January 1996

CHARTING *the* COURSE *for* TAMPA BAY

— DRAFT —

COMPREHENSIVE CONSERVATION & MANAGEMENT PLAN

TAMPA BAY NATIONAL ESTUARY PROGRAM

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Comments, *please!*

Thank you for reviewing *Charting the Course.* The Tampa Bay National Estuary Program would appreciate your written comments as we continue to evaluate bay restoration strategies for the Comprehensive Conservation & Management Plan for Tampa Bay. To reply, simply remove this page and FAX or mail to:

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Your name: _____

Address: _____

(with zip) _____

Phone: _____

General Comments

Specific comments on text or Action Plans may be noted in the wide margins of the document.

Specific Comments

Do you concur with the goals for bay restoration presented in the Goals & Priorities Chapter? What goals would you change or add?

Which specific actions do you consider the highest priority? (Indicate your top five choices using the assigned codes.)

What specific changes or additions would you recommend to accomplish bay restoration goals?

How can we improve the plan's format, readability and design?

Thank you!

Charting the Course for Tampa Bay

Draft

January 1996

The Draft Action Plans and text in this document are provided for review by the Tampa Bay community. Charting the Course was produced by the Tampa Bay National Estuary Program, and recommendations by reviewers will be considered for incorporation into the final plan, to be published and available to citizens in 1996. We welcome your comments and inquiries and encourage your use of the section entitled "Comments, Please" that appears at the beginning of the document.

Published by the Tampa Bay National Estuary Program in cooperation with the U.S. Environmental Protection Agency, Region IV.

PREFACE

Charting the Course culminates four years of technical investigation and community outreach by the Tampa Bay National Estuary Program, which was established in 1991 to assist the region in developing a comprehensive plan to restore Tampa Bay. The Program is a partnership of Hillsborough, Pinellas and Manatee counties; the cities of Tampa, St. Petersburg and Clearwater; the Southwest Florida Water Management District; Florida Department of Environmental Protection; and the U.S. Environmental Protection Agency.

Draft Action Plans that have been developed with assistance from bay experts, advocates and citizens are presented for community review. The Program has scheduled a series of town meetings and community forums to present the plan and solicit additional public input. Comments and revisions will be incorporated in the final Comprehensive Conservation & Management Plan published in 1996.

This strategic blueprint reflects broad-based input from individuals, groups and communities that share a common interest in a healthy bay as a cornerstone of a healthy and prosperous region. Our thanks to these participants for their substantial insights and contributions.

The Tampa Bay National Estuary Program invites your comments and participation as we continue to assist the region in charting the course for the future of Tampa Bay.

HOW TO USE *Charting The Course*

Charting the Course has been designed for easy access and review. A detailed table of contents and index of action plans and associated actions for bay improvement are located at the beginning of the document on pages V - VIII. Tabs direct you to major sections. Other important points of information are provided below to further assist you in your review and understanding of the draft plan for Tampa Bay.

GOALS & PRIORITIES

- Goals and priorities for Tampa Bay are summarized in a chapter immediately preceding bay action plans. These specific and attainable accomplishments, summarized in text and presented in a table, are the foundation for strategies and themes advanced in *Charting the Course.* They relay overall priorities for bay restoration and protection, so that you can better evaluate the benefits of measures to protect this vital natural and economic resource.

ACTION PLANS FOR TAMPA BAY

- *Charting the Course* contains five action plans for the bay's long-term restoration and protection, addressing: Water & Sediment Quality, Bay Habitats, Fish & Wildlife, Dredging & Dredged Material Management, and Spill Prevention & Response. Tabs provide quick access to these action plans.

- Action Plans for Tampa Bay present a range of strategies that allow local communities to maximize return on their investment in bay recovery and protection. Many actions also achieve multiple environmental objectives, such as pollution prevention and water conservation. Each action plan begins with an introduction that summarizes the topic, presents management objectives, and includes a list of actions to address those objectives.

- As this draft goes to press, some technical investigations and cost-benefit analyses continue. This work will be completed in 1996 in preparation for the final version of the Comprehensive Conservation & Management Plan for Tampa Bay. Ongoing studies are noted in applicable action plans.

- References in action plans to local governments under the headline "Responsible parties" refer to Hillsborough, Pinellas and Manatee counties and the cities of Tampa, St. Petersburg and Clearwater, unless otherwise noted, although all local communities in the region are urged to participate.

IMPLEMENTING THE PLAN

- Actions in *Charting the Course* represent important measures to aid in the bay's recovery and long-term protection—to focus resources to accomplish the most benefit for the bay. However, not all water quality actions may be appropriate for implementation by all participating communities. For instance, two different

counties may implement different strategies to achieve the same water quality goal. One county may expand reuse of treated wastewater discharged to the bay as a means to reduce excess nitrogen loadings that pollute the bay, while another may implement best management practices to reduce pollution associated with stormwater runoff to attain the same water quality goal.

As long as water quality goals and a net environmental benefit are achieved, this flexibility is encouraged. This allows communities that share a common interest in the bay's health maximum flexibility to tailor a plan that best fits their available resources. *Charting the Course* presents a comprehensive slate of actions to assist community partners in selecting strong and proactive measures to achieve progress toward goals for the bay's recovery.

While allowing flexibility, all participating communities and agencies are called upon to adopt the goals for Tampa Bay to assure the bay's long-term health and to provide the community with meaningful benchmarks in measuring progress in the bay's recovery. The Tampa Bay National Estuary Program advocates maximizing the use of existing resources to accomplish goals wherever possible.

The Tampa Bay National Estuary Program is a partnership of the U.S. Environmental Protection Agency; Florida Department of Environmental Protection; Southwest Florida Water Management District; The Environmental Protection Commission of Hillsborough County; Hillsborough, Pinellas and Manatee counties; and the cities of Tampa, St. Petersburg and Clearwater. These partners will sign an agreement to implement the final Comprehensive Conservation & Management Plan for Tampa Bay in late 1996. The Tampa Bay NEP will oversee implementation of the plan.

WHAT YOU CAN DO

Action Plans conclude with practical tips on *What You Can Do* at home, at work, on the water, and in your community, to protect and repair Tampa Bay. We also encourage you to use the response card located at the front of *Charting the Course* to provide the Tampa Bay National Estuary Program with your comments and questions.

GETTING A HEAD START

Since the Tampa Bay National Estuary Program was established in 1991, the program has assisted the community in securing more than $1 million in federal and state grants for restoration of bay habitats and resources. Profiles of these head start initiatives, which range from wetland restorations to support of bay scallop recovery, are presented in the chapter on Early Action.

The Tampa Bay NEP also has awarded more than $50,000 in small grants to more than a dozen communities, schools, and organizations for various bay improvement projects. These community partnerships are profiled in the Public Involvement chapter.

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Actions to increase and preserve the number and diversity of healthy bay habitats:

Actions to establish and preserve adequate freshwater inflows to Tampa Bay and its tributaries:

FISH & WILDLIFE

Actions to protect bay fish and wildlife:

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Actions to reduce the impact of dredging and improve material disposal options:

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Actions to improve spill prevention and response:

Introduction

PORTRAIT

Tampa Bay is the lifeblood of this fast-growing region of more than 1.7 million people. Reflected in its waters are the images of communities united by a bay they share and for which they share responsibility.

Local communities depend on the bay for a quality of life that brings both economic and natural dividends. Tampa Bay contributes more than $5 billion annually from trade, tourism, development and fishing to the region that bears its name. Its major seaports and numerous smaller anchorages serve ships from around the world.

Bustling trade through the Port of Tampa, among the busiest in the nation, outpaces cargo activity at the state's other seaports. Small pleasure craft and commercial ships the size of modern skyscrapers vie for position on this increasingly popular bay.

Tampa Bay beckons residents and visitors with its magnificent array of waterscapes, wildlife and recreational opportunities. Nearly 100,000 boats are registered to anglers and boating enthusiasts within the three counties bordering the bay. Numerous local and state parks showcase the bay's beauty and bounty. The bay also boasts sizeable resident populations of bottle-nose dolphins and Florida manatees.

Mangrove islands in Tampa Bay are among the most important bird nesting habitats in the United States. These vital natural outposts are home to as many as 40,000 breeding pairs of 25 species each year, including pelicans, egrets, herons, cormorants, terns, ibis and spoonbills. Many other birds such as the American white pelican and several species of sandpipers spend the winter here, logging thousands of miles on an annual pilgrimage to Tampa Bay.

TROUBLED WATERS

The bay's natural habitats are the nerve center of this dynamic system, but they have sustained heavy damage. Most impacts occurred in a span of about three decades beginning in the 1950s with unchecked development along the bay's shoreline. Studies by the Tampa Bay National Estuary Program reveal the extent of habitat declines driven by massive dredge-and-fill projects to develop navigational channels, waterfront communities and industrial sites.

Dredging and pollution destroyed more than half of the bay's underwater meadows of seagrass and natural shoreline. Small creeks and streams were straightened to speed drainage of wetlands and expand access to the bay, altering natural freshwater flows and allowing fast-growing exotic plants to overtake native wildlife habitats.

As the bayscape was redrawn and as water quality deteriorated, fisheries and wildlife declined. A once-thriving bay scallop fishery was virtually eliminated by the mid-1960s as partially treated sewage poured into the bay. Harvests of clams and oysters also plummeted as bacterial contamination forced the closure of productive shellfishing grounds. Seagrass and wetland destruction hastened the decline of many other popular recreational and commercial species, including seatrout, red drum and snook.

Likewise, populations of nesting birds in Tampa Bay have declined in the last half-century. Particularly vulnerable are species such as the white ibis, which nests in coastal wetlands but requires inland freshwater food sources for survival. White ibis populations have dropped by as much as 75 percent in Tampa Bay. While scientists can't point to a specific cause, a similar pattern of decline triggered by destruction of freshwater wetlands has been documented in the Florida Everglades.

TURNING POINT

Since the 1970s, when the Clean Water Act was established, local communities and industries have made significant strides in improving water quality to restore the damaged estuary. Nitrogen was the chief target. Excess amounts of this naturally occurring and otherwise beneficial nutrient had fueled algal growth in the bay, clouding the water and cutting off light to underwater seagrasses.

The year 1979 marked a turning point in the bay's recovery when the City of Tampa modernized the Howard F. Curren Plant at Hooker's Point, the region's largest wastewater treatment facility. The $100-million project is credited with sharply reducing nitrogen from treated wastewater piped into the bay.

Across the bay, the City of St. Petersburg was pioneering new technology to reuse the nutrient-rich wastewater it pumped to the bay. Started in 1978, this reclaimed water project was one of the most ambitious in the nation and now provides treated wastewater for irrigation to more than 7,000 households and dozens of parks, golf courses and businesses. The City of Clearwater also has contributed to the bay's recovery, investing more than $50 million in the mid-1980s to upgrade wastewater treatment plants to advanced treatment standards.

As discharges of pollutants were reduced, nature responded. Monitoring results show that water quality has improved since 1984. Improved water clarity is believed to have triggered a return of seagrasses to areas that had been barren for decades. Between 1982 and 1992, more than 4,000 acres of seagrasses recolonized the bay.

Aggressive fisheries management, coupled with improvements in water quality and habitats, have helped to reverse the decline of snook and red drum. Monitoring data now indicates that juvenile stocks of these prized gamefish are on the upswing.

This impressive turnaround owes much to environmental regulation and advances in sewage treatment that have helped to cleanse the bay of damaging pollutants. Community support and involvement also have been instrumental in charting the course for the bay's recovery. Building on St. Petersburg's initiative, many local communities are discovering the dual benefits of reusing treated wastewater to reduce demand on dwindling water supplies, while helping to rid the bay of excess nutrients.

Despite this success, other forms of pollution continue to threaten the bay, with potential impacts far greater than bay managers previously thought. New studies have identified air pollution as a significant and persistent source of bay pollution. Recent studies also have revealed the presence of toxic contaminants in bay sediments in some urban, industrial and agricultural areas that are in the middle ranges of contamination nationwide.

DEFINING THE CHALLENGE

Population in the tri-county region is expected to increase about 20 percent to 2.37 million by the year 2010. The challenge to bay stewards will be to maintain water quality gains and continue the bay's recovery while accommodating future growth. The success of local communities over the last 15 years in enhancing water quality while experiencing rapid growth is a promising indication that this can be achieved.

The signs of environmental distress that prompted the bay cleanup were more visible 20 years ago. Additionally, limited resources and competing social needs now require that bay restoration be accomplished with a smaller share of funding. Environmental managers in government and industry will be challenged to define objectives more clearly and implement the most cost-effective strategies to assist bay recovery.

These efforts should be based upon a clear vision, bolstered by broad community support, of what Tampa Bay should look like, what uses it should support, and how it should be managed. This vision is now taking shape and will be refined over the coming months as Action Plans for bay improvement are presented to the community.

With a well-defined, fiscally sound and united effort, Tampa Bay in the year 2010 can be a place where:

- surrounding communities will be recycling wastewater, reducing both the demand on limited drinking water supplies and the amount of excess nitrogen and other pollutants discharged to the bay;
- neighborhoods and businesses will have adopted environmentally friendly landscaping practices, using native and drought-tolerant plants that require less water, fertilizer and pesticides;
- seagrasses will have responded to increased water clarity and recolonized thousands of acres of bay bottom, providing vital fish habitat;
- hundreds of additional acres of productive coastal marshes and mangroves will be in public ownership or otherwise safeguarded, extending permanent protection to these wetland habitats crucial to wildlife;
- toxic contamination of sediments at "hot spots" around the bay will be reduced to levels harmless to fish and shellfish through pollution prevention and treatment;
- farmers will be utilizing low-volume irrigation methods that conserve water and reduce nutrient and pesticide runoff;

- local governments and the Southwest Florida Water Management District will have established minimum flows for rivers impounded by dams to ensure an adequate amount of freshwater to the bay;

- water quality and habitat improvements, combined with wise fisheries management, will have brought about abundant, sustainable catches of trout, red drum, snook and other popular game fish;

- harbor pilots will guide oil tankers along the bay's shipping channels using a state-of-the-art vessel tracking system that will greatly reduce the risk of ship collisions and catastrophic spills;

- bay area port authorities and the U.S. Army Corps of Engineers will have expanded beneficial uses of dredged material and developed long-term disposal options through a coordinated management plan;

- goals and actions in *Charting the Course* will have been incorporated into permits, providing a clear agenda for bay improvement.

This vision of the bay and its management is attainable. Indeed, some goals have been nearly met already; others are achievable within the next five years thanks to measures being taken today by government, citizens and industry. Meeting the remainder of the challenges defined in this plan, and maintaining the hard-won gains that already have occurred, will require the community's long-term commitment.

CHARTING THE COURSE

Today's challenges call for a new direction in bay management, one that involves all stakeholders in developing achievable goals for bay improvement and secures commitments for action. At the heart of this effort is the overall goal of effective and broad-based watershed management, an evolving process that considers the bay and its myriad tributaries as one large, inseparable and interdependent ecosystem.

Watershed management respects and takes into account the connections between animals and their habitats, and between humans and these natural systems. In doing so, it prescribes a "bottoms-up" regulatory approach that emphasizes flexibility and measurable results instead of "top-down" edicts that often fail to take into account the varying needs and conditions of individual ecosystems within a larger estuary.

Strategies to repair and protect the Tampa Bay ecosystem, in the most cost-effective manner and adhering to the principles of watershed management, are the foundation for *Charting the Course.*

Charting the Course presents preliminary action plans to support and advance bay recovery. Action Plans for bay improvement identify necessary steps, associated costs, implementation schedules, and recommendations on ways to use existing resources most effectively. Action Plans also recognize major initiatives and programs already underway. Proposed strategies build on these foundations to accomplish bay recovery.

Charting the Course begins by exploring the state of the bay and the management

structure charged with bay protection. Bay restoration has begun, but much work remains. Recovery will require time, innovative public-private partnerships, and clear strategies that focus on pollution prevention, conservation of natural resources and incentive-based alternatives to regulation. *Charting the Course* presents a vision for Tampa Bay and a chance for all citizens to participate in its restoration.

Volume II of *Charting the Course*, which will be published in 1996, will explore the technical investigations and modeling tools used by the Tampa Bay National Estuary Program to characterize bay conditions and support bay improvement strategies.

About the Tampa Bay National Estuary Program

The Tampa Bay National Estuary Program was established in 1991 to assist the community in developing a comprehensive plan to restore and protect Tampa Bay. The Program is part of a national network of 29 estuary programs established under the Clean Water Act and administered nationally by the U.S. Environmental Protection Agency. The Program receives local administrative support from the Tampa Bay Regional Planning Council.

The landmark agreement establishing the Tampa Bay Program brought together Hillsborough, Pinellas and Manatee counties; the cities of Tampa, St. Petersburg and Clearwater; the Southwest Florida Water Management District; the Environmental Protection Commission of Hillsborough County; Florida Department of Environmental Protection; and the U.S. Environmental Protection Agency in a partnership committed to action. These partners will sign an implementing agreement in 1996, pledging their commitment to bay action plans presented in the final Comprehensive Conservation and Management Plan for Tampa Bay.

The missions of the National Estuary Program are: to set reasonable, achievable goals for the estuary's recovery; to coordinate the many new and ongoing bay management initiatives, from small-scale efforts that focus on individual segments of the bay to broad-based programs that address the estuary as a whole; and to determine how best to implement these programs in the future to avoid costly and ineffective duplication of efforts.

Additional roles of the Tampa Bay Program include evaluating potential options and costs of bay management strategies on a site-specific basis, and developing scientific and economic models to help bay managers attain the goals of the management plan.

Since 1991, the Tampa Bay National Estuary Program has conducted extensive technical investigations to define bay conditions, impacts and environmental needs. Preliminary findings and early action initiatives were reported to the community in Status & Trends, published by the Tampa Bay National Estuary Program in 1993. Additionally, the Program has developed a number of educational outreach programs and provided grants opportunities to involve citizens and communities in efforts to improve their bay.

Members of the Tampa Bay Management Conference

The work of the Tampa Bay National Estuary Program is guided by a Tampa Bay Management Conference, which was convened at the program's outset to provide direction and input into bay problems and solutions from diverse community sectors. The Conference is comprised of key policy leaders representing local, state and federal government; members of the region's scientific and technical communities; business, agricultural and special interest groups; and citizens from throughout the region. Conference participants are recognized here for their considerable contributions in charting the course for Tampa Bay.

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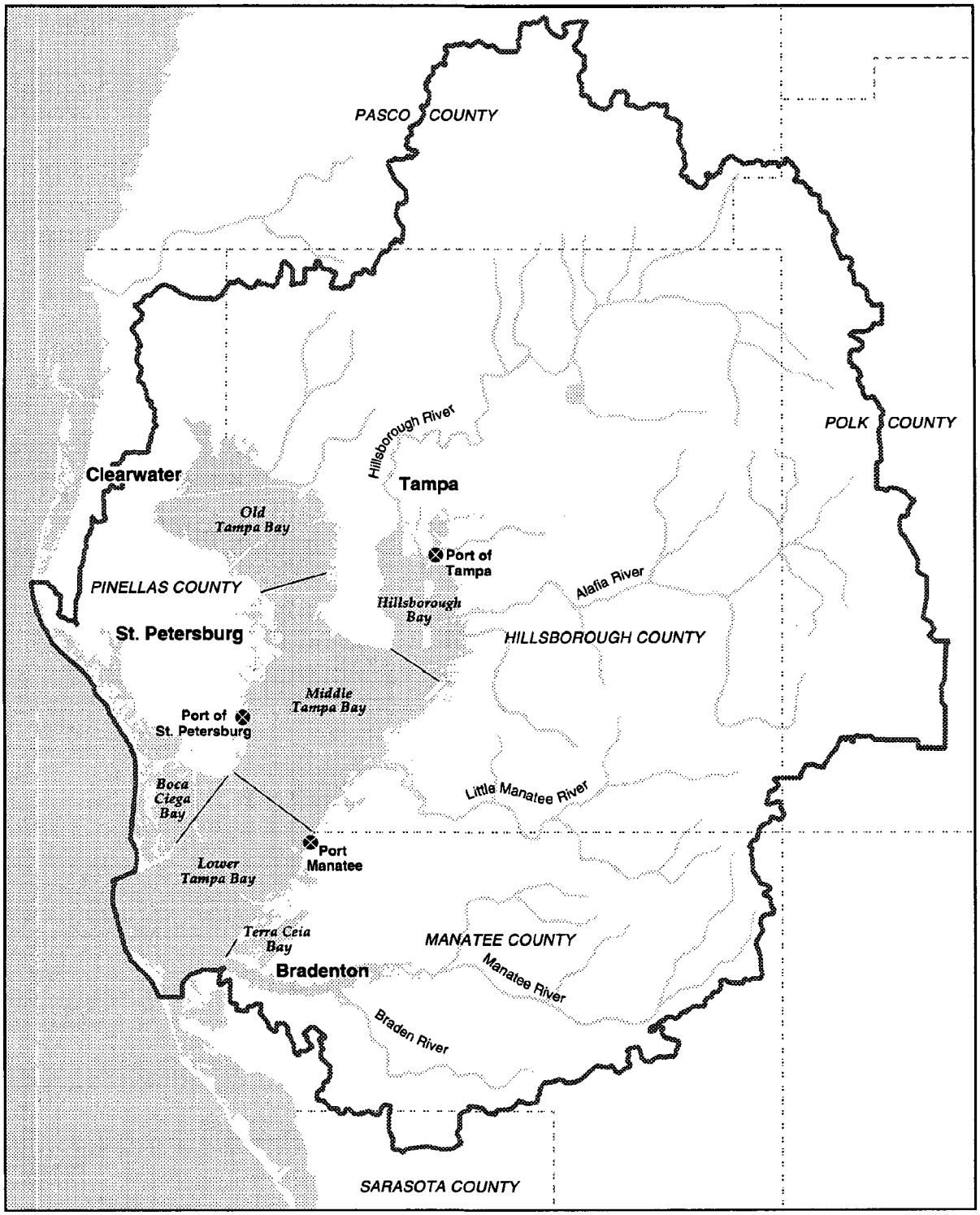
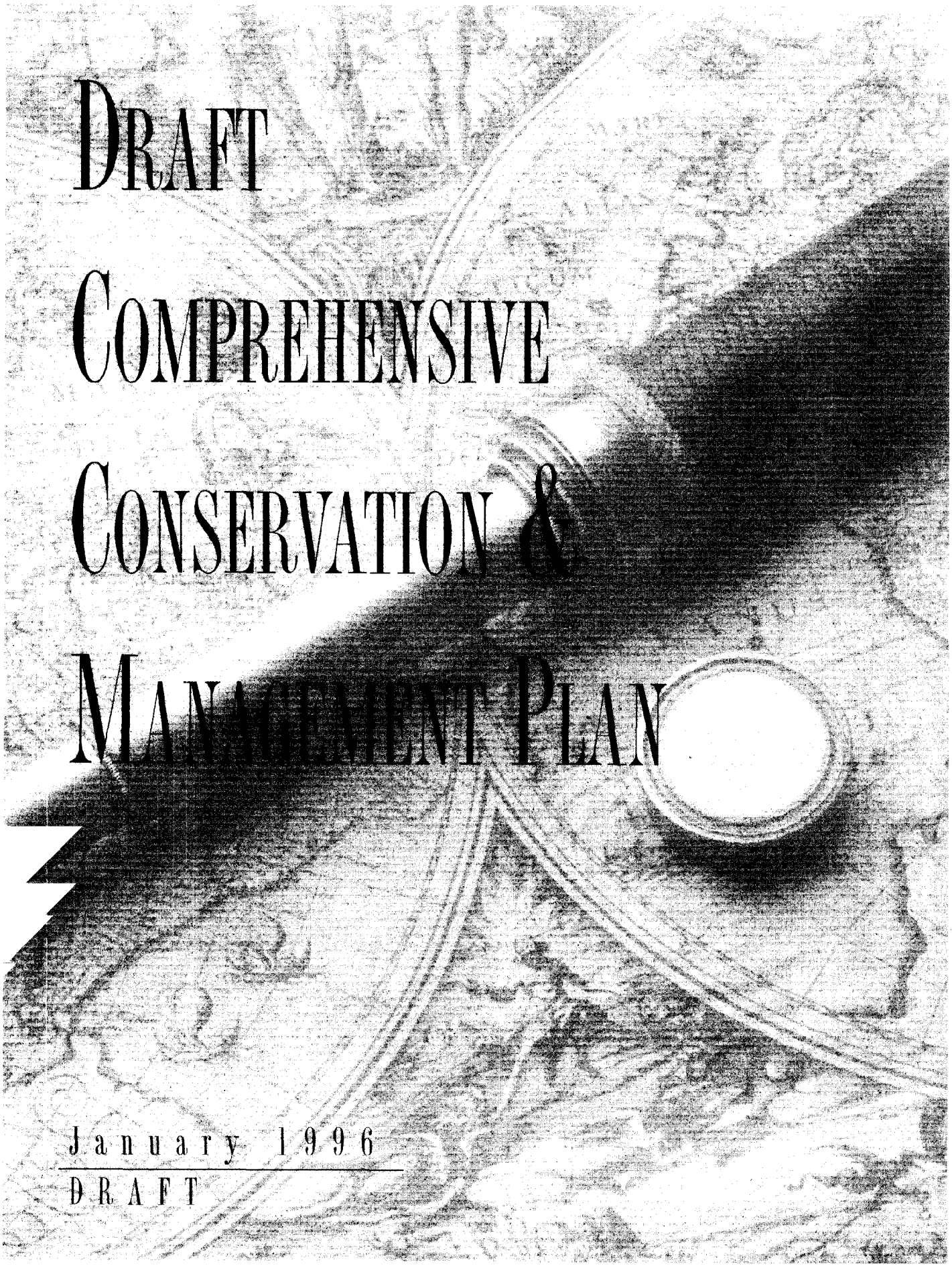
Tampa Bay Watershed Boundaries and Bay Segments — Figure 1



More than 2 million people reside in the 2,200-square-mile Tampa Bay watershed, which reaches into Sarasota, Pasco and Polk counties and includes three major seaports. Tampa Bay is Florida's largest open-water estuary, covering almost 400 square miles.

DRAFT COMPREHENSIVE CONSERVATION & MANAGEMENT PLAN



January 1996

DRAFT

State of the Bay

INTRODUCTION

From the headwaters of the Hillsborough River to the salty waters off Anna Maria Island, Tampa Bay encompasses a rich mosaic of underwater and coastal habitats that support thousands of species of plants and animals. Preserving and restoring these interdependent habitats — even in the face of continued growth — is critical to the bay's future.

Estuaries like Tampa Bay, where saltwater from the sea and freshwater from rivers mix, are among the world's most productive ecosystems. More than 70 percent of all commercially important species of fish depend on estuaries at some stage in their development.[1] Besides marine life, the bay also attracts a remarkable number and variety of birds and animals that depend on its rich tapestry of habitats.

As Florida's largest open-water estuary, Tampa Bay spans almost 400 square miles and receives drainage from a 2,200-square-mile watershed more than five times the bay's size.[2] Activity in this watershed has a profound influence on the health of the bay. Nutrients supplied in stormwater runoff from the watershed fuel the bay's productivity. But excess nutrients and contaminants from neighborhoods, industries, cities and farms pollute the bay.

Achieving a healthy balance of inputs from the land and sea, and redressing past damages to habitats and protecting them in the future, remain vital to the bay's health. These tasks become challenging in the context of modern growth. As population in the tri-county area approaches two million, decisions we make at home, at work and in our communities about how we use and maintain our land and address pollution increasingly influence the state of the bay.

This chapter explores the state of the bay — as well as the management structure charged with the bay's protection — so that the community can direct future efforts where help is most needed and ensure that increasingly limited public funds are spent in a manner that best benefits the bay and the people who live around it. Restoration is a complex, but achievable, task that will require a steady focus on the ecosystem. Decisions based on ecosystem needs — those that recognize how individual habitats affect the health of the whole and how fish and wildlife depend upon this network for survival — can prevent costly and less effective piecemeal treatment.

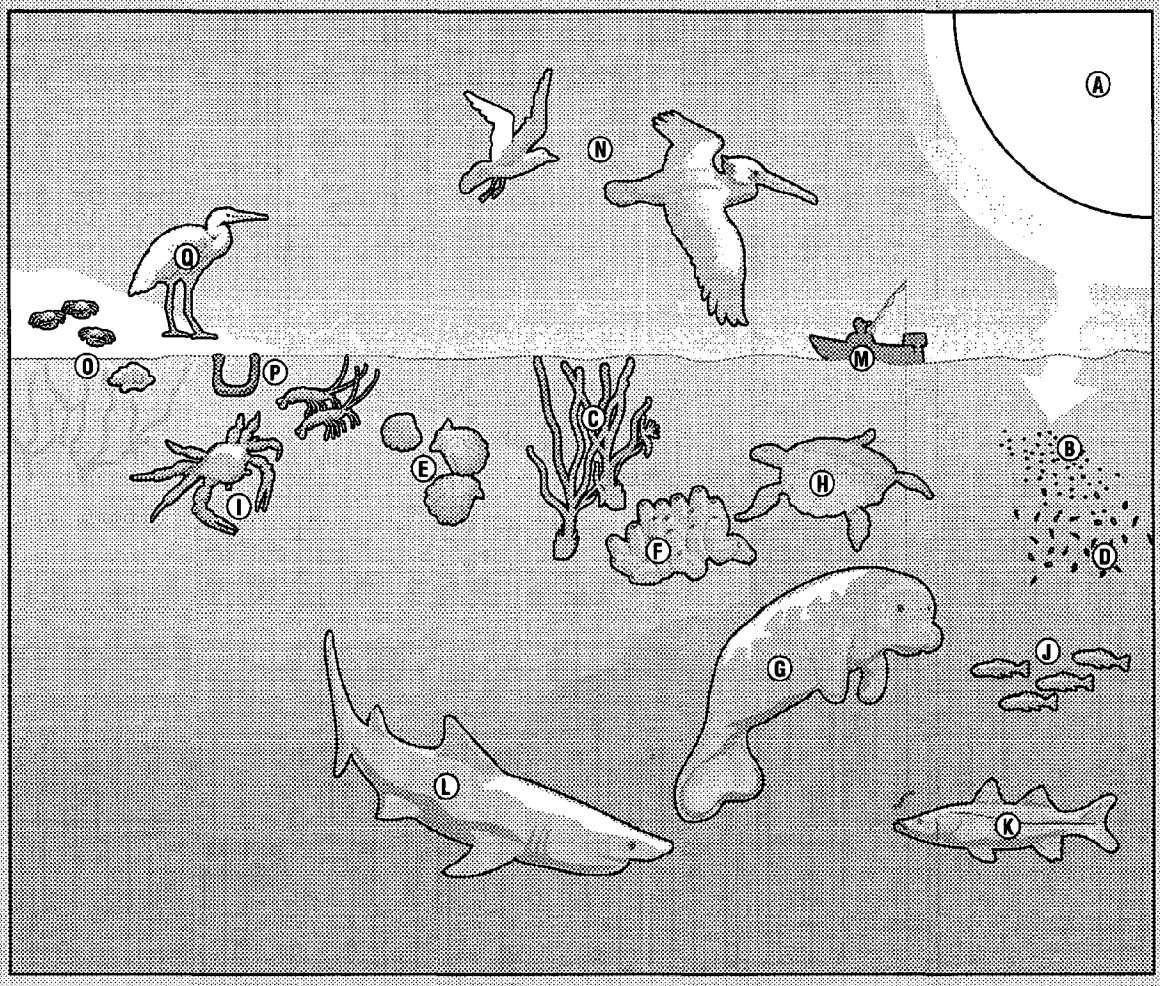
Achieving the goals set out by the Tampa Bay National Estuary Program will require a flexible yet comprehensive, watershed management approach. Watershed management takes into account the overall needs of the estuary, as well as individual variations in specific areas. By considering and capitalizing on these differences, watershed

management goes beyond traditional regulatory programs — just as the bay ecosystem itself encompasses a rich mosaic of habitats often far removed from its visible shoreline. Thus, a plan based on watershed management principles can tailor actions and policies to better protect the bay's multi-faceted resources.

By focusing less on government-imposed regulations and more on the actual requirements of the bay's living resources, watershed management offers opportunities for producing direct, measurable results that are cost-effective and community-specific. In this approach, success is measured less by compliance with strict laboratory standards for water quality than by increases in seagrasses, fish stocks and other biological indicators of a healthy estuary.

The National Estuary Program is committed to a course of action that emphasizes watershed management as a common-sense approach for protecting Tampa Bay well into the next century.

Tampa Bay Food Web



BAY HABITATS

While many bay animals prefer the open water of the estuary, others require the food and shelter supplied by various structural habitats, including seagrasses, mangroves, salt marshes and uplands. Together, these habitats form a natural network that sustains vast populations of fish, birds and other wildlife.

Since 1950, about half of the bay's natural shoreline and nearly 40 percent of its seagrasses have been destroyed, along with significant portions of upland habitat.[3] Most casualties were sustained before the mid-1970s, when the need for "managed" growth gained acceptance.

Figure 2

Tampa Bay's food web provides a "who eats who" perspective of the ecosystem. But in reality, it is far more complex. The marine food web, as its name implies, travels in various directions, bound together by common, interdependent threads. Impacts to any part of the food web affect the health of the whole.

- The bay's food web begins with sunlight[A], which penetrates through the water column.
- The sun's energy is absorbed by tiny one-celled organisms called phytoplankton[B], microscopic algae that are the most prolific plants in the bay. Light also is absorbed by seagrasses[C] and other underwater plants. There are 270 species of phytoplankton in Tampa Bay, and a single quart of bay water may contain as many as 1 million of these minuscule creatures, which give the water its greenish cast. By comparison, the bay harbors only four major seagrass species.
- Small grazing animals called zooplankton[D] and larger bottom-dwelling filter feeders form the next thread in the web. Filter feeders such as the bay scallop[E] and the sea squirt[F] are a prime cleaning service for the bay, siphoning in water containing phytoplankton, skimming off the tiny plants, and discharging clear water. Larger herbivores, such as manatees[G] and green sea turtles[H], consume bigger plants like seagrasses.
- Carnivores and omnivores (opportunistic feeders that eat plants and animals) prey on the zooplankton and the filter feeders. Small carnivores such as the blue crab[I] and pinfish[J] are in turn eaten by larger carnivores such as snook[K], redfish and trout, which are eaten by sharks[L], dolphins and humans[M]. Some birds, such as pelicans[N] and cormorants, also eat the small fish and invertebrates.
- When plants and animals die, their remains sustain another thread in the web, the scavengers. Some of these, such as fiddler crabs[O] and snails, live in burrows along the shoreline. Others, like worms and shrimp[P], dwell in the muds at the bottom of the bay. The muds of the shore and bay bottom may look barren to a casual observer, but they teem with life.
- The scavengers begin another circle of life, providing food for a variety of shorebirds such as the white ibis[Q] and the roseate spoonbill, which frequent the bay's shallows. Small mammals such as raccoons also prey on crabs and snails.

Now, water quality improvements are helping to fuel the bay's recovery. Seagrasses have been a key beneficiary. Since the 1980s, grass beds have waged an impressive comeback in many areas of the bay in response to improving water quality.

Trends for saltwater wetlands are not as clear. Recent studies show a net increase of 3.3 percent in the bay's saltwater wetlands from 1982 to 1990, which is probably attributed to wetland colonization of new emergent land created from bottom-fill, as well as to mitigation and restoration.[4] However, the data do not indicate the quality or level of function of these saltwater wetlands.

Seagrasses and other bottom habitats

SEAGRASSES

Seagrasses provide shelter, nursery and feeding habitat for many popular fish and shellfish, including snook, red drum, seatrout, shrimp and the bay scallop. These shallow grass flats also are an important feeding ground for the endangered Florida manatee, of which only about 1,800 are thought to remain.[5] Grass beds also help to improve water clarity by anchoring bottom sediments.

Because seagrasses require light to grow, light limits the depths at which they occur. Even in the clearest waters of lower Tampa Bay, seagrasses typically grow no deeper than six to eight feet.

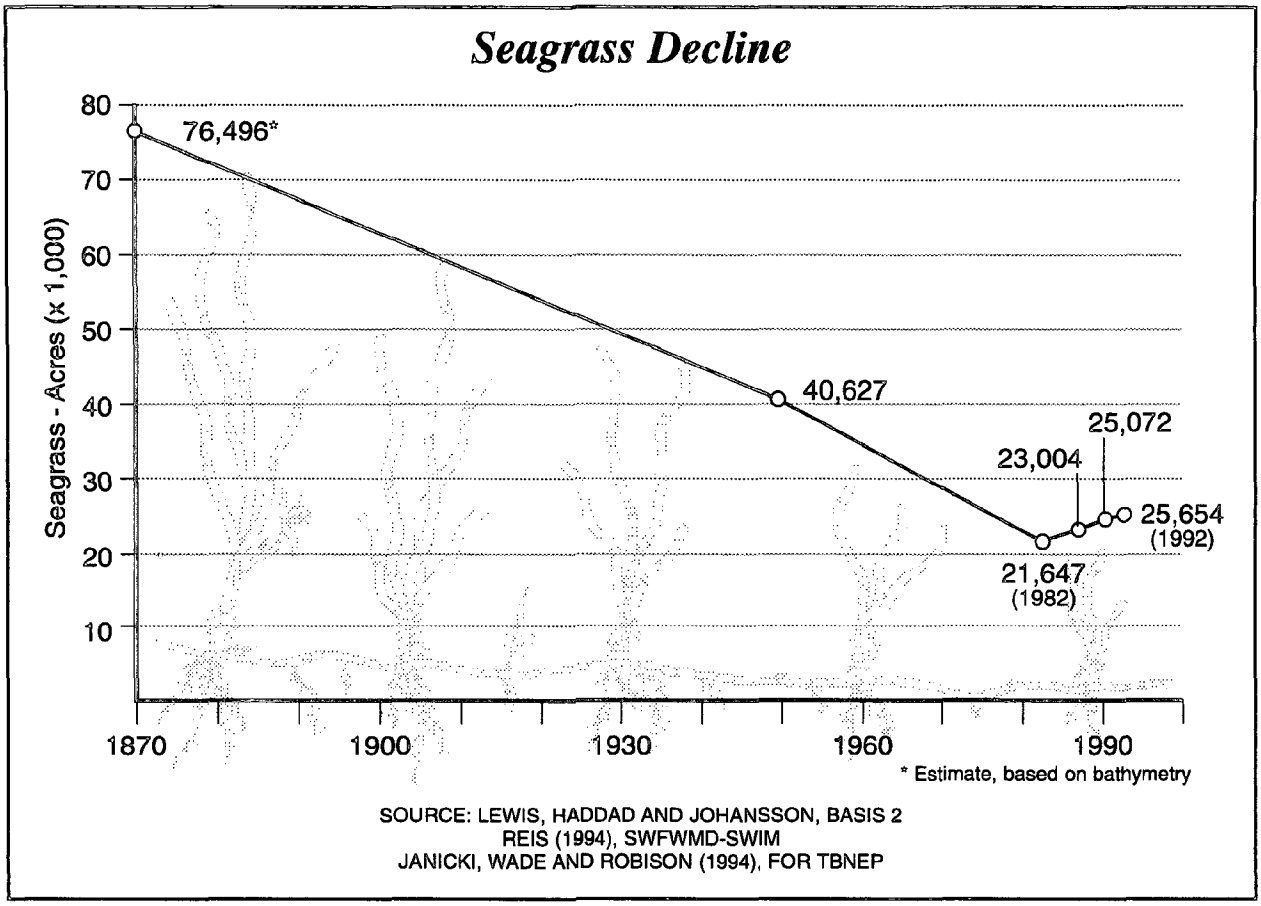
In 1950, about 40,000 acres of seagrass flourished along the shallow shelf of the bay. By 1982, only 21,600 acres remained, and Hillsborough Bay's 2,700 acres of seagrasses had been virtually eliminated.[6] Three factors are believed to have caused the decline: dredging and filling for waterfront development; reduced light penetration as a result of shading by algae fueled by excess nutrients discharged to the bay by sewage treatment and industrial plants; and cloudiness (or turbidity) caused by dredging the main shipping channel.

An estimated 13,200 acres of bay bottom have been filled since the early 1900s, and more than 90 percent of the activity occurred along the bay's shallow shelf, where seagrasses once thrived.[7] Hillsborough Bay is one of the bay's most impacted segments. Its surface area has been reduced by 14 percent as a result of residential development at Davis Islands, creation of spoil islands and construction of port and power generating facilities. That compares to a surface area reduction of 3.6 percent for the entire bay caused by filling for development.[8]

But seagrasses have rebounded in recent years as a result of improving water quality. From 1982 to 1992, bay seagrass coverage increased by about 4,000 acres, or 18.5 percent, raising the bay's total acreage to more than 25,600 acres.[9] Most incoming grass is shoal grass *(Halodule wrightii)*, an early-colonizer that may eventually be replaced in many areas by turtle grass *(Thalassia testudinum)*, a later successional species.

Seagrass gains are largely attributed to upgrades in sewage treatment plants that led to substantial declines in total nitrogen loadings to the bay. Declines in nitrogen loadings resulted in a decline in phytoplankton density and corresponding improvements

Historical Trends in Seagrasses **Figure 3**



in water clarity. Increased water clarity enabled more light to penetrate to underwater seagrasses.

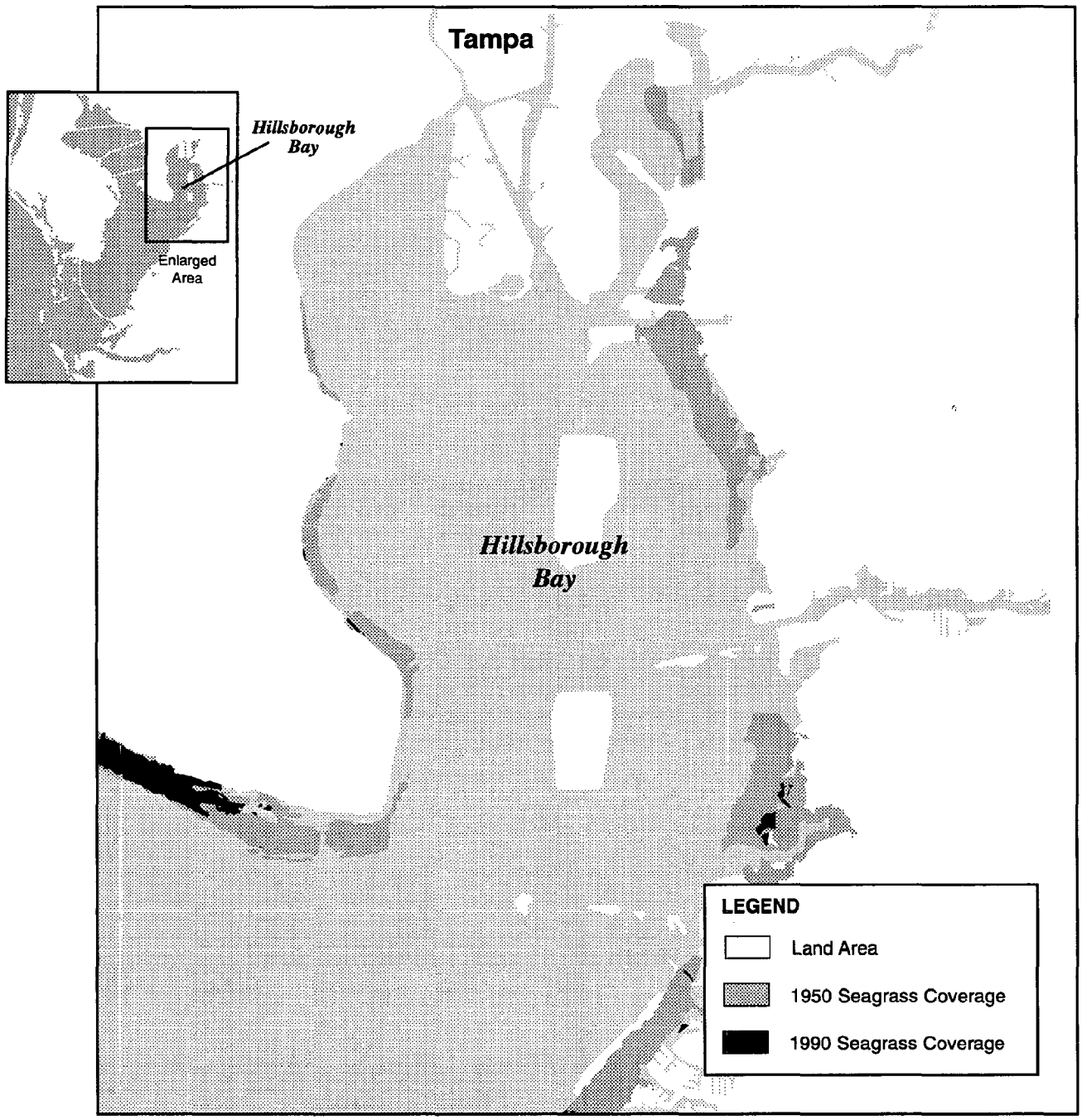
Drought conditions prevalent in the 1980s also may have assisted seagrass regrowth, since less rainfall means fewer nutrients and contaminants that cloud the water wash into the bay. Continued monitoring will be necessary to document the trends in seagrass regrowth.

Although more than 40 percent of seagrasses reveal little or no damage from boat propellers, seagrass scarring is nevertheless an important problem in some parts of the bay. Studies by the Florida Marine Research Institute indicate that about 27 percent* of Tampa Bay's seagrasses are moderately to heavily scarred — second in severity only to the Florida Keys.[10] Signs of chronic damage are evident around many passes and channels. Intense scarring at Cockroach Bay in southern Hillsborough County and at Pinellas County's Ft. De Soto Park has prompted boating restrictions and closures in these areas to protect seagrasses. Early reports indicate that restrictions and caution-

* Includes all Pinellas County seagrasses, including Gulf grass beds outside the boundaries of the Tampa Bay estuary.

1950 vs. 1990 Seagrass Coverage

Figure 4



Since 1950, pollution and dredging in the heavily industrialized Hillsborough Bay sector have claimed more than 90 percent (or 2,277 acres) of seagrasses. This compares to an overall seagrass loss in the bay of almost 40 percent (15,200 acres) for the 1950-1990 period. Recent improvements in water quality are beginning to reverse the course of seagrass declines. From 1982-1992, scientists have documented the return of more than 4,000 acres of seagrass baywide, including 20 acres in Hillsborough Bay. Seagrass coverage in Hillsborough Bay has more than doubled since then.

SOURCE: SWIM (1994) AND R. JOHANSSON (1995)

ary areas in Ft. De Soto Park are working to reduce scarring, but evaluations of specific management techniques are still underway.[11] Studies at Weedon Island Preserve suggest that propeller scars in turtle grass may take more than five years to heal.[12]

Data have not yet been collected in Tampa Bay to evaluate trends in the quality of seagrass and its utilization by animals. However, the Southwest Florida Water Management District recently modified its seagrass monitoring program to include assessments of seagrass quality at 50 locations around the bay. Monitoring parameters include seagrass species diversity, density and quantity of epiphytic algae attached to the grass blades.[13]

SOFT-BOTTOM

More than 80 percent of the bay bottom is soft mud or sand.[14] These bottom sediments support a large diversity of animals, including parchment worms, clams, tunicates (or sea squirts) and conchs, as well as larger bottom-dwellers that feed on these creatures. The surface sediments of this dynamic habitat are constantly churned up and re-deposited by bottom-dwelling animals, as well as by waves, currents and dredging. Remarkably, one square meter of soft bottom may support more than one million invertebrates.

Dredging of navigation channels and underwater disposal of dredged material have impacted an estimated 14,400 acres of bay bottom, mostly in deep-water areas of the bay. An additional 1,200 acres of deep-water soft bottom has been filled to create spoil islands and causeways.[15]

The long-term effects of disposal on these soft-bottom habitats has not been well documented. However, a recently established benthic monitoring program will enable bay managers to assess trends in the health of these bottom communities.

HARD-BOTTOM

Although relatively rare in Tampa Bay, hard- or "live"- bottom habitat features a composition of plants and animals that are unlike any other in the bay ecosystem. Hard-bottom habitat is formed when outcroppings of rock or limestone along the bay bottom are colonized by corals, barnacles, sponges and algae that attract small fish and larger predators. Its colorful inhabitants include sea fans, anemones and tunicates.

A study conducted for the Tampa Bay National Estuary Program revealed major hard-bottom communities at Rocky Point (Old Tampa Bay); along the Gandy Bridge (Old Tampa Bay); near Cockroach Bay (Middle Tampa Bay); and in portions of Lower Tampa Bay.[16] Long-term trends in hard-bottom coverage are not yet available, since this was the first bay-wide attempt to assess the extent of hard-bottom habitat.

Oyster reef communities are another distinct hard-bottom habitat, although they have not been well-documented locally. The reef's intricate structure provides habitat for scores of invertebrates and fish species.

While historical estimates of hard-bottom are sketchy, scientists do know that the bay once supported a thriving oyster fishery. The most recent estimate of oyster coverage is 8,300 acres in 1972.[17] Oysters are not commercially harvested today since most

areas of the bay have been closed to shellfishing because of suspected high levels of bacterial contamination.

Additionally, 11 artificial reefs have been established in Tampa Bay to expand hard-bottom and enhance fishing.[18] Other manmade habitats include bridge and dock pilings, seawalls and spoil islands. Some of these artificial habitats provide additional structure for attaching organisms such as oysters, sponges and tunicates.

Estuarine Wetlands

The natural shoreline of the bay is bordered by a broad intertidal zone of wetlands, submerged at high tide and exposed at low tide. These dynamic wet zones, which include mangroves, marshes and mud flats, provide vital food and protection for various marine creatures. They also buffer uplands from storms and help filter nutrients and particulates in runoff from the surrounding watershed.

MARSHES AND MANGROVES

While mangrove and marsh habitats may occur independently, they often occur together, with red, white and black mangroves interspersed with smooth cordgrass and black needlerush. Mangroves outnumber marshes in Tampa Bay by more than a 3-to-1 ratio.[19] Salt marshes, composed of rushes, sedges and grasses, are the dominant natural habitat along the bay's major tributaries.

Small fish, shrimp and crabs feed on the nutrient-rich detritus formed from decaying mangrove leaves. The sturdy roots of the mangrove trees anchor the shoreline, while the mangrove canopies serve as roosts and nests for a remarkable variety of resident and wintering birds.

Mangroves and marshes also support juvenile fish, such as snook, tarpon, red drum and mullet, and protect them from larger predators. Mature mangroves in quiet lagoons and canals in fairly high-salinity areas provide a little known but important nursery habitat for snook.

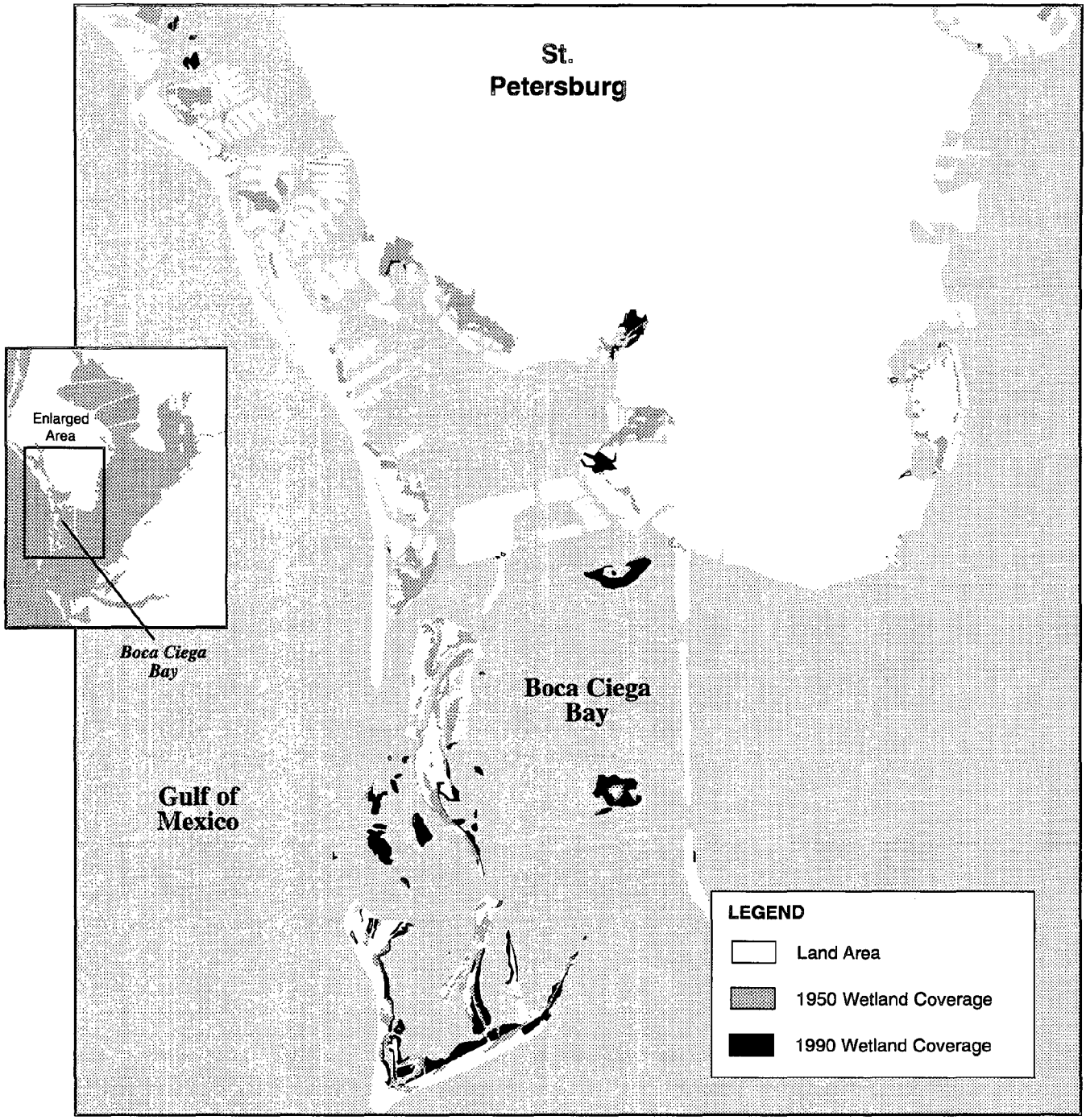
Mangroves in Tampa Bay are particularly vulnerable to damage or destruction from periodic freezes, since the bay is near the northern limit for these species. This underscores the importance of maintaining a healthy abundance of these wetland habitats. Dense stands of mangroves not only are better equipped to survive a freeze, they also provide more food and better habitat for the animals they support.

About 43 percent (9,700 acres) of Tampa Bay's original saltwater wetlands were lost between 1950 and 1990, primarily because of dredging and filling for waterfront development. However, as many as 5,900 acres of new wetlands formed along causeways and other emergent land created from dredged spoil material during this period. Furthermore, from 1982 to 1990, studies indicate a 3.3 percent increase in saltwater wetlands in the bay. Precise estimates are difficult to calculate because of differences in the quality and interpretation of aerial photography. However, the steepest declines occurred between 1950 and 1980, when efforts to develop coveted waterfront property for residential and commercial uses proceeded unchecked.[20]

Recent estimates of wetland habitat in Tampa Bay indicate that about 18,800 acres of

1950 vs. 1990 Saltwater Wetland Coverage

Figure 5



Nearly half of the natural shoreline in Pinellas County's Boca Ciega Bay was lost to waterfront development between 1950 and 1990. Wetland losses throughout Tampa Bay for this period also have been significant. Scientists report a 43 percent (9,700 acres) decline in the bay's existing wetland coverage between 1950 and 1990. However, as many as 5,900 acres of wetlands have formed baywide as a result of newly emerging land along causeways and areas filled by spoil material. The quality or functional level of these new wetlands is unknown.

mangrove forests and saltmarsh remain.[21] However, thousands of acres of this habitat may be damaged from invasion by exotic plants, such as the Australian pine and Brazilian pepper, that choke out native habitats.

MUD FLATS

Non-vegetated mud flats along the bay's perimeter also are an important part of the estuarine wetland system. While mud flats may appear barren and lifeless to an untrained eye, these areas actually are highly productive and valuable.

Mud flats support a diverse community of bottom-burrowing creatures, including worms, clams and crabs, which are pursued by wading birds and raccoons foraging for food at low tide. At high tide, fish enter the flats in search of food.

Mud flats also are prime feeding areas for a number of migratory birds, including avocets and several species of sandpiper, which seek refuge in Tampa Bay each winter.

Associated uplands

Neighboring upland habitats of pine forest, hammock and shrub also have been heavily impacted by development. Often overlooked or undervalued, these buffer areas and associated freshwater wetlands provide critical or essential habitat for numerous animals, including the wood stork, white ibis, bald eagle and fox squirrel. Many of the birds and animals that live in coastal wetlands or along the shore hunt for food in upland forests and fields. Likewise, many upland species depend on adjacent wetlands for survival.

Almost all coastal pine forests have been eliminated from the shores of Tampa Bay, and about 40 percent of this habitat has been lost throughout the watershed.[22] Coastal hammocks and salt barrens also have declined. Coastal hammocks of live oaks and cabbage palms occur in patches where wetlands transition to uplands. Hammocks are home to raccoons, bobcats, foxes and other animals that feed in neighboring wetlands. Fewer than 900 acres of salt barren remain, mostly along the bay's southeastern rim.[23] This rare habitat forms in areas where brackish water moves in during very high tides and evaporates, creating open stretches of salty, dry soil. Historical estimates for many of these transitional zone habitats are unavailable.

Low-salinity habitats

The bay's four major rivers — Hillsborough, Alafia, Manatee and Little Manatee — and more than 100 smaller tributaries provide critical low- and medium-salinity habitat for numerous species of fish and shellfish at early stages in their development. Variations in the salt content of the water, from the low-salinity reaches of the bay's tributaries to full-strength sea water at the mouth of the bay, determine which areas of the estuary are inhabitable for some species and not for others. Oysters, for example, flourish in low-salinity areas of the bay where they are protected from snail predators. Similarly, fish with wide salinity tolerances use low-salinity areas in rivers to avoid predators that cannot tolerate these conditions.

