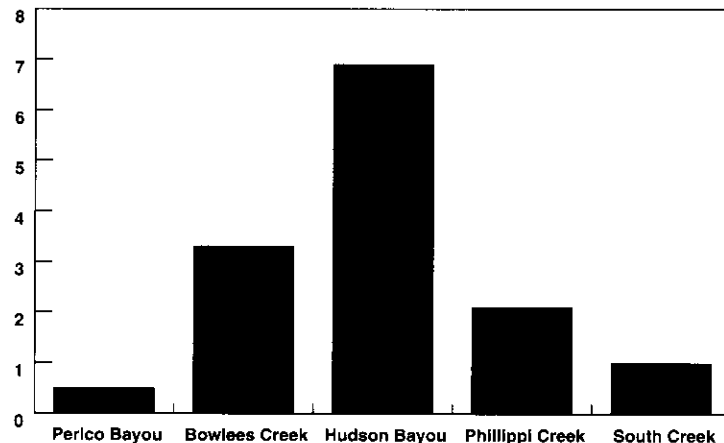


Figure 3.



in sediments in some low-salinity areas. The combined effects of toxic substances found in Sarasota Bay are a source of additional ecological concern. The concentration of toxic substances in vital low-salinity environments is of concern because fish and shellfish require these habitats during sensitive juvenile stages.

Improving stormwater treatment through structural means such as detention ponds can reduce such contaminants by up to 93 percent. Priority areas to receive stormwater treatment to reduce contaminant pollution include Cedar Hammock and Bowlees Creeks in Manatee County and Whitaker Bayou, Hudson Bayou and Phillippi Creek in Sarasota County (*Fig. 4*). Stormwater environmental utilities in both counties will take the lead in providing structural treatment in these tributary watersheds. Stormwater utility fees will not only help reduce flooding in neighborhoods, but also help protect Sarasota Bay.

Loss of freshwater and saltwater wetlands

Healthy wetlands, including both freshwater and intertidal habitats, are important to the vitality of Sarasota Bay because they provide food and shelter for marine life. Wetlands also filter pollutants and help regulate the flow of freshwater into the Bay, and intertidal habitats — salt marshes and mangroves — help protect shorelines from erosion. Since 1950, the area of intertidal wetlands in the Bay watershed has declined 39 percent. Since 1975, freshwater wetlands (as a whole) have declined 16 percent, while non-forested freshwater wetlands have declined 35 percent. Remaining wetlands are fragmented and smaller, and may no longer provide the same level of function.

Because of the importance of freshwater and saltwater wetlands to the Bay's condition, the restoration strategy for Sarasota Bay is designed to restore 18 acres of intertidal wetlands and 11 acres of freshwater wetlands annually. A comprehensive protection, acquisition, restoration and public-education initiative will be facilitated by a wetlands coordinator at the local level. The coordinator will have no regulatory authority, but will instead facilitate activities aimed at restoring and creating wetlands throughout the watershed.

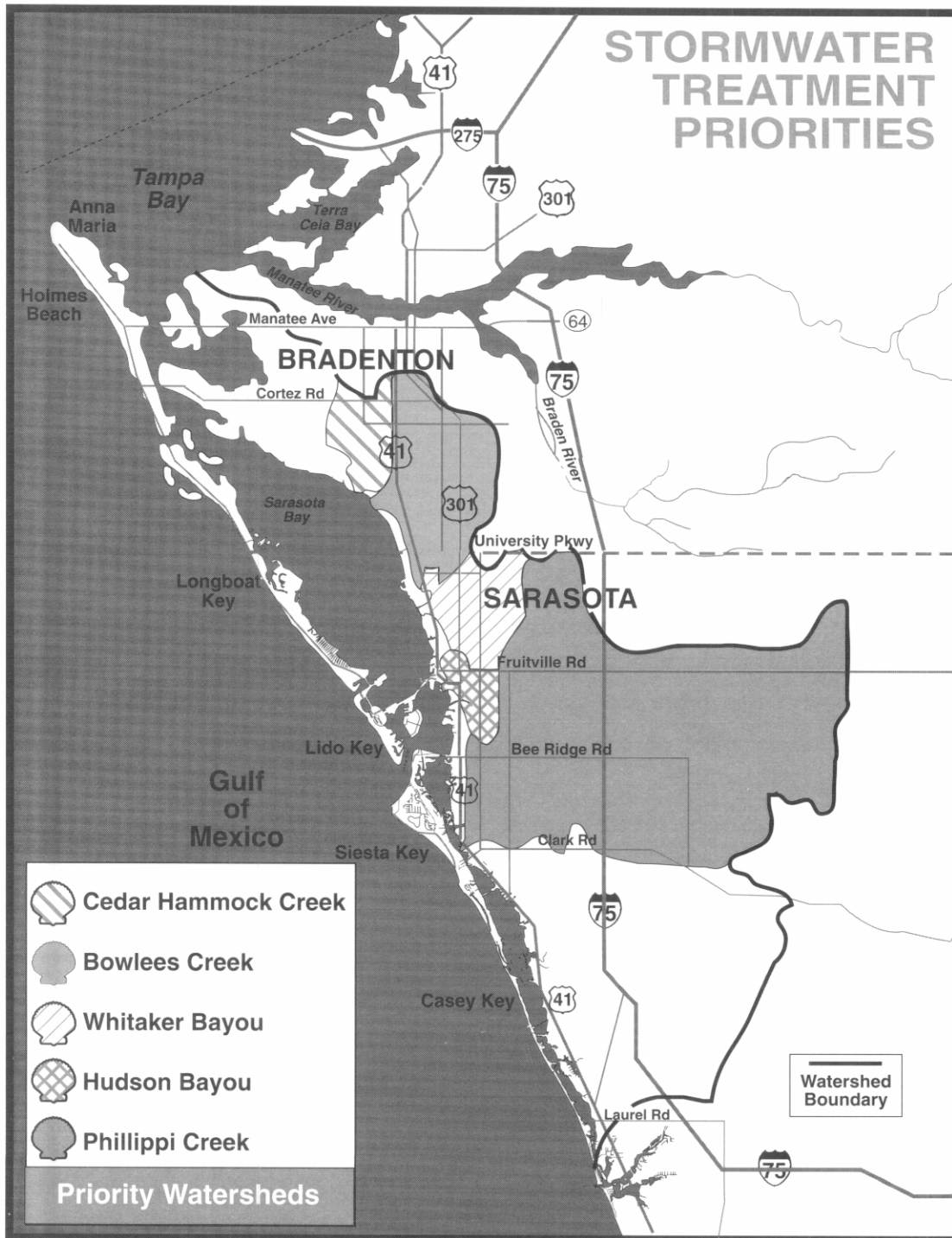


Figure 4.

Declines in living resources and fisheries

The health of Sarasota Bay's fisheries is generally dependent on the quality of Bay waters, wetlands and seagrasses. As with water quality and wetlands, seagrass acreage has generally declined in the Bay, and nitrogen pollution is damaging the habitat value of many remaining seagrass meadows. Seagrasses have declined approximately 30 percent Baywide, except in localized areas where water quality has improved in recent years. Significant shifts of seagrass species (from *Thalassia testudinum* to *Halodule wrightii* and *Ruppia maritima*) in Little Sarasota Bay indicate changing water quality in that area of the Bay: *Thalassia* (turtle grass) generally requires better water quality than *Halodule* (shoal grass) or *Ruppia* (widgeon grass). Seagrass recovery in Sarasota Bay is directly linked with restoring water quality, particularly by reducing nitrogen loadings to the Bay.

In addition, extensive acreage of the Bay bottom (15 percent, or 4,800 acres) was altered to create homesites and boat channels during the 1950s and 1960s. Many of the disturbed areas, particularly areas dredged for fill material and boating channels, are now "sinks" for fine-grain sediment and pollutants. Although many of these sinks are also anoxic (no oxygen) and can no longer support diverse aquatic life found elsewhere in Sarasota Bay, some of these areas could potentially be restored.

In addition to altering bottom habitats, dredge-and-fill activities dramatically altered Bay circulation — the movement and mixing of water. Changes in circulation can modify habitats by changing factors that influence sunlight penetration or the movement of nutrients transported by water. The Sarasota Bay Program's computer model of Bay circulation identified two areas in which circulation has been reduced: Northern Palma Sola Bay and Little Sarasota Bay. The reconstruction of the Palma Sola Causeway in 1996 provides an opportunity to improve circulation in that area. The Sarasota Bay Program has not yet reached a consensus on issues in Little Sarasota Bay, where the closure of Midnight Pass reduced circulation. (*Editors' Note: Further discussion of this matter is pending the outcome of facilitated, problem-solving forums.*)

Since most of the natural factors affecting fish populations — water quality, seagrasses, intertidal wetlands and low-salinity areas — have been degraded over time, declines in Bay fisheries come as no

surprise. The limited data available suggest that Sarasota Bay's fish populations have remained relatively stable since 1978. However, seatrout landings are down 50 percent as compared to earlier decades, although seven times more recreational anglers currently use the Bay than in the 1950s. Comparative historical data are not available on all species, but other interesting facts about Sarasota Bay fisheries were documented by the Sarasota Bay Program in creating a baseline for future comparison. For example, the average angler now requires three to four hours to catch a "keeper" fish in Sarasota Bay. Desirable species, such as spotted seatrout, require an average of 12 hours of effort.

Improving water quality and habitats is expected to result in greater numbers and diversity of fish in the Bay. Testing additional management measures, such as limiting fishing in a conservation area or developing special size and catch limits for the local region, may prove beneficial for the future of the Bay's fisheries. Small seawall reefs for canal communities can mimic natural, shoreline habitat for juvenile fish.

Increased recreational use

Increased recreational use of Sarasota Bay has resulted in conflicts between user groups, such as anglers vs. skiers or boaters vs. swimmers, in certain geographic areas. Locations of special concern are the Intracoastal Waterway (ICW) around Phillippi Creek, Palma Sola Causeway, Venice Inlet, Big Pass, Longboat Pass and the ICW entrance to Big Sarasota Bay just south of Sister Keys. Management and enhancement of recreational uses in the Bay do not receive the same emphasis as similar uses on the Gulf beaches. Management plans targeted to areas of recreational conflict, if developed in cooperation with government agencies and Bay users, would enhance the recreational experience provided by Sarasota Bay. This enhancement in turn would promote stewardship of the Bay, contribute even more to the local economy and protect Bay resources.

In addition, informing residents and visitors of Sarasota Bay's recreational attractions would enhance public concern for Bay resources. A "Heritage Trail," developed with technical assistance from the National Park Service, would promote the cultural, historical, educational, recreational and environmental opportunities that surround the Bay.

The course to 'Paradise Reclaimed'

The combination of excessive pollutant loads, loss of fishery habitats and increased demand for Bay resources has caused a decline in the overall health of Sarasota Bay. Yet, because many of the Bay's problems are caused by people, the solutions are within the community's grasp. The restoration strategy for Sarasota Bay is based on practical, achievable actions that have been tested locally or under similar conditions in other locations.

During the technical investigation conducted by the Sarasota Bay Program in 1989-93, action was taken to restore saltwater wetlands around the Bay to provide habitat for juvenile fish and other marine life. By 1995, approximately 75 acres of this vital intertidal habitat had been restored, with additional projects awaiting funding. The Program also began testing the practicality of using artificial reefs along seawalls to replace habitat lost during dredge-and-fill activities. Preliminary research shows each reef provides habitat for hundreds of juvenile fish, while bare seawall control sites have almost no resident fish populations.

Other action-oriented projects investigated practical options for stormwater treatment in urban settings. For instance, in the Clower Creek basin near Sarasota Square Mall, Sarasota County's Stormwater Environmental Utility and the Sarasota Bay Program examined and implemented cost-effective strategies for improving stormwater treatment in an urban setting. This project is used as a model for stormwater improvements in other drainage basins. Additional early action focused on transplanting techniques for seagrasses, reducing propeller scarring of seagrasses and re-establishing a breeding colony of scallops in the Bay.

Meanwhile, concerted action on wastewater treatment by local governments led to noticeable improvements in Sarasota Bay. In 1990, both the City of Sarasota and Manatee County significantly improved wastewater treatment operations, resulting in a 43-percent reduction in nitrogen loads to the central Bay and a 25-percent reduction in Baywide nitrogen loads. These actions improved water quality in the northern and central parts of the Bay and increased seagrass coverage by 125 acres in central Sarasota Bay.

After evaluating these actions and through intensive collaboration with government agencies and the public, the Sarasota Bay

Program's advisory committees developed a slate of options for improving the Bay. Major actions in the plan, in no particular order of priority, include:

- o Improving treatment and reclamation of wastewater to reduce Bay pollution and enhance water supplies. Treatment priorities are located in Sarasota County; reclamation opportunities are Baywide. Implementing the strategy would reduce nitrogen loads to the Bay by 16 percent. The most significant water-quality improvements would be expected in the central Bay, Roberts Bay and northern Little Sarasota Bay.

- o Preventing and treating stormwater pollution to improve water quality and reduce contaminants in the Bay. Opportunities are Baywide, with emphasis on Manatee County to develop a fee structure to pay for stormwater treatment systems. Implementing the strategy would reduce nitrogen loads by seven percent, and would reduce lead loadings (as a surrogate for other heavy metals) by almost 28 percent.

- o Restoring, enhancing and protecting freshwater and saltwater wetlands to provide habitat, repair freshwater flows in streams and filter pollutants. Opportunities are Baywide. Implementing the strategy would restore an annual average of 18 acres of saltwater wetlands and 11 acres of freshwater wetlands.

- o Restoring and protecting fishery habitats, particularly for juvenile fish. Opportunities are Baywide. Implementing the strategy would significantly increase potential fishery productivity.

- o Improving recreational opportunities in Sarasota Bay while protecting natural resources. Opportunities are Baywide. Implementing the strategy would improve recreational enjoyment of the Bay and reduce recreational use impacts on natural resources.

- o Emphasizing restoration, not solely protection, in community decisions that affect the Bay. Integrating the Sarasota Bay restoration strategy in community decisions will be more cost-effective than a piecemeal approach.

Since its inception in June 1989, the Sarasota Bay Program has made "action now" a principal theme. Program staff and members of the Management Conference have monitored and evaluated local government actions to improve Sarasota Bay; the Program also worked with local governments to develop and implement a series of Early

Action Demonstration Projects that demonstrate the effectiveness and costs of some techniques for solving the Bay's problems.

Local governments surrounding Sarasota Bay have recently made significant strides toward restoring and protecting the Bay; actions addressing wastewater and stormwater pollution have been particularly effective in reducing pollutant loads to the Bay. The Program continues to work with local governments to expand efforts in solving stormwater and wastewater problems.

Meanwhile, creating effective tools for testing restoration techniques required the Program to focus "action now" projects on major Bay problems. The three priority issues identified by the SBNEP Management Conference are inadequate wastewater treatment, stormwater runoff and loss of natural habitat. Given the considerable attention of local governments in addressing wastewater treatment, the Program chose to target habitat loss and stormwater runoff for Early Action Demonstration Projects.

Completed or ongoing projects include 11 habitat-related projects and two stormwater management projects. Funding for the projects is provided from local, state and federal sources including local governments, the Manasota Basin Board of the Southwest Florida Water Management District, the Pollution Recovery Trust Fund of the Florida Dept. of Environmental Protection and the U.S. Environmental Protection Agency through Early Action Demonstration Project grants.

The intertidal habitat restoration projects, conducted with four different local governments, will restore 75 acres, which represent 4.4 percent of Sarasota Bay's intertidal habitat lost since 1950.

Implementation of the stormwater projects will reduce the quantity and improve the quality of stormwater discharge in specific basins, while providing valuable insights into stormwater management techniques for highly urbanized coastal areas.

In addition to successfully developing restoration techniques and cost estimates, Early Action Demonstration Projects also help local government staffs develop expertise in restoration techniques, improve inter-agency coordination, provide opportunities for citizen volunteerism and serve as an outlet for public education on Bay problems and potential solutions.

The restoration plan for Sarasota Bay recognizes the reality of economic and political conditions. Fortunately for Sarasota Bay, many

of the actions that will help restore the Bay also meet other community priorities. For example, improving wastewater treatment and reclaiming treated wastewater in northern Sarasota County will provide an alternative water source for a community in dire need of additional water supplies. Where development occurs, clustering will increase open space and reduce stormwater runoff to protect the Bay. Cluster development also creates a more sustainable community by reducing costs of infrastructure, enhancing wildlife corridors and encouraging closer-knit neighborhoods.

Implementing the Sarasota Bay restoration plan will require a long-term commitment by the community; many actions can be implemented within the first five years, but others require long-term investments of money and effort. Even an action as apparently simple as adopting a local ordinance can require up to two years to provide sufficient public review. The process of restoration will require patience. Other restoration projects in the United States, such as the Great Lakes and Chesapeake Bay programs, required up to 15 years for major improvements to be apparent in those bodies of water.

While a forum of participating government agencies will remain in place to guide implementation of the plan, sustaining effort and commitment during this lengthy term will largely fall to the advocacy of concerned citizens. They must remain constant, despite political change and the potential for public apathy, in providing constructive input and leadership to pursue actions outlined in the Bay restoration plan.

Citizens who will take part in this campaign for Sarasota Bay's recovery and enhancement are a diverse group. Members of conservation organizations and civic groups, representatives of business, industry and commerce, educators, anglers, boaters, homeowners and bird-watchers all have a stake in the Bay and can find a role within the restoration strategy.

Ultimately, the restoration strategy for Sarasota Bay is only as effective as the community's will to implement it.



Immediate Actions for Sarasota Bay Restoration

The Sarasota Bay National Estuary Program recommends immediate community action on the items in this table. These actions are discussed in greater detail in the Action Plans presented in the comprehensive plan.

Action Item	Priority Areas	Responsible Agencies
Wastewater Treatment and Reclamation		
Expand the service area of the City of Sarasota wastewater treatment system.	Whitaker Bayou, Phillippi Creek, Roberts Bay	City of Sarasota, Sarasota County, U.S. Environmental Protection Agency, Florida Dept. of Environmental Protection (FDEP)
Educate the public on the need for consistent wastewater treatment policies.	Sarasota County	Sarasota County
Adopt an ordinance requiring hook-up to central treatment where it is available.	Sarasota County	Sarasota County
Adopt ordinances requiring all wastewater treatment plants to meet or exceed Advanced Waste Treatment standards.	Baywide	All local governments in watershed
Develop a regional wastewater reclamation program.	Baywide	Southwest Florida Water Management District (Swiftnud), local governments
Stormwater Treatment and Prevention		
Implement the Florida Yards & Neighborhoods Program.	Baywide	Local governments, Cooperative Extension Service
Implement a stormwater utility fee in Manatee County; begin master plans for priority watersheds.	Manatee County	Manatee County
Implement stormwater master plans in Sarasota County.	Sarasota County	Sarasota County, City of Sarasota
Freshwater and Saltwater Wetlands		
Appoint wetlands coordinators.	Baywide	Manatee County, Sarasota County, Florida Sea Grant
Fisheries and Other Living Resources		
Improve channel marking.	Baywide	West Coast Inland Navigation District (WCIND)
Implement facilitated forums on Little Sarasota Bay.	Little Sarasota Bay	Sarasota Bay Program
Investigate water circulation improvements in Palma Sola Bay.	Palma Sola Bay	Florida Dept. of Transportation, Manatee County, Bradenton
Recreational Use		
Develop use plans for priority areas.	Palma Sola Bay, passes, Intracoastal Waterway	Local governments, WCIND, Bay users
Enhance boater education to better protect Bay resources.	Baywide	Florida Sea Grant, boater educators
Bay Monitoring and Research		
Implement a long-term monitoring program.	Baywide	Manatee County, Sarasota County

Benefits

Status

Nitrogen load reductions: 35% reduction in Whitaker Bayou; 31% in Phillippi Creek; reduced bacteria; reclaimed water.

City's plant has 3 mgd capacity available to serve priority areas. City seeking permit revision and developing cost estimates for expanding service area.

Public support of necessary improvements, based on understanding of Bay issues.

Sarasota Bay Program consulting with county on program content.

Ensures compliance by property owners and facilitates funding of improvements.

To be implemented in FY 1995-96.

Sets consistent standard; promotes fairness in rates; meets intent of Grizzle-Figg Act.

To be implemented in FY 1995-97.

Eliminates need for direct discharge of effluent to Bay; provides high quality water source.

Master plan to be completed by Swiftmud FY 1994-95.

Significant water conservation and nitrogen load reduction; pesticide load reduction.

Program initiated 1993. Long-term support necessary for maximum benefits.

Improved stormwater treatment in priority basins.

County deliberating fee in 1994. Master planning to begin in 1994. Early action planned or underway in Bowlees Creek and Cedar Hammock Creek.

Toxin loads reduced up to 93% in priority basins; nitrogen reduced by 7% Baywide.

Phillippi Creek and Hudson Bayou implementation began 1993-94.

Restore 18 acres saltwater wetlands and 11 acres freshwater wetlands annually.

To be appointed by FY 1996.

Improve recreation and safety; protect seagrasses.

To be implemented FY 1995-2000

Mutually educate concerned parties; develop consensus on management options.

Ongoing.

Improve circulation, water quality and fishery habitat.

Preliminary plan reviewed by FDOT.

Improve recreational opportunities.

Ongoing.

Reduce boater impacts to Bay resources.

Related video produced in 1994.

Measure results of management actions.

Counties and Sarasota Bay Program implementing monitoring plan.

Background on the planning process

In 1989, seven goals were established to guide the Sarasota Bay Program. These goals were primarily used during development of the five-year work plan; they also served to focus the community on major Bay issues during the Sarasota Bay Program's technical investigation of the Bay's problems. These broad goals are still relevant and are included in the restoration strategy's Action Plans. The goals have been refined and clarified by objectives and policies in each Action Plan. Because the goals overlap and sometimes conflict, a brief discussion of each goal and its relevance to the restoration plan is provided here.

Goal 1: Improve water transparency.

Color (dissolved organic substances), turbidity (suspended sediment) and nutrient enrichment (increased algal abundance) affect water transparency in Sarasota Bay. In several locations, increased color has been identified as a major issue, which is addressed in the Fisheries and Other Living Resources Action Plan. Turbidity was not identified as a significant problem Baywide, but elements of various Action Plans will also reduce turbidity.

In most of Sarasota Bay, nitrogen is the nutrient that limits water transparency. The restoration strategy therefore targets reducing nitrogen loads contributed by stormwater and wastewater. Improving wastewater treatment and reclaiming treated wastewater to minimize discharge is recommended as the most immediate, cost-effective means of reducing nitrogen loads to the Bay.

While stormwater runoff contributes more nitrogen to the Bay than wastewater sources, stormwater treatment technologies are less effective in removing nitrogen. Preventing pollution from nitrogen in stormwater is addressed in Goal 2.

An additional source of nitrogen, atmospheric deposition, is addressed in the Monitoring and Research Needs element of the plan. Concentrations of nitrogen in rainfall may have doubled since the 1940s. Significant reductions in atmospheric nitrogen would require modifications to or reduced use of internal combustion engines, as has occurred in California, as well as other power-generating industrial uses.

Goal 2: Reduce the quantity and improve the quality of stormwater runoff to the Bay.

Stormwater runoff contributes nitrogen, toxins and sediments to Sarasota Bay. Because stormwater treatment technologies are not highly effective in removing nitrogen, pollution prevention is the recommended approach for addressing stormwater sources of nitrogen. Residential land uses comprise the single greatest land use in the region and contribute one-third of the total nitrogen load to the Bay. To help residential property owners improve landscape design and maintenance to reduce nitrogen loads to the Bay, the Florida Yards & Neighborhoods Program was implemented in 1993. The program addresses the quantity and quality of runoff from landscapes and encourages low-maintenance yards that also provide wildlife habitat.

For sediments and toxins, the restoration plan recommends technological improvements in specific tributaries where the highest levels of contaminants were found. Stormwater treatment technologies, particularly when used in sequence in a particular drainage basin, have been shown to be highly effective at reducing loads of sediment and associated contaminants. The priority tributaries for structural treatment in Manatee County are Cedar Hammock Creek and Bowlees Creek; in Sarasota County they are Whitaker Bayou, Hudson Bayou and Phillippi Creek.

Goal 3: Restore lost seagrasses and shoreline habitats, and eliminate further losses.

To protect and restore seagrass habitats, the plan recommends policies and actions related to Goals 1 and 2 that will lead to improved water quality. Justification for such an assumption has been documented in Sarasota Bay. Approximately 125 acres of seagrass beds have been recovered in central Sarasota Bay since improvements were made in treatment of wastewater (43-percent nitrogen load reduction) in 1990.

Restoring and protecting shoreline habitats (intertidal wetlands) remains a high priority for the Bay. Technical work conducted by the Program showed that freshwater wetlands also have been lost and damaged to a significant extent. Therefore, the plan addresses both freshwater and saltwater wetlands for a comprehensive monitoring, restoration, acquisition and public-education program. The wetlands

program, to be administered at the local level, seeks to restore and protect wetland quantity and quality.

Goal 4: Improve beach, inlet and channel management.

This goal was discussed in depth by advisory committees and government agencies involved in the Program. Beach and inlet management plans have been developed by various local governments for specific areas, but a comprehensive plan for the region was deemed beyond the scope of the National Estuary Program's mission.

Goal 5: Provide increased levels of managed access to Sarasota Bay and its resources.

Technical work conducted by the Program determined that several areas of Sarasota Bay require specific, additional management attention to increase recreational enjoyment and protect Bay resources. The plan recommends community-based development of recreational use plans for these areas and also provides detailed recommendations for improving access to Sarasota Bay without damaging the resource.

Goal 6: Establish a management system for Sarasota Bay.

After significant discussion of options for improving management of Sarasota Bay, the Management Conference recognized the need for both governmental and private involvement. To continue government involvement, the Management Conference recommends continuation of the existing conference structure. This could legally be accomplished through passage of the proposed Water Quality Act. Moreover, it is recommended that designation as a Surface Water Improvement and Management Program (SWIM) priority water body is also critical for state funding purposes and to maintain staff to oversee implementation.

Goal 7: Restore and sustain fish and other living resources in Sarasota Bay.

Improving water quality and Bay habitats will allow fisheries and other living resources to recover in abundance and diversity. This recovery is especially critical in Bay tributaries and along shorelines,

which are important habitats for juvenile fish. Artificial reefs for seawalls show promise as juvenile fishery habitat to help offset historical losses of shoreline habitat in Sarasota Bay. The plan includes additional fishery management measures, such as limiting use in a conservation area within Sarasota Bay or testing locally specific harvest regulations.

The following chapters include the Action Plans to achieve these goals and the overall restoration of Sarasota Bay.



The comprehensive
conservation & management plan
for Sarasota Bay, Florida



Wastewater Treatment & Reclamation

Significant opportunities exist to improve the treatment and reclamation of wastewater to reduce the amount of nitrogen that is polluting Sarasota Bay. Too much nitrogen causes an over-abundance of algae, which reduces light penetration to submerged seagrasses and sometimes leads to fish kills.

Wastewater Treatment & Reclamation



Significant opportunities exist to improve the treatment and reclamation of wastewater to reduce the amount of nitrogen that is polluting Sarasota Bay.

Too much nitrogen in the Bay causes an overabundance of algae. This algae reduces light penetration to submerged seagrasses and smothers seagrasses, and sometimes leads to fish kills as oxygen in the water is depleted. The potential effects of nutrient pollution on Bay resources are recognized in state and federal laws that govern the operation of large wastewater treatment plants. However, similar rules for Bay protection do not apply to septic systems and small treatment plants.

Septic tanks are regulated based on human health risks, not environmental risks. Small treatment plants that do not directly discharge to surface waters are considered non-point sources of nitrogen to groundwater, which is not regulated to the extent applied to a large, regional plant with surface water discharge. However, research by the Sarasota Bay Program suggests that a small plant can indirectly contribute as much or more nitrogen to the Bay as a large plant, due to differences in treatment processes (*Table 1*).

Baywide, wastewater contributes 20 percent of the nitrogen that is polluting Sarasota Bay. However, nitrogen pollution from septic systems and small wastewater treatment plants is even more significant in localized regions of the Bay, such as Phillippi Creek, Roberts Bay and Whitaker Bayou. Fortunately, modern wastewater treatment technology will allow most of these nitrogen sources to be significantly reduced. Where these advanced technologies are used in the Bay area,

Pollutant Loading Assessment Septic Tank Nitrogen Loading Methodology		
Steps	Ranges in Literature	Used by SBNEP
1. How much flow?	40 - 80 g/per capita/d	75 g/per capita/d
2. Concentration of N in septic effluent?	40 - 130 mg/l	60 mg/l
3. Absorption/uptake of N in drain field	20 - 40 % loss	50% loss
4. N "decay" as groundwater travels to surface water	Swiftmud: Says no decay Other: Diffusion occurs; decay does not Ostendorf: Decay = 0.00015/day	0.00055/day (Locally Calibrated) ----- 3.7 x greater than Ostendorf decay rate)
g = gallons d = day mg/l = milligrams per liter		
<p style="text-align: center;">References</p> <p>Camp Dresser & Mc Kee, Inc. (1992). Point/non-point source pollution loading assessment. Phase II. Final report to Sarasota Bay National Estuary Program.</p> <p>LaPointe, B.E.; O'Connell, J. D.; and Garrett, G.S. (1990). Nutrient couplings between on-site sewage disposal systems, groundwaters, and nearshore surface waters of the Florida Keys. Biogeochemistry 10: 289-307.</p> <p>IFAS (1985). On-site sewage disposal: Nitrogen behavior. Notes in Soil Science. Institute of Food and Agricultural Sciences, University of Florida.</p>		

Table 1.

such as in Manatee County and the City of Sarasota, the Bay's water quality and seagrass habitats are recovering.

Septic systems and small treatment plants are typically not designed to remove nitrogen. Therefore, nitrogen from septic-system drain fields and from treatment plants with percolation ponds is transported by ground water to tributaries and the Bay.

By combining information on soil types, percolation rates and horizontal-groundwater travel times, technical studies by the Sarasota

Bay Program calculate that, given local soil conditions, a distance of 900 feet is sufficient to lower the nitrogen concentration of septic-tank effluent to levels equal to or lower than that of Advanced Wastewater Treatment (AWT) effluent. In other words, no better treatment technologies exist to further reduce nitrogen loads. This relationship was used as the basis for devising the 900-foot setback distance for septic tanks in coastal areas.

Analysis by the Sarasota Bay Program indicates that even properly functioning septic tanks and percolation ponds within 900 feet of surface waters do not meet the same levels of treatment required of larger plants, such as the City of Sarasota's facility.

Presently, Sarasota Bay area communities are treating about half the wastewater generated in the watershed in ways that do not harm the Bay. Areas of the Bay that could be improved by providing better wastewater treatment include Whitaker Bayou, Phillippi Creek and Roberts Bay. If adequate wastewater treatment is not provided in growth areas in the Little Sarasota Bay and Blackburn Bay, pollution from these sources may be of concern.

Whitaker Bayou's watershed is located in the City of Sarasota and northern Sarasota County; the bayou drains into the central Bay. The City of Sarasota's wastewater treatment plant discharges directly to the bayou approximately 50 percent of the time, but because the plant treats to AWT levels or better, the discharge poses a minimal risk to Sarasota Bay. In 1994, the U.S. Environmental Protection Agency

Estimates of Wastewater Discharges to Whitaker Bayou

	City of Sarasota	Package Plants	Septic Tanks
1992 Flow (mgd)	7.30	0.59	0.94
Effluent concentration of total nitrogen (mg/l)	1.82	9.2 - 20.3	30 - 50
Annual nitrogen loads (lbs/yr)	17,594	31,726	9,270
Percent nitrogen loads to Whitaker Bayou	17	32	9
Percent nitrogen loads to Central Sarasota Bay	8	14	4
Percent nitrogen loads to Sarasota Bay (Baywide contributions)	2	3	1

Table 2.

(EPA) issued a “Finding of No Significant Impact” for the facility. However, septic systems and small treatment plants located in the unincorporated county upstream from the city’s plant are responsible for 41 percent of the nitrogen polluting Whitaker Bayou (*Table 2*).

In the Phillippi Creek watershed, 32,000 septic systems and at least seven small treatment plants contribute approximately 31 percent of the Creek’s total nitrogen load (*Table 3*). In Roberts Bay, the receiving water body for Phillippi Creek, inadequate wastewater treatment is responsible for 27 percent of the nitrogen load. In addition, Sarasota County has detected bacterial levels in many locations in the creek that exceed state standards for bodily contact, causing a potential health hazard.

Estimates of Wastewater Discharges to Phillippi Creek

	Package Plants	Septic Tanks
1992 Flow (mgd)	2.95	7.2
Effluent concentration of total nitrogen (mg/l)	1.6 - 20.3	30 - 50
Annual nitrogen loads (lbs/yr)	31,234	87,750
Percent nitrogen loads to Phillippi Creek	8	23
Percent nitrogen loads to Roberts Bay	6	21
Percent nitrogen loads to Sarasota Bay (Baywide contributions)	2	8

Table 3.

Improving wastewater treatment and increasing wastewater reclamation in the Sarasota Bay watershed would provide another benefit in addition to improving the Bay’s water quality and seagrass habitats — it would also provide a valuable source of freshwater for irrigation and, indirectly, even potable use.

The Southwest Florida Water Management District (Swiftmud) has advised the community that withdrawals of water from the Floridan Aquifer are threatening future water supplies and contributing to the intrusion of saltwater in the underground layers of rock and water. The Sarasota Bay watershed is included in the Southern Water Use Caution Area, where stringent water conservation measures and limited with-

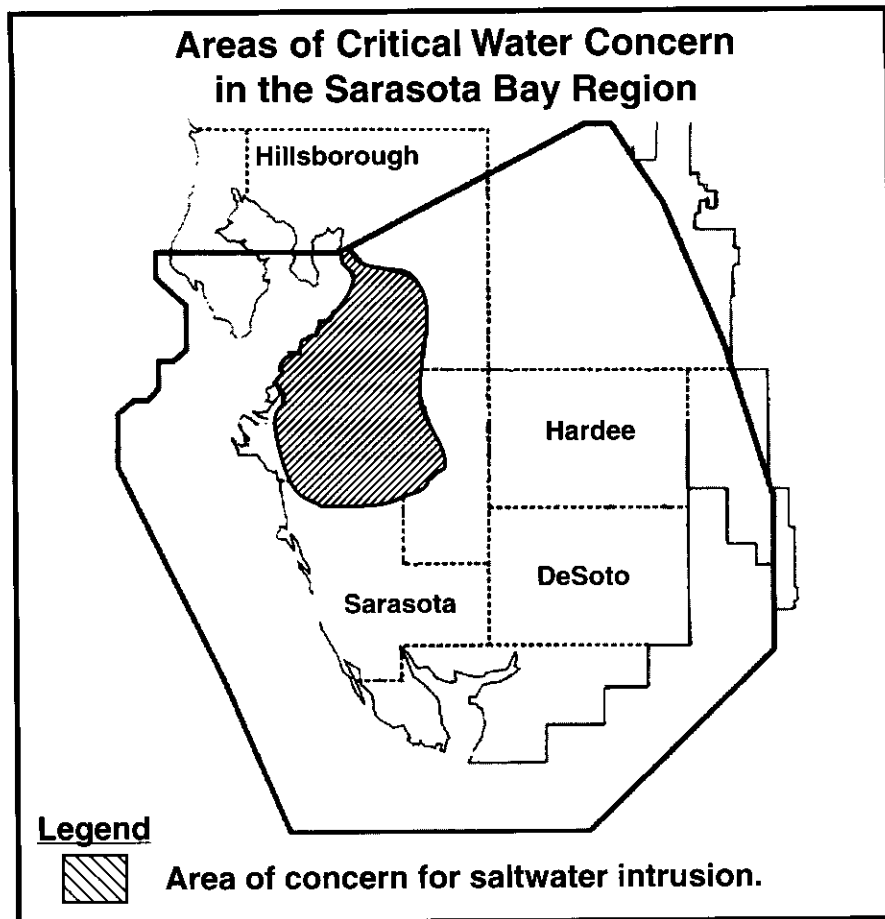


Figure 1.

drawal permits are being considered by Swiftmud (*Fig.1*).

Manatee County and the City of Bradenton provide a significant portion of the potable water supply for the region from the Manatee and Braden River reservoirs. Sarasota County has invested heavily in a well field at the Carlton Reserve to provide water, and continues to purchase water from Manatee County. A regional water-use organization, the Peace River/Manasota Regional Water Supply Authority, plans to withdraw more fresh water from the Peace River, in the Charlotte Harbor watershed. The City of Sarasota receives its potable water primarily from the Verna Wellfield in northern Sarasota County.

Meanwhile, a potentially valuable source of water remains underutilized. When wastewater is treated to advanced secondary levels, such as at the Southwest Sub-Regional Treatment Plant in Manatee County, it is suitable for use in irrigation. This treated effluent is used in Manatee County for agricultural and some urban irrigation. (It should be noted that agricultural and urban reuse has limitations, because irrigation is not needed in the wet summer months in South-

west Florida. Also, residents who apply large amounts of water to their yards can contribute to pollution from stormwater runoff.) In addition to the treated effluent that is reused, slightly more than five million gallons per day (mgd) of treated effluent from the county's Southwest Sub-Regional Treatment Plant is injected 2,700 feet underground.

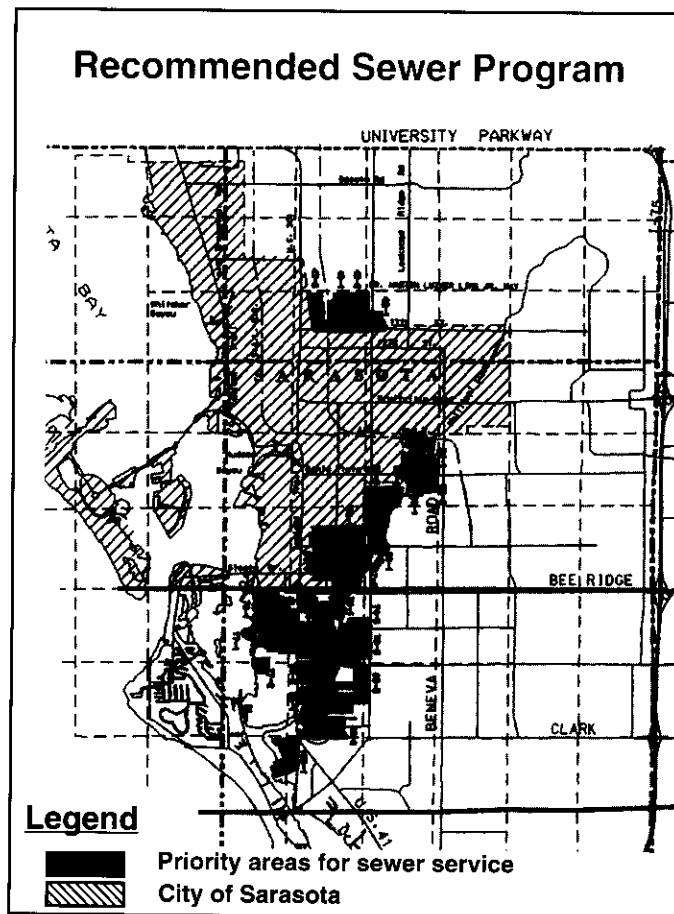
In the City of Sarasota, approximately 50 percent of the plant's treated wastewater is piped to golf courses, pastures and crop land. The city is also participating in some urban reuse, but the issue of storage during the wet season remains.

Limited opportunities currently exist for reclaiming water in Sarasota County, where septic systems and small treatment plants provide the majority of wastewater treatment. As more efficient wastewater treatment is provided in these areas, the community will have more opportunities to reclaim treated effluent and reduce demands on the aquifer. In fact, it is estimated that 5 mgd of water flow through septic systems in the Phillippi Creek watershed and ultimately to Sarasota Bay.

Sarasota County will soon begin to purchase many small wastewater treatment plants; ultimately, the facilities are to become pumping stations to transport wastewater to regional treatment plants. In the near term, the county also will build a wastewater treatment plant to replace the outdated Bent Tree plant. Eventually, the county plans to have four regional wastewater treatment plants with reuse.

Sarasota County officials are developing cost estimates for installing sewers in priority areas now on septic systems (*Fig. 2*). The process of centralizing those neighbor-

Figure 2.



hoods could be accelerated by a cooperative venture between the county and the City of Sarasota. The city's plant has excess capacity, and once permit issues are resolved could provide service to high-priority areas in the county. Eventually, the county plans to have four regional wastewater treatment plants with reuse capabilities in operation.

Pursuing options that will accelerate plans to improve wastewater treatment in the Sarasota Bay watershed makes economic sense. Within the next 15 years, many septic systems now in use will require replacement due to age and/or malfunction. When these septic systems are replaced, they will have to meet new state health standards, which require that septic-system drainfields be located two feet above the seasonal high groundwater level to prevent bacterial and viral contamination of groundwater. The new systems do not prevent nitrogen from reaching groundwater and, ultimately, Sarasota Bay. Installing such a system can result in a three-foot-high mound in yards where they are located. The new systems cost about \$5,000 per household, a cost that would be borne by the property owner. In the Phillippi Creek watershed alone, residents are likely to spend up to \$150 million in the next 20 years replacing the 32,000 septic systems with new systems that will neither reduce nitrogen pollution to the Bay nor provide a source of reclaimed water.

It is important to stress that cost-effective options exist for integrating wastewater treatment and water-supply needs. However, large-scale water reclamation in the region will require cooperation among government agencies to revise policies that currently limit options for storing and using reclaimed water. Storing large amounts of treated wastewater is difficult in rainy summer months. Options for surface and underground storage are being investigated by various municipalities and Swiftmud.

The following strategy includes the most promising avenues in wastewater treatment and reclamation for Bay improvement and community sustainability.



ACTION PLAN GOAL:

Improve water transparency.

ENVIRONMENTAL QUALITY OBJECTIVE:

Reduce total pollutant (nitrogen) loads to Sarasota Bay by 16 percent Baywide. (A 25-percent load reduction has been achieved since 1988 through wastewater treatment improvements.)

Policies to Guide Wastewater Treatment and Reclamation

o All wastewater in the Sarasota Bay watershed should be treated to meet or exceed Advanced Wastewater Treatment (AWT) standards by the time effluent reaches the Bay or its tributaries. (Secondary treatment can be an acceptable level of wastewater treatment if the treated wastewater is appropriately stored or used. Septic systems can be acceptable if nitrogen-removal technologies are incorporated in the septic system or if the septic tanks are located more than 900 feet from the Bay or its tributaries.)

This policy is based on technical work conducted on Sarasota Bay and is supported by Grizzle-Figg legislation governing wastewater disposal in Southwest Florida. The policy's intent is to encourage an even-handed approach to the costs of providing wastewater treatment while retaining a number of treatment options for communities to consider. Communities should be required to protect Sarasota Bay by meeting equivalent treatment standards, regardless of the treatment processes used.

o Treated wastewater should be reclaimed for reuse.

This policy recognizes that efforts to reduce wastewater pollution must be integrated with water-supply needs to most efficiently use public funds and natural resources. Reclamation, rather than disposal, of highly treated effluent is an affordable, long-term approach for the Sarasota Bay watershed.

Objective 1.0: Wastewater treatment and reclamation policies should be consistent throughout the region.

Action 1.1

Local governments in the Sarasota Bay region should require by local ordinance — and appropriate monitoring and enforcement — the wastewater treatment policies in the Sarasota Bay comprehensive restoration plan.

(Editors' Note: Modifications to comprehensive plans require adoption by ordinance; changes to these plans would meet this objective.)

Action 1.2

Educate the public about the need for consistent policies on wastewater treatment and reclamation.

Objective 1.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, City of Sarasota, City of Bradenton.

Cooperating Organizations: Southwest Florida Water Management District, U.S. Environmental Protection Agency, Peace River/Manasota Regional Water Supply Authority, Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services.

Funding:

1.1 Policy consistency

It is anticipated that funding for modification of local comprehensive plans will be made available through the Sarasota Bay Program in the amount of \$40,000 (\$20,000 from the state Coastal Zone Management Program, \$20,000 from Sarasota Bay Program) in fiscal year 1995 pending approval by the Management Conference.

1.2 Education

It is anticipated that \$35,000 will be made available in fiscal years 1995-96 through the Sarasota Bay Program to support septic-tank and wastewater education programs throughout the region (pending approval by the Management Conference).