Called oligohaline from the Greek *oligos* (small) and *haline* (salty), the low-salinity areas occur in the upper reaches of the bay's tributaries, where salinities range from

zero to 10 parts per thousand (ppt), as compared to about 35 ppt at the mouth of Tampa Bay. Downstream, mesohaline or medium-salinity zones occur within a salinity range of 11 to 19 ppt.

Low and medium-salinity habitats are a primary nursery for red drum, snook and tarpon, as well as numerous non-game species including the black mullet. Some of the most highly productive juvenile nursery habitat occurs where the waters of these salinities overlap stationary wetland vegetation. As the fish mature, they typically move to more saline zones in the estuary or out into the Gulf of Mexico.

Efforts to protect these highly productive nursery habitats depend on maintaining the proper seasonal balance of fresh water and salt water within the bay's tributaries. Four major tributaries — the Hillsborough River, Palm River (Tampa Bypass Canal), Manatee River and Braden River — have dams or reservoirs that divert freshwater to serve the region's potable water needs. During dry season, when water demand is highest, reservoirs on the Hillsborough, Palm and Manatee rivers release almost no water downstream.

The impact of reservoirs on the low and medium-salinity habitats downstream is the subject of several ongoing assessments. Results from one study of flow variations on the Manatee River indicate that, on average, river area and volume within the low-salinity band were reduced 33 percent and 22 percent, respectively, as a result of reservoir operations for the period 1982-1992. Consequently, the area of wetlands coinciding with this low-salinity band was reduced by 150 acres or 25 percent.[24]

Modeling comparisons of historic and modern landscapes indicate that net freshwater inflows to the main body of Tampa Bay have changed little since the 1950s, assuming the same amount of rainfall each year.[25] This is mainly a result of increases in urban and agricultural stormwater runoff, which have countered decreases in freshwater flows from rivers. However, long-term measurements of river flows by the U.S. Geological Survey indicate that many rivers in southwest Florida (including some in Tampa Bay) have experienced gradual freshwater declines since the 1930s because of declining rainfall.

FISH AND WILDLIFE

Fisheries

The population of many sport and commercial fish species in Tampa Bay is in a state of flux. Anecdotal reports from sport fishermen indicate some species such as snook and red drum are responding positively to fishing regulations designed to increase their numbers. On the other hand, commercial landings of black (or striped) mullet and spotted seatrout are significantly below historical catches.

A constitutional ban on gill netting, triggered in part by declining mullet stocks, took effect in July 1995. Supporters believe the ban will lead to increases in mullet populations, which are fished almost exclusively by commercial netters. The ban also may benefit other species like trout and sheepshead, targeted by both commercial and recreational fishermen.

Bait fish such as menhaden and herring also were targeted for increased protection following precipitous declines in bait fish landings in the late 1980s. The 1993 ban on purse seining in the bay is expected to stabilize bait fish populations, as well as benefit other fish and birds that feed on the bait fish.

Careful monitoring of fish populations will be necessary to gauge the effectiveness of these existing regulations and determine the need for further management actions.

Until recently, resource managers have had to estimate populations of important fishery species in Tampa Bay from landings data because direct measurements were not available. These data, which record the amounts and types of fish brought to Pinellas and Hillsborough docks by area fishermen, indicate that 3.7 million pounds of 11 commercial species of finfish were harvested from the bay in 1990 — a decrease of 24 percent since 1966. The decrease is largely due to reduced catches of mullet and sea trout, while landings for the remaining species stayed the same or increased slightly.[26]

In fact, records going further back to 1950 show that harvests of spotted sea trout declined 86 percent in the bay by 1990, from 487,000 pounds to 67,000 pounds.[27] Similarly, red drum harvests plummeted from 80,000 pounds in 1950 to 15,000 pounds in 1986, the last full year of available data prior to a statewide ban on commercial red drum harvests.[28] These raw data do not reflect changes in fishery management plans or quotas.

Until recently, mullet was the most sought-after commercial species in the bay, comprising almost half of the 1992 landings of finfish and shellfish, or 2.3 million pounds. By comparison, bay harvests of spotted seatrout and bait shrimp were only 40,000 pounds and 26,000 pounds, respectively.[29]

Although useful, landings are an imprecise indicator of stock sizes because changes in market demand, gear efficiency and fishing regulations may affect them. Recognizing this, the Florida Marine Research Institute in 1989 initiated a Critical Fisheries Monitoring Program (CFMP) to provide more reliable estimates of stock sizes and

distribution of important species and key prey species. The research also is helping clarify the crucial role habitat plays in the life cycles of many species.

A summary of results of the first three years of the CFMP (1989-1991) found that 78 percent of the juvenile spotted seatrout collected were captured over seagrass beds, further validating the importance of seagrass habitat to this species. Small red drum were found in relative abundance in the bay's major tributaries, while small snook are known to frequent at least two of the rivers, the Alafia and the Little Manatee.[30]

Mirroring declines in fish stocks, Tampa Bay's once-thriving commercial shellfish industry also has virtually collapsed, although bait shrimping continues. Harvests of clams and oysters throughout the bay are restricted or prohibited because of documented or potential bacterial contamination from fecal coliform associated with human and animal wastes entering the bay in stormwater runoff. In the few unrestricted areas remaining, shellfish populations are not large enough to support commercial harvest.

However, reassessments of closed or restricted areas are not routinely performed by the state, and it is possible that actual water quality conditions in specific areas do not warrant the restrictions. That's because decisions to classify or reclassify areas according to public health concerns in most cases are based on land use considerations and the *potential* for contamination following a major storm event, rather than actual water quality conditions.[31]

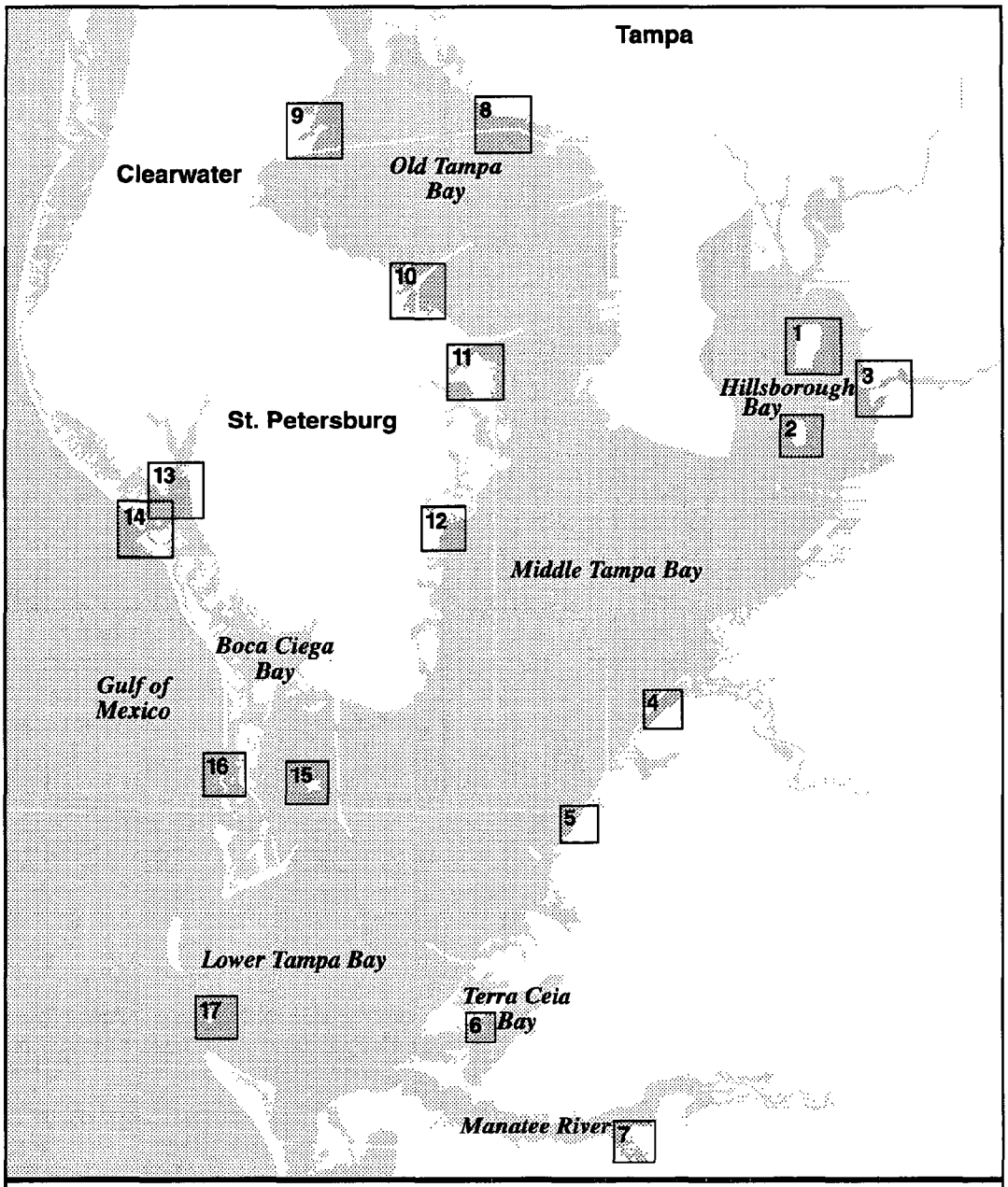
The bay's fisheries also are impacted by entrainment, the capture of planktonic eggs and larvae of fish and shellfish in power plant cooling intakes. The five power plants around Tampa Bay take in a daily average of about 2.3 billion gallons of bay water. An estimated 274 billion fish eggs and 83 billion fish larvae are captured annually in cooling intakes in Tampa Bay, according to power plant monitoring data from the early 1980s.[32] Assuming 100 percent mortality, the impact of steam electric plants on the fishery stocks of Tampa Bay is probably significant. However, in the absence of sufficient baseline data on stock sizes and normal survival rates, it is difficult to fully assess this impact. Further research is needed to understand the cumulative impacts of power plant entrainment on the bay's fisheries.

Habitat declines, fishing impacts and water quality are considered the primary factors responsible for changes in fish populations. The relative impact of each factor is often hard to discern because of natural fluctuations in stock sizes.

Despite these pressures, improving water quality throughout Tampa Bay is creating more favorable conditions for fish and shellfish and for the seagrass habitats they require. One potential beneficiary is the bay scallop, which all but disappeared from Tampa Bay in the 1960s. While experts can't say why the scallop departed decades ago, they suspect these highly sensitive creatures were casualties of pollution. Water quality in Tampa Bay now has improved to levels that may support scallop recovery, and aggressive restocking efforts are underway.

Important Bird Nesting Colonies of Tampa Bay

Figure 6



LEGEND

1. Island 2D (Tampa Port Authority)
2. Island 3D (Tampa Port Authority)
3. Alafia Banks*
4. Cockroach Bay Shell Pit
5. Piney Point
6. Washburn Sanctuary* (Terra Ceia Bird Key)*
7. Dot-Dash (mouth of Braden River)
8. Courtney Campbell Causeway
9. Alligator Lake
10. Howard Frankland Causeway
11. Florida Power/Weedon Island
12. Coffee Pot Bayou
13. Dogleg Key
14. John's Pass
15. Tarpon Key**
16. Shell Key
17. Passage Key**

* National Audubon Sanctuary
**National Wildlife Refuge

SOURCE: NATIONAL AUDUBON SOCIETY, TAMPA BAY SANCTUARIES

Bay Wildlife

Tampa Bay supports a magnificent array of wildlife, from the familiar brown pelican to the lowly sea squirt. But many of these animals also are threatened by impacts to water quality and habitats.

Birds are perhaps the most easily recognized and appreciated creatures in the ecosystem, and mangrove islands in the bay are among the most important nesting sites in the nation. These islands support as many as 40,000 pairs of approximately 25 species each season, including brown pelicans, cormorants, ibis, spoonbills and terns.[33] The bay also attracts sizable and diverse colonies of wintering sea birds, including the American white pelican, which travels more than 2,000 miles on its annual pilgrimage from the Western United States and Canada.

Bird populations have dramatically declined in the last half-century as the region has been developed. Most vulnerable are beach-nesting shorebirds and wading birds such as the white ibis, which lives along the bay but depends upon freshwater food sources for its young. As these inland sources dry up or are converted for development, populations plummet. Flocks once as large as 30,000-40,000 pairs have declined by as much as 75 percent.[34]

In addition to habitat losses, the bay's bird populations also have been impacted by human disruption of rookeries and by entanglement in monofilament fishing line.

Marine mammals and sea turtles feed and reproduce in Tampa Bay. More than 500 bottlenose dolphins are estimated to be year-round residents. The bay also is the winter home of one-sixth of the West Coast manatee herd, or upwards of 200 animals, according to manatee researchers with the Florida Marine Research Institute (FMRI).[35] These gentle, plant-eating giants cluster around the warm-water discharges of the bay's power plants and feed in the grass beds of the bay's perimeter.

Loggerhead turtles also are occasionally observed in the bay near Egmont Key and Fort DeSoto, where they nest on the sandy beaches. And recent stranding data collected by FMRI indicates that the bay may also be an important nursery for Kemp's ridleys, the most endangered of the sea turtles.

Increased boating activity continues to threaten these larger marine creatures. In 1994, 193 manatees were found dead in Florida, up from 145 in 1993. Boat collisions with manatees and propellers that slice the thick hides of these shallow-water creatures are a major cause of manatee injuries and deaths in Florida. Whether the recent upsurge in mortality is an anomaly, or points to an escalating threat from boating activity, is uncertain. Regardless, further increases could be significant for the manatee population, which already has dwindled to about 1,800 animals statewide.

Mostly out of sight to casual observers of the bay is a diverse array of bottom-dwelling creatures known as the benthic community. Included among the more than 1,200 species of benthic organisms documented in the bay are the commonly known blue crab, pink shrimp, brittle starfish and sea squirt.[36] These epifauna, which reside on the surface of the sediment, and their neighboring infauna, which live below the surface, are an important link in the bay's food web. They also play an indispensable role in the cycling of major nutrients, including carbon, phosphorous and nitrogen.

While their feeding habits vary, these animals mostly scavenge on the bottom, feeding on decaying plant and animal material or filtering microscopic organisms like phytoplankton from bay waters. In doing so, filter feeders like oysters, scallops and sea squirts help maintain water clarity.

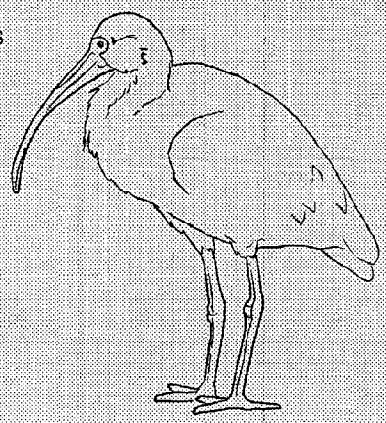
Many of the bay's inhabitants require not one, but multiple, habitats to survive. This points to the critical need for resource management strategies that aim for a balance of diverse, healthy bay and upland habitats, rather than applying resources piecemeal or concentrating solely on boosting wetland acreage.

PLIGHT OF THE WHITE IBIS

Tampa Bay harbors some of the most important wading and shorebird nesting areas in the nation. Most of these nurseries are located on natural or manmade islands well-protected from all but human intruders, who increasingly and often unwittingly disrupt mating and nesting behavior.

Among the dozens of species that nest in and around Tampa Bay are great blue herons, snowy and great egrets, roseate spoonbills and brown pelicans. The bay also harbors the largest nesting colony of rare reddish egrets outside Texas.

Many of these species are dependent upon a variety of different habitats to provide food for themselves and their young. The white ibis exemplifies the need for a diversity of healthy habitats. This familiar wading bird, with its long, scimitar-shaped red bill, is one of the most common of the bay's feathered residents. A jack of all trades, it pokes and prods for food in a variety of habitats, from seashores to river banks to residential backyards. In fact, many gardeners consider it a welcome guest because the ibis devours mole crickets, grasshoppers and cockroaches.



Several thousand pairs of ibis nest in the bay area each year, including about 5,000 pairs at the National Audubon Society bird sanctuaries at the mouth of the Alafia River. But those numbers are a far cry from the 30,000-40,000 pairs counted just 50 years ago, when immense fleecy flocks of the graceful white birds soared over the bay.

The plight of the ibis provides a textbook lesson in why protection of the bay must extend beyond its traditional borders to encompass its life-giving freshwater sources. For although the ibis frequently nests in and along the bay itself, the survival of its offspring depends upon a freshwater delicacy, the crayfish.

Indeed, scientists have found that young ibis fed a diet rich in crayfish grow faster and are more likely to reach adulthood than ibis babies fed primarily fiddler crabs from the shores of the bay. The reason, they suspect, is that the low-salt crayfish diet is healthier for the babies than the high-salt fiddler crab meals. Once the birds reach adulthood, they appear to have no problem digesting insects or saltier food sources, but when they are young, crayfish are critical.

As the bay's freshwater habitats have given way to farms, highways and homesites, the ibis have had to forage farther and farther to find crayfish for their young, or resort to feeding them the more readily available fiddler crabs. Experts say this could be one reason for their declining numbers, and another justification for protecting inland freshwater lakes and ponds.

WATER AND SEDIMENT QUALITY

Since the 1980s, local communities have made significant strides in improving water quality in Tampa Bay. The quality of the bay's water and sediments is important not only to the animals and plants that reside in them, but it also affects human use and enjoyment of the bay.

Excess amounts of naturally occurring and otherwise beneficial nutrients and chemicals can jeopardize the bay's health. The most striking example of this occurred from the 1960s to the late 1970s, when excess nitrogen from discharges of partially treated sewage led to excess algae growth and low dissolved oxygen and light levels in the bay — a condition known as eutrophication. Degraded water quality contributed to seagrass losses and inhibited their natural recovery by blocking light to the bay's underwater grass beds.

Sediment quality also has been impacted by potentially toxic contaminants carried in stormwater runoff, wastewater and atmospheric deposition to the bay. Recent studies by the National Oceanic & Atmospheric Administration (NOAA) reveal high levels of these contaminants in sediments at several bay sites, including upper Hillsborough Bay, Boca Ciega Bay and Bayboro Harbor.[37]

New studies show that atmospheric deposition may play a much larger role in the bay's water quality than previously realized. These airborne pollutants, primarily from industrial and vehicle emissions, fall to the surface of the bay and its tributaries or to land, and are carried to the bay in stormwater runoff. Research financed by the Tampa Bay NEP indicates that about 28 percent of the bay's total nitrogen load may come from atmospheric deposition directly to the bay.[38]

Recent attention also has focused on the problem of sanitary sewer overflows caused by heavy rainstorms that force some municipal treatment plants to shunt raw or partially treated sewage to Tampa Bay. Sewage overflows are of particular concern in St. Petersburg and Pinellas County, where low land elevations and rapid population growth have combined to strain existing municipal sewer and stormwater systems. In August 1995, St. Petersburg was forced to shunt more than 15 million gallons of raw sewage into canals leading to the bay when torrential rains caused sewer backups.[39] Corrective actions will be costly and will take time, but they are necessary to minimize associated water quality impacts and allay public concerns about the bay's safety as a recreational resource.

Since 1974, the Environmental Protection Commission of Hillsborough County has conducted a comprehensive water quality monitoring program in the bay's four major segments. The wealth of data compiled by the Commission is the principal source of information for the following status and trends on bay water quality. A benthic monitoring program has recently been established by the counties surrounding the bay to track trends in sediment quality and the abundance and distribution of bottom-dwelling animals.

Water clarity

Proper water clarity is essential in maintaining the bay's ecological equilibrium. It determines how much and where submerged vegetation will grow and also enhances the aesthetic appeal of the bay. Water clarity is greatest in the lower part of Tampa Bay because of natural circulation and flushing from the Gulf. Here, visibility (based on Secchi disk measurements) extends to an average depth of 2.5 meters (8.2 feet). It naturally decreases moving up the bay, dropping to an average of approximately 2 meters (6.6 feet) in Middle Tampa Bay and Old Tampa Bay. In Hillsborough Bay, which has poor circulation and receives a larger share of nutrients and sediments from major rivers, average water clarity drops to 1.5 meters (4.8 feet).[40]

Water clarity changes noticeably with the seasons, improving in cooler months and declining in summer, when warm temperatures, extended daylight and heavy rains stimulate the growth of microscopic algae (or phytoplankton), which gives the water a greenish cast. Suspended algae in the water column reduces the amount of light that penetrates to underwater seagrasses.

In fact, the ability of seagrasses to recolonize the bay hinges on the amount of sunlight various grass species require, as well as shading factors, such as the amount of drift macro-algae and epiphytic or attached algal growth on grass blades. For most bay species, an estimated 20 to 25 percent of the light striking the bay's surface must penetrate to target depths to allow seagrass regrowth.[41] The light requirement for turtle grass, the most common seagrass species in Tampa Bay, is estimated to be 22.5 percent at the deep edges of the grass beds.[42]

By maintaining or slightly improving water clarity, light conditions should be sufficient to gain back a majority of the seagrasses present in Tampa Bay in the 1950s, excluding areas that have been permanently altered.[43]

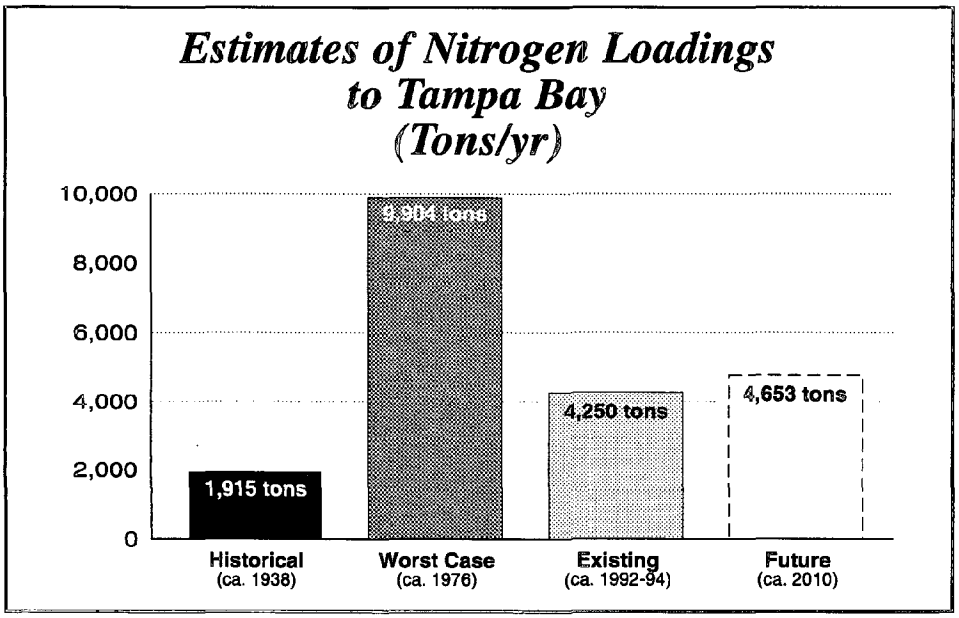
Concentrations of chlorophyll *a* are a useful indicator of algal biomass. In 1991, mean annual levels of chlorophyll *a* for Tampa Bay were near their lowest point since 1974. Overall, levels from 1989 to 1994 were low enough to allow 20 to 22 percent light penetration to target depths throughout the bay.[44]

Nitrogen

Despite progress in bay cleanup, nitrogen continues to be a key focus of concern for Tampa Bay. Excess amounts of this otherwise beneficial nutrient can pollute the bay by accelerating algal growth. Excess algae reduces light penetration to seagrasses and, ultimately, depletes the water of dissolved oxygen.

In 1993, the Tampa Bay NEP set a long-term seagrass restoration goal of 14,000 acres. That goal was based on recovering seagrasses to 1950s levels, except in areas that have been permanently altered. Studies now indicate that as many as 12,000 acres of seagrass can be recovered over time by maintaining existing water quality conditions. That would require local communities to reduce their nitrogen loadings to the bay by about 10 percent by the year 2010 to compensate for increases in nitrogen loadings associated with population growth.[45] Additional seagrass recovery would require further reductions. Nitrogen loading goals for the bay will be finalized in early 1996.

Nitrogen Loading Scenarios **Figure 8**



SOURCE: COASTAL ENVIRONMENTAL, INC.

Estimates of past, present and future loadings of nitrogen are based on computer modeling efforts. Most increases are expected to come from non-point sources, principally stormwater runoff.

The Program has produced estimates of existing and future nitrogen loadings, by source and for each of the bay's seven major segments. Workshops with local governments to apportion nitrogen loading targets will be conducted in 1996 once these goals are finalized.

Water quality improvements are attributed mainly to advances in domestic and industrial wastewater treatment and associated declines in nitrogen in effluent discharged from these facilities. Until the late 1970s, most sewage treatment plants operating along the bay pumped partially treated sewage into Tampa Bay. This nutrient-rich effluent was a chief cause for the pollution that sparked noxious algal blooms and depleted oxygen and sunlight from the bay. In 1976, the bay's total annual nitrogen load was estimated to be 2.5 times greater than the load computed for the years 1985 to 1991.[46]

Today, all 17 sewage treatment plants discharging to Tampa Bay and bay tributaries provide Advanced Wastewater Treatment (AWT), a process that can reduce nitrogen loadings from effluent by as much as 90 percent.[47] The retrofit of Tampa's Howard F. Curren facility at Hooker's Point, the area's largest plant, was a catalyst in the bay's water quality recovery. St. Petersburg's pioneering wastewater reuse program, which eliminated almost all its direct discharges of treated wastewater to Tampa Bay, also contributed to improving water quality. Similar reuse programs now are underway in many other bay area communities.

Toxic Hot Spots of Tampa Bay

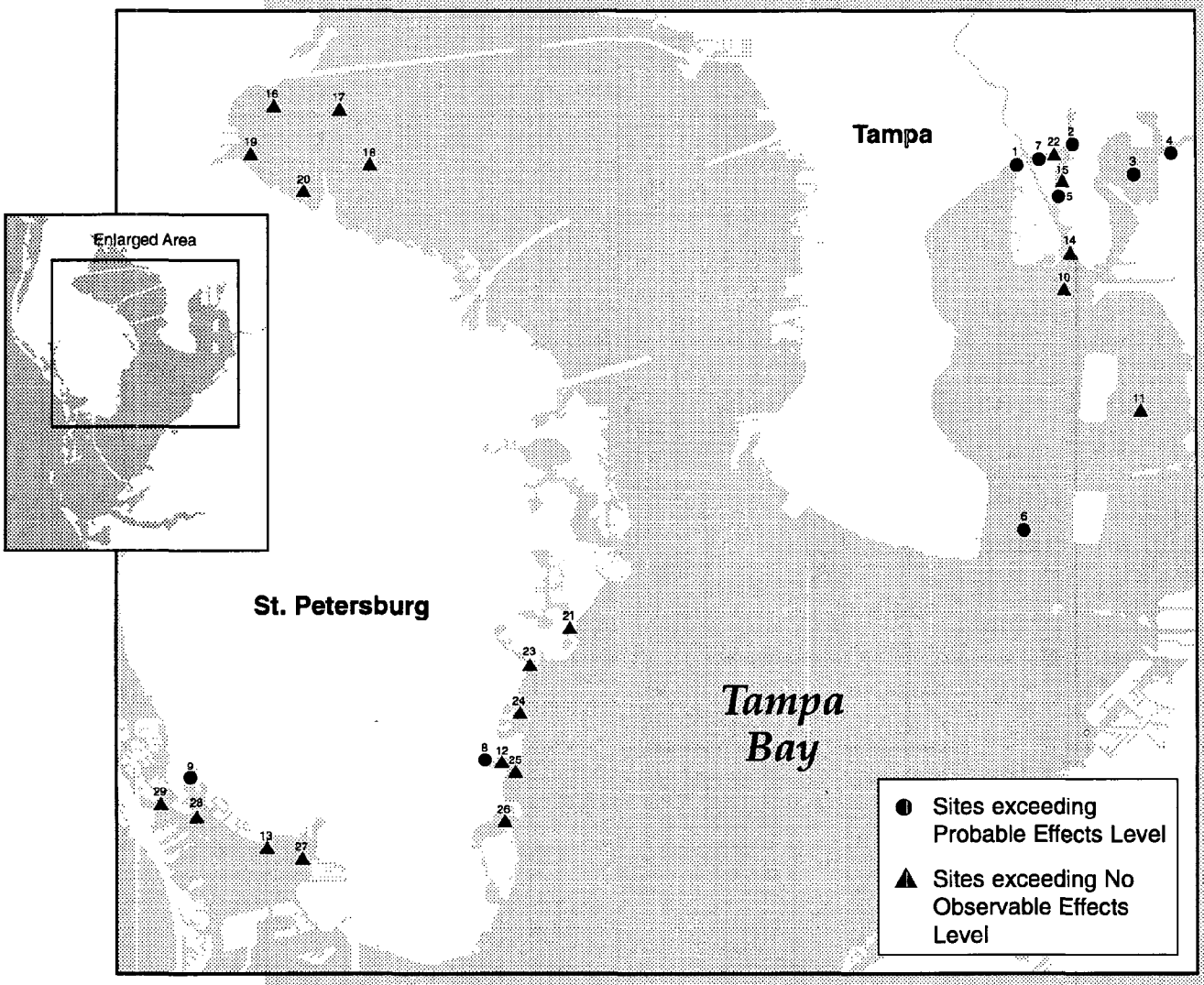


Figure 9 shows sites in Tampa Bay where concentrations of toxic contaminants in sediments have exceeded Florida's Probable Effects Level (PEL) and No Observable Effects Level (NOEL) for biological impact. Sites registering above the PEL indicate that some biological impact to marine organisms is likely. Sites registering above the NOEL are considered "at risk" to biological impact.

PEL and NOEL guidelines are not available for a wide range of toxic pesticides, including chlordane, mirex, dieldrin and endosulfin. Northern Boca Ciega Bay generally had the highest pesticide concentration of the 55 bay sites sampled in two phases. Concentrations of chlordane at northern Hillsborough Bay were the highest of any toxic constituent measured at a Tampa Bay site. Total chlordane and mirex concentrations in oysters from Tampa Bay were relatively high on a national scale. Endosulfin, chlordane and DDT were reported in sediments at Cockroach Bay.

High levels of contamination are confined to relatively few bay segments, primarily around ports, marinas, and other industrial areas. The cleanest segments are around Safety Harbor, Old Tampa Bay, Lower Tampa Bay and Terra Ceia Bay.

Figure 9

LEGEND

Sites Exceeding PELs*:

1. Lower Hillsborough River	(Lead, Zinc, PCBs)
2. Ybor Channel and Turning Basin[1]	(Lead, Zinc, DDT, PCBs)
3. McKay Bay	(PCBs)
4. Palm River	(Cadmium, Lead, Zinc, PCBs)
5. Sparkman Channel	(PCBs)
6. South Hillsborough Bay	(PCBs)
7. Garrison Channel	(Lead, Zinc)
8. N.W. Bayboro Harbor	(Zinc)
9. Inner Bear Creek (Boca Ciega Bay)	(PCBs)

Sites Exceeding NOELs:

10. North Hillsborough Bay[2]	(DDT, PCBs)
11. Central Hillsborough Bay	(Cadmium, DDT, PCBs)
12. Bayboro Harbor	(DDT, PCBs)
13. Lower Boca Ciega Bay	(DDT, PCBs)
14. Cut B Channel	(Cadmium, DDT, PCBs)
15. Sparkman Channel	(Cadmium, DDT, PCBs)
16. West Old Tampa Bay	(DDT)
17. West Old Tampa Bay	(DDT)
18. Old Tampa Bay	(DDT, PCBs)
19. Allen's Creek	(Cadmium, DDT, PCBs)
20. Cross Bayou	(Cadmium, DDT, PCBs)
21. Smacks Bayou	(DDT)
22. Garrison Channel	(Cadmium, PCBs)
23. Lower Coffee Pot Bayou	(DDT, PCBs)
24. St. Petersburg Marina[2]	(Cadmium, DDT, PCBs)
25. Bayboro Entrance	(PCBs)
26. Big Bayou	(DDT)
27. Gulfport	(DDT)
28. Outer Bear Creek	(DDT)
29. Boca Ciega Bay	(Cadmium)

[1] Combines data from 4 points in this area, including three in Ybor Channel and one in Ybor Turning Basin (which exceed the PEL only for zinc and PCBs). Only one of the three Ybor channel sites exceeded the PEL for DDT.

[2] Combines data from 2 samples in this area.

SOURCE: NOAA, MAGNITUDE AND EXTENT OF SEDIMENT TOXICITY IN TAMPA BAY, FL. and STATUS AND TRENDS IN TOXICANTS AND THE POTENTIAL FOR THEIR BIOLOGICAL EFFECTS IN TAMPA BAY, FL.

* PELS ARE BASED ON "EFFECTS RANGE MEDIANS" (ERM) AS CITED IN THIS REPORT.

Toxics of Concern for Tampa Bay

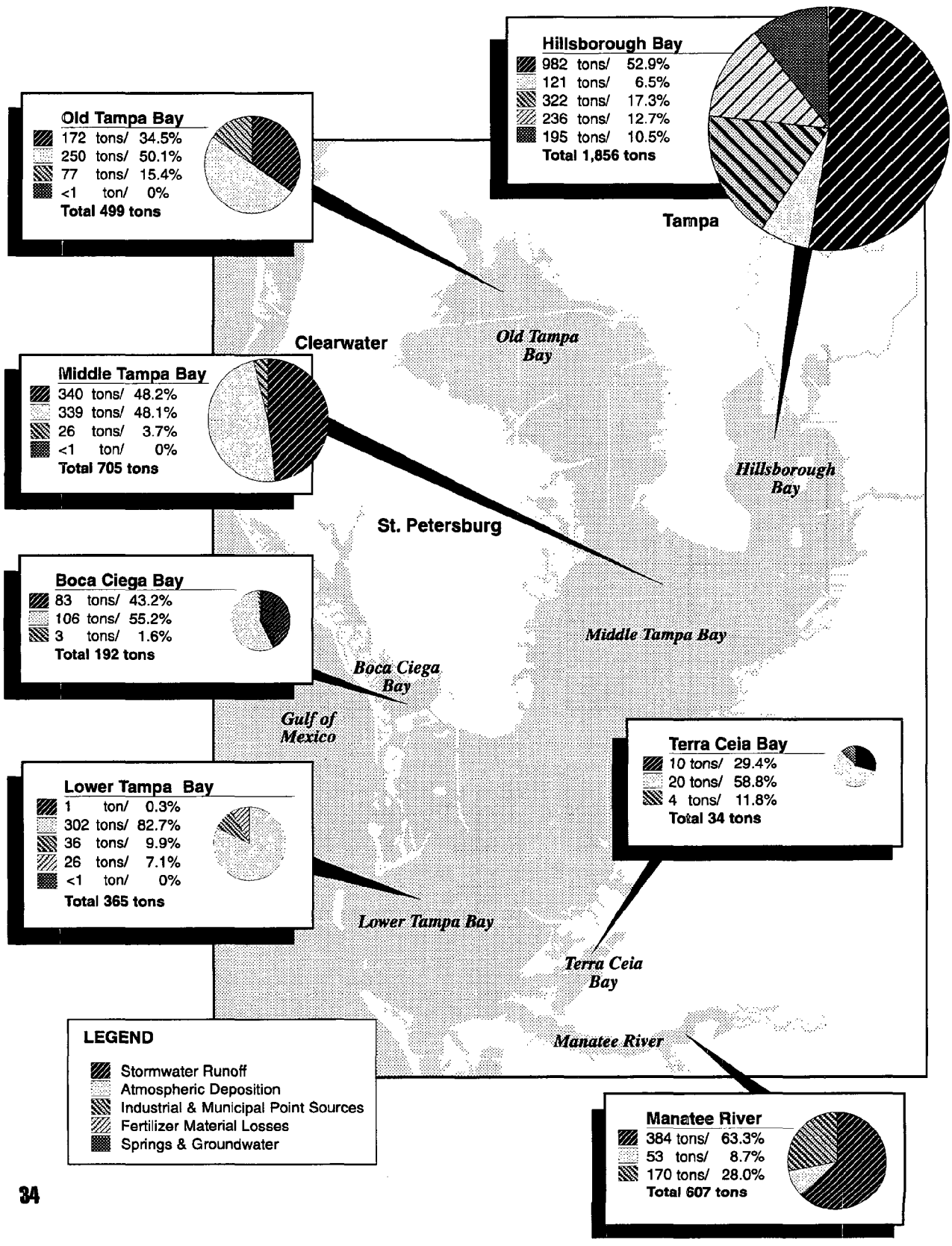
	Contaminant/Impacts	Sources
Heavy Metals	**Cadmium** - Potentially toxic and may concentrate in food webs as it is retained for long periods in biological systems. Does not appear to accumulate in fish or undergo biomagnification, but does accumulate in sediments. High levels of cadmium present in sediments from the Hillsborough Bay/Lower Palm River, Allen's Creek, Cross Bayou and Boca Ciega Bay.	Common trace element widely employed in electroplating applications. Also present in paints, plastics, batteries and domestic sewage sludge.
	Chromium - Exhibits varied levels of toxicity in different fish species. Also listed as a mammalian carcinogen. Highest levels in bay sediments found in Hillsborough Bay near the mouth of the Alafia River, in Boca Ciega Bay near Cross Bayou, and near Bayboro Harbor.	Atmospheric sources include alloy and metal production, coal combustion, waste incineration, cement production. Direct sources include electroplating/metal finishing, wastewater treatment plants, iron/steel foundries and other industrial applications, residential runoff and phosphate fertilizers.
	Copper - Widely distributed in the natural environment, but also demonstrates acute toxicological effects at small concentrations above essential levels. Exceedingly toxic to aquatic biota. Highest levels in bay sediments found in Boca Ciega Bay near Cross Bayou, in Hillsborough Bay near the Alafia River and Davis Islands, and in Middle Tampa Bay near Bayboro Harbor and Papys Bayou.	Large number of human-induced sources to marine environment, including oil and fuel combustion, antifouling paints, metal cleaning operations, plating baths and rinses, commercial pigments and dyes, wood preservatives, leachate from copper pipes, domestic sewage sludge, and copper sulfate used to control algae in reservoirs.
	Lead - Causes a number of acute and chronic human health impacts, and accumulates in sediments. High levels found in bay sediments from Hillsborough Bay near the Alafia River, the lower Hillsborough River, and Boca Ciega Bay near Cross Bayou.	Largest source of lead to the environment originates from its past use as a gasoline additive and from atmospheric deposition from auto emissions. Paint, batteries and domestic sewage sludge also are potential sources.
	Mercury - Naturally occurring in the environment, but also bioaccumulates in biota, causing acute toxicity at high concentrations. Sublethal effects include behavioral changes in invertebrates and birds, growth reduction in fish and algae, and impairment of senses and physical and mental development of children.	Atmospheric sources include municipal waste incinerators, fossil fuel combustion, paint additives (restricted by 1992), and re-emission from land sources. Used to produce batteries, electric switches and other electronic devices. Moves in sediments and water, and through bio-transportation.
	Zinc - Toxic at high concentrations and widespread in the environment. Highest levels in bay sediments found in Boca Ciega Bay near Cross Bayou and in Hillsborough Bay near the Alafia River.	Major application is coating of other metals to protect against corrosion. Used widely as a component in batteries and tires. Sources include municipal wastewater and sludge, direct industrial discharges, surface runoff, and atmospheric deposition.
Pesticides	**DDT** - Animal and potential human carcinogen; biomagnifies in organisms and persists in the environment. Caused wide-spread contamination of fish and wildlife, especially during 1960-80. Banned in 1972. DDT remains in sediments at several bay sites. Highest concentrations are reported at northern Boca Ciega Bay, northern Hillsborough Bay and near the Alafia River and Papys Bayou.	Formerly used to control a broad spectrum of agricultural, silvicultural and household insect pests.

Figure 10

	Contaminant/Impacts	Sources
Pesticides	**Chlordane** - Environmentally persistent insecticide used extensively in termite control and also to control certain agricultural insects. Banned in 1988. Concentrations of chlordane at northern Boca Ciega Bay, Papys Bayou, Mullet Key and northern Hillsborough Bay were the highest of any sites measured in the bay.	Farmers used granular chlordane mixed with fertilizers for broad-spectrum insect control on fields. Also applied occasionally as a liquid spray for some beetles, and on golf courses. Agricultural and urban runoff are among the major documented sources.
	Mirex - Neuro-toxic pesticide; also known as Dechlorane. Sublethal effects in the marine environment include decreased algal growth, reduced fish growth, disrupted blue crab behavior, reduction in body weight and body lipid in salmon. Sublethal effects in birds include reduced reproductive capacity. Causes tumors in rats and mice. Mammalian symptoms include weight loss, enlarged livers, altered liver enzyme response, reproductive failure, fetal abnormalities including cataracts, heart defects, scoliosis and cleft palate. Concentrations of mirex in oysters from Tampa Bay are relatively high compared to many other sites around the nation. Production of mirex discontinued in 1977. Highest concentrations in bay sediments at Boca Ciega Bay, Mullet Key and Cockroach Bay.	Widely applied by aircraft to control fire ants on pastures between 1965 and 1978. Also used as fire retardant in electrical components, fabrics and plastics. Sewage sludge also a potential source.
	Endosulfan - Hazardous neuro-toxic pesticide with acute toxicity to marine organisms, high bioconcentration factor and fairly long half-life. Although not widely sampled for in Tampa Bay, endosulfin has been recorded in sediments from Cockroach Bay and in stormwater from an industrial park in West Tampa.	Introduced about 30 years ago and widely used to control winged insects associated with many row and field crops. Applied as a liquid spray to crops.
	Dieldrin - Pesticide for soil-dwelling insects including termites. Sublethal effects include starvation, liver damage, immunological suppression, decreased fertility, postnatal mortality. A carcinogen for some animals and a mutagen in cell cultures. Highest levels in bay sediments reported at the mouths of the Hillsborough River and Boca Ciega Bay.	Widely used from 1950-1974 to control soil insects on cotton, corn and citrus. All uses banned in 1985 except subsurface termite control and some mothproofing. Dieldrin is a breakdown product of the pesticide aldrin, both of which are long-lasting in soils and not highly water-soluble.
PCBs/PAHs	**PCBs** - Among the most persistent and toxic of organic compounds. Most risk of cancer from consumption of contaminated seafood attributed to PCBs. Biomagnifies. Manufacture ended in 1976. PCBs at sites in Hillsborough Bay exceed Florida's Probable Effects Level (PEL) for biological effects from toxic contaminants. PCBs also found in sediments at Boca Ciega Bay near Cross Bayou.	Formerly employed in a wide variety of industrial applications including insulation in electrical capacitors and transformers; paints, additives, adhesives, and caulking compounds; hydraulic fluids. Sources to environment are varied including direct discharge from production facilities into municipal sewage systems, leaching from disposal sites, refuse incineration and reuse of transformer oil.
	PAHs - Many PAHs are potent carcinogens or mutagens. Highest levels in bay sediments found in Hillsborough Bay near Davis Islands and the Alafia River, Boca Ciega Bay, and Middle Tampa Bay near Papys Bayou.	A group of related compounds present in crude oil and its products, released to the atmosphere during combustion. Also released from burning of non-petroleum substances, such as wood (brush fires). Sources include treated sewage, stormwater runoff and oil spills. Suspected sources include aerial fallout, petroleum refinery wastes, and discharges of drilling fluids.

Existing Annual Nitrogen Loadings to Tampa Bay by Bay Segment (1992 - 1994 average)

Fig. 11



Toxic contaminants

Toxic contaminants represent the other primary focus of concern for water quality managers in Tampa Bay. Toxics of concern, identified in Figure 10, include various trace metals, pesticides, polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs).[48] These substances, some naturally occurring and others synthetic, can be damaging or deadly to marine life when present in sufficiently high concentration; in addition, they have the potential to negatively affect human health.

Recent studies by the National Oceanic and Atmospheric Administration (NOAA) in cooperation with the Florida Department of Environmental Protection provide the most complete assessment to date of toxic substances of concern and their distribution in Tampa Bay.[49] Overall, Tampa Bay has relatively low to moderate levels of most toxic parameters when compared to other urban estuaries. Contamination appears to be centered around large urban centers, ports and marinas, and concentrations generally diminish from the top of the bay toward the Gulf.

However, the studies revealed relatively high levels of contaminants from some local sites when compared to others in Southwest Florida. Generally, Hillsborough Bay — the bay's most industrialized sector and home to the state's busiest port — revealed the highest levels of contamination among bay sites. Upper Hillsborough Bay revealed the highest levels of cadmium, copper, mercury, zinc and lead, as well as the pesticide DDT, which has been banned for more than two decades. Concentrations of chlordane in sediments at a site in northern Hillsborough Bay were the highest of any toxic constituent measured in Tampa Bay.[50]

Boca Ciega Bay and St. Petersburg's Bayboro Harbor, which both border heavily urbanized areas, also ranked among the area's hot spots of contamination.

Concentrations of toxic contaminants in sediments at several bay sites exceeded Florida's Probable Effects Level (PEL), indicating a high probability for biological impact to marine organisms (see Figure 9).[51] Low levels of liver lesions were found in catfish from one site in Hillsborough Bay.[52]

Pesticides in sediments and oysters in Tampa Bay were in the mid-range of concentrations for sites sampled by NOAA around the nation. However, concentrations of chlordane and mirex (no longer manufactured in the United States) in oysters from Tampa Bay were relatively high when assessed on the national scale. Among mollusk samples from the 200 NOAA sites, Cockroach Bay in rural Hillsborough County ranked third nationally in 1988 in total chlordane concentration and fifteenth overall for a three-year period. Among Tampa Bay sites, Boca Ciega Bay had the highest concentration of total pesticides.[53] The pesticides DDT, endrin and endosulfan were recently found in surface waters receiving runoff from the Cockroach Bay drainage basin.[54]

Although levels of contamination documented locally pose no known risk to humans, effects of repeated exposure to low levels of contamination remain largely unknown. Some contaminated sediments remain inert or inactive for many years, but become disturbed by dredging, shipping, storms or bottom-dwelling organisms. Bottom-dwellers that filter contaminated sediments — and the fish, birds and humans that ultimately consume them — may be subject to risk, since some toxic substances increase in concentration as they ascend the food chain.

Pollution Pathways and Sources

Nitrogen and toxic contaminants follow several pathways to the bay, entering through *stormwater runoff* from urban, residential and agricultural lands; *atmospheric deposition* (pollutants transported to the bay in rainfall and dryfall); and municipal and industrial *wastewater* discharged to the bay. Septic tanks and spillage of fertilizer product in handling and transport also contribute to nitrogen loadings in localized bay sectors.

Sources of nitrogen include nitrogen oxides from power plant and vehicle emissions (entering the bay from the atmosphere); treated effluent from municipal and industrial wastewater plants; fertilizer from yards and farms; leachate from septic tanks and small package treatment plants; and animal wastes entering the bay in stormwater runoff (see Figures 11 and 12). Sources of potentially toxic contaminants include metals and chemicals in industrial and municipal wastewater; pesticides from yards and farms; contaminants from roadways and paved surfaces washed into the bay in stormwater runoff; and industrial and vehicle emissions.

STORMWATER RUNOFF

Stormwater runoff from the Tampa Bay watershed contributes about 47 percent of the bay's total annual nitrogen load.[55] Runoff also conveys more than 60 percent of the annual loadings from each of the following metals: chromium, zinc, mercury and lead, as well as significant amounts of other potentially toxic pesticides and substances. Atmospheric deposition and municipal and industrial wastewater transport the bulk of remaining pollutants.[56]

Many toxic contaminants enter the bay attached to fine-grained particles in stormwater runoff. Consequently, total suspended solids (TSS) also are regarded as a pollutant. Solids suspended in the water are of further concern because they reduce water clarity and sunlight available for seagrass growth. Paved surfaces increase the flow of runoff and associated pollution from runoff by preventing natural filtration.

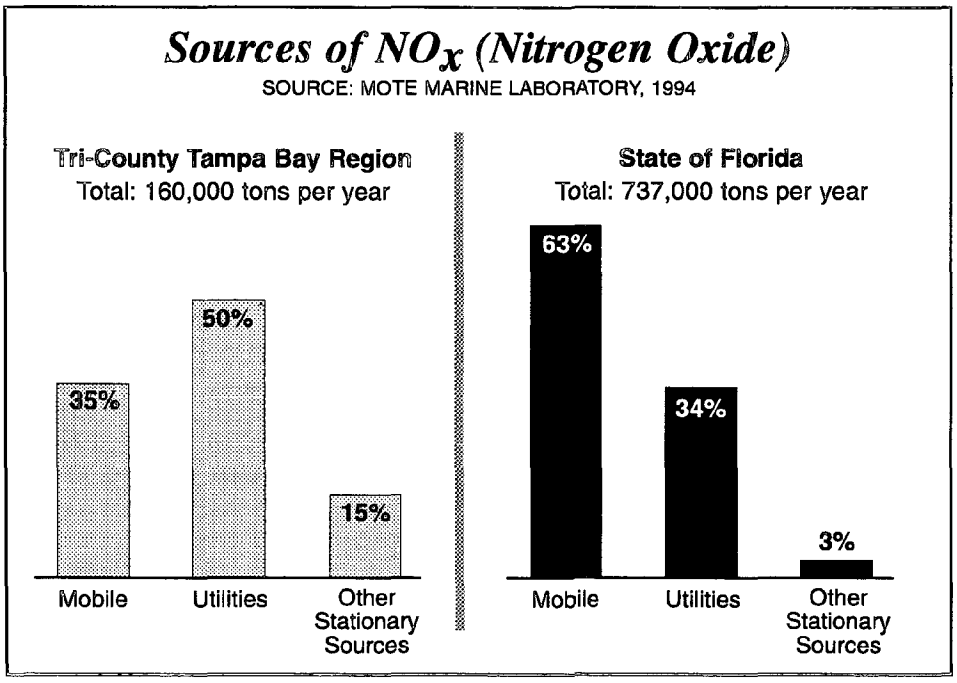
Urban stormwater runoff accounts for about 16 percent, or 680 tons, of the bay's total annual nitrogen loadings. More than half of the nitrogen in urban runoff comes from residential areas, the region's largest land use. By comparison, commercial/industrial sites account for about 20 percent of total nitrogen in urban runoff, although their per-acre contributions are higher than that of residential.[57]

Runoff from intensive agricultural land uses (mostly citrus and vegetable production) contributes about 6 percent of total bay nitrogen loadings, along with sediments and pesticides. Agricultural runoff from pastures and rangelands, which cover roughly 28 percent of the watershed, account for another 13 percent of total bay nitrogen loadings. Forest and wetlands (at 8 percent) and mining (at 4 percent) comprise the remainder of nitrogen loadings in stormwater runoff.[58]

ATMOSPHERIC DEPOSITION

Coastal waters of the United States receive large quantities of nutrients, heavy metals and chemicals from the air — and Tampa Bay is no exception. Until recently, atmospheric deposition (pollutants carried in rainfall and dryfall, which consist of small particles and aerosols) had not been identified as a significant problem for Tampa Bay.

Sources of Nitrogen Oxide **Figure 12**



Studies now suggest that about 28 percent of the bay's total nitrogen loadings are from atmospheric pollutants falling directly on the water.[59]

Nitrogen loadings from atmospheric deposition are actually much higher when pollutants falling in the watershed are included, since many of these will eventually enter the bay in stormwater runoff. About 1,200 tons of nitrogen fall on the open bay each year in rainfall and dryfall. An additional 7,500 tons fall in the watershed, although experts can't say how much of that reaches the bay. EPA estimates that as much as 67 percent of the bay's total nitrogen load could come from the atmosphere.[60]

Between 1995 and the year 2010, nitrogen loadings to the bay from all sources are expected to increase 10 percent, or about 27 tons per year.[61] But those figures do not include changes that may occur if power plants around the bay convert their oil- and coal-fired facilities to a less expensive Venezuelan fuel called Orimulsion. Florida Power & Light (FP&L) already has received conditional regulatory approval to burn Orimulsion at its Port Manatee plant, although the utility still faces administrative hearings and must receive approval from the Governor and Florida Cabinet.

Preliminary estimates show that the quantities proposed for use could add another 30 tons of nitrogen per year to the bay[62]. An advanced pollution control technology called re-burning could lower nitrogen emissions associated with Orimulsion, but the technology is still untested in the United States and will only be tested on one of the two FP&L units converting to Orimulsion. If re-burning proves successful, and both units are converted to Orimulsion, state officials estimate that nitrogen emissions could be reduced substantially.

Several forms of nitrogen are contained in rainfall and dryfall to Tampa Bay.

Nitrogen oxides (NO_x) — mostly linked to power plant and vehicle emissions — are chemically transformed in the air, eventually returning to the Earth in aerosol or dissolved forms, such as nitric acid and other soluble nitrates in rainfall. Combined emissions from motor vehicles and power plants contributed almost 70 percent of the total nitrogen oxides that fell to the earth in United States in 1984. Industrial sources provided another 15 percent.[63]

In the Tampa Bay region, stationary sources (primarily power plants) contribute an estimated 50 percent of the manmade NO_x emissions as compared to 35 percent from motor vehicles.[64] But researchers can't say how much of the local emissions actually are deposited in the region, since airborne contaminants may travel hundreds (or even thousands) of miles before settling to Earth. Experts also can't pinpoint what portion of nitrogen loadings from the atmosphere comes from natural sources, such as lightning. Additional research on natural and manmade sources and the relative contributions from local and distant sources is needed to effectively manage atmospheric deposition in Tampa Bay, which is expected to increase as population, power consumption and motor vehicle traffic grows.[65]

Toxic substances also enter the bay from the atmosphere in large quantities. For example, studies estimate that 44 percent of the bay's total cadmium loading, and about one-sixth of its copper and lead loadings, come from the air.[66] PAHs also enter the bay from the atmosphere, although loadings and specific sources are unknown. PAHs are associated with fossil fuel combustion, such as power plant and motor vehicle emissions and waste incineration.

WASTEWATER

While advances in wastewater treatment and increased regulation have helped reduce pollution, sewage treatment plants and industries discharging directly to the bay ("point" sources) still contribute substantial pollutants to Tampa Bay.

Sewage treatment plants in the watershed contribute about 8 percent (or 340 tons) of the bay's total annual nitrogen loadings.[67] Although all sewage treatment plants with surface discharge to the bay or bay tributaries now provide Advanced Wastewater Treatment, roughly 36 billion gallons of effluent are still discharged to the bay each year, with Hillsborough Bay receiving the largest portion. In 1991, this sector received two-thirds of the cumulative nitrogen load from domestic wastewater treatment plants discharging to the bay.[68]

Wastewater discharged from industrial facilities in the Tampa Bay watershed is responsible for about 6 percent of total nitrogen loadings.[69] The largest categories of industrial sources are fertilizer manufacturing and shipping facilities.

Industrial and municipal point sources also are a major pathway by which toxic substances enter the bay, contributing roughly 30 percent of the bay's total loadings of arsenic, cadmium, chromium and copper, as well as low levels of other contaminants.[70] Homeowners also contribute by discarding toxic cleaners or solvents that local sewage treatment plants cannot completely remove.

OTHER SOURCES

Septic tanks, which are estimated to serve about 20 percent of the watershed's populace, also are a key part of the pollution puzzle in localized sectors of Tampa Bay. Preliminary studies by the Southwest Florida Water Management District suggest that nitrogen loadings from septic tanks, as well as septic waste and sewage treatment sludge, may be substantial in some areas.[71] Septic systems located near the bay pose a particular threat to water quality, since most septic tanks are not designed for nitrogen removal.

High densities of mostly older septic tanks can contribute to degraded water quality (nutrients and pathogens) in creeks where circulation is limited and the water table is near the ground surface. Pinellas County's Allen's Creek and several creeks in Hillsborough County are among those thought to be at risk.[72] Septic tanks along tributaries leading to Tampa's McKay Bay also are believed to be a problem.[73] Springs that feed into the bay's rivers and smaller tributaries also may be impacted by septic tank leachate, especially in areas with very porous soils.[74]

Another 7 percent of the bay's total nitrogen loadings had been attributed to losses of fertilizer — product lost during shiploading and landside en route to port.[75] However, this figure has substantially declined since these estimates were developed in 1991 as a result of efforts to improve portside facilities.

DREDGING AND DREDGED MATERIAL MANAGEMENT

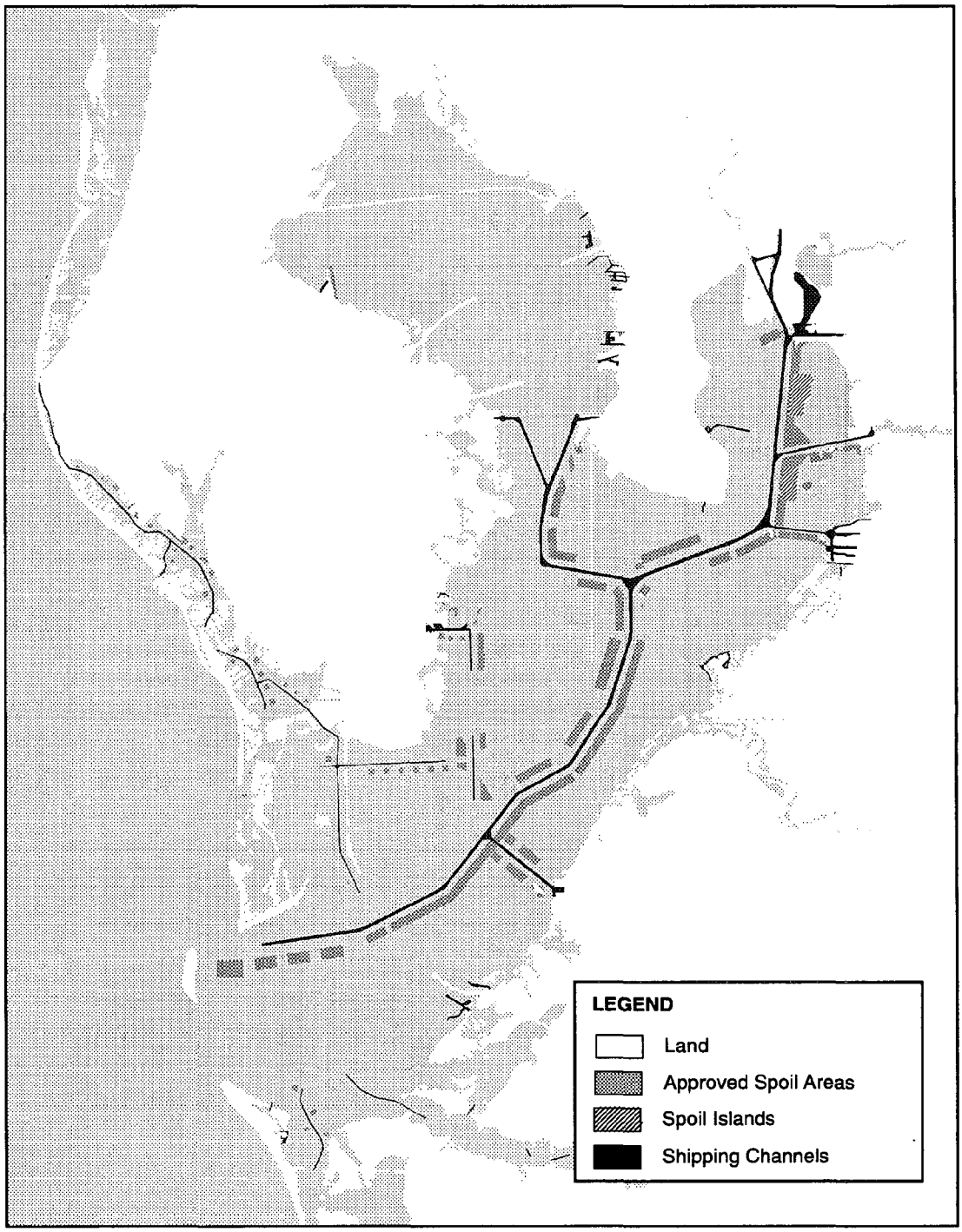
Tampa Bay supports three major seaports and a growing cruise ship industry that contribute more than $5 billion annually to the region's economy. The Port of Tampa is the state's largest port and consistently ranks among the top ten in the nation in trade activity. Smaller ports at Port Manatee and St. Petersburg also contribute substantially to the region.

Maintaining the bay's vast transportation network requires ongoing maintenance dredging and disposal of sediments that accumulate in shipping channels (see Figure 13), activities that have dramatically changed the bay bottom. The Tampa Harbor Deepening Project, begun in 1972 and completed in 1988, required the removal of more than 100 million cubic yards of bay bottom. Another one million cubic yards of material — enough to fill 100,000 dump trucks — is removed from the bottom of the bay each year at an estimated cost of $10 million to service the bay's three major ports.[76]

With an average depth of only 12 feet, regular dredging of the bay is necessary to serve ships entering the bay. The main shipping channel has been dredged to a control depth of 43 feet to allow safe passage of large cargo vessels.[77]

In areas of impact, dredging can cloud bay waters, inhibiting light penetration necessary for seagrasses. Dredging also smothers bottom-dwelling animals and can release substances such as ammonia, which can contribute to algal blooms, from the sediments.

Tampa Bay Shipping Channels and Spoil Areas — Figure 13



SOURCE: COASTAL ENVIRONMENTAL, INC.

Long-term disposal of dredged material and expansion of existing channels represents the greatest challenge in the absence of coordinated planning. Currently, Tampa Bay has two approved disposal sites within the bay on large manmade islands owned and operated by the Tampa Port Authority. At current usage, these islands may serve the disposal needs of the upper bay for another decade.

Officials are exploring options to extend the life of those sites by as many as 20 years by raising the dikes around them to accommodate more material.[78] But beyond then, the upper bay's long-term disposal needs are unresolved — even though annual maintenance dredging is expected to continue to produce one million cubic yards of material annually and some construction dredging is anticipated.

EPA has approved designation of an ocean dumping site 18 miles offshore in the Gulf of Mexico to accommodate approved materials from the middle and lower parts of Tampa Bay. Port Manatee currently utilizes upland disposal sites for its dredged material.

Added dredging and disposal needs for the bay's smaller private, industrial and commercial ports, and numerous residential canals, are unaccounted for, though they are likely to be substantial and must be assessed in developing environmentally sound, long-term management strategies. Currently, owners and users of these facilities and throughways must apply for separate federal, state and local permits and develop independent spoil disposal options, which are not now represented in any strategic plan.

Effective long-term planning and coordination among ports, the Corps of Engineers, and environmental and business interests is needed to explore long-term disposal options and to minimize the ecological impacts of dredging and maximize beneficial uses of spoil.

Spill Prevention and Response

More than four billion gallons of oil and other hazardous materials pass through Tampa Bay each year on large vessels that must navigate relatively narrow channels. Another 18 million tons of refined fertilizer products and phosphate rock are exported from the bay area annually.[79] The fertilizer's hazardous compounds, sulfuric acid and anhydrous ammonia, routinely traverse the bay en route to fertilizer processing facilities.

While this bustling nautical highway brings billions of dollars in economic rewards to the region, it also poses an environmental risk to the bay and underscores the need for effective spill prevention and response.

That risk was brought home to area residents in a dramatic way in August 1993, when two barges and a tanker met near the mouth of the bay in a fiery collision that resulted in a spill of nearly 330,000 gallons of oil.[80] Winds and tides pushed most oil offshore, and the quick response of federal, state and local agencies and the maritime industry helped to spare the bay serious damage. Still, oil coated hundreds of seabirds, fouled

area beaches and blanketed small mangrove islands in the Intracoastal Waterway, with cleanup costs borne by industry and government exceeding $50 million.[81]

Cooperative efforts led by the U.S. Coast Guard, Florida Department of Environmental Protection and Tampa Bay Regional Planning Council have been lauded for providing critical advance planning and response for such accidents. Local governments, shipping interests and local utilities are also a part of this local advance planning network. However, the spill pointed out several important equipment, planning and navigational needs that could help avoid similar tragedies in the future. In particular, officials have pledged renewed efforts to focus on ways to prevent spills from occurring.

Thanks to existing safety protocols, large spills have been relatively rare in Tampa Bay. In fact, small spills averaging 25 gallons or less constitute 95 percent of the 422 spills reported in the Tampa Bay region from April 1993 through September 1995.[82] Many more small spills go undetected. Efforts to address these smaller, chronic discharges are vitally important, since their cumulative impacts may be substantial.

Small spills occur frequently at dockside as boats are refueled. Oily bilge water also enters the bay from smaller craft when bilge pumps are discharged. Leakage and spills of oil and hazardous materials from storage tanks, surface and subsurface pipelines and material-handling accidents and fires also pose a potential threat to the bay.

The region is currently equipped to handle spills of up to 10,000 gallons on Tampa Bay. Larger spills require additional support equipment and personnel from throughout the state and Gulf region.[83] Federal regulations requiring double hulls on all oil-carrying ships constructed after 1997 will assist spill prevention efforts. Existing oil-transport vessels will be phased in, with retrofits beginning in 1995 and completed by 2015.[84]

However, no effective containment methods are available for addressing a major release of water-soluble compounds, such as anhydrous ammonia or sulfuric acid, which could be devastating to the bay environment.

U.S. Coast Guard statistics reveal that 85 percent of all accidents resulting in spills stem from human error, not natural conditions or equipment failures.[85] These statistics have important ramifications in Tampa Bay, which has the longest transit of any Florida port (more than 40 miles) and no coordinated vessel tracking system for commercial vessels.

Ship navigators currently rely on a voluntary broadcast network to relay vessel information and destinations when entering and departing port. Large vessels are equipped with shipboard radar, but the quality and range of these systems vary. In fact, limited navigational equipment on board some vessels forces pilots to rely heavily on personal experience and skills to safely complete each transit.

The State of Bay Management

INTRODUCTION

The struggle to understand and protect Tampa Bay has evolved in less than 25 years from a grass-roots citizens effort to a complex, multi-layered regulatory network involving three counties, a dozen cities, a variety of regional and federal agencies and numerous special interest groups. All this attention has made the bay among the most thoroughly studied estuaries in the nation, but it has also resulted in a confusing and often overlapping maze of regulations and programs that at times make it difficult to discern who is responsible for what.

A major goal of the Tampa Bay National Estuary Program is to bring all parties with an interest in the bay together to develop a blueprint for its future. Finding consensus on the components of the blueprint, and developing a cost-effective yet comprehensive structure within which it can be brought to life, are keys to the Program's success.

This chapter recaps bay management efforts to date and identifies important areas of duplication and omission in the current framework. This assessment is provided to assist the community in identifying obstacles to, and opportunities for, more effective bay management. An inventory of existing regulatory and institutional programs is being completed and will be available when the bay plan is finalized.

Going to Bat for the Bay

Tampa Bay was an early beneficiary of the burgeoning environmental activism of the 1970s, when a newly formed citizens group called Save Our Bay pushed for a halt to uncontrolled dredging and sewage disposal in the bay. Years later, the Hillsborough Environmental Coalition was formed to coordinate and unify local groups with environmental concerns, especially those focused on Tampa Bay. The federal government also was shifting more attention to environmental needs with the establishment of the U.S. Environmental Protection Agency and passage of the Clean Water Act of 1972. One of the major initiatives of EPA in its early years was providing federal grants to upgrade sewage treatment plants.

One of those grants was awarded to the City of Tampa, which had for decades piped partially treated sewage into Hillsborough Bay from Tampa's Howard F. Curren

Treatment Plant. The sewage was believed to be a major reason Hillsborough Bay was clouded with noxious algae and significantly polluted. This grant enabled Tampa to install an Advanced Wastewater Treatment system at the plant, one of the first of its kind in the country. The technological improvements substantially reduced the flow of nutrients such as nitrogen, an achievement that is recognized today as a cornerstone in the bay's recovery.

Subsequent state legislation, through the Wilson-Grizzle and Grizzle-Figg initiatives, required all sewage treatment facilities discharging to the bay to meet advanced treatment standards.

The City of St. Petersburg chose another route to address its sewage disposal problems when it pioneered the first large-scale wastewater reuse program in the state, resulting in almost zero discharge to the bay.

In the late 1960s, the Environmental Protection Commission (EPC) of Hillsborough County was established. Over the years, the EPC has provided a comprehensive long-term water quality record in the bay — critical for tracking and documenting the "bad old days" and the bay's progressive recovery.

A decade later, the Hillsborough Environmental Coalition led efforts to fight environmental impacts associated with the Tampa Harbor Deepening project. The Coalition supported Manatee County's legal action against the federal government regarding the proposed dumping of dredged material from the project into the Gulf of Mexico. The group also worked to improve coordination of coastal land acquisition, efforts which would eventually lead to the establishment of Hillsborough County's Environmental Lands Acquisition and Protection Program (ELAPP). Efforts such as these reinforced the importance of bridging jurisdictional boundaries to effectively protect the Tampa Bay ecosystem.

Residents continued to exert pressure to clean up the bay, and that groundswell of support reached the state Legislature in the early 1980s. The Legislature established a bay study commission composed of elected officials and interested citizens to examine ways to improve bay protection. The study commission resulted in the formation in 1985 of an advisory group, the Agency on Bay Management. An arm of the Tampa Bay Regional Planning Council, the agency has become a vigilant guardian of the bay. The 45-member coalition — which includes elected officials, regulators and representatives of special interest groups and local governments — has been successful in focusing public attention on bay problems and in bringing together diverse and often competing bay users.

The Legislature also created the Surface Water Improvement and Management (SWIM) program in 1987 to restore and protect the state's most threatened waterways. At the urging of the Agency on Bay Management, Tampa Bay was named in the SWIM Act as a priority waterbody within the Southwest Florida Water Management District. The SWIM program has so far expended more than $6 million of State and District funds primarily to restore bay habitats, but also to address pollution in stormwater runoff.

Despite the progress that has been made, many bay managers believe the bay still lacks a comprehensive and cohesive protection scheme. Thus, widespread support

was given in 1990 to Tampa Bay's adoption into the National Estuary Program by EPA to assist the region in developing a comprehensive conservation and management plan for the bay.

A required step in that process is to identify where unnecessary duplication exists in current environmental programs, ensuring that limited public funds are spent in the most effective manner.

Bay Management Expenditures, Overlaps and Gaps

Management of Tampa Bay is currently shared by dozens of federal, state, regional and local agencies and by different departments within those agencies. A short list includes the EPA, the U.S. Army Corps of Engineers, the Florida Department of Environmental Protection, the Tampa Bay Regional Planning Council, the Southwest Florida Water Management District, and the Tampa Port Authority, which has been deeded all state-owned or sovereign bay bottom in Hillsborough County. On the local level, resource management is divided among county and city planning, stormwater, solid waste, wastewater, and environmental protection departments.

A 1994 survey conducted by the Tampa Bay National Estuary Program attempted to quantify how much money is spent to manage and monitor bay quality and administer environmental programs. That study, based on FY 94-95 budgets, indicates that more than $260 million is spent annually by federal, state and local agencies and governments on the restoration and management of Tampa Bay.

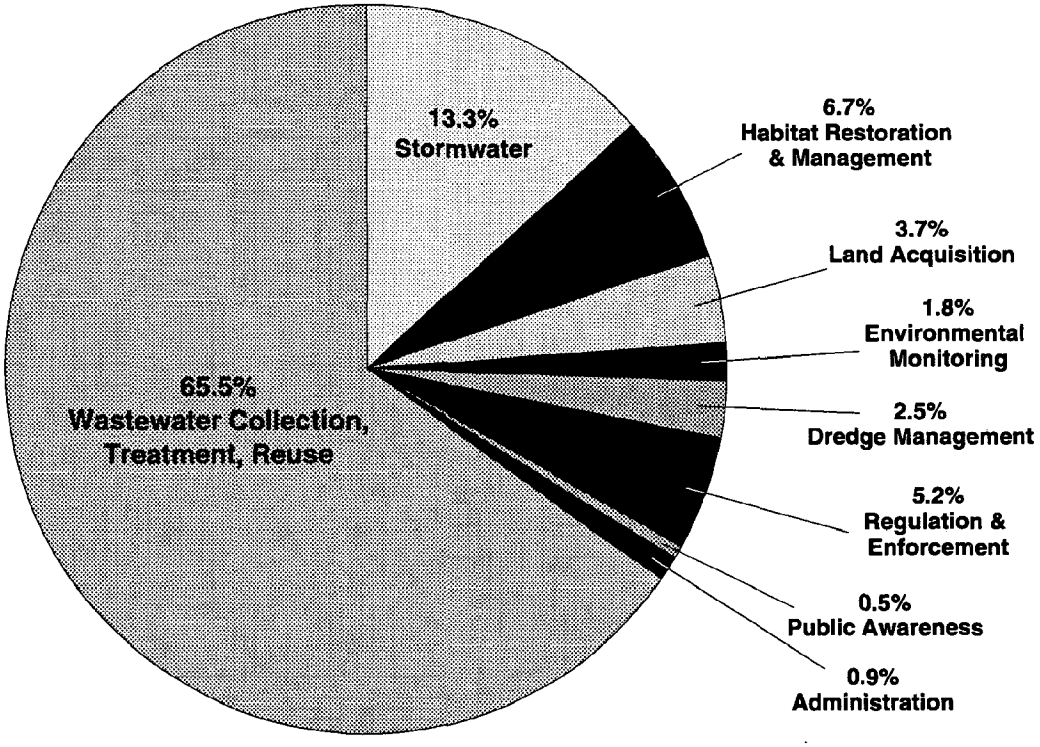
By far, the largest portion of that figure — 65 percent or roughly $170 million — is attributed to wastewater collection, treatment and reuse, and activities that directly or indirectly benefit the bay, even if they aren't performed solely for the bay's benefit. The second largest allocation of about 13 percent, or $35 million, is expended primarily by local governments and the Southwest Florida Water Management District for stormwater management, including handling and treatment. Budgets for habitat restoration, preservation and management totalled approximately $17 million or nearly 7 percent, excluding land acquisition expenditures (nearly 4 percent). Regulation and enforcement, dredging and dredge material management, environmental monitoring and public education comprised the remainder of the expenditures (See Figure 14).

The bay's complex management system has led to duplications in some areas and gaps in others. Bay managers who responded to the National Estuary Program's 1994 survey generally agreed that duplications occur most frequently in permitting and research activities, while gaps are most evident in enforcement and monitoring programs. Bay managers also cited turf-guarding as a problem, and noted the lack of a comprehensive, readily available database through which valuable information about the bay's health and living resources could be shared.

The permitting arena serves as an example of what some believe is unnecessary duplication of effort. An applicant seeking permission to remove or alter wetlands along the bay may have to obtain permits from as many as half a dozen agencies, depending on the extent of wetland impacts and the project's location.

Bay Management and Related Expenditures Federal, State and Local (FY94-95, Draft)

Figure 14



This chart illustrates how money spent on bay restoration and management is allocated by federal, state and local agencies and governments, based on FY94-95 expenditures of more than $260 million.

SOURCE: HAZEN AND SAWYER, *FUNDING SOURCE INVENTORY FOR CCMP ACTION PLANS (DRAFT REPORT)*, JUNE 21, 1995, PREPARED FOR THE TAMPA BAY NATIONAL ESTUARY PROGRAM

That process may be streamlined soon as a result of the state's new Environmental Resource Permit, which will consolidate review of existing dredge-and-fill, stormwater management and sovereign lands permits, and will be issued through the state's water management districts.

Inconsistencies also characterize the permitting process. Because wetland rules and their interpretation vary from one agency to another, the applicant's project could be denied by one agency and approved by another. If the project is approved, the applicant could be required to meet widely varying mitigation and monitoring requirements imposed by each regulatory agency.

Publicly financed restoration projects are further complicated by state agency requirements that they undergo the same rigorous review as private projects — even when the reviewing agencies have participated in the development of the restoration design. This process increases the cost of the project and often delays construction by a year or more.

Indeed, many bay managers believe that permitting is given too much emphasis in the regulatory arena, while monitoring and enforcement are short-changed. Lack of adequate enforcement personnel has been identified by the DEP as a principal reason so many mitigation projects required of private developers have neither been properly constructed, nor constructed at all. The disparity is prevalent throughout the regulatory community, according to bay managers who responded to the NEP's survey.

A New Approach to Bay Management

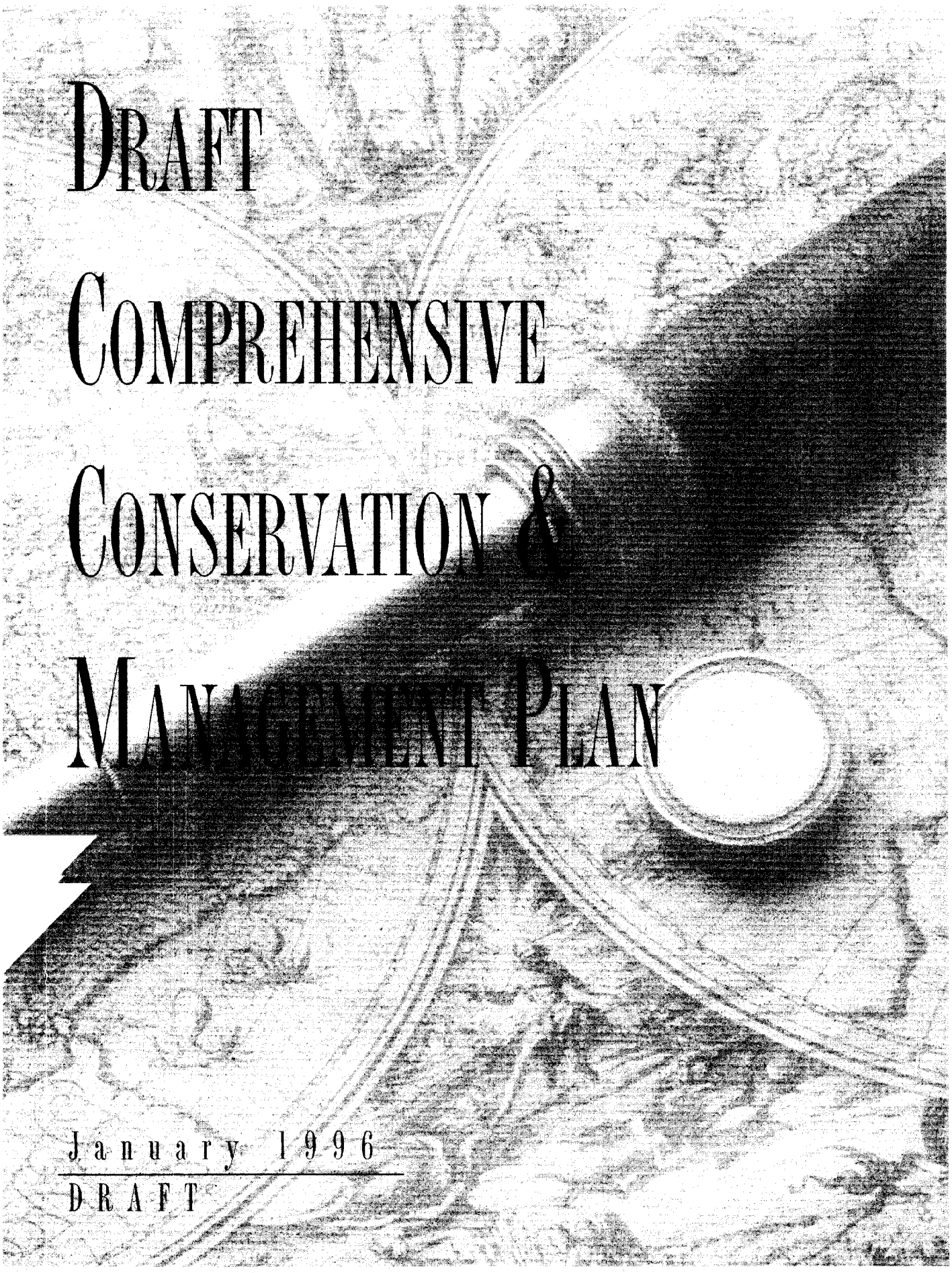
Shrinking public funds, combined with increasing demands for government services and increasing public scrutiny of expenditures, are providing new challenges for resource managers. In the future, they will be pressed to spend money even more judiciously and on programs that yield quantifiable results.

Concurrently, attitudes about environmental management are shifting away from an emphasis on piecemeal oversight and toward a holistic view that assesses the cumulative impacts of human actions on entire natural systems. This approach is called "ecosystem management."

Many bay managers believe the amount of money spent on Tampa Bay is sufficient to adequately manage it, but that it should be re-directed. In particular, they advocate a shift in some resources from permitting to monitoring and enforcement. They also support proactive projects, such as habitat restoration, so long as these projects provide meaningful results and effectively address ecosystem needs.

These managers see ecosystem management as less, rather than more, expensive, since it relies less on micro-reviews of individual permits and more on assessing overall impacts. A critical component of successful ecosystem management is using biological living resources — such as seagrass, fish and scallops — as a measure of the bay's health, in addition to established laboratory standards. Such an approach allows regulators the flexibility they need to achieve realistic, long-term goals and provides taxpayers with a better benchmark to judge the return on their investments.

Making ecosystem management a reality in the Tampa Bay watershed will require a strong management plan backed by a stronger bay management structure that is less cumbersome, more accountable, and committed to addressing ecosystem needs. Bringing this plan to life within the existing bay management structure will be an important focus of the Tampa Bay NEP in overseeing implementation of the master plan for Tampa Bay.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MANAGEMENT PLAN
January 1996
DRAFT

Goals & Priorities for Tampa Bay

Charting the Course advances measurable goals and associated strategies to restore and protect water quality and bay habitats, as the foundation for healthy and diverse populations of fish and wildlife. These goals and priorities for Tampa Bay are the focal point of the master plan for Tampa Bay and the subject of this chapter.

When the Tampa Bay National Estuary Program was formed in 1991, local government and regulatory agency partners pledged to participate with citizens and scientists in the development and implementation of a comprehensive conservation and management plan for Tampa Bay. Subsequent and extensive efforts by the Program's technical advisors over the past four years have centered on developing specific resource goals as long-term measures of success in implementing the bay restoration blueprint.

These goals for Tampa Bay, and the foundation for establishing them, are profiled below and in the accompanying chart.

Goals for Water & Sediment Quality

Water quality goals focus on maintaining the proper water clarity to support seagrasses by controlling nitrogen, which continues to be a major concern in Tampa Bay. Excess nitrogen in rainfall, stormwater runoff, and from domestic and industrial point sources accelerates the growth of algae in the bay, limiting light penetration to seagrasses, which require sunlight to grow. Past water quality declines contributed to the loss of nearly half the bay's seagrasses (or almost 19,000 acres) from the 1950s to the 1980s, although seagrasses are now waging a comeback in areas of the bay where water quality has improved.

In 1993, the Tampa Bay NEP established a long-term seagrass restoration target of 14,000 acres. That goal was based on restoring seagrasses to 1950s levels, excluding areas that have been permanently altered. Subsequent studies by the NEP indicate that as many as 12,000 acres of seagrass can be recovered over time by maintaining existing water quality conditions. That would require local communities to reduce their nitrogen loadings to the bay by about 10 percent by the year 2010 to compensate for increases in nitrogen loadings associated with population growth. Additional seagrass recovery would require further reductions. Nitrogen loading goals for the bay will be finalized in early 1996.

A workshop sponsored by the Tampa Bay NEP in October 1995 brought together local governments, regulatory agencies, utilities and industry representatives to review provisional nitrogen loading goals for Tampa Bay and discuss ways to allocate reductions

in nitrogen inputs once loading targets are finalized in early 1996. Technical investigators project increases in nitrogen loadings of about 30 tons per year associated with population growth, an amount that represents less than 1 percent of present-day levels. Participants discussed various proportional allocation methods, in which dischargers would be required to do their fair share to offset anticipated increases in nitrogen. Those allocations will be reflected in the final bay management plan.

Toxic contaminants in bay sediments represent the other primary focus of concern for bay managers. Studies by the National Oceanic and Atmospheric Administration (NOAA) and Florida's Department of Environmental Protection in the late 1980s and early 1990s documented relatively high levels of pesticides, heavy metals and other contaminants in sediments at some bay sites, and associated impacts to marine life. Currently, the Tampa Bay NEP is integrating these and other studies on sediment chemistry and toxicity with analyses depicting the health of the bay's bottom dwelling communities—the component of the marine ecosystem most impacted by toxics. A closely related study involves evaluating the level of risk to marine and human health associated with these contaminants.

These studies, slated for completion in March 1996, will enable bay managers to better identify toxics of concern in Tampa Bay. They also will provide the basis for establishing management objectives to minimize associated risks to marine life and humans, and to protect relatively clean areas of the bay from being degraded. The Tampa Bay NEP also is investigating the sources and status of these contaminants in priority drainage basins, research that will be used to determine cleanup and containment strategies.

Recent events also have focused the attention of citizens and bay managers on problems associated with sewer overflows and discharges to the bay during heavy rainstorms. That problem came to light recently when the City of St. Petersburg was forced to discharge more than 15 million gallons of raw sewage into Boca Ciega Bay when excessive rainfall infiltrated and overtaxed the city's wastewater collection network. Other communities around the bay have occasionally experienced similar problems during periods of high rainfall. To keep the bay safe for swimming and shellfish harvesting in the future, local communities will need to grapple with infrastructure improvements that will ensure that the significant investments made to upgrade sewage treatment facilities are not diminished by chronic failures in collection and distribution networks.

Goals for Bay Habitats

Charting the Course also sets forth an innovative watershed strategy for coastal habitat restoration and protection that goes further and will accomplish more for Tampa Bay than existing "no net loss" goals for wetlands, which many suspect fall short of that aim. About half of the bay's saltwater wetlands have been lost to development since the 1950s. Development also has exacted an especially heavy toll on the low-salinity portions of the bay's freshwater tributaries, areas that provide critical nursery habitat for numerous species of fish.

Equally important is the fact that some habitats have declined or been degraded more rapidly than others. The resulting imbalance of habitat types has contributed to declines in certain fish and wildlife. A strategy to address this imbalance is the center-

piece of the Tampa Bay NEP's forthcoming watershed plan for coastal habitat restoration and protection. The strategy is based on restoring an optimum mix of habitats to meet the needs of the bay's representative fish and wildlife guilds, groups of animals that share similar habitat and food requirements.

An overall minimum goal is to restore roughly 100 acres of low-salinity tidal marsh habitat every five years, while maintaining and enhancing salt marshes and mangroves at existing levels. The long-term aim is to recover as many as 1,800 acres of these low-salinity habitats over time, either through habitat restoration or enhancement of existing areas that have been severely degraded. The strategy effectively targets one of the major causes of bay wildlife declines—the accelerated decline of a few unique and absolutely crucial habitats whose losses place a "biological chokehold" on the bay ecosystem.

Now being finalized, the coastal habitat master plan coordinates existing local, state and regional restoration programs and identifies priorities for both habitat restoration and protection, including environmental lands purchases and less-than-fee-simple methods such as conservation easements.

A preliminary seagrass restoration target for Tampa Bay of approximately 14,000 acres also has been established. That figure is based on the amount of seagrasses lost predominantly as a result of water quality declines between 1950 and 1990. Water quality improvements stemming from wastewater and stormwater treatment upgrades in the 1970s and early 1980s already are helping to reap rewards in this endeavor.

From 1982 to 1992, 4,000 acres of seagrasses have grown in Tampa Bay as a result of improving water quality conditions. Even as water quality improvements occur, the natural lag time in seagrass regrowth indicates that recovery will be a long-term process.

Goals for Fish & Wildlife

While the Tampa Bay NEP has not adopted any specific goals for increases in fish and wildlife species, the goals established for water quality and habitat restoration will provide direct benefits for fish, birds and other bay inhabitants by improving the areas in which they live, reproduce and feed.

Reductions in nitrogen loading and increases in seagrass coverage, for instance, will assist efforts to increase fisheries and return the bay scallop to Tampa Bay by providing suitable water quality and habitat. Achieving the NEP's seagrass recovery target also will help the bay's population of endangered manatees, which feed in seagrass beds.

Birds, too, will benefit from the goals set forth in the NEP's habitat restoration master plan, which will assure protection and enhancement of existing habitats important for feeding and nesting, and increase other habitats, such as salt barrens and freshwater ponds, which have been severely reduced because of development. The restoration and protection of freshwater ponds, for instance, is critical to the survival of the white ibis, which depends upon freshwater crayfish and insects to feed its young.

Additionally, preserving the flow of freshwater into the bay from its myriad tributaries

will yield dividends for a variety of commercially and recreationally valuable fish, which seek out these sheltered, low-salinity havens as nurseries.

Other Bay Improvement Goals

Other goals, aimed at improving spill prevention and response and dredging and dredge material management, are equally important in preserving the bay's health and promoting cooperative planning.

Objectives for managing dredging and dredged material focus on the development of a long-term, coordinated dredging and dredged material disposal plan involving the bay's three major seaports and the U.S. Army Corps of Engineers. The plan seeks to reduce the environmental impacts associated with dredging, and maximize beneficial uses of material dredged from the bay's shipping channels.

Goals for spill prevention and response emphasize the installation of a state-of-the-art Vessel Traffic System (VTS) that employs a combination of shore-based radar and global positioning technology to monitor and control shipping traffic in the bay. The system would greatly reduce the likelihood of an economically and environmentally devastating spill of oil or hazardous materials.

Measures to Ensure Success

To ensure effective and timely implementation of the bay master plan, local government and regulatory agency partners have pledged to continue regular dialogue and meetings to review actions and evaluate progress toward meeting the bay's goals. Continued monitoring of the bay's health also is essential to this process (see Monitoring Bay Improvement). This allows policy leaders and bay managers to adjust management actions as necessary to keep the plan on track.

Attaining broad-based citizen support for bay restoration and protection will be equally vital to the success of the plan.

An overall theme expressed in various action plans is to better utilize existing federal, state and local resources to carry out recommended actions. A strong focus on compliance monitoring and enforcement also is emphasized throughout the plan and in specific actions to ensure that environmental regulations that have been established are followed.

Finally, the Tampa Bay NEP recognizes the need to continue strong community outreach and education efforts as the plan is implemented. These efforts are discussed in the chapter on public involvement.

GOALS FOR THE RESTORATION & PROTECTION OF TAMPA BAY

The following goals for Tampa Bay aim to preserve important water quality and seagrass gains achieved over the last decade and to proactively manage future growth to continue the bay's recovery. This requires a strong commitment to manage increases in pollution as growth occurs, rather than allow the bay's health to decline. Goals for Tampa Bay also focus on issues that must be addressed to sustain a healthy bay that will support both recreation and commerce. These issues include the bay's coastal habitats and wildlife, dredging and dredged material management and spill prevention. Local governments and agencies in the Tampa Bay NEP have pledged to continue the precedent-setting partnership to assure effective and timely implementation of recommended actions, and to adjust strategies as needed in the future to keep the bay's recovery on track.

GOAL	RESPONSIBLE PARTIES	BENEFITS	STATUS
WATER & SEDIMENT QUALITY Maintain or slightly reduce existing nitrogen loadings* to Tampa Bay to continue the positive course of the bay's recovery and encourage the regrowth of as many as 14,000 acres of seagrasses over time. Compensating for anticipated increases in nitrogen loadings associated with population growth may require a reduction in nitrogen loadings of about 10 percent by the year 2010.	Local governments and citizenry, industries, utilities	Protect existing water quality and seagrass improvements and continue restoration, establishing as many as 14,000 acres of vital fisheries habitat over time, improving lucrative recreational fisheries and tourism markets.	Maintaining present-day nitrogen loading levels may be sufficient to gain back as many as 12,000 acres of seagrass over time. Additional seagrass recovery would require further reductions. Loading goals will be finalized and incorporated into an implementing agreement signed by local governments and agencies in November 1996. See Water Quality Action Plan for strategies.
Protect relatively clean areas of the bay from increases in toxic contamination, and minimize risks to marine life and humans associated with toxic contaminants in impacted areas.	Local governments and citizenry, industries, ports, marinas	Reduce biological impacts to marine life and associated public health risks from toxics; protect healthy areas of the bay from contamination.	Sediment quality guidelines will be developed by Tampa Bay NEP, in cooperation with regulatory agencies and local governments, by March 1996; investigations completed in early 1996 also will help identify sources and status of contaminants in the bay. See action TX-1 to address hot spots of contamination.
Reduce bacterial contamination in impacted areas of the bay to levels safe for swimming and shellfish harvesting.	Local governments and citizenry	Make the bay safe for shellfish harvesting and swimming, and allay public concerns about the bay's use for recreation.	See public health introduction, which covers this issue and associated sewer overflow problem, and related actions.
BAY HABITATS Recover as many as 14,000 acres of seagrasses baywide.	Local governments and citizenry, agencies, industries, utilities	These vital cornerstones of the bay ecosystem provide essential habitat for fish and shellfish; recovery will help spur associated recovery of fish and animal stocks that have declined as seagrasses have been destroyed.	Water quality improvements from the mid-1980s already are aiding seagrass recovery. By preventing future increases in nitrogen loadings to the bay, conditions should allow for the gradual recovery of approximately 12,000 acres of seagrass. See also action BH-4 to reduce propeller scarring of seagrasses.

Restore an optimum balance of habitats to support fish and wildlife. The minimum goal is to restore roughly 100 acres of low-salinity tidal marsh every five years, while maintaining and enhancing salt marshes and mangroves at existing levels. The long-term aim is to recover as many as 1,800 acres of low-salinity habitat.	Local governments and citizenry, FDEP, SWIM, FMRI	Coordinate existing state, local and regional efforts to restore an optimum balance of habitats for bay wildlife, focusing on areas that have suffered the greatest proportional impact. Prioritize habitat restoration and protection/ acquisition efforts.	See Action BH-1 to implement the coastal habitat restoration and protection master plan for the Tampa Bay watershed. Priorities and goals will be finalized in January 1996. Implementation will begin in 1996 through existing agencies with available funding.
Establish and preserve adequate freshwater inflows to Tampa Bay and its tributaries.	SWFWMD, local governments and citizenry	Protect and enhance critical low- and mid-salinity habitats which serve as vital nursery areas for numerous species of fish.	See Action FI-1 addressing impounded rivers. SWFWMD will recommend minimum flows for the Hillsborough and Palm rivers in 1996 and for the Manatee and Braden rivers by 1997.
FISH & WILDLIFE Increase the number, diversity and health of the bay's fish and wildlife populations by restoring water quality and habitats and reducing physical impacts. Efforts to recover bay scallops, establish local manatee protection zones, and improve on-water enforcement of environmental regulations are key actions advanced in this plan.	Local governments and citizenry, regulatory agencies, Florida Marine Patrol	Reduce impacts to the bay by improving surveillance and protection of fisheries, bird nesting islands and habitats; water quality and habitat recovery will also benefit fish and wildlife stocks, enhancing recreation and tourism.	See action BH-1 addressing coastal habitat protection and water quality actions for ongoing and proposed efforts to improve conditions for fish and wildlife. See Fish & Wildlife action plan for other specific measures and implementation schedules.
DREDGING AND DREDGED MATERIAL MANAGEMENT Develop and implement a long-term, coordinated management plan for dredging and dredged material management.	U.S. Army Corps of Engineers, in cooperation with local port authorities	Minimize bay impacts and independent costs associated with these activities and maximize beneficial uses of spoil material; analyze and address long-term spoil disposal needs	This goal is pending approval by Corps of Engineers, which oversees and conducts most of the bay's dredging; other cooperative initiatives involving the bay's three major independent port authorities are beginning. See Action DR-1.
SPILL PREVENTION & RESPONSE Prevent catastrophic spills of oil or other hazardous materials, reduce chronic smaller spills from recreational and commercial vessels, and improve spill response capability. A key goal is the installation of a vessel traffic system for Tampa Bay as soon as possible to improve coordination of ship movements along the bay's 40-mile-long and relatively narrow channel.	Local governments and citizenry, Florida Legislature, port authorities and port users	Vastly improve spill prevention and response capability in Tampa Bay, which has the longest ship transit of any port in Florida and serves three major seaports, including the state's largest.	Multi-interest task force was established by the Florida Legislature under the auspices of the Tampa Port Authority to make specific vessel traffic technology recommendations to the state in 1996, for installation of a system as early as 1997. See Action SP-1 and other spill prevention measures, especially SP-2, focusing on boom anchors to contain spills.

* Preliminary goal, based on nitrogen loadings avg. for 1992-94

Implementation of some bay improvement actions may require state legislative action and federal government cooperation.

Introduction to Action Plans

The Tampa Bay National Estuary Program was established in 1991 to assist the community in developing a comprehensive bay restoration plan featuring long-range strategies for bay improvement. These strategies are the focus of the following five Action Plans, addressing:

- Water & Sediment Quality
  - Stormwater Runoff
  - Atmospheric Deposition
  - Wastewater
  - Toxic Contamination
  - Public Health
- Bay Habitats
- Bay Fish & Wildlife
- Dredging & Dredge Material Management
- Spill Prevention & Response

This strategic blueprint for Tampa Bay is presented in draft form to further enlist input from citizens and community partners. The final Comprehensive Conservation & Management Plan for Tampa Bay will be published in mid-1996.

Action Plans define the bay's most pressing needs, and present strategies to achieve bay goals and maximize the community's long-term return on investment. Some actions can be implemented quickly and with existing resources. Others will require long-term community commitments. Whenever possible, strategies presented in *Charting the Course* seek to strengthen or redirect existing bay programs to accomplish more with available resources.

Action Plans have been developed with assistance from bay experts and advocates working through the Tampa Bay National Estuary Program's management, technical and community advisory committees. Each Action Plan begins with an introduction that summarizes the issue and includes an index of actions, and concludes with ideas on *What You Can Do* to promote and support bay improvement. Cost estimates are presented for each action, but some analyses continue as this goes to press.

Strategies advanced in *Charting the Course* represent important measures to aid in the bay's long-term recovery and protection, but some actions may not be appropriate in all areas. For instance, different land uses may direct local governments to select different strategies to address pollution to the bay. So long as the bay's water quality goals are met, this flexibility is encouraged to enable community partners to select the

most cost-effective course for bay restoration. While flexibility is emphasized, all participants are called upon to achieve the overall goals for bay restoration and protection (see Goals & Priorities) to preserve the bay's health.

The Tampa Bay National Estuary Program is a partnership of the U.S. Environmental Protection Agency; Florida Department of Environmental Protection; Southwest Florida Water Management District; Hillsborough County and the County's Environmental Protection Commission; Manatee County; Pinellas County; and the cities of Tampa, St. Petersburg and Clearwater. These partners will sign an agreement to implement the final Comprehensive Conservation & Management Plan for Tampa Bay in 1996. They are joined by numerous other agencies, citizens, and technical and private-industry advisors who have participated in the development of the bay master plan.

Preliminary analyses suggest that the cost to meet certain water quality goals may be relatively minimal over the plan's lifetime (see Implementation & Financing chapter). Nitrogen loadings to the bay, which continue to be a major focus of concern, may only require an annual reduction of about 1 percent by 2010 to offset anticipated increases associated with population growth in order to provide optimum conditions for seagrass recovery. Several of the proposed actions to reduce excess nitrogen enhance ongoing efforts in pollution prevention and environmental stewardship, and many of those actions could be accomplished with existing bay management resources. Others may require a re-direction of resources to achieve more with existing tax dollars. Additionally, a number of actions seek to improve coordination and planning among local governments and agencies, and may actually result in savings for currently funded activities.

Although costs for meeting other goals have not been fully determined, recommended actions will focus on cost-effective use of existing resources and a clear return on investment. Any additional funds required to restore Tampa Bay will be documented in the final bay management plan, and subject to public consideration to ensure that issues of affordability, accountability and environmental results are given fair hearing.

The Tampa Bay National Estuary Program invites and encourages your comments as we continue to assist the community in developing this important management blueprint for Tampa Bay.

Water & Sediment Quality

Tampa Bay is rebounding from decades of pollution that reached an apex in the late 1970s, when vast algal blooms clouded the water in some bay sectors and seagrasses struggled to survive.

Now, water quality improvements are helping to chart a course for the bay's recovery. Since 1982, more than 4,000 acres of seagrasses—which provide life-support to many of the bay's fisheries—have either sprouted in once-barren areas or filled in previously patchy meadows as a result of water quality gains. Improved conditions also may be setting the stage for recovery of the bay scallop, which disappeared in the 1960s when the bay was badly polluted.

Most water quality gains are attributed to advanced wastewater treatment technologies, which can eliminate up to 90 percent of the nitrogen from treated wastewater discharged to the bay. Municipal sewage treatment facilities now contribute just nine percent of total bay nitrogen loadings, down from 40 percent in the mid-1970s.

Maintaining these water quality improvements as the region grows represents the foremost challenge for the stewards of Tampa Bay. While direct or "point" discharges of pollution to the bay have declined, other sources such as stormwater runoff and atmospheric deposition have increased and are expected to grow as more people settle in the region. Population in the three counties bordering the bay is expected to increase about 20 percent to nearly 2.4 million by 2010. At current treatment levels, that growth will be accompanied by increases in nitrogen loadings.

Nitrogen and potentially toxic contaminants (including heavy metals and pesticides) are the key pollutants of concern to Tampa Bay. Pollution pathways, including stormwater runoff, atmospheric deposition and wastewater are summarized in this section. For more in-depth coverage, please refer to the State of the Bay chapter, which precedes this section.

Nitrogen is a naturally occurring and beneficial nutrient that pollutes the bay and inhibits seagrass growth when excess amounts are present. The Tampa Bay National Estuary Program has established a preliminary goal for the amount of nitrogen the bay can safely assimilate. That goal is to maintain or slightly reduce present-day nitrogen loadings, even in the face of continued population growth and its attendant increase in pollution. To maintain existing levels, local communities would need to gradually reduce total nitrogen loadings to the bay by approximately 10 percent by the year 2010.

Studies suggest that staying within those limits will maintain water quality suitable for the regrowth of as many as 12,000 acres of seagrasses, an amount that represents more than 90 percent of 1950s seagrass levels, minus areas that have been permanently altered.

Potentially toxic contaminants entering the bay in stormwater runoff, wastewater, and from the air represent the other primary focus of concern for bay managers, following studies that identified high levels of heavy metals, pesticides and other substances in sediments at various urban and agricultural sites, including Hillsborough Bay and Boca Ciega Bay. While contamination appears to be localized and few biological impacts have been documented, the persistence of these substances in the marine environment and the prospect of increased contamination associated with population growth support the need for action now before the problem escalates. Additional investigations by the Tampa Bay NEP are underway to identify the sources and status of contaminants in priority drainage basins.

Local governments already are making significant investments each year in stormwater improvements and pollution prevention in the watershed. These actions will continue to be important catalysts in protecting the bay from pollution. Strategies advanced in the National Estuary Program's Water & Sediment Quality Action Plan are designed to focus these substantial efforts and resources to achieve the greatest long-term benefit for the bay.

Local communities may choose different paths to achieve the same water and sediment quality goals. As long as the goals for the bay are achieved, this flexibility is encouraged to assure the most cost-effective course for bay recovery.

MANAGEMENT OBJECTIVES

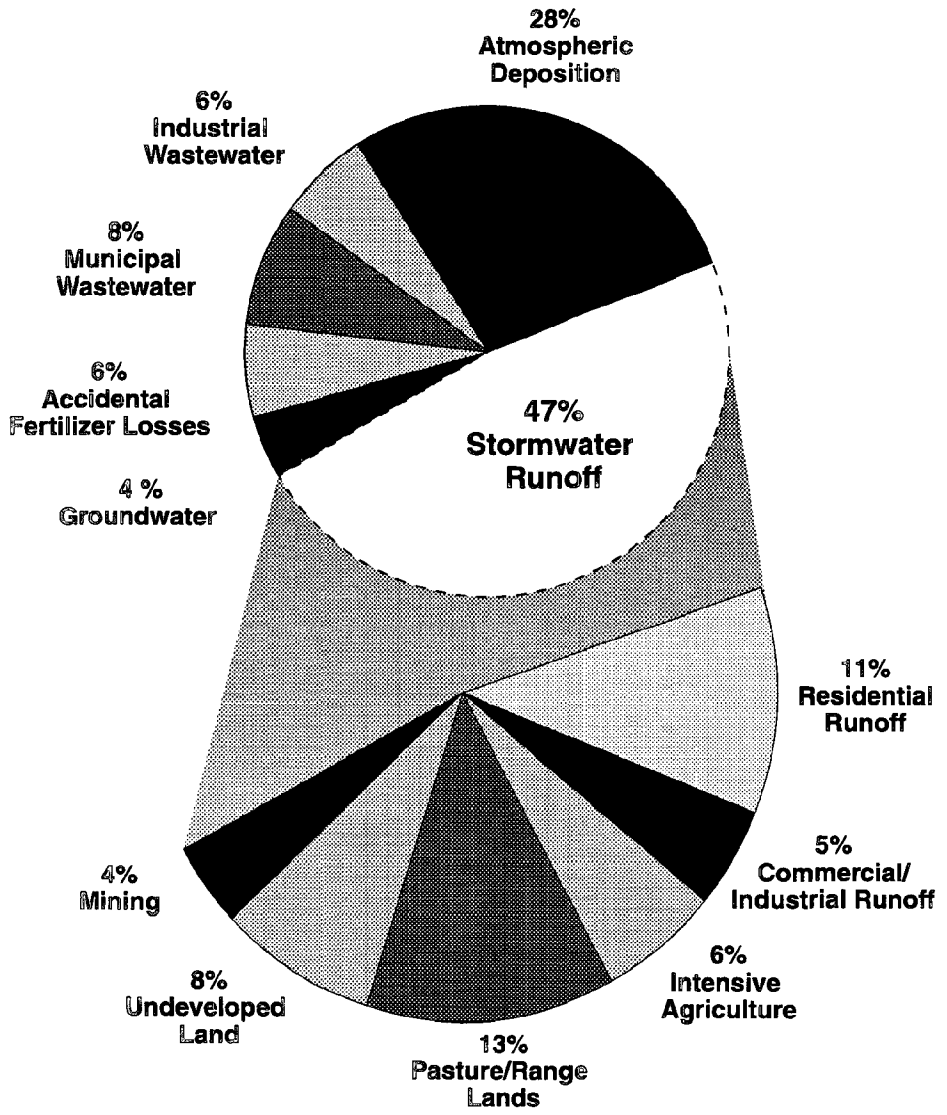
- Maintain or slightly reduce existing nitrogen loadings to Tampa Bay to encourage the regrowth of as many as 14,000 acres of seagrass over time. Compensating for anticipated increases associated with population growth may require a gradual reduction in nitrogen loadings of about 10 percent by the year 2010.
- Protect relatively clean areas of the bay from increases in toxic contamination, and minimize risks to marine life and humans associated with toxic contaminants in impacted areas.

  Note: Sediment quality guidelines are being developed by the Tampa Bay NEP in cooperation with state and federal environmental agencies and local governments for review in March 1996. These will be used to determine specific strategies and goals for management of toxic contaminants.
- Reduce bacterial contamination in impacted areas of the bay to levels safe for swimming and shellfish harvesting.

Per-Acre Nitrogen Loadings from Non-Point Sources

	% Loading	% Watershed	Yield lbs/ac/yr
Residential	11	15.5	4.52
Commercial Industrial/Institutional	5	6.4	5.26
Mining	4	3.2	4.97
Range and Pasture	13	28.4	2.81
Intensive Agriculture	6	6.5	5.63
Undeveloped Land	8	39.93	1.15

Total Nitrogen Loadings to Tampa Bay (1992-1994 average)



SOURCE: COASTAL ENVIRONMENTAL, INC.

STORMWATER RUNOFF

Stormwater runoff carrying fertilizer, pesticides, oils and other contaminants from urban and agricultural lands contributes nearly half of the bay's total annual nitrogen loadings and more than 60 percent of the annual loadings of zinc, mercury, lead and chromium.

Contaminants in runoff come from land-use activities and from air pollutants that fall to the bay's watershed. In fact, air pollutants are believed to be a significant contributor to stormwater runoff to the bay, although scientists still don't know the full measure of those impacts locally (see Atmospheric Deposition).

Approximately 16 percent of the bay's total nitrogen loadings comes from stormwater runoff from urban residential and commercial/industrial land uses, an amount exceeding all direct or "point" discharges of wastewater to the bay from wastewater treatment and industrial plants. Of that, 11 percent comes from residential areas, which dominate the urban landscape. Commercial and industrial sites, by comparison, contribute the other five percent of total bay nitrogen loadings.

Runoff from intensely cultivated agricultural lands (mostly citrus and vegetable production) contributes another six percent of total bay nitrogen loadings, as well as potentially significant quantities of pesticides and sediments from erosion. The pesticide DDT (which has been banned for more than a decade) and endosulfan (an insecticide used to control white flies) have recently been found in surface waters receiving runoff from the Cockroach Bay drainage basin in southern Hillsborough County.

Agricultural runoff also originates from pastures and rangelands, which cover roughly 28 percent of the watershed and account for another 13 percent of total bay nitrogen loadings. Compared to lands in intensive agriculture, these areas may be less cost-effective to treat, since total loadings per acre are relatively small. Undeveloped land (at eight percent) and mining (at four percent) comprise the remainder of nitrogen loadings carried to the bay in stormwater runoff.

Bay water quality is improving, thanks to stricter environmental controls and advances in sewage and stormwater treatment, and associated declines in nitrogen loadings. But concerns about toxic contamination of bay sediments are growing, following studies that revealed concentrations of heavy metals and pesticides at several sites which were damaging to marine life. Many toxic contaminants enter the bay attached to sediments in stormwater runoff, making treatment of sediments in runoff a key component in the strategy to address stormwater pollution.

In fact, stormwater treatment in conventional wetland retention and detention systems can be highly effective in removing sediments from runoff. However, wetland retention/detention is not as effective for reducing nitrogen. Thus, efforts to reduce nitrogen emphasize strategies such as wastewater reuse and pollution prevention measures, as well as efforts to reduce atmospheric deposition of nitrogen to the bay.

The Tampa Bay National Estuary Program has developed a computer model to assist

local governments in selecting the most cost-effective best management techniques to employ in battling stormwater pollution. An overall strategy must focus on pollution prevention, stormwater treatment and monitoring to assure compliance with stormwater permits.

Efforts to address pollution from agricultural runoff will focus on water conservation, integrated pest management and improved compliance with surface water management plans.

SUMMARY OF ACTIONS TO ADDRESS STORMWATER RUNOFF

SW-1 Continue implementation of the Florida Yards & Neighborhoods Program.

SW-2 Assist businesses in implementing best management practices to reduce stormwater pollution and develop model landscaping guidelines for commercial application.

SW-3 Encourage local governments to adopt integrated pest management policies and implement environmentally beneficial landscaping practices on public properties.

SW-4 Reduce impervious paved surfaces, focusing on parking space and design requirements for large commercial developments.

SW-5 Require older properties being redeveloped to meet current stormwater treatment standards for that portion of the site being redeveloped, or provide equivalent compensation.

SW-6 Promote compact urban development and redevelopment.

SW-7 Improve compliance with and enforcement of stormwater permits.

SW-8 Enforce and require the timely completion of consent orders for the cleanup of fertilizer facilities in Tampa's East Bay sector.

SW-9 Encourage "fertigation" and low-flow irrigation on farms to reduce and improve the quality of runoff.

SW-10 Improve compliance with agricultural ground and surface water management plans.

SW-11 Determine minimum widths for vegetated buffers along tributaries.

and management ?

Continue Implementation of the Florida Yards & Neighborhoods Program

SW-1

ACTION:

Continue implementation of the Florida Yards & Neighborhoods Program to encourage residents to use environmentally beneficial landscape management practices to reduce fertilizer, pesticide and water use contributing to pollution in stormwater runoff, and to enhance natural habitats. Enlist home-and-garden retailers, developers, and the landscaping and pest control industries to practice and promote these concepts.

BACKGROUND:

Urban runoff from residential areas contributes an estimated 13 percent of the total nitrogen loadings to Tampa Bay, and also carries potentially toxic substances used in landscape maintenance. Fertilizers from yards and atmospheric deposition to residential lands, are believed to be key sources of the nitrogen loadings.

Residents within the bay's 2,200-square-mile watershed often do not connect their landscape design and maintenance practices with environmental impacts to Tampa Bay. This is especially true for those who do not live on or near the waterfront. Many residents continue to view a highly maintained lawn as the benchmark for a well-landscaped home, and often apply excess fertilizer, pesticides and water to maintain their turfgrass.

However, residents are beginning to grasp the principles of environmentally beneficial landscaping as they learn more about these concepts from the Florida Cooperative Extension Service's Environmental Landscape Management (ELM) program, and from local governments and the Southwest Florida Water Management District, which promote Xeriscape™ concepts.

These concepts have been integrated in the Florida Yards & Neighborhoods Program (FY&N), which was established in 1991 by the National Estuary Programs of Tampa Bay and Sarasota Bay and the Florida Cooperative Extension Service (FCES), which administers the program locally. FY&N promotes least-toxic yard maintenance and the use of beneficial native and drought-tolerant plants to create Florida Yards that reduce runoff and enhance the environment.

From 1993-1995, the FY&N Program worked primarily with neighborhoods in Hillsborough, Pinellas and Manatee counties. Additional funding in 1995 from the West Coast Regional Water Supply Authority (WCRWSA) enabled the program to expand to Pasco County.

But, to achieve broader changes in residential landscape practices, efforts must be directed to reach a larger and more diverse audience. FY&N has already begun expanding its outreach to individual homeowners and lawn service professionals. These efforts should be expanded to reach a larger, more diverse audience, including retailers and developers, and members of the landscaping and pest control industries.

STRATEGY:

Strategies to continue and broaden the Florida Yards & Neighborhoods Program and to enlist developers, retailers and the horticulture/pest control industries in promoting these concepts are proposed below. Implementation of these strategies is contingent upon funding.

The overall objectives of Florida Cooperative Extension Service in administering the FY&N Program are to:

- Develop a stable funding and administrative source for the Program.
- Explore cost-share and cross-promotion of FY&N and other educational programs among local governments and agencies to maximize outreach and impact. Additionally, continue local government and agency input into the FY&N Program through existing advisory committees.
- Maintain a uniform educational program throughout the watershed to provide a consistent message to residents who share common broadcast and print media, while allowing participating counties the flexibility to address specific needs.
- Continue to explore statewide implementation through FCES.

Individuals and Neighborhoods

STEP 1 Continue FY&N outreach to organized community and homeowner associations, with presentations and distribution of the Florida YardStick and the Florida Yards & Neighborhoods handbook.

STEP 2 Expand outreach to enlist individuals in implementing FY&N concepts.

A. Promote Florida Yard concepts at major home improvement outlets, The Florida Aquarium, home and garden shows, and other well-attended public events; provide educational opportunities through these venues.

B. Pursue arrangements to distribute and bar-code FY&N materials so they may be sold at cost through retail establishments, with revenues tagged for additional reprints. Cost recovery through resale will make these materials self-supporting.

C. Increase news publicity efforts and article placements, and promote use of public service announcements on cable, network and government access stations. Encourage individual counties to consider paid media placement campaigns to broaden public interest and awareness of Florida Yard messages.

D. Increase the number of individuals pursuing Florida Yard certification.

Responsible parties: Florida Cooperative Extension Service (FY&N Program), in cooperation with local governments, SWFWMD and WCRWSA

COST:

Costs for staff and materials for program elements above is estimated at approximately $75,000 per county (Hillsborough, Pinellas, Pasco and Manatee). Cooperative funding may be sought from participating local governments, river basin boards of the SWFWMD, WCRWSA, and the Coastal Zone Management Program.

Retailers, Landscape Management and Horticulture Industry

Large and small retailers of gardening products, as well as landscape maintenance and pest control companies, provide a direct link to consumers. That link can be used to promote FY&N practices and consumer purchases of environmentally beneficial plants and yard care products.

A proactive strategy to educate retailers and landscape service companies about FY&N concepts and the potential business value of marketing these concepts and products to environmentally conscious residents is stressed in this Action Plan.