Timetable and Status: Initiate fiscal year 1995; complete in fiscal year 1997.

Objective 2.0: Use the excess capacity of the City of Sarasota wastewater treatment facility to provide sewer service to areas with inefficient package treatment plants and chronic septic-system failures.

Although the city's treated wastewater discharge to Whitaker Bayou would increase, net nitrogen loadings to Phillippi Creek, Whitaker Bayou and Sarasota Bay would decrease.

The plant has excess capacity of approximately 3 mgd, excluding the capacity required by the city's projected growth. The treatment provided by the plant is actually better than that required by state AWT standards by about 30 percent; approximately half the treated effluent is reused. The strategy proposed by the Sarasota Bay Program involves treating as much wastewater as possible from Sarasota County at the city plant through a cooperative agreement between the two governments. The city is preparing cost estimates for the expansion. The Sarasota Bay Program estimates the city's plant could serve 7,000-10,000 additional homes that presently have septic systems, and also provide service to areas now served by selected small treatment plants. This strategy would reduce nitrogen pollution loads to Whitaker Bayou by 35 percent while reducing loads by 16 percent in Phillippi Creek.

To facilitate these actions, the Environmental Protection Agency and Florida Dept. of Environmental Protection (FDEP) must approve changes to the city's permit. Changes are under review by both agencies and are supported by technical work completed by FDEP in 1994. The following actions are required to implement this strategy:

Action 2.1

Modify the wastewater treatment permit of the City of Sarasota to allow the city's plant to provide additional service. (This permit was issued in February 1995.)

Action 2.2

Develop an agreement between the City of Sarasota and Sarasota County to allow for treatment and reuse of wastewater in selected portions of northern Sarasota County.



Action 2.3

Sarasota County should adopt an ordinance requiring residents to hook up to central treatment when it becomes available, pursuant to state regulation.

Action 2.4

Provide sewer service to areas now served by small wastewater treatment plants in the Whitaker Bayou watershed.

Action 2.5

Using the wholesale treatment agreement previously adopted, expand the City of Sarasota's waste treatment service to approximately 6,400 households in the Phillippi Creek watershed in areas with chronic septic-system failures as identified by Sarasota County.

Objective 2.0: Responsibility, Financing and Timetables

Lead Organizations: Sarasota County, City of Sarasota.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services, U.S. Environmental Protection Agency, Southwest Florida Water Management District, Peace River/Manasota Regional Water Supply Authority, private utilities.

Funding:

2.1 Permitting

The Sarasota Bay Program allocated \$60,000 in fiscal year 1994 to develop a conceptual design for expansion of the city wastewater treatment service area (see *Fig. 2*). The county has also contracted for the preliminary engineering report/provision of central water and sewer service, completed in 1994.

2.2 It is anticipated that the City of Sarasota and Sarasota County will develop an agreement to have wastewater treated at the city plant (pending Management Conference approval). The city has funded a study to develop policy for providing sewer service to Sarasota County residents to be finalized in 1995.

2.3 It is anticipated that this ordinance will be developed in Sarasota County with existing staff and

resources.

2.4 The City of Sarasota has completed a draft study providing sewer service for private utilities northeast of the city. Based on this study, total probable construction costs are \$900,000. Revenue to fund these projects is expected to come from special assessments, connection fees, sales tax, Swiftmud cooperative funding and revolving loan funds.

A combination of federal, state and local funding will be required. It is suggested that local governments pursue federal funding through Congressional appropriation (particularly Housing and Urban Development and the Clean Water Act re-authorization processes). State funding should be pursued through the state Revolving Loan Fund and legislative appropriations. Other revenue-generating sources include county sales tax and special assessment districts.

2.5 Sarasota County's draft *Preliminary Engineering Report — Provision of Central Water and Sewer Service Where It Is Not Presently Available in Unincorporated Urban Sarasota County* (PBS&J, 1994) identified areas with chronic septic failures and estimated costs to provide central water and sewer service. The City of Sarasota has completed a draft study to evaluate the feasibility of providing sewer service to areas adjacent to the City's service area, including the Phillippi Creek watershed, with chronic septic problems. The City's study included the cost of wastewater transmission, treatment and disposal (reuse). Based on these studies, total estimated probable construction cost to provide water and sewer service to these areas is \$54 million.

Timetable and Status:

2.1 A task force consisting of representatives from relevant permitting agencies, the City of Sarasota and citizens was formed in 1992 to evaluate the City of Sarasota wastewater treatment permit. The evaluation was sponsored and funded by the City of Sarasota. It is anticipated that the permit to expand the permitted capacity of the City of Sarasota wastewater treatment plant will be granted in the near future based on findings of the task force. The task force concluded that the wastewater discharged at Whitaker Bayou was having no or minimal impact on the Bay, since the wastewater meets drinking water

standards for all parameters except salt content.

2.2 The study is in progress and established policy and agreements are expected to be reached by 1996.

2.3 No action has been taken on this item. A timetable will be established in concert with the implementation of the sewer program.

2.4 According to the report *Franchise Acquisition, Consolidation, Implementation Plan, Wastewater Collection and Treatment Master Plan* (Sarasota County Utilities Dept., 1993), design, construction and consolidation of the Kensington Park facilities is to begin in 1995 and of the Dolomite facilities in 1998. A draft study has been completed for the City of Sarasota to evaluate the cost of serving these areas by the City's wastewater system.

2.5 Sarasota County's report *Franchise Acquisition, Consolidation, Implementation Plan, Wastewater Collection and Treatment Master Plan* (Sarasota County Utilities Dept., 1993) outlines an implementation plan that includes preliminary engineering, for provision of central sewer to areas not presently being served, completed by the end of 1994. Dates for construction are not specified and would be expected to follow preliminary engineering on a project-by-project basis.

Objective 3.0: Provide centralized wastewater treatment (with reuse) in priority areas in northern Sarasota County.

When actions 2.0-2.5 are implemented, approximately 23,000 septic systems and six small treatment plants will still need to be addressed in the Phillippi Creek watershed. Whether service is provided by public or private utilities, areas not included in the city's expanded service area will be centralized. Centralization will occur through improvement and expansion of existing treatment plants or through construction of new facilities.

Action 3.1

Sarasota County should work with private utility owners/operators to develop infrastructure in the Phillippi Creek watershed to facilitate advanced treatment of wastewater (with reuse) in areas where effluent now percolates or is discharged within 900

feet of Sarasota Bay or its tributaries. Such effluent may originate from septic systems and/or package treatment plant percolation ponds and drain fields.

3.1.1

The county should work with private utility owners/operators to develop and implement appropriate funding mechanisms to pay for infrastructure, such as public-private partnerships or special assessment districts.

Objective 3.0: Responsibility, Financing and Timetables

Lead Organizations: Sarasota County, private utility companies.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services, U.S. Environmental Protection Agency.

Funding: Funding mechanisms will be developed in accordance with agreements reached by participating organizations.

Timetable and Status: Sarasota County's report, *Franchise Acquisition, Consolidation, Implementation Plan, Wastewater Collection and Treatment Master Plan* (Sarasota County Utilities Dept., 1993) outlines an implementation plan that includes preliminary engineering for provision of central sewer to areas not presently being served completed by the end of 1994. Dates for construction are not specified and would be expected to follow preliminary engineering on a project-by-project basis. The six small treatment plants in the Phillippi Creek watershed should be serviced by the City of Sarasota.

Objective 4.0: Privately owned utilities should upgrade to meet the Wastewater Treatment and Reclamation policies in this Action Plan.

Action 4.1

Evaluate opportunities to expand privately owned treatment plants to serve priority areas. Focus evaluation on larger, efficient utilities and consider expanding these plants to meet

the policies stated above.

Action 4.2

The county shall work with the private sector to develop and implement appropriate funding mechanisms to pay for plant expansion or improvements, such as appropriate rate structures, public-private partnerships or special assessment districts.

Objective 4.0: Responsibility, Financing and Timetables

Lead Organizations: Sarasota County, private utility companies.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services, U.S. Environmental Protection Agency.

Funding: The report *Preliminary Engineering Report — Provision of Central Water and Sewer Service Where It Is Not Presently Available in Unincorporated Urban Sarasota County* (PBS&J, 1994) summarizes costs for providing central water and sewer service for individual subdivisions. Additional costs of expanding and upgrading privately owned wastewater treatment plants and providing transmission facilities have not been developed.

Revenue to fund these projects is expected to come from special assessments, connection fees, sales tax, Swiftmud grant funds (reuse facilities) and the state revolving loan fund.

Timetable and Status: Sarasota County's report *Franchise Acquisition, Consolidation, Implementation Plan, Wastewater Collection and Treatment Master Plan* (Sarasota County Utilities Dept., 1993) outlines an implementation plan that includes acquisition and expansion of privately owned wastewater treatment plants. The report *Preliminary Engineering Report — Provision of Central Water and Sewer Service Where It Is Not Presently Available in Unincorporated Urban Sarasota County* (PBS&J, 1994) identifies high-priority areas. Acquisitions of the following facilities are scheduled to occur between 1993 and the end of 1996: Atlantic Utilities, Southeast, Southfield, Sunrise (flow to be diverted to proposed new Central District Wastewater Treatment Plant), Proctor Road, Country Manor and Woodland Park. Acquisition of franchise utilities by Sarasota

County has been completed or is underway for the following utility systems: Bent Tree, Plantation, Sorrento, Circlewood, Venice Gardens, Central County, Kensington Park, Dolomite, Atlantic and Meadowood.

Objective 5.0: In areas where central service is unlikely to become available in the foreseeable future, particularly within 900 feet of Sarasota Bay or its tributaries, investigate replacement of standard septic systems with systems that remove nitrogen.

Action 5.1

Sarasota County, the Florida Dept. of Health & Rehabilitative Services (HRS), Florida Dept. of Environmental Protection (FDEP) and U.S. Environmental Protection Agency (EPA) should investigate the appropriateness of available nutrient-removal septic systems for the Sarasota Bay watershed.

Action 5.2

If nutrient-removal septic systems are deemed appropriate for certain areas of the watershed, Sarasota County should adopt an ordinance requiring their use.

Objective 5.0: Responsibility, Financing and Timetables

Lead Organization: Sarasota County.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services, U.S. Environmental Protection Agency.

Funding: The Soil Conservation Service has estimated the cost of upgrading septic tanks with nutrient-removal technology to be \$2,000-\$5,000 per tank. Costs vary based on soil type and topography.

Timetable and Status: U.S. EPA is testing various types of septic systems that remove nitrogen and phosphorus. The results of these tests should be available in 1995 and will provide valuable information to Sarasota County, FDEP and HRS in evaluating the effectiveness and practicality of the systems. However, septic systems are not designed to accom-

moderate reuse of treated wastewater, and maintenance charges are expected to be high on new systems. Also, these septic systems would need to be elevated (at least two feet above mean high groundwater levels), requiring a pump, which increases the risk of failure.

Objective 6.0: Develop a multi-county wastewater reclamation program to minimize discharge of treated wastewater to Sarasota Bay.

Action 6.1

Manatee County, Sarasota County, the City of Sarasota and other appropriate parties should work with Swiftmud to develop a regional program to reclaim treated wastewater in the Southern Water Use Caution Area.

The regional reclamation strategy shall address, at a minimum, the following: expanding reuse for agricultural irrigation and, where appropriate, urban irrigation; investigating alternatives for storing treated wastewater for later use for drinking water or irrigation; converting septic systems and many package plants lacking reuse capabilities in the watershed to more efficient systems.

Objective 6.0: Responsibility, Financing and Timetables

Lead Organizations: Southwest Florida Water Management District-Manasota Basin Board, Manatee County, Sarasota County, City of Sarasota, City of Bradenton.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Health & Rehabilitative Services, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers.

Funding: It is estimated that the cost of developing a regional water-reclamation plan focusing on the Southern Water Use Caution Areas will approximate \$200,000. It is expected that the Sarasota Bay Program will provide \$150,000 toward plan development, with the remainder (\$50,000) to be provided by the Swiftmud-Manasota Basin Board or local governments. The Swiftmud governing board has approved funding for a districtwide reuse plan in the amount of \$200,000.

A total of \$29.8 million has been made available through Congressional appropriation to address wastewater reclamation and water supply in Southwest Florida. One of the proposed projects to receive funding in this area is the recovery of treated wastewater from the Manatee County Southwest Regional Plant through aquifer storage and recovery. Manatee County has estimated the cost of the aquifer storage system to be \$800,000 (that cost estimate assumes an injection rate of 1.5 - 2.0 million gallons/day with a storage capacity of 300 million gallons). Aquifer storage and recovery may be applicable to Sarasota City and Sarasota County as a wet-weather back-up technique.

Matching funds for this project will also be made available through the new water source initiative sponsored by Swiftmud, the Manasota Basin Board and local governments.

The best long-term option for recovery of the City of Sarasota's wet-weather wastewater and Sarasota County's wastewater treatment system effluent — as it develops — appears to be the construction of a wetland treatment system on the Hi-Hat Ranch, the Carlton Reserve or adjacent publicly owned properties. Water from the wetlands system could later be recovered for potable or agricultural uses.

The City of Bradenton is considering a wetland system that will discharge downstream of the Evers Reservoir. City officials plan to pursue partial funding for this project from Swiftmud. Remaining financing could come from city funds, state loan program, taxes, special assessments and wastewater and water rates and fees.

Other potential options for a regional program could include manmade wetlands to recharge surface water systems. Cost for a constructed wetland system with 10 million gallons per day capacity would be in the range of \$2.5-\$3.5 million (land costs, pumping and transmission costs would be additional to this estimate and would be dependent on site selection).

Timetable and Status: Each organization is pursuing independent programs to reclaim treated wastewater, and the local governments need to work together. Manatee County and the City of Sarasota have developed and are implementing comprehensive reuse programs. Sarasota County is in the process of finalizing a reuse master plan. The City of Bradenton is now completing the first phase of a public access reuse and is in the initial phases of considering the wetland

treatment system. A schedule for the development of a regional program has not been formalized. It is anticipated that this schedule will be developed subsequent to the completion of Swiftmud's districtwide reuse master plan in fiscal year 1996 and the Manasota Basin Board reuse plan (\$20,000), to be completed in fiscal year 1995.

Measurements of success

- o Water-quality monitoring data and biological monitoring will document measurable improvements, particularly in but not limited to Whitaker Bayou, Phillippi Creek and Roberts Bay.

- o Physical improvements to treatment systems may be included in the Sarasota Bay Program's Pollutant Loading Model to calculate achievements in relation to these actions. The model estimates that implementing this strategy will reduce nitrogen loadings by up to 35 percent in Whitaker Bayou, 32 percent in Phillippi Creek and 24 percent in Roberts Bay.

- o Water-quality monitoring and biological monitoring will show that nitrogen loadings from wastewater treatment operations in Manatee County remain low.

Anticipated benefits

- o Reducing nitrogen loadings would improve water quality, which will improve fisheries habitats and the aesthetic value of Sarasota Bay.

- o Bacterial contamination from septic-system failures and associated human health risks will be reduced.

- o Treated wastewater effluent could be used to restore natural hydroperiods to damaged wetlands.

- o A coordinated, regional strategy for reuse of treated wastewater would conserve freshwater resources.

Action Update

Increasing the ability of the City of Sarasota's plant to provide wastewater treatment has been limited by permitting issues related to the city's discharge into Whitaker Bayou. A task force including the city, Florida Dept. of Environmental Protection, U. S. Environmental Protection Agency, Southwest Florida Water Management District, the

Sarasota Bay Program and a citizen representative examined the permit issues and recommended a course of action in 1993. The permit was revised in 1995.

A major issue in the deliberations is the need to store large quantities of treated wastewater during the rainy season in order to reduce discharge to Whitaker Bayou. Several options have been presented for using treated wastewater that is not required for irrigation. Those options include: storing treated wastewater underground for later recovery for irrigation or additional treatment and consumption; using the treated wastewater to replace water removed from rivers for potable use; and creating wetlands to further treat wastewater before it enters a surface water system. All these options present permitting challenges and require careful review to assure that natural systems are not harmed.

Members of utilities staffs from Sarasota County and the City of Sarasota have discussed options for the city's plant to provide service in priority areas in the county. This should be more vigorously pursued. Significant opportunities also exist for private utilities to upgrade to appropriate treatment levels, if necessary, and reclaim treated wastewater. Public-private partnerships could be developed to expand facilities to accelerate the pace of providing service to areas now on septic systems or inefficient, small treatment plants.

Investigation of alternative on-site treatment systems for nutrient removal continues. The Sarasota Bay Program and Soil Conservation Service have produced positive results with an innovative filter system being tested in central Florida. The Environmental Protection Agency is testing other systems in the Florida Keys and New England. If the systems appear suitable for Southwest Florida, installation and maintenance costs of the systems require analysis. In addition, the lost potential for reclaiming wastewater treated through these systems must be considered.

Regarding reclamation of treated wastewater, the Southwest Florida Water Management District will be developing a master reuse plan for the district, and has allocated \$200,000 for the initiative. In November 1994, the Manasota Basin Board (Swiftmud) approved the development of a master reuse plan specific to the Bay region. A report on existing reuse systems is anticipated in 1995.

In 1994, the Swiftmud governing board approved \$10 million for implementation of the new water source initiative. Projects selected

through this program included the Manatee County Agricultural Reuse System, Manatee County Aquifer Storage and Recovery System and the Peace River Option (multiple-year funding from the governing board is anticipated, not guaranteed)

In fiscal year 1995, Congress also appropriated \$29.8 million for these and similar projects in Tampa Bay. Funds provided by Swiftmud and Congress will be matched with funds from the respective Basin Boards (Swiftmud) and local governments. Swiftmud has also sponsored numerous reuse projects through the Basin Board Cooperative Funding Program.

What you can do about wastewater pollution

As a property owner

- o Find out how your wastewater is treated. If you are on a septic system, talk to your local elected official about the need to provide sewer service in your area to protect Sarasota Bay. This is particularly important if you live within 900 feet of the Bay or its tributaries. (If a treatment plant provides wastewater treatment in your area, request information from the utility company on the plant's treatment status and any health or environmental violations.)

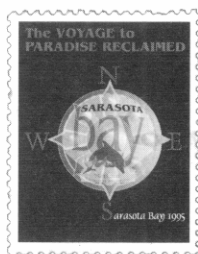
- o Support the community's efforts to reclaim treated wastewater for use in golf-course and agricultural irrigation. If reclaimed

- water is available in your neighborhood for irrigating yards, use the water sparingly to reduce the potential of polluting the Bay through runoff. Find out more about opportunities for using reclaimed water for potable use after additional treatment.



As a civic group member or educator

- o Help your organization or students become informed about wastewater treatment and reclamation issues in your area. Schedule a tour of a local treatment operation or request a presentation from utility operators or government agencies involved in these issues.





Stormwater Treatment & Prevention

Stormwater — the runoff that results from rainfall — must be properly managed year-round to ensure that it remains a resource and does not become a source of pollution.

Stormwater Treatment and Prevention



The Sarasota Bay area annually receives an average of almost 58 inches of rainfall from about 100 storms. More than 60 percent of the annual rainfall occurs during the wet season, from June through September. Stormwater — the runoff that results from rainfall — must be properly managed year-round to ensure that it remains a resource and does not become a source of pollution.

Stormwater contains the highest amount of pollutants early in a storm: it is estimated that this “first flush” carries 90 percent of the total pollutant load in the first one-inch of runoff. To effectively reduce

pollutants entering Sarasota Bay, local communities must target this first flush.

Stormwater runoff contributes both nutrients and toxins to the Bay as rainfall washes pollutants such as fertilizer, pesticides, sediment and petroleum

Baywide Average Annual Loadings by Source for Existing Land-Use Conditions								
	Tot. Phosphorus		Tot. Nitrogen		Lead		Zinc	
Source	(lb)	% of total	(lb)	% of total	(lb)	% of total	(lb)	% of total
Surface Runoff	110,870	45.1	588,210	46.3	30,180	90.3	23,260	25.4
Baseflow	33,800	13.8	112,690	8.9	300	0.9	5,620	6.1
Septic Tanks	8,230	3.3	123,520	9.7	0	0.0	0	0.0
Point Sources	31,140	12.7	109,330	8.6	490	1.5	2,520	2.8
Rainfall	61,730	25.1	337,460	26.5	2,470	7.4	60,080	65.7
TOTAL	245,770		1,271,210		33,440		91,480	

Figure 1.

products from yards, roads and parking lots (*Fig. 1*). Stormwater runoff is the major source of heavy metals and pesticides within

Sarasota Bay; these pollutants can be deadly to marine life or may interfere with reproduction or larval development in fish and shellfish. Heavy metals and pesticides often bind with sediments, so loose soil and fine sediments carry many pollutants to the Bay. Stormwater also contributes 45 percent of Sarasota Bay's nitrogen loads, as previously discussed; an overabundance of nitrogen harms the Bay by increasing algal growth, which reduces light penetration to seagrasses and, through biological and chemical processes, depletes oxygen from the water.

Heavy metals include elements such as lead, copper and cadmium. Lead and cadmium come from vehicle emissions and deterioration of brakes and tires that collect on pavement and, when it rains, run into Sarasota Bay through the tributaries. Copper, often found in higher amounts near marinas, is thought to be associated with anti-fouling bottom paints used on boats. Copper-containing herbicides may be another source of the copper found in Sarasota Bay. Unlike other heavy metals, zinc gets into the Bay mainly through rainfall, although some zinc comes from undetermined atmospheric sources.

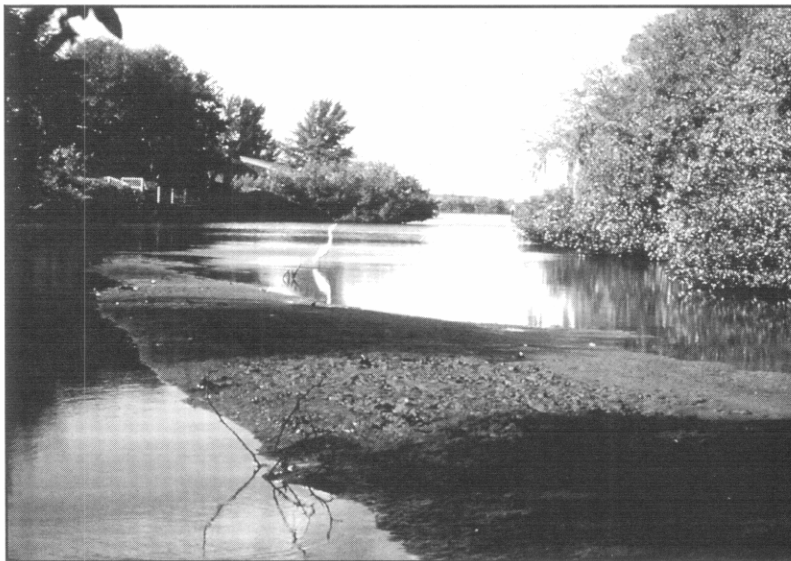
While few toxic substances were found in the central Bay, heavy metals (copper, zinc and lead) were found at elevated levels in several creeks and bayous flowing into Sarasota Bay. Concentra-



tions of heavy metals in some sediments were found to be at levels of ecological, but not human, risk. Pesticides, including those considered less persistent in the environment than banned products such as DDT, were also found in trace amounts in sediments in some low-salinity areas. The combined effects of toxic substances found in Sarasota Bay sediments are a source of additional ecological concern.

Levels of metals detected in Sarasota Bay's shellfish were well above Florida averages for lead, zinc and copper. In fact, lead levels in oysters in Hudson Bayou in downtown Sarasota were the highest concentrations found in any location, based on a review of nationwide data sets. (Sarasota County's Stormwater Environmental Utility plans to investigate potential sources of the bayou's lead contamination.) The concentration of toxic substances in vital, low-salinity environments of creeks and bayous is of concern because fish and shellfish require these habitats during sensitive juvenile stages.

Stormwater treatment technologies such as retention and detention ponds can be up to 93-percent effective in removing heavy



Clower Creek

metals and sediments. In a demonstration project conducted by Sarasota County and the Sarasota Bay Program, a series of relatively low-cost improvements planned for the Clower Creek drainage basin

near Sarasota Square Mall will significantly reduce pollution by sediment and associated contaminants.

Improving stormwater treatment in this manner in the more contaminated tributaries (Cedar Hammock and Bowlees Creek in Manatee County; Whitaker Bayou, Hudson Bayou and Phillippi Creek in Sarasota County) is vital to restore juvenile fishery habitats. However, it will be many years before contaminants that are

highly persistent in the environment, such as lead, decrease (through burial) to levels that no longer interfere with reproduction of shellfish and other marine life.

While treatment structures, plantings and erosion-control devices effectively reduce loads of sediment and associated contaminants, debate continues on how much — or if — nitrogen is effectively removed by such means. Rather than using traditional treatment structures, the most promising course in reducing stormwater nitrogen loads seems to be pollution prevention, *i.e.*, limiting the amount of nitrogen in the region. In the Sarasota Bay area, 30 percent of nitrogen loads come from stormwater runoff from residential sites, which constitute the majority of the region's land use. Rainfall is rich in nitrogen, compared to municipal water supplies, so runoff from developed impervious acreage can contribute significant nitrogen amounts to the Bay. The intensive use of fertilizers on lawns is also partially responsible.

The high contribution of nitrogen flowing into Sarasota Bay from developed neighborhoods runs contrary to popular opinion, which assumes agriculture and golf courses are the major nitrogen polluters. The Sarasota Bay region actually includes only limited land devoted to agriculture, and the Sarasota Bay Program's Pollutant Loading Assessment found that golf-course nitrogen loadings were not regionally significant.

Residential property owners in the watershed, rather than farmers and golf-course managers, will be the key to reducing stormwater nitrogen loadings. Improving landscape design and maintenance to reduce the use of fertilizer, pesticides and water is expected to reduce pollution in Sarasota Bay. In fact, research conducted in the Chesapeake Bay watershed showed that a test plot landscaped with shrubs and ground cover produced no runoff at all, while plots with maintained turf grass produced runoff containing nitrogen. Assuming the same research findings hold true for Southwest Florida, nitrogen loadings to Sarasota Bay could potentially be reduced by these methods (*Fig. 2*).

In October 1993 the Sarasota Bay Program and the Cooperative Extension Service launched the Florida Yards & Neighborhoods Program to provide information and advice on landscape design and maintenance to homeowners in Manatee and Sarasota counties. This

program — involving the landscape industry, developers, homebuilders and retailers — provides a way for each individual to be part of Bay restoration by reducing nitrogen and contaminant loads to Sarasota Bay. It will provide long-term benefits to the area as more natural plant communities are restored, yard by yard and neighborhood by neighborhood.

Education and pollution prevention are the least-expensive methods of environmental management and protection. The Florida Yards & Neighborhoods Program also satisfies federal requirements for local governments to provide opportunities for public involvement in preventing stormwater pollution.

An additional problem related to stormwater management is the alteration of freshwater flows in the Bay's tributaries. More and more of the region is being covered with buildings and paving, which keep rainfall from soaking into the ground and contribute to flooding. To speed drainage of upland areas, streams have been straightened and lined with concrete. Canals and ditches carry large "pulses" of stormwater to tributaries and the Bay. All these alterations contribute to a "feast or famine" condition in which tributaries and Sarasota Bay receive too much or too little freshwater, depending on rainfall. The restoration of wetlands and tributaries as part of stormwater management strategies can address the problem of large amounts of stormwater runoff entering Sarasota Bay by slowing the flow of water into the Bay, and also would serve to filter pollutants from the runoff. In addition, communities around the Bay can improve land-development regulations to reduce the amount of hardened surfaces.

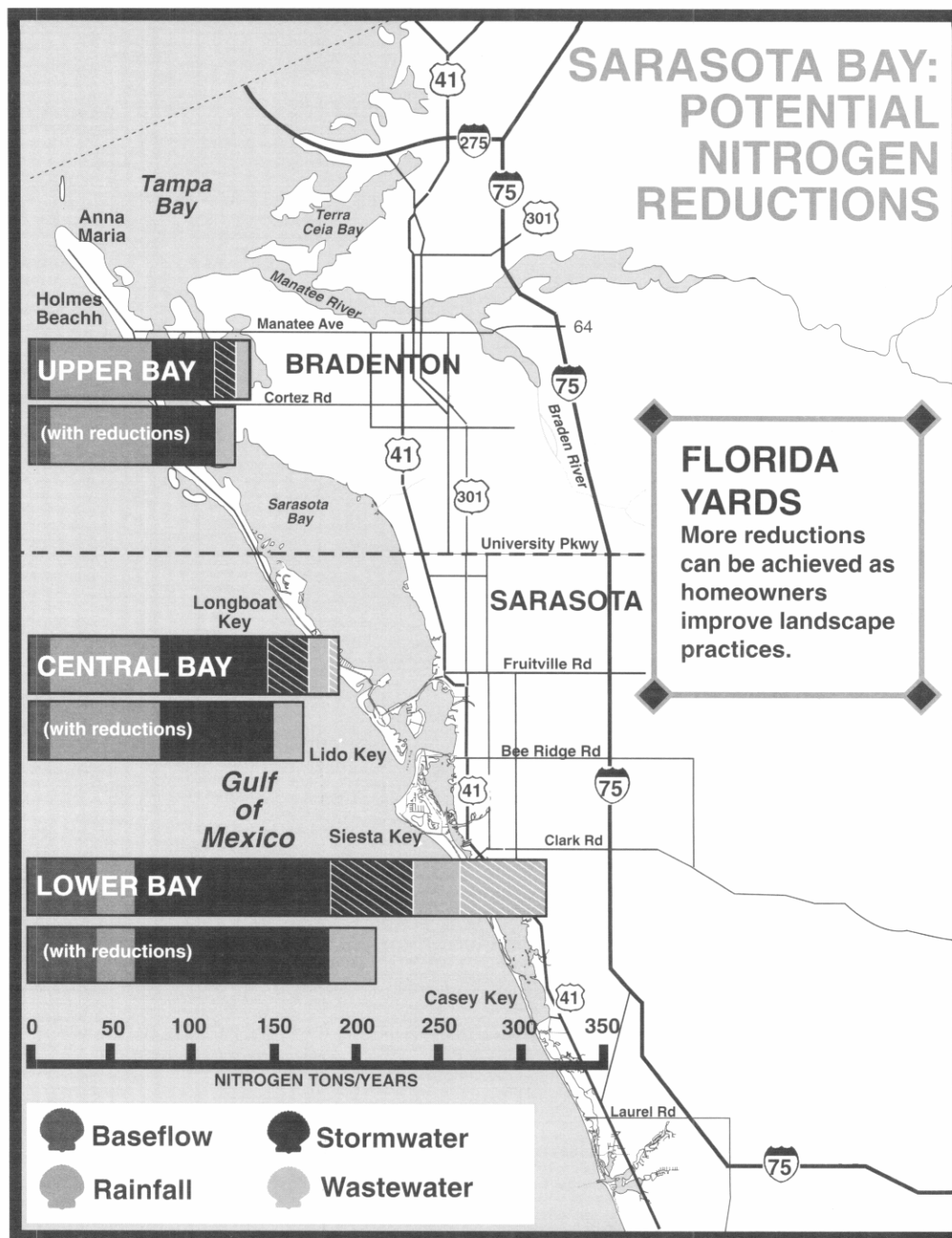


Figure 2.
The hatched areas denote the potential load reductions by implementing the proposed wastewater and stormwater recommendations (including Florida Yards & Neighborhoods.)

ACTION PLAN GOAL:

Reduce the quantity and improve the quality of stormwater runoff to Sarasota Bay.

ENVIRONMENTAL QUALITY OBJECTIVE:

Implementing this Action Plan will reduce contaminant loads, *i.e.*, lead, by 27 percent and total nitrogen loads by seven percent Baywide. Additional nitrogen load reductions will be achieved by modifying residential landscape design and maintenance.

Policies for Stormwater Treatment and Prevention

- o Promote basin-wide pollution prevention, water conservation and stormwater treatment techniques to significantly reduce nitrogen, sediment and toxic substance loadings to Sarasota Bay.

This policy encourages a practical, integrated approach to solving stormwater problems by reducing pollutants and runoff that require costly treatment structures, while recognizing the need for reassessing structural treatment options as technology improves.

- o Replicate, to the extent possible, the quality, quantity and timing of freshwater flows for natural conditions of the Sarasota Bay region.

This policy recognizes the relationship between flood control and the need for maintaining or restoring natural freshwater flows to the Bay.

Objective 1.0: Promote pollution prevention through improved landscape design and maintenance in residential areas.

This approach provides an opportunity for area residents to act individually to help improve Sarasota Bay. The program is also a cost-effective means for government to reduce nitrogen loads to the Bay from stormwater runoff.

Action 1.1

Implement the Florida Yards & Neighborhoods Program, which emphasizes reductions in use of pesticides and water and encourages broader use of slow-release nitrogen fertilizers.

Action 1.2

Coordinate the Florida Yards & Neighborhoods Program with state, regional and local water-conservation education programs and policies for integrated pest management.

Objective 1.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, University of Florida through Cooperative Extension Services, Southwest Florida Water Management District.

Cooperating Organizations: Florida Sea Grant, Florida Dept. of Environmental Protection (FDEP), U.S. Environmental Protection Agency (EPA), U.S. Dept. of Agriculture Soil Conservation Service, Sarasota County Stormwater Environmental Utility, Assn. of Florida Native Plant Nurseries.

Funding: It is anticipated that successful implementation of the Florida Yards & Neighborhoods program (Actions 1.1 and 1.2) will require a 20-year commitment by the community at a cost of \$200,000 per year. Total costs include a full-time coordinator, two assistant coordinators (one each for Manatee and Sarasota counties) and secretarial support. Funds would also provide travel expenses for the Master Gardeners, model yards and educational materials. Cooperative Extension Offices in both counties, in conjunction with stormwater environmental utilities, are expected to contribute to this effort. Sarasota

Bay Program funding is set at \$110,000 to provide interim funding for the initiative between fiscal years 1994-97 (subject to approval of the Management Conference).

Timetable and Status: Implementation began in 1993 through the Cooperative Extension Service in Manatee and Sarasota counties, with funding from U.S. EPA through the Sarasota Bay Program and FDEP. The Florida Yards & Neighborhoods Program is included in Sarasota County's National Pollutant Discharge Elimination System application to U.S. EPA. The program's emphasis on pollution prevention and volunteer involvement and participation from businesses and conservation organizations should be maintained. Because this program is designed to change both perception and practice, review of the program's effectiveness would be appropriate in fiscal year 1997.

Objective 2.0: Reduce sediment and contaminant loadings, *i.e.*, lead, in priority watersheds. Reduce total nitrogen loadings by seven percent Baywide.

Action 2.1

Develop and implement a stormwater management master plan for the Sarasota Bay region, with priority placed on tributaries where the highest levels of contaminants were found: Phillippi Creek, Bowlees Creek, Cedar Hammock Creek, Hudson Bayou and Whitaker Bayou.

2.1.2 Implement a stormwater utility with appropriate rate structure and related public education in Manatee County.

2.1.3 Focus stormwater master plans on reducing toxins, sediment and nitrogen loads to the Bay while also controlling flooding.

2.1.4 Review stormwater utility rate structures and other funding sources in Manatee and Sarasota counties for adequacy to implement master drainage plans.

2.1.5 Research, develop and utilize stormwater treatment technologies to achieve the greatest possible nutrient removal.

(Editors' Note: Swiftmud has conducted extensive research on the removal efficiency of stormwater treatment systems. This work should be recognized in developing the stormwater systems. Ongoing research on atmospheric deposition in the Tampa Bay area should also be recognized and used appropriately.)

Objective 2.0: Responsibility, Financing and Timetables

Lead Organizations: Sarasota County, Manatee County.

Cooperating Organizations: Other local governments, Southwest Florida Water Management District, Florida Dept. of Environmental Protection, Florida Dept. of Transportation, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency.

Funding: Sarasota County

In 1989, Sarasota County created a Stormwater Environmental Utility. An initial rate structure was adopted in 1991, and revised in 1994. Funds have been used to develop master plans for priority basins throughout the county, including Sarasota Bay Program priorities at Hudson Bayou and Phillippi Creek. The U.S. Army Corps of Engineers is presently conducting a flood-control study of Whitaker Bayou.

Preliminary cost assessments for stormwater runoff treatment and flood control have been determined. The total costs for the priority basins are:

Hudson Bayou, \$3.1 million (\$1.5 million has associated water-quality improvements);

Phillippi Creek, \$43.2 million (\$23.3 million has associated water-quality improvements);

Whitaker Bayou, \$5 million (a reconnaissance flood-control project shows figures in the \$5-million range — additional costs for water-quality benefits have not been calculated at this time).

Revenue to conduct the stormwater improvement projects for each watershed is anticipated to come primarily from special assessment districts, supplemented by resources from Swiftmud and state and federal environmental agencies.

Timetable and Status: Sarasota County

Master plans have been prepared for Phillippi Creek and Hudson Bayou in Sarasota County, and a

plan for Whitaker Bayou will be completed in 1996. Other basins have also received preliminary stormwater management needs assessments, and a five-year schedule of improvement has been outlined.

Funding: Manatee County

In 1991, Manatee County began implementation of a stormwater utility with consolidation of utilities within the county. Master plans are being prepared to address stormwater runoff and flood control concerns.

It is anticipated that Bowlees Creek — one of two Sarasota Bay Program priorities in Manatee County — will be given a first priority for plan development within the Sarasota Bay watershed. The master plan for Bowlees Creek will be used as a model for other remaining basins in the Sarasota Bay area.

Preliminary cost assessments for flood control were established in the 1984 county master plan. Best estimates for the priority basins are:

Bowlees Creek, \$6.9 million;

Cedar Hammock Creek, \$4.9 million.

These projects will provide water-quality benefits as well, but were not planned for in the stormwater master plan.

Timetable and Status: Manatee County

Proposals for stormwater projects are under review in the county and master planning has begun. Conceptual design has been completed for the airport drain in Bowlees Creek and a master plan on lower Cedar Hammock will be completed in fiscal year 1995 through co-operative funding with Swiftmud.

(Editors' Note: The Sarasota County Stormwater Environmental Utility rate structure has been under court challenge, and is currently being appealed by the county as it relates to not-for-profit and religious applications. Other ramifications resulting from the legal challenges may occur.)

Objective 3.0: Maintain stormwater management and treatment systems for maximum efficiency in reducing pollutant loads to the Bay.

Maintenance of existing stormwater systems is a concern shared by citizens and regulatory agencies alike. Emphasis on maintenance must be increased to ensure that treatment structures serve their purpose in reducing the quantity and improving the quality of stormwater runoff into Sarasota Bay.

3.1. Stormwater Environmental Utilities in Manatee and Sarasota counties must continue to educate stormwater management staff and the public on appropriate stormwater runoff maintenance techniques.

3.2. Stormwater Environmental Utilities in Manatee and Sarasota counties, or other responsible and appropriate governmental entities, will maintain treatment structures. Local governments must encourage appropriate staffing to provide for routine inspection of treatment structures and enforcement of any violations.

Objective 3.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Transportation, Southwest Florida Water Management District.

Funding: Sarasota County

Sarasota County Stormwater Environmental Utility, adopted in 1989, provides funding for maintenance of streams, creeks and ditches within the Sarasota Bay region. Approximately \$4 million will be made available annually countywide for this effort, equating to about \$21 for an average household in Sarasota County.

Funding: Manatee County

Manatee County's stormwater utility also provides for maintenance of streams, creeks and ditches with the Manatee County region of Sarasota Bay. A dedicated source of funding and amount for stormwater operation and maintenance expense will be determined in fiscal year 1995.

Timetable and Status: The State of Florida has developed a stormwater operator's certification course for public and private personnel responsible

for inspecting treatment structures. Appropriate local government staff should receive this training and certification beginning in fiscal year 1995.

Local governments shall review stormwater maintenance and enforcement personnel in fiscal year 1995 and implement necessary changes in fiscal year 1996.

Objective 4.0: Reduce or mitigate the impact of future development on stormwater loadings to Sarasota Bay.

Action 4.1

Through comprehensive land-use plans and land-development regulations, reduce the amount of existing impervious surface in the watershed and seek alternatives for reducing hardened surfaces in future development.

Reducing the amount of impervious surface will reduce the need for stormwater treatment, since more rainwater will be absorbed in upland areas. It will also help re-establish natural groundwater flows.

4.1.2. Where development occurs, encourage cluster development to provide more open space to reduce stormwater contaminants to the receiving stream.

Clustering concentrates development on a portion of a tract, leaving the remainder as open space.

4.1.3. Provide incentives or credits (financial or otherwise) for removal of existing hardened surfaces or enhancement of existing stormwater treatment systems that reduce stormwater loadings.

Existing land-development regulations actually serve as disincentives for these activities. Developers who wish to remove paving may be required to respond to new, more stringent development regulations, and are given no incentive to go beyond the minimum requirements for stormwater treatment. Manatee and Sarasota counties should encourage developers and property owners to improve stormwater techniques by incorporating credits in stormwater fees or providing other incentives that will prove beneficial in improving Sarasota Bay.

4.1.4. Amend permitting requirements for paving to allow more porous surfaces.

Existing regulations for some types of land development require excessive paved area to be allocated for parking. Local governments should review those requirements in light of stormwater issues and revise the regulations as appropriate.

Objective 4.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, local governments.

Cooperating Organizations: Florida Dept. of Environmental Protection, Florida Dept. of Transportation, Southwest Florida Water Management District, Regional Planning Councils, Florida Dept. of Community Affairs, U.S. Environmental Protection Agency.

Funding: Prior to making formalized recommendations on this issue, a study of the matter is urged. The study will review existing comprehensive plans and evaluate regional policies related to impervious surfaces (business needs for parking spaces, aesthetics, etc.) and make appropriate comprehensive plan changes. A preliminary cost of \$40,000 has been recommended by the Sarasota Bay Program (subject to Management Conference approval) for this effort, estimated to take 18 months to complete.

Timetable and Status:

4.1.2 Local planning agencies shall review clustering options in fiscal year 1996-97.

4.1.3 Sarasota and Manatee counties continue to examine options for stormwater credits.

4.1.4 Local government review and revision of paving requirements will occur in fiscal years 1996-97.

Measurements of Success

- o Sediment and biological monitoring data will show measurable improvements in priority watersheds over time.

- o Implementation of best management practices and physical improvements to treatment systems may be included in the Sarasota Bay Program's Pollutant Loading model to calculate achievements in relation to these actions. The model estimates that implementing this strategy will reduce total stormwater nitrogen loadings by up to seven percent Baywide. Additional load reductions also could be projected using the model if significant landscape modifications are achieved in residential land uses.

Anticipated Benefits

- o Reducing loading of toxins to Sarasota Bay would protect and foster shellfish and other marine life.

- o Reducing sediment and nitrogen loadings would improve water quality, which will improve fisheries habitats and the aesthetic value of Sarasota Bay.

- o Florida Yards & Neighborhoods implementation and clustering development instead of following traditional development practices would increase habitat opportunities for wildlife.

- o Reducing sediment loads would reduce the need for maintenance dredging in tributaries and canals and would provide opportunities for restoring Bay bottom habitats.

Action Update

In the Sarasota Bay watershed, the largest single land use is residential. The intensive use of fertilizers on lawns is thought to be a significant source of nitrogen entering the Bay. To reduce nitrogen loads carried by stormwater runoff, pollution prevention must be a Baywide commitment. The Florida Yards & Neighborhoods Program was launched in 1993 by the Cooperative Extension Service, Florida Sea Grant and the National Estuary Programs of Sarasota and Tampa Bays in an effort to provide a proactive educational campaign. This pilot program is expected to provide thousands of area residents with information on practical ways to reduce stormwater pollution through improvements to residential landscape design and maintenance.

The pilot program is funded through June 1995 by the U.S. Environmental Protection Agency, the Florida Dept. of Environmental Protection, the Sarasota Bay Program and the Tampa Bay National Estuary Program. Additional public resources have been provided by the Cooperative Extension Service, Florida Sea Grant College Extension Program and Southwest Florida Water Management District (Swiftmud). Local governments, Swiftmud and the Cooperative Extension Service are appropriate agencies to provide long-term support of this program.

To date, the Florida Yards & Neighborhoods Program has counseled hundreds of residents about how they can provide a Bay-friendly environment. A coordinator has been hired, and several model yards have been created, including one at the Florida House in Sarasota County. In addition, the Florida Schoolyards program has been initiated to provide further educational outreach incentives to young people in the region.