For homeowners who contract with yard maintenance companies, the prospect of adopting environmentally beneficial landscaping practices can be even more challenging. While companies may be willing to reduce "broadcast" spraying of pesticides, their profits often remain linked to the routine application of these chemicals.

Yard maintenance companies and other members of the horticulture industry also must continue to be targeted through the FY&N program.

The following strategies are proposed for the FY&N program, contingent upon FCES securing funding for implementation.

STEP 1 Develop partnerships with key nursery/garden supply retailers in each county to promote FY&N literature, and with other resources who advocate environmentally friendly landscaping, at point-of-purchase.

STEP 2 Expand existing training programs or develop new ones, as necessary, to educate retail/landscape management personnel about FY&N concepts.

STEP 3 Review existing industry certification programs and recommend changes to incorporate FY&N concepts.
Responsible Parties: Florida Cooperative Extension Service (FY&N Program), in cooperation with local governments, SWFWMD and WCRWSA

COST:

Implementation of steps is contingent upon funding. Costs for development of a point-of-purchase displays/materials depends on design criteria and materials selected for distribution.

Developers and Property Managers

Opportunities exist to promote Model Florida Yards at new residential developments,

or during the annual Parade of Homes, to illustrate to potential homebuyers the beauty, reduced maintenance and environmental benefits of a Florida Yard. Developers could promote Florida Yards as a home purchase feature for the discriminating, environmentally conscious homebuyer. By creating partnerships between developers and nurseries, a Model Florida Yard could be included among new development models. A companion educational brochure that highlights FY&N landscaping principles also could be made available, as part of a developer's sales kit, to potential home buyers.

The following strategies are proposed for the FY&N program, contingent upon FCES receiving funding for implementation.

STEP 1 Promote the development of Model Florida Yards at residential model home developments in each county. Work with homebuilders' associations and realtors to identify appropriate new housing developments.

A. Identify nurseries/landscape architects who will cooperate with developers in landscaping model homes using FY&N design and maintenance principles.

B. Schedule one-on-one meetings and/or a workshop with developers to outline the program.

C. Secure the developer's agreement to include an educational brochure, which highlights Florida Yard landscaping advantages, in the company's sales kit.

Responsible parties: This action could be coordinated by the Florida Cooperative Extension Service (FY&N Program) and local governments.

STEP 2 Develop interpretive signage (incorporating developer and nursery logos), and Florida Yards promotional brochure that includes a cost-benefit analysis of a Florida Yard vs. a conventional, maintenance-intensive landscape (see SWFWMD Xeriscape Model Ordinance for reference).
Responsible parties: FCES

STEP 3 Enlist realtors and property managers to adopt and promote FY&N concepts by providing educational workshops and opportunities to earn Continuing Education Units (CEUs).
Responsible parties: FCES

COST:

Implementation of steps is contingent upon funding. Costs to develop a Model Florida Yard at a residential development are estimated at $5,000, based on plant material, irrigation and interpretive signage. Plants and irrigation costs would be borne by developers, with interpretive signage and consulting provided by FCES. Costs for interpretive signage to promote Model Florida Yards could range from $500-$1,000 per site. Funding sources include participating developers, local governments, river basin boards, board of county realtors and builders' associations.

SW-1

SCHEDULE:

FY&N neighborhood programs are ongoing. Other steps may be initiated beginning in 1996, if FCES is able to secure additional funding from local governments or other cooperating partners.

EXPECTED BENEFITS:

Reduction in fertilizers, pesticides and water use should result in reduced pollutant loads from urban runoff. Increases in the use of native and other beneficial drought-tolerant plants also can enhance habitat value.

MONITORING ENVIRONMENTAL RESPONSE:

FCES surveys participants to assess landscape management changes as a result of the program. Public interest in FY&N also can be gauged by tracking distribution of materials and sales at major retail outlets promoting these concepts, number of professionals certified in FY&N concepts, and number of certified Florida Yards.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

SW-2, SW-3

Assist Businesses in Implementing Best Management Practices to Reduce Stormwater Pollution, and Develop Model Landscaping Guidelines for Commercial Application

SW-2

ACTION:

Encourage and assist businesses in implementing best management practices to reduce stormwater pollution, and develop model landscaping guidelines based on Florida Yards & Neighborhoods principles for commercial application.

BACKGROUND:

Local communities offer various levels of assistance to businesses in assessing site management practices that can contribute to stormwater pollution, and in developing pollution prevention strategies. These efforts can provide bottom-line dividends to participating businesses, by cutting costs of consumable materials such as water or pesticides, and to local governments, by emphasizing pollution prevention as a strategy to reduce costly cleanup or end-of-pipe treatment.

One example is *Hillsborough County's Operation BayWorks—Businesses for a Cleaner Future,* established with help from a Tampa Bay NEP grant. The program enlists and aids businesses in the construction, manufacturing, landscaping and automotive repair industries in the development of pollution prevention plans. Participants learn industry-specific best management practices to reduce stormwater pollution associated with landscape management, construction equipment and repair, and hazardous materials use and disposal. Programs such as this often target smaller, specialty businesses, like automotive repair, whose collective impact on stormwater pollution can be substantial. These smaller businesses typically lack knowledge about their potential impact on the environment, as well as the resources to research best management practices on their own.

Local communities should evaluate programs such as Operation BayWorks as a model for implementation in their own communities to reduce stormwater pollution from commercial sites. Efforts such as these may help local governments meet federal mandates for pollution prevention as required in NPDES (National Pollutant Discharge Elimination System) permits.

Additional steps should be taken throughout the region to encourage businesses to adopt principles of environmental landscape management that are also taught to residents through the Florida Cooperative Extension Services' Florida Yards & Neighborhoods (FY&N) Program. Commercial landscapes typically feature large areas of high maintenance turf grass and exotic plants, which often demand extensive amounts of fertilizer, pesticide and water. Stormwater pollution from these commercial landscapes can be reduced with changes in maintenance practices and landscape design, such as downsizing turf areas and expanding the use of beneficial drought-tolerant and native plants, which require less fertilizer, pesticides and water.

SW-2

These concepts can be packaged for commercial application by developing model landscaping guidelines for incorporation into local government landscape ordinance codes. Guidelines could then be incorporated into the site review process for new developments. They also should be promoted to existing businesses, along with cost analyses that illustrate potential cost savings in maintenance.

Improvements in landscaping practices are one important part of an overall pollution prevention strategy. One highly effective action to curb stormwater pollution from commercial sites and malls is to reduce the amount of impervious surface devoted to parking, by reducing parking space requirements in building codes and promoting alternative, pervious materials for overflow parking (see Action SW-4).

STRATEGY:

STEP 1 Target and assist businesses in implementing site management practices to reduce stormwater pollution. Evaluate Hillsborough County's *Operation BayWorks* as a model for implementation.

A comprehensive program might focus on best management practices for landscaping and landscape maintenance, erosion control, and hazardous materials use and disposal. Workplans may include: business workshops; industry-specific workbooks that promote best management practices and include templates for self-assessment and site management plans; model commercial landscape demonstration sites; follow-up surveys or on-site visits to track progress; regulatory incentives; and recognition through existing environmental awards program and on-site promotional materials or emblems that participating businesses can display.

A. Identify and prioritize local target industries and businesses.

B. Form a business steering committee or utilize an existing structure such as environmental committees of local chambers of commerce to oversee development of the program and materials, with representation from local target industries, environmental agencies and the cooperative extension service. Materials developed for Operation BayWorks may be modified for these purposes.

C. Implement program, including provisions for monitoring results of efforts. ***Responsible parties: local governments in cooperation with chambers of commerce***

STEP 2 Develop and incorporate succinct and user-friendly model landscaping guidelines for local governments and commercial businesses, based on FY&N concepts, into local government landscape codes throughout the Tampa Bay watershed. Guidelines should include cost comparisons for maintenance of traditional landscapes vs. model landscapes. ***Responsible parties: local governments, in cooperation with Florida Cooperative Extension Service, Southwest Florida Water Management District, West Coast Regional Water Supply Authority***

STEP 3 Incorporate model landscape guidelines into local government site review process for new development or, alternatively, provide incentives such as reductions in stormwater utility fees to developers who agree to meet these heightened environmental landscaping standards.
Responsible parties: local governments

STEP 4 Incorporate Steps 1-2 as part of the comprehensive stormwater management plan in NPDES permits, as examples of efforts to meet federal mandates for pollution prevention.
Responsible parties: local governments

STEP 5 Aggressively promote model landscape design and maintenance guidelines and cost-benefit analyses to businesses, developers, real estate management companies and commercial realty enterprises to promote retrofits of existing landscapes and landscape maintenance practices.
Responsible parties: local governments, chambers of commerce, Florida Association of Environmental Professionals, builders associations, Florida Native Plant Society

SCHEDULE:

All steps can be initiated in 1996.

COST:

Second-year implementation costs for Operation BayWorks are estimated at $20,000, plus administrative time. Costs to develop model landscape guidelines, including landscape cost-comparison analysis, are estimated at $20,000.

EXPECTED BENEFITS:

Improved landscaping and site management practices and implementation of model landscaping guidelines will reduce stormwater runoff pollution from commercial sites.

MONITORING ENVIRONMENTAL RESPONSE:

Surveys can be used to track pre-and post-business progress in implementing best management practices to reduce stormwater pollution. Local governments also can gauge business participation by the number of pollution prevention plans developed as a direct result of their outreach. Stormwater sampling also can be employed to monitor pre-and post-water quality at large commercial sites that agree to implement model landscaping guidelines.

REGULATORY NEEDS:

Dependent upon work plan, but may include amendments to local comprehensive plans, landscape ordinances, criteria for commercial site permitting review, and changes to NPDES permits.

RELATED ACTIONS:

SW-1, SW-3, SW-4

SW-3

Encourage Local Governments to Adopt Integrated Pest Management Policies and Implement Environmentally Beneficial Landscaping Practices

ACTION:

Encourage local governments to adopt integrated pest management policies and use environmentally beneficial landscaping practices on public properties to reduce pollution from stormwater runoff. As part of this effort, communities are encouraged to commit a minimum of 50 percent of all new public landscapes and retrofits to existing landscapes to low-maintenance designs featuring native and other beneficial drought-tolerant plants.

BACKGROUND:

Local government facilities and parks are visited frequently by the public, providing an excellent opportunity to expose residents to environmentally sensitive concepts for landscape design and maintenance.

Many communities already have begun to develop some public sites in accordance with Xeriscape™ principles. However, as new landscapes are planned or as existing landscapes are retrofitted, local governments have an opportunity to further reduce runoff pollution and lead by example, serving as models to citizens who are being asked to conserve water and limit pesticide and fertilizer use.

Changes to comprehensive plans and landscape codes continue to reflect environmental impact concerns, but additional steps can help achieve a broad-based impact within a local government's sphere of influence. Additionally, such efforts can be referenced in the required annual reports for National Pollutant Discharge Elimination System (NPDES) permits.

This action seeks a commitment from local governments to devote half of the acreage of all new public landscapes or retrofits to existing landscapes to low-maintenance designs featuring beneficial native or drought-tolerant vegetation that reduce the need for water, fertilizer and pesticides. It also calls on local governments to adopt resolutions to use Integrated Pest Management (IPM), least-toxic landscape maintenance practices that employ pesticides only as a last resort. These efforts should be referenced in local government applications for NPDES permits, which require increased emphasis on pollution prevention.

Furthermore, information about environmental landscape management (ELM) concepts taught by county cooperative extension services should be communicated regularly to government employees involved in landscape maintenance or the purchase of fertilizers, pesticides and plant materials. Annual training sessions with those employees could provide updates on new products and techniques that relate to ELM. Sessions of this type also serve to reinforce the commitment made by elected officials and senior staff to environmental quality and pollution prevention.

STEP 1 Commit a minimum of 50 percent of all new public landscapes and retrofits to existing landscapes to low-maintenance designs featuring native or beneficial drought-tolerant plants, with allowances for areas where reclaimed water precludes the use of xeric vegetation.
Responsible parties: local governments

STEP 2 Adopt a resolution to use Integrated Pest Management (IPM) on all publicly owned lands, including parks and government facilities. IPM employs biological, cultural and chemical techniques to control pests, and emphasizes pesticides as a last resort.
Responsible parties: local governments

A model resolution, based on Sarasota County's IPM Policy, has been developed by the Sarasota County Cooperative Extension Service.

STEP 3 Review purchasing specifications for fertilizer and pesticides to assure government use of least-toxic pesticides and slow-release fertilizers as well as cleaning products and other substances and equipment that may be used in site maintenance.
Responsible parties: local governments, in cooperation with county cooperative extension services

STEP 4 Establish annual training sessions for landscape maintenance and purchasing personnel to assure proper use of ELM concepts, BMPs and least-harmful products. Coordinate with the county cooperative extension services to determine if continuing education credits can be provided for approved training.
Responsible parties: local governments

STEP 5 Identify and develop interpretive signage for a minimum of three high-traffic sites where native plants and Florida Yard design and maintenance concepts can be promoted as an attractive alternative to turf grass and exotic plants. Also, distribute materials, such as the Florida Yards & Neighborhoods brochure and Florida YardStick, available through the Cooperative Extension Service, to promote residents' use of Florida Yards concepts and provide citizens with resources for assistance and additional information. Provide incentives, such as plant giveaways and free design consultations, whenever possible.
Responsible parties: local governments

See also Action SW-2 regarding development of model landscaping guidelines, based on Florida Yards & Neighborhoods principles, for incorporation into local government landscape codes.

SCHEDULE:

All steps can be initiated in 1996 for implementation in 1997.

SW-3

COST:

Steps 1-4 can be implemented with existing resources. Implementation of IPM and other landscaping best management practices may result in cost savings to governments. Costs to develop model landscapes (Step 5) will vary according to site size and specifications. For example, plant materials and signage for a 7,200-square-foot site could be installed for about $5,000.

EXPECTED BENEFITS:

Improvements in landscaping and landscape maintenance will reduce stormwater pollution, conserve water and enhance native habitat. The establishment of environmental landscapes at public locations will provide homeowners with an "in-ground" demonstration of these methods.

MONITORING ENVIRONMENTAL RESPONSE:

Local governments monitor water quality. They also can track the amount of consumable materials used to maintain public landscapes to quantify reductions and possible cost-savings.

REGULATORY NEEDS:

Possible revisions to Local Government Comprehensive Plans and landscape codes.

RELATED ACTIONS:

SW-1, SW-2

Reduce Impervious Paved Surfaces

SW-4

ACTION:

Reduce impervious paved surfaces in the watershed to reduce stormwater runoff and associated pollution by allowing more stormwater to filter through the soil.

BACKGROUND:

The large amount of impervious paved surfaces in the Tampa Bay watershed has greatly increased stormwater runoff and associated pollution of surface waters by preventing stormwater from naturally percolating through the soil. Paved surfaces such as roads, rooftops and parking lots increase both the amount and speed of runoff by channeling rainwater to rivers and bays.

Existing regulations both address and cause the problem. Stormwater systems are designed to move rainwater off roads as quickly as possible to prevent flooding, limiting stormwater infiltration. Additionally, many development standards require that large amounts of impervious surface be incorporated to support traffic or parking. For example, commercial developments are typically required to provide a particular number of parking spaces based on the development's total square footage or anticipated absolute maximum demand. On the other hand, water management district rules require that a certain volume of stormwater be retained on-site to provide water quality treatment. That volume is often tied to the amount of a site's new impervious surface. These apparent contradictions reflect the varied and sometimes competing objectives bay managers and engineers must seek to accommodate.

This action calls for the development of target ratios for impervious-to-pervious surface to guide local governments in efforts to minimize impervious surface, and promotes the use of alternative pervious materials wherever feasible and effective. It also encourages local governments to provide incentives to reduce impervious surface within existing developments, including abandoned or underutilized parking areas.

Parking lots present a major opportunity for alternatives to impervious surface, particularly in overflow areas. Options may include turf block (concrete blocks with holes that allow turf growth and ground water infiltration), grass and specialized pervious hard-surface materials. The cost-effectiveness of alternatives such as these has not yet been evaluated for the Tampa Bay watershed—a shortcoming this action addresses.

Communities can also reduce impervious surface by reducing the required number or size of parking spaces in large developments or malls. For example, the reduction of a standard 10' X 20' parking space to 8' X 18' results in a 17 percent reduction in surface area, or a savings of 510 square feet, for a 3,000-square-foot parking lot with a 350-square-foot drive aisle. Currently, parking space requirements are based on peak usage that may be overestimated and can be addressed with overflow parking utilizing pervious surfaces.

SW-4

STRATEGY:

This strategy calls for the development of target ratios for pervious-to-impervious surface to guide local governments in minimizing impervious surface in their communities, as well as recommendations and evaluations of management options. Local governments also are encouraged to provide incentives to developers in reducing or converting impervious surface.

STEP 1 Develop target ratios for pervious-to-impervious surface for parking lots and new development. Provide recommendations and cost-benefit evaluations in a report to the Tampa Bay NEP Management Committee in early 1997.

A. Assess existing development regulations regarding impervious surface, as well as model rules from other watersheds.

B. Evaluate pervious surface options appropriate for use in the Tampa Bay watershed. Analysis should include costs, benefits, site requirements, effectiveness (pollutant-removal capability and durability) and maintenance requirements.

C. Develop target ratios for pervious-to-impervious surface for new developments as guidelines for local governments, along with specific recommendations for reducing impervious surface through efforts such as reducing parking space requirements or requiring pervious surfaces for overflow parking.
Responsible parties: Tampa Bay National Estuary Program

STEP 2 Based on results from Step 1, revise local government and agency regulations to incorporate target ratios, encourage the use of pervious surface materials and reduce impervious surface. Options may include amendments to stormwater or local development rules and plans to:

- require fewer and/or smaller parking spaces for new developments, particularly malls and multi-family dwellings;
- set a maximum percentage for impervious material for a new site;
- require existing developments to demonstrate the need for their impervious surface, such as parking, or replace or remove excess amounts at time of redevelopment;
- encourage pervious paving materials for overflow parking and multi-level parking for new development projects;
- base stormwater utility rates on impervious surface, not simply property size.

Responsible parties: local governments, SWFWMD

STEP 3 Provide incentives for the replacement or removal of existing impervious surface in underutilized or abandoned areas as properties are redeveloped. Examples of incentives include credits toward stormwater requirements, reductions in stormwater utility fees and density bonuses.
Responsible parties: local governments, SWFWMD

SCHEDULE:

Recommendations from Step 1 are due in early 1997. Implementation of Steps 2 and 3 can be initiated in 1997, based on recommendations.

COST:

Evaluations outlined in Step 1 can be completed within existing NEP budgets. Steps 2 and 3 will require administrative and staff time of local governments and SWFWMD. Costs for incentives for the removal of impervious surface have not yet been estimated, but may be offset by reduced municipal costs in treating stormwater runoff. Costs associated with incentives to property owners to replace or remove impervious surface at the time of redevelopment have not yet been estimated, but will be based on demonstrating a clear return on investment.

EXPECTED BENEFITS:

Reductions in the amount of impervious surface in the watershed will reduce pollutants such as heavy metals, oil and grease, and nitrogen in stormwater discharged to the bay from urban areas.

MONITORING ENVIRONMENTAL RESPONSE:

Local governments monitor ambient water quality in Tampa Bay.

REGULATORY NEEDS:

Possible revisions to local development standards and stormwater regulations.

RELATED ACTIONS:

SW-5, TX-1

SW-5

Require Older Properties Being Redeveloped to Meet Current Stormwater Treatment Standards, or Provide Equivalent Value

ACTION:

Require older properties being redeveloped to meet current stormwater treatment standards, but only for that portion of the property undergoing redevelopment, plus any stormwater "co-mingling" areas*, when more than 3,000 square feet of impervious surface is added or reconstructed. Eliminate other exemptions. Where on-site stormwater treatment is not feasible, allow and require equivalent compensation through off-site mitigation, payments to stormwater "banks", or implementation of other best management practices.

BACKGROUND:

Redevelopment of existing properties is often encouraged and can be highly desirable as a means of re-energizing a community's urban core. Infrastructure and public services are already in place, and development remains concentrated where impacts have already occurred—a strategy many urban planners advocate as a means of discouraging urban sprawl and associated stormwater pollution. To encourage and improve the cost-effectiveness of this option, many local governments offer financial incentives or exemptions to developers. For instance, local governments may offer a developer an exemption from meeting regulatory criteria for stormwater treatment even if significant amounts of new impervious surface are added in redevelopment.

However, properties being redeveloped also are a logical target in efforts to reduce pollution from urban stormwater runoff, since many of these properties were developed prior to the adoption of state stormwater regulations that set criteria for on-site stormwater management. Properties developed prior to 1982 were not required to provide stormwater detention and few of these sites have any means of managing and providing water quality treatment for stormwater. Redeveloped sites also are typically utilized at a higher intensity, further contributing to overall stormwater impacts. These areas are often land-limited, concentrated in downtown business and commercial districts, and in drainage basins that continue to be significant contributors to stormwater pollution.

Local government requirements for redevelopment vary, but most offer exemptions of one form or another from current Southwest Florida Water Management District (SWFWMD) stormwater treatment standards, either for projects under a particular size or in special areas, such as historical districts and downtowns. SWFWMD currently requires that permittees meet new development stormwater treatment standards only if there is an increase in pollution or the discharge point is altered.

* areas where existing property runoff mixes with additional stormwater runoff associated with the redevelopment.

This action seeks to require that properties being redeveloped meet current stormwater standards for that portion that is redeveloped plus stormwater co-mingling areas, but also adds flexibility for alternative means to meet this requirement when on-site treatment is not feasible. It is based on an existing model ordinance for redevelopment in the City of St. Petersburg, which was adopted in 1994 and is widely considered to be fair and equitable as well as environmentally beneficial. Since its adoption, the City has granted only one exemption.

By allowing alternative on-site stormwater treatment or off-site mitigation, communities can still encourage redevelopment without sacrificing stormwater treatment and associated impacts to the bay. This action also provides an assessment of those alternative best management practices that may be allowed when traditional on-site treatment is not feasible. Options may include contributions to a regional stormwater facility located in the same drainage area (possibly through payments to a stormwater "bank"), the collection of stormwater in cisterns or underground vaults, or improvements to existing stormwater systems adjacent to the site, as well as non-structural BMPs such as street sweeping.

STRATEGY:

This strategy calls for revisions to existing rules and regulations to require that properties more than 3,000 square feet being redeveloped meet current stormwater treatment requirements for only that portion of the site that is impacted, except in cases in which on-site treatment is not feasible. In these instances, rule revisions should allow and require developers to provide equivalent value, either through contributions to a stormwater "bank," off-site mitigation, or by implementing approved best management practices.

STEP 1 Compare alternative stormwater treatments (both structural and non-structural) that may be employed in redevelopment projects in the Tampa Bay watershed. Provide cost-benefit analysis for each option that includes limitations, effectiveness for removing pollutants, and site and maintenance requirements. Recommendations shall be reviewed by the Tampa Bay NEP's Technical Advisory Committee in early 1997 and forwarded to the Management Committee for review.
Responsible parties: Tampa Bay NEP

STEP 2 Revise local government comprehensive plans and agency regulations to require that properties being redeveloped meet existing stormwater treatment standards for that portion of the site being redeveloped, plus any stormwater co-mingling areas, when more than 3,000 square feet of new and/or reconstructed impervious surface is added. When on-site treatment is not feasible, allow and require equivalent off-site mitigation or compensation. This would include:

- amendments to SWFWMD stormwater rules to allow alternative stormwater treatments as options for properties being redeveloped
- amendments to local development standards including zoning laws and comprehensive plans to require stormwater treatment for prop-

SW-5

erties being redeveloped and to remove exemptions, and to allow the use of alternative options to meet stormwater requirements that are not feasible on-site

Responsible parties: local governments and regulatory agencies, especially SWFWMD

SCHEDULE:

Step 1 can be initiated by the NEP in 1996 with available funds. Step 2 can be initiated in 1997, following adoption of the final bay comprehensive plan and regulatory approval to allow developers to meet requirements using alternative means in cases where on-site treatment is not feasible.

COST:

Step 1 has been funded by the Tampa Bay NEP. Implementation of Step 2, if approved, will require local government and staff time, as well as costs associated with stormwater treatment or alternative options called for at the time of redevelopment. In-lieu fees deposited by developers into a "stormwater bank" could help finance implementation of alternative stormwater treatment options, such as development of a regional stormwater facility or additional street sweeping. A cost-benefit evaluation of alternative treatments is being developed as part of an ongoing project referenced in Step 1.

EXPECTED BENEFITS:

Additional stormwater treatment from older properties and in the urban areas of the watershed will reduce pollution in stormwater runoff from areas that are traditionally higher contributors. Options built into this action provide flexibility in implementation without sacrificing the need for stormwater treatment or the valuable emphasis on redevelopment.

MONITORING ENVIRONMENTAL RESPONSE:

Local governments monitor ambient water quality.

REGULATORY NEEDS:

Revisions to local development criteria and SWFWMD stormwater permit rule.

RELATED ACTIONS:

SW-2, SW-4, SW-6, TX-1

Promote Compact Urban Development and Redevelopment

SW-6

ACTION:

Convene a conference of local government and regional planners, architects and neighborhood councils to evaluate and recommend actions to more effectively promote compact urban development and redevelopment to minimize urban sprawl and associated environmental impacts.

BACKGROUND:

Suburban growth in the Tampa Bay region and elsewhere has given rise to some inefficient patterns of development that can contribute to increased stormwater pollution and costly infrastructure needs by promoting low-density, single-use development at the expense of fostering compact urban development and redevelopment of previously impacted land.

Most new development today is suburban and characterized by low-density residential and commercial land uses. Single-use land patterns that separate residential development from retail and business sectors are most prevalent. Although commercial uses are usually grouped together in linear corridors flanking major roadways, there are rarely interconnections between sites, increasing the public's dependence on automobiles.

While new developments are subject to various stormwater and land-use regulations, the overall effect of this low-density, single-use development is to commit an ever-increasing per capita share of land resources within the watershed to suburban uses that increase impervious surface and ultimately result in more runoff pollution. Low-density development also results in greater distances between sites, resulting in longer and more frequent vehicle use and associated atmospheric pollution. Perhaps most important, it limits opportunities for efficient mass transit.

Costs to extend infrastructure (utilities, roads, stormwater systems) into outlying areas are extensive and ultimately borne by the community as a whole. As suburban areas expand, large tracts of urban areas are vacated, abandoned, or maintained at less than optimal density, factors which discourage reinvestment and reduce the viability of these inner cores. Existing growth management and concurrency guidelines (primarily related to transportation) often penalize existing urban areas of development for congestion, while further promoting development in outlying areas.

STRATEGY:

This strategy is to convene a conference of experts from related fields and neighborhood interests to evaluate existing growth management strategies and recommend environmentally sensitive policies and actions to more effectively promote compact urban development and redevelopment. Recommendations would focus on encouraging reinvestment and redevelopment of the urban core and the development of mixed-

SW-6

use master-planned communities that cluster uses to conserve land and resources.

STEP 1 Organize a Future of the Region conference to evaluate and recommend environmentally sensitive policies and actions to encourage redevelopment of the urban core and mixed-use, clustering concepts for new development. ***Responsible parties: Tampa Bay Regional Planning Council (to sponsor and organize conference), in partnership with metropolitan planning organizations and local governments.***

The conference should include local government planners and metropolitan planning and transportation organizations, as well as the APA (American Planning Association), AIA (America Institute of Architects) and ASLA (American Society of Landscape Architects), councils of neighborhood associations, and environmental/bay interests.

To promote and encourage reinvestment and redevelopment of the urban core, participants may evaluate ways to:

- Define neighborhood boundaries and plan major traffic corridors to reinforce these boundaries rather than divide neighborhoods. Identify and protect the character and value (i.e., positive factors influencing quality of life) of existing neighborhoods whenever feasible.
- Encourage private reinvestment in declining urban neighborhoods by promoting community appearance, public safety, public services (libraries, schools), and historic preservation.
- Develop a separate zoning category and criteria for small-scale retail and service uses within neighborhoods.
- Develop criteria to support the development of high-density residential uses within existing strip commercial corridors.
- Promote mixed-use corridors and multi-use buildings to help support the use of mass transit.
- Require new development or projects being redeveloped to evaluate potential pedestrian interconnections between commercial and residential/commercial uses. Amend land development codes to require pedestrian connections during commercial plan review.
- Amend Local Government Comprehensive Plans and land development codes to allow an increase in the floor-area ratio (allowable square-footage per acre) within targeted commercial and business corridors as a conditional incentive to encourage vertical parking garages and more efficient use of land resources.
- Provide incentives for development in targeted urban areas by expanding enterprise zones, lowering development exactions, and modifying concurrency requirements.

To encourage the development of mixed-use, master-planned developments that utilize concepts such as clustering and transfer of development rights for environmental, open-space and habitat protection, participants may evaluate whether and/or ways to:

- Amend land development codes to require that all site plans and submittals for subdivisions include a master plan for pedestrian/bicycle traffic. Support the development of Greenways as "alternative" transportation by earmarking ISTEA (Intermodal Surface Transportation Efficiency Act) funds to support these types of projects.
- Establish criteria for a balanced and mutually supportive ratio for commercial-to-residential uses.
- Ensure that comrepehensive plans encourage commercial development along established corridors to provide residential uses as part of a mixed-use development concept. Provide incentives, such as residential density credits, lower parking ratios, and impact fee credits, to encourage mixed-use projects.
- Identify long-range transit corridors and encourage higher density and intensity of development near future transit stops. Include an overlay district with criteria for development standards in comprehensive plans and development codes.

STEP 2 Implement recommendations from Step 1 through local government comprehensive plans, development codes and long-range transportation plans. ***Responsible parties: local governments, Tampa Bay Regional Planning Council***

SCHEDULE:

The conference can be planned in 1996, for implementation in early 1997.

COST:

Staff and administrative time is anticipated for implementation of these steps.

EXPECTED BENEFITS:

Redevelopment of existing areas and higher density and mixed-use development in suburban areas will conserve land and water resources, limit urban sprawl, and reduce pollution.

MONITORING ENVIRONMENTAL RESPONSE:

Local governments conduct water quality monitoring and periodic planning studies that can gauge the net benefit from implementation of these policies.

REGULATORY NEEDS:

Possible amendments to Local Government Comprehensive Plans, land development and zoning codes, and MPO plans

RELATED ACTIONS:

SW-4, SW-5

Improve Compliance With and Enforcement of Stormwater Permits

SW-7

ACTION:

Improve compliance with and enforcement of permits for the construction and operation of stormwater systems by establishing level-of-service targets, providing periodic performance assessments, and continuing efforts to coordinate permitting and enforcement staff to improve continuity in permit oversight.

BACKGROUND:

Noncompliance with permits for the construction and operation of stormwater treatment systems continues to be a major problem facing regulators, despite recent efforts to boost enforcement efforts and improve and streamline permitting oversight. Some stormwater treatment facilities are not constructed to specifications or operated and maintained properly, resulting in increased pollution in runoff to the bay.

In the Tampa Bay watershed, the Florida Department of Environmental Protection (FDEP) and the Southwest Florida Water Management District (SWFWMD) share responsibility for stormwater permitting. Implementation of the new Environmental Resource Permit (ERP), which consolidates various environmental permits into a single application, provides important opportunities to improve permit compliance monitoring and enforcement through increased coordination.

A reorganization of the District in 1994 to increase compliance monitoring and enforcement brought all enforcement and permitting staff together to improve administrative efficiency and communication. A chief engineer for enforcement now reviews major projects from the District field offices for consistency and evaluates enforcement programs.

The District also reassigned four Environmental Specialists and four Engineers, created a Director of Enforcement position, and hired three new field technicians for each of the four District offices within the last three years.

From October 1992 to December 1994, the District issued more than 1400 surface water or wetland management permits in Hillsborough, Pinellas, Manatee and Pasco counties. The District's staff has inspected an estimated 99 percent of those facilities that were constructed. However, thousands of stormwater projects permitted between 1984, when stormwater rules were established, and the early 1990s may not have been monitored due to limitations in enforcement personnel. Some older stormwater projects that were not in compliance with design and monitoring standards have been identified as applicants have sought to renew water-use permits, which the District will not issue unless stormwater systems are in compliance. But existing staff and funding levels may be inadequate to achieve adequate oversight of these older systems which may be poorly maintained or abandoned.

FDEP also has taken steps to improve coordination in these areas. For instance, FDEP's Submerged Lands and Environmental Resource Program has adopted a "cradle to grave" pilot program in which all aspects of project management are assigned, by county, to one individual. All phases of permitting, compliance monitoring and enforcement are handled by that individual. This new approach should increase efficiency since project managers will be more familiar with both the permittees and the specifics of a particular project.

STRATEGY:

A strategy to improve compliance monitoring and enforcement of stormwater permits includes the development of level-of-service targets, continued implementation and assessment of an integrated team-permitting approach, identification and monitoring of older stormwater ponds that may be out of compliance, and evaluation of existing funding and staffing levels as the basis for recommendations for improvement.

STEP 1 Establish "level-of-service" targets for compliance monitoring and enforcement of permits for stormwater construction and maintenance. Targets should include monitoring frequency by compliance monitoring personnel and maintenance frequency for permitted stormwater treatment systems. Level-of-service targets shall be established and made available for review by the Management Committee of the Tampa Bay National Estuary Program (NEP) by December 1996.
Responsible parties: FDEP, SWFWMD, local governments with delegated authority for stormwater permitting, compliance monitoring and enforcement

STEP 2 Identify and monitor older major stormwater systems to determine whether they are in compliance with permit design and maintenance criteria, and bring and enforce compliance where necessary. Monitoring candidates should be targeted based on size of service area and the treatment type (some designs may be more problematic than others).
Responsible parties: FDEP, SWFWMD, local governments

STEP 3 Continue implementation of a team approach that integrates permitting and compliance monitoring and enforcement personnel to maximize efficiency and provide "cradle-to-grave" permit oversight including maintenance monitoring.
Responsible parties: FDEP, SWFWMD, local governments

STEP 4 Evaluate needs for additional funding, staff and/or resources to meet level-of-service targets for compliance monitoring and enforcement. Provide recommendations to the Tampa Bay NEP by December 1996.
Responsible parties: FDEP, SWFWMD, with recommendations to the Tampa Bay NEP

STEP 5 Assess the effectiveness of efforts to improve compliance monitoring and enforcement in the Tampa Bay watershed, including progress toward level-of-service targets (particularly compliance rates), results of integrating personnel for team permitting management, and associated costs to agency and

SW-7

applicant. Results of evaluation should be reported in the Agency on Bay Management's (ABM) State of the Bay Report as well as the Biennial Bay Monitoring Report produced by agency and government partners in the Tampa Bay NEP.
Responsible parties: Tampa Bay NEP, ABM

SCHEDULE:

Steps 1-4 can be initiated in 1996, with timetable as indicated in steps. Evaluation identified in Step 5 can be conducted every two years, beginning in 1997.

COST:

Costs associated with existing staff time to complete Step 1 is estimated at $6,000 based on two months mid-level management time, provided through SWFWMD's existing operating funds. Steps 2-3 can also be implemented with existing staff, although costs associated with this effort estimates have not yet been developed. Costs for additional resources to assist compliance monitoring and enforcement will vary, but sources estimate the annual cost of additional field technicians at approximately $22,000 plus overhead. Support equipment (field truck and survey equipment) is estimated at $20,000 per team.

EXPECTED BENEFITS:

Increased compliance with stormwater permits will decrease pollution from stormwater runoff. An integrated team permitting approach is also expected to improve staff efficiency and cost-effectiveness in permit oversight.

MONITORING ENVIRONMENTAL RESPONSE:

Efforts to improve compliance monitoring and enforcement will be assessed periodically against targets for level of service. Ambient water quality monitoring is conducted by local governments.

REGULATORY NEEDS:

Possible revisions to agency policies.

RELATED ACTIONS:

BH-9

Enforce and Require the Timely Completion of the Consent Orders for the Cleanup of Fertilizer Facilities in the East Bay Sector

SW-8

ACTION:

Enforce and require the timely completion of conditions in the consent orders entered into by CF Industries, CSX Transportation, EAT Terminals, IMC-Agrico and Pakhoed Dry Bulk, for the cleanup of wastewater entering the East Bay sector.

BACKGROUND:

In 1990, the Florida Department of Environmental Protection (FDEP) and the Environmental Protection Commission of Hillsborough County (EPCHC) discovered that five fertilizer shipping facilities in the East Bay area were discharging high levels of nutrients into the bay. A subsequent investigation determined that stormwater was mixing with fertilizer product from these facilities and that the wastewater discharges were not meeting current water quality standards.

Following lengthy negotiations, the five facilities—CF Industries, CSX Transportation, EAT Terminals, IMC-Agrico and Pakhoed Dry Bulk—entered into joint consent orders with FDEP and EPCHC in late 1991. The consent orders included requirements for regular sampling of storm-induced discharges, assessments of wastewater flows and concentrations at the facilities, and sediment sampling at the facilities and at adjacent loading docks. Upon completion of the assessment phase, each facility was to construct or implement the best management practices (BMPs) to manage its nutrient-enriched stormwater discharges.

While all five facilities have begun complying with the terms of their consent orders, progress has varied widely. Some facilities continue to fall short of required water quality standards, and deadlines for completion of site improvements remain undetermined.

IMC-Agrico has completed construction of a detention/treatment facility and is routinely monitoring its outfall, effectively completing the terms of its consent order.

CF Industries is also in its final phase, having completed its assessment, and has applied for a permit to construct a detention facility that would contain a 25-year/24-hour storm event.

Of the five facilities, CSX Transportation is believed to discharge the largest amount of nutrients to the bay. CSX has submitted a permit application and preliminary design plans to construct a retention and treatment system capable of containing a 25-year/24-hour storm event. The adjacent EAT Terminal is still in the process of developing and implementing a treatment strategy for its facility.

Pakhoed Dry Bulk, the smallest of the facilities, is implementing BMPs to reduce the

SW-8

amount of fertilizer product entering stormwater. These improvements include outside conveyer belts, truck load-out areas, and roofing improvements at storage warehouses. Additionally, the company has submitted a permit application and design plans to retain the first inch of rainfall at the facility.

STRATEGY:

STEP 1 Enforce and require the timely completion of the consent orders.

A. Continue to require implementation of best management plans and the construction of systems to detain and treat storm-induced discharges, and develop criteria to determine "compliance."

B. Set deadlines for the final completion of the terms of the consent orders.

C. Bring facilities into full compliance so they may enter a wastewater permitting and monitoring mode.

Responsible parties: FDEP and EPCHC, in cooperation with the five facilities

SCHEDULE:

Step 1-A is ongoing. All facilities should be in full compliance within 12 months of completing construction of treatment systems.

COST:

Costs to implement best management practices at these sites vary according to design and magnitude, and are borne by the facilities under the consent order.

EXPECTED BENEFITS:

Reduced nutrient loadings to the already nutrient-enriched East Bay sector of Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

Individual facilities will monitor outfalls. Ambient bay water quality is monitored by EPCHC and other local governments.

REGULATORY NEEDS:

No further regulatory needs are anticipated.

RELATED ACTIONS:

SW-7

Encourage "Fertigation" and Micro-Irrigation on Farms

SW-9

ACTION:

Encourage farmers to install "fertigation" and micro-irrigation systems that reduce runoff from agricultural operations.

BACKGROUND:

Stormwater runoff from agricultural operations contributes significant amounts of nitrogen, pesticide residues and suspended solids to waterways. This action is aimed at reducing pollutant loadings to the bay from runoff associated with agricultural operations.

While agriculture accounts for only six percent of the bay's total nitrogen loading, studies commissioned by the Tampa Bay NEP indicate it is a major contributor in localized areas of south Hillsborough and Manatee counties. The studies indicate that 23 percent of the land in the Little Manatee River basin is intensively farmed, mainly with row crops and citrus groves. These operations contribute an estimated 23 percent of the total nitrogen load entering the bay from that watershed. In the Manatee River segment, farming operations comprise an estimated 13.5 percent of the nitrogen load.

Agricultural practices have become increasingly more sophisticated and improvements aimed at conserving water also may be adapted to reduce fertilizer use and, subsequently, farm runoff. One technique developed in recent years allows fertilizer to be applied through drip or microjet irrigation systems. This practice, called "fertigation," enables farmers to apply liquid fertilizer in smaller, more precise doses, reducing the chance of over-fertilization. Use of fertigation can benefit the farmer, as well as the bay, by lowering overall operating costs.

Although liquid fertilizer is generally more expensive than granular forms, fertigation can be more cost-effective since less is used in well-managed fertigation systems. However, to realize these costs savings, farmers must be properly instructed in the operation of fertigation systems, which are computer-controlled and require some training to master.

Farmers are not required to install fertigation systems. Nevertheless, more than 95 percent of Florida strawberry growers use drip irrigation, and most of those fertigate. A smaller percentage of vegetable growers has converted to micro-irrigation, but most who have also fertigate. The situation is reversed among citrus growers: most have converted to micro-irrigation, but a smaller percentage fertigate. However, rules developed by the Southwest Florida Water Management District (SWFWMD) offer opportunities to encourage and expand use of fertigation where practicable.

Rules adopted by SWFWMD for the Southern Water Use Caution Area require farmers to reduce water use by specific amounts over a period of years. The farmers may

utilize a variety of irrigation methods to achieve the efficiencies required. One method of reducing water consumption is through the use of micro-irrigation systems, which deliver controlled amounts of water directly to a plant's root zone. These systems also can be used to apply liquid fertilizer in the same controlled manner. If growers choose micro-irrigation systems to comply with new water use restrictions, they will have the opportunity to fertigate as well. Growers should be aware of the environmental benefits as well as the costs associated with fertigation so they can make the best choices for their irrigation systems.

The district's Agricultural Ground and Surface Water Management Plan program (AGSWM) for farmers provides another opportunity to promote the use of fertigation. This program allows farmers to implement a surface water management plan in lieu of obtaining an Environmental Resource Permit. The voluntary plans are developed by the Natural Resources Conservation Service (formerly the Soil Conservation Service) and administered by SWFWMD. The plans could be strengthened by encouraging the use of fertigation, particularly where micro-irrigation systems already exist.

Ongoing actions: Implementation of SWFWMD water conservation rules for agricultural users.

STRATEGY:

The strategy for this action focuses on more aggressive promotion of fertigation techniques, improved instruction in the use of fertigation systems, and the investigation of funding programs that could provide financial assistance to farmers who wish to install fertigation systems.

STEP 1 Include fertigation among the techniques considered Best Management Practices by the state Institute of Food and Agricultural Services (IFAS). Fertigation is currently not listed as a BMP in materials provided by IFAS through its cooperative extension services.
Responsible parties: IFAS, local cooperative extension services

STEP 2 Investigate the potential for strengthening Agricultural Ground and Surface Water Management Plans to strongly encourage fertigation systems where micro-irrigation systems already are in place. Where micro-irrigation is not already being used, encourage its use along with fertigation.
Responsible parties: SWFWMD, Natural Resources Conservation Service, local soil and water conservation districts

STEP 3 Hold workshops and provide instructional materials about the correct use of fertigation systems. Contact local suppliers of fertigation systems and urge them to provide detailed guidance and support in the use of the systems.
Responsible parties: local cooperative extension services

STEP 4 Explore possible cost-sharing programs, such as low-interest revolving loans, to provide financial assistance for the installation of micro-irrigation systems coupled with fertigation systems. For example, a fund might be

established from nitrogen trading credits and administered through the Florida Farm Bureau. Ensure that the funding assistance available is sufficient to warrant participation by growers.
Responsible parties: Natural Resources Conservation Service, U.S. Department of Agriculture, Florida Department of Agriculture & Consumer Services, Agricultural Stabilization and Conservation Service, and local soil and water conservation districts

SCHEDULE:

Steps 1 and 2 can be accomplished in 1996. Steps 3 and 4 can be initiated in 1996, with a cost-sharing program identified or established in 1997.

COST:

Steps 1, 2 and 3 involve administrative costs. Costs for Step 4 have not yet been identified. Representative costs for a fertigation system are estimated at about $700 (for mixing and nurse tank), plus installation at $1,000 an acre. This estimate includes both the cost of the micro-irrigation system and fertigation components.

EXPECTED BENEFITS:

Use of fertigation systems is expected to reduce the amount of nitrogen entering the bay in agricultural runoff. Research being conducted by the Hillsborough County Engineering Services Department in cooperation with local growers may help quantify the benefits of fertigation versus conventional fertilization practices. Farmers installing fertigation systems can monitor and report fertilization application rates using fertigation systems to compare to baseline applications without these systems in place.

MONITORING ENVIRONMENTAL RESPONSE:

Ambient water quality in surface waters receiving runoff from agricultural lands is monitored by local governments and will be reported in a biennial Bay Environmental Monitoring Report.

REGULATORY NEEDS:

Revision to SWFWMD guidelines for Agriculture Ground and Surface Water Management Plans to encourage fertigation systems where micro-irrigation already is in use.

RELATED ACTIONS:

SW-10, TX-4

Improve Compliance with Agricultural Ground and Surface Water Management Plans

SW-10

ACTION:

Improve compliance with Agricultural Ground and Surface Water Management plans to reduce nutrient and pesticide runoff to the bay.

BACKGROUND:

Florida Statutes exempt certain agricultural activities from surface water permitting requirements designed to minimize impacts to wetlands, flooding and water quality degradation. However, confusion about or misinterpretation of the exemptions has led to agricultural activities which may have adverse environmental impacts.

In an effort to boost compliance with surface water rules, the Southwest Florida Water Management District (SWFWMD) and the Natural Resources Conservation Service (NCRS), formerly the Soil Conservation Service, have developed a voluntary program that assists farmers in protecting water resources. The Agricultural Ground and Surface Water Management Program, or AGSWM, educates farmers about exemptions and helps farmers develop water management plans that often enable them to qualify for a permit exemption.

A matrix of Best Management Practices has been developed for the program, listing each BMP and its potential benefits. Using this matrix, NRCS specialists inspect an agricultural operation and evaluate which BMPs are suitable. A plan is developed and the farmer is asked to implement its recommendations, providing a faster, non-regulatory avenue for compliance with surface water rules.

Since the program's creation in 1991, surface water management plans have been developed for more than 3,000 acres of farmland in Hillsborough and Manatee counties. While these efforts are impressive, the percentage of agricultural lands managed under these plans remains small in comparison to the farmed acreage in the region. Both Hillsborough and Manatee counties, for example, had more than 112,000 acres devoted to citrus, vegetables or some other form of intensive agriculture in 1990.

Compliance also has been a lingering problem for the program. Few if any follow-up inspections are conducted to ensure that farm operators have implemented the plans. Lack of sufficient staff has been identified as a major reason for the lack of follow-up.

The AGSWM program provides a streamlined, less cumbersome approach for growers to comply with the intent of SWFWMD's wetlands and water quality protection rules. But without a reasonable effort to check on the implementation of the AGSWM plans, the effectiveness of the program cannot be determined.

STRATEGY:

The strategy for this action involves one regulatory action to monitor compliance with AGSWM plans and one voluntary action to encourage greater participation in the program.

STEP 1 When SWFWMD visits a farm in conjunction with a water use renewal permit, it can use that occasion to check compliance with the farm's AGSWM plan. The site visit made at the time of water use permit renewal provides a convenient time to verify that an existing AGSWM plan is being implemented as agreed to by the grower.

If the inspection shows that a farming operation is not in compliance with the approved AGSWM plan, SWFWMD could allow a grace period during which to comply. Failure to comply within the grace period could be grounds to nullify the permit exemption and require a formal Environmental Resource Permit.
Responsible parties: SWFWMD, NRCS

STEP 2 Recruit growers in Hillsborough and Manatee counties who have successfully implemented AGSWM plans to showcase the results of their efforts to other growers who qualify for the AGSWM program.
Responsible parties: SWFWMD, NRCS, local extension services

SCHEDULE:

Both steps could be implemented in 1996.

COST:

Both steps could be accomplished with existing resources.

EXPECTED BENEFITS:

More widespread participation in and compliance with the AGSWM program will reduce agricultural runoff and wetland impacts, improving water quality in the bay.

MONITORING ENVIRONMENTAL RESPONSE:

Ambient surface water quality and sediment monitoring will be conducted as part of the biennial Bay Environmental Monitoring Report.

REGULATORY NEEDS:

Possible amendments to SWFWMD permitting criteria to require farmers with approved surface water management plans to undergo site inspections at the time of their water use permit renewal.

RELATED ACTIONS:

SW-9, TX-4

Determine Minimum Widths for Vegetated Buffers

SW-11

ACTION:

Determine minimum widths for vegetated buffers along the bay and its tributaries by developing performance guidelines and evaluating existing requirements against these standards. Amend stormwater regulations to include these minimum widths.

BACKGROUND:

Vegetated buffers along tributaries can reduce pollutant loads of metals, solids and nutrients by more than 50 percent. Vegetation or grass within these buffer strips slows runoff, allowing solids and contaminants to settle out before reaching the bay or its tributaries. Buffers also can enhance habitat and stabilize shorelines. For these reasons, vegetated buffers along surface waters are considered a vital and highly effective component in overall stormwater management planning and pollution prevention.

But while all local governments require setbacks, setback widths vary and no studies have been conducted to determine their effectiveness in protecting water quality or enhancing habitat—a need which this action addresses. Existing local government setbacks range from 25-50 feet. This action calls for the development of "performance" guidelines for vegetated buffers and an evaluation of existing regulations against these criteria. Findings will be used to develop minimum widths for vegetated buffers based on site-specific conditions as the basis for revisions to existing standards.

STRATEGY:

This strategy involves the development of minimum widths for vegetated buffers based on performance guidelines, and calls for revisions to existing standards, where necessary, to properly protect the bay and maximize the effectiveness of these buffers.

STEP 1 Develop "performance" guidelines (e.g., percentage of total suspended solids removed or amount of water percolating through the soil) for vegetated buffers along tributaries. In developing guidelines, reviewers should consider reductions in total suspended solids (TSS) and other pollutants such as nitrogen; shoreline stabilization; and habitat enhancement value.
Responsible parties: SWFWMD-SWIM

STEP 2 Develop a technically sound means for determining minimum widths for a variable or constant buffer based on performance guidelines. Calculations should be based on site-specific conditions such as slope, adjoining land use, soil type, vegetation and land cover. Water quality monitoring at select test sites will be required to validate methods.
Responsible parties: SWFWMD-SWIM

STEP 3 Based on results of Steps 1 and 2, evaluate the adequacy of existing requirements for vegetated buffers, and revise to include minimum widths. Revisions may include amendments to stormwater rules and local development standards (zoning laws and comprehensive plans) to require minimum widths. Alternatively, allow developers to incorporate these minimum widths into their projects to meet existing stormwater quality requirements. ***Responsible parties: local governments***

SCHEDULE:

Steps 1 and 2 can be initiated in 1996, if funding is available. Step 3 can be implemented in 1997.

COST:

Estimated costs for Step 1 are $40,000. Methods testing in Step 2 is also estimated at $40,000, including a pilot monitoring program. Staff time to evaluate the adequacy of existing requirements may entail one mid-level staff person for two weeks ($2,000) with support from each local government. Legal and staff time only are anticipated in Step 3.

EXPECTED BENEFITS:

Performance guidelines will allow local governments to fully evaluate the effectiveness of this best management practice. Minimum buffer widths also will lead to improved water quality and reduced runoff, as well as improved habitat enhancement and shoreline stabilization.

MONITORING ENVIRONMENTAL RESPONSE:

Water quality is monitored by local governments. However, to test the effectiveness of performance guidelines, additional monitoring at representative sites will be necessary.

REGULATORY NEEDS:

Possible revisions to local development criteria and stormwater rules.

RELATED ACTIONS:

None anticipated.

AD

ATMOSPHERIC DEPOSITION

Research emerges as the priority need in evaluating and addressing pollution that enters the bay from the atmosphere.

As recently as 1991, researchers believed that atmospheric deposition had minimal impact on the bay's water quality. Studies now suggest that about 28 percent of the bay's total nitrogen load falls directly to the bay from the atmosphere.[1] The bay also receives significant quantities of potentially toxic contaminants from the air, including heavy metals such as cadmium, copper, lead and zinc, which are primarily industrial in origin, although vehicle emissions also are a source.[2]

In fact, experts estimate that about 44 percent of the bay's total cadmium loading of more than 7,000 pounds come from the atmosphere. Cadmium is associated with electroplating and battery production.[2] Polycyclic aromatic hydrocarbons (PAHs) associated with fossil fuel combustion also enter the bay from the air, although specific sources are unknown.

Actual pollution figures are probably much higher if contaminants falling on the watershed are considered, since some of these eventually will enter the bay in stormwater runoff. About 650 tons of nitrogen fall on the open bay each year; another 3,600 tons are estimated to fall in the watershed, a portion of which enters Tampa Bay as stormwater runoff.[1]

But while experts now know that the contribution to pollutant loadings from atmospheric deposition is substantial, little empirical evidence exists to tie pollution to sources. For example, stationary sources (primarily coal-fired power plants, but also waste incineration and industrial facilities) are estimated to be a major manmade source of local nitrogen oxides (NO_x) emissions, contributing about 66 percent as compared to about 34 percent from motor vehicles.[3] But researchers can't say how much of the emissions generated locally come back to Tampa Bay, since airborne contaminants may travel hundreds (or even thousands) of miles before settling to the earth. Wastewater treatment plants also may contribute nitrogen as gaseous ammonia generated as a byproduct. Bay managers also can't pinpoint what portion of nitrogen loadings from the atmosphere come from natural sources, such as lightning or natural releases from wetlands.

These and other important questions must be addressed in order to develop effective long-term strategies to manage sources of atmospheric deposition. Atmospheric deposition to Tampa Bay is expected to increase as population, power consumption and traffic grows, although increases may be mitigated in part by provisions in the Clean Air Act, which requires utilities and motor vehicles to reduce emissions. Future management will require coordination at the regional and national level to assure broad implementation and enforcement of pollution controls. Pollution prevention through energy conservation also must be emphasized.

Between 1995 and the year 2010, nitrogen loadings to the bay from all sources are expected to increase 10 percent, or about 27 tons per year.[4] But those figures do not include changes that may occur if power plants around the bay convert their oil- and coal-fired facilities to a less expensive Venezuelan fuel called Orimulsion. Florida Power & Light already has received conditional regulatory approval to burn Orimulsion at its Port Manatee plant, although the utility still faces administrative hearings and must receive approval from the Governor and Florida Cabinet.

Preliminary estimates show that the quantities proposed for use could add another 30 tons of nitrogen per year to the bay. An advanced pollution control technology called re-burning could lower nitrogen emissions associated with Orimulsion, but the technology is still untested in the United States and will only be tested on one of the two FP&L units converting to Orimulsion. If re-burning proves successful, and both units are converted to Orimulsion, state officials estimate that nitrogen emissions could be reduced substantially.

Tampa Bay was recently selected for participation in EPA's Great Waters Program, which provides funding to assist research of atmospheric deposition to the nation's *great waters.* The $100,000 award will help support a three-year project to investigate sources of atmospheric deposition and its contribution to stormwater pollution, information that will be used in the development of a long-term strategy to address the problem. That study begins in 1995, and will be assisted by researchers from Chesapeake Bay and local and state agencies.

SUMMARY OF ACTIONS FOR ATMOSPHERIC DEPOSITION

AD-1 Identify sources and monitor effects of atmospheric deposition to Tampa Bay, and develop an Action Plan to address atmospheric deposition.

AD-2 Promote public and business energy conservation.

[1] *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida.* TBNEP Technical Publication #04-94 and addenda. (1994)

[2] *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs.* TBNEP Technical Publication #01-95. (1995)

[3] *Literature Compilation and Data Synthesis for Atmospheric Deposition to the Tampa Bay Watershed.* TBNEP Technical Publication (Draft).

[4] *Estimating Critical Nitrogen Loads for the Tampa Bay Estuary: An Empirically Based Approach to Setting Management Targets.* TBNEP Technical Publication #03-95 and addenda. (1995)

Identify Sources and Monitor Effects of Atmospheric Deposition to Tampa Bay

AD-1

ACTION:

Identify sources and monitor effects of atmospheric deposition to Tampa Bay. Based on the results of these investigations, develop an action plan to reduce atmospheric deposition.

BACKGROUND:

Recent studies by the Tampa Bay National Estuary Program estimate that about 28 percent of the bay's total nitrogen loadings are directly deposited to the bay from the atmosphere. Atmospheric deposition also contributes significant quantities of toxic substances to the bay, including heavy metals and PCBs.[1,2]

While specific sources of atmospheric deposition to Tampa Bay have not yet been identified, studies suggest that power plants and vehicles are major contributors. Stationary sources in Hillsborough and Pinellas Counties alone produce more than 120,000 tons of nitrogen oxides or NO_x emissions per year, mostly from coal-burning power plants. Mobile or vehicle sources in those counties contribute an additional 60,000 tons of NO_x emissions per year.[3] But experts don't know what proportion of local emissions come back to Tampa Bay in the form of atmospheric deposition, since air pollutants can travel hundreds or even thousands of miles before settling to the earth.

This action calls for additional research to identify sources of emissions, their contributions to atmospheric deposition in the bay and watershed, and their effects on the bay. Tampa Bay was recently nominated by the Tampa Bay NEP and selected for participation in the EPA Great Waters Program, which provides funding and assistance in the research of atmospheric deposition. Other national waterways assisted by this program include the Great Lakes and Chesapeake Bay. Results of the Great Waters study, which begins in 1995, will be used in the development of an action plan to reduce atmospheric deposition to Tampa Bay.

A task force* of national researchers and representatives from local governments, agencies and utilities has been established to oversee the Great Waters study of Tampa Bay. A detailed study plan is being developed and will include research to identify sources, the amount and relative contribution of nutrient and toxic emissions and related deposition to the bay, as well as the contribution to stormwater pollution from atmospheric deposition to the watershed.

STRATEGY:

STEP 1 Implement the Great Waters research plan for Tampa Bay, which is expected to require three to four years for completion. The plan will investigate:

- the relative contribution to atmospheric deposition from local and remote sources;
- the importance of ammonia to the total nitrogen input budget for Tampa Bay;
- the distribution of nitrogen deposition in the watershed;
- the contribution of dryfall to local atmospheric deposition;
- the contribution to stormwater from atmospheric deposition in the watershed.

Staff from the Tampa Bay NEP and FDEP Air Quality Division will coordinate the efforts of the Great Waters Study in its inaugural year.
Responsible parties: Great Waters Task Force

STEP 2 Based on results of the Great Waters Study, design and implement additional studies, if warranted, to determine specific sources of atmospheric deposition to Tampa Bay.
Responsible parties: Great Waters Task Force, local governments

STEP 3 Based on Great Waters findings, develop an action plan that includes cost-benefit analyses of options to reduce atmospheric deposition. Options could include voluntary reductions in emissions; additional regulatory criteria for permits and other requirements associated with power plants and motor vehicles; reductions in the incineration of toxic materials through expanded mandatory or voluntary recycling and higher quality fuels; and more stringent local and state air pollution rules. A preliminary draft of this action plan will be prepared by the Tampa Bay NEP in cooperation with the Great Waters Task Force by October 1998.
Responsible parties: Tampa Bay NEP in cooperation with Great Waters Task Force

SCHEDULE:

Steps 1 and 2 will be initiated in 1995 and 1996. A draft action plan to address atmospheric deposition to Tampa Bay will be released in October 1998.

COST:

Costs for research associated with Great Waters projects (Steps 1 and 2) are estimated to range from $200,000-$500,000. Potential funding sources include the EPA Great Waters Program; EPA/FDEP 319(h) grant funds; Florida Pollution Recovery Trust Fund: SWFWMD-SWIM; Florida Department of Transportation; local government air programs; local utilities; Electric Power Research Institute; and air emission permits or permit violation fees. More than $100,000 in federal funds already has been committed.

AD-1

While action plans have not yet been developed, the following comparison illustrates the costs associated with reducing a ton of NO_x from both power plants and motor vehicles.

Estimated costs to retrofit power plant "wet bottom" or "cyclone" (Group 2) boilers (used by some local plants) to reduce NO_x range from $2,000-$4,500 per ton of NO_x reduction. Ratepayer increases would most likely finance these emission controls.

By comparison, vehicle emission controls might entail engine controls ranging anywhere from $1,000-$1,500 per car. Reformulated fuel associated with these engine upgrades could raise gas prices by an additional $.05-$.15 per gallon. All told, the price tag associated with a ton of NO_x reduction from motor vehicles is estimated at about $30,000—about 10 times higher than the cost to reduce a ton of NO_x from power plants.

EXPECTED BENEFITS:

Research will enable bay managers to allocate responsibility for cleanup and direct resources to areas of greatest need. The bay's air, water and sediment quality are all expected to benefit from actions to reduce or maintain NO_x and toxic emissions, which also will affect pollution in stormwater runoff that captures deposition to the watershed.

MONITORING ENVIRONMENTAL RESPONSE:

Atmospheric deposition monitoring will begin in 1995 and will continue throughout the duration of the three-year Great Waters project. Long-term monitoring needs have not yet been determined.

REGULATORY NEEDS:

None anticipated for Steps 1-2, however regulatory changes may be called for in the action plan developed in 1998.

RELATED ACTIONS:

AD-2

[1] *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* TBNEP Technical Publication #04-94 and addenda (1994).

[2] *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs,* TBNEP Technical Publication #01-95 (1995).

[3] *Attainment/Maintenance Plan for the Tampa Bay Florida Ozone Nonattainment Area,* Environmental Protection Commission of Hillsborough County and Pinellas County Board of County Commissioners (1994).

* The Great Waters Task Force is comprised of representatives from EPA Region IV and the Great Waters Program; the Tampa Bay National Estuary Program; local government air, water quality and transportation departments; local utilities, and the state departments of transportation and environmental protection.

Promote Business and Public Energy Conservation

AD-2

ACTION:

Promote energy conservation to businesses by increasing participation in EPA's Green Lights and Energy Stars programs. Continue to promote public energy conservation.

BACKGROUND:

An estimated 28 percent of the bay's total nitrogen loading comes from atmospheric deposition to the surface of the bay. That figure climbs as high as 66 percent when contaminants falling in the watershed are included, since a portion of these will eventually enter the bay in stormwater runoff.

Power plants are a major source of nitrogen emissions, along with motor vehicles, and energy conservation may provide a viable source-reduction strategy at the local level. Local utilities already devote considerable efforts to promote energy conservation to residents, with incentives such as rebates for energy-smart heat pumps and energy audits to pinpoint problems and identify opportunities for energy savings. These programs should be continued, and the public information literature developed for distribution with customer billings expanded to emphasize the link between energy use, air pollution and bay water quality, since residents don't automatically make the connection.

Of particular importance are businesses that are heavy energy users. Voluntary programs that help businesses reduce energy consumption are appealing because they prevent pollution, are non-regulatory and decrease overhead costs. The U.S. Environmental Protection Agency sponsors three such programs: *Green Lights,* which targets light-intensive businesses such as hospitals and shopping malls; *Energy Star Buildings,* which focuses on a holistic approach to building efficiency; and *Energy Star Office Equipment,* which addresses energy-intensive computers, copiers, monitors, fax machines and printers.

Lighting accounts for 20-25 percent of all electricity sold in the United States—and lighting for industry, stores, offices and warehouses represents 80-90 percent of total lighting electricity use, so the use of energy-efficient lighting has a direct effect on pollution prevention. Every kilowatt-hour of lighting electricity not used prevents emissions of 1.5 pounds of carbon dioxide, 5.8 grams of sulfur dioxide, and 2.5 grams of nitrogen oxides, which are of particular concern in Tampa Bay. *Energy Stars'* participants further increase bottom line business and environmental payback by addressing additional energy-demanding features within their facilities such as heating and cooling. Implementation of *Energy Star* programs may also reduce other pollutants associated with coal- or oil-fired power plants, such as mercury, a pollutant of concern within the Tampa Bay watershed.

Cox Newspapers, a *Green Lights* participant and owner of the Atlanta Journal and Constitution, estimates its annual savings at more than $55,000 since upgrading its lighting. The company reduced its total annual electricity and its lighting electricity

AD-2

usage by more than 1.2 million kilowatt hours and 63 percent per kilowatt hour respectively at a 350,000-square-foot facility. These energy savings translated into the prevention of 1.6 million pounds of CO_2, 7.6 million grams of SO_2 and 2.7 million grams of NO_x per year.

Nationally, more than 1,800 businesses participate in *Green Lights* and *Energy Stars*, including approximately a dozen partners in the Tampa Bay region. This action calls for targeting an additional 100 businesses, and expanding cross-marketing opportunities through environmental agencies and local governments. For example, local governments promoting best management practices to reduce stormwater pollution through programs such as Hillsborough County's *Operation BayWorks* should also promote business participation in *Green Lights* and *Energy Stars* to increase bottom line benefits for participants and the environment. Utilities also are encouraged to work through the Florida Yards & Neighborhoods program administered by local county cooperative extension services to promote household energy audits.

STRATEGY:

STEP 1 Develop and provide the U.S. Environmental Protection Agency with a target list of 100 light- and equipment-intensive businesses in the watershed for possible participation in the program. Also investigate exterior lighting sources to determine if energy reductions can be made without compromising public safety. Additionally, encourage local government partners in the Tampa Bay NEP, and local newspapers to participate as *Green Lights/Energy Stars* partners.
Responsible parties: Tampa Bay NEP, in cooperation with local electric utilities (Tampa Electric Company, Florida Power Corporation, Florida Power & Light) and chambers of commerce

STEP 2 Sponsor a biennial workshop with U.S. EPA in Hillsborough, Pinellas and Manatee counties, in partnership with the local utilities and chambers of commerce. Also, request that EPA evaluate administrative requirements of volunteer participants to investigate opportunities to streamline reporting requirements.
Responsible parties: Tampa Bay NEP, local utilities, EPA

STEP 3 Promote *Green Lights* and *Energy Stars* through local chambers of commerce, business associations and downtown partnerships, and seek their endorsements and commitments to promote these initiatives.
Responsible parties: Tampa Bay NEP, Agency on Bay Management, local utilities

STEP 4 Increase cross-promotion of *Green Lights* and *Energy Stars* by local governments and environmental agencies in their contacts with businesses, and incorporate *Green Lights* concepts into their programs where applicable.
Responsible parties: local government stormwater and environmental management departments

STEP 5 Encourage utilities to include information in customer billing newsletters about the link between energy usage and bay water quality and the benefits of energy conservation.
Responsible parties: Tampa Bay NEP, Agency on Bay Management

SCHEDULE:

All steps can be initiated in 1996. Target lists should be completed by December 1996, for April 1997 workshops.

COST:

Staff time is involved in all steps. Business partners can expect cost savings associated with reduced energy use as a result of implementation.

EXPECTED BENEFITS:

Energy conservation will result in reduced emissions from power plants and atmospheric deposition to the bay.

MONITORING ENVIRONMENTAL RESPONSE:

An atmospheric deposition monitoring program will provide estimates of nitrogen deposition in the Tampa Bay area.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

AD-1

WASTEWATER

WW

Reclaiming treated wastewater for commercial and residential uses represents one of the most promising opportunities for reducing nitrogen loadings to Tampa Bay and conserving precious water supplies in the future. St. Petersburg's pioneering effort in reuse in the 1970s which drastically reduced the city's direct discharges to the bay from the its four treatment plants paved the way for many of the projects now planned and underway. The City of Tampa is currently exploring ways to reclaim up to 50 million gallons of nutrient-rich wastewater it now discharges daily to Hillsborough Bay, to relieve pressure on the region's potable water supplies.

But evaluations of reclaimed water projects must consider the net effect to the bay and its tributaries when large discharges are withdrawn. For instance, declines in nutrient loadings that may pollute the bay must be weighed against the impact of redirecting a fresh water source from the bay.

Once a pervasive problem for the bay, point-source pollution has declined substantially with improved regulation and advances in treatment technologies. In fact, the retooling of Tampa's Howard F. Curren wastewater treatment plant at Hooker's Point in 1979 is widely regarded as a chief catalyst in the bay's water quality recovery. Advanced wastewater treatment technologies employed there and at other upgraded facilities can curb up to 90 percent of the nitrogen from treated wastewater discharges.

Direct or "point" discharges of wastewater to Tampa Bay from municipal sewage treatment plants and industries now contribute about 14 percent of total bay nitrogen loadings, roughly one-quarter of the amount contributed from "non-point" sources represented in stormwater runoff. These regulated point sources also contribute roughly 30 percent of the bay's total loadings of arsenic, cadmium, chromium and copper, as well as low levels of other contaminants.

Experts expect continued declines in point source pollution as the use of reclaimed water expands. Because point sources are concentrated and easily identified, they often are among the most cost-effective to treat. The strategy to address wastewater from point sources focuses on expanding the use of reclaimed water where projects are beneficial to the bay; improved treatment of industrial effluent; pollution prevention; and monitoring to improve compliance with discharge permits.

SEPTIC SYSTEMS

In some bay sectors, leachate from septic tanks, which serve about 20 percent of the region's populace, may contribute substantially to nitrogen loadings. Preliminary studies by the Southwest Florida Water Management District (SWFWMD) also suggest that a proportionate amount of nitrogen loadings to the bay may come from disposal of septage waste and sewage treatment plant sludge containing nitrogen and heavy metals.

Septic tanks located near the bay pose the greatest potential threat to water quality, particularly along creeks where flushing is limited and the water table is near the ground surface.

SUMMARY OF ACTIONS FOR WASTEWATER

WW

WW-1 Expand the use of wastewater reuse where reuse benefits the bay.

WW-2 Establish maximum limits on the amount of nitrogen discharged to the bay in industrial wastewater.

WW-3 Extend central sewer service to priority areas around the bay now served by septic systems.

WW-4 Require standardized monitoring of wastewater discharges.

WW-5 Revise HRS rules to incorporate environmental performance or design standards for septic tanks.

Expand Wastewater Reuse Where Reuse Benefits the Bay

WW-1

ACTION:

Expand and encourage the reuse of highly treated domestic and industrial wastewater where reuse produces a net benefit for Tampa Bay.

BACKGROUND:

St. Petersburg's pioneering efforts in wastewater reuse for residential irrigation in the late 1970s were at the forefront of a technological movement that would offer both substantial benefits and some important challenges to a region anxious to conserve its dwindling freshwater supplies and at the same time save the bay from an overly rich diet of nutrients discharged in wastewater.

Today, projects to reclaim wastewater for irrigation and other applications are underway in all three counties bordering the bay. Local governments now reuse roughly 40 million* gallons of treated wastewater per day, mostly for urban and agricultural irrigation, but also for industrial purposes. Projects planned or underway in local communities (see reuse table) will more than triple that amount.

The Wilson-Grizzle Bill, which called for advanced technology to limit pollutants discharged to the bay from domestic wastewater facilities, was a driving force behind these early efforts and a lifeline for a polluted bay. The legislation prompted the City of Tampa in 1979 to upgrade its wastewater treatment plant at Hooker's Point, a change that helped bring about sweeping improvements in the bay's water quality. At the same time, St. Petersburg was launching its reclaimed water project, which eliminated most of its direct wastewater discharges to the bay. The Wilson-Grizzle legislation was eventually repealed but a subsequent Grizzle-Figg bill reinstated the requirements for advanced wastewater treatment.

The potential benefits of reuse to the bay and to a water-thirsty region are substantial. Reuse has helped to reduce annual nitrogen loadings to the bay by approximately 150 million tons and will play a key role in the strategy to reduce future loadings. It is also widely recognized as a cost-effective, long-term alternative source of water for irrigation and commercial applications and potentially for potable needs. Reuse is a key element of the Southwest Florida Water Management District (SWFWMD) strategy to protect the Floridan Aquifer from saltwater intrusion in highly sensitive portions of southern Hillsborough and Manatee counties, collectively known as the Southern Water Use Caution Area. Reclaimed water also may be used to augment wellfields and freshwater inflows to the bay.

Nevertheless, projects to reclaim wastewater should be evaluated carefully to determine their net impact to the bay and to address various public health and logistical concerns. The City of Tampa is now proposing a project to reclaim as much as 50 million gallons of the treated wastewater it discharges daily to Hillsborough Bay from

* as of 1990, seeking update of figures

its Howard F. Curren facility at Hooker's Point. Discharges from this facility now represent about 7 percent of the total freshwater inflow to Hillsborough Bay during the dry months of the year.

While the bay will benefit from the reduction in nutrients to this heavily impacted harbor, a portion of this nutrient-rich load may be rerouted to the Tampa Bypass Canal, mixed with canal water, and then pumped to the Hillsborough Reservoir. Additionally, Hillsborough Bay will lose 7 percent of its fresh water inflow. A planning and environmental impact assessment for this project began in late 1995.

STRATEGY:

This strategy is to evaluate and recommend implementation of reclaimed water projects that result in a net benefit to Tampa Bay.

STEP 1 Evaluate the environmental impacts of the major reuse projects planned for the Tampa Bay region, including the net effects of reducing or eliminating the discharge (changes in salinity and pollutant loadings) and any corresponding impacts to rivers and reservoirs. Evaluations also should adequately address the project's ability to satisfy any public health concerns or perceptions stemming from the use of reclaimed water to augment potable water supplies.

The Tampa Bay National Estuary Program recommends implementation of those reuse projects that benefit the bay.
Responsible parties: local governments, SWFWMD, Florida Department of Environmental Protection (FDEP)

STEP 2 If current reuse expansion plans coupled with other efforts to reduce pollution are insufficient to meet long-term goals for nitrogen reduction in the bay, investigate additional opportunities to expand reuse by inter-connecting distribution systems or constructing larger storage facilities.
Responsible parties: local governments, SWFWMD, in cooperation with the Tampa Bay NEP

SCHEDULE:

The status of major reuse projects that are planned or underway is provided in Table 1. Evaluation of the City of Tampa project to reclaim treated wastewater currently discharged to Hillsborough Bay began in 1995.

COST:

Estimated costs and funding sources for major projects are provided in Table 1. Information was provided by wastewater reuse coordinators, utility officials and environmental planners associated with these projects.

EXPECTED BENEFITS:

Reuse projects have the potential to substantially reduce long-term nitrogen loadings

WW-1

to Tampa Bay, and also help to conserve the region's dwindling water supplies. Both the amount of water conserved through a project and the anticipated reduction in nitrogen loadings are presented in Table 1. However, major projects should be evaluated to identify any potential drawbacks for the bay or public health concerns associated with reuse.

MONITORING ENVIRONMENTAL RESPONSE:

Ambient water quality is monitored by local governments. Local government and industrial applicants for reuse permits also will be required to conduct water quality monitoring as a condition of the permit.

REGULATORY NEEDS:

FDEP regulations currently discourage the discharge of reclaimed water to natural wetlands. Since wetland rehydration is one of the potential uses for reclaimed water in the Tampa Bay region, amendments to FDEP regulations or policies may be needed to allow these uses in cases where there is a net environmental benefit for the bay. The issue of "ownership" of reclaimed water and control over how that water can be used also should be clarified.

RELATED ACTIONS:

FI-1

Table 1. Summary of major projected or funded domestic wastewater reuse projects in the Tampa Bay region

Local Government	Plant/Project	Total Reuse Vol. (mgd)	Cost ($x10^6)	Funding Source	TN reduction (tons/yr)	Project Status
Hillsborough County	NW Service Area: 1) River Oaks, NW Reg.WWTP - Service to residential and commercial uses and golf courses, and connection to Dale Mabry/ Van Dyke WWTP- 2) Dale Mabry/Van Dyke WWTP - extend service to an additional 1,550 residences	15.0	15.0 44.0	County CIP, SWFWMD RWIU*	34.5	9-phase county project to be completed by the year 2000, as part of 5-year CIP*. Distribution to individual residences is part of 20-year plan with expected completion in 2015.
	Central Service Area: 1) Connect Valrico & Faulkenburg WWTPs; extend service to golf courses and residential areas; construct storage facilities; interconnect with raw water line to Cargill plant.	16.0	10.0 15.0	County CIP, user fees, SWFWMD RWIU	36.5	WWTP connection lines and storage facilities in design phase. Construction part of 5-year CIP with expected completion in 2000.
	South Service Area: 1) South County Reg./ Summerfield WWTP - Extend service area and hook up additional homes	6.5	3.3	County CIP, user fees	14.8	Part of 20-year plan, with expected completion in 2015.
Tampa	Howard Curran WWTP - AWT effluent to Hillsborough River Reservoir or Tampa Bypass Canal, to augment potable water supply	50.0	100	User fees, SWFWMD, State, bonds	137.0	Begin design in 1996. Projected to be on-line in 2000.
Plant City	Effluent to CF Industries, agricultural users	8.0	14.0	Plant City Util. board, SWFMWD (Gov. board & Hills. River Basin Board)	18.3	Pending; expected to be on-line by 1998-1999.
Pinellas County	North Plant - extend service to 500 additional homes (if flow available)	9.0	NA	NA	20.6	Underway; expected completion by 1998-1999. This represents the county's maximum reuse capacity.
	McKay Creek & South Cross Bayou -WWTP upgrade, transmission main, infill lines	23.0	23.0 phase 1 60.0 phase 2	User fees, bonds, CIP, SWFWMD, State	52.5	
St. Petersburg	NE, SE, SW, Albert Whitted Plants - expand overall distribution network, adding 5000 additional homes	4.2	20.0	User fees, SWFWMD	11.4	Expected completion by 2005.

Table 1. Summary of major projected or funded domestic wastewater reuse projects in the Tampa Bay region (continued)

Local Government	Plant/Project	Total Reuse Vol. (mgd)	Cost ($x10^6)	Funding Source	TN reduction (tons/yr)	Project Status
Clearwater	No new reuse projects are planned					
Oldsmar	No new reuse projects are planned					
Safety Harbor	City to treat East Lake Woodlands effluent, return to golf courses	0.3	4.5	User fees, SWFWMD	0.68	Expected completion by 1997.
Largo	Increase reuse from 6 to 12 mgd	6.0	8.0	User fees, SWFWMD	13.7	Expected completion by 2000.
Manatee County	Network SW, SE, and N Plants - expand distribution to county residences and homes in west Bradenton, and east to agricultural areas (MARS*)	17.2	50.0	Federal grant, 50/50 SWFWMD	39.3	Expected completion by 1999.
Bradenton	AWT Discharge to augment Braden River flow	6.0	3.5	User fees, bonds, SWFWMD	13.7	Feasability study initiated; timetable not projected for implementation.
Palmetto	1) Distribution main to Frog Creek area (agriculture), in cooperation with Manatee Co. (MARS) 2) Distribution system to city parks, golf course, schools	1) 0.9 2) 0.3	1) 3.5 2) 1.1	User fees, CIP funds, SWFWMD funds, County funds	2.74	Will reuse 90% of their effluent by 2000.
Polk County	no new reuse projects are planned					
Lakeland	no new reuse projects are planned					

* RWIU - Reclaimed Water Improvement Unit. Similar to special taxing district, used to fund reuse water systems within county subdivisions.

CIP - Capital Improvement Plan

MARS - Manatee Agricultural Reuse System

Calculation of TN reduction is based on the difference between TN load from direct surface discharge to the bay from WWTPs and TN load associated with wastewater reuse.

Establish Maximum Limits on the Amount of Nitrogen Discharged to the Bay in Industrial Wastewater

WW-2

ACTION:

Establish maximum limits on the amount of nitrogen in industrial wastewater discharged to the bay, based on loading targets established through the Tampa Bay National Estuary Program.

BACKGROUND:

This action seeks to establish limits on the amount of nitrogen discharged to the bay from industrial point sources to assist in long-term efforts to hold the line on nitrogen loadings. Industrial point sources contribute an estimated 6 percent (255 tons) of the bay's total annual nitrogen loading and about 14 percent of its total suspended solids (TSS) loading. Municipal point sources, by comparison, respectively contribute an estimated 8 percent of the bay's nitrogen loadings and less than 1 percent of its TSS loadings. TSS loadings are a focal point of concern for bay managers because they contribute to turbidity in some bay sectors.

Existing state standards governing industrial discharges to Tampa Bay (called WQBELs) allow discharges up to the receiving water body's ability to assimilate the pollution. But these standards were set before the water quality requirements for the bay's seagrasses were established by the Tampa Bay NEP. The Program has now computed the amount of nitrogen the bay can safely assimilate without impeding the health and recovery of seagrasses. These loading estimates should be the basis for the development of maximum limits on the amount of nitrogen discharged from industrial point sources.

Maximum limits would be incorporated into permits as permits are renewed or issued. Relatively little would be required of existing point sources, unless existing discharges increased. New industrial point sources would be required to compensate in one of several ways for the amount of nitrogen discharged to the bay. For example, an applicant might choose to implement on-site treatment of wastewater or contribute to a "bank" for improvements elsewhere.

STRATEGY:

STEP 1 Allocate Total Nitrogen (TN) loadings for Tampa Bay to each of the bay's seven segments, as well as to major municipal and industrial point sources.

A series of workshops to allocate the bay's nitrogen loadings to responsible parties will be conducted by the Tampa Bay NEP in 1996.
Responsible parties: Tampa Bay NEP

STEP 2 Amend the Florida Administrative Code to link loading targets established in Step 1 to NPDES point source discharge permits to require that industri-

WW-2

al dischargers meet a particular bay segment's load allocation. Loading targets should be tailored to specific industries to account for variations in wastewater among different manufacturing processes.
Responsible parties: Florida Department of Environmental Protection (FDEP), U.S. Environmental Protection Agency (EPA)

STEP 3 Assign loading limits to existing industrial discharges as permits are renewed, and allow flexibility in how those targets are met. For example, a business may meet a net loading target by implementing various point or non-point source controls, or possibly by contributing to a "bank" for bay pollution controls implemented off site. Additionally, dischargers should be allowed to trade with other nitrogen sources.
Responsible parties: FDEP

STEP 4 Require new permit applicants to demonstrate how they will meet allocated targets for TN loads for a particular bay segment. Since targets most likely will involve holding the line on these loadings, an applicant would need to be prepared to compensate by some means for all new point source loadings.
Responsible parties: FDEP

SCHEDULE:

Step 1 will be initiated in 1995. Remaining steps can be initiated in 1996/1997, if warranted.

COST:

Staff time will be required to develop amendments to regulations. Costs to comply with TN limits would be borne by private industry. A cost-benefit analysis is underway.

EXPECTED BENEFITS:

The establishment of maximum limits for nitrogen discharged in industrial wastewater will assist bay managers in maintaining the bay's existing nitrogen loadings to support seagrass recovery.

MONITORING ENVIRONMENTAL RESPONSE:

Pollutants in industrial wastewater discharges will be monitored as a condition of permit. Ambient water and sediment quality is monitored monthly by local governments.

REGULATORY NEEDS:

Amendments to the Florida Administrative Code.

RELATED ACTIONS:

Not applicable.

Extend Central Sewer Service to Priority Areas Now Served by Septic Tanks

WW-3

ACTION:

Extend central sewer service to high density areas along the bay and its tributaries where water quality problems associated with septic tanks have been documented.

BACKGROUND:

Preliminary studies conducted for the Southwest Florida Water Management District (SWFWMD) suggest that leachate from septic tank drainfields may contribute about 5 percent of the bay's total annual nitrogen loadings and significantly more in localized areas. Malfunctioning septic systems can also contribute bacteria and viruses (pathogens) associated with fecal coliform in human waste to surface waters. Ground water carries nitrogen from septic tank drainfields to surface waters. Septic systems located closest to the bay and its tributaries pose a particular concern.

There are nearly 100,000 septic tanks in the Tampa Bay watershed. Areas that demand close scrutiny for water quality impacts from septic tanks include creeks, where flushing is limited and the water table is close to the surface of the land, and other nearshore areas of the watershed with high densities of mostly older tanks. Among these are Allen's Creek in Pinellas County, several creeks and the Ruskin inlet near the mouth of the Little Manatee River, and Tampa's McKay Bay.

Elevated levels of fecal coliform and nitrogen have been reported in many of these and other areas around the bay. But few site-specific studies have been conducted to directly link septic tanks to these impacts, which may be due to natural causes or animal waste carried in stormwater runoff. Nevertheless, the sandy soils in Southwest Florida are not highly suitable for septic tanks, and preliminary studies point to the potential for nitrogen impacts in some areas.

This action calls for further investigations at suspected problem sites to document the impact from septic tanks, along with efforts to extend central sewer service to areas where problems are identified. Nearshore areas with high densities of septic tanks (more than two per acre) should be evaluated first.

Conversion from septic to central sewer service can be costly, with hook-up fees ranging anywhere from $2,000 to $5,000 or more. This underscores the need to investigate financing options such as interest-free loans and cost-share grants or partnerships to assist residents in areas slated for central sewer service.

STRATEGY:

STEP 1 Identify areas adjacent to the bay and its tributaries where septic tanks are suspected of causing water quality impacts. Areas with septic tanks installed prior to 1983, when siting criteria was established, should be given high priority status.
Responsible parties: local governments

WW-3

STEP 2 Analyze worst-case scenarios for nitrogen loadings from septic tanks based on their proximity to the creek or surface water. Where necessary and cost-effective, install meters and wells to monitor groundwater seepage into the creeks or affected areas.
Responsible parties: local governments

STEP 3 Based on results from steps 1 and 2, extend central sewer service to coastal areas where water quality problems have been documented.
Responsible parties: local governments

STEP 4 For new developments where central sewer service is available or feasible, develop and implement a local regulation to require its utilization. Where central sewer service is not feasible, determine the most environmentally beneficial means to provide sewage treatment.
Responsible parties: local governments

SCHEDULE:

Local governments and agencies can begin implementation of Steps 1 and 2 in 1996. Implementation of Step 3 will depend on results from analyses and cost and financing factors. Step 4 can be pursued in 1997. Conversion from septic to central sewer service is already underway in some areas as part of existing capital improvement plans.

COST:

Costs to analyze water quality in suspected problem areas may cost upwards of $2,000, based on 10 samples at $200 each. Monitoring of wells and seepage meters is estimated at $125-$250 per station. Funding options for residents converting to central sewer service must be developed to make implementation affordable and feasible.

EXPECTED BENEFITS:

Efforts to convert high density coastal areas served by septic tanks to central sewer service will help to reduce nitrogen and pathogen levels in the bay and bay tributaries.

MONITORING ENVIRONMENTAL RESPONSE:

Nutrient loadings from on-site septic systems traditionally have been hard to quantify, however monitoring and modeling called for in this action will assist in this effort.

REGULATORY NEEDS:

Revisions to local government comprehensive plans and the development of implementing ordinances.

RELATED ACTIONS:

WW-4, PH-2, PH-3

Require Standardized Monitoring of Wastewater Discharges

WW-4

ACTION:

Require standardized monitoring of wastewater discharges from industrial and municipal facilities, and improve regulatory and public access to permit compliance monitoring data.

BACKGROUND:

Improvements in the monitoring and reporting standards governing industrial and municipal facilities discharging wastewater to Tampa Bay will improve the accuracy of information used to develop bay water quality models and pollution control standards—efforts that will lead to improved environmental oversight. Inadequacies in the existing system prevent effective trends analysis and limit the public's and regulatory community's ability to effectively monitor discharges.

Standardized units of measurement for wastewater concentrations and flows are necessary to calculate wastewater loadings to the bay. Municipal wastewater treatment facilities currently are required to report standardized flow measurements, but some industrial point sources are not. Furthermore, requirements to report the concentration of nutrients or other contaminants in wastewater vary considerably among facilities with permits to discharge.

Efforts also are needed to improve local government, agency and public access to data collected from these facilities. Most computerized permit compliance data is available only through the Tallahassee office of the Florida Department of Environmental Protection (FDEP), and often requires extensive time and effort for retrieval.

This action calls for the standardized reporting of a core group of parameters from all point-source facilities discharging more than 100,000 gallons per day, and improved access to monitoring data collected from these facilities.

STRATEGY:

STEP 1 Revise FDEP Rule 62.4 to require the measurement and reporting of a core group of parameters from all point-source facilities with NPDES permits discharging an average daily flow of more than 100,000 gallons of wastewater. The core group should include concentrations of total nitrogen, total phosphorus, total suspended solids, total ammonia, and average daily or monthly flow (actual discharges, not values estimated in permits). These core parameters are in addition to any permit-specific reporting that may be required. An exemption may be allowed for parameters which that facility is not reasonably expected to discharge. Revisions to existing permit criteria should be added as permits are renewed.
Responsible party: FDEP

WW-4

STEP 2 Enforce the use of standard reporting units for the core group of parameters, including flow rate. Nutrient concentrations are required as mg/l—flow as average daily flow or monthly flow (mgd or mgm).
Responsible party: FDEP (for permitting), applicable point-source facilities (for standardized monitoring and reporting)

STEP 3 Accelerate the data entry and internal quality assurance process followed by FDEP to allow access to permit compliance data within 90 days from the time a compliance report is submitted.
Responsible party: FDEP

STEP 4 Provide access to the FDEP computerized database for permit compliance at the regional level through District offices. Access to this database should be available by modem or on disk.
Responsible party: FDEP Tallahassee and District offices

SCHEDULE:

All steps can be initiated in 1996.

COST:

Staff time is anticipated in revisions to the existing FDEP Rule 62.4 and with efforts to improve and provide more timely access to the compliance monitoring database. Costs to comply with standardized sampling and monitoring criteria will be incurred by point-source facilities and are expected to be minimal.

EXPECTED BENEFITS:

Improved monitoring standards will improve the data used to develop bay water quality models that are the basis for many of the most significant management actions for the bay.

MONITORING ENVIRONMENTAL RESPONSE:

Results will be measured in improved data quality and accessibility.

REGULATORY NEEDS:

Revisions to FDEP Rule 62.4, to include measuring and reporting standards for a core group of parameters in each NPDES permit.

RELATED ACTIONS:

WW-2

Revise HRS Rules to Incorporate Environmental Performance or Design Standards for Septic Tanks

WW-5

ACTION:

Revise the rules of the Department of Health and Rehabilitative Services (HRS) governing septic tank siting and monitoring to incorporate environmental performance or design standards to protect the bay environment and further assure public health and safety.

BACKGROUND:

Preliminary studies conducted for the Southwest Florida Water Management District (SWFWMD) indicate that as much as 5 percent of the bay's total nitrogen loadings may come from the nearly 100,000 septic tanks in the Tampa Bay watershed.

The Florida Department of HRS currently oversees and approves the siting and monitoring of all on-site sewage treatment systems with a capacity of 10,000 gallons per day or less, including septic tanks and other on-site systems. Existing permitting criteria (Florida Administrative Code (FAC), Chapter 10D-6) focuses mainly on public health interests and does not include potential impacts from water pollution except those that relate to bacteria and viruses and the contamination of public drinking water supplies.

A January 1995 revision allows HRS to consider impacts to ground and surface waters from septic systems, but leaves the basic siting and design standards essentially unchanged. For example, the rule does not contain effluent quality standards pertaining to nutrients that leach from septic systems to ground water and surface water, except in the Florida Keys. Proposed maintenance schedules are included, but they are advisory only. Furthermore, septic systems constructed prior to the establishment of the current design criteria may continue to operate—even in high-density areas where their presence may aggravate local water quality problems—as long as the load to them does not change substantially.

This action is to develop environmental performance or design standards for the design and siting of septic tanks and to incorporate these guidelines into HRS regulatory guidelines. This process should begin with a determination of the allowable concentrations or loadings of nitrogen and pathogens to surface waters. Environmental performance standards could then be established to require a minimum level of nitrogen removal from a septic system. However, since these criteria may be difficult to establish and enforce, officials may opt to develop design and operating standards that would help to prevent nitrogen contamination of ground or surface waters from septic tanks. Design standards could include stricter setbacks from surface waters, minimum wet-season water table depths, soil permeability and content, and recommended maintenance intervals. At sites where performance standards cannot be met, local governments may require septic tanks with nitrogen-removal capability.

WW-5

STRATEGY:

STEP 1 Request that the U.S. Environmental Protection Agency (EPA) (Region IV) organize a regional panel of experts that includes representatives from HRS, the Florida National Estuary Programs and the Gulf of Mexico Program to develop environmental performance or design standards for septic tanks.
Responsible parties: EPA, Tampa Bay National Estuary Program, HRS

STEP 2 Revise FAC Chapter 10D-6 to incorporate environmental performance or design standards established in Step 1.
Responsible parties: HRS

STEP 3 Determine and promote the minimum schedules for septic tank maintenance based on environmental standards in cooperation with private companies that provide pump-out services. Additionally, require that septic tanks be pumped out at time of property transfer, or that the property owner provide documentation that the system has been pumped out within the previous three years.
Responsible parties: local governments

SCHEDULE:

All steps can be initiated in 1996.

COST:

Administrative costs and staff time only are anticipated in this action, but the environmental standards that are developed may require additional resources for environmental protection. HRS and legal staff time to revise the current rule is estimated at $50,000.

EXPECTED BENEFITS:

The establishment of environmental performance or design standards for septic tanks will help reduce nitrogen loadings to the bay and prevent future siting of septic tanks in areas vulnerable to water quality impacts.

MONITORING ENVIRONMENTAL RESPONSE:

Ambient water quality is monitored by local governments.

REGULATORY NEEDS:

Revisions to FAC Chapter 10D-6 to incorporate environmental performance or design standards for septic tanks.

RELATED ACTIONS:

WW-3, PH-1, PH-2

TOXIC CONTAMINATION

TX

Stormwater treatment, pollution prevention and improved access to hazardous waste disposal are key components of the strategy to reduce the amount of toxic contaminants entering the bay.

Recent studies by the National Oceanic & Atmospheric Administration (NOAA) point to contamination of bay sediments at several sites around the bay by heavy metals, pesticides and other substances that at sufficiently high concentration can be damaging or deadly to marine life.

Sediments from Hillsborough Bay, the bay's most industrialized sector and home to the Port of Tampa, generally revealed the highest levels of contaminants. Concentrations of cadmium, lead and zinc at Hillsborough Bay exceeded Florida's Probable Effects Level (PEL) for toxic contamination, guidelines that predict biological impact to marine life. Pinellas County's Boca Ciega Bay and Bayboro Harbor also ranked among the bay's hot spots of contamination.

Many toxic pollutants enter the bay attached to sediments in stormwater runoff, but atmospheric deposition (associated with industrial and vehicle emissions) and wastewater discharges also contribute significant quantities of contaminants to the bay. Pollutants tend to concentrate around ports, marinas and industrial harbors, as well as major stormwater outfalls.

Overall, toxic parameters in the bay's sediments are in the middle ranges nationally. Among 200 sites studied nationwide, samples of oysters from rural Cockroach Bay ranked third nationally in 1988 in total concentrations of the agricultural insecticide chlordane, which was banned that year. Sediments there also revealed high levels of the pesticide DDT, which was banned in the early 1970s, but persists in the marine environment.

The Tampa Bay NEP will utilize a trio of tests—evaluating sediment chemistry, toxicity, and the health and diversity of bay bottom communities—to assess overall bay bottom quality. Results from these analyses will be used to classify areas of the bay that are heavily contaminated, exceeding threshold levels for biological impact, and for which sediment capping or removal may be considered; those that are polluted but more readily restorable by reducing or maintaining existing pollutant loads; and toxic-free areas that should be protected from contamination. Management actions will vary according to sediment classifications.

In a related study, the Tampa Bay NEP is investigating the sources and status of toxic contaminants in priority water basins, information that will be used to develop a more comprehensive action plan in 1996. That investigation will help identify which pollutants pose a continuing threat to the bay and those that represent past or inactive sources of pollution.

A key initiative this year is to develop resource-based sediment quality guidelines to serve as the benchmark in evaluating the relative magnitude and risks associated with

TX

toxic contaminants in Tampa Bay. Sediment contamination may increase as the region grows. Addressing the problem now, before it escalates, is crucial to the bay's long-term health.

SUMMARY OF ACTIONS TO ADDRESS TOXIC CONTAMINATION

TX-1 Direct stormwater improvements and other resources to hot spots of contamination.

TX-2 Improve business and homeowner opportunities for hazardous waste disposal.

TX-3 Reduce toxic contaminants from ports and marinas.

TX-4 Promote integrated pest management on farms to reduce pesticides in runoff.

TX-5 Establish maximum concentration limits in discharge permits for toxic contaminants of concern to Tampa Bay.

Direct Stormwater Improvements and Other Resources to Hot Spots of Contamination

TX-1

ACTION:

Direct stormwater improvements and other resources to hot spots of sediment contamination.

BACKGROUND:

Studies by the National Oceanic & Atmospheric Administration (NOAA) have revealed relatively high levels of potentially toxic metals and contaminants in sediments from several sites in Tampa Bay. Areas of heaviest contamination include portions of Hillsborough Bay (particularly along Ybor Channel, Garrison Channel and the base of the Hillsborough and Palm rivers) and Boca Ciega Bay. Levels of several contaminants in sediment samples from these sectors exceeded Florida's Probable Effects Level (PEL) for toxic materials, indicating that some biological impact to marine life could be expected.

Several other bay sites registered below the PEL but above the No Observable Effects Level (NOEL), which serves as a threshold for the probability of biological impact. These sites include Allen's Creek and Cross Bayou (Pinellas shore/Old Tampa Bay); Bayboro Harbor, Lower Coffee Pot Bayou, the Municipal Marina (City of St. Petersburg) and Bear Creek (City of Gulfport).

A key effort in 1996 will be to develop sediment quality guidelines to determine the amount of a potentially toxic contaminant the bay can safely assimilate. This information will enable bay managers to devise appropriate strategies for cleanup or containment. The Tampa Bay NEP also is investigating the sources and status of toxic contaminants in several of the bay's most impacted drainage basins.

This action is to direct stormwater improvements and other resources to the bay's hot spots to reduce or contain sediment contamination. The Tampa Bay NEP also recommends continued monitoring and sampling to assess trends in the quality of bay sediments and the animal communities they support. Efforts to reduce pesticides in agricultural runoff are presented in a separate action promoting integrated pest management in the stormwater section of this action plan. Also see Action TX-3, which focuses on important pollution prevention measures and the development of a more detailed action plan once technical studies by the NEP are finalized in 1996.

Many toxic contaminants enter the bay attached to sediments in stormwater runoff, making stormwater treatment a key strategy in toxics reduction. BMPs to reduce total suspended solids (TSS) in runoff include retention ponds, vegetated buffer strips, swales and underdrains, as well as non-structural means such as street sweeping or stricter zoning standards to limit development density in sensitive areas. Treatment methods that address large or multi-parcel sites are preferred, since they increase the likelihood of operational success and may offer an added opportunity for habitat creation.

TX-1

In areas of long-standing sediment contamination, where the source of pollution is no longer active, this action encourages bay managers to consider other opportunities for the cleanup or containment of sediments.

STRATEGY:

Based on the identification of hot spots of sediment contamination in the bay and in accordance with sediment quality guidelines developed in early 1996:

STEP 1 Direct stormwater improvements to drainage basins where stormwater runoff is contributing to hot spots of sediment contamination.

The Tampa Bay NEP has developed a computer model to assist local governments in selecting the most cost-effective mix of best management practices to employ in a given area.
Responsible parties: local governments

STEP 2 Address contamination from sources that are no longer active or from pollutants that have been banned such as DDT; examine options for and assess the feasibility of sediment cleanup or containment.
Responsible parties: local governments, SWFWMD-SWIM department

STEP 3 Continue local government monitoring of sediment chemistry and benthic communities to track changes and trends in bay sediment quality.
Responsible parties: local governments

SCHEDULE:

All steps can be initiated in 1996, after the sources and status of contaminants are identified and sediment quality guidelines are finalized. The computer model referenced in Step 1 will be made available to local governments in 1996.

COST:

Costs to implement stormwater improvements and other controls are dependent on the BMP selected. Funding options include SWFWMD-SWIM (through District basin boards), local government stormwater utilities and operating and maintenance budgets, and permit application fees. Sediment chemistry and benthic monitoring for the bay is estimated at $150,000 per year. The best management practices "optimization" model (see Step 1) will evaluate the cost-effectiveness of various practices to address stormwater pollution.

EXPECTED BENEFITS:

Reduced toxic contamination of bay sediments and associated impacts to marine life as a result of reduced pollutant loadings and other efforts to contain or restore heavily impacted areas.

TX-1

MONITORING ENVIRONMENTAL RESPONSE:

Ongoing benthic and sediment chemistry monitoring by local governments, together with monitoring requirements for NPDES permits, will be used to assess the effectiveness of management actions to reduce toxic contaminants in the bay.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

TX-3, TX-4, SW-5

Improve Business and Homeowner Opportunities for Hazardous Waste Disposal

TX-2

ACTION:

Improve hazardous waste disposal by small businesses and residents by evaluating opportunities to better serve or educate these markets through existing programs, or develop new collection facilities in large metropolitan areas that are not served.

BACKGROUND:

Florida generates about 718,000 tons of regulated hazardous waste each year, including approximately 116,000 tons from the Tampa Bay region. Experts estimate that another 10-20 percent is generated by unregulated sources such as conditionally exempt small quantities generators* (CE-SQGs) and residents[1]. CE-SQGs are businesses that generate less than 100 kg (approx. 25 gallons) of hazardous waste per month (or 1 kg of acutely toxic hazardous waste), and whose waste disposal is not strictly regulated.

Households and CE-SQGs pose a potentially significant source of pollution. Improper handling, storage and disposal of hazardous materials can lead to air, soil, surface water and groundwater contamination, which can directly or indirectly impact the bay and public health and safety. Of key concern are hazardous materials such as paints, pesticides, batteries and other chemicals discarded with trash, and materials released (accidentally or intentionally) on the ground, in storm drains or in sanitary sewer systems. Landfills receiving hazardous waste discarded with trash are not specially equipped to deal with these materials, which may be burned or buried in pits.

These materials are often discarded with trash because access to hazardous waste collection facilities in most areas is limited, either by hours of operation or by location. Hillsborough County, for example, operates two household hazardous waste facilities, in Apollo Beach and on Sheldon Road (Town & Country), which are open one weekend per month at alternating sites. But major metropolitan areas such as the City of Tampa and Brandon are not served by household hazardous waste collection facilities, although residents may use sites in unincorporated Hillsborough County.

Options for small businesses also are limited, mainly because increasing service to these markets can be costly and complex. In Hillsborough County, CE-SQGs may transport their waste to the County's Orient Road facility on Wednesday mornings, under an arrangement with Universal Waste, which operates the facility. However, there are no real incentives for businesses to use the facility, which assesses a charge for the waste it receives. Pinellas and Manatee counties also provide household hazardous waste collection and attempt to assist small businesses in properly disposing of hazardous wastes.

This action calls for improving community and CE-SQG opportunities for proper hazardous waste disposal by aggressively exploring options to better serve and educate these markets, including establishing permanent household hazardous waste collection facilities in communities not currently served.

STRATEGY:

STEP 1 Organize a task force and meeting to evaluate methods to improve opportunities for hazardous waste disposal for small businesses and residents, such as:

- promote "milk run" services, in which haulers arrange to pick up waste from CE-SQGs on days they service municipal landfills;
- allow CE-SQGs to use household hazardous waste collection facilities;
- provide mobile collection service at central sites several times a year, perhaps in conjunction with large events that draw high attendance;
- expand existing service either by expanding weekend hours of operation, providing recycling services such as "swap shops," or siting additional permanent facilities where demand has been justified;
- encourage broader utilization of existing facilities by increasing promotion, and develop partnerships with major retail stores to promote municipal collection facilities;
- develop partnerships with manufacturers to assist in the collection and recycling of materials such as paint.

Additionally, evaluate ways to reduce consumer demand/consumption of hazardous waste materials by promoting "green" shopping through partnerships with major retailers.
Responsible parties: task force to include city and county hazardous waste/solid waste coordinators, FDEP, SQG program coordinators, user groups, Tampa Bay NEP

STEP 2 Encourage the City of Tampa and other unserved communities to evaluate establishing permanent household hazardous waste collection facilities.
Responsible parties: City of Tampa, FDEP, Tampa Bay NEP

STEP 3 Cross-market and aggressively promote pollution prevention programs such as the Florida Department of Environmental Protection's P2 Program and Hillsborough County's Operation BayWorks. The P2 program offers businesses free and confidential on-site assessments to assist them in reducing their waste stream and costs. Operation BayWorks assists target business sectors in developing pollution prevention plans by offering industry-specific best management practices and technical assistance.

- Distribute promotional flyers on the P2 Program (and Operation BayWorks in Hillsborough County) in mailings to/meetings with SQGs.
- Promote these programs through local chambers of commerce and the USF small business development center, through chamber publications and presentations. Invite chambers to serve as partners in promoting the concept of Businesses for a Cleaner Future by

TX-2

aggressively promoting these services and targeting 100 chamber members for participation/sign-up during a given time period.

Responsible parties: local governments, in cooperation with chambers of commerce, FDEP

STEP 4 Develop summary recommendations from steps 1-3 for review by the Community Advisory and Management Committees of the Tampa Bay National Estuary Program by May 1996.
Responsible parties: task force identified in Step 1

SCHEDULE:

Steps 1-3 shall be initiated in 1996, with final recommendations (Step 4) provided by May 1996.

COST:

All steps require staff and administrative time. Implementation costs will vary according to recommendations. Costs to construct and operate a permanent household hazardous waste collection facility vary depending on design and level of service. The Pinellas County facility, built within a Class 1 landfill, cost between $300,000 to $400,000 to construct. Potential funding sources include local governments and state agency grants.

EXPECTED BENEFITS:

Expanded hazardous waste disposal will help to reduce toxic contaminants that enter the bay in stormwater runoff, or through groundwater, wastewater, or atmospheric deposition.

MONITORING ENVIRONMENTAL RESPONSE:

Municipal solid waste departments track both the amount of hazardous waste they receive and statistics on usage. These can be evaluated as recommendations are implemented to measure progress. Local governments conduct bay sediment sampling to track the amount and distribution of toxic contaminants in the bay.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

TX-3

[1] 1991 figures (most recent available) from FDEP, reported by the Tampa Bay Regional Planning Council in the proposed Strategic Regional Policy Plan, 1995.

* The Florida State Legislature requires all counties to implement a Small Quantity Generator (SQG) program to notify and verify all businesses that are potential generators of hazardous waste. Counties can assess up to $50 per occupational license to fund this program.

Reduce Toxic Contaminants from Ports and Marinas

TX-3

ACTION:

Reduce toxic contaminants from ports and marinas by aggressively promoting voluntary waste stream assessments by the Florida Department of Environmental Protection (FDEP). Additionally, develop and implement an Action Plan that targets specific sources of toxicants after these sources have been identified by the Tampa Bay National Estuary Program in 1996.

BACKGROUND:

Studies by the National Oceanic & Atmospheric Administration (NOAA) reveal relatively high levels of toxicity in sediments at some sites in Tampa Bay as compared to other areas in southwest Florida and the nation. Sediment toxicity was highest overall in northern Hillsborough Bay near the Port of Tampa, especially in Ybor Channel and adjoining waterways. Other hot spots of contamination were reported in Bayboro Harbor, Boca Ciega Bay and portions of western Middle Tampa Bay.

Overall, sediments around ports, marinas and industrial harbors, and near major stormwater outfalls, exhibit relatively high levels of some toxic substances, as recent studies on Tampa Bay confirm. Shipyards and associated port and industrial facilities use and release toxic substances to the bay mainly in stormwater runoff and through direct or point discharges. Substances may include petroleum products, metals, metal treatment chemicals and anti-fouling paints, and contaminants associated with ship repair and scrap iron stockpiles.

Like ports, marinas located at the water's edge are often key point sources of contamination. Pollutants associated with marinas and boating include oil and oil-based products discharged to the bay in bilge water and during engine maintenance, boat repair and fueling; paints, lacquers, thinners, strippers and solvents; and sewage, detergents and gray water, discharged directly from boats.

This action calls for confidential waste stream assessments of the bay's ports and major marinas through the Florida Department of Environmental Protection's P2 Program, along with the development of a more comprehensive Action Plan to address toxic contaminants once sources have been identified by the Tampa Bay National Estuary Program. P2 includes free assessments and recommendations on ways to curb and properly dispose of hazardous materials.

This action also calls for evaluation of several nationally renowned best management and pollution prevention programs and publications from Puget Sound and Chesapeake Bay for marinas and boaters for possible implementation in Tampa Bay in 1996.

All states are required by recent amendments to the Coastal Zone Reauthorization Act (CZRA) of 1990 to adopt programs to control various sources of coastal non-point

pollution. Section 6217 of CZRA includes recommendations on best management practices for marinas and boaters, which will be evaluated as part of the effort to design an effective pollution prevention campaign for Tampa Bay.

TX-3

STRATEGY:

STEP 1 Work with local port authorities to promote free and confidential waste stream assessments conducted by the P2 Program to port tenants. Participants would then receive a free on-site assessment followed by a report identifying pollution prevention and cost-saving strategies.
Responsible parties: FDEP P2 Program, in cooperation with the port authorities and the Tampa Bay National Estuary Program

STEP 2 Following completion of a 1995 NEP study to identify the sources and status of toxic contamination in priority basins, develop an Action Plan that presents strategies to reduce or prevent pollution from these sources. Action Plan shall be completed for review by the Tampa Bay NEP Management Committee by May 1996.
Responsible parties: Tampa Bay National Estuary Program, target groups, local governments

STEP 3 Encourage marinas to request a free and confidential P2 environmental audit to identify pollution sources and appropriate best management practices. Target the bay's 10 largest marinas for participation and audits by December 1996.

Identify major marinas and yacht clubs in the Tampa Bay area and promote the program through direct mail, telephone follow-up and presentations to marina associations. Seek endorsements and co-promotion through these membership associations and from the Center for Marine Conservation and the Clean Water Trust program of BOAT US.
Responsible parties: FDEP P2 Program, with assistance from local Florida Sea Grant Extension Program, Tampa BayWatch

STEP 4 Review model programs from other regions that promote environmentally responsible marina and boat maintenance practices as models for implementation in the Tampa Bay region, and submit recommendations to the Tampa Bay Management Conference by May 1996. Pursue public-private partnerships to maximize promotion and cost-share opportunities.
Responsible parties: Tampa Bay National Estuary Program, Center for Marine Conservation, Tampa BayWatch, user groups

STEP 5 Promote the P2 Program to expand business and local government awareness and participation in the program.

Evaluate P2's existing marketing plan and business utilization, and make recommendations on how to more aggressively target and expand business participation. Submit recommendations to FDEP by February 1996.
Responsible parties: Tampa Bay NEP, in cooperation with FDEP and local chambers of commerce.

SCHEDULE:

Steps 1 through 5 can be initiated in 1996. Dates for completion of actions or recommendations are noted in steps.

COST:

P2 assessments are provided free to businesses that request them, and frequently result in cost savings as a result of reducing toxic materials use and properly disposing on substances. Costs to implement toxic contaminant reduction strategies developed through Step 2 will depend on actions recommended. Cost-effective educational programs can be developed by tailoring existing model programs from other regions, and by aggressively pursuing funding partnerships. Financing may be pursued from local governments, educational grants or the West Coast Inland Navigational District.

EXPECTED BENEFITS:

Waste stream assessments and implementation of best management practices at ports and marinas will reduce pollution to the bay.

MONITORING ENVIRONMENTAL RESPONSE:

Sediment quality monitoring by local governments, and waste stream reports that identify reductions, can assess progress in reducing toxic contamination.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

TX-1, TX-2

Promote Integrated Pest Management on Farms

TX-4

ACTION:

Encourage the use of Integrated Pest Management (IPM) techniques on farms to reduce pesticide residues in the bay from agricultural runoff.

BACKGROUND:

Agriculture is an important component of the bay region's economy, with an estimated value of $1.3 billion a year. About one-third of all the land in the bay watershed is used for some form of agriculture. Pasture and range lands comprise the majority of that acreage, followed by citrus groves and row crops.

Because Florida's wet, humid climate promotes the growth of weeds, molds and insects that can damage crops, use of pesticides, herbicides and fungicides is greater in Florida than in any other state. These chemicals tend to adhere to fine soil particles that may be carried in runoff to streams, lakes and bays, where they can be assimilated by aquatic animals through the food chain, impairing reproduction or growth.

A recent comprehensive study conducted by the National Oceanic and Atmospheric Administration (NOAA) assessed the levels and effects of pesticides in bay sediments. While concentrations of most substances were below levels expected to cause biological harm, the Tampa Bay NEP has identified five pesticides of special concern to Tampa Bay: chlordane, dieldrin, DDT, endosulfan and mirex. Of these, only endosulfan is still actively used by farmers in the Tampa Bay watershed, to control whiteflies and other insects on tomatoes. The remainder are banned or severely restricted.

IPM, a program utilizing biological and chemical weapons to efficiently control pests, is a proven method of reducing use of toxic chemicals and minimizing their release to the environment. IPM techniques include examination of crops to identify pest infestations; use of least toxic control materials such as soaps or oils; use of pheromones to disrupt insect reproductive cycles; and release of pest predators such as ladybugs. Many farmers employ "scouts," full-time or contract employees trained to identify and assess the severity of pest problems and recommend solutions based on IPM principles.

Because no requirements currently exist for IPM use, it is not known how many Florida farmers employ IPM practices, although local extension agents report that most farmers use at least some aspects in their pest management programs. Surveys now being conducted by the University of Florida's Institute of Food and Agricultural Sciences (IFAS) will clarify the extent of IPM usage.

Local agricultural extension agents provide educational materials and assistance to farmers who wish to learn about IPM. They incorporate IPM concepts in training seminars that farm operators attend to earn Continuing Education Credits, which can be applied toward the renewal of their pesticide applicator's license. Additionally, IFAS scientists have prepared brochures describing pesticides least likely to pollute ground

or surface water, based on soil types and leaching potential. These "grower's guides" offer a range of pesticide options for 54 different crops grown in Florida.

However, many farmers are not aware or do not take advantage of these resources. Compounding this problem is the rise in growth of "corporate farming," in which packing houses own or lease the land and contract with growers to produce the crops. One effect of this has been to shift some of the decision-making from the growers to the packing houses. Hence, packing house managers, as well as growers, may need to be targeted by IPM educational programs.

Because most farm operators obtain pesticide application licenses from the state Department of Agriculture and Consumer Services, tying IPM education to the licenses would ensure that farmers are exposed to IPM concepts. The licenses must be renewed every five years, and a farmer can meet the renewal requirements either by passing an exam or taking courses equal to eight Continuing Education Units (CEUs). Requiring that one section of the exam pertain specifically to IPM practices, or that at least one CEU credit be devoted to IPM training, would offer farmers an incentive to learn more about IPM concepts.

Endosulfan has been targeted for special attention by the Tampa Bay NEP because it alone of the five pesticides of special concern in Tampa Bay is still in use and because little is known about the quantities applied. Sold under the brand names of Thiodan and Phaser, it was until recently practically the only effective treatment for whiteflies, although its use probably has declined in the last two years because of the availability of newer compounds. However, it remains a part of many farmers' pesticide rotation schedules. In fact, nearly one-quarter of all the water quality samples collected in 1991 through 1994 from freshwater creeks and streams draining agricultural lands in Cockroach Bay contained at least one form of endosulfan, according to Hillsborough County's Environmental Protection Commission. As an unrestricted-use pesticide sold over-the-counter, endosulfan also may be purchased by homeowners.

A working group composed of experts from the agricultural and scientific sectors could help gather data on who is buying endosulfan, what it is being used for, and how much is being applied. The group also could recommend ways to reduce or restrict its usage.