In related actions, Sarasota County has adopted an Integrated Pest Management policy for public lands requiring that least-toxic methods of pest control be employed. Manatee County has adopted guidelines for drought-tolerant landscapes that are recommended for new development. Florida Yard maintenance practices are also recommended for new developments in Manatee County, particularly in coastal areas and the watersheds of drinking-water reservoirs. In both counties, several schools are participating in demonstration projects to educate students, parents and nearby homeowners on the values of Florida Yards & Neighborhoods Program.

To reduce stormwater contaminant loads and help moderate stream flows, Sarasota County's Stormwater Environmental Utility has produced master plans for the Phillippi Creek and Hudson Bayou watersheds, and is developing a master plan for Whitaker Bayou. The county began implementing the Phillippi Creek plan in 1993 with the acquisition of land for a major detention area at the Creek's headwaters. While the project is mainly designed for flood control, it also provides some water-quality benefits and will help moderate stream flows during storms. Sarasota County revised its stormwater fees in 1994 to pay for capital improvements identified in the master plans.

As Manatee County develops a stormwater utility fee, master planning is set to begin and early action projects for improving stormwater treatment are being developed for Bowlees and Cedar Hammock creeks, two treatment-priority areas identified by the Sarasota Bay Program. The county's stormwater fee will initially be used for maintaining existing stormwater treatment structures and will be revised based on the master plans.

Landscape treatments and stormwater structures alone will not be sufficient if the community intends to "turn back the clock" on nitrogen pollution in Sarasota Bay. Innovative approaches to land use should also be explored to manage future growth. Creating incentives to remove paving in existing developments, reducing paving requirements in new developments and investigating benefits of clustered development require scrutiny by local planning agencies and the community. The Southwest Regional Planning Council is encouraging developers of large properties to examine ways to decrease paved areas and/or use porous paving materials. In addition to improving the Bay, these cost-effective actions can enhance the region's appearance, wildlife diversity and sense of community.

What you can do about stormwater pollution

As a property owner

- o Make your landscape a model Florida Yard, emphasizing plants that reduce the need for water, fertilizer and pesticides while providing wildlife habitat. Having a Florida Yard also helps reduce surface runoff from your property and helps keep runoff clean by limiting erosion and reducing chemical applications in your landscape.

Contact your county's Cooperative Extension Service for information on the Florida Yards & Neighborhoods Program.

- o Support your county's Stormwater Environmental Utility. The fees you pay now for planning and improving stormwater treatment will help determine the future quality of Sarasota Bay's water and sediments, as well as shellfish and other marine life.

- o Report maintenance problems in stormwater ponds or ditches to your county's stormwater department.

- o Clean up neighborhood trash, and don't litter. Most trash that reaches Sarasota Bay is transported by stormwater runoff from land.

- o Dispose of waste properly; don't dump oil, paint, cleaning fluids or pesticides in storm drains.

As a developer

- o Incorporate Florida Yard concepts in community landscape guidelines.

- o Participate with local governments in developing fair incentives or credits to reduce paved surfaces or exceed minimum treatment standards in new and existing developments.

- o Cluster buildings and paved areas to the extent allowed by development regulations to increase open space.

As a civic group member or educator

- o Adopt a roadside or shoreline for cleanup by your group.

- o Paint stormwater-pollution prevention messages on stormdrains to increase Bay awareness among area residents and visitors. Contact the stormwater department in your county for information on the Stormdrain Stenciling Program.

- o Request a presentation about stormwater management plans in your community from your county's stormwater department. Presentations on the Florida Yards & Neighborhoods Program are available through the Cooperative Extension Service.

As a farmer or golf course manager

- o Implement Best Management Practices to reduce the potential for fertilizer runoff from fields or fairways. Contact the Cooperative Extension Service and Soil Conservation Service for technical assistance.



Freshwater & Saltwater Wetlands

Healthy wetlands, both freshwater and saltwater, provide a number of essential benefits to Sarasota Bay: food and shelter for Bay life, filtration of pollutants and help in regulating the flow of freshwater into the Bay.

Freshwater and Saltwater Wetlands

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healthy wetlands, both freshwater and saltwater, provide a number of essential benefits to Sarasota Bay: food and shelter for Bay life, filtration of pollutants and help in regulating the flow of freshwater into the Bay. Saltwater, or intertidal, wetlands include salt marshes and mangrove forests, which help protect shorelines from erosion in addition to their other benefits.

The area of intertidal wetlands in the Sarasota Bay watershed has declined 39 percent since 1950, according to research conducted for the Sarasota Bay Program. Since 1975, freshwater wetlands as a whole have declined 16 percent, while non-forested freshwater wetlands have declined 35 percent. Remaining wetlands are fragmented, smaller and may no longer provide the same level of function (*Fig. 1*).

Historic land-use trends in Manatee and Sarasota counties account for the majority of wetland loss. In Manatee County, agriculture and development began on the Manatee River, then moved westward to Sarasota Bay. This pattern of settlement led to the destruction of many freshwater wetlands but spared many mangrove wetlands in the Bay that are now protected by regulations. In Sarasota County,

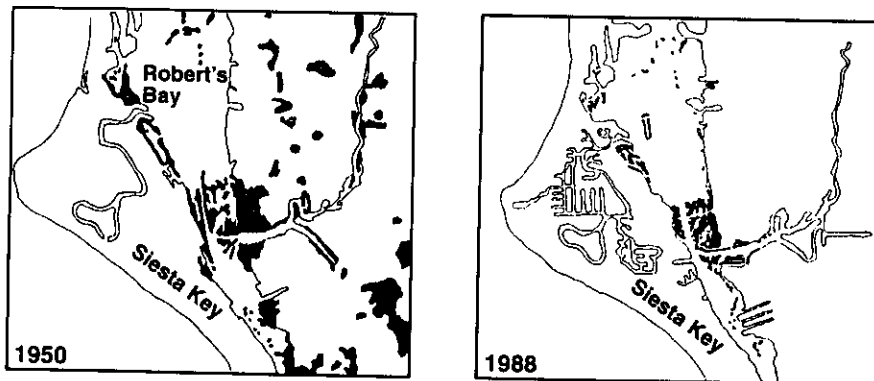


Figure 1.
Loss and fragmentation of tidal and freshwater wetlands and wetland soils (dark areas), 1950-88, in Phillippi Creek and adjacent waters of Roberts Bay. Source: Estevez (1993).

growth historically focused along the Bay, eventually causing destruction of 80 percent of the natural mangrove shoreline but sparing many freshwater wetlands. The trend in Sarasota Bay mirrors state-wide trends (*Fig. 2*).

The future of remaining wetlands in the intertidal zone may be affected by accelerated rates of sea-level rise. At current rates of sea-level rise, high tides experienced in the Sarasota Bay area will be about two inches

higher than present in the year 2020, and nearly 10 inches higher in 2115. Accelerated rates of sea-level rise based on the most recent estimates of global warming indicate that high tides could be about six inches higher than present in 2020 and about 25 inches higher in 2115.

The quality of existing wetlands, both freshwater and saltwater, depends on the amount of disturbance by people and nature. Freezes, erosion, dredging, filling and encroachment of non-native plants damage wetlands. Radical pruning of mangroves does not appear to be a common practice in the Sarasota Bay area. While about 33 percent of all mangrove wetlands show some evidence of trimming, only seven percent of the total remaining mangrove wetlands are pruned to less than one-third of their natural height. By comparison, about 66 percent of mangrove wetlands are affected by encroachment of non-native plants, such as Brazilian pepper and Australian pine.

Existing regulatory programs focus on preventing additional

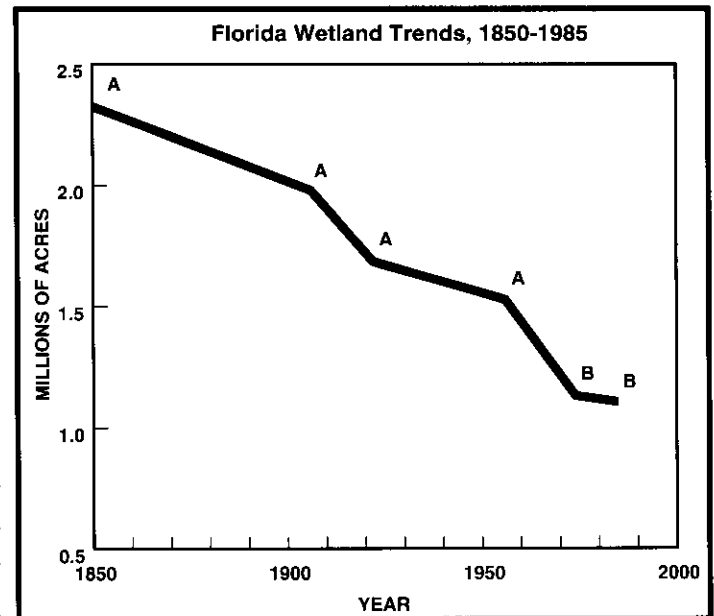


Figure 2. Source A: Shaw and Fredine (1956). Source B: Frayer and Hefner (1991).

losses of wetlands. According to a 1994 report from the Florida Office of the Auditor General, existing regulatory wetland programs control the rate of loss, but do not totally prevent wetland loss. A similar situation exists in the Sarasota Bay watershed.

The Sarasota Bay Program recommends restoration and enhancement of wetlands, rather than just protection, as the guiding policy for regulations, monitoring and enforcement. To facilitate this shift in emphasis, the Program has developed a schedule of actions, including monitoring, restoration, enhancement and protection, to create a comprehensive approach to wetlands. This strategy should be facilitated by a local wetlands coordinator, whose position would be dedicated to the wetlands program. The wetlands coordinator would have no direct regulatory role, but would perform advisory, advocacy and educational functions in coordinating implementation of the following actions.

Restoration projects, building upon work already completed or currently underway by the Sarasota Bay Program, would help coordinate the restoration of 75 acres of intertidal habitat that began in 1989 (*Fig. 3*). The objective is to restore at least 18 acres of intertidal wetlands, such as at Leffis Key (*Fig. 4*), and 11 acres of freshwater wetlands annually. Work would continue to be conducted in cooperative ventures between the State of Florida (Dept. of Environmental Protection) and local governments. It is envisioned that many restoration activities would be integrated with road or recreational improvements planned by both state and local governments. Freshwater wetlands restoration may be integrated with stormwater treatment improvements and wastewater reclamation efforts.

Private property owners should be informed of opportunities to replace hardened shoreline-protection structures with more natural slopes, vegetation, terracing or other more Bay-friendly alternatives. The Florida Yards & Neighborhoods Program, discussed in the Stormwater Action Plan, would assist in providing information on those alternatives. For shorelines that require seawalls, small artificial reefs that mimic red mangrove root systems are being developed to provide juvenile fishery habitat (see Fisheries and Other Living Resources Action Plan).

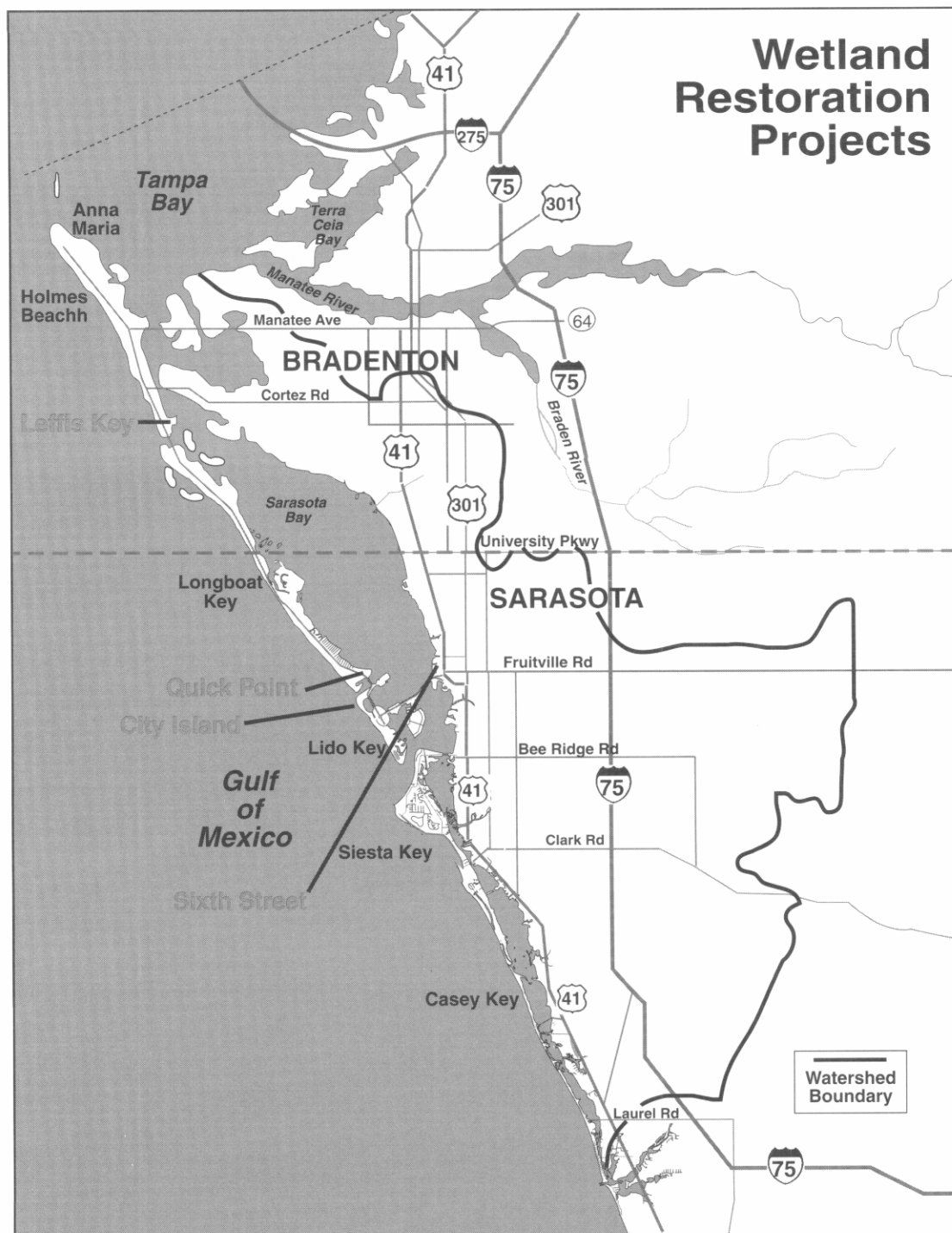


Figure 3. Completed wetland restoration projects:

- Leffis Key
- Quick Point
- City Island
- Sixth Street



Figure 4.
Restoration
chronology of
Leffis Key,
Manatee County,
from 1990, 1991
and 1993.

ACTION PLAN GOAL:

Restore shoreline habitats and eliminate further losses.

ENVIRONMENTAL QUALITY OBJECTIVE:

Annually restore or create 18 acres of intertidal wetlands and 11 acres of nonforested, freshwater wetlands.

Increase the quantity, improve the quality and protect the diversity of freshwater and saltwater wetlands in the Sarasota Bay watershed.

This objective supports existing policies that protect wetlands from additional losses through emphasizing the need to restore and enhance wetlands.

Policy for Freshwater and Saltwater Wetlands

Objective 1.0: Implement comprehensive wetland protection and restoration.

Action 1.1

Manage wetlands by watershed so that historic hydroperiods are restored and maintained.

This approach is critical to restoring or maintaining the unique characteristics of each tributary in the Sarasota Bay region. Managing the restoration and protection of wetlands by tributary watershed will assist in restoring natural balances in stream flows, plant communities and habitat for marine life and wildlife. This approach shall be addressed in local government comprehensive plans, future watershed management decisions and wetland restoration and enhancement projects.

Action 1.2

Enhance, restore and create wetlands throughout the Bay region.

These activities will be led by the wetlands coordinator in conjunction with local, state, regional and federal agencies as well as citizen groups. The coordinator will assist in integrating funding sources, facilitating permitting processes and advising the public and agency staff on technical aspects of projects. The position may be established within a department of local government or through the Florida Sea Grant Extension Program.

Action 1.3

Include wetland protection in local comprehensive plans, ordinances and land-development regulations. Incorporate wetlands and open space concepts in road, bridge, stormwater, wastewater and other infrastructure projects.

The wetlands coordinator will bring to the attention of local governments opportunities to improve policies and regulations to further enhance wetlands in a manner consistent with the Sarasota Bay restoration plan.

Action 1.4

Recognize the importance of adjacent upland areas as buffers in restoring, creating or protecting wetlands.

Recent scientific analysis has shown that upland buffers adjacent to wetlands are important in preserving the natural functions and wildlife benefits of wetlands. Local, regional and state agencies shall recognize this importance in future decisions related to wetlands. Sufficient upland buffers will allow landward migration of intertidal wetlands in the event of accelerated rates of sea-level rise.

Action 1.5.

Integrate reviews of development proposals among all appropriate governmental agencies and jurisdictions when wetlands are an issue.

The wetlands coordinator shall facilitate resolution of technical issues in the permitting of major projects. If a conflict arises regarding the technical merit of a project with regard to wetlands, the

coordinator shall participate in constructive problem-solving to assist all appropriate agency staff and the public in resolving such conflicts. The coordinator will not be part of official permit reviews.

Action 1.6

Develop priorities and protect wetlands through public ownership or private conservation arrangements.

Both Manatee and Sarasota counties are implementing land-acquisition programs for environmentally significant lands. Bay priorities should be recognized in these programs, and the wetlands coordinator should facilitate innovative ownership arrangements to protect remaining undeveloped saltwater and freshwater wetlands.

Action 1.7

Remove exotic plants from wetlands.

This action requires a comprehensive plant-removal program. This program would also enhance emergency evacuation plans for the region, since many evacuation routes from barrier islands are lined with Australian pines, which have shallow root structures and topple easily in strong winds. It is envisioned that the wetlands coordinator would take a lead role in facilitating development of this program, in conjunction with citizen groups and natural resource, transportation and emergency management agencies.

Action 1.8

Coordinate wetlands activities with the Sarasota Bay Program, citizen organizations and existing citizen advisory committees of local governments.

This action provides for communication among these key participants in the wetlands strategy and assures the wetlands coordinator of continued citizen input and support for the participants' activities.

Action 1.9

Develop and implement policies that are consistent across jurisdictions regarding shoreline alterations such as docks, seawalls or other shoreline protection alternatives.

Myriad regulations and agencies are involved in these activi-



ties, which have direct physical impacts on Sarasota Bay. The wetlands coordinator will oversee ongoing review and revision of policies related to such projects, supported by permitting agencies.

Action 1.10

Provide proactive, cooperative consultations to the private and public sectors on development proposals and regulatory issues that impact wetlands.

Local governments, through the wetlands coordinator, should provide this service in order to enhance the wetlands protection aspect of development, transportation or other projects with significant wetland impact. This action is not intended to encourage another layer of bureaucratic review, but to streamline the review process by providing up-front, constructive input during planning of projects with major wetlands implications.

Action 1.11

Provide technical information to programs providing public education and citizen involvement in wetlands issues.

The wetlands coordinator will share this responsibility with the Florida Sea Grant marine extension agent in the watershed. Public demand for this type of assistance far exceeds current staff levels.

Action 1.12

Require that compensation for permittable damage be applied to wetland restoration and creation activities in the Sarasota Bay region.

The State of Florida and Sarasota County use fees from environmental violations for restoration activities. This action would expand that funding mechanism to use fees paid in the permitting process as compensation for environmental damage. This action will be implemented by local governments through ordinance.

Objective 1.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, Florida Sea Grant.

Cooperating Organizations: Florida Dept. of Environmental Protection (DEP), Southwest Florida Water Management District, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Florida Game & Freshwater Fish Commission.

Funding: The Sarasota Bay Program anticipates making \$135,000 available between fiscal years 1995-97 to support the wetlands coordinator and update the habitat inventory, and for habitat restoration, pending approval by the Management Conference, as outlined in Actions 1.1, 1.2, 1.3, 1.5, 1.8, 1.9, 1.10 and 1.11. Restoration activities will be coordinated throughout the region by the wetlands coordinator.

Cost per acre to restore wetlands, as mentioned in Actions 1.4, 1.6, 1.7 and 1.12, approximates \$20,000. The Sarasota Bay Program goal is to restore 18 acres of intertidal wetlands per year, totaling \$360,000. These funds will be made available on a project-specific basis using available funding sources through Pollution Recovery Trust Fund through the FDEP, the Florida Surface Water Improvement and Management program, the Manasota Basin Board and other participating organizations. Restoration of at least 11 acres of freshwater wetlands is also a Sarasota Bay Program goal, and will be addressed by the wetlands coordinator. This goal may be met through the establishment of a wetlands treatment system in conjunction with a regional wastewater reclamation system (see Wastewater Treatment and Reclamation chapter).

Timetable and Status: A wetlands coordinator for the Sarasota Bay area (Manatee and Sarasota counties) will be appointed by fiscal year 1996 through a partnership of the local governments and Florida Sea Grant. The wetlands coordinator will facilitate actions with key agencies and the public. Implementation of actions will be underway by fiscal year 1996. *(Editors' Note: Priority areas for restoration include, but are not limited to, Sister Keys and Quick Point, Town of Longboat Key; Big and Little Edwards Islands, Palmer Point and "Skiers" Island, Sarasota County; Palma Sola Causeway, Manatee County; and Selby Gardens, City of Sarasota.)*

Objective 2.0: Provide opportunities for citizen involvement in wetlands protection, enhancement and acquisition.

Action 2.1

Support an ongoing education program on mangrove protection and care.

The Florida Sea Grant program should continue to be supported through the Manatee and Sarasota Cooperative Extension Services.

Action 2.2

Encourage citizen groups to "adopt" restored or protected wetlands for trash and exotic-plant removal.

The wetlands coordinator shall assist local governments involved in restoration and protection activities by recruiting volunteer wetlands stewards to oversee long-term maintenance of sites.

Action 2.3.

Promote neighborhood wetlands protection and homeowner shoreline management through the Florida Yards & Neighborhoods Program.

Objective 2.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, Florida Sea Grant.

Cooperating Organizations: Florida Dept. of Environmental Protection, Southwest Florida Water Management District, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers.

Funding: It is anticipated that the Sarasota Bay Program will provide \$10,000 for educational materials (pending approval of the Management Conference) supporting the implementation of the wetlands programs as they develop.

Timetable and Status:

2.1 Florida Sea Grant currently offers mangrove education presentations.

2.2 Implement a wetlands adoption program by fiscal year 1998.

2.3 Implementation began in 1993 through the Cooperative Extension Service and will be supported technically by the wetlands coordinator.

Measurements of Success

- o Intertidal wetlands: Restore or create a minimum average of 18 acres per year, not including activities associated with mitigation.
- o Freshwater wetlands: Restore or create an average of 11 acres of non-forested wetlands per year, not including open water systems, stormwater treatment facilities or activities associated with mitigation.
- o Periodic wetlands mapping will measure net gains in wetland acreage and monitor the maintenance or enhancement of quality in existing wetlands.

Anticipated Benefits

- o Increase productive nursery habitat for fisheries by at least 18 acres per year of historical intertidal wetlands loss.
- o Restore and increase natural filtration of pollutants before they reach the Bay.
- o Restore historic hydroperiods in wetlands to help regulate freshwater flow to the Bay.
- o Increase native wildlife habitat.

Action Update

From 1989-94, the Sarasota Bay Program facilitated a Baywide effort to restore intertidal wetlands. Approximately 75 acres of wetlands will be restored by 1995 through partnerships with four different local governments (City of Sarasota, Manatee County, Town of Longboat Key, Sarasota County), the Florida Dept. of Environmental Protection, the U.S. Environmental Protection Agency and Southwest Florida Water Management District. These projects restore habitat for juvenile fish, crabs, wading birds and other marine life, and also provide a valuable educational opportunity for the public through volunteer plantings, informative tours and coverage by news media.

This emphasis on wetlands restoration and enhancement will be continued and expanded through the work of a wetlands coordinator appointed by local governments. The coordinator will facilitate a comprehensive, proactive campaign to restore and enhance both freshwater and saltwater wetlands, and will intensively encourage private-sector involvement ranging from volunteer plantings and wet-

lands adoption to private land trusts for wetlands conservation. The coordinator also will play a key role in pursuing grants and other funding for wetlands restoration. The Sarasota Bay Program has proposed a significant spoil-island restoration initiative to the U.S. Army Corps of Engineers; the wetlands coordinator would facilitate local government involvement in those projects. In addition, options are being explored for creating or restoring freshwater wetlands using water reclaimed from wastewater treatment processes.

In some cases, protecting remaining intertidal wetlands requires land acquisition. Significant strides were made in this effort recently with two major acquisitions. In 1991, Manatee County paid \$1.6 million for 16.5 acres of the historic Crosley-Horton estate, including a quarter-mile of shoreline along Sarasota Bay. In 1992, the Town of Longboat Key, with assistance from the Sister Keys Conservancy, purchased Sister Keys, a group of small islands in the central Bay, for \$1 million. These spoil islands, which had been proposed for residential development, are surrounded by mangroves and lush seagrass beds.

Both Manatee and Sarasota counties are developing priorities for acquiring additional environmentally sensitive lands. Bayshore lands should be strongly emphasized in these deliberations.

What you can do about wetlands restoration and protection

As a property owner

- o Protect wetlands on or adjacent to your property by limiting landscape maintenance (fertilizing, mowing, using pesticides) near wetlands. Provide a buffer zone of native plants between maintained areas and wetlands. Remove non-native, invasive plants, such as Brazilian peppers, Australian pines and Melaleuca (punk) trees from the wetlands.

- o Avoid pruning mangrove trees if they are located along your shoreline. Mangrove pruning is regulated by the State of Florida. Contact the Florida Dept. of Environmental Protection in Tampa for information on permit requirements.

- o Investigate opportunities to create a more natural shoreline along your property. Contact the Sea Grant Extension Program or Florida Yards & Neighborhoods Program of the Cooperative Extension Service.

- o Investigate opportunities to protect wetlands through conservation easements or living trusts.

As a civic group member or educator

- o Visit a wetland to learn more about these fragile ecosystems. Contact the Manatee County Public Works Dept. for a tour of the wetland created at the county's Lena Road landfill, or contact the county's Environmental Action Commission for information on the restored wetland at the Coquina BayWalk at Leffis Key. In the City of Sarasota, visit the Sarasota BayWalk restored habitat on City Island, South Lido Park on Lido Key or the Sixth-Street Lagoon south of the Van Wezel Performing Arts Hall. Another restored habitat, Quick Point Nature Preserve, is located on the southeast tip of Longboat Key.

- o Talk with your local government about opportunities to protect or restore a wetland through planting, trash pickup and exotic-plant removal.



Fisheries & Other Living Resources

The future of the Bay's fisheries depends on the community's ability to restore and protect productive seagrass beds and juvenile habitats such as tributaries and mangrove shorelines.

Fisheries & Other Living Resources

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The channel inlets on this charted because position.

Fisheries and Other Living Resources



A

productive fishery contributes positively to the Sarasota Bay area's economy and quality of life. Given that almost 50 percent of Sarasota Bay is less than three feet deep at low tide, the Bay is a prime area for flats fishing by recreational anglers. Recreational anglers may hook trout, redfish and snook, while some commercial and recreational fishers net mullet in the Bay. Sarasota Bay is also home to Cortez village, one of the oldest commercial fishing centers in Florida. The future of the Bay's fisheries depends on the community's ability to restore and protect productive seagrass beds and juvenile habitats such as tributaries and mangrove shorelines. Conservative harvest is also important in maintaining the vitality of the fishery.

Declines in water quality and productive habitats, combined

with increased fishing pressure, have resulted in reduced fisheries in Sarasota Bay (Fig. 1). Some factors causing the fishery decline are indirect, such as cumulative damage by pollution from wastewater and stormwater runoff. Other factors are direct, such as scarring of seagrass beds by boat propellers when

**SPOTTED SEATROUT COMMERCIAL LANDINGS
IN THE SARASOTA BAY AREA**

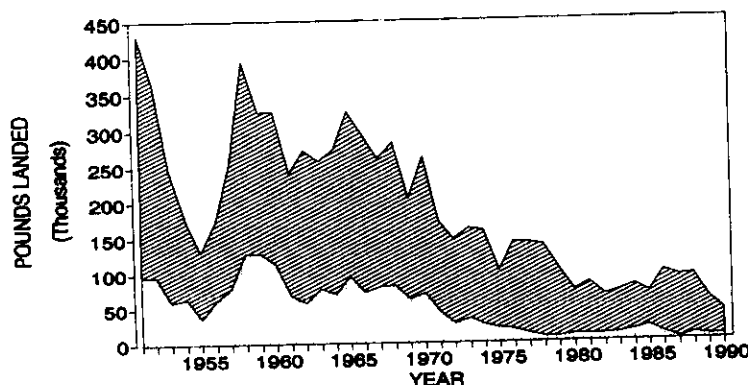


Figure 1.



unwary boaters run over grassy shoals. Alteration and degradation of juvenile fish habitats are the most likely cause of the 50-percent decline in commercial landings of seatrout from historic levels in the 1950-60s. Limited data are available for historical comparison, but it appears that sea trout landings have remained relatively stable since the mid-1970s (*Figs. 2 and 3*).

Although surveys of recreational angling on the Bay have not been conducted in the past, baseline information now exists through the Sarasota Bay Program, for future comparison. The fishery data indicates that the average recreational angler in Sarasota Bay now

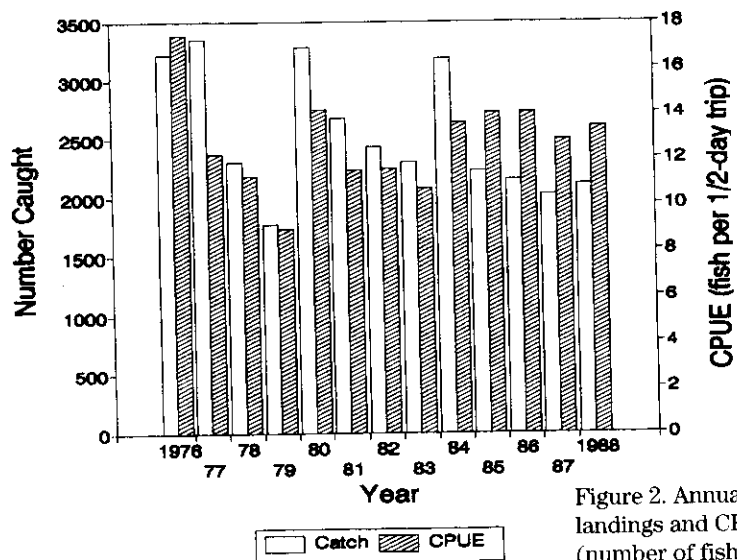


Figure 2. Annual landings and CPUE (number of fish landed per half-day trip) of Capt. Jonnie Walker.

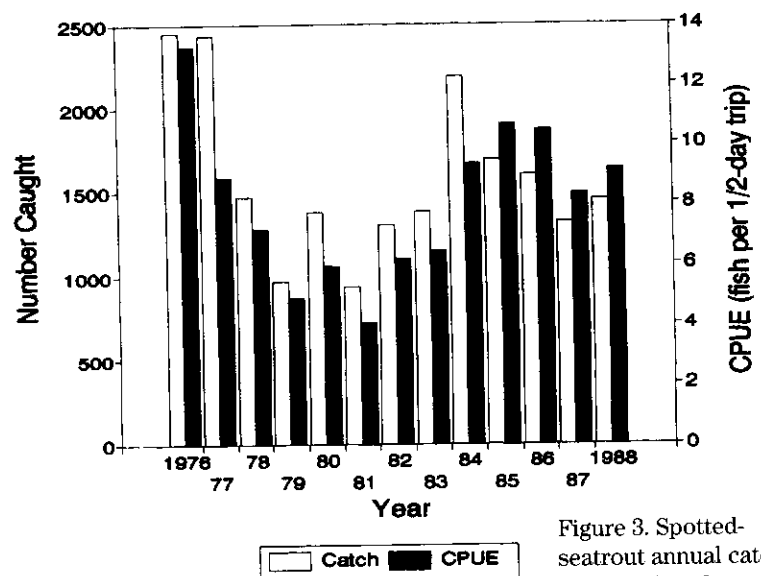


Figure 3. Spotted-seatrout annual catch (landings) and per catch per unit effort (CPUE) of Capt. Jonnie Walker.

catches one “keeper” fish every three to four hours, while the average angler hunting spotted seatrout requires up to 12 hours to catch a keeper.

Restoring water quality and fishery habitat such as seagrass beds, tributaries and intertidal zones in the Bay is expected to improve finfish and shellfish populations in Sarasota Bay from present conditions. Observations throughout the world indicate that habitat quality affects fishery abundance and diversity. As water quality degrades, seagrasses decline and, in general, areas of Sarasota Bay with less-productive seagrass meadows also have low numbers of fish.

In addition to improving existing habitat, the innovative technology of placing small artificial reefs adjacent to seawalls could substantially increase fish abundance in residential canals. In an Early Action Demonstration Project conducted by Mote Marine Laboratory for the Sarasota Bay Program, seawall reefs attracted more than 100 times the number of juvenile fish as seawalls without the artificial reefs.

Restocking the Bay with certain fish species from state hatcheries was considered by the Sarasota Bay Program. However, the only local, state-run hatchery — located in Manatee County — is dedicated for the next several years to raising juvenile fish to restock waters in Southeast Florida.

As habitats are being restored, it is important to protect existing fish populations. The Sarasota Bay Program could find no evidence of significant over-fishing by either commercial or recreational fishers in the Bay. The Program’s advisory committees determined that fishery harvest, a statewide management issue, is best addressed within the forums provided at the state level before groups such as the Florida Marine Fisheries Commission. Fishery regulations must be honored by all those harvesting finfish from the Bay. The population within the Sarasota Bay area has increased fourfold since 1950, and more than 80,000 saltwater fishing licenses have been issued in Manatee and Sarasota counties. It is critical that these harvesters honor catch limits and release fish that are not legal to keep or will not be used. Therefore, the community should support efforts to educate the public on appropriate angling practices.

While fishery harvest is managed at the state level, regional differences in species size and abundance should be further investi-

gated. The Sarasota Bay area could provide an excellent opportunity for state officials to test regionally specific harvest limits for various species. In addition, a limited-use zone is recommended for Sarasota Bay to test the advisability of reducing habitat disturbance in highly productive habitats. An area adjacent to Sister Keys in the central Bay is being considered for this test, which would be designed by a coalition of Bay users, scientists, representatives of conservation groups and appropriate agency personnel. The parameters for use of the area and monitoring protocol would be developed by this coalition.

As with finfish, shellfish populations are affected by loss of appropriate bottom habitat. Opportunities for harvest are limited by contamination from bacteria and heavy metals spurred by stormwater runoff. Currently only two small areas of Sarasota Bay are conditionally approved for shellfish harvest. Restoring shellfish populations is important for Bay water quality because these “filter feeders” help cleanse impurities from the water. In tributaries, appropriate stormwater treatment must first be provided to remove heavy metals and animal waste. Stormwater management should also moderate “pulses” of freshwater, which adversely affect shellfish reproduction. Improved wastewater treatment is also needed in some tributaries to prevent human bacterial contamination. Accumulated bottom sediments then may be removed or covered with clean sediment, and areas may be seeded with juvenile oysters or clams.

Bay scallops, on the other hand, may be more immediately restored to Sarasota Bay through relocating juvenile scallops from other locations to form breeding colonies. Scallops require healthy seagrass beds and good water quality. Baywide, 30 percent of seagrasses have been lost, and scientists believe loss of habitat and water-quality declines during past decades prevented the continued survival of these fragile creatures. In recent years, however, improvements in water quality have been noted in the central and northern Bay due to improved wastewater treatment. A 20-percent increase (125 acres) in seagrass coverage has been documented in the central Bay. This increase leads scientists to believe the time is right to reintroduce breeding populations of scallops into Sarasota Bay. An Early Action Demonstration Project conducted by Mote Marine Laboratory for the Sarasota Bay Program indicates some areas of the Bay may be appropriate for scallop colonization, and expansion of the effort is pending final analysis.



To protect seagrasses from scarring by boat propellers, a combination of improved channel marking and boater education is recommended. The central portion of the Bay alone has more than 900 markers. Many of these markers are superfluous, poorly maintained, illegal or provide limited navigational aid. For the sake of bottom habitats and boater safety, the Sarasota Bay Program recommends a comprehensive renovation of Bay signage, including clearly marking channels near highly productive seagrass meadows, as recommended in an Early Action Demonstration Project conducted by the Environmental Studies Program of New College for the Sarasota Bay Program. New College also introduced successful educational tools, including informative decals that are affixed to rental-boat consoles and a popular brochure explaining the issue and appropriate marine practices. Signs at boat ramps also appear to be effective in alerting boaters to seagrass protection.

The most significant increase in seagrass coverage can be achieved by improving water quality through reducing nitrogen loads in wastewater and stormwater (see Wastewater and Stormwater Action Plans). Research has shown a direct correlation between the depth of sunlight penetration and the depth to which seagrasses will grow. In many areas of the Bay, reducing nitrogen pollution that causes algae to increase in the water column would allow more light to reach seagrasses. In other areas, reducing nitrogen pollution would prevent overgrowth of algae on seagrass blades, which should increase the acreage and habitat value of seagrasses.

Along with nitrogen pollution, turbidity reduces light penetration. Turbidity occurs when sediments are suspended in the water, causing it to appear cloudy; turbidity can be caused by wind, waves and boat propellers. In the lower Bay, where the waterway becomes quite narrow, heavy boat traffic may contribute to higher turbidity. Slower boat speeds, required in the lower Bay to prevent boat collisions with manatees, may alleviate this effect.

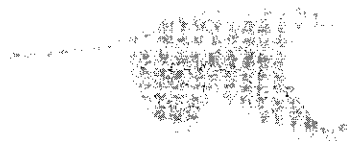
Additional seagrass acreage may be restored by repairing deep holes created by dredging. Approximately 15 percent (5,054 acres) of Bay bottom has been dredged, and some of those areas have become "sinks" that collect sediment and contaminants. The sediments are anoxic (no oxygen) or hypoxic (low dissolved oxygen) and can no longer support diverse aquatic life. Technology exists to fill dredge

holes with clean sediment to a depth where sunlight could reach seagrasses, which could be planted in the clean sediment to hasten habitat recovery.

Water circulation has major impacts on water quality and seagrass abundance, and is strongly relevant to the health of fishery habitats. The circulation model of Sarasota Bay provided through the University of Florida characterized two areas where circulation has been reduced by human activity: Little Sarasota Bay near the former Midnight Pass, and Palma Sola Bay north of the Manatee Avenue Causeway.

In 1983, a pass located between Siesta and Casey Keys was migrating north and threatening homes on the south end of Siesta Key. The homeowners received state and local government authority to close the inlet, known as Midnight Pass, and relocate it farther south. The homeowners' efforts to reopen the pass were unsuccessful, and the inlet closed. Subsequently, Sarasota County requested a permit to reopen the pass, which was denied by the state in 1991. The Sarasota Bay Program has completed technical work in Little Sarasota Bay as part of the analysis of Baywide environmental conditions. Those findings were presented in the "Framework for Action" report. Initial technical work raised more questions about the condition of Little Sarasota Bay, and additional investigations were conducted in 1993. *(Editors' Note: Further discussion of this matter is pending the outcome of facilitated, problem-solving forums.)*

Water circulation in northeastern Palma Sola Bay is affected by a causeway that is slated for reconstruction in 1996-97. The Florida Dept. of Transportation and the Sarasota Bay Program are integrating transportation and recreational improvements with options for improving circulation and restoring wetland habitat in the area (see Recreational Use Action Plan). Circulation may be enhanced by constructing culverts under the causeway.



Restore and sustain fish and other living resources in Sarasota Bay.

ENVIRONMENTAL

QUALITY OBJECTIVE:

Increase the overall productivity of Sarasota Bay through improved water quality and habitat, thus enhancing finfish and shellfish populations.

**Policies for Fisheries
and Other Living Resources**

- o Increase and protect fishery habitat, particularly for juveniles of recreationally and commercially important species.

This policy recognizes the need not only to protect habitat from further degradation and loss, but also to increase available fishery habitat. The policy also recommends an emphasis on habitat for juvenile fish in restoration efforts because of the significant historic losses in that category.

- o Protect existing fish populations.

This policy recognizes the need to maintain the status of fish populations while restoration efforts are pursued.

Finfish

Objective 1.0: Increase available habitat for juvenile fish in Sarasota Bay.

Action 1.1

Educate the public on the need for improved fishery habitat.

If the community is to support paying for projects and initiatives that improve fishery habitat, the public must be properly informed. Government agencies and private organizations seeking support for such activities should incorporate the Sarasota Bay Program's findings in educational programs.

Action 1.2

Restore, enhance and protect the value of saltwater wetlands as fishery habitats.

Saltwater wetlands are critical fishery habitat areas (see Wetlands Action Plan).

Action 1.3

Improve Sarasota Bay tributaries to restore the value of fishery habitats.

Activities affecting Bay tributaries — such as stormwater management projects, Bay-bottom habitat restoration or wastewater discharges — will seek to restore the tributaries as fishery habitat, particularly for juvenile fish.

Action 1.4

Install seawall habitat modules along seawalls and under docks where appropriate.

1.4.1. Encourage private-sector manufacturing and marketing of the most effective designs for these modules.

1.4.2. Encourage voluntary installation of habitats by homeowners through education, incentives and permitting assistance.

Objective 1.0: Responsibility, Financing and Timetables

Lead Organizations: Florida Sea Grant, Manatee County, Sarasota County.

Cooperating Organizations: Southwest Florida Water Management District, Florida Dept. of Environmental Protection, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, private industry.

Funding: It is anticipated that approximately \$30,000 will be made available by the Sarasota Bay Program to support enhanced education about juvenile fish in Sarasota Bay (subject to Management Conference approval) between fiscal years 1995-98.

Timetable and Status: Several agencies produce literature and other educational materials for schools and the general public. Materials distributed in the Sarasota Bay region would benefit from localizing issues and solutions for area residents and Bay users.

Objective 2.0: Protect existing fish populations.

Action 2.1

Establish a conservation area near Sister Keys with limited access or activity.

This project will be developed in a joint effort by appropriate agencies, Bay users and citizen groups. Consensus will be reached regarding access and activities allowed in the conservation area. Enforcement will also be addressed in developing the project.

Action 2.2

Promote catch-and-release and other angling practices to increase conservation.

Agencies and citizen groups involved in angler education will continue to emphasize conservation and integrate practical instructions for anglers into literature, classes or other educational efforts.

Action 2.3

Seek designation of Sarasota Bay as a test area for enhanced fisheries management measures combined with careful monitoring.

The Sarasota Bay area will work with the Florida Marine Fisheries Commission to test fishery harvest measures designed specifically for local conditions. The pilot program will be carefully monitored to rate the effectiveness of selected measures and assess the value of such an approach in other regions of Florida.

Objective 2.0: Responsibility, Financing and Timetables

Lead Organization: Florida Sea Grant.

Cooperating Organizations: Town of Longboat Key, other local governments, Florida Dept. of Environmental Protection, private organizations, Florida Marine Fisheries Commission, Sister Keys Conservancy, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Southwest Florida Water Management District, U.S. Fish and Wildlife Service.

Funding: It is anticipated that \$15,000 will be made available to support enhanced fishery protection

programs in the Sarasota Bay region through the Sarasota Bay Program (subject to approval by the Management Conference).

Timetable and Status: Begin in fiscal year 1995 to incorporate these policy, programs and permitting activities related to Sarasota Bay.

2.1 Establish conservation area fiscal year 1996-97.

2.2 Enhance catch-and-release through promotion in fiscal year 1996.

2.3 Begin development in fiscal year 1996; initiate pilot in fiscal year 1997.

Shellfish

Objective 3.0: Restore and enhance shellfish habitats.

Action 3.1

Reduce levels of contaminants in tributaries and restore natural stream flows to creeks and streams (see Stormwater Action Plan).

Action 3.2

Establish oyster reefs in appropriate locations in Sarasota Bay.

As bottom habitats are restored, deploy appropriate bottom structure to allow oysters to colonize.

Action 3.3.

Continue scallop seeding where water quality has improved.

Colonization of scallops can be used as an indicator of water-quality improvements in Sarasota Bay.

Objective 3.0: Responsibility, Financing and Timetables

Lead Organization: Florida Dept. of Environmental Protection.

Cooperating Organizations: Local governments, Florida Sea Grant, Mote Marine Laboratory.

Funding: It is anticipated that \$20,000 will be made available from Sarasota Bay Program funds between fiscal years 1996-98 for scallop and oyster seeding in the Bay area (pending approval by the Management Conference).

Timetable and Status:

3.1 See Stormwater Treatment and Prevention Action Plan for details on reducing levels of contaminants in tributaries and in restoring natural stream flows.

3.2 Begin in fiscal year 1997, pending approval by the Management Conference.

3.3 Begin in fiscal year 1997, pending approval by the Management Conference.

Bottom Habitats

Objective 4.0: Protect seagrasses from scarring by boat propellers.

Action 4.1

Improve channel marking on the Intracoastal Waterway (ICW) and connector channels Baywide. Use paired red and green U.S. Coast Guard-approved markers. Replace nonconforming markers and remove superfluous markers. Structural markers should be lighted where appropriate.

The West Coast Inland Navigation District, in cooperation with the U.S. Coast Guard and local governments, will work with boaters and other concerned citizens to develop a comprehensive strategy for improving the marking system in Sarasota Bay.

4.1.2.

Mark priority areas including but not limited to the entrance to Palma Sola Bay from the Intracoastal Waterway (ICW); the Longboat Pass connector with the ICW; Big Sarasota Bay dogleg near Sister Keys; the Big Pass connector with the ICW; and connectors between the ICW and neighborhoods Baywide. (This action provides a priority list for the effort described in Action 4.1 above.)

Action 4.2

Educate boaters on the need to protect seagrass beds.

Seagrass-protection information should be stressed in boater education courses, literature and signage with continued emphasis on production and distribution of decals for rental boats, as well as

informational brochures to be provided to boat registration offices. Comprehensive natural-resource-protection signage for boat ramps should be developed incorporating messages regarding seagrasses, marine mammals, marine debris and seabirds.

Objective 4.0: Responsibility, Financing and Timetables

Lead Organization: West Coast Inland Navigation District (WCIND).

Cooperating Organizations: Local governments, U.S. Coast Guard, Florida Sea Grant, private organizations, local sheriff's' departments, local tax collection offices.

Funding: It is anticipated that approximately 20 new markers will be needed in the Sarasota Bay region. Cost of the markers, depending on design, location and quality, is approximately \$1,000 each. Funding requests through local government to WCIND will be a part of the fiscal year 1995 budget process. It is anticipated that an additional \$10,000 will be made available to enhance boater education programs on resource protection (subject to approval by the Management Conference).

Timetable and Status:

4.1-4.1.2 Implement fiscal years 1995-2000.

4.2 Implement fiscal years 1995-97. Provide ongoing support.

Objective 5.0: Maximize opportunities for re-establishing and protecting seagrass habitat throughout Sarasota Bay.

Action 5.1

Implement water-quality improvement strategies to increase productive seagrass habitat (see Wastewater and Stormwater Action Plans).

Action 5.2

Using appropriate techniques, restore seagrass habitat in selected areas of disturbed Bay bottom by using dredge material to elevate the bottom to within six feet of mean sea level, pending outcome of demonstration project.

State environmental regulators have indicated they have concerns relating to the quantity of material and its disposition.

Action 5.3

Enforce boat speed limits in Little Sarasota Bay to reduce turbidity. (This action was implemented in 1993 as part of the manatee protection program.)

Objective 5.0: Responsibility, Financing and Timetables

Lead Organizations: Florida Dept. of Environmental Protection, local law-enforcement agencies.

Cooperating Organizations: Local governments, U.S. Coast Guard, Florida Sea Grant, private organizations and local sheriffs' departments.

Funding: Funding to improve water quality and improving bottom habitat is provided through the Stormwater and Wastewater Action Plans (see these Action Plans for details.)

Funding for Action 5.2 may be made available through the Pollution Recovery Trust Fund or the U.S. Army Corps of Engineers for bottom restoration if the pending Early Action Demonstration project is successful.

Funding for law enforcement on Sarasota Bay has been recently increased, and present funding levels appear adequate.

Timetable and Status:

5.1 See Wastewater and Stormwater Action Plans.

5.2 Pending outcome of benthic habitat repair action demonstration project.

5.3 Fiscal year 1995 through local law-enforcement agencies.

Objective 6.0: Enhance circulation in critical areas, recognizing species that will be impacted by circulation changes.

Action 6.1

Pending facilitated forums and results of additional technical work on Little Sarasota Bay by the Sarasota Bay Program, consider reopening Midnight Pass. (*Editors' Note: Additional information is pending completion of public meetings.*)

Action 6.2

Improve circulation in northeastern Palma Sola Bay during

reconstruction of the Palma Sola Causeway.

Objective 6.0: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, City of Bradenton, Sarasota County, Florida Dept. of Transportation.

Cooperating Organizations: Southwest Florida Water Management District, Florida Dept. of Environmental Protection, West Coast Inland Navigation District, U.S. Army Corps of Engineers.

Funding: It is anticipated that improvements on the Palma Sola Causeway will be included in the highway-improvement projects planned in fiscal year 1996. The Florida Dept. of Transportation has agreed to include culverts under the highway to increase water circulation in Palma Sola Bay. Culvert costs are included in the plans for the entire road project.

Decisions on Midnight Pass are pending mediated forums, scheduled for 1995, to be conducted by the Sarasota Bay Program.

Timetable and Status: Preliminary plans for installing culverts in the Palma Sola Causeway have been approved by Florida Dept. of Transportation. Construction is pending.

Decisions on Midnight Pass are pending ongoing mediated forums.

Measurements of success

- o Biological monitoring will show improvements in quantity and quality of fisheries and habitat.
- o Biological monitoring will show increases in scallop populations.

Anticipated benefits

- o The diversity and quantity of finfish and shellfish populations in the Bay will increase.
- o Recreational opportunities in Sarasota Bay will increase.

Action Update

For Sarasota Bay's fisheries to recover, water quality and habitats — particularly for juvenile fish — must be improved. Water quality in the northern and central regions of Sarasota Bay has re-

sponded favorably to upgrading of wastewater treatment plants, and the quantity and quality of seagrass habitat have increased. These signs bode well for the future of Sarasota Bay's fishery and serve as a valuable lesson for residents of the lower Bay, where improvements are planned in wastewater treatment. Additional measures to protect and restore seagrasses must include improving channel marking to help boaters avoid grassy shoals and expanding boater education programs regarding seagrass protection.

Circulation — the movement and mixing of water in the Bay — affects water quality and fishery habitat. Two areas of Sarasota Bay have received special attention regarding circulation: Palma Sola Bay and Little Sarasota Bay. In Palma Sola Bay, reconstruction of a causeway will provide an opportunity to improve circulation. The Sarasota Bay Program has not yet reached consensus on management options in Little Sarasota Bay, where closure of Midnight Pass altered circulation. *(Editors' note: Further discussion of this matter is pending national peer review of technical work and the outcome of facilitated, problem-solving forums.)*

Because they are prime areas for juvenile fish, restoring tributary and shoreline habitats is critical for restoring Sarasota Bay. Stormwater treatment programs in Manatee and Sarasota counties are being implemented and will have a profound, positive effect on tributary habitats by reducing pollutants, restoring natural patterns of freshwater flows and eventually restoring degraded bottom sediments. Additional intertidal wetland restoration is planned for shoreline habitats around the Bay, particularly near spoil islands created during dredging of the Intracoastal Waterway. A proposal has been submitted to the U.S. Army Corps of Engineers to launch a major restoration effort for those islands.

An artificial approach to enhance juvenile-fish habitats holds promise for the miles of Bay shoreline bordered by seawalls. Small, carefully designed reefs have been shown to be successful in research conducted in a canal community on Longboat Key. Following appropriate scientific and regulatory review, permitting, manufacturing and marketing of the reefs will be pursued.

As Sarasota Bay's water quality and habitat are restored, populations of most species of finfish and shellfish will increase. An exception is scallops, which require a "critical mass" of healthy adults to

establish a successful breeding colony. While scallops may be restored to Sarasota Bay through natural migration, it is possible to speed their recovery by transferring colonies from other locations. Recent tests in both Tampa and Sarasota Bays indicate that this may be possible as scallops have successfully spawned in Sarasota Bay and Tampa Bay.

Protection of existing fish populations from over-harvest is becoming increasingly important as the number of recreational anglers in the Bay increase. While anglers are encouraged to conserve fish populations through catch-and-release programs, a small area will be established in Sarasota Bay to test whether limiting use in a highly productive area of the Bay will help protect and restore fish populations. Catch and size limits specific to Sarasota Bay may also be tested.

What you can do about fisheries and other living resources

As an angler

- o Practice catch and release. Keep only those fish that are within legal size limits and that you will use.

As a boater

- o Use channel markers and current navigational charts to avoid running aground on seagrass beds.
- o Obey speed limits and no-wake zones to reduce turbidity (cloudiness) in the water and avoid collisions with manatees.
- o Take care during marine-engine maintenance to prevent oil, gas and chemical spills. Also, bring all trash back to shore for proper recycling or disposal.

As a property owner

- o Where seawalls exist, investigate opportunities to install an artificial reef to provide habitat for young fish.
- o Help reduce pollution of Bay waters to help seagrasses



recover (see Wastewater and Stormwater Action Plans).

- o Avoid pruning mangroves, and pursue opportunities for establishing a natural shoreline where appropriate (see Wetlands Action Plan).

As a civic group member or educator

- o Participate in efforts to establish a conservation area in the Bay to test the benefits of reducing habitat disturbance in highly productive areas of Sarasota Bay.

- o Educators can request presentations on fishery protection from Sea Grant Extension Service, Mote Marine Laboratory or local fishing guides. Educators also can arrange tours at Mote Marine Aquarium, the South Florida Museum (manatee exhibit) and the Florida Aquarium in Tampa to learn more about the Bay's living resources.





Recreational Use

Sarasota Bay, despite significant degradation from its pristine state, is still a beautiful, beckoning gem, a jewel that could be an even greater source of pride and economic advantage for the community.



Recreational Use



he number-one recreational use of Sarasota Bay is simply looking at it, according to a public opinion survey by the Sarasota Bay Program. The aqua-blue water that is present in many areas of the Bay is an important aspect of people's attraction to Bay waters. Sarasota Bay is also popular among local and visiting anglers and boaters; wildlife observation and swimming are other popular pastimes enjoyed in or near the Bay. Maintaining and enhancing these recreational opportunities is an important aspect of efforts to restore Sarasota Bay, and can help instill a sense of ownership and stewardship among area residents and visitors to help protect the estuary. Such a sense of ownership will also help generate public support for policies that require financial support or changes in behavior.

Sarasota Bay, despite significant degradation from its pristine state, is still a beautiful, beckoning gem, a jewel that could be an even greater source of pride and economic advantage for the community. Local governments, businesses and citizens can work together to promote the Bay as a significant recreational and educational opportunity for residents and visitors, avoid damage to the Bay's natural resources and develop long-term supporters and protectors.

A number of actions are being recommended to guide the genesis of this recreational policy for Sarasota Bay. High-use areas of the Bay deserve careful management strategies to improve public safety and increase user enjoyment. Channel markers and other Bay signage should be approached from a comprehensive perspective with an eye to resource protection, boater safety and aesthetic concerns.

Improved access and user education are priorities that can be combined into a tapestry of recreational opportunities that can increase awareness of Bay resources and the need to protect them. The National Park Service would be an excellent partner in establishing a “Heritage Trail,” using signs and literature to link environmental, educational, cultural and historical destinations around the Bay. The Park Service provides technical expertise to local communities seeking to develop such information.

Ultimately, emphasis on improving and managing the recreational opportunities related to Sarasota Bay can be a key to the Bay’s recovery.



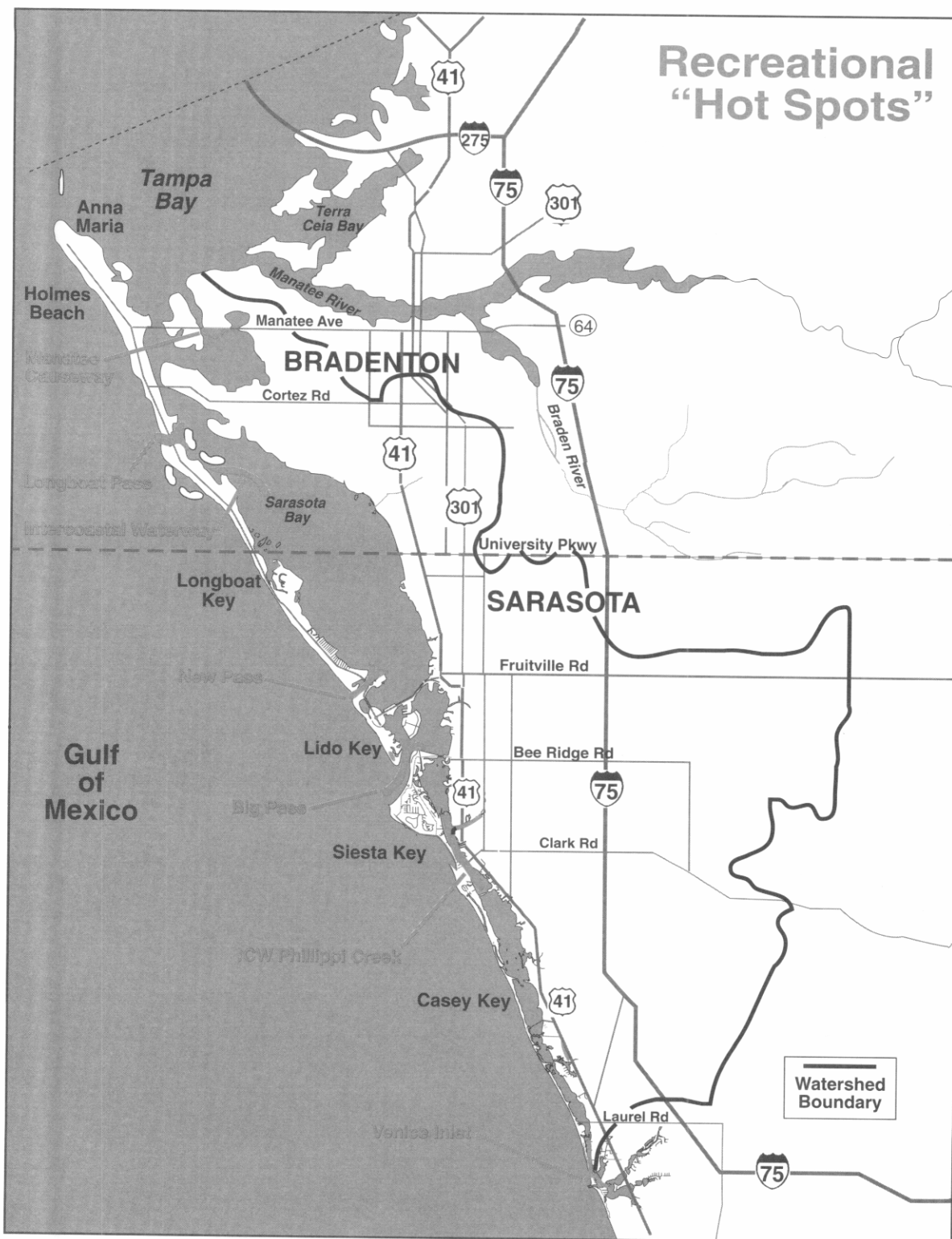


Figure 1. Areas of concern.

ACTION PLAN GOAL:

Provide increased levels of managed access to Sarasota Bay and its resources.

ENVIRONMENTAL QUALITY OBJECTIVE:

Recreational use of Sarasota Bay shall not adversely impact Bay resources.

Policy for Recreational Use

Enhance recreational opportunities on Sarasota Bay while protecting Bay resources.

This policy recognizes that recreational use of the Bay can and should be enhanced. Meanwhile, Bay resources must be protected or efforts to enhance recreation on Sarasota Bay will be self-defeating.

Objective 1.0: Improve management of existing high-use areas within the Sarasota Bay region.

Action 1.1

Develop management plans for the following areas, possibly including special recreational-use areas to protect Bay resources and enhance recreational enjoyment (*Fig. 1*).

1.1.1: Palma Sola Causeway. If the Manatee Avenue road enhancement project is completed, significant opportunities exist to improve water circulation and better manage multiple recreational uses in the Palma Sola Bay area (see Fisheries and Other Living Resources Action Plan).

1.1.2: Longboat Pass, New Pass, Big Pass and Venice Inlet, the Intracoastal Waterway (ICW) “dogleg” in the northern Bay near Sister Keys and the ICW near Phillippi Creek require additional management, particularly on weekends and holidays, to make recreation safer and more enjoyable.

Objective 1.0

Action 1.1: Responsibility, Financing and Timetables

Lead Organizations: Manatee County, Sarasota County, City of Bradenton, Florida Dept. of Transportation (FDOT), West Coast Inland Navigation District.

Cooperating Organizations: Other local governments, Bay users, City of Sarasota, local law enforcement agencies, Florida Dept. of Environmental Protection (FDEP).

Funding:

1.1.1 It is anticipated that funding for the proposed culverts to improve circulation will be made available through existing FDOT revenue as a part of the Palma Sola Causeway improvements. Additional funding will be pursued through the FDEP Pollution Recovery Trust Fund.

1.1.2 It is anticipated that funding for the development of special management plans for priority areas will be provided through the Sarasota Bay Program in the amount of \$20,000 pending Management Conference approval.

Timetable and Status:

1.1.1 Construction is scheduled for fiscal year 1996.

1.1.2 Funds will be made available in fiscal years 1997-98.

Action 1.2

Enforce boat speeds and no-wake zones in Sarasota Bay.

Objective 1.0

Action 1.2: Responsibility, Financing and Timetables

Lead Organizations: Florida Marine Patrol, local marine law enforcement, U.S. Coast Guard.

Cooperating Organization: Coast Guard Auxiliary.

Funding: Existing revenue allocated for local law enforcement programs will meet the needs of this action. Marine law enforcement activities have been significantly increased since 1989.

Timetable and Status: Ongoing.

Objective 2.0: Reduce recreational use impacts on fragile or threatened natural-resource areas within Sarasota Bay.

Action 2.1

Improve channel marking to protect threatened marine areas, such as seagrasses (for more information on a comprehensive revision of Bay markers, see Fisheries and Other Living Resources Action Plan).

Action 2.2

Post markers to discourage boats from approaching bird rookeries.

This action should be incorporated in the comprehensive signage improvement recommended in Action 2.1, and should be conducted in cooperation with the Audubon Society sanctuaries program, involved in the management of a number of rookery islands in the Bay.

Action 2.3

Discourage deliberate feeding of seabirds and marine mammals through education and/or signage.

Educational information for anglers and boaters, in particular, should incorporate this message to reduce injuries to or changes in behavioral patterns of birds and mammals.

Objective 2.0: Responsibility, Financing and Timetables

Lead Organization: U.S. Fish and Wildlife Service.

Cooperating Organizations: Local governments, private organizations, Florida Dept. of Environmental Protection, Audubon Society, Sarasota County Sheriff's Dept.

Funding: Funding for these actions will be provided through the Fisheries Action Plan Objective 4.0.

Timetable and Status: See Fisheries Action Plan 4.0.

Objective 3.0: Improve recreational access to Sarasota Bay.

Action 3.1

Facilitate neighborhood-initiated improvements for visual access to the Bay through the Florida Yards & Neighborhoods Program.

The Florida Yards & Neighborhoods Program, now coordinated through Manatee and Sarasota counties' Cooperative Extension Services, will provide liaison or referral service to other appropriate county departments to assist neighborhoods in environmentally appropriate projects to improve visual access to the Bay. Public money may or may not be provided, depending on local preferences (for Florida Yards & Neighborhoods status and funding, see Stormwater Action Plan).

Action 3.2

Enhance recreational use of publicly owned Bayfront land.

Local governments should place property in public ownership to maximize enjoyment of the Bay.

Action 3.3

Acquire undeveloped Bay shoreline as public recreation Bayfront parks or low-impact preserves.

Local government staff and citizen advisors will integrate Bay shore land into priorities for acquisition, conservation easements or other protection measures and develop public access to sites as appropriate.

Action 3.4

Identify Bay vista points in local comprehensive plans and consider them in landscaping, road-building and other construction.

Vista points should be defined through community consensus and continue to be incorporated into local comprehensive plans. The activities need to be coordinated with the local and state departments of transportation to maximize opportunities for improvement. Such a program should include a scenic vista network to promote Bay viewing.

Objective 3.0: Responsibility, Financing and Timetables

Lead Organization: Local governments.

Cooperating Organizations: Southwest Florida Water Management District, Florida Dept. of Transportation, Florida Dept. of Environmental Protection, National Park Service, private organizations.

Funding:

3.1 See Stormwater Action Plan Objective 1.0 for funding details.

3.2 Local and private resources are anticipated to contribute to development of this action.

3.3 Manatee and Sarasota counties have appointed citizen panels to review acquisition of lands for public ownership throughout the region. This process should be used to identify and prioritize lands for purchase in the Sarasota Bay area.

3.4 The Sarasota Bay Program will work with the National Park Service to develop a network of vista points. Sarasota Bay Program will provide \$20,000 toward development of this network (pending approval of the Management Conference). It is anticipated that matching funds and staff will be provided by the National Park Service.

Timetable and Status:

3.1 See Stormwater Action Plan.

3.2 Initiate review in fiscal year 1996; complete planning in fiscal year 1998. Implementation shall be concurrent as opportunities are assessed.

3.3 Integrate Bay priority areas into ongoing local government deliberations on environmental land acquisition.

3.4 Initiate in fiscal year 1996; complete in fiscal year 1998.



Objective 4.0: Improve education of recreational users to protect the resources of Sarasota Bay.

Action 4.1

Work with appropriate organizations to increase enrollment in boater education programs to promote better protection of Bay resources.

West Coast Inland Navigation District and local and state agencies will emphasize Bay resource protection in literature, curricula and other informational efforts aimed at boaters. Agencies will assist private-sector boating educators to emphasize resource protection in the courses.

Action 4.2

Target youths, tourists and visitors to improve awareness and sensitivity about the Bay.

Numerous opportunities exist to capitalize on local creative talent to promote Bay stewardship. This is an ideal niche for private organizations to assist in restoring Sarasota Bay. Government agencies providing funding for outreach activities should be aware of Bay issues and assist private organizations in focusing their events or projects on those priorities.

Objective 4.0: Responsibility, Financing and Timetables

Lead Organizations: Florida Sea Grant, local governments.

Cooperating Organizations: Florida Marine Patrol, Florida Dept. of Environmental Protection, West Coast Inland Navigation District, private organizations.

Funding: Funding for these initiatives will be provided through Fisheries and Other Living Resources Action Plan Objectives 1.0, 2.0, 3.0 and 4.0 (see these Action Plans for details).

Timetable and Status: See Fisheries and Other Living Resources Action Plan Objectives 1.0, 2.0, 3.0 and 4.0.

Objective 5.0: Promote the Sarasota Bay region as 'paradise' reclaimed.

Action 5.1

Develop and market a system of integrated recreational opportunities.

Local governments will seek assistance from the National Park Service in developing a plan, informational material and a promotional campaign linking existing historic, environmental and cultural locations around Sarasota Bay. This system will include identifying the area as a scenic destination and establishing vista points. Maps will be developed to provide visitors and residents with locations to view and enjoy Sarasota Bay.

Objective 5.1: Responsibility, Financing and Timetables

Lead Organizations: Local governments, National Park Service.

Cooperating Organizations: Private organizations, local chambers of commerce.

Funding: It is anticipated that \$20,000 will be made available through the Sarasota Bay Program (pending approval of the Management Conference) in fiscal year 1997 to support promotion of this area as paradise reclaimed.

Timetable and Status: Initiate in fiscal year 1996.

Action 5.2

Promote litter prevention throughout the Sarasota Bay region.

Stormwater runoff from land is a significant carrier of litter and debris to Sarasota Bay. Local governments must continue to strongly support anti-litter campaigns and existing volunteer clean-up efforts.

Objective 5.2: Responsibility, Financing and Timetables

Lead Organizations: Keep Manatee Beautiful, Keep Sarasota Beautiful.

Cooperating Organizations: Local governments, private organizations.

Funding: It is anticipated that a total of \$5,000 — \$2,500 to Manatee County, \$2,500 to Sarasota County — will be provided by the Sarasota Bay Program for this initiative (pending Management Conference approval).

Timetable and Status: Roadway and shoreline adoption programs are underway in Manatee and Sarasota counties, and support for those activities should be continued.

Measurements of success

- o Public-opinion evaluation will be used to determine whether recreational experiences improve for Bay users.
- o Roadway and Bay shoreline clean-ups will yield less debris as litter-prevention campaigns become more effective.

Anticipated benefits

- o Residents and visitors will gain greater enjoyment from recreation on Sarasota Bay.
- o Tourism and related businesses will benefit from enhanced recreational opportunities through better Bay management.
- o Public safety will be improved.

Action Update

Although avid users of Sarasota Bay are among some of the most ardent supporters of Bay restoration, increased recreational use of the Bay can bring increased problems. Management attention is required to resolve existing or potential conflicts between uses and to protect the Bay's natural resources.

In an effort to establish a balance between man and nature, development of management plans for high-use areas is slated to begin in 1995, with leadership provided by the West Coast Inland Navigation District, local governments and Bay users. The management plan for recreational use along the Palma Sola Causeway is likely to come first, since preliminary road improvements are scheduled for 1995-96. Water circulation in the northern portion of Palma Sola Bay will be addressed at the same time by installing culverts under Palma Sola Causeway, creating improved flushing.

Improving recreational access to Sarasota Bay will be an important step in increasing a sense of ownership and stewardship among area residents and visitors. The Florida Yards & Neighborhoods Program, launched in 1993, provides a useful forum for neighborhoods to seek technical assistance from government agencies on improving

visual access to the Bay without damaging Bay resources such as mangrove trees and marshes.

As for public Bayfront lands, the Sarasota Bay Program urges local governments to revise recreation plans to enhance those areas along the Bay that are suitable for public access. Both Manatee and Sarasota counties are developing priorities and funding sources for acquiring environmentally sensitive land, and the Sarasota Bay Program recommends that undeveloped Bayfront acreage be carefully considered in those deliberations.

Education of Bay users is another high priority. Work has begun on a video to enhance boater education courses with additional emphasis on natural-resource protection; the video is to be produced by Sarasota County with funding from the West Coast Inland Navigation District and the National Estuary Programs of Sarasota Bay and Tampa Bay. The production will be provided to boater education groups for use in their courses. Public-service announcements will also be produced for local television broadcasts. A comprehensive review of existing boater education curricula and potential enhancements is also planned in conjunction with organizations that provide boater education.

The National Park Service has expressed interest in providing technical assistance to develop a linked system of recreational, environmental, cultural, historic and possibly commercial destinations surrounding the Bay. (A similar project is being conducted by the National Park Service for the Chesapeake Bay Program.) This effort would help promote Sarasota Bay as both an active and passive recreational destination, enhance tourism and provide environmental education benefits.

What you can do about recreational use

As a civic group or educator

- o Participate in planning special management for high-use areas of Sarasota Bay.
- o Safe-boating instructors can incorporate Bay resource-protection messages in existing curricula to help raise boater awareness.
- o Assist local government efforts to place undeveloped Bayshore lands under protective status through acquisition, conservation easements or other means.



- o Advise local governments on ways to improve use and enjoyment of public Bayshore lands.
- o Promote litter prevention among group members or students (see Stormwater Action Plan).

As a Bay user

- o Avoid boating near bird rookeries.
- o Don't feed seabirds. Many injuries to seabirds occur when the birds are hooked as they pursue bait or fish on a line.
- o Don't feed marine mammals; feeding interferes with their natural behavior and is illegal.

As a business person

- o Boat rental and sales centers, travel agencies, hotels and restaurants can distribute literature that promotes environmentally friendly Bay recreation. Contact local and state environmental agencies and Mote Marine Laboratory for available literature, decals and other educational materials.






A detailed topographic map of the Sarasota Bay region, showing various landmarks, roads, and elevation contours. The map includes labels for 'Sarasota Pt.', 'Mira Mar Beach', 'Sarasota Pt. 12th', 'OVRD PWR, TV AND T CABS', 'Cable Area', 'Philippi Cr.', 'BASCULE BRIDGE', 'Slickney Pt.', 'White Beach', and 'Heron'. Elevation contours are marked with numbers like 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 22, 24, 25, 26, 27, 28, 29, 30. A large, semi-transparent white box with a thin black border is centered over the map, containing the title and a paragraph of text.

Governance to Oversee Implementation

The Sarasota Bay region continues to experience rapid population growth and increased development. The resulting impacts of pollutants and human use could further damage Sarasota Bay.

Governance to oversee implementation

 **S**arasota Bay, a small subtropical estuary on the southwest coast of Florida, is the center of a community of 500,000 people. The Bay's economic, aesthetic and recreational values make it a highly valuable asset to the community.

Like other areas of the United States and Florida, the region continues to experience rapid population growth and increased development, with population expected to grow by 25 percent during the next 10 years. The resulting impacts of pollutants and human use could further damage Sarasota Bay.

Since June 1989, the Sarasota Bay National Estuary Program has been assisting the Manatee-Sarasota community in developing and implementing a comprehensive strategy for restoring Sarasota Bay. By October 1994, total revenues for Program activities exceeded \$8 million. Approximately 50 percent of these resources are provided through federal funding through Section 320 of the Water Quality Act of 1987 — National Estuary Program; the remainder is provided by state and local governments and other federal agencies.

Fostering a cooperative spirit among federal, state and local governments and private citizens, the Program pursued a variety of technical, public outreach and early action projects to support development of the comprehensive management plan for the Bay. By June 1994, 43 projects had been approved by the Management Conference (see Actions Taken to Restore Sarasota Bay for details). Results of these projects have provided valuable information to the community and have been used to help formulate the comprehensive plan presented in this document.

The Management Conference began deliberating on Bay management issues in the fall of 1993. On February 24, 1994, after in-depth discussion, the Policy and Management Committees of the Sarasota Bay Program provided clear guidance for developing long-term Bay management options:

- o The Management Conference did not wish to establish another layer of bureaucracy.
- o The institution to be established should not have regulatory authority.

With these policies at the forefront, the Sarasota Bay Program's Citizen Advisory Committee took the lead in developing the Governance to Oversee Implementation Action Plan.

ACTION PLAN GOAL:

Establish an appropriate institutional structure to oversee implementation of Sarasota Bay Comprehensive Conservation and Management Plan.

ENVIRONMENTAL QUALITY OBJECTIVE:
Improve Sarasota Bay to the maximum extent possible, given best-available technology and economic constraints.

Policy for Governance

- o Oversee and promote implementation of the Sarasota Bay restoration plan to ensure effective participation of public agencies and private citizens.

Objective 1.0: Maintain the existing committee structure and appropriate support staff to ensure effective implementation of the Sarasota Bay Comprehensive Conservation and Management Plan.

(Editors' Note: The Management Conference agrees that the existing Management Conference structure was effective during the planning process and should continue during implementation).

Action 1.1:

Implement the Comprehensive Conservation and Management Plan (CCMP).

Action 1.2:

Support Clean Water Act reauthorization for continuing appropriation for Comprehensive Conservation and Management Plan implementation.

Action 1.3:

Designate Sarasota Bay (in 1995) as a State of Florida Surface Water Improvement and Management program priority water body.

Designation will improve opportunities for obtaining State implementation funds.

Action 1.4:

Conduct an independent strategic assessment of program performance at intervals not to exceed three years subsequent to approval by Florida's governor and the U.S. Environmental Protection Agency administrator.

Objective 1.0: Responsibility, Financing and Timetables:

Lead Organization: City of Sarasota.

Cooperating Organization: Sarasota Bay National Estuary Program Management Conference.

Funding: It is anticipated that the Sarasota Bay Program will receive approximately \$200,000 per year through Section 320, Water Quality Act, for fiscal years 1995-98, totaling \$800,000, for staff salaries and projects. Requests will be made to local governments for fiscal years 1995-98 in amounts no less than those shown below:

Sarasota County — \$50,000

Manatee County — \$50,000

City of Sarasota — \$33,000

Manasota Basin Board — \$133,000 for implementation of Program goals.

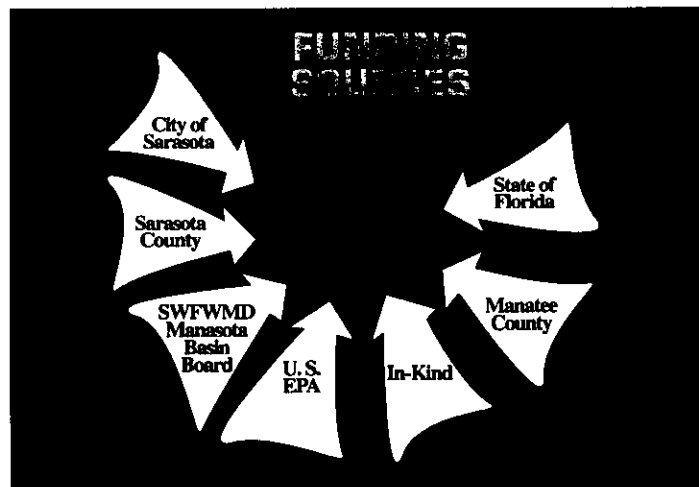
Total: \$266,000.

This commitment by local governments will ensure completion of the action plan elements listed in the Comprehensive Conservation Management Plan (CCMP).

Timetable and Status:

1.1: Complete fiscal year 1995.

1.2: Initiate fiscal year 1995; complete fiscal year 1998.



Immediate Action

- o Promote Clean Water Act reauthorization.
- o Designate Sarasota Bay as a priority Surface Water Improvement and Management Program water body.

Measurements of success

The Management Conference shall report to the people annually on progress made toward completing actions and achieving "Measurements of Success" listed in the Sarasota Bay restoration plan.

Anticipated benefit

Sarasota Bay should continue to show improvement through monitoring of Action Plan implementation as the CCMP is implemented.

Action Update

During the CCMP development process it was determined that the structure utilized throughout the planning phase was extremely successful and, therefore, should be continued during the implementation phases.

The Sarasota Bay National Estuary Program Management Conference consists of four committees: policy, management, citizen advisory and technical advisory. Following is a discussion of the roles and responsibilities of each of those committees:

Policy Committee

The Policy Committee establishes the general policies and goals for the Program and sets priorities by reviewing and approving annual budgets and workplans and evaluating progress in meeting the goals set forth by the Management Conference.

Management Committee

The Management Committee serves as liaison between the Policy Committee and the Technical and Citizen Advisory Committees. This committee advises the Policy Committee on all matters for which the various committees have direct responsibilities. The Management Committee regularly reviews workplans, funding plans, work products and all other activities of the Program and makes recommendations to the Policy Committee regarding the need for action on specific program needs. The Management Committee selects and approves contractors and approves changes in annual operating budgets.

Technical Advisory Committee

The Technical Advisory Committee's primary role is to provide technical advice and support to the Program. The TAC also reviews and comments on the technical content of the completed projects, offers suggestions and advice on implementation policies, reviews monitoring data and makes recommendations to the Management Committee on technical issues.



Citizen Advisory Committee

The Citizen Advisory Committee (CAC) provides a mechanism for structured citizen input to the Sarasota Bay National Estuary Program and assists in disseminating information relevant to the Program to the public. The CAC also helps establish Program goals and objectives, helps set funding levels, assists with public participation activities, communicates Program activities to user groups, provides public input on research priorities, reviews technical findings and helps further develop and implement the Comprehensive Conservation and Management Plan. The CAC works closely with the Program staff through the Project Director and the Public Communications Coordinator to assist in the development of an effective public education and participation program.

Roles of the committees during implementation

During the implementation phase, the Policy Committee will continue to make policy and budget decisions for the Program and will meet at least three times a year.

The Management Committee will continue to meet as necessary. In conjunction with the Citizen and Technical Advisory Committees, the Management Committee will work to integrate with the National Estuary Program and the Surface Water Improvement and Management (SWIM) Program managed by the Southwest Florida Water Management District.

The Citizen Advisory Committee will continue meeting on a regular basis and will assist Program staff on implementation efforts when public involvement and assistance is needed.

The Technical Advisory Committee (TAC) will continue to meet as needed to review future research and monitoring projects that will assist in determining the success of implementation. The expertise of the TAC should be relied upon to review projects for both the Sarasota Bay National Estuary Program and SWIM, following SWIM designation of Sarasota Bay by the Florida Dept. of Environmental Protection.

State of Florida involvement: ecosystem management

The State of Florida will continue to serve as the co-chair of the Policy Committee through the Florida Ecosystem Management Office

in the Office of the Secretary, Florida Dept. of Environmental Protection. Local restoration and permitting issues will be coordinated through the Tampa DEP district office. Sarasota Bay will continue to be used as a model for ecosystem management in Florida.

Southwest Florida Water Management District involvement

The Southwest Florida Water Management District (Swiftmud) has recommended inclusion of Sarasota Bay as a SWIM Program priority water body. This would make the Sarasota Bay watershed eligible for funding for certain restoration activities related to stormwater and habitat restoration. Approval of Swiftmud's recommendation occurred in 1995. With approval of the SWIM designation, the Policy Committee is coordinating activities to avoid duplication.

Staffing

The responsibility of the Program staff during implementation of the CCMP will be similar to those held during the planning phase. The Program staff will consist of a five-member staff during implementation: an executive director, program manager, technical planner, public communications coordinator and secretary. The responsibility of each staff member will be reviewed as the sponsorship is shifted from Swiftmud to the City of Sarasota to maximize efforts toward implementing the Comprehensive Conservation and Management Plan. During this time, position descriptions will be reviewed to determine accuracy and if any changes are necessary.

Program goals, 1995-98

During 1995, 1996, 1997 and 1998, the Program will continue to implement Action Plan elements approved by the Policy Committee in the CCMP. The Policy Committee will continue to review the workplan annually and approve projects and budgets based on available funding.

Program goals for the next four years include:

- o Effectively support and coordinate CCMP implementation activities throughout the region.
- o Attempt to attract significant resources to the community for CCMP implementation.

- o Produce a revised CCMP in 1998 which will outline implementation activities undertaken, Bay improvements, etc.

- o Address Federal Consistency Review of National Estuary Programs (report in preparation.)

Wastewater

- o Assist local governments in meeting wastewater treatment needs.

- o Assist in development of a regional wastewater reclamation plan.

Stormwater

- o Assist in implementing the Florida Yards & Neighborhoods Program.

- o Support construction of stormwater retrofit projects in priority watersheds identified in the CCMP.

- o Assist local governments in revising comprehensive plans.

Wetlands

- o Assist the community in restoring approximately 100 acres of intertidal habitat.

- o Educate the public regarding the importance of wetlands.

Fisheries and other living resources

- o Help market and deploy additional artificial reefs in canal-front communities.

- o Assist in establishing an aquatic preserve at Sister Keys.

- o Continue introduction of scallops to Sarasota Bay.

Recreational use

- o Work with the community to develop key vantage points around the Bay and develop a plan for implementing a system of scenic views through a heritage trail.

- o Promote the Sarasota Bay region to visitors and residents as "Paradise Reclaimed."

Stormwater

Florida Yards & Neighborhoods and SchoolYards Programs

This project will fully implement and further institutionalize the Florida Yards & Neighborhoods Program and the Florida SchoolYards Program into state, regional and local governments. The programs emphasize reductions in the use of pesticides and water and encourage broader use of slow-release fertilizers. The programs shall be coordinated with other water-conservation education programs and policies for integrated pest management.

Total Budget: \$110,000.

Local government comprehensive plan consistency

This project will assist local governments, through the comprehensive planning process and land-development regulations, to meet goals of the Sarasota Bay National Estuary Program, including reduction of the amount of existing impervious surface in the watershed. Alternatives will be explored for reducing hardened surfaces in future development.

Total Budget: \$80,000.

Wetlands

Protection and restoration

This ongoing work will enhance, restore and create wetlands throughout the Bay region. These activities will be led by a wetlands coordinator, in conjunction with local, state, regional and federal agencies as well as citizen groups. The coordinator will assist in integrating funding sources, facilitating permitting processes and advising the public and agency staff on technical aspects of projects. The coordinator will conduct periodic monitoring of wetlands to evaluate their condition.

Total Budget: \$135,000.

Education and outreach

This project will support ongoing education programs on wetlands protection, enhancement and acquisition, and particularly, mangrove protection and care.

Total Budget: \$15,000.



Monitoring and research

- o Continue to coordinate the regional ambient monitoring program.
- o Conduct additional research to determine regional sources and biological implications of nitrogen from atmospheric deposition as well as identify sources of toxics to the Bay.

Proposed projects

The following descriptions summarize projects scheduled for completion by the Management Conference during the next four years by various Action Plans. As the program expands, additional projects will be added.

Wastewater

Ordinance development

This project is a part of the local government comprehensive consistency work (see Stormwater 4.1). The Program will assist local governments in developing model ordinances consistent with wastewater treatment policies and other policies in the CCMP for inclusion in each of the local governments' comprehensive plans. Local governments, as part of the state required evaluation and appraisal process, are required to modify and update their comprehensive plans and strive for consistency with planning programs and surrounding local governments.

Total budget: \$40,000, included in Stormwater Action Plan.

Septic tank and wastewater education

This project will develop programs to educate the public about the need for consistent policies on wastewater treatment and regional reclamation.

Total Budget: \$35,000.

Regional wastewater reclamation plan

This project will assist local and regional governments in developing a regional approach to reclaim treated wastewater in the Southern Water Use Caution Area (SWUCA).

Total Budget: \$150,000.

Fisheries and other living resources

Juvenile fish habitat education

This project will educate the public on the need for improved fishery habitat, particularly for juvenile finfish.

Total Budget: \$10,000.

Artificial reef marketing

This project will encourage private industry to manufacture and market seawall habitat modules for voluntary installation by homeowners along seawalls and under docks where appropriate. Providing citizen education, incentives and permitting assistance is another component of this project.

Total Budget: \$20,000.

Sister Keys Aquatic Preserve

This project will establish a conservation area near Sister Keys with limited access or activity. The project will be developed in a joint effort by appropriate agencies, Bay users and citizen groups. Consensus will be reached regarding access and activities allowed in the conservation area. Enforcement also will be addressed in developing the project.

Total Budget: \$10,000.

Catch-and-release education and promotion

This project will promote catch and release and other angling practices to increase conservation. Agencies and citizen groups involved in angler education will continue to emphasize conservation and integrate practical instructions for anglers into information for distribution (*i.e.*, brochures, guides, videos, etc.), classes and other educational efforts.

Total Budget: \$5,000.

Scallop recruitment

This project will continue scallop seeding in areas where water quality improvement has been documented.

Total Budget: \$20,000.

Boater education

This project will educate boaters on the need to protect seagrass beds through boater education courses, literature, and signage. Continued emphasis will be placed on production and distribution of decals for rental boats, as well as informational brochures to be provided to boat registration offices.

Total Budget: \$10,000.

Recreational use

Special area management

This project will develop management plans for areas identified in the CCMP to protect Bay resources and enhance recreational enjoyment.

Total Budget: \$20,000.

Scenic view access plan

This project will facilitate neighborhood-initiated improvements to enhance visual or recreational access to the Bay. A plan will be developed identifying visual access points around the Bay and potential citizen groups for access plan implementation. Points will be included in the Sarasota Bay Heritage Trail, be developed with local governments, cultural and tourism interests, and other environmental education opportunities.

Total Budget: \$20,000.

“Sarasota Bay: Paradise Reclaimed” promotion

This project will promote the Sarasota Bay area as “paradise reclaimed” by developing a plan, informal material and promotional campaign linking existing historical, environmental and cultural locations around Sarasota Bay. Maps will be developed to provide visitors and residents with vista locations including restoration sites for popular viewing and enjoying Sarasota Bay.

Total Budget: \$20,000.

Anti-litter campaign

This project will promote litter prevention and continued volunteer clean-up efforts throughout the Bay area.

Total Budget: \$5,000.



Monitoring and research

Long-term water quality monitoring plan

Based on U.S. Environmental Monitoring Assessment Program protocol, a long-term water quality monitoring program will be undertaken by both Manatee and Sarasota counties. The program will ensure continuity among monitoring programs for Tampa Bay, Sarasota Bay and Charlotte Harbor and provide water quality trend information.

Total Budget: Resources for the long-term water quality monitoring program will be provided through existing local government budgets.