STRATEGY:

STEP 1 Revise the state pesticide applicator licensing renewal criteria to incorporate in the renewal exam a specific section on IPM. For applicants who choose to earn CEU credits instead of taking the exam, at least one of the credits should encompass IPM training.
Responsible parties: Florida Department of Agriculture and Consumer Services, state pesticide coordinator

STEP 2 Seek increased federal support from the federal government to implement existing IPM educational and application programs.
Responsible parties: Tampa Bay NEP, Agency on Bay Management

STEP 3 Convene a task force to explore:

- the extent of endosulfan use in the Tampa Bay watershed
- associated environmental effects, by analyzing existing information
- specific recommendations to reduce or restrict the use of endosulfan, including less toxic alternatives

The task force should include local growers, extension agents, university researchers, manufacturers representatives, and pest scouting services, as well as EPA, FDEP, SWFWMD and the Florida Department of Agriculture and Consumer Services.
Responsible parties: Tampa Bay NEP, local extension services, area pest scouting services and representatives of chemical manufacturers

STEP 4 Implement the recommendations of the endosulfan task force (Step 3), preferably through voluntary cooperation by manufacturers and area farmers.
Responsible parties: area farmers, regulatory agencies as applicable

SCHEDULE:

Step 1 could be initiated in 1996 or at the next review of the pesticide license renewal criteria, with the development of new guidelines focusing on knowledge of IPM. Steps 2 and 3 can be initiated in 1996, with a report due from the endosulfan task force in fall 1997. Recommendations could be implemented in 1998.

COST:

The costs of revising pesticide license renewal criteria need to be determined. Steps 2, 3 and 4 can be accomplished with existing resources.

EXPECTED BENEFITS:

Reduced use of pesticides, particularly endosulfan, by area farmers will reduce the risks to birds, fish and other aquatic life in Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

Periodic measurements of pesticide concentrations in sediments will be conducted by local governments as part of the benthic monitoring program for Tampa Bay.

REGULATORY NEEDS:

Revisions to the pesticide applicator licensing renewal criteria developed by the Florida Department of Agriculture and Consumer Services.

RELATED ACTIONS:

SW-9, SW-10

Establish Maximum Concentration Limits in Discharge Permits for Toxics of Concern to Tampa Bay

TX-5

ACTION:

Establish maximum concentration or loading limits in point-source discharge permits for toxics of concern to Tampa Bay.

BACKGROUND:

A toxics characterization study conducted for the Tampa Bay NEP identified domestic and industrial point sources as significant contributors to loadings of key toxic substances of concern to Tampa Bay. For example, industrial point sources contribute more than 30 percent of the bay's total annual loadings of the heavy metals cadmium and copper, and about 27 percent of the bay's chromium loadings.

The Tampa Bay NEP is identifying point- and non-point sources of contamination in three basins draining to the bay's most heavily contaminated sectors. This investigation will help pinpoint where concentration or loading limits may be necessary. A companion study is underway to classify areas of the bay where sediments are at or above threshold levels for biological impact to marine life, areas that are restorable, and relatively toxic-free areas that should be protected from contamination.

This action is to establish maximum concentrations or loading limits in permits for point source facilities discharging toxics of concern to heavily impacted areas of the bay—where pollutants pose a threat to the bay's living resources—and to enforce compliance with these standards. The toxics of concern to Tampa Bay are the metals cadmium, chromium, lead, mercury, zinc and copper, PAHs, PCBs and several pesticides including DDT.

Existing permit limits for point-source discharges cover some contaminants of concern. This action calls for revisions to existing discharge limits where warranted. Some larger facilities are required to periodically test for many potentially toxic chemicals, but this requirement does not extend to smaller industrial facilities whose collective impact may be substantial. Compliance with these new limits may entail additional wastewater treatment or the use of alternative materials in manufacturing and processing.

STRATEGY:

STEP 1 Identify specific point sources contributing toxics of concern to the bay's hot spots of sediment contamination.

(Tampa Bay NEP is now investigating the sources and status of contaminants in basins draining to the bay's most heavily contaminated sectors. This step calls for further investigations to identify sources of toxics of

TX-5

concern in the bay's remaining impacted basins.)
Responsible parties: FDEP

STEP 2 For point sources identified in Step 1, establish maximum concentrations or loading limits needed to reduce or eliminate the continued contribution of these contaminants of concern.
Responsible parties: FDEP

STEP 3 Revise discharge permits to include these limits, and the necessary reporting and monitoring requirements to ensure compliance.
Responsible parties: FDEP, Environmental Regulation Commission

SCHEDULE:

All steps can be initiated in 1996. Efforts to identify applicable point sources should be completed by March 1996 for the first three drainage basins, and limits established by March 1997. Monitoring and reporting should commence within six months of the adoption of these limits.

COST:

Staff time only is anticipated in the establishment of loading limits for application point-source facilities and in the revisions to permit criteria. Costs to identify point sources contributing contaminants of concern to hot spots around the bay are estimated at $150,000. Point-source dischargers will be responsible for costs associated with compliance with discharge and monitoring criteria.

EXPECTED BENEFITS:

Loading limits on the toxics of concern discharged from point sources to already heavily impacted areas of the bay will reduce the pollution and the potential for biological impact to marine life in the bay, and improve the reporting standards for toxics of concern that are not now effectively traced.

MONITORING ENVIRONMENTAL RESPONSE:

Monthly monitoring reports of effluent quality by point-source dischargers will document the success of this action. Ambient water quality is monitored by local governments.

REGULATORY NEEDS:

In cases where the State standard may not be adequate, revisions to FDEP rules may be required to lower loading limits in NPDES permits.

RELATED ACTIONS:

TX-1, WW-2

PUBLIC HEALTH

PH

Despite recent strides toward bay recovery, many residents still regard the bay as too polluted to swim in, and its fish and shellfish too contaminated to eat. This lingering, and largely incorrect, perception stems from the 1960s and 1970s, when the piping of raw or partially treated sewage into the bay resulted in algal blooms that decomposed, producing noxious odors, and bacterial contamination made some segments unsafe even for swimming.

Today, state laws require sewage treatment of the highest level, and the bay is beginning to regain its status as a premier recreational resource. However, substantial emergency discharges of raw or partially treated sewage still occur when heavy rains cause stormwater to seep into some municipal sewer systems, and bacterial contamination still results in the occasional closure of bay beaches to swimming and shellfish beds to recreational harvesting. Correcting these problems would be a significant step toward maximizing recreational enjoyment of the bay and allaying public fears about its safety.

Both swimming and shellfish harvesting are restricted when heavy rains wash stormwater, with its potentially high bacteria content from animal wastes and soils, into areas where those activities are permitted and monitored. However, decisions about when to close shellfish beds or public beaches are usually based on the threat of contamination, and not on actual sampling that detects high levels of coliform bacteria.

In the case of public beaches, local health agencies around the bay use different criteria to determine when a beach should be closed. No common water quality standards exist for the bay's beaches—a shortfall that this action plan addresses.

Shellfish beds, on the other hand, are closely regulated by the state. Limitations on funding and manpower, however, as well as the lack of a substantial harvestable resource, often mean that Tampa Bay's remaining approved or conditionally approved shellfish harvesting beds are not reevaluated as thoroughly or as frequently as areas with more significant shellfish resources. Many scientists believe water quality in the bay may have improved enough in recent years to explore the potential of reclassifying and upgrading some areas—another idea addressed in this action plan.

Knowing the bay's beaches and shellfish beds are monitored routinely and comprehensively, and that decisions about closures or restrictions are based upon hard scientific evidence of contamination—not merely the potential of pollution—is critical to restoring positive public attitudes about the bay and fostering appreciation of its wide-ranging recreational opportunities.

Additionally, public health concerns can be reduced by corrective actions aimed at eliminating accidental or intentional discharges of sewage to the bay during severe storm events. Sewage overflows are of particular concern in St. Petersburg and Pinellas County, where low land elevations and rapid population growth have contributed to strain existing municipal sewer and stormwater systems. In August 1995, St. Petersburg was forced to shunt 15.6 million gallons of raw sewage into canals

PH

leading to Tampa Bay when torrential rains caused massive sewer backups in portions of the city. Pinellas County has experienced similar problems at its McKay Creek and South Cross Bayou facilities, and Hillsborough County also has occasionally been forced to discharge partially treated sewage to bay tributaries in times of excessive rainfall.

It will be important in future years for communities to correct these problems, through aggressive investigations and upgrading of their systems, to ensure that the substantial water quality gains achieved by improved treatment facilities are not offset by inadequate collection and distribution networks.

Actions Summary for Public Health

PH-1 Establish water quality standards for saltwater beaches.
PH-2 Assess opportunities to reclassify shellfish beds closed to harvesting.
PH-3 Install additional sewage pump-out facilities for recreational boaters and live-aboard vessels.

Establish Water Quality Standards for Saltwater Beaches

PH-1

ACTION:

Develop local water quality standards for beaches and encourage all counties and cities in the Tampa Bay region to use those standards for monitoring public beaches.

BACKGROUND:

Beach closures resulting from fecal coliform in the water have been a problem in some parts of the bay where swimming is permitted, such as Spa Beach in St. Petersburg and Picnic Island Park in Tampa. The closures are usually a result of poor water quality, as evidenced by the presence of fecal coliform, usually found in small areas in high concentrations after heavy rainstorms.

Sampling of area beaches is typically conducted monthly by local public health units. However, there are no uniform standards for restricting swimming and other water-contact recreation, such as windsurfing, in saline waters. Consequently, bay area communities have applied different standards to determine whether beaches should be temporarily closed, possibly analyzing different parameters and using different sampling techniques. Consistent standards would improve public health protection and maximize recreational use of the bay while helping to identify sources of water quality problems at bay beaches.

STRATEGY:

STEP 1 Review existing standards, parameters and sampling techniques used by local governments and public health units for testing of beach waters. An assessment of these standards has been completed as part of a technical study for the Tampa Bay NEP.
Responsible Parties: local government health units and environmental management departments

STEP 2 Establish uniform standards, sampling techniques and monitoring schedules for waters near public beaches. The standards should be parameters commonly monitored for public health concerns and should be formally adopted by each government in the form of a local regulation.
Responsible Parties: Florida Department of Environmental Protection (FDEP)—to organize and direct effort, local government health units and environmental management departments

SCHEDULE:

Step 1 can begin in 1996, with standards available for adoption in 1997.

COST:

Only staff time, document preparation and administrative costs are anticipated.

PH-1

EXPECTED BENEFITS:

Increased public health protection and increased knowledge about the status and problems of bay waters.

MONITORING ENVIRONMENTAL RESPONSE:

Using a uniform set of standards and sampling techniques to test beach waters will increase the effectiveness of bay monitoring programs. Sampling can be done more frequently and results can be compared to other portions of the bay, so trends in water quality can be determined and problem areas more readily identified.

REGULATORY NEEDS:

Amendments to local or state regulations will be needed to adopt a uniform standard for marine water quality monitoring.

Assess Opportunities to Reclassify Shellfish Beds Closed to Harvesting

PH-2

ACTION:

Reevaluate shellfish harvesting areas in the bay to identify pollution sources and potential for upgrading to less restrictive classifications.

BACKGROUND:

Development and overharvesting have taken a severe toll on Tampa Bay's once-thriving oyster, clam and scallop fisheries. Currently, no commercial harvest of shellfish takes place in Tampa Bay, and recreational harvests of clams—the only bay shellfish approved for consumption—are restricted by poor water quality. The declines in Tampa Bay mirror those throughout the state, where approved shellfish harvesting areas are shrinking by an average of 1 percent a year.[1]

Shellfish are extremely vulnerable to environmental changes and tend to concentrate bacteria and other pollutants in their systems, where they can be transmitted to humans. Consumption of raw contaminated shellfish is the primary cause of shellfish-related illnesses in humans. For this reason, the state closely regulates shellfish harvesting waters, using fecal coliform (a type of bacteria contained in the intestinal tracts of warm-blooded animals) as an indication of pollution. The Florida Department of Environmental Protection's (FDEP'S) Shellfish Assessment Section is responsible for monitoring and classifying shellfish beds.

Fecal coliform enters a body of water in rainfall runoff, and shellfish harvesting areas are graded according to their potential for contamination after a heavy rainfall. Land use surrounding a harvesting area is the major factor in determining the presence of coliform; thus, an area bordered by dairy farms, sewage treatment plants or septic tanks may not be considered appropriate for shellfishing. Harvesting areas are monitored by the state at least once a month to gauge water quality, and areas can be opened or closed as needed. Comprehensive surveys are conducted every five to six years.

Three classified shellfish areas remain in Tampa Bay: two are approved for conditional harvests, and one is closed. Conditionally approved areas meet water quality standards that allow harvesting some of the time. These areas are located in Boca Ciega Bay near Mullet Key and south of Port Manatee in Manatee County. The third area, Cockroach Bay, is closed because of persistent coliform contamination.[2]

With improving water quality throughout much of the bay, better control of stormwater runoff and the potential for restocking the bay scallop, some scientists believe new recreational shellfish harvesting areas could be established and existing areas upgraded to less restrictive classifications in the next decade. However, limited state resources likely mean that any effort to expand or reclassify harvesting areas will have to come from local governments. The state Department of Environmental Protection can certify local laboratories and personnel to administer such a program.

PH-2

STRATEGY:

STEP 1 Monitor restricted or closed shellfish harvesting areas to identify land-based sources of potential or actual water quality problems.
Responsible parties: local government environmental management departments, with assistance from the FDEP's Shellfish Assessment Division

STEP 2 Identify a clear process to reclassify areas as harvestable and establish local shellfish monitoring programs—certified by the state—to survey and test selected areas with the potential for reclassification.
Responsible parties: local government environmental management departments, with assistance from the FDEP's Shellfish Assessment Division

STEP 3 If economically feasible, pursue reclassification of areas with sufficient water quality to allow recreational harvests of shellfish.
Responsible parties: local governments, with support from the Agency on Bay Management

SCHEDULE:

All steps can be initiated in 1996.

COST:

Laboratory, personnel, equipment and administrative costs for a local shellfish monitoring program are estimated at $100,000 yearly for each participating government. This figure could be reduced by training existing personnel to perform some monitoring and testing duties.

EXPECTED BENEFITS:

Increased water quality protection for classified shellfish harvesting areas and increased public use of the bay for recreation.

MONITORING ENVIRONMENTAL RESPONSE:

Identifying sources of potential contamination of shellfish beds helps pinpoint remedial actions to improve those areas. Additionally, a local shellfish monitoring program could conduct more frequent surveys of shellfish harvesting areas and more closely track improvements in water quality.

REGULATORY NEEDS:

None anticipated.

1. Personal communication with David Heil, FDEP Shellfish Assessment Section
2. Ibid.

Install Additional Sewage Pump-out Facilities for Recreational Boaters and Live-aboard Vessels

PH-3

ACTION:

Assist local governments in obtaining assistance through the Florida Clean Vessel Act grant program to construct sewage pump-out facilities at publicly owned marinas bordering Tampa Bay.

BACKGROUND:

In the past, efforts to reduce sewage discharges in Tampa Bay justifiably have focused on improvements to land-based wastewater treatment plants serving one or more municipalities. But with these facilities now operating under strict pollution prevention rules, attention should be shifted to the smaller, yet continual discharges of the thousands of boaters who routinely ply the bay.

While many private marinas offer sewage pump-out facilities, currently only two public marinas in the region have pump-out stations. Only one of the two, in downtown St. Petersburg, is located directly on the bay. Providing more pump-out facilities would help reduce fecal coliform as well as nitrogen loadings and suspended solids associated with sewage while encouraging boaters to become more responsible stewards of the bay they enjoy.

Pathogens associated with human wastes can severely impact a body of water, leading to restrictions on bathing, swimming and shellfish harvesting. Although the exact effect of sewage discharges from boats on Tampa Bay is not known, studies in other waterways indicate the untreated human wastes of one boater can be equal to the treated wastes of thousands of people. More than 100,000 boats are registered in the three-county area surrounding Tampa Bay, and many more transient boaters pass through. In addition, an unknown number of live-aboards reside at bay area marinas.

Guidelines proposed by the U.S. Clean Vessel Act call for one pump-out station for every 300-600 boats. Additionally, a new state law, effective October 1994, prohibits boaters from dumping raw sewage into Florida waters and requires many boats 26 feet or longer to have a working toilet with waste storage on board when in state waters. To aid compliance, the state is offering grants for the next five years to assist marinas in adding or improving pump-out facilities. The grants, administered by the Florida Marine Patrol, will cover 75 percent of the project's cost, and can be used for public education and for planning, permitting, purchasing and installation of pump-out equipment and portable toilet dump stations. Marinas awarded funds may charge boaters up to $5 for a pump-out.

STRATEGY:

STEP 1 Identify public marinas on the bay used by a large volume of boaters, particularly within the City of Tampa. The U.S. Coast Guard or community

PH-3

boating groups may be able to assist in identifying the most frequently used marinas.
Responsible parties: City of Tampa and other municipalities, Florida Marine Patrol, Agency on Bay Management (ABM)

STEP 2 Based on results of Step 1, encourage the responsible municipality to apply for a state grant to construct a sewage pump-out station at the marina.
Responsible parties: local government environmental management departments, ABM, Tampa Bay National Estuary Program

STEP 3 Construct a sewage pump-out facility at marinas awarded grants and provide educational materials to boaters on-site explaining the importance of the facility and how to use it. Disseminate educational materials to boating clubs in the region making them aware of the facility.
Responsible parties: local governments

SCHEDULE:

Steps 1 and 2 can be initiated in 1996. Step 3's schedule is dependent upon awarding of grant, but construction could begin in 1997.

COST:

Installation and construction costs vary depending on type of equipment selected. Costs for a stationary or portable pump-out unit range from approximately $2,000-$6,000. Costs for a portable toilet waste station vary from $1,100-$1,800. With a state grant paying 75 percent of the construction costs, the project's costs to a municipality would be substantially reduced. In addition, construction and maintenance costs could be recouped by charging boaters a minimal user fee.

EXPECTED BENEFITS:

Providing sewage pump-out services for boaters will help reduce pathogens as well as nitrogen and solids in Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

Use of the pump-out stations can be tracked to determine effectiveness. Boaters at the participating facility also can be surveyed to ascertain if they are using the pump-out service and how it can be improved.

REGULATORY NEEDS:

None anticipated, with the exception of permits required for installation.

What You Can Do...

To Protect The Bay From Water Pollution:

As a homeowner:

- Create a model Florida Yard featuring native and other beneficial drought-tolerant plants that reduce the need for water, fertilizer and pesticides, and improve habitat for wildlife. Information and assistance is available from your county extension service, which administers the Florida Yards & Neighborhoods Program, and from local chapters of the Florida Native Plant Society.
- Install low-flow irrigation and plumbing devices to conserve water.
- Support community and regional efforts to recycle treated wastewater. If reclaimed water is available in your neighborhood, use it sparingly to reduce the potential of polluting the bay with runoff.
- If you have a septic tank, make sure it is cleaned and inspected regularly.
- Dispose of used motor oil and household chemicals properly by taking them to an approved recycling center and participating in state and county recycling days. Don't dump oil, paint, cleaning fluids or pesticides in storm drains; report such violations to your county stormwater department.
- Support stormwater utility fees to ensure improved stormwater treatment in your community.

As a developer:

- Incorporate native plants and environmentally beneficial landscaping concepts in your development. Contact the Tampa Audubon Society or the Florida Association of Environmental Professionals for a presentation on commercial eco-scaping and how it can enhance your bottom line.
- Work with local governments to develop fair incentives for reducing paved surfaces in new and existing developments and for incorporating landscape designs that enhance the environment.
- Cluster buildings and paved areas to the extent allowed by regulations to increase open space and wildlife corridors.

As a business owner:

- Practice environmentally friendly landscaping at your business and install low-volume irrigation and plumbing fixtures to save water and money.
- To reduce the use of hazardous materials that may contaminate ground water or surface water runoff, contact the Florida Department of

Environmental Protection and ask about the P2 Program, which provides free and confidential on-site waste-stream audits that can save your business money and prevent pollution to the bay.

- To learn more about best management practices to reduce stormwater pollution from your property, contact your local stormwater department. In Hillsborough County, ask for information on Operation BayWorks—Businesses for a Cleaner Future.
- Adopt a section of shoreline through the Adopt-A-Shore program and encourage employees to participate in coastal cleanup days.

As a neighborhood, civic group member or educator:

- Adopt a shoreline or roadside for cleanup by your group.
- Stencil storm drains with "no dumping" messages to increase awareness of stormwater pollution among residents and visitors.
- Request a presentation about stormwater management plans in your community from your county's stormwater department.

As a farmer or golf-course operator:

- Implement best management practices to reduce water use and runoff of fertilizer and pesticides. Contact the county extension service, soil conservation service or the Southwest Florida Water Management District for assistance.

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Bay Habitats

BH

Tampa Bay's rich mosaic of underwater and coastal habitats support hundreds of species of fish and wildlife, from the familiar brown pelican to the bottom-hugging sea squirt. Since the 1950s, almost half of the bay's original saltwater wetlands have been lost to dredging and filling for shoreline and port development. Bay seagrasses declined by nearly 40 percent in this same period, although they are waging a comeback in some areas thanks to recent improvements in water quality.

Neighboring upland habitats of pine forest, oak hammock and shrub also have been heavily impacted by development. Almost all coastal pine forests have been eliminated from the shores of Tampa Bay. These buffer zones and associated freshwater wetlands provide critical habitat for numerous animals, including the wood stork, white ibis, bald eagle and fox squirrel.

Highly productive up-river, low-salinity habitats that provide life-support to many of the bay's juvenile fisheries also have sustained damage from invasive exotic plants and diversions of freshwater for drinking and irrigation.

The restoration and protection of these diverse habitats is crucial to the bay's health. Studies now being finalized suggest that as many as 12,000 acres of seagrass can be recovered along the bay's shallow shelf by maintaining existing water quality conditions.

Strategies to repair and preserve the bay's coastal habitats will be directed by a habitat restoration and land acquisition master plan, produced by the Tampa Bay National Estuary Program in 1995 in cooperation with area agencies and governments. The plan includes a preliminary list of priority projects, and seeks to restore a productive balance and diversity of coastal and associated upland habitats. Targets include the restoration of at least 100 acres of low-salinity tidal stream habitat every five years—or as much as 1,800 acres over time—while maintaining or enhancing mangroves and salt marshes at existing levels.

Land acquisition and habitat protection, through conservation easements and other special arrangements with property owners, also are vitally important components of the habitat master plan for Tampa Bay. A key priority will be the purchase of nearly 1,500 acres of bayfront property at Terra Ceia Isles in Manatee County. Acquisition of this important tract would bring more than 6 percent of the bay's total mangrove acreage, and several hundred acres of vital low-salinity, freshwater and upland habitat, into public ownership, and substantially boost restoration opportunities.

Finger-fill residential canals constructed in the 1950s and 1960s require special focus because of degraded water quality, habitat loss and siltation. A key effort will be to

provide incentives and opportunities for homeowners to enhance canal habitats and soften shorelines.

BH

MANAGEMENT OBJECTIVES

- Increase and preserve the quantity, quality and diversity of seagrass communities, recovering as many as 14,000 acres over time.
- Restore and preserve an optimum balance of wetland and associated upland habitats to support bay wildlife, specifically:
  - restore at least 100 acres of low-salinity tidal marsh every five years
  - protect existing levels of mangroves and salt marshes
- Protect hard bottom, oyster reef, and soft bottom communities.

SUMMARY OF ACTIONS FOR BAY HABITATS

BH-1 Implement the Tampa Bay master plan for habitat restoration and protection.

BH-2 Establish and implement mitigation criteria for Tampa Bay, and direct mitigation to high priority projects.

BH-3 Reduce propeller scarring of seagrass.

BH-4 Evaluate whether to establish a special management area for the protection of coastal habitats in Tampa Bay.

BH-5 Restrict impacts to hard-bottom communities.

BH-6 Restrict off-road vehicle access along causeways and coastal areas.

BH-7 Require mandatory education for recreational boaters.

BH-8 Encourage waterfront residents to enhance shorelines and limit runoff from yards.

BH-9 Improve compliance with and enforcement of wetland permits.

BH-10 Expand habitat mapping and monitoring programs.

Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

BH-1

ACTION:

Implement the Tampa Bay master plan for habitat restoration and protection, developed by the Tampa Bay National Estuary Program (NEP) in 1995 in cooperation with local, regional and state agencies and interests.

BACKGROUND:

The Tampa Bay NEP will finalize a master plan for habitat restoration and protection in early 1996 to coordinate and strategically focus the many existing state, regional and local programs now engaged in these efforts.

The plan, designed in cooperation with these programs, recognizes that some habitats have declined faster than others and seeks to "restore the balance" to more environmentally beneficial proportions. It emphasizes the restoration of tidal stream habitats in tributaries to Tampa Bay, low-salinity areas that are vital to juvenile fisheries. Overall, the plan establishes a minimum restoration goal of 100 acres of low-salinity tidal marsh every five years—or as many as 1,800 acres over time—while preserving mangroves and salt marshes at existing levels.

The plan also identifies a preliminary list of priority projects for restoration and protection, through outright purchase or special arrangements such as conservation easements on private property.

This new strategic focus has important implications in Tampa Bay and elsewhere. Traditionally, habitat restoration and land acquisition have been largely opportunistic endeavors: Agencies and communities have sought to purchase and restore habitat based on what was available or, in some cases, most visibly connected to the bay. This approach toward highly visible projects helped to build community awareness of the environmental plight and needs of the bay at a time when this was critically needed. It also demonstrated to skeptics that habitat restoration was possible.

In recent years, agencies and local governments have increasingly focused on restoring a mosaic of habitat types within a given project to maximize the benefits to fish and wildlife. The emerging habitat master plan for Tampa Bay takes this concept a step further by pursuing and selecting sites based on their potential to support the critical needs of certain species.

The draft plan identifies a series of wildlife "guilds" or groups of animals that have common habitat and feeding needs. By tuning restoration and protection efforts to meet these needs, efforts and resources can be more effectively utilized.

The white ibis provides a textbook example of how this new planning approach might protect an impacted species. Populations of the white ibis have declined dramatically

BH-1

in the last half-century, resulting in its listing by the Florida Game & Freshwater Fish Commission (FGFWFC) as a species of special concern. Adult ibis nest along the bay, but require inland freshwater sources of food for their young. These shallow freshwater wetlands or "frog" ponds, as they are sometimes known, have been hit hard by inland development—forcing ibis to travel farther and farther to find food for their young. A habitat restoration strategy devised with the ibis in mind might seek to restore small freshwater ponds on properties that are closer to the birds' nesting areas to compensate for the loss of these food sources in the watershed.

Another habitat strategy might direct bay managers to eradicate Brazilian pepper from various small but highly valuable low-salinity portions of creeks and streams that serve as juvenile nurseries for many species of fish. Such results-oriented strategies bode well for communities seeking to maximize their return on bay improvement expenditures.

A draft of the plan is available from the Tampa Bay NEP. Provisions to direct public and private mitigation credits to these priority projects also are a part of the plan (See Action BH-2).

Ongoing efforts:

Pinellas, Hillsborough and Manatee counties all have administrative programs for the public purchase of environmentally sensitive lands. Pinellas and Hillsborough counties' programs are funded by local taxes that complement state-funded public land acquisition programs such as Preservation 2000, Save-Our-Rivers, and Conservation and Recreational Lands (CARL). Manatee County's program is for the purchase of land in the Lake Manatee Reservoir and is financed by the County's Water Utilities Enterprise Fund. Private land acquisition programs such as the Nature Conservancy also contribute to the preservation of upland and wetland habitats.

State environmental agencies such as the Southwest Florida Water Management District (SWFWMD) and its Surface Water Improvement & Management (SWIM) Program, the Florida Department of Environmental Protection (FDEP) and the Florida Marine Research Institute (FMRI), are the principal players in habitat restoration and enhancement. Local municipalities and other agencies such as the Florida Department of Transportation (FDOT), and local port authorities and utilities also engage in large-scale habitat mitigation and restoration. Like habitat protection efforts, these programs have been only minimally coordinated and are driven largely by opportunity and permitting considerations.

STRATEGY:

This action presents steps to implement the Tampa Bay master plan for habitat restoration and protection, including elements to assure and more effectively direct key funding sources.

STEP 1 Convene implementing groups by April 1996 to develop a written strategy to implement the master plan according to its established priorities.
Responsible parties: Tampa Bay NEP (to organize workshop), SWFWMD, FDEP, FMRI, FGFWFC, local governments

Reconvene work group of implementing agencies, local governments and organizations every two years, beginning in 1998, to assess progress toward goals and reevaluate priorities.
Responsible parties: Tampa Bay NEP

STEP 2 Direct credits from public and private mitigation projects to priority projects identified in the plan. (See Action BH-2 on mitigation banking)

STEP 3 Ensure that the list of priority projects for habitat restoration and protection is incorporated into local government and agency permit reviews and conditions.
Responsible parties: local governments, FDEP, SWFWMD

STEP 4 To assist in and more effectively direct funding to implement the habitat restoration master plan:

Pursue a permanent source of funding for the SWIM Program;

Amend provisions of the State Pollution Recovery Trust Fund to require that monies from fines collected in the Tampa Bay region be spent in this region and within a specific period of time (e.g., five years)

Secure a permanent source of funding for Preservation 2000, the state environmental lands acquisition program.

Amend provisions of the Hillsborough County Pollution Recovery Trust Fund to require that monies collected from fines be spent within a reasonable period of time.

[Note: These financing elements are part of the Tampa Bay NEP's 1996 state legislative agenda.]

SCHEDULE:

Implementation to begin in 1996. Timetables for various priority projects will be listed in the habitat master plan.

COST:

Costs associated with implementation of the plan will be finalized in early 1996. However, existing SWIM habitat restoration projects may provide some basis for comparison. The current SWIM plan for Tampa Bay includes proposed projects for FY 91-92 through FY 93-94, a total of 16 major and 15-21 smaller projects for a total budget of $4.5 million or about $1.5 million annually. SWFWMD cost analyses indicate that the cost for the creation/restoration of intertidal wetlands (including design,

BH-1

permitting, plans, construction and monitoring) range from $30,000 (managed in-house) to $50,000 (contracted to private firm) per acre.

EXPECTED BENEFITS:

Implementation of this strategic watershed plan for habitat restoration and preservation will improve the quality, diversity and quantity of critical coastal habitats that support bay wildlife.

MONITORING ENVIRONMENTAL RESPONSE:

Progress in implementing the habitat restoration and land acquisition master plan—and in meeting specific targets for habitat recovery—will be monitored by local governments and agencies and reported in the Biennial Bay Monitoring Report.

REGULATORY NEEDS:

Revisions to trust fund provisions and other regulatory changes to ensure and more equitably direct long-term funding for habitat restoration and acquisition.

RELATED ACTIONS:

BH-2

Establish and Implement Mitigation Criteria for Tampa Bay

BH-2

ACTION:

Establish criteria for mitigation of impacts to tidal habitats in the Tampa Bay watershed, and develop a regional mitigation banking plan that implements those criteria.

BACKGROUND:

Mitigation—the process by which applicants whose projects include impacts to wetlands create new ones in their place or restore or enhance existing wetlands—in Florida is required of both private developers and public agencies to compensate for loss of natural habitats. Typically, these manmade wetlands are established on the same site as the project, in an area not slated for development.

But keeping track of these projects—and how closely they mimic natural wetlands—has proven difficult with the government's limited resources. Studies by the Florida Department of Natural Resources Aquatic Preserves Division and Marine Research Institute in 1988 reported a failure rate of more than 80 percent for mitigation projects in Southwest Florida and Tampa Bay. A follow-up study by the Florida Department of Environmental Protection (FDEP) showed that one-third of applicants issued permits by the agency had never even attempted the required mitigation. Of those that had, only 13 of 62 mitigation projects were deemed "ecologically successful," meaning they generally provided the same functions as natural wetlands destroyed by the project.

In addition to problems with enforcing mitigation requirements, some bay managers believe the mitigation criteria used by the state is insufficient to protect some particularly valuable bay habitats.

Problems with the current mitigation program, and pressures from private interests who view it as too cumbersome, have led to a new concept called "mitigation banking." It allows developers to compensate for wetland losses in one place by preserving, restoring or creating wetlands in another to achieve a no-net loss of wetlands.

A new FDEP rule allows mitigation banking in some instances, although it remains a controversial issue. Proponents say mitigation banking can consolidate manmade marshes into central areas, increasing the odds for success and making the permits easier to monitor and enforce. Proponents also say it will result in larger wetland areas that are more useful for birds and other wildlife than, for instance, a tiny wetland in the middle of a shopping center or along a busy road. Critics say mitigation banking will make it easier to destroy wetlands. If an applicant can simply pay to restore marshes somewhere else, they fear there will be little incentive to preserve wetlands on site.

Many concerns about mitigation banking stem from provisions (or lack of provisions) in the new state rule.

BH-2

Under the rule, mitigation banks are optional and can be either publicly or privately owned or operated. The state encourages a free-market approach, so does not specify how much a developer can be charged for mitigation credits. Generally, the price of credits covers the cost of the restoration and monitoring for several years, in addition to providing a margin of profit for the private restoration company. Banks are jointly administered by the FDEP and the state's water management districts.

The state rule also allows private companies to purchase lands for mitigation banks, or developers themselves to purchase and operate mitigation banks. Additionally, the new rule permits developers to transfer their mitigation to publicly owned lands if the landowner agrees, as is the case with a bank on state-owned property at Little Pine Island in Lee County.

Whether mitigation banks should be permitted on publicly owned lands is a key area of disagreement among bay managers. Some believe mitigation should only be allowed on private lands, with those lands subsequently turned over to a public agency for management. Others say mitigation banking offers a chance to restore damaged public lands much faster than limited government funds currently permit.

The shortcomings of the current mitigation program and the lack of a significant track record with wetland mitigation banking will continue to make the issue of how and where banks should be used complex and controversial.

The Tampa Bay National Estuary Program (NEP) supports the creation of mitigation criteria designed specifically for the Tampa Bay region, including the development of a regional mitigation banking plan tailored to the needs of the bay ecosystem.

A regional mitigation banking plan would accomplish several goals. First, it would ensure appropriate siting of banks in areas where they are most likely to succeed and where other valuable habitats, such as mature pine forests, are not sacrificed for wetlands. A regional plan also would prevent a profusion of widely scattered banks that are difficult to monitor, and would give local governments guidance in drafting future land use plans.

This action also directs mitigation to priority projects for habitat restoration and enhancement identified in the Tampa Bay NEP's habitat master plan (see Action BH-1).

STRATEGY:

STEP 1 Identify areas where mitigation banks should be used in the Tampa Bay watershed, and develop criteria for management and operation of those banks.

Convene a workgroup of the Natural Resources Committee of the Agency on Bay Management (ABM) by April 1996 to evaluate and develop recommendations. Recommendations shall be forwarded to the Tampa Bay NEP by September 1996. Consult existing banking criteria guidance developed by the federal Environmental Protection Agency (EPA), Army Corps of Engineers (ACOE), Florida Game & Freshwater Fish Commission

(FGFWFC), Fish & Wildlife Service (FWS), National Marine Fisheries Service (NMFS) and the Southwest Florida Water Management District (SWFWMD) for reference. Private industry and other non- governmental and environmental groups should be urged to participate.

Permitting agencies should continue to emphasize avoidance of wetland impacts in lieu of on- or off-site mitigation. Where wetlands impact cannot be avoided, on-site mitigation should be encouraged. If on-site compensation is not feasible or likely to be effective, mitigation banking should be considered.

The workgroup should consider:

- evaluating whether mitigation conducted by local governments and private developers should count toward overall habitat restoration goals for Tampa Bay
- establishing specific criteria to decide when on- or off-site mitigation is most appropriate
- ownership, management and associated cost issues, including whether mitigation banks operated on private lands purchased by the developer or private bank operator should be deeded to a public agency
- limitations on the total number of mitigation banks, and the number that one private operator can manage, and provisions to make banks large enough to increase ecological values and prevent a glut of banks with no "customers"
- siting considerations, to ensure that wetland values lost in one area are replaced in the same general area, thus preventing an overall decline in water quality or habitat within one watershed (for example, positioning banks adjacent to existing wetlands could make replicating the types of wetlands lost easier, increase its probability of success, and boost its value to wildlife)
- provisions to ensure the bank mimics as closely as possible the values, appearance and function of the original habitat. Where this is not practical, mitigation credits should be granted at a higher ratio, as in the case of red mangroves, salt barrens or other critical habitats within Tampa Bay
- bank monitoring, enforcement and penalties for noncompliance with banking criteria
- whether the state should establish minimum standards for environmental professionals conducting mitigation projects to increase the chances that manmade marshes will flourish
- provisions for enhancement and preservation of existing wetlands within a mitigation bank as compensation if the environmental benefits of such activity will significantly exceed the level of impact
- whether mitigation banks should be considered a replacement for publicly financed restoration projects
- safeguards to protect productive native uplands from conversion to wetlands

BH-2

- mandating the establishment of a trust fund to ensure long-term management of the mitigation bank. The trust fund could be managed by a public agency, with additional oversight by a non-profit group such as the Nature Conservancy

Responsible parties: ABM

STEP 2 Implement recommendations from Step 1, and direct mitigation credits to high-priority restoration areas, as identified in the Tampa Bay NEP habitat restoration and protection master plan.
(See Action BH-1)
Responsible parties: Tampa Bay NEP, in conjunction with FDEP, SWFWMD, FGFWFC and local governments

SCHEDULE:

Step 1 can be initiated in April 1996 with recommendations by September. Step 2 can be initiated in 1996 and completed in 1997.

COSTS:

To be determined, based on recommendations in Step 1.

EXPECTED BENEFITS:

The establishment of regional mitigation criteria enables bay managers and the community to provide safeguards for and more effectively utilize mitigation banking for the benefit of the region.

MONITORING ENVIRONMENTAL RESPONSE:

Bay marsh and mangrove habitats are monitored every five years using photo interpretation methods. The success of mitigation banks will be monitored through permits.

REGULATORY NEEDS:

Possible amendments to local permitting rules and/or the state mitigation banking rule.

RELATED ACTIONS:

BH-1, BH-4, BH-5

Reduce Propeller Scarring of Seagrass

BH-3

ACTION:

Reduce propeller scarring of seagrasses and other shallow water habitats by installing channel markers or implementing other management actions where seagrass scarring is severe and by increasing boater awareness of these habitats and methods for protection.

BACKGROUND:

Boating activity on Tampa Bay, where there are nearly 100,000 registered recreational boats, is intense and increasing—along with damage to seagrass meadows and other sensitive marine habitats.

Propeller scars from boats that cut through shallow seagrasses beds or run aground can leave sandy trenches that may stay barren for years. Seagrasses in some sections of Tampa Bay—including portions of Cockroach Bay Aquatic Preserve, Ft. DeSoto Park, Bishops Harbor and the Double Branch/Rocky Creek portion of Upper Tampa Bay—are severely scarred, particularly around narrow channels and passes.

The Florida Marine Research Institute (FMRI), which recently completed a statewide survey of prop scarring, is investigating the most appropriate methods for protection in areas of Tampa Bay where scarring is severe, including marking of existing channels. Findings from this study will comprise the basis for specific recommendations by the Tampa Bay National Estuary Program to reduce prop scarring in the bay. This action also calls for continued efforts to emphasize boater education by expanding distribution of the Boater's Guide to Tampa Bay and installing additional interpretive signage at high-use boat ramps where warranted.

Studies are underway at Cockroach Bay Aquatic Preserve in Hillsborough County and Ft. DeSoto Park in Pinellas County, where boating restrictions to protect seagrasses are in place, to monitor the effectiveness of various management methods employed. These management efforts range from motor boat exclusion zones and restricted access areas posted with signs to unrestricted areas where sensitive areas are posted with educational signs.

FMRI will use findings from these studies along with other efforts around the state to develop recommendations of the most effective strategies for protection at these and other heavily impacted bay sites, and to develop a cost-effective program to monitor prop scarring and associated seagrass reestablishment.

Additionally, interpretive signage installed at high-use boat ramps around the bay can help to raise boater awareness of sensitive seagrass meadows and other vital marine habitats. Expanding this effort to other areas of intense use around the bay is another important part of a comprehensive habitat protection strategy. Boaters also can be reached through expanded distribution of the Boater's Guide to Tampa Bay, which was produced in 1992 by FMRI and Tampa Bay NEP for distribution to boaters in Hillsborough, Pinellas and Manatee counties.

BH-3

STRATEGY:

STEP 1 Evaluate results of the FMRI investigation of methods to reduce prop scarring in severely damaged areas, which will be based, in part, on an evaluation of existing management efforts in boat-restricted areas. Recommendations should stress the need for uniformity in management methods employed around the bay, especially in boat restriction zones. A draft report will be submitted to the Tampa Bay NEP in January 1996. Recommendations will be incorporated into the final Comprehensive Conservation & Management Plan for Tampa Bay.
Responsible parties: Tampa Bay NEP

STEP 2 Implement and monitor seagrass protection strategies advanced in Step 1. Periodically monitor seagrass scarring in Tampa Bay to evaluate impacts, recovery, and associated management needs, and to reclassify restricted areas where appropriate.
Responsible parties: local governments and FDEP

STEP 3 Expand distribution of the Boater's Guide to Tampa Bay through major marinas, boating and fishing clubs, The Florida Aquarium, boat ramps, and retail outlets in accordance with existing terms and conditions.

Note: First-tier distribution to county tax collectors' offices, Florida Marine Patrol and county marine sheriff's units has been completed by the Tampa Bay NEP and the FDEP/FMRI; reorder process for these public and non-profit entities is in place.

A. Develop target list of distribution outlets and identify major boat shows and fishing tournaments for targeted events distribution. Evaluate corporate sponsorship and distribution partnership with a major sporting goods or boating retail operation.

B. Distribute letter with sample, order form and terms and conditions. Follow up by phone with major distribution outlets.

C. Distribute orders with reorder form/procedures.

Responsible parties: FDEP/FMRI, with assistance from Florida Marine Patrol, Coast Guard Auxiliary, Tampa BAYWATCH, Florida Sea Grant Extension Program

STEP 4 Identify high-use boat ramps not already posted and design and install interpretive signage in these areas to educate boaters about bay habitats and their role in habitat protection. Ideally, sign design should be uniform throughout the watershed to maximize cost-efficiency and impact.

[Note: Evaluate opportunities to modify or duplicate the existing bay signage series developed for the Tampa Bay NEP and installed at more than a dozen boat ramps around Tampa Bay.]
Responsible parties: FMRI, with assistance from local governments and Tampa BayWatch

STEP 5 Design, develop and distribute a boat decal about prop scarring to boaters, boat rental and sales outlets, and tackle shops.
Responsible parties: Tampa Bay NEP (for design and initial production), FMRI, Tampa BayWatch, Florida Marine Patrol and local government marine units and tax collectors' offices (for distribution)

[Note: Preliminary designs for a boater decal have been developed by the Tampa Bay NEP.]

SCHEDULE:

FMRI's report is due to the NEP in January 1996. Implementation of Steps 2 through 5 can begin in 1996.

COST:

Costs to implement management actions to protect seagrasses in areas where there is intense scarring will vary depending on recommendations. For example, the cost to purchase and install a channel marker or buoy is estimated at $500. Costs to reprint an additional 30,000 copies of the Boater's Guide to Tampa Bay on recycled stock are estimated at $8,300, and could be financed through the Sport Fish Restoration Fund. Costs to reproduce the imbedded fiberglass master sign on Tampa Bay produced for the Tampa Bay NEP by Pannier Graphics in Pennsylvania is approximately $1,000, excluding any design modifications. The sign is designed with a space for the logo of the local municipality or project sponsor.

EXPECTED BENEFITS:

Targeted efforts to educate boaters, coupled with more direct management actions and channel marking where warranted and enforcement of these actions, can reduce prop scarring of seagrasses. Other sensitive bird and coastal habitats also will benefit as boaters become more aware of them and how to protect them.

MONITORING ENVIRONMENTAL RESPONSE:

Prop scarring is monitored where management actions are implemented to test the effectiveness of these methods. Prop scarring trends baywide will be monitored as part of a program now being designed by FMRI (recommendations due in January). Seagrass coverage is monitored every two years by SWFWMD-SWIM.

REGULATORY NEEDS:

Pending final recommendations

RELATED ACTIONS:

BH-1, BH-10, FW-1

Evaluate Whether to Establish a Special Management Area for the Protection of Coastal Habitats in Tampa Bay

BH-4

ACTION:

Evaluate whether to establish a special management area to improve protection of coastal habitats within Tampa Bay, or pursue classification of those habitats as a state Ecosystem Management Area.

BACKGROUND:

Current state Wetland Resource (Dredge and Fill) permitting rules typically require permittees to provide compensatory mitigation (e.g., wetland creation, restoration, enhancement) for permitted wetland impacts after the impacts have been incurred. The amount of mitigation required is based upon general guidelines for the ratio of impacted acreage to mitigation acreage, but is usually negotiated on a case-by-case basis depending upon the type (e.g., forested vs. herbaceous wetlands) and functional quality of the wetland systems involved. These compensatory mitigation guidelines have been developed to theoretically result in a "no-net-loss" of wetland resources. However, according to a study completed by FDER in 1992, the majority of wetland mitigation sites required as a condition of permit issuance have either not been constructed, or are out of compliance with the terms and conditions set forth in their respective permits.

Additionally, current rules may not provide adequate protection for some important marine habitats for which mitigation is especially difficult, such as seagrasses and hard bottom communities.

Studies show a 43 percent decline (9,700 acres) in the bay's existing wetland coverage from 1950 to 1990, although several thousand acres of new wetlands were formed during this period as a result of newly developed emergent land. The vast majority of these losses can be attributed to the physical impacts associated with dredge and fill activities. During the same time period, there has been a net loss of about 15,000 acres of seagrasses because of dredge-and-fill impacts and past water quality declines, although seagrasses are now staging a comeback in some areas thanks to improving water clarity. Little information is available on historic impacts to hard-bottom communities, but bridge and dock construction has destroyed oyster reefs and other hard-bottom in some of these areas.

This action is to investigate the costs and benefits of providing stricter protection for tidal wetlands, seagrasses and other coastal habitats in Tampa Bay, through either the existing state Ecosystem Management Area designation or a new "special management area" classification. Within this special area, more stringent rules would apply to mitigation requirements. For example, amended rules might require:

- all mitigation to be constructed and an approved monitoring program initiated prior to the permittee being allowed to incur the permitted wetland impacts. The permittee will be required to attain a "successful" mitigation at project completion.
- higher bonding requirements for projects within the designated area, and higher mitigation ratios that will result in a "net gain" in wetland acreage.
- development of an ecologically defensible, quantitative mitigation formula for specific estuarine habitats so regulated interests could predict their mitigation requirements.

Efforts such as these could contribute significantly to the attainment of the habitat recovery targets established by Tampa Bay NEP for emergent tidal wetlands and seagrasses.

STRATEGY:

This action calls for the Agency on Bay Management (ABM) to evaluate whether and by what means a special management area should be established for the protection of special habitats surrounding the bay, preferably through an existing state classification.

STEP 1 Convene a workgroup of Tampa Bay area wetland resource regulators from applicable federal, state and local agencies, and local governments, to further evaluate the need and means for designating the coastal habitats of Tampa Bay as a "special management area" with permitting criteria necessary to attain habitat recovery targets. The group also would define the boundaries of this area.

Permitting criteria could include the development of a quantitative habitat evaluation and mitigation formula, for all specific estuarine habitat types. The rules for the "special management area" also could include provisions for off-site mitigation and payment into mitigation banks where on-site mitigation is not feasible.
Responsible parties: ABM

STEP 2 Based upon the consensus findings of the workshop, ABM and the Tampa Bay NEP will work with local legislators to develop and support state legislation to designate the tidal wetlands of Tampa Bay as a "special management area" with permitting criteria necessary to attain long-term habitat recovery targets established by the Tampa Bay NEP Management Committee.
Responsible parties: ABM, Tampa Bay NEP, local legislators

STEP 3 FDEP, SWFWMD, and counties with delegated wetland permitting authority establish new rules, or amend existing rules, to incorporate the provisions of the special management area.
Responsible parties: FDEP, SWFWMD, Pinellas County, Manatee County and Hillsborough County EPC

BH-4

SCHEDULE:

Pending assessment to determine the need and associated costs and benefits of a Special Management Area. If endorsed by the Technical Advisory Committee of the Tampa Bay NEP, the work group could be convened in Spring 1996 to further define the boundaries and provisions of the designation.

COST:

A cost-benefit analysis for implementing this action will be conducted based on recommendations from ABM.

EXPECTED BENEFITS:

A special management area could produce a net gain in, and provide heightened protection for, designated bay habitats.

MONITORING ENVIRONMENTAL RESPONSE:

Mitigation monitoring is required of the permittee to document "success." A baywide monitoring program has been established to monitor trends in habitat quantity.

REGULATORY NEEDS:

Possible amendments to chapters 17-312 and 40D-4, Florida Administrative Code. Passage of state laws designating the tidal wetlands of Tampa Bay as an ecosystem or special management area.

RELATED ACTIONS:

BH-2,BH-3,BH-5,BH-9

Restrict Impacts to Hard Bottom Communities in Tampa Bay

BH-5

ACTION:

Amend Wetland Resource (Dredge and Fill 17-312, Florida Administrative Code (FAC)) and Management and Storage of Surface Waters (40D-4, FAC) permitting rules to recognize estuarine hard-bottom communities as unique resources, and to provide for increased protection of these resources.

BACKGROUND:

The vast majority of the submerged bay bottom in Tampa Bay is characterized by loose sediments such as sand or mud. Subtidal hard-bottom, or live-bottom, communities exist in sparse areas of the bay bottom where natural rock outcrops protrude into the overlying water column. The hard surface of the rock provides an ideal substrate for colonization of a diverse assemblage of marine invertebrates including sponges, gorgonians and corals, and the shelter afforded by the rock outcrops attracts large numbers of a wide variety of fishes. These characteristics make hard-bottom communities some of the most unique and highly productive natural habitats in Tampa Bay.

Hard bottom communities are known to exist in Old Tampa Bay near Rocky Point and the Gandy Bridge, as well as southwest of the Skyway Bridge near Terra Ceia Bay. However, the baywide distribution of these important habitats—particularly in deeper waters—remains undocumented.

Oyster reefs are another type of hard-bottom community found in Tampa Bay. They typically occur in shallower waters along the shoreline, predominantly within the intertidal zone and provide a unique substrate for other encrusting organisms. Relatively little is known about the distribution and health of Tampa Bay oyster reefs despite their recognized importance and potential economic value.

Current state Wetland Resource (Dredge and Fill) permitting rules typically require permitees to provide compensatory mitigation (e.g., wetland creation, restoration, enhancement) for permitted wetland impacts after the impacts have occurred. The amount of mitigation required is based upon guidelines for the ratio of impact acreage to mitigation acreage, but is usually negotiated on a case-by-case basis. Current rules, however, do not distinguish estuarine hard-bottom communities from other types of regulated wetlands and submerged bottom types. Consequently, these unique habitats are typically not afforded any additional regulatory protection. While it is not clear how many acres of natural hard-bottom communities have been lost in Tampa Bay, it is clear that impacts to these unique habitats are not easily mitigated, and that a greater recognition and protection is needed.

This action would provide for the identification and protection of hard-bottom communities in Tampa Bay by including them in the "Special Management Area" proposed by the Tampa Bay National Estuary Program. The designation would allow for changes to existing permitting criteria necessary to provide needed protection to these communities.

BH-5

STRATEGY:

STEP 1 Undertake a comprehensive benthic survey of Tampa Bay with the objective of mapping the detailed distribution of natural hard-bottom communities, including both oyster reefs and rocky outcrop live-bottoms. A small-scale survey of hard-bottom communities has been completed, but a more detailed investigation is needed. The survey would document the species composition and ecology of natural hard-bottom communities and compare them to artificial reef communities. Volunteers could be enlisted to help identify and map these areas.

Ensure the distribution of these maps to applicable regulatory agencies and local governments so that these areas are recognized in permitting decisions. ***Responsible parties: Florida Department of Environmental Protection (FDEP) Marine Research Institute, Tampa BayWatch Bay Conservation Corps, Florida Sea Grant Extension Program***

STEP 2 Designate hard-bottom communities as part of the Special Management Area for Tampa Bay, with special permitting criteria. [See Action BH-5] ***Responsible parties: local governments***

SCHEDULE:

Step 1 can be initiated in 1996 and completed in 1997. Step 2 can be accomplished in 1996, pending recommendation from the Agency on Bay Management regarding the establishment of a Special Management Area for the protection of specific habitats.

COST:

The benthic survey could be conducted for approximately $50,000. Financing options include Florida Seagrant, local governments and research funds available through Florida Salt Water Fishing License revenues.

EXPECTED BENEFITS:

More effective protection of natural hard-bottom communities in Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

The bay monitoring program will include a hard-bottom mapping element, to be updated periodically (every five years).

REGULATORY NEEDS:

Amendments to chapters 17-312 and 40D-4, FAC. Passage of state laws designating the tidal wetlands of Tampa Bay a "Special Management Area."

RELATED ACTIONS:

BH-1, BH-10

Restrict Off-Road Vehicle Access Along Causeways and Coastal Areas

BH-6

ACTION:

Restrict off-road vehicle access in environmentally sensitive areas of causeways and coastal areas.

BACKGROUND:

The sandy shoulders along the bay's causeways have become popular impromptu recreation spots. On any weekend, the "beaches" along the Gandy and Courtney Campbell causeways, the Pinellas Bayway and the approach to the Sunshine Skyway Bridge are packed with cars, people, jet-powered personal watercraft and dogs.

Most of these makeshift beaches along the bay have no parking or sanitary facilities and few restrictions on use. Vehicles travel up and down the beach, eroding it and preventing emergent vegetation from growing along the shoreline. On the Gandy Causeway, the Florida Department of Transportation (FDOT) periodically dumps new sand on the beach, but much of it is washed into the water by the constant traffic and is forming a large sandbar just offshore.

At all the sites, vehicles have carved paths through mangroves in order to park right on the edge of the bay. Mangroves also are "trimmed" by beachgoers for campfires. Lack of sewage and trash facilities pose aesthetic and water quality problems for the bay, while the varied and often incompatible activities that occur there (i.e., personal watercraft users sharing a relatively limited space with swimmers and anglers) often present a safety concern.

No information exists on exactly how many people visit these areas, but observations indicate that hundreds use these areas every weekend, especially during the spring and summer.

Limiting vehicle access by creating designated parking areas on these beaches would reduce erosion and impacts to mangroves, while still allowing people to enjoy the bay shoreline. These parking areas could be created inexpensively by the use of natural landscaped berms or bollards—sections of telephone poles buried in the ground at widths too narrow for a vehicle to pass through. Beachgoers would park landward of the bollards and then walk to the water.

If more control over these areas is desired, sanitary and trash facilities, security lights and picnic facilities could be installed. Mangroves and marsh grass could be planted to revegetate sections of the shoreline, and a small fishing pier or boardwalk could discourage foot traffic through these vegetated areas.

Limiting access to these areas will be the responsibility of whoever maintains the road or causeway. In most cases, that will be either the FDOT or a county transportation department. Enforcement would be provided by local law enforcement agencies.

BH-6

STRATEGY:

STEP 1 Identify areas along the bay shoreline where off-road vehicle access should be controlled. Recommendations from the Agency on Bay Management (ABM) should be submitted to the FDOT by the Tampa Bay Regional Planning Council and respective local governments by September 1996.
Responsible parties: ABM, Tampa BayWatch

STEP 2 Implement restrictions on designated causeways and Coastal roads. A pilot project at a single site could be implemented first, to gauge public reaction and effectiveness. Other sites could follow, drawing upon the lessons learned at the test site. One site that might serve as a test area is located in Tampa off Cypress Street, where Hillsborough County and the City of Tampa are participating in a joint effort to clean up and restrict access to that bayside beach.
Responsible parties: FDOT, local transportation departments in Manatee, Pinellas and Hillsborough counties

STEP 3 Develop and implement a recreation plan for causeway beaches that enhances the environmental integrity of the areas while still allowing passive recreation. The plans could include sanitary and trash facilities, boardwalks and habitat restoration components. This is an optional step that depends heavily upon availability of local government funding, although some components —such as shoreline cleanups and habitat restoration projects—could be accomplished with volunteer labor.
Responsible parties: local government parks and transportation departments, volunteer groups such as the Bay Area Environmental Action Team and the Bay Conservation Corps of Tampa BayWatch.

SCHEDULE:

STEP 1 can be accomplished in 1996, with Step 2, a pilot project, implemented in 1997. Other sites could follow in 1998, with a detailed causeway recreation plan developed in future years as funding becomes available.

LOCATION:

Identified causeways and coastal areas throughout the bay and its tributaries.

COST:

Identification of areas in need of vehicle access restrictions can be accomplished at no cost by the ABM and Tampa BayWatch. Implementation of the restrictions varies considerably according to how extensive the measures are. The cost of installing bollards in designated parking areas is approximately $32 per bollard. At least 20-30 bollards would be needed at most sites, for a total cost of about $1,000 per site. Implementing a full-scale recreational facility, with restrooms, picnic tables and other amenities would cost a minimum of $100,000 per site, with annual operating expenses estimated at as much as $80,000, based on two full-time staff people, one vehicle, regular trash pickup and other services.

EXPECTED BENEFITS:

Controlling vehicle access will permit emergent vegetation to recolonize along now-barren areas of the bay shoreline, improving fish and wildlife habitat, reducing erosion and adding to the aesthetic appeal of the bay.

MONITORING ENVIRONMENTAL RESPONSE:

Any marsh or mangrove plantings conducted at the sites will be monitored by the appropriate state or local agency.

REGULATORY NEEDS:

None anticipated. Enforcement of the vehicle access restrictions can be accomplished under existing local ordinances.

RELATED ACTIONS:

BH-1

Require Mandatory Education for Recreational Boaters

BH-7

ACTION:

Improve boating safety, increase environmental awareness and reduce destruction of bay habitats by supporting statewide legislation to require mandatory education of boaters. (Note: Bill number will be inserted once established for 1996 legislative session)

BACKGROUND:

During the 1996 legislative session, Florida will again consider legislation to require boaters to complete an approved boating instruction course or pass a course equivalency exam to operate vessels of 20 hp or more. The education requirements will be phased in, with boaters born after October 1980 subject to the course requirements first. In the year 2000, the legislation will expand to cover boaters born after October 1975.

Under the proposal, affected boaters must have completed an education course before operating a boat in state waters. Exemptions are provided for boats operating on private (one-owner) lakes or ponds, or persons licensed by the Coast Guard. The bill offers an equivalency exam for experienced boaters and a temporary certification for boat renters.