Seagrass mapping

To determine trends in seagrass coverage, aerial mapping and monitoring efforts must be repeated and analyzed. Data sets from Tampa Bay, Sarasota Bay and Charlotte Harbor would be consistent to provide a regional long-term trend in seagrass coverage in cooperation with the SWIM Program.

Total Budget: \$20,000.

Data Management

This project would place all water quality, fishery and sediment chemistry data into the STORET data base.

Total Budget: \$30,000.

Toxic Loads Identification

Surface sediments would be collected along transects of tributaries to Sarasota Bay. Sediments would be analyzed for lead, zinc, copper, mercury and aluminum content as well as grain size, moisture and organic content. Particular emphasis will be placed on identifying the source of elevated metals in Hudson Bayou, Whitaker Bayou, Phillippi Creek, Bowlees Creek and Cedar Hammock Creek, the five priority watersheds identified in the CCMP. With this information, areas with toxic sediments could be identified with greater precision, and possible contamination sources could be identified and acted upon.

Total Budget: \$100,000.



Atmospheric deposition assessment

Several stations would be established at the edges of Sarasota Bay (both mainland and barrier islands). Weekly integrated samples of bulk deposition would be collected and processed for nutrients and selected metals. Using this information, modes of deposition would be determined to assess the relative importance of rainfall vs. dry deposition. Better precision in the estimate of atmospheric contributions would help refine management expectations and perhaps provide additional impetus to control watershed sources.

Total Budget: \$100,000.

Governance

Economic analysis of Sarasota Bay

This project would determine the economic value of Sarasota Bay not only as an environmental resource, but as a recreational and commercial resource as well. Community support for restoration efforts could be further strengthened and restoration costs would be better substantiated by knowing the economic value of the Bay resource.

Total Budget: \$120,000.

Program administration and operations

Funding will provide staff and administrative support to:

- o Assist the Manatee/Sarasota community in effectively implementing the CCMP.
- o Continue the Sarasota Bay Management Conference structure for policy and decision making.
- o Communicate the CCMP and progress to the public.
- o Continue to develop support and seek resources for implementation efforts.
- o Develop budget initiatives for presentation to local governments.
- o Coordinate designation of Sarasota Bay in 1995 as a state of Florida Surface Water Improvement and Management Program (SWIM) priority water body. (*Editors' Note: Sarasota Bay was included as a SWIM priority water body in 1995.*)
- o Provide the Management Conference with periodic progress reports on CCMP implementation as well as other ongoing activities.

o Develop and produce a revised CCMP in 1998, including a report on the state of Sarasota Bay.

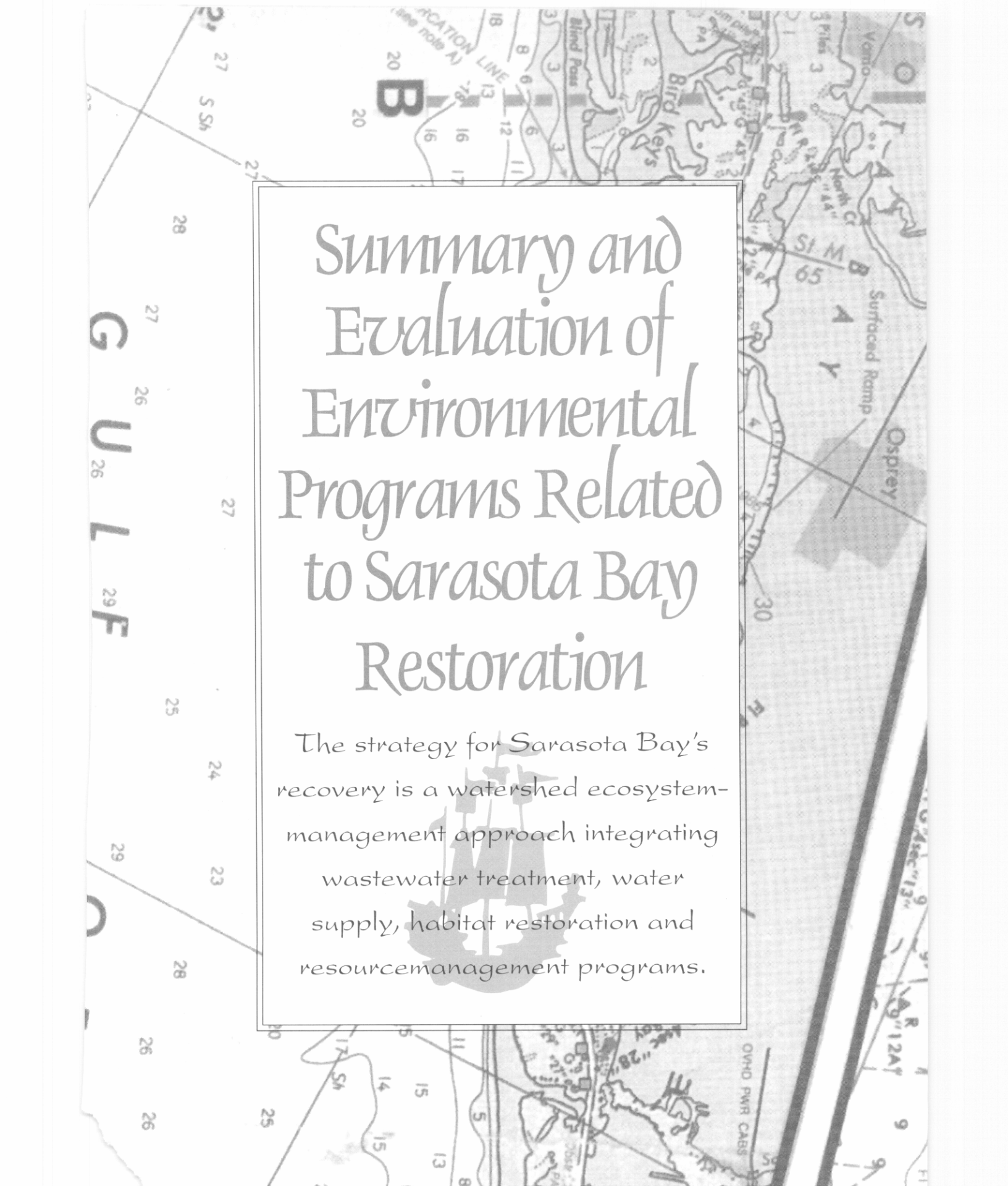
Total Budget: \$1,155,000 in fiscal years 1995 - 98..

What you can do to help Sarasota Bay

o Support clean-up and protection initiatives and vote for Sarasota Bay.

o Get involved in restoration activities.





Summary and Evaluation of Environmental Programs Related to Sarasota Bay Restoration

The strategy for Sarasota Bay's recovery is a watershed ecosystem-management approach integrating wastewater treatment, water supply, habitat restoration and resource management programs.

Summary and Evaluation of Environmental Programs Related to Sarasota Bay Restoration

Federal regulations pertaining to Section 320 of the Clean Water Act require each National Estuary Program to evaluate existing environmental programs in its region. This report is intended to meet federal requirements while providing a constructive assessment of agencies and programs that have major impact on Sarasota Bay.

In March 1993, the Sarasota Bay National Estuary Program released the "Framework for Action" report, the most extensive evaluation of any estuarine system in Florida. The report summarized three years of research on Sarasota Bay and presented the Program's preliminary management plan. The draft strategy provided in the "Framework for Action" was revised into the comprehensive plan for Sarasota Bay.

As part of this process, senior scientists and environmental managers were interviewed about the effectiveness of environmental programs in the region (DeMoss, 1992). The interviews built upon an earlier analysis of agency effectiveness (Freeman, 1990) conducted by the Sarasota Bay Program. These reports and subsequent research by Program staff are the basis for the following information.

Evaluation of environmental programs related to major Bay issues

Federal, state and local environmental programs in Southwest Florida are generally designed to protect the environment. These programs have successfully reduced pollutant loads from point-source discharges, slowed the loss of wetlands and slowed or reversed declines in some fishery populations. However, modeling and technical work completed by the Sarasota Bay Program suggest that existing policies and programs may not be adequate in the long term to restore coastal systems such as Sarasota Bay.

The Sarasota Bay Program promotes a policy of natural-resource restoration and enhancement in addition to anti-degradation. An immediate opportunity to reflect this proactive philosophy exists through Florida's water policy. Such a mission statement may encourage creative problem-solving and positive action. Regulators and managers may also be more inclined to amend rules or processes that express innovative efforts to restore or improve natural resources.

This approach is an integral, vital mechanism for reducing environmental impacts and enhancing natural systems. The state may determine that Florida's water policy should promote comprehensive watershed approaches integrating wetlands, wastewater, water supply and resource management programs.

The restoration plan for Sarasota Bay recognizes that people intervene in nearly every facet of the Bay's natural functions, and that those activities must be addressed in a proactive, integrated fashion. The following discussion presents issue-specific examples of regula-

tory policy that could be improved to facilitate Sarasota Bay restoration. Most policies also have implications for other coastal communities.

1.0. Wastewater treatment

Inadequately treated wastewater is a significant contributor of nitrogen to Sarasota Bay. Nitrogen is the limiting nutrient for algal productivity in the Bay; thus, excessive loads of nitrogen stimulate algal productivity that harms Bay resources. Wastewater treatment in the Sarasota Bay region (Anna Maria Island to the north, Venice to the south) is provided by 45,000 septic tanks, 71 small treatment plants and two regional treatment systems; the regional plants treat approximately 50 percent of the watershed's wastewater, with the remaining wastewater treated by septic tanks and small treatment facilities. Septic tanks and small treatment plants contribute more than twice as much nitrogen to Sarasota Bay as the two regional operations, despite having 50 percent of the volume.

Although past regulatory efforts have targeted regional treatment operations — successfully reducing nitrogen loads from those facilities — environmental risk associated with septic tanks and small treatment plants has received less attention at state and national levels. This unequal distribution of regulatory emphasis presents a significant long-term risk to Sarasota Bay and Florida's coastal ecosystems and results in an uneven distribution of treatment costs as residents in neighboring communities pay for varying methods and levels of wastewater treatment.

The Sarasota Bay Program has adopted a technology-based approach to wastewater, based on a consistent standard for the treatment level of effluent as it reaches tributaries or the Bay. A similar approach may be valid at the state level as well. The policy for Sarasota Bay states:

"All wastewater in the Sarasota Bay watershed shall be treated to meet or exceed Advanced Wastewater Treatment (AWT) standards by the time effluent reaches the Bay or its tributaries. (Secondary treatment can be an acceptable level of wastewater treatment if the treated wastewater is appropriately stored or used. Septic systems can be acceptable if the systems remove nitrogen or are located more than 900 feet from the Bay or its tributaries.)"

1.1. Septic tanks

Continued high-density use of septic tanks in Southwest Florida is a significant threat to coastal ecosystems. Conventional septic tanks are not designed to remove nitrogen, so nitrogen is readily introduced into groundwater and is slowly transported to receiving streams and, ultimately, to the Bay. Nationally peer-reviewed technical work by the Sarasota Bay Program estimates that septic tanks located within 900 feet of the Bay emit effluents that do not meet AWT standards as they reach surface waters — a condition inconsistent with Grizzle-Figg legislation governing wastewater disposal in Southwest Florida. Such areas are therefore not appropriate for traditional septic tanks, and should be part of a central wastewater treatment system.

Septic tanks also do not provide an opportunity for water reclamation. It is estimated that nearly eight million gallons per day (mgd) of reclaimable water are discharged through septic tanks in northern Sarasota County alone. As developers continue to install septic tanks, opportunities are lost for reclaiming water used by those homeowners.

The Southwest Florida Water Management District (Swiftmud) estimates that the Floridan Aquifer that provides water to the area is presently overpumped by approximately 50 mgd. This overusage threatens the integrity of the aquifer due to saltwater intrusion.

Regulatory authority for septic tanks

Florida Dept. of Health and Rehabilitative Services (HRS) is responsible for permitting of septic tanks in Florida. The department reviews septic tank applications for public-health risks from bacterial contamination or excessive nitrate levels in groundwater wells. In some areas of the state where groundwater levels are near the surface, such as in the Sarasota Bay watershed, HRS now requires that septic-system drainfields be located two feet above the seasonal high groundwater level. Although these regulations reduce health risks from bacteria, the environmental health risk of nitrogen contamination is not considered.

Reduced funding at the federal level for wastewater treatment infrastructure has slowed the ability of local governments to centralize wastewater treatment.

Ideas for improving septic tank regulation

The State of Florida should incorporate risks of groundwater pollution in septic-tank regulations, with appropriate agency monitoring and enforcement. Guidelines should be developed for regional septic-tank placement, considering soils, housing densities, water-table levels and proximity to bodies of water.

1.2. Small wastewater treatment plants

Seventy-one small wastewater treatment plants (less than 1 mgd treatment capacity) operate in the Sarasota Bay watershed, all located in Sarasota County. Some meet AWT standards, but many others do not, contributing nitrogen loadings to groundwater and the Bay from drain fields and percolation ponds. Such treatment systems can therefore operate similarly to septic tanks. Modeling by the Sarasota Bay Program indicates that small treatment facilities processing 600,000 gallons per day near a Bay tributary load nearly twice the nitrogen as a 7.3-mgd regional plant discharging directly to the Bay that meets AWT levels.

Although these plants meet state guidelines for discharge, these smaller operations are considered non-point sources of nitrogen to groundwater and are not regulated to the same extent as the large, regional plants with surface-water discharge. Regulatory emphasis on larger point-source discharges has effectively reduced nitrogen loads into Sarasota Bay by 25 percent since 1990. However, current regulations limit government's abilities to reduce non-point source loadings from smaller treatment plants and septic tanks, while discharge to surface waters from large facilities is strictly regulated.

Regulatory authorities for small treatment plants

The U.S. Environmental Protection Agency (EPA) and the Florida Dept. of Environmental Protection (DEP) have extensive regulatory authority over direct discharges to surface waters of the United States and Florida, respectively. Their authority over indirect discharges to surface waters via groundwater is limited.

Ideas for improving regulation of small treatment plants

In the near term, regulatory authority of small treatment plants

should be extended to the environmental risk associated with groundwater transport of nitrogen from drain fields and percolation ponds. These operations should be regulated in similar fashion to direct discharge operations by applying similar permitting, compliance and enforcement standards. Facilities unable to meet such standards in a reasonable length of time should be phased out of operation and replaced with regional wastewater treatment systems with water reclamation capabilities.

In the Sarasota Bay watershed, many small treatment plants near coastal waters should be upgraded or replaced. Many of these plants have been termed “antique” by regulators, and several have come under consistent regulatory scrutiny for various treatment or disposal violations. In addition, wastewater treated by many of these facilities cannot be reclaimed, causing the community to lose a valuable source of water. Regional treatment or mandatory water reclamation by private utilities would ensure opportunities for larger-scale water reclamation.

1.3. Regional wastewater treatment and reclamation

Saltwater intrusion has been identified as a major environmental issue in Southwest Florida. Swiftmud estimates that current demand on the Floridan Aquifer for potable water exceeds safe yield by 50 mgd. Swiftmud has proposed significant changes in permitting to limit use. Expansion of alternative sources such as surface-water systems in the Sarasota Bay area will increasingly be viewed as a viable potential water source. Reclamation of treated wastewater has tremendous potential as a sustainable water source for Southwest Florida.

More than 100 mgd of AWT effluent is discharged into Tampa Bay, Sarasota Bay and Charlotte Harbor. This effluent meets or exceeds Class I drinking water quality standards for all parameters except for total dissolved solids, and the effluent therefore is actually of better quality than much of the water pumped for potable use from wells or surface waters in Southwest Florida. As improved wastewater treatment is provided in areas served by septic systems and small treatment plants to protect coastal waters from pollution, more treated wastewater will be made available for reuse by the community.

Reusing treated wastewater on a regional basis would help give



the aquifer time to recharge through natural processes. In the future, highly treated wastewater may actually be returned to a reservoir, rivers or streams for later recovery for potable use. In Virginia, for example, effluent from several AWT facilities is discharged directly to the regional Occaquon Reservoir, after additional purification using charcoal filters, where it is later treated for potable use. If this cycle of water treatment and reuse were fully embraced in Southwest Florida, it would be possible to recharge the aquifer, augment surface-water resources, reduce pollutant loads and improve water quality and flows in rivers for fishery productivity.

The link between water supply and coastal ecosystem management is strong in the Sarasota Bay region, and integrating solutions to these issues makes economic and environmental sense. Two major wastewater treatment operations are located in the Sarasota Bay watershed: Manatee County's Southwest Regional Treatment Plant (13.5-mgd facility with Advanced Secondary Treatment, urban and agricultural reuse and deep-well injection) and the City of Sarasota's treatment plant (13-mgd facility with AWT and urban and agricultural reuse).

Analysis by the Sarasota Bay Program indicates that treated effluent produced by these facilities has minimal impact on the Bay for all conventional water-quality parameters. Treatment facilities that meet the wastewater policy recommended by the Sarasota Bay Program contribute four percent of the nitrogen load to the Bay. Septic tanks and small treatment plants that are not consistent with the policy are responsible for 16 percent of the Baywide nitrogen load.

In assessing remaining impacts of these operations on the Bay, it became clear that policies and regulations governing effluent storage and disposal should be improved to further limit wastewater nitrogen loads to Sarasota Bay and to vastly increase opportunities for reusing treated wastewater. An example is the City of Sarasota's wastewater treatment plant, now operating at less than its available capacity. Current federal and state permits regulating the plant's direct discharge to the Bay limit expansion of the plant's service area, even though such expansion would result in a net reduction of nitrogen loads to the Bay by servicing areas on septic systems and inefficient small treatment plants. However, wet weather conditions in the area limit conventional reuse opportunities, and reuse systems for agricul-

tural and urban irrigation generally reclaim only about half of yearly total flows due to wet weather conditions in the summer.

The City of Sarasota discharges approximately 50 percent of its AWT water to Sarasota Bay. In Manatee County, approximately 40 percent of the treatment plant's effluent is injected in a deep well due to wet weather conditions. In total, more than 9 mgd of reclaimed water is disposed of at the two facilities. At build-out, according to existing land-use plans, the Sarasota Bay watershed could generate as much as 50 mgd of reuse water.

Past efforts to pursue large-scale reclamation of treated wastewater have been unsuccessful in Southwest Florida due to the following permitting and policy constraints:

- o State water policy does not specifically list reclaimed water as a potential source of potable water.

- o Current state and federal regulations require that water injected into the Floridan Aquifer or surficial aquifers determined to be of drinking-water quality be treated to drinking-water standards first, which is a financially impractical option for reusing treated wastewater. In some cases, such as in the City of Sarasota, treated wastewater is of better quality for all parameters than water pumped from municipal wells.

- o Regulations encourage appropriate discharge of treated wastewater rather than wastewater reclamation. For example, treated wastewater could be used to create a freshwater wetland to help moderate stream flows and further "polish" the effluent, which could be reused after traveling through the wetland. However, discharge of treated wastewater through wetlands to surface waters has not been possible because phosphorus concentrations that naturally exist in the wetlands exceed the state's discharge limit to surface waters of 0.2 milligrams per liter (mg/l). Although phosphorus in the treated wastewater may be below the state's limit upon entering the wetland, the naturally high phosphorus levels in the wetland result in elevated levels at the point of discharge to surface waters.

Many rivers in Southwest Florida also have naturally high phosphorus levels; natural phosphorus levels in the Peace and Little Manatee rivers can be more than 5 mg/l, far exceeding state limits (0.2 mg/l) for waters discharged from wetlands, for example. Direct surface-water discharges, on the other hand, can be at 1 mg/l of phosphorus.

- o A variety of environmental policies prohibit storage of reclaimed water in reservoirs and phosphate pits because of possible infiltration to the Floridan Aquifer and phosphorus levels in water exiting such storage facilities.

- o Augmenting surface-water supplies with reclaimed water to offset withdrawal has not been sought by local governments due to permitting difficulties and the cost of moving established discharge points.

- o Studies conducted in Denver, CO, suggest that the public will consider reclaiming wastewater for potable supply as long as it is shown to be safe and necessary.

Regulatory authorities for water reclamation

The U.S. EPA, FDEP and Swiftmud regulate water reclamation.

Ideas for improving water reclamation

Florida's water policy should promote alternatives for storing and reclaiming water. The Sarasota Bay Program's policy states:

"Treated wastewater shall be reclaimed for reuse."

A similar statement may be applicable for other areas of the state. Meanwhile, FDEP and EPA should reconsider policies that limit storage and recovery options for reclamation and instead should promote such opportunities.

2.0. Stormwater

Stormwater is a major contributor of nitrogen as well as a major source of contaminants such as heavy metals and pesticides to Sarasota Bay. The Sarasota Bay restoration strategy recommends pollution prevention of stormwater runoff to limit nitrogen loads from stormwater, as well as stormwater treatment for reducing contaminant loads.

2.1. Pollution prevention

Although stormwater contributes approximately 45 percent of the nitrogen loaded into Sarasota Bay, nitrogen is not effectively removed from runoff through conventional treatment technologies. Although wet detention systems designed to meet state permitting criteria remove about 50 percent of nitrogen from stormwater runoff (Dye and Rushton, 1993), the range of efficiencies varies from 20-90

percent (Tomasko, *et al.*, 1993). Significant technical debate continues on whether nitrogen is removed by wet detention treatment systems or whether it percolates into groundwater to resurface elsewhere for transport to nearby surface waters.

Considering this important technical question, compounded by the high cost of retrofitting stormwater treatment facilities for nitrogen removal, the Sarasota Bay Program is not recommending regionwide retrofit of stormwater systems for nitrogen removal until additional technical analysis on this matter is completed. Retrofit is recommended in the five priority watersheds for toxicity reduction, re-establishment of natural stream flows and flood control. The Sarasota Bay Program recommends a strategy to reduce nitrogen loading from stormwater through voluntary improvements in landscape design and maintenance. Thirty percent of the nitrogen that goes into the Bay comes from stormwater runoff from residential land uses. Incorporation of low-maintenance landscape design and maintenance guidelines in development rules could be highly effective in preventing nitrogen and pesticide runoff from area communities.

2.2. Retrofit and treatment

Present stormwater management and permitting programs that require detention of the first inch of rain on-site are sufficient protection from toxic substances and sediments. Stormwater treatment structures provide flood protection and remove 80-90 percent of sediments and contaminants. Existing stormwater programs also reduce erosion from stream beds and banks in urban areas and can help maintain more-consistent stream flows. Many of these benefits will be lost, however, if treatment structures are not maintained. Many of the region's stormwater management structures are filling with sediments, which reduce their treatment abilities. Monitoring and maintenance to ensure the integrity of these facilities must be improved to ensure their effectiveness.

Regulatory authorities for stormwater management

Stormwater management has been regulated by local governments, the FDEP and Water Management Districts since 1984. The U.S. EPA recently began to emphasize stormwater management through the National Pollutant Discharge Elimination System (NPDES), which

requires local governments to seek a permit for discharge of stormwater runoff to surface waters.

Stormwater management is provided in Sarasota County by a Stormwater Environmental Utility (SEU) funded by a fee assessed to property owners. The SEU is developing master plans for the county's drainage basin; those plans will focus on water quality as well as flood control. In Manatee County, the SEU has been adopted, master planning has begun and a fee structure is being deliberated. The fee initially will be used to maintain existing stormwater treatment structures and will be revised to pay for improvements after master plans are completed for the basin.

Ideas for improving stormwater management

The State of Florida should conduct a thorough evaluation of nitrogen-removal efficiencies for stormwater treatment systems. The analysis should be designed to determine whether stormwater retrofit of entire watersheds can effectively reduce nitrogen loadings. All associated agencies should also promote preservation and creation of natural Florida landscapes on public and private lands. Local governments should incorporate low-maintenance, habitat-enhancing landscape design and maintenance guidelines in land development regulations. These guidelines should be tied to stormwater fee incentives to promote retrofit of landscapes in previously developed areas. Opportunities also exist for local governments to pursue these low-cost alternatives as a part of the NPDES stormwater management permitting process. Local governments should also be sufficiently staffed and trained to inspect stormwater treatment structures.

3.0. Wetlands

In the Sarasota Bay watershed, 39 percent of intertidal wetlands and 16 percent of freshwater wetlands have been lost since 1950. Although significant intertidal habitat-restoration projects have been developed by the Sarasota Bay Program, in partnership with the FDEP and local governments, prospects for restoring freshwater wetlands are less clear. Opportunities to restore wetlands in the urban area have become severely limited as development has replaced natural areas.

The creation of freshwater wetlands is not promoted on as large a scale as it could be through the permitting process. One reason

for the absence of effective mitigation may be that the state has documented numerous failures of wetlands restoration/creation projects conducted by the private sector to offset development. However, Florida has examples of manmade wetlands that have succeeded: consider the Orlando Easterly Wetlands Project, which “polishes” treated wastewater prior to discharge to the St. Johns River. The discharge from the wetland is of higher water quality than that of the river itself. The 1,200-acre wetland is also a highly productive wildlife habitat and environmental education tool.

Opportunities exist to create wetlands in the process of solving other regional problems, such as flood control, stream flow restoration, or wastewater storage, recovery and discharge.

Regulatory authorities for wetlands

Wetlands in the Sarasota Bay watershed are regulated by the U.S. Army Corps of Engineers, FDEP, Swiftmud and Manatee and Sarasota counties. Permit review is also provided by the U.S. Fish & Wildlife Service, U.S. EPA and other agencies.

Ideas for improving wetlands

Restoration of wetlands and monitoring of created wetlands deserves higher priority in agency management decisions. Protective regulations have slowed the loss of wetlands, but restoration or enhancement measures would be expedited by addressing the following:

- o Wetlands restoration and enhancement should be a strong goal of local governments through the appointment of a wetlands coordinator.

A primary mission of the coordinator should be facilitating restoration projects using stormwater, wastewater, etc.

- o The FDEP could be allowed, via legislative authority, to use a limited amount of Pollution Recovery Trust Funds to increase staff.

- o The FDEP could be provided legislative authority to expend a greater percentage of the trust funds annually.

- o Creation of wetlands for treatment of stormwater, in concert with conventional stormwater management systems, may be a viable alternative for nitrogen removal.

4.0 Fisheries and other living resources

The Sarasota Bay restoration strategy for fisheries focuses on improvements in water quality and increased habitat to provide opportunities for improved fishery productivity. Special attention to achieving this goal should be considered in decisions relating to intertidal wetland restoration, tributary restoration and freshwater in-flow. For example, permit decisions on placement of wastewater treatment discharges do not consider fishery productivity. Water-quality conditions adjacent to the discharge are of primary concern, but using wastewater to augment stream flows to optimize low-salinity regimes is not considered. In other states, such as Texas, water withdrawal credits are given for discharging highly treated wastewater to maintain flows. In Florida, highly treated wastewater could improve water quality of some rivers, particularly in Southwest Florida.

Regulatory agencies should promote the use of innovative technology, such as artificial reefs for seawalls, to increase sub-tidal habitat for fishery enhancement. The Sarasota Bay Program has determined that fishery harvest is a statewide management issue best addressed within the forums provided at the state level, such as the Marine Fisheries Commission. However, the Sarasota Bay area could provide a location for testing regional fishery management measures that would reflect regional differences in species abundance and size.

Regulatory authorities for fisheries

The Florida Marine Fisheries Commission recommends actions to the Florida Legislature for consideration. A debate is currently in progress on combining the Florida Marine Fisheries Commission and the Florida Game and Fresh Water Fish Commission.

Ideas for improving fisheries

Highly treated wastewater should be viewed by FDEP and U.S. EPA as a tool for enhancing water quality and stream flows to improve fishery productivity. Reclaiming wastewater for discharge through wetlands or to surface waters could actually benefit natural systems. Regulatory agencies should also facilitate permitting of artificial reefs for seawalls.

5.0. Recreational use

The primary recreational use of Sarasota Bay is viewing. The Bay is also popular with anglers and boaters. For the majority of the region's residents and visitors, a Bay view has been limited to what can be seen from their car. However, the advent of a series of intertidal wetland-restoration projects around Sarasota Bay provides more opportunities to enjoy the Bay with limited impact on the estuary. These projects also highlight the growing emphasis of local parks and recreation departments on enhancing recreational use of Bayfront lands while restoring natural functions that could significantly improve recreational opportunities along the Bay and helping to promote a sense of stewardship among residents and visitors.

In managing existing recreational use, communities also have opportunities to restore habitat. An example is the Palma Sola Causeway in Manatee County, where road improvements, recreational management and habitat restoration may be integrated in a comprehensive, interjurisdictional project involving municipal, regional and state agencies.

Sufficient enforcement of laws regulating recreational use of the Bay continues to be a source of debate. Limited enforcement manpower is often cited as a problem, yet numerous law enforcement watercraft operate daily in Sarasota Bay's 50 square miles. Improved boater education, channel marking and signage are recommended.

Regulatory authorities for recreational use

Local parks and recreation departments, in cooperation with natural resource departments, have jurisdiction over recreation and signage. The West Coast Inland Navigation District (WCIND) and U.S. Coast Guard have jurisdiction over channel marking and navigation in the Intracoastal Waterway system. The Florida Marine Patrol and various local government police forces have jurisdiction over boat operators in all other areas of Sarasota Bay.

Ideas for improving recreational use

Sarasota Bay is one of the region's most prized natural resources. Enhancing recreational opportunities should be a priority.

- o Local governments should consider adopting a policy to address Bayfront recreation, natural-resource enhancement and envi-

ronmental education on all public projects adjacent to Sarasota Bay.

- o The WCIND and U.S. Coast Guard should develop a proactive program to address inadequate signage in the Bay. Solutions should be developed with input from Bay users.

- o The community should continue to promote the Sarasota Bay area as a major scenic attraction.

6.0 Monitoring

Conflicting information on the quantity and quality of marine resources is common in Florida. Resources such as seagrass coverage or fisheries abundance continue to decline historically, despite a lack of negative trends in water quality monitoring programs. For example, the most recent 305(b) report by FDEP indicates that water quality in Little Sarasota Bay has been “stable” during the 10-year period since Midnight Pass was closed. However, Culter (1992) documented dramatic changes in benthic community structure in Little Sarasota Bay. These changes are thought to be related to the recurrent hypoxic conditions and periods of reduced salinity now experienced in that region of the Bay (Tomasko *et al.*, 1992), which are in turn attributed to changes in circulation and flushing (Sheng and Peene, 1992).

In addition, large-scale losses (more than 20 square miles) of seagrass coverage in southern Charlotte Harbor have been documented by Duke and Kruczynski (1992), despite a lack of trends in water quality (Montgomery, 1993), or actual positive trends in water quality (Coastal Environmental, 1993). To successfully evaluate the effectiveness of Bay restoration strategies, it will be necessary to combine traditional water quality monitoring programs with monitoring programs that focus more directly on living marine resources.

Regulatory authority for monitoring programs

The Florida Dept. of Environmental Protection is responsible for reporting on the status and trends of surface waters on a biennial basis. In Manatee County, the Environmental Action Committee is responsible for the actual monitoring of surface waters. In Sarasota County, surface water quality monitoring has been reimplemented under the direction of the county's Natural Resources Dept.

Ideas for improving monitoring programs

The Sarasota Bay Program has helped to implement a resource-based monitoring program in addition to a water quality monitoring program. At a minimum, aerial photography and ground-truthing of seagrass bed coverage should be conducted every two years. Randomly located transects should be visited on an annual basis to determine changes in depth limits, coverage and/or species composition of seagrass meadows. Such a program of resource-based monitoring would ensure continuity among Tampa Bay, Sarasota Bay, Charlotte Harbor and the Indian River Lagoon systems.

The water quality monitoring program is based on a stratified, random location of sampling sites. Circulation and benthic habitat work (compiled in the "Framework for Action" report) has been used to provide "regions" within which random selections have taken place. Monthly monitoring is essential to reduce data noise. This program ensures continuity among Tampa Bay, Sarasota Bay, Charlotte Harbor and the Indian River Lagoon.

Fisheries abundance should be monitored via the State of Florida's Fisheries Independent Juvenile Fish Monitoring Program. Recreational fish surveys (creel surveys, etc.) should be implemented on a biennial basis.

Wetlands monitoring should be performed on a five-year cycle. Such a monitoring program should involve the "quality" assessment that is part of work done for the Sarasota Bay Program (Estevez, 1992).



Conclusion

A more comprehensive, integrated approach to solving Bay and water-supply issues could significantly improve the environmental resources in the region. Adopting consistent policies for wastewater treatment and reclamation is the first step. Nitrogen loading to groundwater from septic tanks and small treatment facilities should be better documented throughout Southwest Florida, and appropriate regulatory measures developed.

Innovative approaches that link water supply and wastewater programs have tremendous potential, particularly as technology advances. Significant opportunities also exist to include wetland and fishery enhancement in regulatory decisions on stormwater and the treatment and reclamation of wastewater. Financial constraints and conflicts between human uses and the health of natural systems will require unprecedented creativity among regulators, elected officials and citizens if Florida's coastal resources are to be restored.

Literature Cited

Coastal Environmental Engineering, Inc. 1993. Status and trends in water quality in Charlotte Harbor. Draft report to the Southwest Florida Water Management District.

Culter, J. 1992. Estuarine bottom assessment. Pp. 8.1-8.18. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

Demoss, T. 1992. Governance study for Sarasota Bay. Final Report to the Sarasota Bay National Estuary Program. Sarasota, FL.

Duke, T., and Kruczynski, W. 1992. A summary of the report: status and trends of emergent submerged vegetated habitats of the Gulf of Mexico, USA. Pp. 11-28. *In:* *The Environmental and Economic Status of the Gulf of Mexico*. Gulf of Mexico Program. Stennis, MS.

Dye, C., and Rushton, B. 1993. *Proceedings of the third biennial stormwater research conference*. Southwest Florida Water Manage-

ment District.

Estevez, E. 1992. Tidal wetlands. Pp. 6.1-6.20. *In: (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) Sarasota Bay: Framework for Action.* Sarasota Bay National Estuary Program. Sarasota, FL.

Freeman, E. 1990. Toward restoration of Sarasota Bay: a study of the effectiveness of programs designed to protect Sarasota Bay. B.S. Thesis in Environmental Studies. New College. Sarasota, FL.

Montgomery, R. 1993. Current state of the Harbor. Presentation to Charlotte Harbor Conference. March 13, 1993. Punta Gorda, FL.

Sheng, Y.P., and Peene, S. 1992. Circulation and its effect on water quality. Pp. 5.1-5.18. *In: (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) Sarasota Bay: Framework for Action.* Sarasota Bay National Estuary Program. Sarasota, FL.

Tomasko, D.; Alderson, M.; Clark, P.; Culter, J.; Dixon, K.; Edwards, E.; Estevez, E.; Heyl, M.; Lowrey, S.; Sheng, Y.P.; and Steveley, S. 1992. Technical Synthesis Chapter. Pp. 14.1-14.16. *In: (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) Sarasota Bay: Framework for Action.* Sarasota Bay National Estuary Program. Sarasota, FL.

Tomasko, D.; Smith, H.; and Alderson, M. 1993. A watershed strategy for reducing toxin and nutrient loadings from stormwater runoff in Sarasota Bay, Florida. Pp. 73-78. *In: (C. Dye and B. Rushton, eds.) Proceedings of the third biennial stormwater research conference.* Southwest Florida Water Management District.





Summary of Technical Investigations on Sarasota Bay

The extent and severity of the problems within Sarasota Bay are more substantial than originally believed, particularly in regard to the levels of toxic contaminants found in tributaries and the degree of habitat loss.

Summary of Technical Investigations on Sarasota Bay

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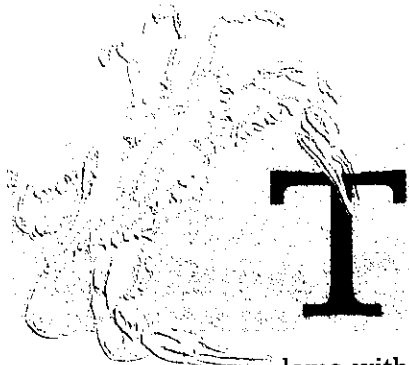
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The extent and severity of the problems within Sarasota Bay are more substantial than originally believed, particularly in regard to the levels of toxic contaminants found in tributaries and the degree of habitat loss. Metals contamination, in addition to contamination from pesticides and polychlorinated bi-phenyls (PCBs), is believed to be a significant issue in Hudson Bayou, Cedar Hammock Creek, Bowlees Creek, Whitaker Bayou and Phillippi Creek.

While these locations comprise a relatively small proportion of the total area of Sarasota Bay, they make up a large proportion of the extremely important low-salinity nursery habitat for Sarasota Bay's fisheries. Tidal wetlands, an important nursery area for early juvenile finfish and shellfish, have declined by 46 percent during the past 40 years.

Oysters from tributaries with sediment contamination had elevated levels of copper and zinc compared to other sites in Florida, and had greatly elevated levels of lead when compared to both state and national data sets. This information indicates that contamination by metals—the product of stormwater runoff and possibly unidentified point source discharges—is an important issue in Sarasota Bay.

Stormwater pollution is also the major source of nutrient loadings, accounting for approximately 45 percent of the nitrogen and phosphorus entering Sarasota Bay.

Nutrient pollution is an important issue, since Sarasota Bay currently receives approximately three times as much nitrogen as would be loaded from a pristine, undeveloped watershed (M. Heyl, personal communication). Nitrogen enrichment is associated with degraded seagrass meadows; the lushest, most productive meadows are found in waters receiving minimal nitrogen loads. It is also apparent that circulation and flushing patterns play an important role in determining the magnitude of water-quality degradation associated with nutrient overenrichment in the Bay.

Data from continuous monitoring of dissolved oxygen (D.O.) and faunal utilization studies suggest that the State of Florida's Trophic State Index (TSI) can fail to identify critically stressed Bay habitats as such. The TSI classifies almost all of Sarasota Bay as "good," with only Little Sarasota Bay ranking a "fair." However, the index does not contain a specific term for critical sags in near-dawn D.O. levels. Preliminary data from ongoing studies indicate that a value lower than the current state standard of 4 milligrams O₂/liter (mg/l) might be more biologically relevant.

Impacts of Pollutants on Sarasota Bay

Metals

Habitats located outside the mouths of the tributaries feeding into Sarasota Bay do not appear to be heavily impacted by metals contamination (Dixon, 1992; Lowrey, 1992). The data from the sediment and shellfish contamination studies indicate that elevated metals concentrations appear primarily in the tributaries, with anthropogenic (human-induced) enrichment typically increasing as one progresses upstream.

Areas showing significant amounts of metals include Hudson Bayou, Cedar Hammock Creek, Phillippi Creek, Whitaker Bayou and Bowlees Creek, as well as areas near points of substantial stormwater runoff. Levels of mercury in shellfish (the only regulated metal) were below federal action limits for health and safety, but shellfish concentrations were well above Florida averages for lead, zinc and copper.

The routes of entry for metals into Sarasota Bay vary. Most zinc entering Sarasota Bay appears to come from direct atmospheric deposition and precipitation, while most lead enters via stormwater runoff (Camp Dresser & McKee, 1992). Metals deposited on paved surfaces by direct atmospheric deposition are then incorporated into stormwater runoff.

The routes of entry into Sarasota Bay for metals other than lead and zinc have not been determined, but they might be expected to follow a similar pattern as in other major estuaries. Data from Chesapeake Bay indicate that in addition to zinc, significant amounts of lead, copper and cadmium enter the Bay via direct precipitation on the open water (Haberman *et al.*, 1983). Lead and cadmium are incorporated into stormwater runoff via dry deposition of automobile exhaust onto paved surfaces, as well as through the deterioration of brakes and tires (Haberman *et al.*, 1983).

Another source of metals contamination is marine activities. In Chesapeake Bay, copper loadings related to boaters' use of antifouling bottom paints were thought to equal loadings from industrial and municipal sources (Haberman *et al.*, 1983). With

more than 30,000 registered boats in Manatee and Sarasota counties, the potential role of antifouling paints on copper loading into Sarasota Bay deserves further attention. In addition, the use of copper-containing herbicides for weed control along roads may be associated with elevated copper levels found in the sediments of stormwater-control structures (Lowrey, personal communication).

In some tributaries, problems with metals enrichment are exacerbated by contamination from pesticide residues and PCB's (Dixon, 1992; Lowrey, 1992). The biological consequences of synergistic effects between different metals or between metals and pesticides residues are mostly unknown. However, by definition, synergistic effects are greater than the sum of individual effects. More detailed investigations would seem appropriate to determine the biological effects of sediment contamination by multiple factors.

Low-salinity habitats are essential for juvenile snook, redfish, tarpon, spotted seatrout, striped mullet and pink shrimp (Edwards, 1991). As these areas become increasingly contaminated by various toxins, both lethal and sub-lethal effects would act to reduce the sizes of future populations of recreationally and commercially important species (Haberman *et al.*, 1983).

Role of nutrients

The availability of nutrients plays an important role in determining the trophic status of Sarasota Bay. Nitrogen, rather than phosphorus, appears to be the primary limiting nutrient in both Tampa Bay, to the north (Johansson, 1991), and Charlotte Harbor, to the south (Montgomery *et al.*, 1991). The damaging effects of nitrogen enrichment include additional factors other than increased abundances of phytoplankton (*Fig. 1*). Under conditions of increased nutrient availability in the water column, one would also expect elevated levels of epiphytic algae (which would shade seagrasses), and greater amounts of drift algae (capable of shading seagrasses and producing recurrent low near-dawn dissolved oxygen levels). Seagrasses, on the other hand, draw on nutrient supplies in the sediments. With lower nutrient loads, less algae can be supported.

Baywide, approximately half of all nitrogen and phosphorus loadings come from stormwater runoff, and roughly one-quarter of loadings come from direct atmospheric deposition (CDM, 1992). The



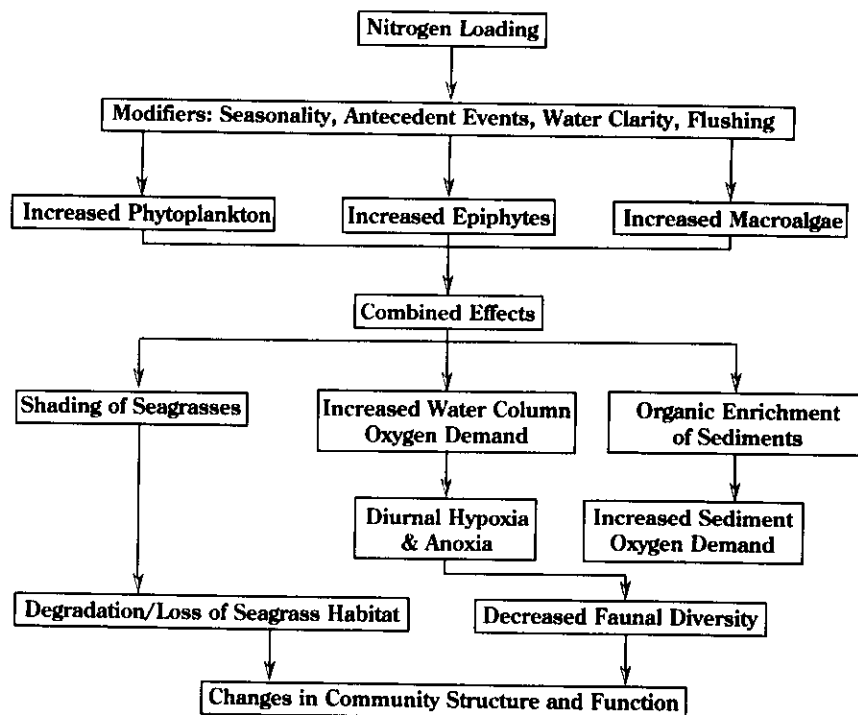


Figure 1.

remaining nutrient loads are divided among baseflow (groundwater contributions to tributaries), septic tanks and point sources.

Wastewater

Point sources of pollution can cause localized water quality problems, but the overall status of water quality in Sarasota Bay does not seem to be strongly impacted by point sources of pollution (CDM, 1992). In addition, many point sources of nutrient pollution have been upgraded in recent years. The documented reduction over time of phosphorus and nitrogen levels in waters offshore of Whitaker Bayou (Lowrey, 1992) may be associated with the upgrade to nutrient-removal technology at the City of Sarasota's wastewater treatment plant.

While not prominent Baywide, septic systems play a significant role in nitrogen loading in segments of Sarasota Bay whose watersheds have concentrations of septic tanks. In Roberts Bay, septic tanks are thought to contribute approximately 27 percent of total nitrogen loads (CDM, 1992). While properly functioning septic systems may not pose health problems, their primary function is that of minimizing health risks through reducing bacterial contamination rather than removing nitrogen and phosphorus in effluent.

For the soils characteristic of the Sarasota Bay region, carbonate binding sites generally prevent groundwater transport of phosphorus to nearby surface waters (Institute of Food and Agricultural Sciences, 1985). In contrast, the processes of absorption, biological uptake, denitrification and volatilization might remove only 20-40 percent of the nitrogen load before septic-tank effluent reaches groundwater (IFAS, 1985).

Once in the groundwater, nitrate is relatively free to travel, as opposed to ammonium, which might still absorb onto binding sites. The method used in the 1992 CDM study to calculate the impact of septic tanks on nitrogen loadings is the best effort to date for the Sarasota Bay area, as it was locally calibrated using data on nutrient concentrations in receiving waters.

By combining information on soil types, percolation rates and horizontal-groundwater travel times, an algorithm was produced that relates groundwater nitrogen concentrations to the distance from known nitrogen sources (CDM, 1992, Appendix B). This algorithm calculates that, given local soil conditions, a distance of 900 feet is sufficient for the processes of microbial uptake, denitrification and ammonium absorption to lower the nitrogen concentration of septic-tank effluent to levels equal to or lower than that of advanced wastewater treatment (AWT) effluent. In other words, no better treatment technologies exist to reduce nitrogen loads any further. This relationship was then used as the basis for the 900-foot setback distance for septic tanks in coastal areas.

In parts of the Bay watershed, particularly in Sarasota County, package sewage treatment plants are common. The levels of treatment and means of effluent disposal for these plants vary. Plants with direct surface discharge must meet state-mandated rules of AWT levels for biological oxygen demand, total suspended solids, total nitrogen and total phosphorus [respectively, 5, 5, 3, 1 (mg / l)]. In contrast, several plants treat effluent only to secondary levels, with up to seven times the nitrogen concentration of AWT effluent (approximately 20 mg/l) and four times the phosphorus concentration of AWT effluent (approximately 4 mg/l).

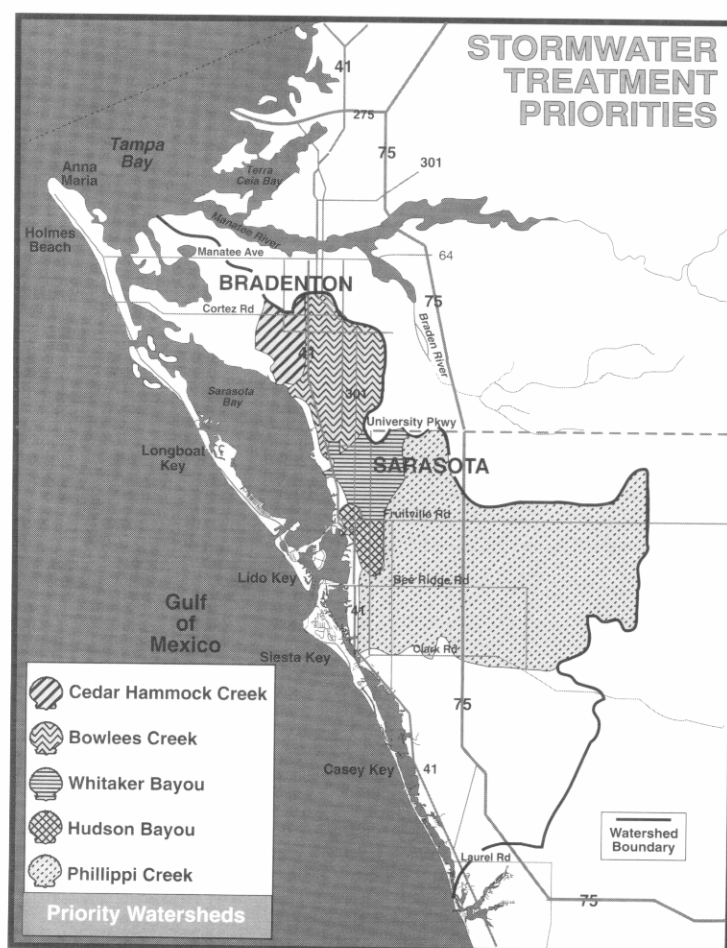
If percolation ponds are used for these secondary treatment plants, the nutrient-loading potential for these plants can be estimated using information on groundwater migration of nutrients within sep-

tic-tank effluent streams. In certain areas, package plants with secondary treatment and percolation ponds can be larger contributors to nitrogen loads than direct surface discharges of effluent (Tomasko, unpublished data). Consequently, replacing septic systems with secondary treatment plants that use percolation ponds for treatment may exacerbate problems in some areas, and might not result in any reductions in total nutrient loadings to nearby surface waters. Connecting septic systems to secondary plants with reuse of effluent, or to advanced wastewater-treatment plants with or without reuse, would be the only way to ensure a decline in nutrient loads associated with wastewater.

Stormwater

Stormwater loadings of nitrogen and phosphorus would be expected to decrease if agricultural land is replaced by residential land uses (CDM, 1992). However, if natural areas are developed for

Figure 2.



housing, stormwater loadings of nutrients would be expected to increase (data from CDM, 1992). Estimates of nutrient-removal efficiencies of wet detention ponds, the most common stormwater treatment systems in use, average only 50-percent removal for nitrogen (data from Tomasko *et al.*, 1993). Consequently, if half the entire watershed were retrofitted with stormwater structures for nitrogen reduction (an improbable event), nitrogen loads would be reduced by less than 13 percent

Baywide. The somewhat limited return on investment from stormwater retrofits for nutrient removal has resulted in retrofits mainly being considered where toxin pollution is a major issue (*Fig. 2*).

Approximately 40 percent of Sarasota Bay's watershed is in residential land use (CDM, 1992). Due to extensive use of lawn fertilizers, the nutrient concentration of runoff from residential areas is second only to various agricultural land uses (CDM, 1992), and residential stormwater runoff is thought to contribute as much as 30 percent of total nitrogen loads to the Bay. Consequently, source control of nutrient runoff (*e.g.*, educating homeowners as to the impacts of lawn fertilizers, etc., on Bay waters) is an essential tool for improving water quality in Sarasota Bay.

Connections between nutrient loads, water quality and seagrasses

Seagrasses are among the most important habitats in Florida's estuarine environments, indispensable for the role they play in nutrient cycling, primary production, sediment stabilization and as habitat for juvenile and adult finfish and shellfish (see reviews in Zieman, 1982; Thayer *et al.*, 1984). These underwater meadows cover nearly 26 percent of the bottom of Sarasota Bay, or 8,319 acres (Culter, 1992).

The most-often-cited cause of seagrass decline and disappearance worldwide is that of anthropogenic nutrient enrichment of nearshore waters (Larkum, 1976; Kemp *et al.*, 1983; Cambridge & McComb, 1984; Orth & Moore, 1984; Silberstein *et al.*, 1986; Neverauskas, 1987; Valiela *et al.*, 1990; Reyes & Merino, 1991; Tomasko & Lapointe, 1991; Lapointe *et al.*, in press), mostly through the processes of increased abundances of epiphytic algae, macroalgae and phytoplankton. The nutrient-loading evaluation for Sarasota Bay provides useful data on the sources and quantities of nutrient loading on a watershed-by-watershed basis, thus allowing a direct comparison between nutrient loads and seagrass responses. Also, traditional monitoring programs can be used to determine the relationships between modeled nutrient loads and water-column parameters.

Within a given area, with hydraulic variables remaining similar from measurement to measurement, water quality can correlate well with loadings. A comparison of nitrogen loadings vs. Chlorophyll *a* levels in Hillsborough Bay (a part of Tampa Bay) shows a clear pattern over a

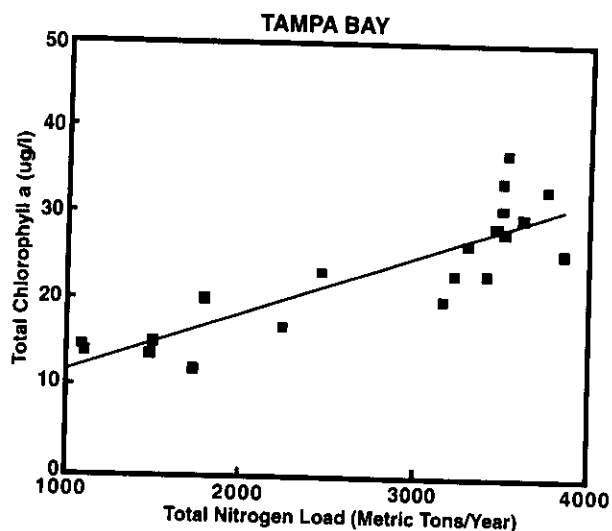


Figure 3.

concentrations are slightly higher in the waters off Perico Island, compared to Siesta Key, despite watershed nitrogen loads only 12 percent that of waters off Siesta Key. Clearly, traditional water-quality parameters do not sufficiently characterize the amount of nitrogen loaded into nearshore waters of Sarasota Bay.

This lack of fit between modeled nitrogen loads and measured water quality in Sarasota Bay led Tomasko *et al.* (in review) to model the relationship between nitrogen loads and areal seagrass biomass

period of 22 years (Fig. 3).

In contrast, water-quality parameters did not clearly reflect differences in watershed nutrient inputs in Sarasota Bay (Table 1). Despite having a nitrogen load 12 times higher than Leffis Key, the waters off Siesta Key have annual average total nitrogen values only 21 percent higher than Leffis Key. Additionally, Chlorophyll *a* concen-

Table 1.

Nitrogen loads, flushing rates, and water-quality parameters for Bay segments containing study sites.				
Site	Annual Nitrogen Load (kg TN/yr)	Flushing Rate (% in 10 d)	Annual Avg. TN (mg/l)	Annual Avg. Chl/g (mg/L)
Siesta Key	219,098	76	0.73 (0.34)	8.38 (2.18)
Raccoon Key	85,713	81	0.62 (0.24)	4.86 (1.21)
Perico Isle	28,355	81	0.60 (0.28)	8.46 (3.15)
Leffis Key	17,994	64	0.60 (0.24)	4.50 (1.35)

and productivity (Figs. 4 and 5). Areal biomass (at similar depths) was negatively correlated with watershed nitrogen loads ($R^2 = 0.584$, $P < 0.001$), as was areal productivity ($R^2 = 0.536$, $P < 0.001$). The sparsest, least productive seagrass meadow, off Siesta Key, was in waters that

received the greatest nitrogen input. The two locations with the lowest watershed nitrogen loads, Leffis Key and Perico Island, had the densest and most productive seagrass meadows.

Short *et al.* (1993) and Tomasko *et al.* (in review) suggest that water-quality monitoring programs can fail to detect threats to seagrass habitats arising from anthropogenic nutrient enrichment of nearshore waters. Subsequently, monitoring programs should be geared towards utilizing seagrasses as “bio-indicators” of system health. A tiered approach to seagrass monitoring, including aerial photography and a combination of randomly located and permanent transect markers should be enacted (*e.g.*, Ries, 1993; Virnstein, 1993).

In the part of Sarasota Bay near the mouth of Whitaker Bayou, seagrasses were thought to be eliminated in the past due to the discharge of secondarily treated sewage from the City of Sarasota’s wastewater treatment plant (Dr. Robert Orth, personal communication). Perhaps associated with the implementation of nutrient-removal technology at this plant, declines in water-column nitrogen and phosphorus have been detected in this region (Lowrey, 1992). Additionally, this same area, central Sarasota Bay, has shown a 20-percent increase in seagrass coverage from 1984 to 1990 (Culter, 1992).

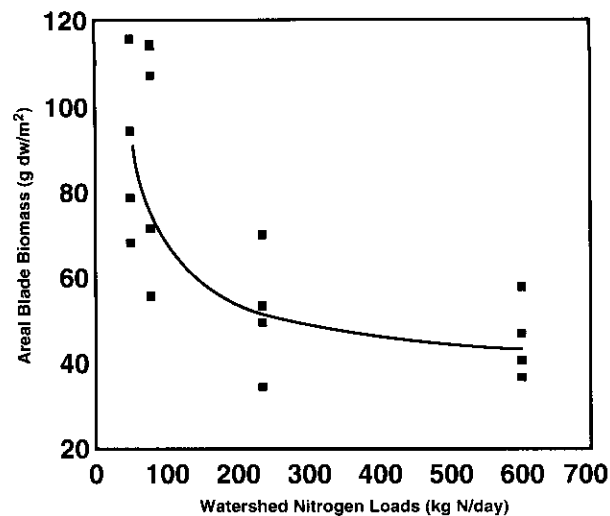


Figure 4.

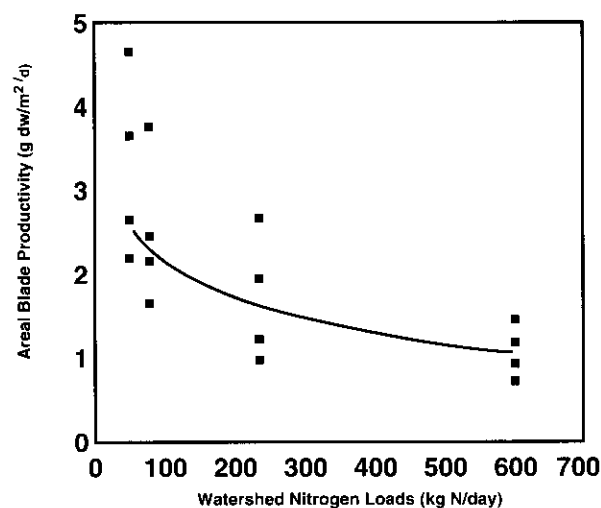


Figure 5.



Water clarity and seagrasses

Water clarity varies from region to region throughout Sarasota Bay. Nearshore areas are more heavily influenced by terrestrial runoff and bottom resuspension due to currents and wave action (Sheng and Peene, 1992), with concomitant increases in suspended and dissolved substances. Suspended substances increase both the scattering and absorption of photosynthetically active radiation (PAR), while dissolved substances increase the absorption of PAR, mostly in the region of blue light (McPherson and Miller, 1987). Areas closer to passes are exposed to water more characteristic of the Gulf of Mexico, with greater water clarity.

The availability of light, as modified by various light attenuators, is the primary abiotic factor controlling the areal extent and productivity of seagrass communities (see reviews in Dennison, 1987; Morris and Tomasko, 1993). Accordingly, it is crucial to understand the relationships between various light attenuators, water clarity and the health of seagrass systems within Sarasota Bay.

Many studies have documented the decline of seagrasses associated with degraded water clarity (*e.g.*, Cambridge and McComb, 1984; Orth and Moore, 1984; Giesen *et al.*, 1990). In addition, a limited amount of information exists on the resurgence of seagrasses associated with improvements in water clarity in Australia (Shepard *et al.*, 1989) and Tampa Bay (Johansson, 1992).

The shallow slope of the bottom of Sarasota Bay would allow dramatic increases in seagrass coverage with minimal increases in water clarity. According to bathymetric data for Sarasota Bay (Sheng *et al.*, in preparation), roughly 46 percent of Little Sarasota Bay is less than two feet deep at Mean Lower Low Water (approximately three feet at Mean Sea Level). This depth is equal to the deep edge of grassbeds in the central portion of Little Sarasota Bay.

If water clarity in Little Sarasota Bay were to improve to values typically found in Roberts Bay, seagrasses could grow to one more foot of water depth. In Little Sarasota Bay, that would result in an increase in potential acreage from 986 acres of Bay bottom to 1,434 acres of Bay bottom, a possible increase in seagrass habitat of 448 acres — equal to 45 percent of existing habitat.

Light availability not only delimits most seagrass meadows at their deep edges, it can also regulate the biomass and productivity of seagrasses within existing meadows. Short (1990) has shown a linear



response between light levels and the biomass of seagrasses grown under controlled conditions. Hall *et al.* (1990), using field experiments in Tampa Bay, have shown that turtle grass, *Thalassia testudinum*, has reduced density, biomass and productivity when shaded.

Since the faunal utilization of seagrass beds varies directly as a function of the density of seagrass meadows (Stoner, 1983; Sogard *et al.*, 1987), light-limited seagrass meadows would be expected to contain fewer fish and invertebrates than meadows in areas of greater water clarity.

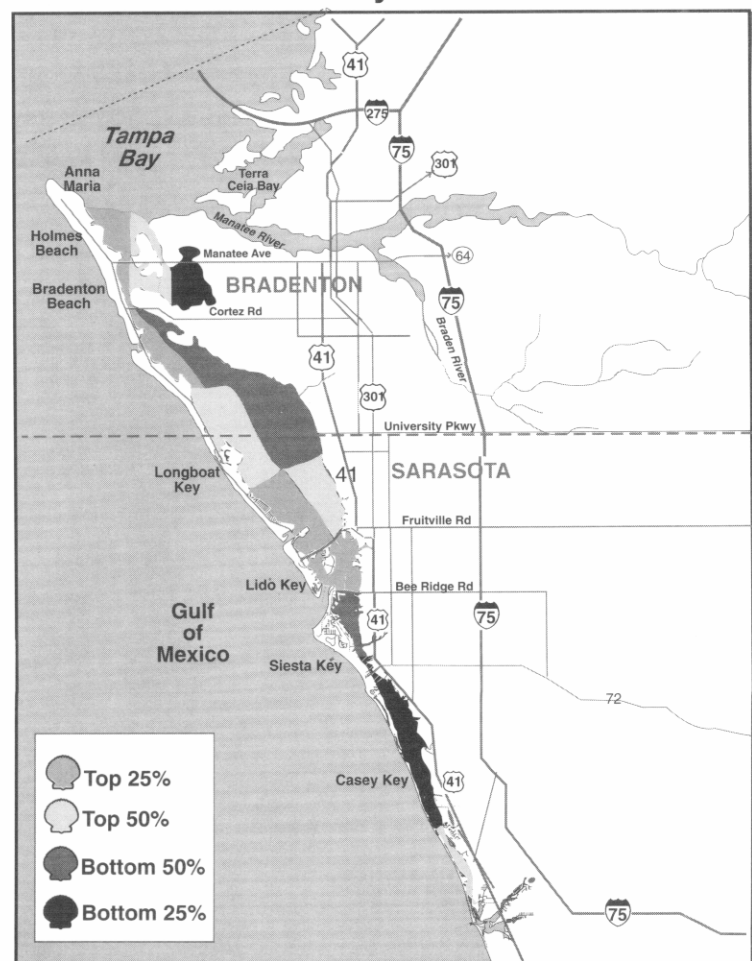
Geographic differences in water clarity

Figure 6 illustrates the geographic variation in water clarity found throughout Sarasota Bay, based on a relative water-clarity index (*i.e.*, segments were compared against each other, rather than using an absolute scale). The map quantifies what has been observed by many boaters and anglers: Palma Sola Bay and Little Sarasota Bay have reduced water clarity, Blackburn Bay and waters offshore of downtown Sarasota have better water clarity than Roberts Bay and the waters offshore of Bowlees Creek, and the greatest water clarity is found closest to the various passes.

To determine the usefulness of the current method of measuring light penetration, segment-

Figure 6.

Relative Water Clarity Index



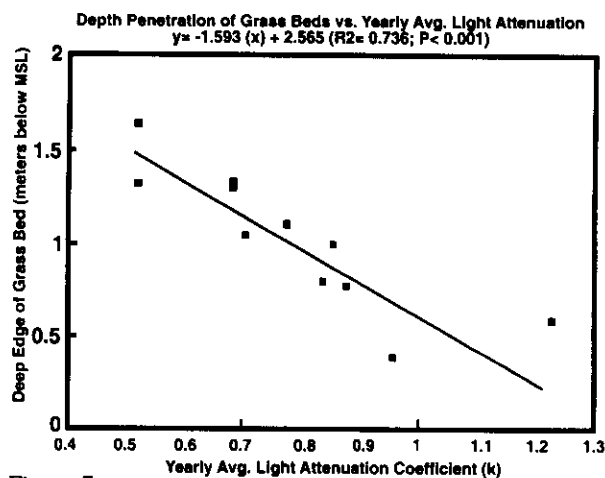


Figure 7.

wide values for light attenuation were plotted against the depth of the deep edge of seagrass meadows within these segments. Elsewhere, a significant relationship has been found between these two variables (*e.g.*, Vicente and Rivera, 1982; Dennison, 1987; Giesen *et al.*, 1990; Duarte, 1991). Such a pattern exists for Sarasota Bay (*Fig.*

7), indicating that the current method of measuring light penetration seems sufficient for predicting depth limits for seagrasses.

However, in some parts of Sarasota Bay the most important light attenuators responsible for seagrass depth limits appear to be the amount of epiphytic algae on seagrasses. In Roberts Bay, for example, seagrasses grow to a depth of approximately 60 percent of surface irradiance (Tomasko, unpublished data). However, the very heavy epiphyte loads for seagrasses from this area further reduce light by another 80 percent (Dixon, unpublished data). The net effect is that 12 percent of surface irradiance reaches the blades at these deep edges, but the water column is not as important as the heavy fouling due to algal epiphytes.

Importance of different light attenuators

Estuarine ecology has not progressed much beyond the point that increased water clarity is viewed as good and decreased water clarity is viewed as bad. This information does little to aid resource managers in achieving improvements in water clarity. If the relative importance of various light attenuators (*i.e.*, color, turbidity, Chlorophyll *a*) is not known, it is difficult to devise appropriate courses of action to increase water clarity.

Knowledge of which factors are most responsible for light attenuation can be used to draft specific resource management options. For example, previous work on the east coast of Florida has shown that wakes from boats can create sufficient sediment resuspension as to increase turbidity values, and thus decrease water clarity (U.S. Fish and Wildlife Service, 1979).

Information from the water-quality monitoring program is being used to determine which light attenuators are most closely associated with variation in Sarasota Bay's water clarity. Substantial spatial differences exist in the degree of importance of various light attenuators (Kirkpatrick, unpublished data). For example, data from December 1993 suggest that light attenuation in Little Sarasota Bay is dominated by non-pigmented suspended materials. In contrast, Roberts Bay is dominated by pigmented suspended materials. In other words, Little Sarasota Bay lacks water clarity due to an abundance of suspended inorganic materials, while Roberts Bay's reduced clarity is primarily due to an abundance of phytoplankton.

Phytoplankton could decrease with nutrient load reductions, but inorganic suspended materials might not be affected. Consequently, improving water clarity would require different actions in different parts of the Bay.

Dissolved oxygen

Critical levels of dissolved oxygen

Dissolved oxygen (D.O.) plays a critical role in regulating the health of estuarine systems. Typically, low dissolved oxygen levels are the result of human-induced nutrient enrichment of nearshore waters, often referred to as cultural eutrophication (Ryther and Dunstan, 1971; Officer *et al.*, 1984; Rosenberg, 1985). Unfortunately, low dissolved oxygen has become increasingly common in a variety of estuarine and marine areas from the coasts of Denmark and Sweden to Chesapeake Bay and the Gulf of Mexico (*e.g.*, Turner and Allen, 1972; Rosenberg, 1990; Rossignol-Strick, 1985; Stachowitsch, 1984).

Physiological effects of hypoxia (< 2 mg/l D.O.) on fish and shellfish are well known (Butler *et al.*, 1978; Kapper and Stickle, 1987; DeFur *et al.*, 1990). Behavioral changes in marine organisms can also be induced by hypoxia (Hagerman and Szaniawska, 1986; Kramer, 1987). If marine organisms cannot evade hypoxic waters, as in blue crab migrations (Bailey and Jones, 1989), they must be able to adapt to conditions or perish. Using information from the Chesapeake Bay, the eggs and larvae of bay anchovies, *Anchoa mitchilli*, are extremely susceptible to hypoxic conditions (Chesney, 1989), and their survival and geographic distribution within estuarine systems might be somewhat controlled by hypoxia.

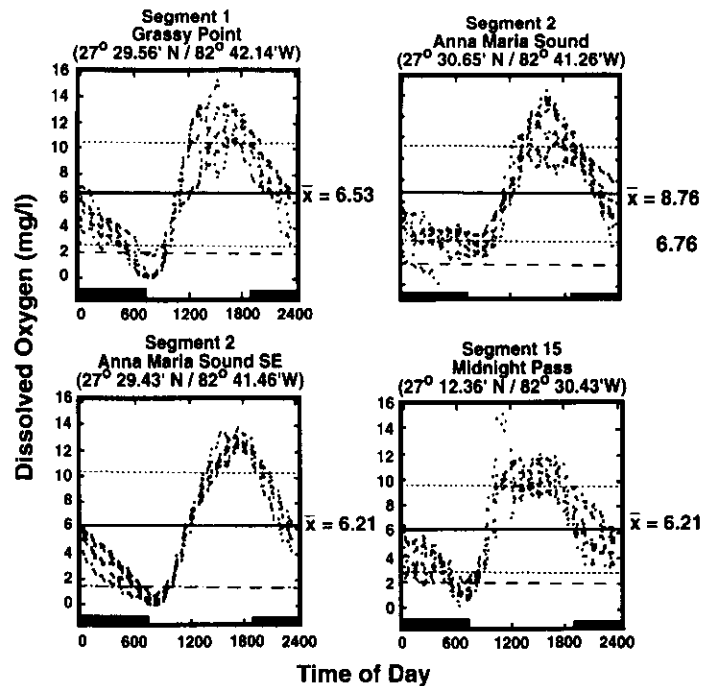


Figure 8.

Dissolved oxygen levels in Sarasota Bay

Preliminary data suggest that many healthy portions of Sarasota Bay, with diverse fauna, regularly experience dissolved oxygen sags to less than 4 mg/l (*Fig. 8*). As shown in Table 2, the location with the greatest abundance of shrimp was the only site out of four in which D.O. levels did not fall below 2 mg/l on a nightly basis. Pending further validation, it appears that a near-dawn D.O. minimum less than the current state standard of 4 mg/l might be more appropriate for detecting degraded water quality. For most of Sarasota Bay, evaluation of the extent of hypoxic conditions will require monitoring efforts near dawn, or the use of continuously recording instrumentation.

Faunal abundance at four sites in Sarasota Bay. Data are summarized from Marshall and Leverone (in review). Values are means (n=2) of samples taken in August 1993.			
Site	Organisms per sample	Shrimp per sample	Number of species
Grassy Point	47.0	29.0	9
Anna Maria Sound	539.0	511.0	22
Anna Maria Sound, S.E.	75.5	33.5	25
Midnight Pass	28.5	26.0	10

Table 2.

Near-dawn D.O. sags are probably the most important water-quality variable affecting species diversity and abundance in estuarine locations. Reliance on D.O. sampling during daylight hours biases water-quality classification schemes, so that optimistic evaluations of water quality are often unwarranted.

Present and Future Habitat

Status and trends of various habitats

Much has been written on the value of freshwater and tidal wetlands in terms of shoreline stabilization, wildlife utilization and filtering of runoff. From 1950-90, Sarasota Bay lost an estimated 1,813 acres of tidal wetlands, a 46-percent decline (Estevez, 1992); freshwater wetlands showed a similar dramatic decline during that time (Beeman, 1992). Also, fully 97 percent of freshwater wetlands within the Bay's watersheds have been altered to some degree by dredge and/or fill activities (Beeman, 1992).

The spatial variation in patterns of wetlands loss can be summarized as follows: Manatee County has lost proportionally more of its original freshwater wetlands than Sarasota County, and Sarasota County has lost proportionally more of its original tidal wetlands than Manatee County. This configuration of wetlands loss reflects dissimilar demographic trends and agricultural practices within our watershed (Estevez 1992).

Although seagrasses have declined approximately 30 percent Baywide compared to historical coverage (Mangrove Systems, Inc., 1988), areas such as Longboat Pass and New Pass show positive trends for coverage. In the Longboat Pass area, seagrass increases may be due to growth on flood tidal shoals created by pass dredging (Darryl Hatheway, personal communication). In the New Pass area, better water quality (Lowrey, 1992) appears to be allowing seagrasses to grow into deeper, previously unvegetated areas (Culter, 1992).

Disturbed bottom areas, which comprise 13 percent of Sarasota Bay's bottom habitat (Culter, 1992), are mostly found in shallow water adjacent to the shoreline. However, several other disturbed areas that apparently once served as borrow sites for fill material are



located further from shore. Most of these features are not recognizable from water level, but become apparent from an aerial perspective.

In Little Sarasota Bay, data indicate significant shifts in the species composition of seagrass meadows (Culter, 1992). Areas previously vegetated with *Thalassia testudinum* (turtle grass) are now mainly vegetated with *Halodule wrightii* (shoal grass) and *Ruppia maritima* (widgeon grass). It has been postulated by some that the replacement of *T. testudinum* by *R. maritima* was caused by lowered salinities, perhaps associated with pass closure and reduced flushing. However, annual average salinities in Little Sarasota Bay exceeded 25 parts per thousand (ppt) from October 1988 to September 1989 (Sarasota County, 1989), and exceeded 30 ppt from October 1987 to September 1988 (Sarasota County, 1988). More recent data also indicate that Little Sarasota Bay usually has salinities in excess of 30 ppt, and therefore cannot accurately be portrayed as "brackish" or "low salinity" except during periods of heavy rainfall (Tomasko, unpublished data).

Additionally, *R. maritima* can tolerate a wide range of salinities, from brackish to hypersaline (Conover, 1964; Tabb and Roessler, 1989; Dunton, 1990). As such, *R. maritima* does not require low salinities to establish itself, nor would high salinities cause its exclusion. Since shoal grass often replaces turtle grass in areas of degraded water quality (Reyes and Merino, 1991; Tomasko and Lapointe, 1991; Lapointe *et al.*, 1992b), this species shift suggests significant changes in water quality in Little Sarasota Bay. This apparent alteration of water quality appears to be due mainly to the modified circulation patterns and reduced flushing rates that have accompanied the closure of Midnight Pass in 1983 (Sheng and Peene, 1992).

Functions of wetland habitats

Mangrove ecosystems have been shown to play an important role in shoreline stabilization (see reviews in Odum *et al.*, 1985). Although salt marsh grasses are important shoreline stabilizers in higher latitudes, they have not been extensively studied in west-central Florida (Estevez and Mosura, 1985). Regardless, it can be stated with confidence that the extensive decline in tidal wetlands, both in area and edge, produced concurrent declines in shoreline stability. Unstable shorelines erode more easily, with resultant increased sediment

resuspension, increased turbidity and decreased water clarity. Freshwater wetlands perform similar functions in terms of shoreline stabilization along creeks and ponds.

In addition to stabilizing shorelines and functioning as wildlife habitat (see reviews in Odum *et al.*, 1985; Lewis and Estevez, 1988), wetlands filter runoff before it enters creeks, ponds and the Bay itself. Due to differences in funding sources and research directions, tidal wetlands are better understood than freshwater wetlands in terms of shoreline stabilization, but freshwater wetlands are better understood than tidal wetlands as concerns filtering of stormwater runoff.

Dense vegetation along creek banks slows the velocity of runoff, thus increasing the infiltration of water into surface soils and groundwater. As a result, the “first flush” of runoff is dampened, and metals and nutrients are more likely to be absorbed onto soil particles and/or incorporated into plant biomass. In the absence of filtering vegetation, stream velocities are initially elevated compared to natural systems. In addition, after the “first flush,” stream velocities drop off more rapidly in the absence of filtering vegetation (*Fig. 9*).

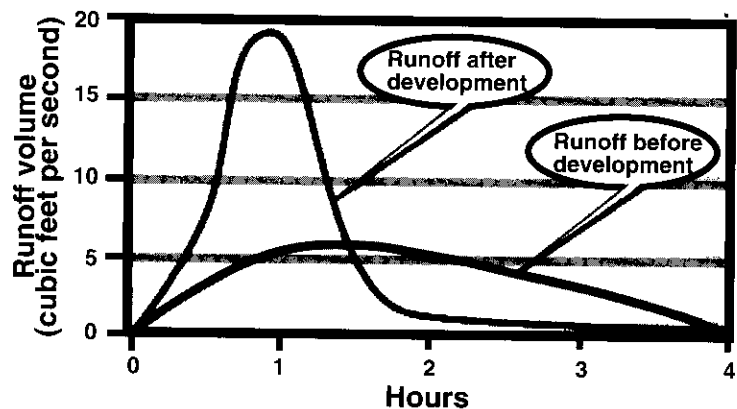


Figure 9.

Streams and creeks without vegetative cover exhibit a pattern of “feast or famine.” When rains occur, velocities and pollutant loads are magnified; when dry weather dominates, creeks have reduced flow and volume. Since estuarine areas exhibit decreased productivity with both too much and too little freshwater inflow (see review in Browder, 1991), wetlands habitats should be protected and restored to the fullest extent if only for their function as filters of stormwater runoff. The critical importance of re-establishing natural patterns of freshwater input into estuarine areas is evidenced by the priority consideration granted it by the Task Force on Resource-Based Water Quality in Tampa Bay (Agency on Bay Management, 1990).

Even if all remaining wetlands could be completely protected

from loss due to development (an unlikely scenario), Sarasota Bay would still be left with only a fraction of its original wetlands habitat. Those few remaining wetlands exhibit various levels of disturbance, due to ditching, invasive species, pruning, insect damage and freeze damage (Estevez, 1992). Accordingly, increasing wetlands by restoration and/or creation activities would seem to be an appropriate course of action. With limited funds for such activities, prioritizing areas for wetlands restoration/creation could be appropriate, with rankings based on a holistic approach to estuarine functioning.

In addition to preserving remaining wetlands and restoring/creating wetlands to ameliorate the effects of past losses, strategies must be developed to deal with anticipated future losses. It is easy to foresee additional declines in wetlands due to continued development throughout the region. Although the rate of wetlands destruction due to development might be slowed by current and future legislation, it seems reasonable to assume that both freshwater and tidal wetlands would continue to be lost. In addition, an accelerated rate of sea level rise, associated with global climate change, might produce additional losses of wetlands.

Wetlands issues connected with accelerated sea-level rise include:

- o Hardened shorelines and development of upland areas can eliminate the possibility of landward migration of wetlands.
- o Encroachment of invasive species can hinder landward migration of wetlands.
- o Sediment accumulation rates in wetlands can be insufficient to accommodate elevated rates of sea-level rise.

Although uncertainties exist in predicting global climate change and sea-level rise, a prudent course of action might include a variety of activities. Purchasing acreage upland from existing wetlands might alleviate the problems associated with wetlands migration in areas with appropriate slopes and land-use patterns. Wetlands delimited at their upland edges by seawalls, causeways and/or extensive reaches of invasive species might be very expensive to maintain with an elevated rate of sea-level rise.

Relationships between recreation and habitat

Recreational activities vary in their dependence on habitat quality. Some activities, such as boating or cruising, can take place just as easily and be just as enjoyable regardless of the location in Sarasota Bay. The level of enjoyment of other activities — such as fishing, snorkeling and birdwatching — depends on the health of the Bay at that particular location.

Recreational fishing has many forms. Individuals who use castnets to capture mullet can do quite well in locations where adults of other species are more difficult to catch. Generally, recreational fishing can be a quite diverse activity, with anglers requiring various habitats; one person's fishing hole may be viewed as a lifeless void by other anglers.

A problem that arises in characterizing the various habitats in Sarasota Bay is the emphasis placed on determining the "value" of such habitats. While the area around the old Midnight Pass seems to be functioning as a nursery for various juvenile fish (Edwards, 1992), seasonal aggregations of sought-after species, typical of open pass areas, no longer occur. As a result, this area is no longer a recreational fishing focal point. The question arises both in this example and in many others as to the type of habitats we are aspiring to preserve, enhance or create.

While some may argue the merits of maintaining a mosaic of estuarine habitats, others might argue in favor of maximizing the area of those habitats in shortest supply. In turn, identifying habitats in shortest supply depends on what species are being considered. Pass-type communities are obviously much different from quiescent, lagoonal environments. Both these areas are important, but which is most vital depends on what species are being considered, which might also vary with the age of the targeted species.

A primary issue affecting recreational fishing in Sarasota Bay is that of more people trying to catch fewer fish. A sevenfold increase in population during the last 40 years has greatly increased fishing pressure; during the same period, dramatic declines in fisheries habitat have occurred (an approximate 45-percent decline in mangrove area, and a 30-percent decline in seagrass area). There appears to be a relationship between declines in habitat, increased fishing pressure

and the finding that the average angling experience is less productive than it used to be.

Based on this scenario, it seems that protecting remaining fisheries habitats, although essential, is not sufficient. To truly increase the level of enjoyment of recreational angling, new fisheries habitat must be created on a continuing basis.

Literature Cited

Agency on Bay Management. (1990). Goals and strategies for Tampa Bay — Results of the forum. Tampa Bay Regional Planning Council, Task Force on Resource-Based Water Quality.

Alderson, M. (1988). *Saving Bays and Estuaries: A Handbook of Tactics*. U.S. Environmental Protection Agency.

Bailey, B., and Jones, R.B. (1989). Association between advected hypoxic water and crab wars in the lower Potomac River. (Abstract) *In*: Tenth Biennial International Estuarine Research Conference, Baltimore, MD. Estuarine Research Federation, p. 4.

Beeman, R.D. (1992). Trends and status of freshwater wetlands. *Framework for Action*. Sarasota Bay National Estuary Program.

Browder, J.A. (1991). Watershed management and the importance of freshwater flows to estuaries. Pp. 7-22. *In*: (S.F. Treat and P.A. Clark, eds.) Proceedings, Tampa Bay Area Scientific Information Symposium 2. 1991 February 27 - March 1; Tampa, FL. 528 p.

Butler, P.J.; Taylor, E.W.; and McMahon, R.R. (1978). Respiratory and circulatory changes in the lobster (*Homarus vulgaris*) during long-term exposure to moderate hypoxia. *J. Exp. Biol.* 73: 131-146.

Cambridge, M.L., and McComb, A.J. (1984). The loss of seagrass in Cockburn Sound, Western Australia I. The time course and magnitude of seagrass decline in relation to industrial development. *Aquat. Bot.* 20: 229-243.

Camp Dresser & McKee, Inc. (1992). Point/non-point source pollution loading assessment. Phase I. Final Report to Sarasota Bay National Estuary Program.

Carter, V., and Rybicki, N. (1986). Resurgence of submersed aquatic macrophytes in the tidal Potomac River, Maryland, Virginia, and the District of Columbia. *Estuaries* 9: 368-375.

Chesney, E.J. (1989). Laboratory studies on the effect of hypoxic waters on the survival of eggs and yolk-sac larvae of the bay anchovy *Anchoa mitchilli*. (Abstract) *In*: Tenth Biennial International Estuarine Research Conference, Baltimore, MD. Estuarine Research Federation, p. 4.

Conover, J.T. (1964). The ecology, seasonal periodicity, and distribution of benthic plants in some Texas lagoons. *Bot. Mar.* 7: 4-41.

Culter, J. (1992). Estuarine bottom assessment. *Framework for Action*. Sarasota Bay National Estuary Program.

DeFur, P.L.; Mangum, C.P.; and Reese, J.E. (1990). Respiratory responses of the blue crab *Callinectes sapidus* to long-term hypoxia. *Biol. Bull.* 178: 46-54.

Dennison, W.C. (1987). Effects of light on seagrass photosynthesis, growth and depth distribution. *Aquat. Bot.* 27: 15-26.

Dixon, L.K. (1992). Bivalved shellfish of Sarasota Bay. *Framework for Action*. Sarasota Bay National Estuary Program.

Duarte, C.M. (1991). Seagrass depth limits. *Aquat. Bot.* 40: 363-377.

Dunton, K.H. (1990). Production ecology of *Ruppia maritima* L. s.l. and *Halodule wrightii* Aschers. in two subtropical estuaries. *J. Exp. Mar. Biol. Ecol.* 143: 147-164.



Edwards, R.E. (1991). Nursery habitats of important early-juvenile fishes in the Manatee River estuary system of Tampa Bay. Pp. 237-252. *In:*(S.F. Treat and P.A.Clark, eds.) *Proceedings, Tampa Bay Area Scientific Information Symposium 2. 1991 February 27-March 1; Tampa, FL. 528 p.*

Edwards, R.E. (1992). Fishery Resource Assessment. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

Estevez, E.D. (1992). Status and trends of Sarasota Bay's tidal wetlands. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

Estevez, E.D., and Mosura, L. (1985). Emergent vegetation. Pp. 248-278. *In:*(S.F. Treat, J.L. Simon, R.R. Lewis III and R.L. Whitman Jr., eds.). *Proceedings, Tampa Bay Area Scientific Information Symposium. Burgess Publishing Co., Inc., Minneapolis, MN.*

Giesen, W.B.J.T.; van Katwijk, M.M. and den Hartog, C. (1990). Eelgrass condition and turbidity in the Dutch Wadden Sea. *Aquat. Bot.* 37: 71-85.

Haberman, D.; Mackiernan, G.B.; and Macknis, J. (1992). Toxic Compounds. *Chesapeake Bay: A Framework for Action*. Chesapeake Bay Program.

Hagerman, L., and Szaniawska, A. (1986). Behavior, tolerance and anaerobic metabolism under hypoxia in the brackish-water shrimp *Crangon crangon*. *Mar. Ecol. Prog. Ser.* 34: 125-132.

Hall, M.O.; Tomasko, D.A.; and Courtney, F.X. (1990). Responses of *Thalassia testudinum* to in situ light reduction. Pp. 53-58. *In:*(W.J. Kenworthy and D.E. Haunert, eds.). *The Light Requirements of Seagrasses: Results and Recommendations of a Workshop*. South Florida Water Management District.

Heyl, M. (1992). Point and non-point source loading assessment of Sarasota Bay. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

Institute of Food and Agricultural Sciences (1985). On-site sewage disposal: Nitrogen behavior. *Notes in Soil Science*. Institute of Food and Agricultural Sciences, University of Florida.

Johansson, J.O.R. (1991). Long-term trends of nitrogen loading, water quality and biological indicators in Hillsborough Bay, Florida. Pp. 157-176. *In:* (S.F. Treat and P.A. Clark., eds.) *Proceedings, Tampa Bay Area Scientific Information Symposium 2. 1991 February 27-March 1; Tampa, FL*. 528 p.

Kapper, M.A., and Stickle, W.B. (1987). Metabolic responses of the estuarine gastropod *Thais haemastoma* to hypoxia. *Physiol. Zool.* 60: 159-173.

Kramer, D.L. (1987). Dissolved oxygen and fish behavior. *Env. Biol. Fishes* 18: 81-92.

Lapointe, B.E.; Littler, M.M.; and Littler, D.S. (1992a). Nutrient availability to marine macroalgae in siliciclastic versus carbonate-rich coastal waters. *Estuaries* 15: 75-82.

Lapointe, B.E.; Tomasko, D.A.; and Matzie, W. (1992b). Final Report: Eutrophication and trophic structuring of marine plant communities in the Florida Keys. Florida Dept. of Environmental Regulation Contract # CM-300.

Lewis, R.R. III, and Estevez, E.D. (1988). The ecology of Tampa Bay, Florida: an estuarine profile. U.S. Fish. Wildl. Serv. Biol. Rep. 85(7.18). 132 pp.

Lowrey, S. (1992). Bay water and sediment quality. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

- McPherson, B.F., and Miller, R.L. (1987). The vertical attenuation of light in Charlotte Harbor, a shallow, subtropical estuary, South-western Florida. *Est. Coast. Shelf Sci.* 25: 721-737.
- Odum, W.E.; McIvor, C.C.; and Smith, T.J. III (1982). The ecology of the mangroves of south Florida: a community profile. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC. FWS/OBS-81/24. 144 pp.
- Officer, C.B.; Biggs, R.B.; Taft, J.L.; Cronin, L.E.; Tyler, M.A.; and Boynton, W.R. (1984). Chesapeake Bay anoxia: origin, development, and significance. *Science* 223: 22-27.
- Orth, R.J., and Moore, K.A. (1984). Distribution and abundance of submerged aquatic vegetation in Chesapeake Bay: an historical perspective. *Estuaries* 7: 531-540.
- Rosenberg, R. (1985). Eutrophication—the future marine coastal nuisance? *Mar. Poll. Bull.* 6: 227-231.
- Rosenberg, R. (1990). Negative oxygen trends in Swedish coastal bottom waters. *Mar. Poll. Bull.* 21: 335-339.
- Rossignol-Strick, M.A. (1985). A marine anoxic event on the Brittany Coast, July 1982. *J. Coast. Res.* 1: 11-20.
- Ryther, J.H., and Dunstan, W.M. (1971). Nitrogen, phosphorus and eutrophication in the coastal marine environment. *Science* 171: 375-380.
- Sarasota County (1988). *Ambient Water Quality Annual Report*. Environmental Services Laboratory, Sarasota, FL.
- Sarasota County (1989). *Ambient Water Quality Annual Report*. Environmental Services Laboratory, Sarasota, FL.
- Sheng, Y.P., and Peene, S. (1992). Circulation and its effect on water quality. In: (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.
- Short, F.T. (1990). Light limitation on seagrass growth. Pp. 26-28. In: (W.J. Kenworthy and D.E. Haunert, eds.). *The Light Requirements of*

Seagrasses: Results and Recommendations of a Workshop. South Florida Water Management District.