A similar bill was tendered during the 1995 legislative session, but had no sponsors in the House or Senate and failed to make it out of committee. However, the 1996 version of the legislation has received sponsorship from Sen. Karen Johnson and Rep. Emmett Kelly, and also is supported by the Marine Industry Association, the Personal Watercraft Association and other marine businesses.

More than 700,000 recreational boats are registered in Florida, with about 100,000 of those in the tri-county Tampa Bay region. Approximately 6,200 teenage Floridians would be required to comply with the first phase of the mandatory education.

In 1994, there were 1,017 boating accidents and 74 boating fatalities in Florida. The Florida Marine Patrol reports that most accidents involved 22- to 35-year-olds, emphasizing the importance of legislation that eventually will require mandatory education for that age group. In addition, the marine patrol reports that 73 percent of all boat operators have no formal training in boating safety.

Increasing boating activity also has led to extensive damage and destruction of marine habitats—and the deaths or injuries of manatees, sea turtles and other marine animals. Studies by the Florida Department of Environmental Protection (FDEP) estimate that more than one-third of the 25,000 acres of seagrasses in Tampa Bay are scarred as a result of boats that carve through shallow grass flats or run aground and dredge their way free. Additionally, between 1976 and 1992, 22 manatee deaths in Tampa Bay

were attributed to collisions with boats. To protect the state's marine habitats and inhabitants, the Tampa Bay National Estuary Program (NEP) believes that environmental impacts should be addressed in any boating education program approved by the state.

The proposed legislation would immediately instruct an emerging group of Florida boaters in basic boating skills, making them better equipped to navigate safely and more responsibly in Florida waters. Just as important, it would—over time—ensure that the age groups traditionally involved in the most boating accidents receive boating safety instruction before they take to the water. However, because of the age thresholds included in the bill, the vast majority of the state's current boaters will be exempt. At its best, only those born after 1975 will be subject to mandatory education. Thus, it will be many years before a largely uneducated boating public is replaced by a largely educated one.

Candidates would be able to choose from one of any number of courses approved by the National Association of State Boating Law Administrators (which requires a minimum eight hours of instruction) or pursue a home correspondence option with course-equivalency exam. Those who pass the exam receive a lifetime certification, which verifies that the operator has successful by completed basic boating safety instruction; it is not a license. Certification cannot be revoked and does not require renewal. However, failure to obtain the certification will be a second degree misdemeanor, punishable by a $250 fine or six months in jail.

Support for this initiative is widespread. Backers include the major marine industry groups, a variety of state agencies and environmental groups and Mothers Against Drunk Drivers. A public opinion poll conducted by the Tampa Bay NEP in 1992 showed that almost 90 percent of the Tampa Bay respondents—and approximately 75 percent from a boaters-only sample—favored mandatory boater education.

STRATEGY:

STEP 1 Organize formal support for a mandatory boater education bill that requires phased-in instruction for the majority of Florida boaters and includes environmental education elements. Draft a letter of support from the Tampa Bay NEP to the Tampa Bay legislative delegation, Governor and Cabinet members, and key legislators chairing committees likely to review the bill, with distribution to area press.
Responsible parties: Tampa Bay NEP

Organize additional support for legislation through businesses, community and environmental advocacy groups, and individuals represented on the Tampa Bay NEP community advisory committee.
Responsible parties: Tampa Bay NEP Community Advisory Committee, Agency on Bay Management, Tampa BayWatch

STEP 2 Ensure that approved courses include environmental awareness elements such as potential impacts to seagrasses, manatees and sea turtles, and that course instructors have adequate training and materials for such instruction. This effort is being led by the Center for Marine Conservation in coopera-

BH-7

tion with the Coast Guard.
Responsible parties: FDEP, Center for Marine Conservation, Coast Guard Auxiliary

SCHEDULE:

Step 1 will coincide with the 1996 state legislative session. Step 2 can be initiated in 1996 and continue through 1998, since Florida Marine Patrol staff estimates it will take two years to establish approved boating safety courses in all 67 counties.

COST:

No costs are anticipated for Step 1 beyond staff time to prepare letters of support. Step 2 will require FDEP administrative costs and costs for production of materials to address environmental impacts from boating. Potential sources of funding for these materials include boat registration fees and saltwater fishing license fees. Boaters will likely pay a modest registration fee for the boating course to cover administrative costs.

EXPECTED BENEFITS:

Trained and informed boat operators will result in fewer boating accidents and may result in decreased impacts to shallow water habitats and marine animals.

MONITORING ENVIRONMENTAL RESPONSE:

The FDEP's ongoing seagrass scarring studies and marine mammal monitoring programs will help determine if boater education is instrumental in reducing environmental impacts.

REGULATORY NEEDS:

Legislative passage of [Bill name and number].

RELATED ACTIONS:

BH-3, FW-1, FW-2

Encourage Waterfront Residents to Enhance Shorelines and Limit Runoff from Yards

BH-8

ACTION:

Encourage waterfront residents to enhance or naturalize shorelines and limit runoff from yards.

BACKGROUND:

About half of Tampa Bay's natural shoreline has been altered by development or hardened through the construction of seawalls, piers and jetties that limit plant and animal life. These changes have led to significant declines in intertidal marsh and mangrove habitat, which supply food and shelter to numerous species of fish, shellfish and invertebrates.

This action presents steps to encourage waterfront residents to soften or enhance seawalls and shorelines with native vegetation, limestone rip-rap, terracing or habitat reefs. When properly designed, these improvements not only benefit the environment, but also can boost property values by improving shoreline stability and aesthetic appeal. However, cost, permitting complexity, and lack of information about suitable options are often key deterrents to homeowners, who also are limited by site-specific considerations.

Local communities seeking to encourage waterfront residents to enhance shorelines may gain the most by targeting larger, finger-fill communities, where group permits are feasible, especially when seawalls are replaced or repaired.

Limiting pollution in runoff from waterfront yards also is encouraged. Residents can help to reduce pollution to Tampa Bay by applying the eco-landscaping techniques prescribed by the Florida Yards & Neighborhoods (FY&N) Program, which is administered by local cooperative extension services. A companion FY&N homeowner's guide, which features low-maintenance landscape design and maintenance tips, is ideally suited to the environmentally conscious waterfront resident. Adopt-A-Canal programs also may be effective in select areas in improving water and habitat quality in canals through public stewardship and education. Another issue of concern to canal-front residents is maintenance dredging, which is addressed as a separate action plan (See Action DR-2).

STRATEGY:

The following strategy focuses on incentives and efforts to streamline procedures for residential shoreline enhancement, as well as informational resources to assist waterfront residents in evaluating shoreline options and implementing landscaping practices to reduce runoff from their yards.

STEP 1 Develop property tax incentives or dis-incentives to encourage habitat enhancement along seawalls, and establish cost-share programs to promote

BH-8

group-permit shoreline enhancement projects.
Responsible parties: local governments, Southwest Florida Water Management District (SWFWMD), in cooperation with Florida Department of Environmental Protection (FDEP) Beaches and Shores Division

STEP 2 Initiate rule-making to develop a low-fee or cost-free General Permit that streamlines application process for group and individual shoreline enhancement.
Responsible parties: SWFWMD, FDEP, local governments

STEP 3 Amend state rules to require that habitat enhancement features be incorporated when seawalls are constructed or repaired.
Responsible parties: FDEP

STEP 4 Develop and distribute a resource card (#10-envelope size) to waterfront residents through annual property tax notices to promote available resources and publications addressing shoreline enhancement, waterfront landscaping, exotic plant control and canal dredging. Publications noted below should be featured, as well as brochures on exotic species control and residential canal dredging. The resource card also should reference local property tax incentives and cost-share programs available for group shoreline enhancement projects.
Responsible parties: local governments and the Tampa Bay National Estuary Program (NEP) (production), Tax Assessors Offices (distribution), also distribute through Tampa BayWatch, Agency of Bay Management (ABM)

4.1 SWFWMD's 1993 report on Best Management Practices for Improvement of Residential Canals includes informative boilerplate text for a public brochure on enhancement of hardened shorelines. Text should be expanded to provide more detail on general shoreline design options, associated costs, and appropriate contacts, and then produced as a brochure for public distribution.
Responsible parties: SWFWMD (brochure), SWFWMD and local governments (distribution), Florida Sea Grant Extension Program

4.2 The FY&N Handbook, produced by the Florida Cooperative Extension Service and the National Estuary Programs of Tampa Bay and Sarasota Bay, assists residents in designing and maintaining low-maintenance, environmentally beneficial Florida Yards, which minimize fertilizer, pesticide and water use. Special sections are devoted to waterfront landscaping, shoreline enhancement, and septic tank maintenance. Local governments may arrange for reprints of this publication through FCES or refer inquiries to local cooperative extension services.
Responsible parties: local governments, Florida Cooperative Extension Service

STEP 5 Explore the costs and benefits of implementing Adopt-A-Canal programs in areas with strong neighborhood associations. Include existing materials as core of a curriculum, but also promote proper boat maintenance and oil-sorb products for boat bilges. Encourage backyard maintenance-free (or low-maintenance) buffer zones to limit fertilizer and pesticides in direct runoff.
Responsible parties: local governments, Florida Seagrant (Marine Extension agents)

SCHEDULE:

All projects can be initiated in 1996 for implementation in 1997. Incentives and cost-share options will be investigated by the Tampa Bay NEP, which also will develop boilerplate design and text for the resource card (Step 4) to provide to local governments. These elements will be included in the final version of the plan.

COST:

The Program is investigating costs to produce: 1. Resource card—100K quantity, #10 envelope-size color cardstock, printed 2 sides/1 color; 2. Brochure on shoreline options, 25K quantity, first run. Reprint costs for the FY&N handbook are $1 per book. Local governments can achieve cost-recovery by providing these materials at cost of production as an alternative to free distribution.

Tax incentives and cost-share programs may be pursued through existing ad valorem taxes and river basin boards.

EXPECTED BENEFITS:

Improved shoreline habitat and water quality and associated increases in fisheries.

MONITORING ENVIRONMENTAL RESPONSE:

Existing bay monitoring programs will track trends in water quality and habitats. Environmental response also may be assessed by monitoring group permits for shoreline enhancement.

REGULATORY NEEDS:

Possible amendments to Florida Administrative Code, Chapters 40D-4, 17-4, 17-312.

RELATED ACTIONS:

SW-1, DR-2, BH-1

Improve Compliance with and Enforcement of Wetland Permits

BH-9

ACTION:

Improve compliance with and enforcement of permits governing wetland mitigation by establishing level-of-service targets, providing periodic performance assessments, and continuing efforts to coordinate permitting and enforcement staff to provide greater continuity in oversight.

BACKGROUND:

State rules regarding mitigation for wetland impacts have been developed to offset wetland losses. However, a study of mitigation compliance completed by the Florida Department of Environmental Regulation (now FDEP) in 1992 concluded that the majority of mitigation projects had either never been constructed or failed to comply with the terms of their permit and did not function properly. The generally low success rate statewide has been largely attributed to staffing shortfalls and organizational structures that have traditionally segmented rather than integrated permitting, compliance monitoring and enforcement functions. Without strong compliance monitoring and enforcement, regulated interests often have little incentive to perform compensatory mitigation in a manner consistent with the rules.

Wetland mitigation rules are administered by the FDEP (through the agency's wetland resource permitting program), SWFWMD (through the Management and Storage of Surface Waters [MSSW] program), and by local governments with delegated or legislative authority for wetland permitting.*

Non-compliance with wetland mitigation permits in the Tampa Bay watershed has likely contributed to a net loss of both freshwater and tidal wetlands. However, documenting these trends has been extremely difficult because efforts to track compliance between and within various regulatory agencies has been inconsistent and lacking in sufficient detail. Inconsistent mitigation ratios, wetland delineation criteria, and design and performance standards have further complicated efforts to assess results.

Improving permit compliance will require that agencies focus first on recognizing and permitting effective mitigation designs, as well as increasing inspections during and after construction, and following up to promote better project maintenance by regulated interests. Access to mitigation sites also is a factor. In this regard, locally administered programs may have an advantage over state or regional programs.

The state's new Environmental Resource Permitting (ERP) program, which consolidates existing Wetland Resource, MSSW, and Sovereign Lands regulatory programs into a single permitting function, is expected to improve compliance monitoring and enforcement by increasing interagency coordination and reducing inconsistencies and duplication. Implementation of the ERP will create key opportunities for the consoli-

* Pinellas County has been delegated authority from SWFWMD to administer its own wetland and stormwater permits. The Environmental Protection Commission of Hillsborough County (EPCHC) has received legislative authority from the state for local permitting.

dation and reorganization of these functions within regulatory agencies and participating local governments, and the creation of uniform standards for wetland delineation.

BH-9

STRATEGY:

The strategy to improve wetland permit compliance monitoring and enforcement focuses on establishing level-of-service targets, continued implementation and periodic assessment of integrated permitting concepts advanced through the ERP program, and evaluation of existing staffing and funding resources and needs as the basis for recommendations for action. This strategy also calls for standardization of monitoring and reporting requirements within and between enforcing agencies and municipalities.

STEP 1 Conduct a workshop to establish level-of-service targets for wetland permits (performance criteria and monitoring requirements) and compliance monitoring and enforcement within the Tampa Bay watershed, and assess associated staff and funding needs. Participants also should evaluate ways to standardize reporting and monitoring methods between and within agencies.

Recommendations of actions to improve compliance monitoring and enforcement shall be submitted by the group to the Tampa Bay NEP by March 1997. As a first step, participants are called upon to define steps and issues to be addressed in the workshop and make recommendations by May 1996, for incorporation into the final Comprehensive Conservation Management Plan (CCMP) for Tampa Bay.
Responsible parties: FDEP and SWFWMD (to organize workshop): participants to include U.S. Army Corps of Engineers (USACE), EPCHC, U.S. Fish & Wildlife Service (USFWS), Florida Game and Fresh Water Fish Commission (FGFWFC), Pinellas County, and other local governments that may be seeking delegated authority for wetland permitting

Note: See Action SW-7 addressing stormwater compliance monitoring and enforcement. Strategy elements for assessment of stormwater and wetland compliance monitoring/enforcement needs may be combined.

STEP 2 Expand agency and local government permitting staff training and regular retraining to increase the emphasis on recognizing quality wetland mitigation designs as a first step to ensure that quality projects are permitted.
Responsible parties: SWFWMD and FDEP, USACE, EPCHC, USFWS, FGFWFC, Pinellas County

STEP 3 Continue to integrate permitting and compliance monitoring and enforcement functions in an effort to maximize efficiency and provide "cradle to grave" permit oversight. Also, encourage interagency compliance monitoring teams where feasible, including federal agencies.
Responsible parties: FDEP, SWFWMD, EPCHC, USFWS, FGFWFC, applicable local governments

STEP 4 Based on recommendations from Step 1, standardize mitigation success criteria as well as monitoring and reporting requirements for created and

restored wetlands.
Responsible parties: FDEP, SWFWMD, EPCHC, USFWS, FGFWFC, applicable local governments

STEP 5 Assess the effectiveness of efforts to improve compliance monitoring and enforcement in the Tampa Bay watershed, including progress toward level-of-service targets (particularly compliance rates), results of integrating staff to assist in these efforts, and associated costs to agencies and applicants. Results of the assessment should be reported in the Agency on Bay Management's State of the Bay report and in periodic progress reports tracking implementation of the CCMP.
Responsible parties: FDEP, SWFWMD, EPCHC, USFWS, FGFWFC, applicable local governments

SCHEDULE:

A preliminary "scope" for the workshop is requested by February 1996, for incorporation into the final CCMP. Recommendations from the workshop are due March 1997. Implementation of Steps 3 and 4 can begin in 1997.

COST:

Only staff time is anticipated in the implementation of this strategy, although recommendations from step 1 may call for additional resources or changes in existing allocations.

EXPECTED BENEFITS:

Improved permit compliance monitoring, enforcement and reporting.

MONITORING ENVIRONMENTAL RESPONSE:

See Step 5.

REGULATORY NEEDS:

Possible amendments to procedural and administrative rules of the Florida Administrative Code, Chapter 40D-4.

RELATED ACTIONS:

SW-7

Expand Habitat Mapping and Monitoring Programs

BH-10

ACTION:

Ensure implementation of adequate habitat mapping and monitoring programs to track trends in areal extent and quality of seagrass, mangroves, coastal marshes and oligohaline habitats in Tampa Bay over time.

BACKGROUND:

A critical element of the bay's management plan is the establishment and maintenance of a monitoring program to measure progress toward meeting the goals of the Tampa Bay National Estuary Program (NEP). This is very important to the local and state governments implementing actions, since counties, cities and state agencies must have adequate information to evaluate whether efforts spent on pollution abatement or other changes in the watershed are reflected in improvements in bay quality. Monitoring of habitats is also necessary to track progress toward reaching long-term restoration and protection goals set by the program, and provide essential information that can be used to redirect and refocus the plan.

One of the first efforts of the Tampa Bay NEP was to initiate a multi-year effort to develop a baywide monitoring program capable of reliably measuring changes in bay quality. This plan incorporates and expands on existing programs where possible, and consists of seven major elements: water quality, benthic, seagrass, bay scallop, fisheries, coastal marshes and mangroves, and oligohaline habitats.

This action ensures implementation of habitat monitoring elements defined in the baywide monitoring plan.

STRATEGY:

STEP 1 Continue existing Southwest Florida Water Management District-Surface Water Improvement and Management (SWFWMD-SWIM) monitoring program mapping areal extent of seagrass in Tampa Bay, to track trends in areal extent and progress toward restoration goal.

The extent of seagrass coverage in all areas of Tampa Bay is currently being monitored by SWFWMD-SWIM every two years. To date, no permanent funding source for the mapping program has been identified. ***Responsible parties: SWFWMD***

STEP 2 Implement the Seagrass Conditions Monitoring Program as developed by the Tampa Bay NEP Technical Advisory Committee. Hillsborough County monitors seagrass conditions in Cockroach Bay, and Pinellas County conducts seagrass monitoring in Fort DeSoto Park.

SWFWMD-SWIM is conducting the first year of the Seagrass Conditions

Monitoring Program throughout the bay as a pilot project. Potential responsible entities for conducting quarterly seagrass conditions monitoring in upcoming years remain to be identified. The City of Tampa conducts seagrass quality monitoring in Hillsborough Bay.
Responsible parties: SWFWMD, Florida Department of Environmental Protection-Florida Marine Research Institute (FDEP/FMRI)

STEP 3 Continue existing annual benthic monitoring through 1996. Evaluate results of the four-year baseline in 1997 and redirect the program as appropriate.
Responsible parties: Hillsborough, Pinellas and Manatee counties

STEP 4 Develop and implement a monitoring program to track habitat quantity and quality in mangroves, coastal marshes, oligohaline habitats and associated uplands.

Development of these elements of the habitat monitoring program will be initiated as part of the habitat restoration and protection master plan. This plan will identify responsible entities for implementation.
Responsible parties: to be determined. Responsible parties may include SWFWMD, FDEP, local governments

STEP 5 Report results and integration of environmental monitoring programs to bay managers on a regular basis, to allow for redirection and refocus of management programs as necessary.

A template Biannual Environmental Monitoring Report (BEMR) is under development. Each ongoing monitoring program is responsible for the development of a summary chapter in the BEMR. An integral element of the report will be the bay managers' summary, which will contain an integrated analysis of conditions and trends in Tampa Bay. Areas of the bay that show signs of degradation or improvement will be noted in the bay managers' summary, to allow for changes in management actions as warranted.
Responsible parties: initial effort part of a 1995 Tampa Bay NEP project. The long-term coordinator for production of the report has not yet been determined.

SCHEDULE:

Steps 1 and 3 are ongoing. Implementation of Step 4 should begin in 1996. The first biannual monitoring report will be produced in October 1995 as part of an ongoing Tampa Bay NEP project.

COST:

Seagrass mapping: $40,000 every two years for update
Seagrass quality: $36,000 every two years
Estimated marsh/mangrove/coastal upland mapping: $120,000 for true color and color infrared baseline maps; $45,000 every two years for update

Benthic monitoring: $150,000 annually ($50k per county)
Estimated marsh/mangrove/coastal upland quality: $40,000 every two years
BEMR: Production, printing and distribution costs every two years, estimated at $10,000.

EXPECTED BENEFITS:

Implementation will provide adequate information to track trends in habitat extent and quality, and will provide managers with an "early warning system" to detect areas that may need additional management action.

MONITORING ENVIRONMENTAL RESPONSE:

Results of all bay monitoring programs will be included in the BEMR.

REGULATORY NEEDS:

None anticipated

RELATED ACTIONS:

BH-1, BH-2, BH-5,

FRESHWATER INFLOW

FI

Maintaining an adequate supply of fresh water to Tampa Bay and its tributaries is crucial to preserving the bay's health. This is especially important for rivers impounded by dams that drastically restrict those flows at certain times of the year.

The bay's four major rivers and numerous smaller tributaries provide critical low-salinity habitats to dozens of species of fish and shellfish at important stages in their development. They are the primary nursery habitat for red drum, snook and striped mullet. While these dynamic habitats tend to be small, they may support thousands of juvenile fish each year. As these fish mature, they typically move to more saline areas of the bay or out into the Gulf of Mexico, although some species return to these rivers during various seasons.

These vital ecosystems have declined as dams and development have altered the amount and timing of freshwater inflows to the bay. Additionally, many smaller creeks and streams that once served as nurseries to fish have now been channeled, filled or altered through development.

The area's largest dams, on the Hillsborough and Manatee Rivers, release almost no water downstream during peak periods of the dry season; annually, they retain about 35 percent and 29 percent of their respective up-river flows for drinking, irrigation, and industrial uses.

Recent studies show little overall change in the amount of freshwater entering the bay proper since the 1950s, because declines in natural flows have been partially countered by steady increases in stormwater runoff from the watershed. But some significant changes have occurred upstream in the low-salinity zones favored by the young of many of the bay's most popular fish. Declines here and associated declines in fisheries make preservation and restoration of remaining low-salinity habitats vital.

Strategies to preserve and restore Tampa Bay's freshwater tidal streams are addressed in the Tampa Bay NEP's master plan for habitat restoration, which will be finalized in early 1996 (see BH-1). The following action focuses on establishing seasonal freshwater inflows to the bay from rivers impounded by dams.

MANAGEMENT OBJECTIVES

- Maintain optimal freshwater inflows to Tampa Bay and its tributaries.
- Establish and maintain minimum seasonal freshwater inflows for rivers impounded by dams: Hillsborough River, Manatee River, Braden River and Palm River.

ACTION TO ADDRESS FRESHWATER INFLOW

FI-1 Establish and maintain minimum seasonal freshwater flows downstream of dams.

Establish and Maintain Minimum Seasonal Freshwater Flows Downstream of Dams

FI-1

ACTION:

While safeguarding water supply and flood control functions, establish and maintain minimum seasonal freshwater inflows downstream of dams on the Hillsborough, Manatee and Braden rivers, and below Control Structure S-160 on the Palm River, to restore and preserve the biological productivity of the estuary's critical juvenile fisheries habitats.

BACKGROUND:

Estuaries, where fresh water and salt water mix, are highly productive natural habitats for fish and other marine life. The juveniles of many aquatic species, including spotted seatrout, snook, red drum and tarpon, depend on the low- and medium-salinity portions of these shallow waters, especially in the tidal sections of rivers and streams. However, the productivity of these habitats as nurseries and feeding areas depends largely on maintaining an adequate supply of freshwater from upstream at various times of the year.

In this region, fresh water from reservoirs and ground water supply potable water for drinking, irrigation and industrial uses. Demand for fresh water in the tri-county area is expected to increase from 544 million gallons per day (mgd) in 1990 to 765 mgd in 2020, according to the Southwest Florida Water Management District (SWFWMD).

Florida Statutes Section 373.042 (1991) directs the state's water management districts to establish "minimum flows" for watercourses and "minimum levels" for surface waters and aquifers. Minimum flows are defined in the statute as the limits at which further withdrawals would be "significantly harmful to the water resources or ecology of the area." Additionally, district Water Management Plans (DWMPs) identify strategies to address ecosystem needs, including schedules for establishing minimum flows and levels [Chapter 62-40.473, FAC].

Minimum flows based on river ecology have not yet been set for the Hillsborough, Palm and Braden rivers. A preliminary minimum flow of 0.425 cubic feet per second (roughly 275,000 gallons per day), which is the estimated leakage from the dam, was set for the Manatee River in 1991; the flow's adequacy is now being examined by SWFWMD in cooperation with Manatee County.

Minimal flows were not required when control structures were constructed on the Hillsborough, Palm, Braden and Manatee rivers (all before 1972). Nevertheless, a series of ongoing and recently completed studies should provide SWFWMD with sufficient information to set thresholds for each river to protect the productivity of the river and the bay downstream.

A minimum flow is not planned for the Alafia River because the SWFWMD Needs

and Sources Study concluded that water supplies were not needed from the Alafia for the 1990-2020 planning horizon.

Other studies on the Braden, Hillsborough, Manatee and Little Manatee rivers, and the Tampa Bypass Canal, have addressed various aspects of river flow and ecology. Evaluation of these studies will provide information necessary to set minimum flow requirements.

STRATEGY:

This action is to evaluate and set minimum seasonal freshwater inflows to Tampa Bay to protect the ecological integrity of vital downstream fisheries habitats.

STEP 1 Conduct technical workshops for each impounded river to evaluate results of freshwater studies and develop recommendations for minimum freshwater flow requirements.

Tampa Bay National Estuary Program (NEP)-sponsored workshops are ongoing and include analysis of technical studies, discussions of alternatives, and efforts to gain commitments from participants for consensus recommendations. An initial workshop on the Manatee River was held in August 1995. Workshop participants include representatives of local governments, SWFWMD, Florida Department of Environmental Protection, scientists and engineers, utilities and interest groups.

In assessing available studies, participants will consider:

- whether flows to the downstream portions of impounded rivers have been quantified
- whether sufficient information exists to identify a set of target "living resources" and their environmental requirements as a basis for establishing minimum flow recommendations
- if appropriate flows to restore and maintain low-salinity habitats can actually be determined from the studies
- the impacts of various flow release scenarios on public water supplies and economic development.

Responsible parties: Tampa Bay NEP

STEP 2 Establish seasonal flow requirements by renewal dates for water use permits for the Hillsborough, Palm, Manatee and Braden rivers, incorporating recommendations from Step 1, along with other socio-economic and environmental factors.
Responsible parties: SWFWMD

STEP 3 Implement minimum seasonal flows. Implementing parties may evaluate and pursue various options to meet minimum flow requirements, including water conservation to reduce demand on impounded water; augmentation of wellfields or reservoirs with highly treated wastewater or stormwater, as long as public health concerns are addressed; and relocating point source

FI-1

discharges to augment freshwater flows downstream of dams.
Responsible parties: local governments, West Coast Regional Water Supply Authority (WCRWSA)

STEP 4 Monitor the environmental response. Develop and implement a program to determine spatial and temporal changes in water quality and in-stream biology in response to these limits, perhaps by expanding local government water quality and benthic monitoring programs to address these monitoring needs.
Responsible parties: to-be-determined (possibly permit applicant)

SCHEDULE:

Ecological assessment studies are now being conducted as a permit condition for water use withdrawals. SWFWMD will evaluate withdrawal rates and recommended minimum flows for each river by the permit renewal dates, which are:

Manatee River & Braden River	1997
Hillsborough River & Palm River	2000 (flows will be set in 1995-96)

COST:

Steps 1 and 2 require administrative and staff time and associated studies, which are financed by the local governments seeking permits for water withdrawals. Costs to comply with seasonal minimum flows (Step 3) will depend on the magnitude of the effort. One basis for cost analysis is to compute the cost and yield for various alternative sources of water, such as construction of a new reservoir, to replace the amount of additional water released downstream.
For example, Manatee County residents now pay about $1.62 per 1,000 gallons to have water delivered to their homes, which includes reservoir and treatment costs and a Readiness to Serve charge. To meet a 5.0 cfs freshwater flow (up from .0425) from the existing dam would require new alternative potable water sources, ranging from $.08 per 1,000 gallons for construction of a new reservoir at Gilley Creek to nearly $.80 per 1,000 gallons for development of an off-stream reservoir. Both options would increase potable yields, in addition to allowing more water over the dam to sustain the biological needs of downstream ecosystems.

For the average Manatee County household, which uses roughly 6,500 gallons per month indoors, the Gilley Creek option would increase monthly water bills by about 4.9 percent or $0.52 per month. For the off-stream reservoir option, monthly water bills would rise 49 percent or an additional $5.14 per month.

The costs to monitor the environmental response to minimum flows have not yet been finalized. However, Manatee County estimates that it spends about $100,000 now to monitor water quality downstream of the reservoir, which is about half of the county's annual bay monitoring expenditure.

EXPECTED BENEFITS:

Establishing and maintaining appropriate freshwater inflows to the bay from rivers

impounded by dams will restore and protect vital fisheries habitat downstream of those control structures. Low-salinity portions of these tributaries are vital nursery areas for several species of fish, including red drum and snook.

MONITORING ENVIRONMENTAL RESPONSE:

Ongoing fisheries, water quality and benthic monitoring programs (summarized in Monitoring Bay Improvement) are used to track the overall environmental quality of the bay and its tributaries. Water flows or release rates are recorded by Manatee County at the Lake Manatee dam on the Manatee River, and by the City of Bradenton at the Evers Reservoir dam on the Braden River. SWFWMD records flow at the Tampa Bypass Canal (Palm River), and USGS records flow at the Hillsborough Reservoir dam.

Monitoring to detect environmental responses to new freshwater inflows set as a result of this action may be required as a condition for the renewal of water use permits.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

BH-1, WW-1

What You Can Do...

To Protect and Restore Bay Habitats

As a homeowner:

- Where seawalls exist, investigate opportunities to enhance or soften shorelines with vegetation or rip-rap and to install artificial reefs to provide habitat for young fish.
- Remove Brazilian pepper, melaleuca trees and other invasive exotic plants from your property and plant native flowers, trees and shrubs.
- Avoid pruning mangroves, which provide important habitat for fish and wildlife.
- Support local and state habitat restoration and land acquisition and protection programs.
- Visit a bay restoration site to learn how coastal habitats are restored and why. Contact the Southwest Florida Water Management District SWIM department or your local government environmental department.
- Join the Bay Conservation Corps directed by Tampa BAYWATCH for hands-on involvement in the bay's restoration and protection.
- Take a walk on the wild side with The Florida Aquarium by participating in weekend BayWalks at Weedon Island Preserve in Pinellas County and Tampa's McKay Bay.

As a boater:

- Use channel markers and up-to-date navigation and tide charts to avoid running aground on or scarring seagrass beds.
- Obey regulations restricting boat access to certain portions of the bay.

As a neighborhood, civic group member or educator:

- Encourage your group to participate in a wetland restoration or bay improvement project. For ideas and information, contact Tampa BAYWATCH and the Southwest Florida Water Management District SWIM department.

Portions of What You Can Do are reprinted with permission from the Sarasota Bay National Estuary Program.

Fish & Wildlife

FW

Efforts by the Tampa Bay National Estuary Program (NEP) to protect and enhance Tampa Bay's diverse fish and wildlife resources focus primarily on establishing healthy environments through improvements in water quality and habitats. But increased enforcement of existing regulations to limit physical impacts associated with fishing, boating, and foot traffic in bird rookery areas also is a priority.

Hundreds of species of marine and terrestrial animals rely on Tampa Bay and the rich tapestry of environments it provides. Mangrove islands in Tampa Bay are among the most productive nesting sites in the nation for birds such as the brown pelican, roseate spoonbill, white ibis and reddish egret. As many as 40,000 pairs of birds nest each year on these islands, which support two of the state's five largest brown pelican colonies. Other birds, such as the American white pelican from Canada and several species of the sandpiper, are seasonal visitors to the bay.

Tampa Bay also attracts as many as 200 endangered manatees during the winter months, when the gentle marine mammals gather at the warm-water plumes discharged by the power plants bordering the bay. About 50-100 of these gentle giants are year-round residents. Manatee mortality has tripled in Tampa Bay from an annual average of about 4 (from 1976-1985) to more than 12 (from 1990-1994). Boating collisions and propeller strikes claimed about 20 percent of the 61 manatees that died in the bay during this last four-year period.

Three species of sea turtles—loggerhead, green and Kemp's ridley—feed in the bay, and as many as 500 bottle-nose dolphins reside here year-round. Like the manatee, these larger marine creatures are threatened by accidental boat strikes and ingestion of and entanglement by marine debris, particularly monofilament fishing line.

The bay's once plentiful supplies of fish and shellfish have declined in recent decades, a result of habitat loss and historic declines in water quality as well as pressures from overharvesting. Recent bans on purse seines and gill nets are expected to sharply reduce commercial harvesting of some species, such as spotted seatrout. While a precise figure of the historical decline is difficult to estimate, fisheries scientists report that the amount of bay finfish brought to market at local ports in Hillsborough and Pinellas counties decreased by more than 24 percent between 1966 and 1990, from 4.8 million pounds to 3.7 million pounds.

Records going back even further, to 1950, show that catches of spotted sea trout declined by 86 percent by 1990, from 487,000 pounds to 67,000 pounds. Similarly, red drum harvests between 1950 and 1986 plummeted by 81 percent, from 80,000 pounds to 15,000 pounds, although these raw landings data do not reflect changes in

FW

fishery management or quotas. Loss of seagrass habitat and overharvesting are suspected in the decline of these popular sportfish.

Recent water quality gains and associated seagrass recovery have made some bay managers hopeful that the bay may again support scallops, which disappeared from these waters more than three decades ago. While scientists can't pinpoint the cause for the collapse of the local population, they suspect declining water quality was to blame. Stocking efforts designed to jump-start a self-sustaining scallop population are now underway, primarily in the lower portions of the bay where seagrasses and salinities are most favorable.

Harvests of oysters and clams have been severely limited in the bay because of actual or suspected contamination (see Public Health actions, Water & Sediment Quality Action Plan).

Preserving Tampa Bay's rich fish and wildlife bounty will require continued focus on water and sediment quality, improved enforcement to minimize impacts to habitats and wildlife, and restoration and protection of habitats and food sources.

MANAGEMENT OBJECTIVES

- Increase the number, diversity and health of the bay's fish and shellfish populations, and restore a self-sustaining bay scallop population.
- Restore and protect wildlife habitats and food sources, and promote regional wildlife habitat planning.
- Minimize physical impacts to bay wildlife and habitats.

SUMMARY OF ACTIONS FOR FISH & WILDLIFE

[Reader note: Many of the strategies to support fisheries and wildlife focus on water quality and bay habitats. Please refer to the draft bay action plans addressing Water Quality and Bay Habitats for these related actions.]

FW-1 Improve on-water enforcement of environmental regulations.

FW-2 Establish and enforce manatee protection zones.

FW-3 Support restoration of the bay scallop.

FW-4 Improve public awareness of hazards to bay wildlife.

FW-5 Assess the need to investigate the cumulative impacts of power plant entrainment on bay fisheries.

FW-6 Continue and expand the Critical Fisheries Monitoring Program.

Increase Enforcement of Environmental Regulations on the Bay

FW-1

ACTION:

Increase enforcement of environmental regulations on Tampa Bay by obtaining support for increased allocation of Salt Water Fishing License revenues to marine law enforcement.

BACKGROUND:

Efforts by the Tampa Bay National Estuary Program (NEP) to protect Tampa Bay's diverse fish and wildlife resources have focused largely on establishing optimum water quality and habitat environments. But increased enforcement of existing environmental regulations to minimize impacts associated with fishing, boating and foot traffic in bird rookeries, is also a key priority of the Program's strategic blueprint for the bay.

When the Salt Water Fishing License Rule was enacted by the state in 1989, anglers and local communities alike expected it to be a boon for local marine enforcement. The rule was established to identify and collect a user fee from saltwater anglers for the conservation and management of fishery resources. It stipulates that **marine research** and **marine enhancement/habitat restoration** shall each receive *not less than 30 percent* of the revenues collected, and that *no more than 30 percent* be allocated for marine law enforcement. Remaining revenues are split among the Marine Fisheries Commission (2.5 percent), administration (5 percent), and a state environmental education trust fund (2.5 percent).

In fact, statewide allocations for marine enforcement have averaged about 20 percent over the past five years, which is two-thirds of the 30 percent maximum allowed by law and anticipated by many supporters of the bill. Despite allocations statewide, five fewer marine patrol officers are assigned to the Tampa Bay district today than when the Rule was enacted in 1989.

Overall, the state has collected more than $68 million since the Salt Water Fishing License Rule was enacted. Of $11.8 million in revenues collected from salt water fishing licenses and special stamps statewide in FY 93-94, about 17 percent or $2.3 million was allocated by the Florida Department of Environmental Protection (FDEP) to the Florida Marine Patrol for statewide law enforcement. It is not known how much of that allocation came back to the Tampa Bay region (District IV, Florida Marine Patrol*), which contributed more than $1.4 million in revenues that year.

District IV's budget has increased by only about 5 to 10 percent annually since the passage of the Rule, mostly to compensate for increasing fuel prices, and declined in FY 94-95. Requests for additional Marine Patrol officers have not been granted. Some suspect that general revenues for the Florida Marine Patrol have been depleted as salt water fishing license revenues have been established — a "lottery syndrome"

FW-1

that results in few or no net increases in available funding to address resource needs.

The Florida Marine Patrol, a part of the state's Division of Law Enforcement, enforces state saltwater fishing regulations, boating safety rules and other wildlife and habitat protection measures. It also is the first line of defense in emergencies such as marine accidents and hurricanes, and employs a select number of special environmental enforcement officers to investigate land-based environmental crimes such as illegal dumping.

Enforcement needs are growing on Tampa Bay, which has one of the lowest ratios of marine patrol officers per registered boats—only 1-2 officers per shift per county for nearly 100,000 registered recreational boats. Local municipal marine enforcement units pick up the slack in some counties, but cannot provide the coverage needed to effectively monitor the 400-square-mile bay and adjoining Gulf coastline, according to local Marine Patrol officials. Enforcement needs have increased further with the recent passage of the marine net ban.

* District IV, which includes Tampa Bay and Sarasota Bay, stretches north to Levy County, south to Sarasota County and east to Polk and Highland counties.

STRATEGY:

This strategy calls for a review of saltwater fishing license revenue expenditures for marine law enforcement to secure additional marine patrol officers for Tampa Bay, and possible revisions to the state Salt Water Fishing License Rule to require a minimum allocation for marine law enforcement.

STEP 1 Evaluate allocations and expenditures of revenues collected through the Salt Water Fishing License, as well as general revenue and other related expenditures by the FDEP marine law enforcement statewide. The Agency on Bay Management (ABM) has requested and received information about these revenues, and ABM and NEP may be developing a formal position on this issue in the near future.
Responsible parties: ABM, TBNEP, FDEP

STEP 2 Seek FDEP support for the additional allocation of revenues to marine law enforcement officers in Tampa Bay. Additionally, NEP may consider a formal legislative request to require that a minimum percentage of Salt Water Fishing License revenues be directed to marine law enforcement.
Responsible parties: ABM, TBNEP, FDEP

SCHEDULE:

All steps will be initiated in 1996.

COST:

This action calls for a reallocation of existing funds, rather than new expenditures, to address environmental enforcement needs.

EXPECTED BENEFITS:

Increased enforcement of the bay's fisheries and environmental regulations will improve protection of fish and wildlife, as well as the habitats they depend upon. Efforts to bolster enforcement also send a message to resource users and anglers that existing regulations are important, and that the quality of the public's natural resource won't be sacrificed for the illegal actions of a few.

MONITORING ENVIRONMENTAL RESPONSE:

Florida Marine Patrol can provide information annually on enforcement actions and associated benefits to the resource. District IV is encouraged to provide this information in the State of the Bay report published annually by the ABM.

REGULATORY NEEDS:

Revisions to the state Salt Water Fishing License Rule.

RELATED ACTIONS:

BH-8

* Revenue and salt water fishing license data provided by FDEP, August 1995

Establish and Enforce Manatee Protection Zones

FW-2

ACTION:

Officially designate through local ordinance or state rule 10 manatee protection zones in Tampa Bay. Encourage the use of boat propeller guards outside designated manatee protection zones.

BACKGROUND:

Research continues to bolster evidence that Tampa Bay is an important year-round or seasonal home to many endangered manatees. In fact, more than 200 of the estimated 1,800 manatees remaining in the state, or one-sixth of the Florida Gulf Coast population, seek refuge in the winter at the warm-water discharges surrounding the bay 's power plants.[1] Additionally, the bay's seagrass meadows and numerous natural and manmade fresh water sources provide critical feeding and gathering areas for manatees throughout the year.

Although several no-wake areas were established in the bay for boater safety, only one, a protected area in St. Petersburg's Coffeepot Bayou, was created primarily to protect manatees. Increases in manatee deaths associated with propeller strikes or collisions reinforce the need for more protective measures in Tampa Bay. Manatee deaths in Tampa Bay and adjacent coastal waters have risen from an average of 4.1 manatees a year between 1976 and 1985, to an average of 10.1 manatees a year from 1986 to 1994. Of the 141 manatee deaths verified in the bay area from 1976 to 1994, 29 (17 percent) died from collisions with watercraft.[2]

The Florida Department of Environmental Protection's (FDEP's) Florida Marine Research Institute (FMRI) and local manatee experts in academia have identified 10 areas of the bay where manatees would benefit from increased protection, based on the best available manatee population and distribution data. The areas are important as either winter refuges from cold water, seagrass feeding areas, sources of fresh water, or migration routes. The recommended zones are:

- warm-water outfalls of Florida Power Corporation's (FPC's) Bartow and Tampa Electric Company's (TECO's) Port Sutton power plants (winter sanctuaries)
- Culbreath Bayou in Tampa (seagrass beds and fresh water source)
- Anna Maria Sound near Perico Island (seagrasses)
- lower Manatee River near Palmetto (fresh water and seagrasses)
- upper Braden River near Bradenton (fresh water source)
- Hillsborough River near Sulphur Springs (fresh water)
- Upper Terra Ceia Bay near the U.S. 19 Bridge (seagrasses)
- Terra Ceia Bay near the wastewater treatment plant discharge in Palmetto (fresh water)
- the mouth of the Little Manatee River up to E.G. Simmons Park (seagrass beds)

- the Rocky Point area, southwest side of the Courtney Campbell Causeway (seagrass beds)

Designation of the zones could be done unilaterally by local governments, or in conjunction with rules developed by the FDEP. Once designated, maximum boating speeds and entry restrictions would be put into place for the zones. The limits might require boaters to travel at idle speeds year-round within the zones, and forbid boat entry entirely during certain times of the year such as winter, when large numbers of manatees congregate in just a few small areas. The restrictions would be periodically re-evaluated and adjusted as needed, based on updated manatee population data. Consequently, continued research into manatee movements, habitat requirements and mortality should continue.

The Florida Marine Patrol (FMP) and local marine law enforcement units would enforce the restrictions in the manatee zones. However, the amount of money allocated to FMP activities in the Tampa Bay area currently is not sufficient to ensure adequate enforcement, thus this action also proposes additional funding for the FMP through the existing Salt Water Fishing License to compensate for any increased needs. Enforcement also could be enhanced through public education, as well as citizen monitoring and reporting of speed violations.

Recognizing that manatees travel great distances and will not always remain within the protected zones, this action also encourages boaters to install special cage-like guards on their propellers to avoid causing propeller injuries to manatees outside the protected areas. These guards, which now are manufactured commercially and cost about $100 each, also can protect the bay's seagrasses from propeller damage.

STRATEGY:

STEP 1 Hold a joint meeting of the Tampa Bay NEP and the Agency on Bay Management, including a presentation from FMRI, to discuss the justification and ramifications of establishing the proposed manatee protection zones. These groups should make a recommendation on implementation to the NEP's Policy Committee.
Responsible parties: Tampa Bay NEP, Agency on Bay Management (ABM), FDEP/FMRI

STEP 2 Implement recommendations from Step 1.
Responsible parties: FDEP, local governments

STEP 3 Increase funding for the Florida Marine Patrol in Tampa Bay (see Action FW-1) and local law enforcement marine units to ensure adequate enforcement of boating speed and entry restrictions within the manatee protection zones.
Responsible party: Florida Legislature (through Salt Water Fishing License revenues), local governments

STEP 4 Organize and train qualified volunteers to monitor and report speed or entry violations within the protection zones.
Responsible parties: FDEP, working with local environmental action groups such as Tampa BAYWATCH.

STEP 5 Continue ongoing manatee population and mortality studies in Tampa Bay. Reassess justification for the protection zones periodically based on monitoring data to determine the need for changes.
Responsible parties: FDEP/FMRI

STEP 6 Promote the use of propeller guards to avoid injuring manatees outside the protection zones.
Responsible parties: Tampa BAYWATCH, Florida Conservation Association, local boating and environmental groups and fishing clubs

SCHEDULE:

Steps 1-4 can be initiated in 1996, with appropriate rulemaking and financing in place in 1997. Step 6 also be can initiated in 1996, with demonstrations of the propeller guards to various boating and fishing groups. Step 5 is an ongoing project that should continue indefinitely.

COST:

Designation of manatee protection zones would involve administrative and noticing requirements, as well as posting of designated areas. However, gaining public and boater support for designation of the zones and associated boating restrictions is expected to be a staff-intensive effort. Step 3 could be accomplished with a greater allocation of revenues from the state Salt Water Fishing License, or legislative authorization of a law requiring local governments to transfer 25 percent of funds received in fines and penalties to the FDEP's FMP for those violations where arrests were made by FMP officers. The funds received from those transfers should be used exclusively for increasing enforcement capabilities of the FMP in the district generating the funds.

EXPECTED BENEFITS:

Designation of manatee protection zones will increase protection of manatees and vital seagrass habitats within Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

FDEP/FMRI currently monitors manatee abundance, distribution and mortality in Tampa Bay. These reports can be incorporated within the Tampa Bay NEP's Biennual Environmental Monitoring Report.

REGULATORY NEEDS:

Passage of local ordinances and/or state rules designating manatee zones. Legislative action also may be needed to ensure adequate funding for FMP and local enforcement of the restrictions.

RELATED ACTIONS:

BH-4, BH-7, FW-1, FW-4

[1] August 1995 data from Dona Banowitz, manatee statistics coordinator at FMRI

[2] Ibid.

Support Bay Scallop Restoration

FW-3

ACTION:

Support bay scallop restoration by assisting stocking, spawning and monitoring efforts.

BACKGROUND:

Improving water quality in Tampa Bay has created opportunities in the southern portion of the bay for recovery of the bay scallop, which all but disappeared from the bay in the 1960s. Experts suspect that bay pollution was a key factor in the collapse of this highly sensitive species.

Studies by the Tampa Bay National Estuary Program (NEP) indicate that bay water quality has improved to levels necessary to support the reintroduction of this mollusk. However, stock sizes are so depleted that seeding is needed to jumpstart a sustainable population.

To assist recovery, the Tampa Bay NEP has supported pilot projects by the University of South Florida (USF) to seed the bay with almost a quarter-million juvenile scallops raised in laboratories. Large seed stocks are necessary since natural predation and mortality of young scallops is high.

While improving water quality and observed growth and reproduction of caged scallops at several bay locations indicate that scallop restoration may be achievable, the Tampa Bay NEP also is conducting a study through the Florida Marine Research Institute (FMRI) to evaluate the effectiveness of existing stocking strategies. That study, due in January 1996, will help bay managers tailor and evaluate the effort.

Funding from the Program is now directed to the second phase of this effort, which has allowed USF to seed an additional 100,000 juvenile scallops with the help of citizen volunteers recruited along the bay. More than 50 waterfront residents in the southern portion of the bay have each adopted as many as 500 juvenile scallops, placed in "scallop condominiums" along docks until they spawn. A single adult may release as many as 500,000 eggs, but fewer than 5 percent are expected to survive to adulthood. Most adult bay scallops die shortly after spawning.

Other groups also are assisting in efforts to bring about return of the bay scallop. In August 1995, Tampa BAYWATCH directed a scallop air lift, with assistance from WFLA-TV, the Florida Marine Patrol and the Florida Conservation Association, transporting nearly 2,000 adult scallops by helicopter to Tampa Bay from the Steinhatchee River. The caged mollusks, expected to spawn this fall, have been placed at protected sites in Ft. DeSoto Park Aquatic Preserve.

FW-3

STRATEGY:

STEP 1 Continue support for the scallop stocking program, which is directed by USF. Phase 1, involving the seeding of almost 250,000 stock, and Phase 2, which placed an additional 100,000 juvenile scallops at waterfront docks in the southern portion of the bay, have been completed.

Pending a full program evaluation, Phase 3 would support placement of as many as two million additional scallops annually over a period of about five years.
Responsible parties: USF

STEP 2 Monitor the bay to assess trends in scallop recovery.

- Define monitoring objectives and evaluate the effectiveness of using citizens to meet these monitoring needs.
- Develop an alternative monitoring program if existing citizens-monitoring is deemed insufficient.

Responsible parties: FMRI (for monitoring objectives, evaluation of citizens monitoring), to-be-determined (for long-term monitoring) in 1996

STEP 3 Evaluate the effectiveness of existing stocking techniques in assisting bay scallop recovery, and provide recommendations to the Tampa Bay NEP by early 1996.
Responsible parties: FMRI in cooperation with USF

STEP 4 Fully evaluate the stocking program in Tampa Bay in 1997 to assess progress and initial efforts toward re-establishing a sustainable bay scallop population in the southern portion of the bay.

If a scallop population has not been re-established, and if monitoring and program evaluation fail to indicate a reasonable probability for success, determine whether the program should continue, or explore alternative techniques that may be more cost-effective. Provide recommendations to the Bay Management Coordinating Council by June 1998.
Responsible party: FMRI in cooperation with USF

SCHEDULE:

STEP 1 (Phase 1: 1992-1993) (Phase 2: 1994-1995) (Phase 3, pending evaluation of stocking techniques)

STEPS 2,3 Pending results of 1995 studies by FMRI

STEP 4 1997

COST:

Scallops costs for Phase 3, which is pending, are estimated at $.05 each, which includes administrative support and overhead. Placing 2,000,000 scallops annually

would cost about $100,000. Costs for monitoring and program performance review are to-be-determined.

FW-3

EXPECTED BENEFITS:

Recovery of this popular shellfish species, which depends on healthy seagrasses and favorable water quality conditions, may provide some of the most important evidence to date that Tampa Bay is on the course to recovery.

MONITORING ENVIRONMENTAL RESPONSE:

The bay will be monitored to track population trends, and sightings and data from commercial fishermen will be incorporated. Evaluations will factor in appropriate recovery lag time for population recovery.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

FW-6

Improve Public Awareness of Hazards to Bay Wildlife

FW-4

ACTION:

Improve public awareness of the hazards of marine debris, feeding and other human impacts to bay wildlife.

BACKGROUND:

Coastal environments are among the most popular recreation areas for people, but human activities can be detrimental to bay habitats and wildlife. Some activities that may cause harm include boating and the use of jet skis, propeller scarring of seagrasses, human and pet intrusion into bird and turtle nesting areas, wildlife feeding, and littering of bays and beaches with debris and monofilament fishing line.

Plastic bags and monofilament fishing line are among the most hazardous types of marine debris. Birds and marine animals, such as sea turtles and bottlenose dolphins, and seabirds that utilize coastal areas for feeding and nesting can become entangled in fishing line, causing injury or death. During a single coastal clean-up day, 36 miles of monofilament line were retrieved from 20 bird nesting islands by citizen volunteers in and around Tampa Bay. Ingestion of plastic bags or other marine debris also can kill wildlife.

Impacts to wildlife also are caused by people who feed them and by human intrusion into nesting sites. For example, dolphin or seabird feeding can cause injuries and create a dependency on humans for food. Human and pet intrusion into the bay's bird nesting colonies, and destruction of nests, also is a pervasive problem.

The strategy to improve public awareness about these impacts to wildlife focuses on placing educational signage in bayside locations where boaters, recreational fishermen, residents and tourists congregate—at fishing piers and public boat ramps. Signage also is needed to protect the bay's numerous bird rookeries.

The Tampa Bay National Estuary Program (NEP) also strongly supports continuation of the annual Florida Coastal Cleanup, sponsored by the Center for Marine Conservation.

STRATEGY:

STEP 1 Survey local and state governments to determine who is responsible for fishing piers and public boat ramps and their trash receptacles. Also, survey existing signage and the environmental messages they contain.
Responsible parties: Tampa BAYWATCH, Florida Department of Environmental Protection (FDEP)/Florida Marine Research Institute (FMRI), Center for Marine Conservation

STEP 2 Develop educational signage that can be affixed to trash receptacles or dock/sign posts. Signage will educate boaters/fishers about the adverse impacts to wildlife caused by marine debris, the feeding of wildlife, and other disturbances. Particularly at fishing piers, develop signage that discourages feeding birds, identifies the problems of monofilament fishing line and fishing line recycling options, and steps to release hooked/entangled birds.

Responsible parties: local governments, Tampa BAYWATCH, National Audubon Society, Pinellas Seabird Rehabilitation Center, FDEP/FMRI, Center for Marine Conservation

STEP 3 Install signage. Assure that pick-up of trash is timely, especially after weekends and holidays.
Responsible parties: local governments

STEP 4 Conduct annual cleanups at colonial bird nesting sites during the non-nesting season to remove monofilament fishing line and debris.
Responsible parties: Tampa BAYWATCH, National Audubon Society, U.S. Fish & Wildlife Service (USFWS)

STEP 5 Work with the USFWS and the National Audubon Society to develop and install signage, as appropriate, designed to protect bird rookeries throughout Tampa Bay from human intrusions.
Responsible parties: USFWS, National Audubon Society, Tampa BAYWATCH

STEP 6 Work with local "Adopt-a-Shore" coordinators to include fishing piers, docks and boat ramps as "adoptable" sites, and encourage their adoption and routine cleaning a minimum of three times per year.
Responsible parties: local Keep Florida Beautiful affiliates, Tampa BAYWATCH, Center for Marine Conservation

SCHEDULE:

All steps can be initiated in 1996.

COST:

Costs for the development and installation of signage are estimated at $300 per sign.

EXPECTED BENEFITS:

Increased public awareness of the harmful effects of marine debris, wildlife feeding and other intrusive activities.

MONITORING ENVIRONMENTAL RESPONSE:

The National Audubon Society monitors bird populations and mortality. FMRI records bottlenose dolphin and sea turtle strandings. Beach/bay cleanups coordinated by the Center for Marine Conservation, Keep Florida Beautiful affiliates, Tampa BAYWATCH and other partners track the amount of marine debris collected by volunteers at various sites throughout the bay.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

FW-1, FW-2

FW-5

Assess the Need to Investigate the Cumulative Impacts of Power Plant Entrainment on Bay Fisheries

ACTION:

Determine whether a comprehensive study to assess the cumulative impacts of multiple power plant operations on Tampa Bay fish populations is needed. If a study is warranted and shows cumulative adverse impacts, adjust plant operations and maintenance schedules as appropriate to reduce power plant entrainment.

BACKGROUND:

Currently there are five steam electric plants utilizing open-cycle cooling systems on Tampa Bay: Tampa Electric Company's (TECO's) Big Bend, Gannon and Hooker's Point facilities and Florida Power Corporation's (FPC's) Higgins and Bartow plants (currently, FPC's Higgins Plant in not operating). Open-cycle, or once-through, cooling is the most economical method of condensing steam from the turbines of steam electric plants. However, the volumes of ambient bay water used for this purpose, and the quantities of waste heat added to the bay as a result, can be significant.

Although the discharge of heated bay water from the power plants into the subtropical Tampa Bay estuary produces temperature changes that have demonstrable impacts (subject of a Florida Department of Environmental Protection [FDEP] study), another problem results from the capture of planktonic eggs and larval fish and shellfish in the cooling-water intakes of the power plants. This process, called entrainment, can lead to high rates of mortality from physical and thermal stress. Estimates from power plant monitoring in the early 1980s project that 274 billion fish eggs and 83 billion fish larvae are entrained annually in Tampa Bay. However, in the absence of sufficient baseline information on current stock sizes, natural survival rates and losses caused by habitat degradation, fishing pressure and other factors, it is extremely difficult to assess the impact of power plant entrainment on overall bay fisheries populations.

Under the current regulatory system, each power plant must obtain operating permits from the Environmental Protection Agency (EPA) and the FDEP. But the permit review process only examines the localized impacts of each individual plant; the cumulative impacts of multiple facilities on the fish populations of the bay are rarely evaluated or considered.

Conducting a comprehensive study of cumulative impacts is an expensive and lengthy task, and could be fraught with legal complications. There currently is no requirement in the state rules governing power plants that cumulative impacts be addressed, and initiating such a study in Tampa Bay may necessitate a rule change. Additionally, the lack of suitable background information of fish populations, and the effects of other human-related impacts such as fishing, may make a study on entrainment inconclusive. Finally, the cost of a cumulative impacts study would be substantial, as would the installation of best available technologies to reduce the capture of eggs and larvae.

Entrainment and impingement studies financed by power companies in the Hudson River exceeded $2 million a year for monitoring and $1 million for analysis. And while some techniques to decrease entrainment are relatively low in cost (i.e., TECO's installation of fine-mesh screens on intake pipes at its Big Bend plant), other solutions such as the construction of cooling towers to reduce the need for bay water can cost hundreds of millions of dollars.

Thus, the need to assess the cumulative effects of entrainment must first be demonstrated and the possible benefits of such a study balanced against its cost implications for utilities and their customers. This action seeks to develop a consensus on whether further research into power plant entrainment is warranted.

STRATEGY:

STEP 1 Conduct a joint workshop involving regulators, fisheries scientist and representatives of the electric utility industry to evaluate the need, costs, cost/benefit and ramifications of conducting a study of the cumulative impacts of entrainment.
Responsible parties: EPA, FDEP, Florida Marine Research Institute (FMRI), local power plant representatives

STEP 2 (Contingent upon Step 1) If a study is deemed necessary and justified, workshop participants should design a scope, identify potential data needs and funding sources, and conduct a comprehensive entrainment study. Based upon the results of that investigation, a plan to minimize entrainment through measures such as adjusting the operating or maintenance schedules of power plants for periods of peak plankton and juvenile abundance should be developed.
Responsible parties: EPA, FDEP, FMRI, local power plant representatives

STEP 3 If warranted, amend state and federal rules to require a cumulative impact review for all future power plant siting and operating permits located on Tampa Bay National Estuary Program (NEP) waterways.
Responsible parties: EPA, FDEP

SCHEDULE:

Step 1 can be accomplished in 1996. Step 2, if necessary, can be initiated in 1997. Step 3 can be initiated following the completion of the study, if the results of the study show a need for further action to reduce entrainment.