Sogard, S.M.; Powell, G.V.N.; and Holmquist, J.G. (1987). Epibenthic fish communities on Florida Bay banks: relations with physical parameters and seagrass cover. *Mar. Ecol. Prog. Ser.* 40: 25-39.

Stachowitsch, M. (1984). Mass mortality in the Gulf of Trieste: the course of community destruction. *Mar. Ecol. P.S.Z.N.I.* 5: 243-264.

Stoner, A.W. (1983). Distribution of fishes in seagrass meadows: role of macrophyte biomass and species composition. *Fisheries Bulletin U.S.* 81: 837- 846.

Taylor, A.W. (1967). Phosphorus and water pollution. *J. Soil and Water Conserv.* 22: 228-231.

Thayer, G.W.; Bjorndal, K.A.; Ogden, J.C.; Williams, S.L.; and Zieman, J.C. (1984). Role of larger herbivores in seagrass communities. *Estuaries* 7: 351- 376.

Tomasko, D.A., and Lapointe, B.E. (1991). Productivity and biomass of *Thalassia testudinum* as related to water-column nutrient availability and epiphyte levels: field observations and experimental studies. *Mar. Ecol. Prog. Ser.* 75: 9-17.

Turner, R.E., and Allen, R.L. (1972). Bottom water oxygen concentration in the Mississippi River Delta bight. *Contrib. Mar. Sci.* 25: 161-172.

U.S. Fish and Wildlife Service. (1979). Turbidity study of the Intracoastal Waterway, Hobe Sound, FL. Unpublished manuscript. 29 pp. + appendices.

Vicente, V.P., and Rivera, J.A. (1982). Depth limits of the seagrass *Thalassia testudinum* (Konig) in Jobos and Guayanilla Bays, Puerto Rico. *Carib. J. Sci.* 17: 73-79.

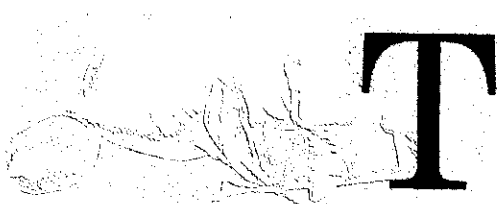
Zieman, J.C. (1982). The ecology of seagrasses of South Florida: a community profile. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC. FWS/OBS-82/25. 158 pp.

A nautical chart of the Sarasota Bay area. The chart shows various depth soundings (e.g., 13, 14, 16, 18, 19, 23, 25, 26, 27, 28, 29), navigational markers (e.g., 'O', 'F', 'M', 'E', 'X', 'I', 'C'), and geographical features like 'Sarasota Bay', 'C K B U R N', 'KEY', and 'Surfaced Ramps'. A scale bar in yards (0 to 500) is located in the bottom right corner. The title 'Monitoring and Additional Research Needs for Sarasota Bay' is centered in a white box.

Monitoring and Additional Research Needs for Sarasota Bay

Future monitoring programs for
Sarasota Bay must incorporate
both traditional and newer
elements to capture system
changes effectively.

Monitoring and Additional Research Needs for Sarasota Bay



The comprehensive monitoring program proposed in this section is designed to track progress made in improving the health of Sarasota Bay as a result of implementation of the Sarasota Bay National Estuary Program's Comprehensive Conservation and Management Plan (CCMP). The monitoring program will determine the effectiveness of implementing elements of the CCMP.

Historically, water-quality monitoring in Florida has often provided conflicting information on status and trends; these monitoring programs have also resulted in the collection of data with high degrees of statistical variation. While some variation is expected and normal, too much variation can mask trends by increasing the amount of "noise" in the data.

Furthermore, examples exist in which monitoring data have not shown trends in water quality during periods when biological monitoring programs have suggested that significant changes in habitat quantity and/or quality have occurred. For example, the most recent state 305(b) report by the Florida Dept. of Environmental Protection indicates that water quality in Little Sarasota Bay has remained "stable" over a 10-year period encompassing the closure of Midnight Pass in 1983. However, Sheng and Peene (1992) have documented, via a three-dimensional circulation model, that dramatic changes in flushing rates have occurred because of the pass closure, and Culter (1992) has documented species shifts in both flora and fauna in Little Sarasota Bay that are normally attributed to changes in circulation-sensitive water-quality parameters.



Therefore, the Sarasota Bay Program's Technical Advisory Committee (TAC) concluded that future monitoring programs for Sarasota Bay must incorporate both traditional and newer elements to capture system changes effectively. It was determined that conventional water-quality monitoring must be continued, with adjustments. Traditional water-quality monitoring must be supplemented by monitoring programs aimed at specific "bio-indicators," including seagrasses, wetlands and fisheries.

Monitoring variables, sampling frequency and analytical techniques

The Sarasota Bay National Estuary Program's Technical Advisory Committee debated the appropriateness of various monitoring approaches during meetings in 1993 and 1994. The specific recommendations of the TAC are:

- o The water-quality monitoring program for Sarasota Bay should be based on randomly located stations stratified within discrete areas with similar circulation patterns.
- o Data collection from stations at non-random locations should be continued if needed, but these data should not be included when extrapolating data from random locations.
- o Water-quality monitoring should be at monthly intervals, with samples taken from each of five stations per region sampled on the same day. As Sarasota Bay does not exhibit strong stratification, surface samples alone are sufficient.
- o For each separate month, different stations should be chosen at random for each region, to permit unbiased assessment of water quality in these regions.
- o Water-quality parameters must include temperature, salinity,



pH, total nitrogen and dissolved inorganic nitrogen, total phosphorus and orthophosphate, Chlorophyll *a*, turbidity, color, either biological oxygen demand or total organic carbon, total suspended solids, secchi disk depth and light attenuation coefficients. Other parameters may be added if needed.

- o Fisheries status should be monitored via the State of Florida's Fisheries Independent Juvenile Fish Monitoring Program, as designed by the Florida Dept. of Environmental Protection's Marine Research Institute (FMRI).

- o Recreational fish surveys (creel surveys, etc.) should be implemented on a two- to five-year frequency, following procedures outlined by FMRI.

- o Monitoring programs for shellfish abundance and condition should be carried out every five years. Levels of toxic contaminants should be assessed for both oysters and clams.

- o Seagrass meadows should be monitored via aerial photography and ground-truthing on a biannual basis, following procedures outlined by the Southwest Florida Water Management District (Swiftmud) for Tampa Bay and Charlotte Harbor.

- o Randomly located transects in approximately 20 seagrass meadows should be visited annually to determine changes in depth limits, coverage and species composition of these meadows.

- o Wetlands monitoring, including information on quality as well as quantity, should be performed on a five-year cycle.

In accordance with state requirements, sampling methodologies should be described in a peer-reviewed and approved Quality Assurance/Quality Control (QA/QC) plan. When appropriate, water-quality samples must be acid-fixed in the field (total nitrogen), filtered in the field (orthophosphate) or measured in the field (dissolved oxygen, salinity, pH, etc.). All water samples must be held on ice until initial processing. Analytical techniques should be either U.S. Environmental Protection Agency (EPA) methodology or standard methods.

The monitoring program for Sarasota Bay follows the protocol outlined by EPA's Estuarine Monitoring and Assessment Program (EMAP). If the monitoring program is implemented as outlined above, it would ensure continuity between Tampa Bay to the north and Charlotte Harbor to the south. Water quality and estuarine habitats

along the entire length of west-central Florida would therefore be assessed by the same approaches.

Testable hypotheses

The implementation of this monitoring program would provide information on local and regional scales. Specifically, the monitoring program should be able to answer the following hypotheses:

- o Are water-column nutrient concentrations increasing, decreasing or remaining stable in various parts of Sarasota Bay?
- o Are phytoplankton populations increasing, decreasing or remaining stable in various parts of Sarasota Bay?
- o Is water clarity increasing, decreasing or remaining stable in various parts of Sarasota Bay?
- o Is the extent of seagrass meadows increasing, decreasing or remaining stable in various parts of Sarasota Bay?
- o Are fish populations increasing, decreasing or remaining stable in various parts of Sarasota Bay?
- o Is the extent of freshwater and intertidal wetlands increasing, decreasing or remaining stable in various parts of Sarasota Bay?

Data management and analysis

Data collected through the monitoring program would be stored as follows:

- o Results of the wetlands mapping effort would be stored on Swiftmud's Geographic Information System (GIS); present and future seagrass mapping efforts would also be stored on this system. Maps, data analysis, etc. can be made available to anyone requesting such information from Swiftmud's GIS manager.
- o Water-quality data will be stored in Florida's STORET system, which allows for the downloading of water-quality data to any who request such information. All monitoring results will therefore be securely stored and readily available to anyone wishing to review or analyze the data.



Expected monitoring performance and timetable for data analysis

The Sarasota Bay Program's monitoring program would use EMAP's guidance for water-quality monitoring, supplemented by the collection of biological data. The randomized sampling of water quality is designed to allow unbiased assessment of water quality in Sarasota Bay, while the biological monitoring program would assess the overall health of the system. However, system responses to specific actions may not be detected in the short term, depending on climatic changes, local weather conditions and the size of pollutant-load reductions achieved by these actions. The monitoring program is designed such that statistical (power) analysis can be used to modify the program as needed. It is recommended that such an analysis be carried out two to three years after implementation of the proposed monitoring program.

Summary of costs of monitoring needs for Sarasota Bay

Long-term water-quality monitoring plan

Based on EMAP protocol, a long-term water-quality monitoring program would be undertaken by both Manatee and Sarasota counties. The program could ensure continuity among monitoring programs for Tampa Bay, Sarasota Bay and Charlotte Harbor.

Proposed Budget: Resources for the long-term water-quality monitoring program will be provided through existing local government budgets.

Initial upgrade of seagrass mapping for trend analysis

A modest investment would ensure continuity of data sets among Tampa Bay, Sarasota Bay and Charlotte Harbor.

Proposed budget: It is anticipated that \$15,000 will be made available by the Sarasota Bay Program for seagrass mapping (pending Management Conference approval).

Continued seagrass monitoring

To determine trends in seagrass coverage, mapping efforts must be repeated and analyzed. Such a program could be coordinated with efforts in Tampa Bay and Charlotte Harbor.

Proposed budget: It is anticipated that an additional \$5,000 will be made available by the Sarasota Bay Program from 1995-97 (pending Management Conference approval).

Wetland monitoring and assessment

The proposed budget would cover efforts in 1995.

Proposed budget: It is anticipated that the wetland coordinator will conduct the assessment.

Data management

The proposed budget would cover efforts to place all water-quality, fishery and sediment-chemistry data in the appropriate data base (STORET and/or ODES).

Proposed budget: \$30,000, pending approval of the Management Conference.

Additional research needs for Sarasota Bay

During 1993 and 1994, TAC discussions centered on developing a method for prioritizing additional research needs for Sarasota Bay. A list of research needs was presented to the TAC on November 5, 1993, based on recommendations within the "Framework for Action" report. This list was mailed out to TAC members, with a form asking them to submit brief summaries of projects they thought should be incorporated into a research needs list.

Subsequently, 14 project proposals were mailed out to the TAC. They were to be examined, and each TAC member was asked to prioritize the projects into the following three categories:

Category 1: Projects that need to be funded and would generate information crucial to Bay management issues.

Category 2: Projects that should be funded and hold promise for providing information necessary for Bay management.

Category 3: Projects that should be considered for funding if time and money allow, but are of reduced immediate need and/or relevance.

Proposals within Category 1 include:

- o Further assessment of toxic contaminant levels and sources in the tributaries to Sarasota Bay.
- o Measurement of the rates of atmospheric deposition of nutrients and toxins to Sarasota Bay.
- o Identification of critical nursery habitats for finfish and shellfish in Sarasota Bay.
- o Determining the spatial and temporal extent of hypoxic events within non-vegetated portions of Sarasota Bay's bottom.
- o Determining the significance of elevated turbidity levels associated with dredging and/or beach renourishment on seagrasses in Sarasota Bay.

Proposals within Category 2 include:

- o Large-scale, expanded testing of seawall reefs.
- o Circulation studies on beach-renourishment impacts.
- o Development of a sewage tracer (coprostanol index) using pristine areas.
- o Source identification for polychlorinated byphenols (PCBs) in tributary sediments.
- o Circulation studies focusing on reopening Midnight Pass.

Proposals within Category 3 include:

- o Assessing populations of trout, mullet, drum and snook.
- o Independent monitoring of juvenile fisheries populations.
- o Baywide recreation fisheries catch-and-effort survey.
- o Analysis of stranded dolphin tissues for contaminants.

The highest-priority projects are described in greater detail below:

Further assessment of toxic-contaminant levels in the tributaries to Sarasota Bay

Surface sediments would be collected along transects covering the entire length of developed and urbanized tributaries to Sarasota Bay. Sediments would be analyzed for lead, zinc, copper, mercury and aluminum content as well as grain size, moisture and organic content. Particular emphasis would be placed on identifying the source of

elevated metals in Hudson Bayou, Whitaker Bayou, Phillippi Creek, Bowlees Creek and Cedar Hammock Creek. With this information, areas with toxic sediments could be identified with greater precision, and possible contamination sources could be identified and acted upon.

Proposed budget: \$100,000, in fiscal year 1995-97, pending approval by the Management Conference.

Measurement of the rates of atmospheric deposition of nutrients and toxins into Sarasota Bay

Several stations would be established at the edges of Sarasota Bay (both mainland and barrier islands). Weekly integrated samples of bulk deposition would be collected and processed for nutrients and selected metals. Using this information, modes of deposition would be determined to assess the relative importance of rainfall vs. dry deposition. Better precision in the estimate of atmospheric contributions would help refine management expectations and perhaps provide additional impetus to control watershed sources.

Proposed budget: \$100,000, pending approval of the Management Conference.

Identification of critical nursery habitats for finfish and shellfish in Sarasota Bay

The entire shoreline of Sarasota Bay would be surveyed by seining, trawling and/or push-netting during times of the year when selected important species would be of an age requiring nursery habitats. Relative catch rates (*e.g.*, no / m² of area seined) of juveniles would be used to identify productive nursery areas. The results could be used to identify areas of critical importance for sustaining adult fish populations, as well as to provide a guide for improving local habitat-restoration efforts.

Proposed budget: \$80,000, with funding unidentified at this time.

Determining the spatial and temporal extent of low-dissolved oxygen (hypoxic) events within non-vegetated portions of Sarasota Bay's bottom

Recurrent hypoxia (dissolved oxygen [D.O.] < 2 milligrams per



liter [mg/l]) has been shown to be a potential factor contributing to reduced finfish and shellfish populations in vegetated areas of Sarasota Bay. This project would establish the relationship between recurrent hypoxia and animal abundance in unvegetated areas (bare sand and/or mud) of Sarasota Bay.

Proposed budget: \$40,000, with funding not determined at this time.

Determining the significance of elevated turbidity levels associated with dredging and/or beach renourishment on seagrasses in Sarasota Bay

Monitoring and research need to better establish the relationships, if any, between beach-renourishment efforts, elevated turbidity and the health of seagrass habitats in Sarasota Bay. If significant negative impacts can be found, it may be necessary to reduce such impacts by restricting the areas, times of the year and/or tidal conditions under which renourishment would be allowed.

Proposed budget: \$30,000, with funding not identified.

The list of research priorities gives guidance on which areas need further investigation, given limited funds. However, projects ranked as low priorities are not necessarily dispensable; they may simply be considered a "responsibility" of existing agencies. For example, the TAC agreed that independent monitoring of juvenile fish populations and Baywide recreational catch surveys were needed for monitoring purposes. However, these two projects were given lower priority for research needs. Perhaps research funds should be focused on answering new questions, while monitoring funds should be focused on reporting back on questions that have already been asked.

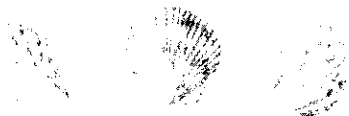
Literature cited

Coastal Environmental Engineering, Inc. 1993. Status and trends in water quality in Charlotte Harbor. Draft report to the Southwest Florida Water Management District.

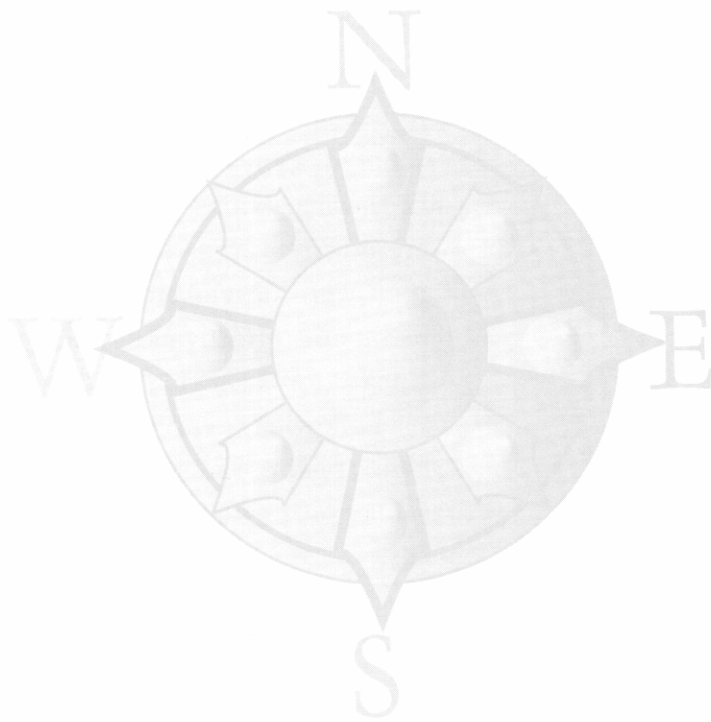
Culter, J. 1992. Estuarine bottom assessment. Pp. 8.1-8.18. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.

Duke, T., and Kruczynski, W. 1992. A summary of the report: status and trends of emergent submerged vegetated habitats of the Gulf of Mexico, USA. Pp. 11-28. *In:* *The Environmental and Economic Status of the Gulf of Mexico*. Gulf of Mexico Program. Stennis, MS.

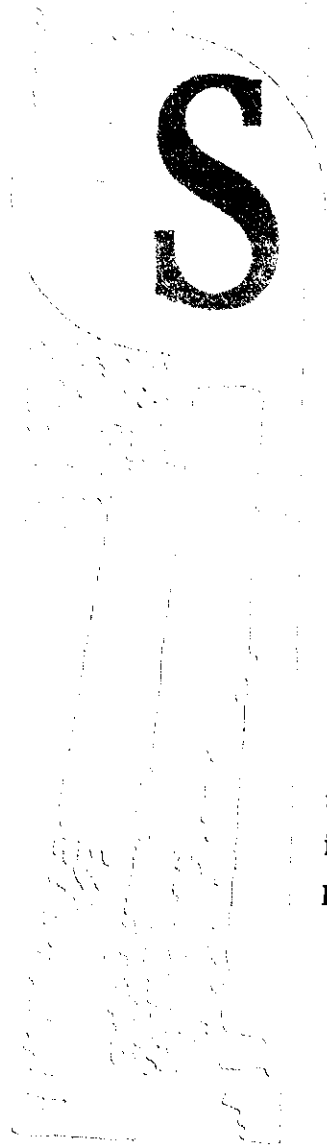
Sheng, Y.P., and Peene, S. 1992. Circulation and its effect on water quality. Pp. 5.1-5.18. *In:* (P. Roat, C. Ciccolella, H. Smith and D. Tomasko, eds.) *Sarasota Bay: Framework for Action*. Sarasota Bay National Estuary Program. Sarasota, FL.



Actions Taken to Restore Sarasota Bay



Actions Taken to Restore Sarasota Bay



ince its inception in June 1989, the Sarasota Bay National Estuary Program has made "action now" a principal theme. Numerous actions have been taken by the community to improve Sarasota Bay, and the Program has promoted, sponsored, monitored and evaluated these activities. Many of these projects were already in progress or nearly completed; others were developed by the Program to illustrate the effectiveness and develop cost estimates for basinwide application.

Following is a brief summary of actions taken to restore Sarasota Bay. For additional information, please refer to individual action plans.

Wastewater treatment

During the past 25 years, Manatee County and the City of Sarasota have spent more than \$250 million for infrastructure in regional wastewater treatment systems. Sarasota County residents have spent similar amounts of resources in replacing old, less-effective septic tanks and small wastewater treatment systems or installing new ones. Several private utilities in Sarasota County have excellent wastewater treatment service records.

Manatee County

In Manatee County, major improvements to the Southwest Regional Wastewater Treatment Plant in 1990 significantly decreased pollutant (nitrogen) loads to the upper portions of Sarasota Bay. The plant serves Longboat Key, the City of Anna Maria, Holmes Beach, Bradenton Beach and much of the urbanized unincorporated area of Manatee County. It treats wastewater to advanced secondary levels and reclaims approximately 60 percent of its wastewater for agricultural and urban uses; the remainder of the treated effluent is injected into a deep well. The county also has installed a tailwater recovery system that recirculates reuse water to irrigate agricultural fields near the treatment plant. Significant improvements in water quality in northern Sarasota Bay have resulted from these actions.

City of Sarasota

In 1991, the City of Sarasota completed upgrading its wastewater treatment plant to meet Advanced Wastewater Treatment (AWT) standards, combined with reuse of 50 percent of this highly treated effluent. The city previously discharged secondary effluent into the Bay at Whitaker Bayou. The upgrade to AWT and the increased

distribution of reuse reduced nitrogen loadings to the central Bay by 43 percent. A permit to expand the plant was granted in Fall 1994. Approximately 130 acres of seagrasses have recovered in an area just south of the mouth of Whitaker Bayou, substantiating water quality improvements.

Sarasota County

Sarasota County has developed conceptual engineering plans for its wastewater treatment system in northern Sarasota County as specified in the Comprehensive Conservation and Management Plan (CCMP). The first phase of the County plan is consistent with the priority areas specified in the CCMP (*i.e.*, expansion of the Sarasota County's wastewater treatment system by using excess capacity at the City of Sarasota's treatment plant). Priority neighborhood areas have been identified in the Phillippi Creek watershed.

Stormwater treatment and prevention

In 1992-93, both Manatee and Sarasota Counties developed Stormwater Environmental Utilities (SEUs). Sarasota County's utility also serves the City of Sarasota.

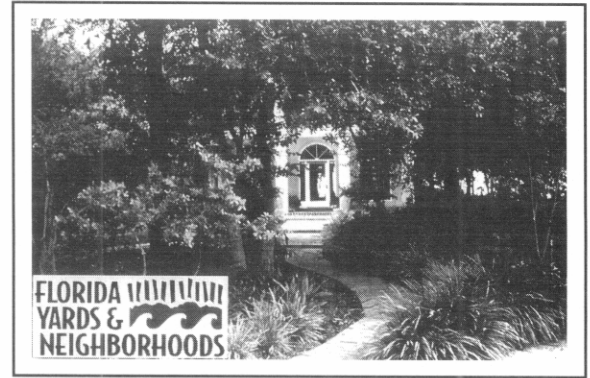
Sarasota County has adopted a rate structure and has developed master plans for improving stormwater management in two priority watersheds: Phillippi Creek and Hudson Bayou. The county and the City of Sarasota are cooperatively developing a stormwater management plan for Whitaker Bayou. These actions are included as requirements of the Nonpoint Pollution Discharge Elimination System (NPDES) permit issued for Sarasota County by the U.S. Environmental Protection Agency.

It is anticipated that Manatee County will adopt a utility rate structure to develop stormwater management strategies for improving the priority watersheds of Bowlees Creek and Cedar Hammock.

A series of projects were conducted by the Sarasota Bay Program to assist both counties in testing actual stormwater management techniques that significantly reduce the quantity and improve the quality of stormwater runoff in targeted areas:

Florida Yards & Neighborhoods Program

The Florida Yards & Neighborhoods Program has the greatest potential for improving Sarasota Bay in terms of stormwater runoff by reducing the quantity and improving the quality of runoff from residential properties. The Florida Yards & Neighborhoods Program, a community education and action program, seeks to:

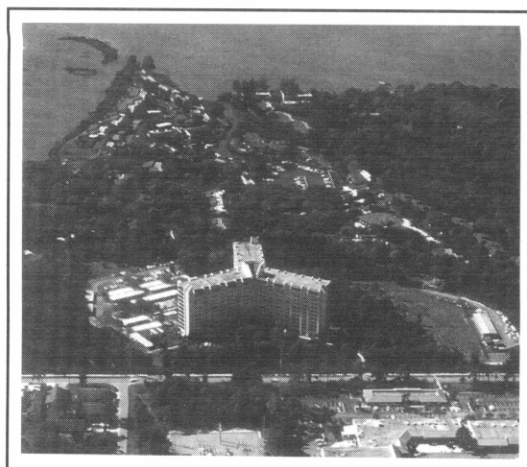


- o Improve home and yard design and maintenance to improve and protect the Bay's water quality and increase native wildlife habitat.
- o Reduce water usage throughout the region.
- o Provide a way for each resident of the community to play a substantial, active role in water-resource protection.

In 1993, the Sarasota Bay Program and Cooperative Extension Service launched the Florida Yards & Neighborhoods Program to provide information and advice on landscape design and maintenance to homeowners in Manatee and Sarasota counties. More than 25 Master Gardeners have been recruited and trained to address Florida Yard questions from homeowners and community neighborhoods. Four model Florida Yards located at public facilities were installed in 1993-94, providing education opportunities for residents. The "Florida Yards & Neighborhoods Handbook," a guide for homeowners, explains how to design an environmentally friendly landscape featuring carefully selected plants suited to the climate, natural conditions and wildlife of southwest Florida. Tips on cost-saving landscape maintenance also are included to help residents reduce water, fertilizer and pesticide use; a helpful section for waterfront homeowners addresses shoreline management. A recognition program for Florida Yard homeowners, the Florida Yardstick, also was developed in 1994. Major initiatives to institutionalize the Program are planned in 1995-96. This project is ongoing.

Cooperators: Manatee County Cooperative Extension Service, Sarasota County Cooperative Extension Service, Florida Sea Grant College, University of Florida, Institute of Food and Agricultural Services (IFAS), Swiftmud, Florida Dept. of Environmental Protection (FDEP).

Project Cost: \$135,000.



Clower Creek stormwater management

This project investigates alternatives for stormwater management with emphasis on improving runoff water quality in a highly urbanized watershed. Following analysis of data collected during storms, improvements to several existing treatment structures were recommended. The project showed that improving existing treatment structures can

be effective in reducing pollutant loads (nutrients, sediments and associated toxics). Two other recommendations of this project include routine maintenance of stormwater treatment systems, channels and culverts; and implementation of best management practices. Construction will begin in 1995.

Cooperators: Sarasota County, Florida Dept. of Transportation (FDOT), U.S. Environmental Protection Agency (U.S. EPA).

Project Cost: \$100,000.

Airport drain stormwater management

This project consists of expanding an existing desiltation basin in an industrialized watershed (with some residential land use) to capture sediments and reduce nutrients and heavy metals entering Sarasota Bay. A wet detention treatment system will be installed to improve water quality in Bowlees Creek, treating 25 percent of this priority watershed. Construction will begin in 1995.

Cooperators: Manatee County, Manasota Basin Board of Swiftmud, U.S. EPA.

Project Cost: \$137,500.

Aqualane Canal

Aqualane Canal, located just south of Phillippi Creek, has been identified as a "hot spot" for sediments and contaminants. This project will determine the effectiveness of "Water Quality Inlets" for removing sediments and hydrocarbon loadings from stormwater runoff in a highly urbanized area. These devices have been successfully utilized in other urban areas, particularly Maryland. If successful in the Sarasota Bay

area, these structures would have widespread application throughout the southwest region of Florida. This project will be completed in 1995.

Cooperators: Sarasota County, U.S. EPA.

Project Cost: \$40,000.

Habitat restoration and protection

One of the major impacts threatening Sarasota Bay is the extensive loss of intertidal habitat and the encroachment of exotic plant species. Intertidal habitat has declined approximately 40 percent in Sarasota Bay, impacting juvenile fisheries. Past dredging activities have altered the Bay bottom and destroyed seagrasses. Loss of seagrasses is estimated at 25-30 percent Baywide; in some areas estimated loss is 80 percent.

To meet the challenge of restoring lost habitats and arresting further declines, the Sarasota Bay Program and local governments developed and implemented a series of habitat restoration projects. These projects included design elements to encourage and enhance juvenile fisheries of recreationally important species. Habitat restoration sites were designed and excavated to include lagoons of varying depths and salinity, and shorelines were irregularly shaped to increase diverse fishery habitat. Implementation of these projects also assisted in developing realistic cost estimates for Baywide application and establishing an annual habitat restoration goal of approximately 18 acres for saltwater wetlands and 11 acres for freshwater wetlands:

Sarasota BayWalk at City Island

This project developed a productive intertidal habitat on 4.5 acres of City Island in Sarasota, including intertidal pools, 25,000 plants and a nature trail with interpretive signs. The Sarasota BayWalk, dedicated in April 1992, is visited by more than 20,000 people each year. More than one mile of natural, intertidal shoreline was created at the site. Scientific monitoring suggests that the area is equal in fishery productivity to the average natural area of similar type.

Cooperators: City of Sarasota, Sarasota County, FDEP, U.S. EPA.

Project Cost: \$200,000.





Coquina BayWalk at Leffis Key

This project developed a productive intertidal habitat on 30 acres near Coquina Beach in Manatee County. Excavation, grading and boardwalk construction were completed in 1994; volunteers planted more than 50,000 native plants and trees,

and educational signs were added in 1994. Leffis Key is featured in the *Florida Wildlife Viewing Guide*. It also was featured in the June 1993 issue of *Good Housekeeping*, a national magazine. In 1993, the project won an Environmental Excellence Award from the Florida Marine Research Institute.

Cooperators: Manatee County, FDEP, U.S. EPA.

Project Cost: \$315,000.



Sixth Street Canal and Sarasota Civic Center restoration

This project restored and increased shoreline habitat in a downtown canal area in the City of Sarasota. The project was included in the City's master plan to enhance the culturally, environmentally and

economically important Bayfront area. The site provides natural filtration of stormwater, oyster habitat and exceptional opportunities to view the Bay with walkways and overlooks. The project was completed in 1993.

Cooperators: City of Sarasota, FDEP, U.S. EPA.

Project Cost: \$130,000.



Quick Point Preserve

This project will restore 34 acres of an environmentally sensitive site on the southeastern tip of Longboat Key. The area was significantly impacted by dredge-spoil material from New Pass and has extensive exotic vegetation. A tidal inlet leading to

an interior lagoon will be excavated to provide circulation and improve water quality within the site and a low-impact nature trail through the preserve is planned. Construction is scheduled to begin in 1995.

Cooperators: Town of Longboat Key, Manasota Basin Board, Swiftmud, FDEP.

Project Cost: \$300,000.

Hog Creek

Hog Creek, a small tributary draining an industrial area in the City of Sarasota, is included in the Sarasota Civic Center Complex renovation master plan. The City and Florida Power & Light Corp. are restoring the creek bank and bottom by removing non-native plants, grading banks and revegetating the area with native plants. The project will be completed in 1995.

Cooperators: City of Sarasota, Florida Power & Light Corp., U.S. EPA.

Project Cost: \$56,000.

Creating optimal fishery habitat

After monitoring the Sarasota BayWalk habitat restoration site, it was determined that ponds and inlets with smooth bottoms and linear shorelines were not as productive for fisheries as those with more natural features. Highly productive fishery micro-habitats will be designed for Quick Point Preserve and the Coquina BayWalk on Leffis Key.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$6,700.

Seawall habitat enhancement (habitat modules)

This project consists of the development, demonstration and evaluation of methods for enhancing habitat value of seawalls and increasing juvenile fishery productivity by installing reef-type structures in canalfront communities. Four types of habitat modules were constructed and are being tested. Results show the modules are inhabited by hundreds of fish and other marine life. Discussions with the Florida Dept. of Environmental Protection suggest that these reef-type structures may be deployed without special permits and with only



a notification to FDEP. If marketed on a wide scale to canalfront homeowners, the modules would greatly increase available habitat for juvenile fish.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$76,750.



Seawall removal and shoreline naturalization

This project, located at the Caples Campus, University of South Florida (Sarasota), removed a 325-foot-long crumbling seawall and stabilized the resulting natural beach with native vegetation. Students from the New College Environmental Studies Program monitored the project. The project was completed in 1992.

Cooperators: New College, University of South Florida (Sarasota), FDEP.

Project Cost: \$10,000.

Benthic habitat repair (sediment capping)

This project will create a structurally complex reef-type environment in an area that currently has limited habitat value. The reefs will be created as agreed upon by the community. The project will be initiated in 1995.

Cooperators: Mote Marine Lab, Manatee County, FDOT, FDEP, U.S. EPA.

Project Cost: \$50,000 plus costs for construction, movement and placement of reef materials.



Seagrass signage

This project investigated whether seagrass beds can be effectively protected from motorboat propeller damage by marking an area with buoys. Markers were installed in three locations in Sarasota Bay. At these locations, propeller scars were monitored and boater behavior was recorded. A survey was

conducted, focusing on boaters' experiences with seagrass beds. The project found that marking grassflats reduced scarring by nearly 30 percent, and investigators recommended that improved marking of the Intracoastal Waterway (ICW) was most appropriate.

Cooperators: New College, University of South Florida (Sarasota), U.S. EPA.

Project Cost: \$30,000.

Seagrass transplanting and restoration

This project utilizes a new biotechnological approach (clonal micropropagation) previously tested in ponds at Sarasota BayWalk. Bottoms of newly created lagoons at Coquina BayWalk on Leffis Key were vegetated with seagrasses. This project will be completed in 1995. Also, in 1991 seagrasses from a protected area were transplanted to an area directly south of Whitaker Bayou to assist in documenting the existence of water quality improvements in that area. The seagrasses survived.

Cooperators: FDEP, Florida Marine Research Institute, U.S. EPA.

Project Cost: \$37,500.

Sister Keys seagrass assessment

This project provided an intensive characterization of bottom habitats in the area surrounding Sister Keys, a group of undeveloped islands. Seagrass mapping, bathymetry, species diversity and other environmental parameters were included. The assessment was used as research by the Town of Longboat Key and the Sister Keys Conservancy in their successful purchase of the islands for public use in 1992 for \$1 million.

Cooperators: American Littoral Society, Swiftmud.

Project Cost: \$5,000.

Fisheries productivity

Declines in recreationally important fisheries have been attributed to reduced water quality and loss of productive intertidal habitat, along with increased fishing pressure. Loss of bottom habitat has contributed to reductions in shellfish populations.



Due to recent upgrades to wastewater treatment systems in the north and central portions of the Bay and improvements in stormwater management, water quality has improved enough that fisheries populations may rebound. Initial efforts to relocate juvenile scallops from other locations to Sarasota Bay have proved successful. Also, oyster habitat was a design feature at the Sixth Street Canal Habitat Restoration site in the City of Sarasota.



Re-establishing scallop population

This project demonstrated the feasibility of re-establishing a breeding population of Bay scallops, *Argopecten irradians concentricus*. The test site is a protected seagrass meadow in Pansy Bayou, an area with limited entry. Scallops were collected

and transported from another water body to Pansy Bayou. Survival and reproduction were documented, illustrating the potential for reintroducing scallops in this part of the Bay. This project will be completed in 1995.

Cooperators: Mote Marine Laboratory, FDEP, U.S. EPA.

Project Cost: \$13,300.

Technical assessment and characterization

Several technical projects were completed to support development and implementation of the Comprehensive Conservation and Management Plan (CCMP). The major technical findings were summarized in the "Framework for Action" report released in March 1993. The findings and recommendations of these technical projects provided the basis for the Action Plans in the CCMP.

Baywide segmentation

This project divided Sarasota Bay into areas of similar hydrologic and habitat components. The segmentation scheme was used in the characterization effort to organize data and help focus attention on

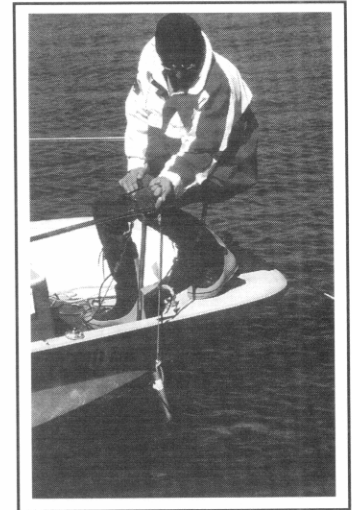
problem areas. The project was completed in 1990.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$8,000.

Water quality monitoring

This project implemented a five-year quarterly synoptic water quality monitoring program to assess the status and trends for water quality within Sarasota Bay. The innovative monitoring program focused on light and light-related parameters. The analysis addressed historical water quality and sediment chemistry. Data were used to create a water clarity index, which was then used to develop regionalized Bay improvement strategies. The Estuarine Monitoring and Assessment Program (EMAP) of the U.S. EPA has been used to assist local governments in developing water quality monitoring programs capable of detecting long-term trends in water quality. The project also addressed viral and bacterial contamination in the Phillippi Creek watershed.



Cooperators: Manatee County, Sarasota County, Mote Marine Laboratory, Swiftmud, U.S. EPA.

Project Cost: \$547,000.

Water quality model

This project developed and calibrated a water quality model capable of determining the expected response of water column nutrient levels, water column chlorophyll concentration and, to the extent possible, light attenuation coefficients to a 25-30 percent reduction in nutrient loading in Roberts Bay and upper Little Sarasota Bay. The project addressed such problems as:

- o The time lag associated with eliminating groundwater transport of nutrients in septic-tank leachate.
- o The influence of long-term enrichment of sediment nutrient pools on the response time of water quality.
- o The influence of circulation patterns within Roberts Bay and upper Little Sarasota Bay on the responses of water quality parameters to nutrient load reduction.
- o The relative importance of epiphytic algae on light reduction

to seagrasses and recurrent hypoxia.

The model also will be used to forecast improvements in water quality as various nutrient reduction strategies are developed and implemented. The water quality model also could be used by local governments to assess Bay impacts from proposed changes in land use patterns. The project was completed in 1994.

Cooperators: University of Florida, Dept. of Coastal and Oceanographic Engineering, Swiftmud, U.S. Geological Society (USGS), U.S. EPA.

Project Cost: \$77,600.

Wetland status and trends

This project described the location and status of freshwater and intertidal wetlands in the study area. Information from this effort documented historical wetlands losses and their potential causes, provided information on the present condition of wetlands, and helped define restorative measures. The project was completed in 1992.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$100,000.

Estuarine bottom habitat assessment

This project characterized Bay bottom types and investigated the status of Bay bottom habitats. Information from this effort documented losses of submerged aquatic vegetation and their causes, defined the extent and condition of bottom habitats and helped define restorative measures. The project was completed in 1992.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$75,000.

Seagrass depth as affected by light attenuators

This project assessed the effects of light-related parameters on seagrasses throughout Sarasota Bay. Information from this effort was used to determine what water quality parameters most strongly affect the distribution, biomass and productivity of seagrasses throughout the Bay. Data were gained to determine the spatial and temporal variation in the importance of assorted light attenuating water quality parameters, thus affecting seagrass growth. This information was used

to assist in developing strategies for improving Bay water quality and fisheries habitat. This project was completed in 1994.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$29,000.

Baywide circulation modeling

This project designed and developed a basinwide circulation model that showed how fresh and saltwater move and mix in Sarasota Bay. Activities included data collection and analysis, model calibration and verification, and reporting. Emphasis was placed on tides, wind, runoff and turbidity. A preliminary model, completed in Spring 1992, focused on Little Sarasota Bay. The model presented scenarios should alterations to Bay circulation occur. The preliminary circulation model was expanded in 1993 to include Big Sarasota Bay and passes. This project was in completed 1994.

Cooperators: University of Florida, Coastal and Oceanographic Engineering, USGS.

Project Cost: \$720,000.

Effects of the Manatee River on Bay circulation

This project was developed as a result of preliminary data analysis from the Baywide Circulation Model project. This work involved installation of an instrument platform at the mouth of the Manatee River to determine the effects of flow from the river on the north portions of Sarasota Bay, in particular Anna Maria Sound. Results of this project were incorporated into the Baywide Circulation Model. This project was completed in 1994.

Cooperators: University of Florida, Coastal and Oceanographic Engineering, USGS.

Project Cost: \$40,000.

Regional beach and inlet management plan

The Sarasota Bay Program participated on the City of Sarasota's Technical Advisory and Oversight Committee to assist in developing a regional beach and inlet management plan for both Big Sarasota Pass and New Pass. Management plans for Longboat Pass and the Venice



Inlet also are in preparation.

Cooperators: City of Sarasota, Sarasota County, Manatee County, Town of Longboat Key, City of Venice, FDEP.

Project cost: Funds for inlet management plans were provided by the respective local governments.

Impacts of sea-level rise

This project assessed impacts on environmental, cultural and community resources in the Sarasota Bay area given different rates of sea-level rise (SLR). Data from this project will be used to review and improve existing land use and zoning regulations or develop new programs that will promote adequate and appropriate long term land use. This project was completed in 1992.

Cooperators: Tampa Bay Regional Planning Council, Mote Marine Laboratory, Swiftmud, U.S. EPA.

Project Cost: \$47,700.

Fishery resource assessment

This project assessed finfish stocks and availability in Sarasota Bay through a recreational fishing survey. The project also investigated species diversity as an indicator of Bay health. This project was completed in 1992.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$100,000.

Fishery nursery habitat assessment

This project investigated spatial and temporal variation in abundances and species diversity of finfish and shellfish in Roberts Bay, Little Sarasota Bay and Blackburn Bay. Information from this project is critical for assessing the potential impacts of altered circulation patterns in the Little Sarasota Bay area. This project was completed in 1994.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$40,000.

Effects of hypoxia on marine organisms

This project better characterized the quality of various benthic habitats throughout Sarasota Bay and assessed the spatial extent of

hypoxic (Dissolved oxygen [D.O.] ≤ 2 mg/l) conditions in areas where previous sampling efforts had failed to identify critically low dissolved oxygen problems. This project was completed in 1994.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$30,000.

Shellfish contamination assessment

This project investigated the types and levels of contamination in Sarasota Bay's shellfish and any associated health risks. Data from this effort was used to target areas for improved stormwater treatment or retrofit. This project was completed in 1992.

Cooperators: Mote Marine Laboratory, U.S. EPA.

Project Cost: \$100,000.

Point and non-point source pollutant loading assessment

This project developed a model to describe types and quantities of pollution being delivered to Sarasota Bay. It described pollution loading from point sources (pipes) and non-point sources such as septic systems, stormwater, agriculture and golf courses. Data from this effort were used to develop recommendations on how land use, stormwater and sewage treatment plants can be improved or better managed in the future to reduce pollution loadings to the Bay. This project was completed in 1992.

Cooperators: Camp, Dresser & McKee, Inc., Swiftmud, U.S. EPA.

Project Cost: \$400,000.

Resource access and use assessment

This project inventoried recreational resources and access opportunities, measured recreational resources and uses and investigated conflicts between uses, access and Bay quality. The project related present trends to future impacts and provided recommendations for access and use management. This project was completed in 1992.

Cooperators: John J. Whelan, Architect, and Associates, Swiftmud, U.S. EPA.

Project Cost: \$40,000.

Data management

This project provided for the progressive purchase of new and/or the upgrading of current computer hardware and software as previously recommended. New and/or upgraded computer equipment purchased in 1991 provided efficient storage and analytical capabilities of data generated by the technical assessment work. This project was completed in 1992.

Cooperators: Camp, Dresser & McKee, Inc., Mote Marine Lab, Swiftmud, U.S. EPA.

Project Cost: \$82,000.

Wastewater treatment evaluation

This project assisted local governments in developing and evaluating options for expanding wastewater treatment discharge capacity. The project evaluated the feasibility of the City's providing sewer service to adjacent areas currently on septic tanks. This project was completed in 1994.

Cooperators: City of Sarasota; Post, Buckley, Schuh & Jernigan, Inc.

Project Cost: \$68,400.

Finance strategy development

This project investigated options for funding priority policies and actions outlined in the CCMP. An assessment of ongoing work by local governments and identification of appropriate funding sources and mechanisms was conducted. Information from this effort led to development of a comprehensive finance strategy to support implementation of the restoration plan.

Cooperators: Post, Buckley, Schuh & Jernigan, Inc., U.S. EPA.

Project Cost: \$30,000.

Base program analysis

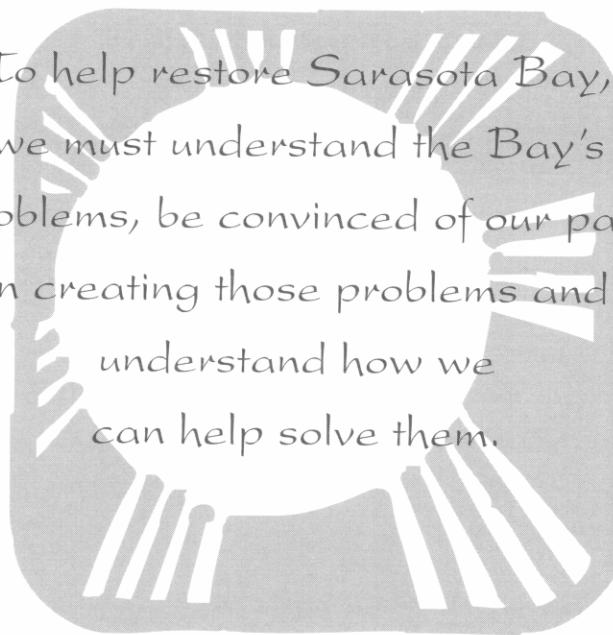
This project investigated the adequacy of environmental legislation and levels of effort by regulatory agencies on all government levels: federal, state, regional and local. Information from this effort was used to develop recommendations for long-term Bay management. This project was completed in 1991.

Cooperators: University of South Florida, New College.

Project Cost: \$2,000.



To help restore Sarasota Bay,
we must understand the Bay's
problems, be convinced of our part
in creating those problems and
understand how we
can help solve them.



Citizen Involvement in Sarasota Bay Restoration



It is fitting that the plan to restore Sarasota Bay should culminate with the public's role in restoration. After all, the first voices raised in defense of the Bay were those of people whose livelihoods and lifestyles depend on a healthy Bay. From fishers to families with generations of Baywatchers in their past, people noticed the Bay's decline and spoke out. Growing public sentiment, government support and the best efforts of science have brought the Sarasota Bay community closer than ever before to solving some of the area's most pressing environmental problems.

Some solutions to the Bay's problems will require action by elected officials and their appointed staffs. But all the solutions will require support from or action by the public, either through advocating the best options for government decisions or by changing individual actions to improve or protect the Bay.

To be motivated to help restore Sarasota Bay, we must understand the Bay's problems, be convinced of our part in creating those problems and understand how we can help solve them. Then we will be ready to act.

Understanding the Bay's problems

A public-opinion survey conducted for the Sarasota Bay Program in 1990 indicated that people were concerned about the Bay's health, but did not fully understand the Bay's problems (FAU, 1990). For example, while nearly 74 percent of the people surveyed were "very concerned" about the loss of native habitat and its effects on fishing and shellfishing, less than 45 percent were "very concerned" about the

effects of stormwater runoff. Clearly, the impact of stormwater pollution on fishing and shellfishing was not understood.

Recognizing that people cannot be part of solutions if they do not understand the problems, the Sarasota Bay Program's Citizen Advisory Committee (CAC) focused the Program's outreach efforts on helping the public understand Bay problems. Sarasota Bay Program staff made numerous presentations to community groups to highlight what were emerging as the Bay's three major problems: stormwater runoff, wastewater discharge and habitat loss.

In discussions following these presentations, many misconceptions about Bay issues were evident. For example, many people said they believed the City of Sarasota's treated wastewater discharge to Whitaker Bayou was the major source of pollution to Sarasota Bay. Many incorrectly assumed the discharge was "raw sewage," and that the city was making little headway in improving treatment levels or removing the discharge from the Bay, despite the fact that the city has upgraded the plant to Advanced Wastewater Treatment and water quality has improved in the area.

People were generally surprised to learn that stormwater is the major source of pollution Baywide, and that residential areas in the watershed are significant sources of stormwater pollution.

Another example of general misunderstanding by the public became apparent during workshops on the state's mangrove-pruning regulation. As part of the CAC's first Action Plan in 1990-91, two workshops were held by the Sarasota Bay Program and Florida Sea Grant College, with support from the Tri-County Chapter of the Landscape Maintenance Assn. Many citizens who attended the workshops generally had little knowledge of the ecological necessity of mangroves, and were unaware of scientific information on the negative impacts of pruning.

Whose problem is it?

The public's relationship to Sarasota Bay may be described by four basic categories:

- o People who live next to the Bay.
- o People who use the Bay for work or recreation.
- o People who don't use the Bay, but like knowing it's there.
- o People who don't think about the Bay at all.

According to the Program's public-opinion survey, the final category includes only about two percent of the Manatee-Sarasota community, indicating that just about everyone has a stake in Sarasota Bay.

Many people might say that those who benefit the most from a healthy Bay — waterfront-property owners and Bay users — also have the greatest potential for harming the Bay. In some ways, that may be true.

For example, owners of waterfront property depend on Sarasota Bay for the view and water access that enhance quality of life and increase property values. Yet stormwater runoff from waterfront properties has an immediate impact on the Bay's water quality, and improper mangrove pruning damages an important part of the Bay's ecology.

Boaters rely on the Bay for recreation, yet unwary boaters damage seagrass beds by running aground in shallow water. Pumping contaminated bilge water into Sarasota Bay is another potential cause of damage to the Bay.

Scientific work by the Sarasota Bay Program indicates that wherever we live, work or recreate in the region, each of us contributes to the Bay's problems. Stormwater runs off roads, parking lots, yards and farms, so anyone who drives a car or fertilizes a yard may be contributing to Bay pollution.

Wastewater pollution is another significant problem, particularly in the southern reaches of Sarasota Bay. Septic systems near tributaries and Bay waters, as well as some package treatment plants, are polluting the Bay in southern Sarasota County. Residents of the City of Sarasota still contribute to Bay pollution as well; although the city has greatly improved the treatment level of the effluent and is expanding reuse operations, discharge to the Bay continues. Relying on existing wastewater treatment operations means residents of Sarasota

County or the City of Sarasota who flush a toilet or take a shower also contribute to the Bay's problems.

Bay pollution is everyone's problem. Fortunately, the majority of Sarasota Bay-area residents care what happens to the Bay. More than 80 percent of people surveyed in Manatee and Sarasota counties were "very" or "fairly" concerned about local Bay waters. And most (nearly 65 percent) were even willing to pay more in taxes to restore Sarasota Bay.

Who is 'the public,' anyway?

The Sarasota Bay area is home to about 500,000 people in two counties (Manatee and Sarasota) and nine incorporated cities or towns. Approximately 400,000 residents are of voting age, but only about half those are registered and actually vote. Three-quarters of the total population are older than 35, and more than one-third are over 65 (FSU, 1991).

Seasonal residents represent 10-25 percent of the total population, depending on the source of the estimate. On the barrier islands, such as Siesta Key and Longboat Key, the percentage of winter-season residents is probably much higher, around 70-90 percent (FSU, 1991). The area also has seasonal renters and tourists whose impact on the economy and on the Bay is significant, but difficult to quantify.

The makeup of the community, with so many part-time residents and newcomers, presents a challenge to environmental education and protection efforts. While these population groups may be some of the most intensive users of Sarasota Bay, they might not think of the Bay area as home and therefore may have less of a stake in protecting Bay resources. Certainly their understanding of threats to the Bay's fragile ecology is likely to be less than that of year-round residents, whose incomplete knowledge of Bay issues has been documented by the Program.

To the benefit of Bay outreach programs, the Sarasota Bay area has many clubs, civic organizations and conservation groups whose memberships expand considerably during the winter season. These groups provide forums for reaching large numbers of people with Bay education and action programs. Some areas have close-knit neighborhood associations that provide an excellent way to reach people who have a strong sense of community. The commitment and participation

of all these organizations will be essential in changing public attitudes and actions related to the Bay.

The children of the Sarasota Bay area are some of the most ardent Bay supporters. More than 55,000 students are enrolled in Manatee and Sarasota public schools, and both school districts have been strongly supportive of improving Bay education. The Program has provided funding to both school districts for teacher training and curriculum development (see summaries of public-school programs in this chapter). Instructional programs emphasize understanding how Sarasota Bay's natural system is supposed to work, how people have damaged that system and how they can help repair it. Students take the messages to heart — and to their homes — sharing the Bay-protection message with parents and friends.

How the public can help

The number and diversity of people already active in promoting and protecting the Bay are encouraging signs for Sarasota Bay's future. Environmental organizations, teachers and students, trade associations, private foundations, civic clubs, church groups and neighborhood associations are participating in Bay-improvement projects. This core of commitment is expanding, but the pace must be accelerated to make significant strides in restoring the Bay.

To accelerate the public's involvement in restoring Sarasota Bay, the Program's Citizen Advisory Committee has been developing a strategy to:

- o Target specific Bay problems and educate the public to help solve those problems.
- o Target segments of the community most closely associated with the various problems.
- o Tailor education and involvement programs to reach those people most effectively.

Solving Sarasota Bay's problems will be a long-term process, so people will need to be strongly motivated to maintain their commitment to restoring and protecting the Bay. To forge that commitment, people need to be involved in hands-on activities that promote personal interaction with the Bay. People learn best when they *do*. A personal experience with Sarasota Bay, such as planting marsh grass, cleaning a shoreline or monitoring grass flats, is much more likely to influence

a person's actions than simply reading a brochure.

Educating people about the Bay's problems and involving them in solutions can be accomplished in a variety of ways. To investigate ways to expand the pace of educating the public on Bay issues, the Program contracted with Florida State University's Conservatory in Motion Picture, Television & Recording Arts to develop a plan for the use of broadcast media and videos. Graduate students researched the local television and radio market and conducted telephone interviews with most major clubs, neighborhood associations and civic groups in Manatee and Sarasota counties. The research produced three primary methods for disseminating information about the Bay: promoting activities worthy of news coverage, providing videos and related instructional materials to schools and making personal presentations to community groups.

The Program has pursued all three avenues. News coverage of Program activities, and subsequent examination of Sarasota Bay's problems, averages two articles per month in local media. The Program's Speakers' Bureau includes citizen volunteers who use the Program's 15-minute video on Bay problems, "Sarasota Bay: Reclaiming Paradise," in group presentations. Copies of the video are provided to each school in Manatee and Sarasota counties, and teachers in both counties are incorporating the video in instructional programs.

Public outreach by the Program began by producing a Bay reference book, the "State of the Bay Report, 1990." This illustrated volume presented what the community knew about Sarasota Bay at that time. The Program also participated with Sarasota County in producing the "Bay Repair Kit," an award-winning guide to Bay-friendly living. After the original printing of 3,000 copies was distributed in 30 days, the Program participated with the American Littoral Society, William & Marie Selby Foundation, NCNB Community Foundation and Sarasota County in reprinting the "Bay Repair Kit." Approximately 20,000 of the total 30,000 copies were mailed to residents living near Sarasota Bay; the remainder are still being distributed by mail upon request or at community events. Copies were also provided to each public school in Manatee and Sarasota counties.

The Program produces a newsletter, the *Bay Monitor*, several times a year, providing news of Program activities in the context of defining and solving Bay problems. The *Bay Monitor* is also the vehicle

for awarding the Program's "Bay Hooray!" award, which recognizes groups and individuals who work to restore and protect Sarasota Bay (see related information in this chapter). Recognizing exemplary stewards of the Bay helps encourage others to participate, and describes model projects that other organizations could adapt.

As Sarasota Bay's problems were better defined through the Program's technical work, more specific messages based on major issues were developed. The Citizen Advisory Committee produced Citizen Action Plans in 1991 and 1992, targeting education efforts to specific Bay problems and specific audiences.

For example, loss of mangrove habitat was one focus of the 1991 plan. The Program capitalized on the community's interest in a controversial mangrove-pruning regulation implemented by the State of Florida in 1991. Workshops were held to explain the complex mangrove-pruning rules, strongly emphasizing the importance of mangroves to Sarasota Bay's ecology. Promotion for the workshops targeted waterfront areas, landscape-maintenance professionals, utilities' maintenance supervisors and local government employees who are involved in mangrove regulation or shoreline maintenance. More than 200 people attended the workshops, and many more requested explanatory literature developed by Florida Sea Grant College. The strong interest in the topic has prompted Sea Grant and the Sarasota Bay Program to develop a more comprehensive approach to educating target groups on mangrove protection.

The public learned more about habitat loss and restoration through the Program's Early Action Demonstration Projects (see Early Action Demonstration Projects chapter). Thorough media coverage of projects at various stages allowed the Program to deliver strong messages about the extent of habitat loss and the need for restoration strategies.

Stormwater was another topic covered by the 1991 Citizen Action Plan. The Program worked with stormwater managers in Sarasota and Manatee counties to develop a stormdrain-stenciling program called "Paint the Way to a Better Bay," launched in Fall 1991. The counties coordinate and supply a citizen-volunteer program in which clubs, schools and other organizations stencil a pollution-prevention message on catch basins in neighborhoods. By Spring 1994, nearly 200 people in Manatee and Sarasota counties had painted more than 800

drains. Support for the ongoing program continues from the counties' stormwater management departments.

Another stormwater-related project involved developing coloring-book pages for a booklet produced by the Soil Conservation Service. Coloring books were distributed to Sarasota County school students, and the coloring pages were distributed separately at community events and to teachers.

The 1992 Citizen Action Plan built on its predecessor. The 1992 plan expanded volunteer activities related to the Bay with a community grants program designed to encourage citizen groups to develop projects that educate and involve the public in Bay protection and restoration.

The emphasis on preventing stormwater pollution continues with resources for developing the Florida Yards & Neighborhoods Program, which motivates area residents to improve yard design and maintenance to conserve water and protect the Bay. The Florida Yards & Neighborhoods Program was formally initiated in Fall 1993 by hiring a regional coordinator through the University of Florida's Sea Grant Extension office. Initiatives to expand the program are proposed in this document and will be presented to the community in 1995. A Florida Yards & Neighborhoods handbook (a how-to manual) has been completed to assist homeowners in modifying their landscapes. The focus on habitat loss continues with plans to research ownership of critical wetlands to help local governments plan acquisition strategies. Protecting seagrass habitats was included in the 1992 plan, and the Program also plans to expand boater-education programs.

Ready to act

Developing outreach projects has helped the Program better refine what types of citizen activities are most effective. Those lessons will be applied in developing a strategy to involve citizens in implementing the Bay restoration plan.

The citizen's role in restoring Sarasota Bay is threefold:

- o To advocate appropriate decisions by government.
- o To make lifestyle changes necessary to protect the Bay.
- o When possible, to participate in Bay education and improvement projects to involve other people in restoring Sarasota Bay.

While there is much government must do to alter Bay policies and improve management activities, the will of the people ultimately drives the decisions of elected officials. Therefore, part of the public's role in restoration is supporting and encouraging government's movement toward better Bay policies and management. This support may range from advocacy on specific issues to financial commitments, such as bonds, fees or taxes to pay for improving the Bay.

The public's commitment to improving habits of daily living also is required to restore and protect Sarasota Bay. Research by the Sarasota Bay Program documents what many have long believed: individual lifestyles have an impact on the Bay. Many of our daily activities — yard maintenance, waste disposal and so on — can be improved to better protect and restore Sarasota Bay.

For people with time, interest and energy, participating in Bay education or improvement projects will help spread the word and the work throughout the community. Clubs, schools and government agencies can help make projects and programs available to citizens eager to do their part.

Public outreach programs for Sarasota Bay

Since 1989, the Sarasota Bay Program has investigated numerous ways to educate and involve citizens in restoring the Bay, including programs for public schools, action projects, exhibits at community events, opportunities for volunteers, workshops and publications.



Public school education

With considerable assistance from Citizen Advisory Committee members, the Program developed several projects in conjunction with the public-school districts in Manatee and Sarasota counties. Those projects include teacher training, curriculum enhancement, literature distribution, field trips, an educational display and other activities.

Elementary classroom activities: In Fall 1990, the Program worked with Manatee County fifth-grade teachers to develop "Sarasota BayBook, Vol. I," a collection of classroom activities for use in conjunction with an existing curriculum on estuarine ecology. The booklet was used in classrooms during Spring 1991, and in-service training sessions

were provided to fifth-grade teachers in the fall of that year. The booklet was first used in classrooms during the 1991-92 school year and revised in Summer 1992 based on teacher evaluations. The booklet continues to be used in the local school system.

BayWalk habitat tours: The Program worked with Mote Marine Laboratory in Spring 1991 to provide guided tours of the Sarasota BayWalk tidal habitat, an Early Action Demonstration Project restoration site on City Island, for 4,500 school children from Manatee, Sarasota and other counties. Tours were provided by high-school students, citizen advisors and other area residents.

In the 1991-92 school year, the Program worked with Sarasota County teachers to develop printed student field guides for use in the BayWalk. Different guides were designed for elementary, middle- and high-school students. The guides, which emphasize observation and critical thinking, provide information on Bay issues highlighted in BayWalk signage. They also include a worksheet to encourage student interaction.

Environmental educators' workshop: The Program hosted a workshop for environmental educators from each school in Manatee and Sarasota counties in Fall 1991. Teachers learned about Bay issues and collected information on available programs from various agencies and organizations. They also toured the Mote Marine Aquarium, Sarasota BayWalk and the Pelican Man's Bird Sanctuary.

Bay reference material: The Program provided classroom sets of the "State of the Bay Report, 1990" and the "Bay Repair Kit" to each school in Manatee and Sarasota counties in Fall 1991.

Bay display: The Program developed a display representing Bay issues and the community's efforts to solve Sarasota Bay's problems. The display is rotated among schools and other public facilities in Manatee and Sarasota counties.

Manatee County middle-school curriculum: In a joint effort with the Tampa Bay National Estuary Program, the Program provided funds to the Manatee County School Board to develop a middle-school curriculum on Sarasota Bay. A pilot program was developed in the 1991-92 school year, with each school designing unique activities and field exercises for the grade level of choice. The program was expanded to additional grades at each school in the 1992-93 school year.

Sarasota County middle-school science: The Program participated with the Selby Foundation, Mote Marine Laboratory, Selby Botanical Gardens and the Sarasota County School Board in providing training for middle-school science teachers in Spring 1992. The Program provided funding and instruction for part of a college-credit course in marine science for teachers. The Program also purchased aquaria for sixth-grade classrooms in Sarasota County and sponsored a workshop to provide instruction for teachers on tank set-up and maintenance.

Stormwater coloring pages: The Program provided artwork to the Soil Conservation Service in Sarasota County for a coloring book for elementary-school students. The artwork features a manatee and other Bay animals to focus on stormwater runoff and how children can help protect Sarasota Bay from pollution; it is distributed separately to teachers who reproduce the pages for classroom use. The Program also distributes stormwater coloring books, provided by the Santa Monica Bay Restoration Project that feature the "Teenage Mutant Ninja Turtles."

Classroom presentations: Program staff and citizen advisors provide presentations to students and teacher organizations on Sarasota Bay's problems and the Program's efforts to develop solutions. Beginning in Spring 1992, presentations included the use of a 15-minute video, "Sarasota Bay: Reclaiming Paradise," and a "Check Your Bay-Q" worksheet for use in discussions following the video.

Bay Monitor Newsletter

The Program released the first issue of its *Bay Monitor* newsletter in February 1991. The publication relates Bay issues in a lively, readable manner and includes features on the Program's technical projects, Early Action Demonstration Projects and public-outreach activities. Direct-mail circulation is 5,000-10,000 copies per issue, depending on distribution needs.

The newsletter is the vehicle for promoting the "Bay Hooray!" award, which the Program uses to recognize groups or individuals whose efforts benefit Sarasota Bay.

Media plan and productions

In 1991, the Program contracted with Florida State University's Film & Motion Picture Conservatory at the Asolo Center in Sarasota to research and develop a plan for video productions and the use of broadcast media. The CAC provided oversight for the development of the plan, and the Citizen Advisory, Management and Policy Committees participated in review of a script and storyboards for a 15-minute Speakers' Bureau video on Sarasota Bay's problems and the Program's role in developing solutions. The Program's 15-minute video, "Sarasota Bay: Reclaiming Paradise," was completed in Spring 1992 and distributed to schools beginning in Fall 1992. The video is used in speaking engagements by Program staff, and is used by the Program's Speakers' Bureau, called BayNET. Additional productions are planned.

CAC Action Plan

The CAC developed Action Plans for fiscal years 1991 and 1992, focusing on major Bay issues. The 1991 Action Plan targeted mangrove protection and restoration, seawalls, stormwater, septic systems and a mediation assessment on Little Sarasota Bay issues. The 1992 plan included seagrass protection, boater education, the Florida Yard program, newcomer and tourist education, wetlands, volunteerism/citizen monitoring and a community grants program. An additional Action Plan for fiscal year 1995 will soon be implemented to support the Comprehensive Conservation and Management Plan implementation.

Additional outreach activities

'Bay Repair Kit': In 1989, the Program participated with Sarasota County in publishing the "Bay Repair Kit," a homeowner's guide to Bay-friendly living.

Bay reference material: The Program published a reference guide to Bay issues and the Sarasota Bay Program's role in restoring the Bay, the "State of the Bay Report, 1990," describing Sarasota Bay's problems as they were understood in 1990, before the Program began its technical work.

Boater education: To support ongoing boater education related to the Seagrass Signage Early Action Project, the Program reprinted a brochure educating boaters on seagrass flats in an effort to reduce propeller scarring of these vital habitats. The brochure is

distributed at community events and through boat-registration offices in Manatee and Sarasota counties.

Carefree Learner brochure: The Program participated in producing a brochure to promote the general public's use of the *Carefree Learner* floating classroom, a non-profit educational effort of Sarasota High School.

Bay display: The Program developed a tabletop display for use at conferences, meetings and workshops. The display represents Sarasota Bay's problems and the Program's role in developing solutions.

Community events: The Program participates in a host of community events, such as Earth Day celebrations, the *Bradenton Herald* Fishing College, the Cortez Fishing Festival and Mote Marine Laboratory's annual open house.

In 1991, the Program sponsored Coastweeks activities, including a photography exhibit with local camera clubs and Sarasota Bay Day. Bay Day included tours of the Sarasota BayWalk habitat and boat tours of the Bay's underwater habitats on Sarasota High School's *Carefree Learner*. The Program also helped promote Coastal Cleanup and participated in the cleanup at the Leffis Key restoration site.

Adopt-A-Shore: The Program supported establishment of Adopt-A-Shore programs in Manatee and Sarasota counties in 1991-92.

The 'Bay Hooray!' program

The Sarasota Bay Program began awarding the "Bay Hooray!" in 1991 to promote the efforts of groups and individuals who are helping to protect and restore the Bay. Winners receive an engraved award, plus a feature in the Program's newsletter. Past winners of the "Bay Hooray!" include:

Junior League of Sarasota: The Junior League of Sarasota, the first winner of the "Bay Hooray!," earned the award by helping Sarasota County adopt an environmental pest-management policy for public lands.

Junior League members spent several months researching and developing the pest-management program with government staff members and lawn-care professionals. When county commissioners adopted the policy in April 1991, Sarasota County became the first municipality in the nation to institute such a program. The policy requires the county to use integrated pest-management practices that emphasize using

minimal amounts of chemicals and using less-toxic products. Organic substances also may be substituted, while pest-resistant plantings are encouraged.

Limiting the amount of chemicals used for landscape maintenance helps protect the Bay environment. Fewer chemicals applied means that fewer chemicals will reach Sarasota Bay through groundwater and stormwater runoff.

Rick Meyers, environmental educator, Manatee County schools: During the past seven years, Rick Meyers has introduced the mysteries of beach and Bay life to more than 25,000 students through coordinating environmental-education programs in Manatee County schools. An equal number of fourth-graders have followed Meyers to the county landfill and Lake Manatee to contrast how humans and nature dispose of waste.

Meyers encourages students to draw their own conclusions about how humans can hurt and help the environment. In addition to teaching, he is an active volunteer with the Manatee County chapters of the Audubon Society, Florida Conservation Assn. and Science Teachers' Assn. Meyers received the "Bay Hooray!" for his innovative Bay-education programs for students and his active participation in community groups helping to conserve Sarasota Bay resources.

Sarasota High School's *Carefree Learner* floating classroom: Wonder, awe and new-found concern for Sarasota Bay are typical reactions to a trip aboard the *Carefree Learner* floating classroom. In a short cruise, passengers learn important basics about water quality and Bay habitats while seeing and touching creatures pulled from the Bay. Shrimp, crabs and fish often are taken back to classroom aquaria for additional study, then returned to the Bay. Classroom instructional materials help students gain understanding of the Bay's ecosystem before and after their cruise.

The *Carefree Learner* program, based at Sarasota High School, provides one of the best hands-on learning experiences available on any estuary. As a true community-based project helping people understand and care about the Bay, the *Carefree Learner* program was a natural choice for a "Bay Hooray!"

Leah Wilcox, Native Plant Society president, volunteer master gardener, Florida Yards and Neighborhoods Program:

Hardly a day goes by without Leah Wilcox doing something to

help preserve native plants and the wild animals that depend on natural habitat for survival.

The Sarasota resident, who is president of the Native Plant Society and a volunteer for a wildlife rehabilitation center, received a "Bay Hooray!" award for her dedication to restoring natural habitat.

Whether it's helping with Bay habitat restoration plantings or volunteering for the Florida Yards and Neighborhoods program as an advisor, Wilcox rarely says "no" when help is needed.

Wilcox, whose own yard is a beautiful backyard wildlife habitat, also is licensed to take care of wild birds and reptiles for TLC for Wildlife, a nonprofit group in Sarasota. She often visits classrooms with owls and other birds to teach children the importance of wild animals' surviving in the changing environment.

"We are not going to have any natural habitat left if we don't take better care of what we have," Wilcox said, "I enjoy being able to give a little back to nature."

Honorable Mentions: "Bay Hooray!" Honorable Mentions have gone to Kristin Jamerson and her Tidy Island neighbors and to Larry Smith with Wildlife Rescue Service of Florida, Inc.

Kristin Jamerson and her neighbors in the Manatee County community of Tidy Island approached shoreline erosion the natural way — they planted smooth cordgrass along the shore of their neighborhood to reduce erosion and provide habitat for marine life.

Larry Smith, executive director of Wildlife Rescue Service, coordinated an ambitious shoreline cleanup called Project Clean Coast. In 25 Saturday sessions in 1991, volunteers removed seven tons of trash from Manatee and Sarasota county coastal shores. The cleanup's aim was to protect wildlife from trash-related injuries, and Smith reports a dramatic drop in wildlife emergencies after the cleanup.

Community response to technical findings and proposed management options

In 1993-94, the Sarasota Bay Program's public-participation activities focused on releasing the findings of the technical assessment through publication and distribution of the "Framework for Action" report and the summary publication, "Sarasota Bay: Reclaiming Paradise." The Program also continued successful outreach activities through the Speakers' Bureau, Bay Partners community projects and Florida Yards & Neighborhoods Program. Following is a summary of the Program's recent outreach focusing on plan development:

Community responds to *Reclaiming Paradise*

More than 8,000 residents of Manatee and Sarasota counties requested and received free copies of the "Reclaiming Paradise" summary of the Program's characterization of Bay problems. The publication also included Bay improvement options developed by citizen and technical advisors in 1992. The Program's Speakers' Bureau used the publication with the related video, also titled "Sarasota Bay: Reclaiming Paradise," in reaching out to hundreds of community groups during the year. The effective use of the video earned an Award of Distinction from the Florida Public Relations Assn.

Florida Yards & Neighborhoods Program launched

The Sarasota Bay Program assisted Florida Sea Grant and the Cooperative Extension Services in Manatee and Sarasota counties in launching the Florida Yards & Neighborhoods Program in 1993. The effort is also coordinated with similar work in the Tampa Bay region, with the objectives of reducing stormwater runoff from yards, increasing native wildlife habitat and conserving potable water.

A Florida Yard coordinator was hired to manage the two-year pilot, overseeing volunteer advisors who assist homeowners with landscape surveys and advising on improvements. The coordinator also has managed development of Model Florida Yards in Manatee and Sarasota counties, where the public can learn more about appropriate landscaping in the Sarasota Bay watershed. Three model yards were dedicated in 1994: the Tingley Memorial Library in Bradenton Beach, Longboat Key Park and one of two model yards at the Florida House Conservation Learning Center in Sarasota County.

A mass-media campaign promoting Florida Yards & Neighborhoods concepts was launched in 1994 to coincide with the release of a practical, how-to guide for homeowners interested in improving their landscapes.

Florida SchoolYards promote environmental problem-solving

The Sarasota Bay Program continued its support of issue-oriented estuarine education in the public schools by initiating the Florida SchoolYards program in Manatee and Sarasota schools. Associated with the Florida Yards & Neighborhoods Program, Florida SchoolYards helps teachers and students conduct environmental assessments of their schools and develop Action Plans to address priority problems. Some projects from Action Plans will also be funded. The projects demonstrate Bay-friendly techniques such as appropriate landscape design and maintenance, cisterns and the value of created wetlands for stormwater treatment.

Bay Partners surround Bay with citizen action

In 1993, the Sarasota Bay Program assisted 11 organizations in implementing Bay Partners projects to educate and involve citizens in Bay-related activities throughout the region. This successful program was implemented again in 1994 to encourage public participation in citizen-oriented actions in the Bay restoration strategy. Following is a summary of activities by Bay Partners:

- o Just for Girls of Manatee County educated its staff and members on Bay issues. Staff and member volunteers helped run the Sarasota Bay Program booth at community events, providing activities for youngsters while adults discussed Bay problems and solutions.

- o Mote Marine Laboratory conducted two Bay Partners projects. Tours of the Sarasota BayWalk were conducted through Spring 1994, with thousands of visitors enjoying the restored mangrove habitat during the JASON Project transmissions at Mote. A "Sarasota Bay-Q" display for the Mote Aquarium was completed, featuring Bay problems and solutions and emphasizing the individual's role in restoring Sarasota Bay.

- o The City of Anna Maria Development Committee dedicated a model Florida yard landscape at Pine Avenue Park, where islanders

and visitors can see plants that are appropriate for coastal yards.

- o The City of Venice worked with Venice Elementary School to create a native planting area at the school. Plants were then moved to the Pelican Man's Bird Sanctuary in Venice. The area continues to be used as an educational resource on the campus.

- o The Pelican Man's Bird Sanctuary in Sarasota posted signs at fishing piers to inform anglers about seabird protection.

- o Creation of the Sarasota Bay exhibit for the Gulf Coast World of Science Hands-On Museum is completed and available for viewing at the Science Center with the help of the Sarasota County Cooperative Extension Service.

- o Sarasota County's Stormwater Environmental Utility provided technical advice to the Pollution Control Division for a video on preventing stormwater pollution during construction. The video will be used in a new state certification course for stormwater operators.

- o The Environmental Library of Sarasota County held a series of lectures on Bay topics and conducted a summer reading program for children; the adult lecture series was so popular, it was repeated in 1994. The library has also offered to be a local repository for all major technical reports from the Sarasota Bay Program so details on Bay research will be more readily accessible to the public.

- o Selby Botanical Gardens and the Florida Conservation Assn. (FCA) teamed up to present a Baywide poster contest for school children during Earth Week 1993. Florida Conservation Assn. members provided fishing trips and other prizes for the winners, while Selby provided numerous educational programs and activities during the week-long celebration of Sarasota Bay.

- o Students at New Directions High School stayed busy with Bay activities in the 1992-93 school year, including shoreline clean-up, multi-media presentations for fellow students and an environmental assessment of the campus.

- o Residents of Lido Shores north of St. Armands Circle coordinated with the City of Sarasota and Florida Dept. of Transportation to remove non-native plants from the causeway between City Island Lagoon and Pansy Bayou.



Community assistance in Comprehensive Conservation and Management Plan development

The Comprehensive Conservation and Management Plan (CCMP) for Sarasota Bay is truly a community plan, not a plan produced by staff for community review. Public involvement in the development of the CCMP began with the formal establishment of the Management Conference and direction by the Policy Committee at that time to make public involvement a "high priority." Every effort has been made since then to ensure effective participation by the public in development of the plan.

The first step in ensuring adequate public involvement was to appoint members to the Citizen Advisory Committee (CAC) who represent the community, so community input could occur throughout the process. The CAC has reviewed and approved Program budgets and workplans and significant documents produced by the Conference.

In fact, the CAC, in concert with the Technical Advisory Committee (TAC), participated in drafting the "State of the Bay Report 1990," the "Framework for Action 1993" and the "Comprehensive Conservation and Management Plan 1995."

The preliminary management plan for Sarasota Bay was actually released in the "Framework for Action 1993," more specifically, in its Sarasota Bay Improvement Options chapter. The options presented in that chapter were approved by the Management Conference after intensive discussion with both the citizen and technical advisors (approximately 20 subcommittee meetings) and after review by both the Management and Policy Committees.

The management options in the "Framework for Action" were then presented to the community in a series of heavily attended public forums sponsored by the League of Women Voters in Sarasota and Manatee counties, the Chambers of Commerce of Manatee and Sarasota counties, the Coalition of City Neighborhood Associations, Mote Marine Laboratory, Sarasota County Council of Neighborhood Associations, Sarasota County Civic League, Taxpayers' Association of Sarasota County and Keep Manatee Beautiful, Inc. Those two-hour forums were

held on April 14, 1993, at Bradenton Municipal Auditorium, Bradenton; April 19, 1993, at Mote Marine Laboratory, Sarasota; April 29, 1993, at Laurel Middle School, Nokomis; May 1, 1993 at University of South Florida, Sarasota.

At these forums, extensive comments were received on the proposed management options. Formal comments were not taken; these forums were information-gathering exercises for preparation of the CCMP.

It should be noted that most of the options presented at the forums were ultimately refined and incorporated into the CCMP based on citizen input.

Subsequent to the public forums, the Program staff prepared six Action Plans for community review during the summer of 1993. These Action Plans were reviewed in depth by both the Citizen and Technical Advisory Committees during the fall of 1993 and winter of 1994. The CAC edited the Action Plans line by line. Presentations on the draft action plans were also given to the local commissions and boards for input. Comments from the local elected officials and appointed board members were incorporated into the Action Plans, and a first draft of the CCMP was released in July 1994.

In August 1994, the draft CCMP was distributed to the relevant federal, state and local agencies for review and the public at large. More than 300 pages of comments were received on the plan; each comment was addressed or incorporated into the Plan based on technical merit.

At the urging of the CAC, the Program Director and staff briefed more than 200 community leaders (in groups or individually) on the proposed CCMP in an attempt to build grassroots support for the plan. In addition, more than 50 presentations on the Plan were given to community organizations in 1994-95. Groups who participated in this process included, but were not limited to:

- American Business Women's Assn.
- American Littoral Society
- Audubon Society
- Boat manufacturers
- Council of Neighborhood Assn.
- Civic League
- Developers and Home Builders Assn.
- Florida Conservation Assn.
- Florida House Foundation
- Homeowners associations (approximately 30)



Garden clubs
Greater Sarasota Chamber of Commerce
Growth and Environmental Restraint Organization
(GEO)
Keep Manatee Beautiful
Keep Sarasota Beautiful
Kiwanis (Manatee and Sarasota)
League of Women Voters (Manatee and Sarasota)
Manasota 88
Manatee County Chamber of Commerce
Mote Marine Laboratory and Board of Directors
Marine Fisheries Commission
Native Plant Society
New College Foundation
Organized Fishermen of Florida
1000 Friends of Florida
Re-Leaf
Restore Our Bays
Ringling School of Art and Design
Rotary
Saint Stephen's Episcopal School
Save Our Sand
Save Our Bays
Selby Foundation
Selby Gardens
Sierra Club
Taxpayers Association of Sarasota County
Tingley Memorial Library Foundation
Turtle Watch(es)
Zonta

It is believed that enough support has been built within the respective organizations and among community leaders through this process to provide for substantial implementation of the plan.

The second draft of the CCMP was presented to the Management and Policy Committees in a joint workshop on November 9, 1994. On November 18, 1994, the Policy Committee approved the CCMP pending resolution of sponsorship. A public hearing on the plan was held on January 30, 1995.

Prior to receiving final comments on the plan, Mark Alderson (Program Director) and Dr. David Tomasko (Senior Scientist) presented a 30-minute overview of the CCMP describing the major elements and related costs.

Here is a summary of questions received from citizens after that presentation:

What is the extent of the sewer program proposed and the cost?

The CCMP proposes to provide sewer service to those communities within 900 feet of Phillippi Creek and Whitaker Bayou, which are in close proximity to the City of Sarasota. It also recommends converting eight small treatment plants to pumping stations and delivering the wastewater to the City. The approximate cost is \$54 million.

Is the plan binding?

The plan is not binding, but rather a handshake agreement between all parties.

I have heard that septic tanks work in other areas of Florida. Why not here?

Homes in the area proposed to receive central sewer service were constructed prior to 1983 or before more stringent regulations for septic tanks were put in place. Therefore, most septic tanks in this area have their drainfields at or below the groundwater table. Little or no treatment occurs if the drainfield is in the groundwater table; in other areas of Florida, the drainfield and groundwater are separated. Organic content of the soil also plays a key role in denitrification.

Are septic tanks a health risk?

The Sarasota Bay Program presently has a study underway to determine if a health risk exists, but we believe so. (*Editors' Note: Work completed by the Sarasota Bay Program in March 1993 indicated that a significant health risk does exist from septic tanks in Phillippi Creek.*)

How was this plan produced?

The plan was produced subsequent to an intensive study of Bay problems. The Action Plans presented here evolved from recommendations made by the principal investigators of the specific scientific work. Citizen and technical advisors reviewed these recommendations during a two-year period to generate the CCMP. Four public forums were also held in 1993 to get public comment and feedback on management options.

Did the City look at deep-well injection as an alternative to discharge? I thought four test wells were dug.

The City of Sarasota did look at deep-well injection as an option, but we believe there is a fracture in the saline aquifer near



Sarasota, which did not make it a viable alternative. During the long term, deep-well injection for disposal purposes will probably be phased out anyway, as the water is too valuable.

Can wastewater be injected to protect against saltwater intrusion?

There are some test sites along the east coast of Florida to look at this. It has not been considered on this coast to our knowledge. Manatee County will soon be testing aquifer storage and recovery.

Can we recommend no fertilizer use?

The plan does not recommend a ban on fertilizer use in the region. Rather, the plan recommends a voluntary pollution prevention program in Florida Yards & Neighborhoods.

Has the City wastewater plan failed recently? I have heard that it has failed four times.

Not to our knowledge. A pumping station failed recently, resulting in a relatively small amount of raw sewage being discharged near Marina Jack. No long-term problems will result, and the problem was corrected.

Can recycling of wastewater work?

In Virginia, highly treated wastewater is being discharged to the Occuquon Reservoir. Many rivers in the United States receive wastewater that is later recovered after mixing for potable supply. In fact, U.S. Environmental Protection Agency manuals suggest that local governments consider water sources that receive high wastewater flow because the river flows are more adequately maintained.

Can we have people come out and review the plan?

Yes, as stated in the public notice, the plan is available at our program office for review.

How can people on fixed incomes afford to pay for sewer at \$8,400 per household?

Sarasota County is presently looking at alternatives including sales tax, bonds, etc.

Is it worth it?

That is a decision to be made by the community.



The Policy Committee (which includes elected officials representing the public in both counties) approved the City of Sarasota as the sponsor for the Program on March 20, 1995. The Sarasota City Commission unanimously accepted Program sponsorship on April 3, 1995, completing the Sarasota Bay Program CCMP development process.





Management Conference Membership

Policy Committee

Management Committee

Special Recognition

Citizen Advisory Committee

Technical Advisory Committee

Management Conference Membership

Policy Committee

The Honorable Mollie Cardamone
Commissioner, City of Sarasota

Rebecca Eger
Southwest Florida Water
Management District
Governing Board Co-chair,
Manasota Basin Board

Dr. Rick Garrity
Deputy Assistant Secretary
Florida Dept. of
Environmental Protection

The Honorable Pat Glass
Commissioner, Manatee County

Mike McGhee
Director, Water Division
U.S. Environmental
Protection Agency - Region IV

The Honorable Jack O'Neil
Commissioner, Sarasota County

Management Committee

George Henderson
Senior Research Scientist
Florida Marine
Research Institute

Charles Hunsicker
Manatee County
Public Works

The Honorable Billie Martini
Councilwoman,
City of Holmes Beach

David Moore
Deputy Executive Director
Southwest Florida
Water Management District

Eddie (A.J.) Salem
Chief, Planning Division
U.S. Army Corps of Engineers

David Sollenberger
Manager, City of Sarasota

John Stevely
Extension Agent
Florida Sea Grant College

Jon Thaxton
Chairman, Citizen Advisory
Committee

John Wesley White
Administrator, Sarasota County

Special Recognition

Ray Cunningham
Director, Water Division
U.S. Environmental
Protection Agency - Region IV

Roxane Dow
Federal Coordinator
Florida Dept. of
Environmental Protection

Mark Farrell
Assistant Executive Director
Southwest Florida Water
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Peter G. Hubbell
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Executive Coordinator for
Ecosystem Management
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U.S. Environmental
Protection Agency - Region IV

Steve Taylor
Project Officer
U.S. Environmental
Protection Agency - Washington, DC

Virginia Wetherell
Secretary
Florida Dept. of
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Bob Ardren
Betty Jane Banks
Karen Bell
Jack Bispham
David Bulloch
Margaret Chamorel
Orville Clayton
Charles Edwards
Gaines Finley
Allen Garner
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Peter Kent
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David Levin
Ellen Maloff
Rick Meyers
Jono Miller
Belinda Perry
Jack Petrecca
George Pickhardt
William Salomone
Mollie Sandberg
Virginia Sanders
Doris Schember
Harry Schmielau
Marjorie Smith
Mark Taylor
Jon Thaxton
Jonnie Walker
Margaret Warson

Technical Advisory Committee

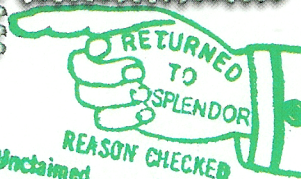
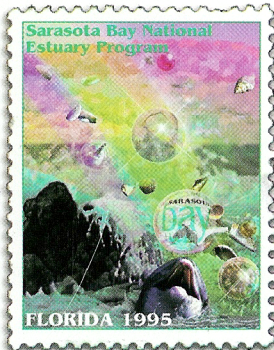
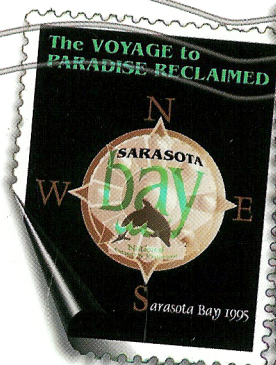
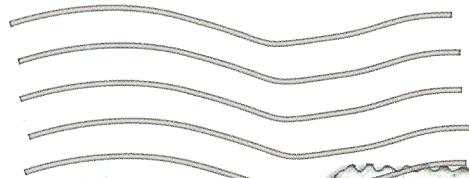
Laura Ammeson
Dr. Gustavo Antonini
Jim Armstrong
Reed Beaman
Dr. Susan Bell
Sarah Blanchard
Robert Brown
Allen Burdett, Jr.
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Karen Collins
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Susan Lowrey
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Dr. Karen Steidinger
John Stevely
Steven Suau
Doug Taylor
Steve Taylor
Dr. Clifford Truitt
Larry Turner
Dean Ullock
Chuck Wirth
Hans Zarbock, P.E.





FINIS



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REASON CHECKED

Unclaimed _____ Refused _____

Attempted-Not known _____

Insufficient Address _____

No such street _____ number _____

No such office in state _____

Do not remail in this envelope

Sarasota Bay National Estuary Program • The Voyage to Paradise Reclaimed