COST:

Step 1 entails only administrative costs. Step 2, the comprehensive cumulative impacts assessment, will likely involve extensive field, lab work and data analysis that could cost from $1 million to $5 million. The costs of remedial action to reduce entrainment have not yet been determined, but are expected to be substantial and should be evaluated in detail.

FW-5

EXPECTED BENEFITS:

Enhanced fish stocks in Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

FDEP is the state agency responsible for power plant siting and permitting. EPA has authority over power plant siting and operation permits. Monitoring of fish stocks is conducted by the FMRI. Results of any entrainment study, and subsequent actions to reduce the problem, will be reported in the Tampa Bay NEP's Biennial Environmental Monitoring Report.

REGULATORY NEEDS:

Possible amendments to the federal Water Pollution Control Act (Sections 316a, 316b and 402) and the Florida Electric Power Plant Siting Act (Sections 403.501 through 403.517, F.S.).

RELATED ACTIONS:

FW-6

Continue and Expand the Critical Fisheries Monitoring Program

FW-6

ACTION:

Continue the state's Critical Fisheries Monitoring Program and expand it to include oligohaline portions of the bay's tributaries.

BACKGROUND:

Tracking the long-term health of bay fisheries is an important component of the ongoing monitoring program being developed for the Tampa Bay management plan. Recent water quality improvements in the bay, along with new regulations on commercial and recreational fishermen, make a regular assessment of fisheries trends even more critical for bay managers. The fisheries surveys will serve as a barometer for the success of management efforts, and provide an early-warning system to alert managers to potential problems that may require additional actions.

Currently, the Florida Department of Environmental Protection's (FDEP's) Critical Fisheries Monitoring Program (CFMP) provides the most comprehensive sampling of fisheries in the bay. This program, conducted by the FDEP's Florida Marine Research Institute (FMRI), employs stratified random and fixed-station monitoring to assess the abundance and distribution of fish and macroinvertebrates in Tampa Bay. The stratified random sampling divides the bay into specific habitat types (i.e., seagrasses, deep-water, riverine), which are sampled at varying locations twice a year, usually in the spring and fall and using gear suited to that particular bottom type. The fixed-station monitoring samples 24 stationary sites scattered throughout the bay once a month, using a single type of fishing gear. Both survey methods record the number, species and length of fish and invertebrates captured, as well as the temperature and salinity of the water.

The program is financed by revenues from the state's Salt Water Fishing License. More than $3.2 million was allocated statewide to CFMP in fiscal year 1994-1995, with about $700,000 of that dedicated to sampling in Tampa Bay.

While the monitoring attempts to be as thorough as possible, funding and manpower limitations mean that some areas of the bay potentially important to fish recruitment and survival are not surveyed. For example, of the bay's myriad tributaries, only the Little Manatee, Manatee and Alafia rivers are sampled. The Hillsborough and Palm rivers and numerous tidal creeks in Upper Tampa Bay, such as Double Branch and Rocky Creek, are not assessed. The existing program could be expanded to include more oligohaline areas, using cost-effective fixed-station monitoring. Additionally, a quick visual examination of fish and invertebrates for the presence of visible lesions could be added to assist bay managers in tracking the long-term movement of toxic contaminants through the bay system.

FW-6

STRATEGY:

STEP 1 Evaluate the need and costs to expand Critical Fisheries Monitoring into small tributaries and oligohaline areas, and identify candidate tributaries.
Responsible parties: Tampa Bay National Estuary Program (NEP) and FDEP/FMRI

STEP 2 Require field scientists conducting the sampling to perform a quick visual examination for lesions on the fish and invertebrates they collect, and record the species, lesion type and location of the lesions, as well as the location the affected fish were caught.
Responsible parties: FDEP/FMRI

STEP 3 Incorporate results of the CFMP in Tampa Bay in the Biennial Environmental Monitoring Report, and redirect sampling efforts as needed.
Responsible parties: FDEP/FMRI, Tampa Bay NEP

SCHEDULE:

The Tampa Bay NEP and FDEP/FMRI will evaluate the feasibility of expanding fisheries sampling and develop a formal recommendation by April 1996. The detection of lesions indicative of toxic contamination could begin in 1996. The first expanded sampling could begin in 1997.

COST:

The estimated annual cost for the current Tampa Bay sampling program is $700,000. The cost of sampling six or seven additional sites is estimated at $50,000, based on salary estimates for two additional full-time staff personnel. Financing sources for additional sampling (if needed) could be pursued through a change in FMRI's current allocation from the Salt Water Fishing License revenues or identification of new revenue sources.

EXPECTED BENEFITS:

Implementation will provide more comprehensive information about the status and trends of bay fisheries, and will provide managers with an early-warning system to detect areas that may need additional management action.

MONITORING ENVIRONMENTAL RESPONSE:

FDEP/FMRI currently monitors the health and abundance of fisheries within Tampa Bay. These reports can be incorporated in the Tampa Bay NEP's Biennial Environmental Monitoring Report for the bay.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

TX-1, TX-3, BH-1, FW-1, FW-3, FW-5

What You Can Do...

To Protect and Support Bay Fisheries and Wildlife:

As an angler:

- Practice catch and release. Keep only fish of legal size, which you will use.
- Properly dispose of or recycle used monofilament fishing line and removed snagged fishing line you come upon while fishing.

As a boater:

- Observe speed limits and no-wake zones to reduce turbidity in the water and to avoid collisions with manatees.
- Bring all trash, sewage and other shipboard waste back to shore for proper disposal.
- Avoid boating near bird rookeries during the nesting season to keep from disturbing birds and their young.
- Don't feed seabirds. Many injuries to birds, especially pelicans, occur when they are hooked while pursuing bait or fish on a line.
- Don't feed marine mammals; it interferes with their natural behavior and is illegal.
- Boating safety instructors can incorporate bay-protection information into existing programs to raise awareness of the bay's inhabitants and resources.

As a neighborhood, civic group member or educator:

- Participate in a coastal cleanup and Adopt-A-Shore programs to reduce litter along the bay.
- Learn more about the bay's inhabitants by requesting materials and information from a bay stewardship organization, such as the Center for Marine Conservation, Tampa BAYWATCH, the Agency on Bay Management, Florida Marine Research Institute and the Tampa Bay National Estuary Program. For information on the bay's fabulous bird colonies, contact the National Audubon Society's Tampa Bay Sanctuaries.
- Incorporate a Tampa Bay curriculum into core school lessons. Teaching materials are available from Hillsborough, Pinellas and Manatee county

school systems and from local newspaper-in-education programs. Also contact the Florida Aquarium Learning Lab.

- Take an educational tour of the Lowrey Park Zoo, the Suncoast Seabird Sanctuary, the Florida Marine Research Institute, the Clearwater Marine Science Center, The Florida Aquarium or Mote Marine Laboratory in nearby Sarasota.

As a business person:

- Boat rental and sales companies, travel agencies, hotels and restaurants and real estate agencies can distribute materials that promote environmentally friendly bay recreation. Contact local and state environmental agencies for brochures, booklets and other materials.

Portions of What You Can Do are reprinted with permission from the Sarasota Bay National Estuary Program.

Dredging & Dredged Material Management

Coordination among local ports in long-term planning for dredging and dredged material disposal is essential in Tampa Bay to minimize environmental impacts and maximize cost-sharing opportunities and beneficial uses of spoil material.

With an average depth of only 12 feet, regular dredging of the bay is necessary to maintain safe passage through shipping channels serving the bay's three major seaports, its shore-based power plants and industries, and recreational boaters. But dredging can take a toll in areas of immediate impact, clouding the water, smothering bottom life and releasing potentially harmful substances that bind to fine particles in sediments.

Disposal of dredged material presents another important challenge. Deepening of the 40-mile main shipping channel in the 1970s required the removal of almost 100 million cubic yards of sediment. Maintenance dredging to support the bay's three commercial ports scoops another 1 million cubic yards of material from the bottom of the bay each year—enough to fill about 100,000 dump trucks. Most material is generated by the U.S. Army Corps of Engineers to maintain the main ship channel, which serves the ports and numerous port-related industries.

Not yet reflected in any long-term plans are dredging and disposal needs of smaller industrial ports and the extensive network of finger-fill canals serving residential communities. These needs must be assessed and recognized in developing environmentally sound, long-term management strategies.

Currently, most dredged material from the upper segments of the bay is deposited on two large spoil islands located in Hillsborough Bay and managed by the Tampa Port Authority. These sites are expected to serve this sector's disposal needs for another decade. Officials are exploring the feasibility and options for extending the life of the islands another 15 years by raising the dikes to contain more material. Beyond then, long-term disposal needs for upper Tampa Bay are unresolved.

There are no long-term plans for disposal of material from the southern half of the main shipping channel. Although EPA has approved a dumping site 18 miles out into the Gulf of Mexico, this site is expected to accommodate material from only a small portion of the lower part of Tampa Bay. Shipping distances and associated costs currently preclude use of this site to accommodate the vast quantities of material generated in the bay's upper sector surrounding the Port of Tampa.

DR

Coordination of individual port plans by the U.S. Army Corps of Engineers, which oversees and conducts most of the major dredging projects on Tampa Bay, will be an important first step in effective long-term management. Representation from other maritime, business, utility and environmental interests also is important to assure a compatible coexistence in the future between protection of the bay ecosystem and continued growth of the ports and industries dependent upon the bay's shipping channels.

Momentum for cooperative planning already is building thanks to a recent state-financed study by the port authorities that explore areas of mutual concern and ways to increase cooperation. Among the more than a dozen proposals approved by the bay's three port authorities is an effort to establish and maintain shared dredged disposal sites, an action endorsed by the NEP in this plan.

The June 1995 report was prepared by an independent consultant and proposes other priority measures, such as the establishment of a vessel tracking system for the bay, permanent funding for the PORTS navigational network, and the development of an oil spill model.

MANAGEMENT OBJECTIVES

- Improve planning and coordination for dredging and for long-term spoil disposal.
- Minimize environmental impacts from dredging and spoil disposal.
- Maximize beneficial uses of dredged material.

SUMMARY OF ACTIONS FOR DREDGING & DREDGE MATERIAL MANAGEMENT

DR-1 Develop a long-term, coordinated strategy for dredging and dredged material management for Tampa Bay.

DR-2 Develop dredge disposal plans for residential canals.

Develop a Long-Term, Coordinated Strategy for Dredging and Dredged Material Management for Tampa Bay

DR-1

ACTION:

Develop a long-term management plan that coordinates individual dredging and dredged material management plans of the bay's three major seaports and the utilities and industries that rely on the bay's navigational channels.

BACKGROUND:

Tampa Bay serves three major seaports with independent, tax-supported port authorities. Various utilities and industries also share the bay's 40-mile-long deepwater transportation highway. This action calls for the development of a long-range plan to coordinate dredging and dredged material management for Tampa Bay to maximize shared disposal and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities in the future. The U.S. Army Corps of Engineers (USACE), as the major coordinator and sponsor of dredging projects in the bay, is the logical choice to spearhead this comprehensive planning effort.

On average, about 13 million gallons of petroleum products pass through Tampa Bay each day on tankers and barges carrying fuel for power plants, jetliners, and automobiles. Another 18 million tons of fertilizer is exported from Tampa Bay each year to ports around the world, along with vast quantities of other cargoes. Indeed, waterborne commerce is a cornerstone in the region's economy, contributing an estimated $5 billion per year.

With an average depth of only 12 feet, regular dredging of ship channels and berths is needed to serve these seaports and industries. Ship channels, which are dredged to depths of up to 43 feet, must be cleared periodically to remove silty sediments.

Coordinated planning among ports and area industries will help ensure that the most environmentally sensitive and cost-effective strategies are pursued, especially in regard to long-range dredge material disposal, for which there are only limited existing plans. Cooperative planning also enables bay managers to investigate options for beneficial uses of spoil material, ensure minimal impacts to nesting birds on dredge disposal islands, and explore best available technologies to reduce sediment resuspension during dredging.

In fact, local port authorities already have begun working together to examine mutual concerns and foster cooperation. Results of a study conducted for Tampa Bay's port authorities and the Florida Department of Transportation in 1995 cited the establishment and maintenance of shared dredge disposal sites as one of 13 recommendations adopted by the participants.

The Tampa Port Authority (TPA) estimates that about 840,000 cubic yards of material

will be generated annually to maintain the upper part of the main ship channel, which extends south to the Gadsen Point widener. Associated long-term disposal needs exceed the current 8.5-million- cubic-yard capacity of the Port Authority's two spoil islands in Hillsborough Bay. TPA has proposed to meet the shortfall by raising the islands' dikes from 20 to 30 feet, a strategy being reviewed by the Florida Department of Environmental Protection (FDEP) and the USACE, which issue and periodically reassess the port's maintenance dredging permit.

Maintenance dredging of the main ship channel between Gadsen Point and the mouth of Tampa Bay is expected to generate another 350,000 cubic yards of material a year. Dredged material from the lower segment of that channel, below CUT B, will be discarded at a recently-approved ocean disposal site 18 miles from the bay's entrance. There are no long-term plans for disposal of the remainder of the material.

Port Manatee's development blueprint includes plans to enlarge its turning basin and widener, and dredge its harbor channel to maintain a 40-foot mean low water depth. A total of about 3.1 million cubic yards of material will be removed for these projects in order to keep pace with the anticipated shoaling of some 220,000 cubic yards of material each year. To avoid impacts to nearby Aquatic Preserves, the Port Authority will contain all construction and maintenance dredging material at several upland sites on its property. However, the Port Authority has not yet analyzed whether these upland sites can handle the entire 25-year payload that is anticipated.
The Port of St. Petersburg, the smallest of the bay's three major seaports, has no existing long-term dredged material disposal plans, relying instead on land disposal for its sporadic dredging needs. Also unknown is how private facilities plan to dispose of their dredged material, an issue which should be addressed in long-term planning scenarios.

STRATEGY:

This strategy focuses on establishing an advisory committee to support development and implementation of a long-range plan to coordinate dredging and dredged material management for Tampa Bay, and highlights additional planning needs that must be addressed to complete this coordinated strategy.

STEP 1 Establish a committee directed by the Corps of Engineers and comprised of the bay's three major seaports, port-related industries and utilities, and major commercial/private ports, as well as FDEP, EPA, local governments and environmental interests including representatives of Egmont Key State Park, for the purposes of:

- coordinating existing port and industry plans for dredging and dredged material management, and developing a long-range strategy that integrates these plans for environmental as well as economic benefits
- exploring beneficial uses for spoil material

- investigating and encouraging best available technologies to reduce sediment resuspension during dredging and for dredged material disposal and containment

Responsible parties: U.S. Army Corps of Engineers, in cooperation with local port authorities

STEP 2 Develop a 25-year plan for disposal of maintenance material removed from the southern segment of the main ship channel from the Gadsen Point widener to the western end of Cut A, at the mouth of the bay. The U.S. Army Corps of Engineers (USACE) should develop the plan in consultation with the advisory committee established in step 1. Planning should incorporate relevant elements of the Corps' former Long-Term Management Strategy (LTMS) procedures for dredging management.
Responsible parties: USACE, in cooperation with the step 1 advisory committee

STEP 3 Confirm the ability of Port Manatee's existing and future upland spoil disposal sites to accommodate spoil material from channel and berthing areas for the next 25 years. Amend the Manatee County Port Authority's Master Plan to reflect the results of that analysis.
Responsible parties: Manatee County Port Authority

STEP 4 Develop and adopt a long-range plan for disposal of dredged material from the Port of St. Petersburg and its channel.
Responsible parties: St. Petersburg Port Authority

STEP 5 Determine status of long-term spoil disposal plans for privately maintained shipping channels in the Bay, particularly channels serving Big Bend and other utilities.
Responsible parties: Advisory Committee, Step 1

SCHEDULE:

Establishment of a committee to oversee coordination of the bay's dredging and dredged disposal planning could be accomplished in 1996, pending federal approval and funding for the Corps to direct these efforts.

COST:

Step 1 involves administrative costs on the part of USACE. Costs to implement step 2 are estimated at $150,000, with possible cooperative funding from the Tampa Bay port authorities, Army Corps of Engineers and the Florida Department of Transportation. Estimates for steps 3 and 4, which would be funded by responsible port authorities, are in development. Implementation and costs associated with step 5 are dependent on recommendations of the committee.

EXPECTED BENEFITS:

Coordinated, long-range planning will help to minimize impacts to bay habitats and water quality from dredging and dredged material disposal and maximize beneficial

DR-1

uses of spoil material, while fostering cooperation that is likely to yield cost-savings for taxpayer-supported port authorities. Removal of muck from channels also can help to improve water quality in localized areas.

MONITORING ENVIRONMENTAL RESPONSE:

The Army Corps of Engineers will be responsible for monitoring progress on long-range planning and implementation.

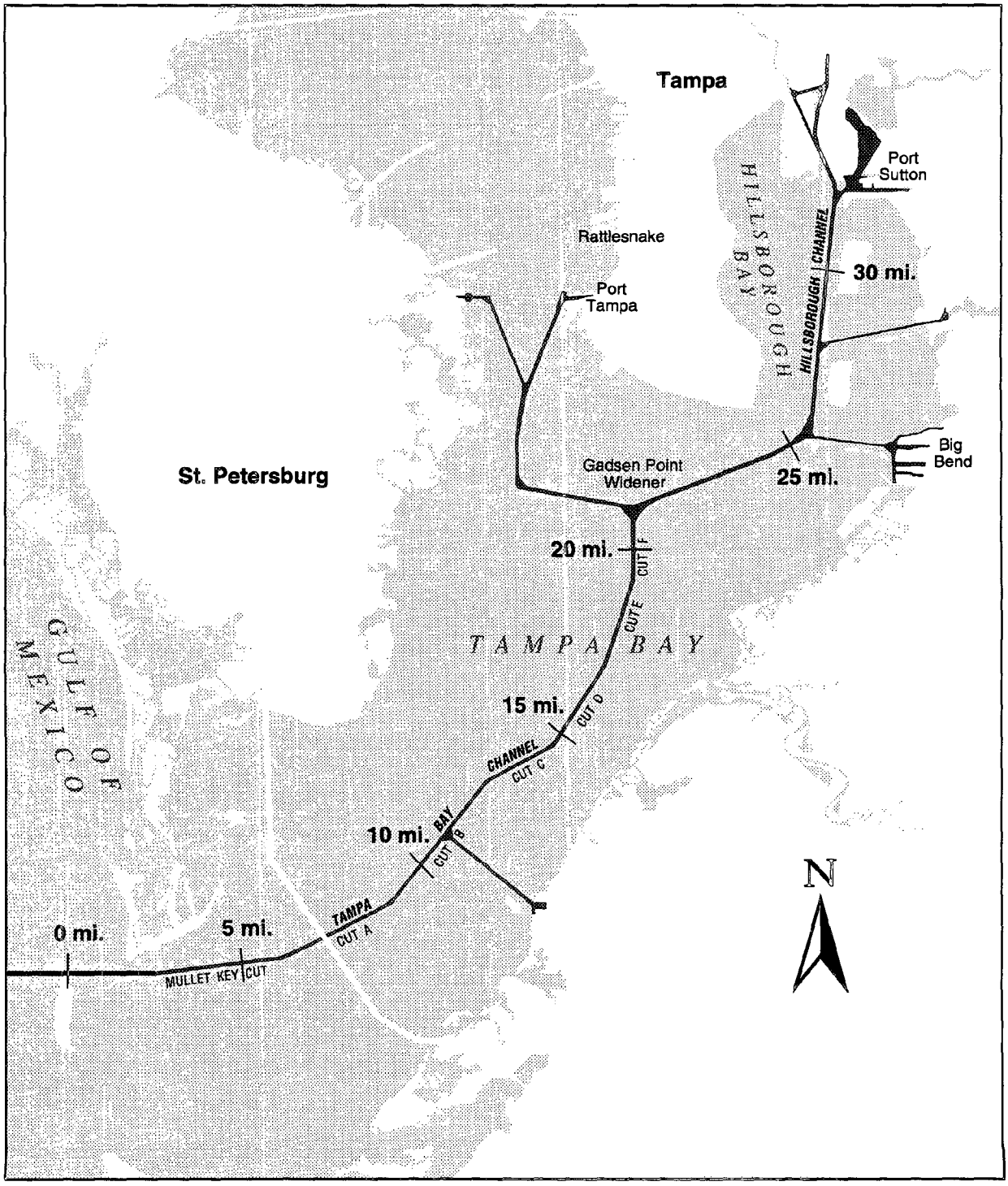
REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

DR-2

Tampa Bay Shipping Channels



SOURCE: TAMPA PORT AUTHORITY

Develop Dredge Disposal Plans for Residential Canals

DR-2

ACTION:

Assess the long-term spoil disposal needs associated with maintenance dredging of existing residential canals and commercial marinas; and develop a plan to address those needs.

BACKGROUND:

Shoreline developments featuring finger-fill canals are a prominent fixture in Tampa Bay. Construction of most of these canals occurred in the 1950s and 1960s, and many now are experiencing severe siltation that, in some cases, renders them unusable by adjacent landowners who purchased the property specifically for its boating access. Silting of commercial and private marinas also is a widespread problem throughout the bay.

These dead-end canals and marina basins often are plagued by poor water quality caused by a lack of tidal flushing, the build-up of oxygen-deficient sediments, and contamination with nutrients, petroleum hydrocarbons, and toxic chemicals.

Routine, coordinated dredging of these areas could improve water quality in these canals, as well as preserving the cumulative economic value of existing residential and commercial waterfront property. However, costs to dredge residential canals and dispose of dredge materials will be borne largely, if not exclusively, by the waterfront residents that are direct beneficiaries of improvements.

Currently, maintenance dredging of privately owned waterways is rarely done because local governments are reluctant to assume the financial responsibility for the dredging and there are no federally or state-approved disposal sites for the dredge spoil. In addition, the high costs of the dredging (removing 20,000 cubic yards of muck from a 200-yard long canal may cost as much $200,000) put the work beyond reach of many private residents and homeowner groups. But failing to address this chronic problem may compound the environmental damage to canals, as frustrated homeowners resort to propeller dredging, or other undesirable methods, to keep their canals navigable.

In the Tampa Bay area, only Manatee County performs maintenance dredging of residential finger canals and other private navigation channels within its jurisdiction. This is because Manatee County historically has required developers to deed the canal bottoms to the county as rights-of-way. Homeowners here petition the county to have their canal dredged at the residents' expense, usually through a special assessment.

This action calls upon local governments to assess dredging needs for residential canals and marine basins, and to develop long-term plans for the disposal of dredge materials from these areas. A key effort will be to identify landside disposal sites that can accommodate this material. If successful, the planning effort may result in a streamlined permitting process for homeowners who do wish to dredge their canals.

To obtain this faster permit, the applicants could be asked to enhance or replace portions of hardened seawalls along the canal sides with more environmentally friendly materials, such as rip-rap, vegetation, or terraced blocks that help support vegetation and sealife (see Action BH-8).

STRATEGY:

STEP 1 Conduct a simple water-depth survey of canals and marina basins in the bay, and interview waterfront residents, to assess the severity of siltation in those waterways, and prioritize dredging needs.
Responsible parties: local governments

STEP 2 Incorporate dredge disposal projections for finger canals and marina basins into long-term dredge material management plans, and identify land-side disposal sites to accommodate the material.
Responsible parties: local governments

STEP 3 Identify funding mechanisms to finance maintenance dredging of private waterways. Options include special assessments and user fees.
Responsible parties: local governments

SCHEDULE:

All steps can be initiated in 1997, with appropriate funding.

COST:

Costs to perform dredging and removal of spoil to an approved site will be borne in some fashion by the adjacent property owners who will benefit from the work, and those costs are likely to be substantial. Conducting a simple water-depth survey to determine depths and muck layers in canals and marina basins throughout Tampa Bay is estimated to cost from $50,000-$100,000, depending on level of detail. Identifying upland disposal sites to contain the material may require the purchase of land or land easements. Step 3 involves administrative costs only.

EXPECTED BENEFITS:

The primary beneficiaries of this action are waterfront homeowners, who also will pay for any dredging and dredge material disposal. Routine dredging of dead-end canals and marina basins may also improve local water quality.

MONITORING ENVIRONMENTAL RESPONSE:

The impacts of dredging projects in these canals will be monitored as a result of permits issued for these activities.

REGULATORY NEEDS:

Local governments may need to enact rules or special taxing districts to establish a funding mechanism for maintenance dredging of private waterways.

DR

What You Can Do...

About Dredging and Dredged Material Management

As a bay user:

- Encourage the U.S. Army Corps of Engineers and local port authorities and to develop a coordinated and comprehensive plan for dredging and long-term disposal of dredged materials.
- Report dredging activities you suspect may be occurring illegally.

Spill Prevention & Response

Installation of an integrated vessel tracking system to guide large ships through Tampa Bay ranks as one of the highest priorities in the prevention of oil and hazardous materials spills.

On average, about 14 million gallons of oil and other hazardous materials pass through Tampa Bay each day on huge ships the size of modern skyscrapers. These ships traverse a long, relatively narrow shipping channel that leaves little room for navigational errors.

In addition, billions of gallons of hazardous materials and chemicals—including petroleum products, phosphoric and sulfuric acid and anhydrous ammonia—are stored in tanks at various ports and industries along the bay. While spill prevention efforts are essential for all hazardous materials, they are particularly significant in dealing with highly toxic, water-soluble compounds such as anhydrous ammonia or sulfuric acid. A spill of these materials could have a severe, but relatively short-term, impact on the bay's fish and wildlife, as well as threaten public safety.

A three-vessel collision at the entrance to Tampa Bay in August 1993 was a vivid reminder of the bay's vulnerability. More than 330,000 gallons of oil escaped, fouling area beaches and mangroves and killing dozens of seabirds. But more extensive damage was averted due to favorable tide and weather conditions and quick deployment of response crews.

While large spills have been rare in Tampa Bay, the cumulative impact of countless small spills of less than 25 gallons from fuel and bilge pump discharges and unintentional leaks represent a chronic problem.

Tampa Bay is currently equipped to handle cleanup of oil or fuel spills of up to 10,000 gallons with mobile equipment transported by response crews. Larger spills require that equipment and personnel be brought in from other parts of the state and Gulf region. That makes effective advance planning and coordination essential.

SP

MANAGEMENT OBJECTIVES

- Prevent catastrophic spills of oil and hazardous materials.
- Reduce chronic smaller discharges from boats, ships, marinas and other sources.
- Minimize the environmental impact of spills through planning and response.

SUMMARY OF ACTIONS FOR SPILL PREVENTION & RESPONSE

SP-1 Establish an integrated vessel tracking system for Tampa Bay and permanently fund the PORTS system.

SP-2 Install permanent boom anchors near environmentally sensitive areas.

SP-3 Evaluate state piloting requirements and improve state authority over federal vessels carrying hazardous materials.

SP-4 Identify the most appropriate entity to inspect coastal bulk oil storage facilities in the Tampa Bay watershed.

SP-5 Improve fueling and bilge-pumping practices among recreational boaters.

Reader note: An additional action to "evaluate the need for a risk assessment of overland and underwater pipelines carrying hazardous materials" is in review, and will be the focus of a meeting organized by the Tampa Bay NEP in 1996, involving industry and environmental agency representatives.

Establish an Integrated Vessel Traffic System for Tampa Bay and Permanently Fund the PORTS System

SP-1

ACTION:

Establish an integrated vessel traffic system for Tampa Bay to reduce the potential for maritime collisions and spills of hazardous materials. Additionally, secure a permanent source of funding for PORTS, which provides real-time tide and current data to recreational and commercial mariners and to the spill response community.

BACKGROUND:

Tampa Bay is home to three major seaports, a growing cruise ship industry, and dozens of power plants and businesses that utilize the bay for transportation. Approximately 10,000 ships and large vessels pass through Tampa Bay annually, transporting more than 4 billion gallons of oil, petroleum products, and other hazardous materials.

Guiding large tugs and ships along the bay's 44-mile main ship channel, in fair and foul weather, through shallow depths, and amid increasing boating activity challenges even the most experienced mariner. The absence of a coordinated vessel tracking system for the bay increases this pressure, as well as the potential for spills resulting from accidents.

Currently, pilots and ship captains on Tampa Bay utilize a voluntary radio broadcast network to relay vessel information when entering or departing port. Large vessels are equipped with ship-board radar, but the quality and range of these systems vary. In fact, limited navigational systems on some vessels force pilots to rely heavily on personal knowledge and skills to safely complete each transit.

Tampa Bay had been one of several ports scheduled to receive a U.S. Coast Guard vessel traffic system (VTS) in 2002, but this acquisition now appears unlikely. That system would have consisted of a shore-based radar system and personnel to coordinate traffic flow and transmit data to vessels via radio.

However, even this enhanced system would have limitations due to its exclusive reliance on radar. While radar can pierce fog and darkness, its accuracy and range is limited in heavy rain. Severe and sudden thunderstorms—a summer signature in Tampa Bay—can reduce visibility and radar capabilities to zero, increasing the potential for groundings and accidents.

Some new technologies available would reduce or eliminate this risk. One of those is a differential global positioning system (DGPS), which transmits high-precision data on vessel movements directly to the ship—in all weather conditions. A key feature of the system is a lap-top, computerized piloting tool that can be carried aboard vessels or installed on ships. This lap-top device enables pilots to view the position and movements of other large vessels as they occur. Collision-avoidance data and weather

SP-1

information also are provided by the system, which would be fully integrated with radar surveillance to provide 100 percent coverage of vessel traffic on Tampa Bay.

Global positioning technology, coupled with shore-based radar, provides the safest available means for navigation. This added protection is particularly vital to Tampa Bay, which has the longest transit of any port in Florida. Because there are no anchorages along the route, once a pilot has committed to a transit, he must proceed or risk grounding.

While collisions and spills are infrequent, they do occur. Since 1970, several major spills have occurred in Tampa Bay. The largest of these occurred in August 1993, when more than 330,000 gallons of oil flowed from a collision of three vessels at the mouth of Tampa Bay. Clean-up costs to contain the spill and scour oil-soaked beaches exceeded $50 million. Investment in a more technologically sophisticated vessel tracking system for Tampa Bay could easily be recouped by avoiding even a single accident involving hazardous materials.

The Tampa Bay National Estuary Program supports implementation of the best available vessel positioning technology as soon as possible. A legislative report summarizing a state study of navigational needs for Florida ports was completed in January 1995. The draft of this report noted compelling reasons to install a more sophisticated VTS for Tampa Bay, in advance of the proposed Coast Guard system. It recommended that a local technology committee be established to investigate various configurations and financing mechanisms for a combined GPS-radar system for implementation by July 1, 1997. That committee has been organized under the purview of the Tampa Port Authority, with preliminary recommendations expected in early 1996. Meanwhile, Tampa Bay pilots will be supplied with prototype lap-top navigators to help evaluate this new technology.

The Tampa Bay Program also supports permanent funding for the ongoing management of Tampa Bay's Physical Oceanographic Real-Time System (PORTS), which provides tide and current data to navigators. The system's "real-time" measurements are most critical to pilots of large commercial vessels and to spill response crews who must carefully execute containment and cleanup.

In recent years, the PORTS system-which is based in St. Petersburg-has received funding from maritime industries and the Hillsborough County phosphate severance tax. In 1995, the Florida Legislature approved a one-time loan of $77,000 through the Coastal Protection Trust Fund for maintenance of the system. However, no permanent funding source exists for this unique system, which is currently the only one of its kind in the nation.

STRATEGY:

STEP 1 Support efforts to implement a vessel tracking system utilizing best available technology as soon as possible in Tampa Bay.
Responsible parties: Tampa Bay NEP, in cooperation with local government partners and the Agency on Bay Management

STEP 2 Establish a permanent source of funding for PORTS. Funding options include: county boater registration fees, navigation districts, port user fees, Florida Coastal Protection Trust Fund, Hillsborough County Phosphate Severance Tax. The last two sources currently provide maintenance funding, but long-term commitments have not been secured.
Responsible parties: local governments and Florida Legislature

SCHEDULE:

Steps 1 and 2 are both ongoing.

COST:

Sources estimate that a combined GPS-radar system will cost $2 million, including installation and training, and another $450,000 annually to maintain the system. Funding options for installation and maintenance include: user fees (all vessels entering port), Florida Seaport Transportation and Economic Development Trust Fund, State Transportation Trust Fund, General Revenue and the Coastal Protection Trust Fund.

Ongoing maintenance funding for the $1.2-million federally financed PORTS system, which was installed in 1991, is estimated at $220,000.

EXPECTED BENEFITS:

A combined vessel positioning and information system and real-time weather and current data will ensure the highest level of spill prevention and response for Tampa Bay.

MONITORING ENVIRONMENTAL RESPONSE:

Collision-avoidance data from the new vessel traffic system could be used to measure the success of this technology to aid in spill prevention. The Coast Guard Marine Safety Office tracks all oil and hazardous materials spills.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

SP-2, SP-3

Install Permanent Boom Anchors Near Environmentally Sensitive Areas

SP-2

ACTION:

Install permanent boom anchors, along with risers and equipment storage facilities, near environmentally sensitive areas of Tampa Bay to enable quick and effective deployment of oil containment equipment in the event of an oil or hazardous materials spill.

BACKGROUND:

An environmental workgroup supporting the development of Tampa Bay's Area Contingency Plan (ACP) on oil spills met several years ago to prioritize areas of the bay for protection from spills. That workgroup identified the following seven priority areas, along with site-specific protection strategies to guide response:

- *Terra Ceia Bay* - Block off sensitive inner embayments and direct material east to a causeway collection area.
- *Bishops Harbor* - Protect inner portions of the harbor and direct material south to causeway collection area.
- *Cockroach Bay/Little Manatee River* - Protect inner areas portions of Cockroach Bay and Piney Point and direct material south to Port Manatee or north to Bahia Beach or Apollo Beach.
- *Bullfrog Creek* - Protect the creek and direct material to Cargill along the north side of the Alafia for collection, or south to TECO property.
- *Bower Tract* - Block entrances to creek and direct material to Courtney Campbell Causeway for collection.
- *Weedon Island* - Implement Island's own spill response plan and direct material to nearby causeway for collection.
- *Ft. DeSoto* - Protect inside "arrow" of Ft. DeSoto Park, directing material to Ft. DeSoto Beach for collection.

For each area, the group recommended the development of more detailed response plans, including maps identifying response staging, equipment storage and material collection areas; access points; boat ramps and channel markers; and water depths. The group also strongly urged the installation of permanent boom anchors, where feasible and appropriate, to improve spill response and reduce boom deployment time.

Permanent boom anchors are most effective in small areas that are easily contained, such as creeks, embayments or canals. They provide a permanent fixed point from which to deploy floating oil booms that are used to surround and contain spilled material, or deflect it to other areas for cleanup, saving critical time for spill response crews.

This action is to determine the best locations for these boom anchors, a task that the Florida Marine Research Institute has begun with a grant from the Tampa Bay NEP, and to promote installation of these anchors to aid in the protection of these vital areas of the bay.

STRATEGY:

STEP 1 Reconvene the Oil Spill Contingency Plan's environmental workgroup in the spring of 1996 to consider results and recommendations on boom anchor locations by the Florida Marine Research Institute. Proposed anchor sites will be evaluated on the basis of technical and permitting feasibility, potential for navigational hazard, liability considerations, and cost of implementation. Recommendations from the workgroup will be presented in the final Comprehensive Conservation & Management Plan for Tampa Bay, which will be completed in mid 1996.
Responsible parties: US Coast Guard Marine Safety Office

STEP 2 Secure commitment for installation and maintenance of boom anchors, and install them at recommended sites.
Responsible parties: Based on Step 1

SCHEDULE:

Step 1 will occur in 1996, with the goal of having boom anchors installed by 1998.

COST:

No additional costs are anticipated for step 1. While installation and construction costs for permanent boom anchors will vary, costs are estimated $3,000-5,000 per anchor. Long-term maintenance costs are additional.

EXPECTED BENEFITS:

Installation of permanent anchors will save critical time in boom deployment, enhancing protection of the bay's most ecologically sensitive resources in the event of a spill.

MONITORING ENVIRONMENTAL RESPONSE:

The Florida Department of Environmental Protection's Bureau of Emergency Response monitors environmental responses to oil spills.

REGULATORY NEEDS:

Permits will be required for anchor installations.

RELATED ACTIONS:

P-1

SP-3

Evaluate State Piloting Requirements and Improve State Authority Over Federal Vessels Carrying Hazardous Materials

ACTION:

Improve state oversight of harbor pilots and expand state authority over federal vessels carrying hazardous materials.

BACKGROUND:

More than 5,000 vessels traversed Tampa Bay in 1993 on their way to or from the bay's three ports, located at Tampa, St. Petersburg and Port Manatee. Together, these ports provide more than 75,000 jobs and generate a combined economic impact of more than $5 billion a year. The Port of Tampa alone is the nation's seventh largest in terms of cargo tonnage.

But this bustling waterborne commerce puts the environmental resources of the bay at risk from collisions and groundings that can result in massive spills of oil and other hazardous materials. An estimated 14 million gallons of petroleum products pass over the bay daily, along with anhydrous ammonia, sulfuric acid and other products associated with the bay area's thriving fertilizer industry.

The nature of the bay itself compounds the risk of accidents. With an average depth of only 12 feet, the skyscraper-sized ships plying its waters must rely upon a meandering 80-mile network of dredged deep-water channels to safely reach their destination. Some of the bay's most ecologically productive mangrove forests, marshes and seagrasses lie just a few hundred yards from the edge of the shipping channel, and shoaling along these steep edges provides a constant navigational hazard.

A journey from the Gulf of Mexico into the Port of Tampa can take three to seven hours, and mariners at the helm of the ships must make split-second decisions to avert catastrophes. Highly skilled and locally knowledgeable harbor pilots are the first line of defense against accidents, and are especially important given that there presently are no emergency anchorages for ships to pull into in case of emergency, and a huge container vessel may require a mile or more to come to a complete halt.

Currently, the bay's harbor pilots undergo a rigorous training, examination and apprenticeship period before being allowed to guide a ship on their own. The piloting system is governed by the state Department of Professional Regulation (DPR) and appointed representatives of the piloting and maritime industries, who serve on the state Board of Pilot Commissioners. All state pilots must have a federal pilot's license, but federal pilots are not required to obtain a state license.

A fiery three-way ship and barge collision that occurred at the mouth of Tampa Bay in August 1993 served as the catalyst for a reexamination of the current oversight mech-

anisms. That accident resulted in a spill of more than 330,000 gallons of oil, coating nearby beaches and mangrove islands for weeks and killing dozens of seabirds.

Following the spill, the state Legislature passed a bill expanding the grounds for discipline of state pilots, to include actions against a driver's license for alcohol- or drug-related reasons, and piloting while in an impaired state. The bill also closed a loophole which had prevented discipline of state pilots whose federal licenses had been placed on probation or who had voluntarily surrendered their federal license in lieu of prosecution. Enhanced access to the piloting system was also granted to qualified minority and women applicants.

Despite these improvements, additional changes could further reduce the risk of an oil or hazardous materials spill in the bay. Requiring that state pilots be used on more vessels is one suggestion. For example, state pilots are not required on U.S.-flagged vessels under 1,600 gross tons and tugs and barges under 10,000 gross tons. This category encompasses vessels such as small ammonia tankers and propane gas barges, which require an exclusion or "safety zone" while in the shipping channels because of the hazardous nature of their cargoes.

Vessels over 1600 gross tons and petroleum barges over 10,000 gross tons require only a federal pilot with minimal local experience, while barges of any size not carrying petroleum products are exempt from all pilotage requirements.

Enhancing the licensing requirements and disciplinary procedures governing state pilots is another way to improve navigational safety. Training of state pilots could be expanded to mandate the successful completion of at least one continuing education course every two years at a facility approved by the Board of Pilot Commissioners. Since pilots currently are not required to take an exam to renew their license, these refresher courses would ensure that their skills remain sharp and up-to-date. Additionally, pilots involved in a major accident should have their licenses suspended pending the outcome of an investigation into the cause of the accident.

STRATEGY:

STEP 1 Require a state-licensed pilot on board any vessels carrying hazardous materials and requiring a "safety zone" while traversing the bay.
Responsible parties: Florida Department of Business Regulation, Florida Legislature, U.S. Coast Guard

STEP 2 Suspend the license of any pilot involved in a major accident until the completion of a preliminary investigation into the cause of the mishap.
Responsible parties: Florida DPR, State Board of Pilot Commissioners

STEP 3 Require that state pilots successfully complete at least one continuing education course at an approved facility every two years in order to renew their license.
Responsible parties: Florida DPR, State Board of Pilot Commissioners

SP-3

SCHEDULE:

Step 1 will require at least administrative rule changes, and possibly legislative action that could be initiated in 1996 or 1997. Steps 2 and 3 could be accomplished through administrative rule changes by the Board of Pilot Commissioners, commencing in 1996.

COST:

Three to four of the ships crossing Tampa Bay each week require a safety zone for passage, but do not currently require pilots on board. Given this relatively low number, it is not anticipated that additional harbor pilots will be needed to handle this small increase in their workload. Therefore, the costs associated with Steps 1 and 2 are only administrative. The cost of Step 3, requiring ongoing education, will be borne by the Tampa Bay Harbor Pilots, who already send many of their members to refresher courses. The estimated cost of a one-week seminar at a facility such as the Marine Institute of Training and Graduate Studies in Maryland is $4,000.

EXPECTED BENEFITS:

The risk of a catastrophic spill of oil or other hazardous materials in Tampa Bay will be reduced.

MONITORING ENVIRONMENTAL RESPONSE:

The measure of success for this action will be its implementation, which will help to prevent spills to the bay.

REGULATORY NEEDS:

Possible changes to Chapter 310 of the Florida Statutes, governing regulation of licensed industries in the state. Possible federal legislation to address the need for pilots on cruise ships. Administrative rule changes by the Florida Department of Professional Regulation, through the Board of Pilot Commissioners.

RELATED ACTIONS:

SP-1, SP-2

Identify the Most Appropriate Authority To Inspect Coastal Bulk Oil Storage Facilities In The Tampa Bay Watershed

SP-4

ACTION:

Identify the most appropriate entity to conduct annual inspections of coastal bulk oil storage facilities.

BACKGROUND:

Petroleum products comprise the largest cargo category at the Port of Tampa, and vast quantities of oil and other fuels are stored in tanks at and near the port. Tank failures caused by equipment malfunctions, structural problems or an airplane or vehicle collision could result in a spill of millions of gallons of oil into the bay, with potentially devastating economic and environmental damage.

Under the federal Oil Pollution Act (OPA) of 1990, 21 bulk oil storage facilities at the Port of Tampa with a combined capacity of more than 471 million gallons of oil were designated Significant and Substantial Harm Facilities, with special inspection and planning requirements. OPA gave responsibility for inspecting the waterfront components of these facilities—including docks—transfer pipelines and vessel safety to the U.S. Coast Guard, while inspection of the landside components—including containment berms, fencing and the tanks themselves—was assigned to the U.S. Environmental Protection Agency (EPA).

This division of responsibilities has some disadvantages, however. One drawback is that EPA's manpower limitations may prevent it from inspecting all the coastal storage facilities it is assigned, increasing the risk of a spill. The cost of performing the inspections also is a limiting factor, since the inspections are done by personnel from EPA's regional office in Atlanta. Additionally, the inspectors are not able to work with facility managers on a regular basis to ensure that their spill prevention safeguards are the best possible.

Because spill prevention is critical to preserving the natural resources of Tampa Bay, this action seeks to determine whether EPA authority over inspections of these facilities should be delegated and, if so, to identify the authority best equipped to take over this responsibility.

The Coast Guard is one potential candidate to assume this duty, since it already conducts inspections of the docks, vessels and oil transfer components associated with the oil storage facilities. The Coast Guard also maintains a high profile among local maritime interests through its local Marine Safety Office, and would be a convenient and familiar contact point. However, Coast Guard officials are concerned about the costs of training their personnel to conduct the additional inspections, as well as legal and enforcement ramifications.

SP-4

State or local government environmental and emergency response personnel represent another possible solution. Like the Coast Guard, their proximity to the facilities increases the likelihood that inspections would be performed regularly, and they have a vested interest in preventing pollution from entering Tampa Bay. However, financing obstacles exist with this option as well.

Even if the authority to conduct the coastal facility inspections is delegated, EPA likely would retain control of enforcement and compliance issues. The local entity, however, would serve as an early warning system to identify problems and target facilities with a history of non-compliance, forwarding its observations and concerns to EPA.

EPA also would continue to conduct inspections of inland oil storage facilities.

STRATEGY:

This action proposes a workshop to identify whether delegation of the inspections of coastal bulk oil storage facilities is appropriate; what authority is best suited to assume the duty; and what training and additional funding would be necessary to test this approach in the Tampa Bay watershed.

STEP 1 Sponsor a workshop to evaluate options for improving inspections of coastal bulk oil facilities in the Tampa Bay watershed. The workshop should involve spill response experts from EPA, the Coast Guard, Florida Department of Environmental Protection (FDEP) and maritime interests, as well as local environmental management and emergency response personnel. The workshop should explore cooperative planning, delegation of authority if appropriate, training and funding requirements, development of uniform inspection forms and criteria, and legal and enforcement issues. ***Responsible parties: Tampa Bay NEP, Coast Guard, EPA, FDEP, maritime interests, local government environmental management and emergency response personnel***

STEP 2 Forward the recommendations of the workshop participants to the Coast Guard and EPA representatives serving on the Regional Response Team, which has authority to implement spill prevention plans and inspections. The recommendations can be implemented regionally, or just in Tampa Bay, through a letter of agreement between EPA and the delegated agency. ***Responsible parties: Tampa Bay NEP***

SCHEDULE:

The workshop (Step 1) should be held in early 1996, with the recommendations forwarded to the Regional Response Team for implementation in FY 1996-97.

COST:

Organizing a workshop will involve only administrative and staff costs. The Oil Pollution Act already provides a mechanism for funding inspections of coastal oil storage facilities, so no additional funds will be needed to conduct the inspections.

However, some additional training of personnel may be necessary if authority for the inspections is delegated.

SP-4

EXPECTED BENEFITS:

Consolidating inspections of bulk oil storage facilities along Tampa Bay will improve spill prevention efforts, reducing the potential risks to bay fisheries and wildlife from a spill.

MONITORING ENVIRONMENTAL RESPONSE:

Not applicable.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

SP-1, SP-2, SP-3

Improve Fueling and Bilge Pumping Practices Among Recreational Boaters

SP-5

ACTION:

Improve fueling and bilge pumping practices among recreational boaters.

BACKGROUND:

As the number of recreational boaters utilizing Tampa Bay increases, the incidences of small fuel spills and releases of oily bilge water also are expected to escalate. Small, but chronic, spills occur routinely through careless fueling habitats, operation of outboard motors, discharges of oily bilge water, and improper disposal of used oil products. According to the National Research Council, these small spills account for 90 percent of the oil that ends up in the nation's waterways.

Although many boaters store their boats on land, thousands of vessels remain in the bay at marinas, yacht clubs and countless docks. Some boat insurance policies require automatic bilge pumps, but boat owners also pump their bilges manually. The cumulative amount of oil entering the bay as a result of recreational vessel bilge pumping can be substantial.

Typically, recreational vessels stored dockside use automatic bilge pumps to prevent accidental sinkings from equipment failures or storms. These pumps are activated when the interior volume of water reaches a certain level. The bilge water that is automatically pumped from vessels with internal engines may contain small amounts of fuel, cleaning solutions, and other chemicals that pollute the bay.

In addition, fuel spills frequently occur when boat owners fill their tanks. Boat owners often can't tell when the tank is full until the overflow valve discharges diesel or gasoline into the bay.
Federal and state laws prohibit the discharge of any fuel or oil within 12 nautical miles of shore. As little as one cup of fuel can cause a "fuel sheen," which is a misdemeanor that can result in a warning or fine. To help prevent discharges, very large commercial vessels are required to have oil-water separators. However, these are not required, and are often impractical, for smaller vessels. Additionally, only vessels longer than 26 feet in length are required to have a placard reminding the operator that oil discharges are prohibited.

If a substantial amount of fuel or oil is spilled in a bilge, the vessel owner or operator is required to hire an oil recycling contractor to pump the water-oil mixture into an approved container. If a spill empties directly into navigable waters, operators also must also immediately notify the U.S. Coast Guard. State law also prohibits the discharge of oil dispersants or bilge cleaners into bay waters.

Though enforcement of these regulations is difficult because of the number of boaters and marinas on the bay, current U.S. Coast Guard procedures since April 1995 allow

enforcement officers to cite violators. The Tampa Marine Safety Office conducts daily patrols and has written 33 tickets to recreational boaters (and 22 to commercial boaters). Fines range from $50 to $1,000 for a first offense, depending on the size of the spill and can escalate up to $25,000 a day for large spills.

Boater education remains the most effective long-term strategy for reducing chronic spills of oil, fuel and oily bilge water to the marine environment. According to a 1992 survey by the Tampa Bay NEP, boaters are more concerned than land-bound residents about environmental impacts, so heightened awareness may accelerate responsible actions by this group.

There are no recreational bilge pump-out facilities in Tampa Bay. If a marina has drums set up to receive oily-water, boat owners often have to manually pump their bilge water into buckets and transfer it to a drum—a cumbersome practice that dissuades all but the most environmentally conscientious boaters. Davis Island Yacht Club has established such an operation; boat owners are charged 55 cents per gallon, which pays for the drums to be hauled away properly.

Use of existing commercial products can assist these efforts. Bilge pillows, diapers, and oil-absorbent pads, available at most marine stores, act like a magnet in separating oil from bilge water. Boat owners put them in their bilges and dispose saturated pads, oil-water mixtures, and other hazardous boat chemicals in a proper waste container or with a recycler. Various fuel-air separators, designed to fit most vessels, also are available for less than $50 for installation in the vent line.

Boater education courses, offered by the Coast Guard Auxiliary now include environmental protection and fueling safety components. Coast Guard Reservists that are SEA PARTNERS present environmental programs and attend boat shows to educate the public and boaters. This action seeks to reduce small spills by improving education of new boaters and boat owners who store their vessels in the water.

STRATEGY:

The strategy to improve fueling and bilge-pumping practices encourages boat owners with internal engines and fuel tanks to install fuel-overfill protection devices and oil-water separators, where feasible. It also emphasizes boater education and outreach to yacht clubs, sailing organizations, marinas, and "high-dry" facilities where boats are stored.

STEP 1 Encourage registered boat owners to install fuel overfill protection devices and oil-water separators in automatic bilge pumps. Encourage boat owners to switch bilge pumps "off" when fueling, and to visually inspect bilges after fueling.
Responsible parties: Florida Department of Environmental Protection (FDEP), U.S. Coast Guard Auxiliary, Marine Manufacturers Association, Sea Grant

SP-5

STEP 2 Develop education materials that will stimulate solutions to bilge contamination and fuel handling situations. Ideally, materials will include a free sample "oil sorb" product that will allow the recreational boater to see, first hand, the practical application of such a product.
Responsible parties: FDEP, U.S. Coast Guard Auxiliary, SEA PARTNERS, Sea Grant

Note: Extensive educational material produced by manufacturers and other boater environmental education programs (Puget Sound Alliance, Chesapeake Bay Foundations, CMC etc.) already exists and can be tailored for local use.

STEP 3 Distribute educational materials to yacht clubs, sailing schools, boating organizations, and boat shows around the bay, as well as to all marinas that store boats in the water and in "high and dry" facilities. Form or utilize an existing speakers bureau to address these groups and possibly distribute free oil-sorb samples in partnership with one of the leading manufacturers.
Responsible parties: FDEP, U.S. Coast Guard Auxiliarists, SEA PARTNERS, Sea Grant Marine Extension, CMC

SCHEDULE:

The Tampa Bay National Estuary Program will convene the organizations listed above to evaluate on-going programs and materials, and develop a plan to implement the Steps 1 - 3 (with new or existing materials) in 1996.

COST:

Costs will to develop and distribute educational materials will be determined based on format selected, but should be accomplished through existing resources or available grants. Manufacturer and boat dealership sponsors should be aggressively pursued.

EXPECTED BENEFITS:

Reduced small spills during fueling and during automatic bilge pumping.

MONITORING ENVIRONMENTAL RESPONSE:

The measure of success for this action will be a reduction in the number of minor spills reported.

REGULATORY NEEDS:

None anticipated.

RELATED ACTIONS:

BH-4, TX-3, PH-3

What You Can Do...

To Improve Spill Prevention and Response

As a boater:

- Take care to avoid spills of fuel, oil and other materials during boat maintenance or fueling, and use oil-sorb products to remove excess oil from bilges that discharge to the bay.
- Encourage your marina to implement best management practices to reduce runoff from boat maintenance areas and parking lots.
- Report oil spills promptly to the Coast Guard or Florida Marine Patrol.

As a citizen or civic group member:

- Support efforts to acquire more oil spill cleanup equipment for Tampa Bay and to implement a vessel tracking system that will help prevent catastrophic spills.
- Volunteer to clean and rehabilitate wildlife injured by oil spills. Instructional seminars are coordinated by the Pinellas Seabird Rehabilitation Center.
- Support the installation of permanent boom anchors in environmentally sensitive portions of the bay. In the event of a spill, the anchors would enable cleanup crews to quickly deploy oil booms to protect these fragile areas.

DRAFT COMPREHENSIVE CONSERVATION & MANAGEMENT PLAN

January 1996

DRAFT

Implementation & Financing

Introduction

This chapter describes how the comprehensive management plan will be implemented by local governments, agencies and other bay stakeholders, and discusses the oversight role of the Tampa Bay National Estuary Program in ensuring that the goals of the plan are achieved.

Local government and agency partners in the Tampa Bay NEP will sign an agreement in late 1996 pledging to carry out the recommendations of the final management plan. The agreement will include specific goals for the recovery of vital resources, such as seagrasses and wetlands, as well as water and sediment quality goals for nitrogen and toxic contaminants. It also will spell out each partner's responsibility for meeting those goals, and a timetable for achieving them.

But how those targets are reached will be left up to individual communities, who may select the most suitable options from among a range of alternatives. Many of those options are described in this plan as examples of how a community might comply with its commitment to reduce pollution in the bay. This approach not only emphasizes flexibility, but allows local governments to focus their limited resources in the most cost-effective and environmentally beneficial manner.

Additionally, the implementation strategy outlined in this chapter addresses how these goals and initiatives for Tampa Bay will be integrated into existing management plans and regulatory programs.

Existing bay management expenditures also are presented to provide readers with an understanding of how much money is currently allocated and where it is going. Financing options that follow illustrate possible sources of revenue and approaches to accomplish goals of the plan that might not otherwise be achieved with existing resources. Wherever possible, the Tampa Bay NEP advocates the reallocation or more efficient use of existing revenues to carry out recommended actions.

Implementing the Plan for Tampa Bay

Successful implementation of the bay restoration blueprint will require firm commitments for action, flexibility for local governments to pursue the most cost-effective strategies to achieve a particular goal, integration of goals and strategies into existing

regulatory programs and rules, and effective oversight to ensure that actions are carried out in a timely manner.

Commitments will be secured through an implementing agreement signed by regulatory and local government partners in the Tampa Bay NEP in 1996, after the bay management plan has been finalized. These partners include Hillsborough, Pinellas and Manatee counties; the cities of Tampa, St. Petersburg and Clearwater; the Southwest Florida Water Management District; Florida Department of Environmental Protection; and U.S. EPA. Other relevant agency and industry partners also will be encouraged to become part of the formal implementing agreement.

This agreement will incorporate the finalized goals for Tampa Bay and equitably assign responsibility for achieving them. A draft version of the goals and priorities for Tampa Bay is presented in Chapter Three, immediately preceding the section on Bay Action Plans.

To strengthen this agreement, the Tampa Bay NEP has applied to the U.S. EPA to participate as a community pilot project under the President's new XL Initiative on Reinventing Environmental Regulation. Acceptance into this program will give EPA the flexibility it needs to allow other regulatory agencies, local governments and industries to pursue the most environmentally beneficial and cost-effective strategies for bay restoration and protection. Concurrent flexibility from the state, the Southwest Florida Water Management District, and local regulatory agencies is anticipated.

A key focus of the Tampa Bay NEP over the coming months will be to secure final commitments from those agencies, local governments and community partners identified as "responsible parties" to implement specific actions advanced in *Charting the Course.*

Allocations of nitrogen loading targets for Tampa Bay to local governments and possibly to other dischargers also will be finalized in 1996. To ensure that these allocations are equitable, the Tampa Bay NEP is investigating proportional allocation schemes, in which dischargers are assigned a fair share of the cleanup burden based on their contribution to the problem. Additionally, the Program is investigating the use of loading reduction credits, to allow public and private interests who discharge less than their pollutant allocation to sell or trade the remaining amount to another discharger that cannot meet its limits.

The NEP also advocates public and private partnerships to achieve more cost-effective results than could be attained through individual actions.

Action Plans to Achieve Bay Goals

In accordance with a schedule agreed to in the implementing agreement, each participating local government and agency will be asked to submit an action plan detailing how it intends to achieve the bay goals and associated responsibilities for review by the NEP's Management and Policy Committees. Communities may select from various strategies advanced in the plan to reach water quality, habitat restoration, and other applicable bay improvement goals. These action plans should include descriptions of proposed projects, how that project contributes to achieving goals (quantified,

where applicable) with supporting documentation of benefits, an implementation schedule, and a cost and financing plan.

These action plans are particularly important in relation to nitrogen loading goals, because they will be incorporated into regulatory permits and may replace existing standards where a net benefit to the bay can be demonstrated. These action plans may be based on ongoing watershed initiatives begun prior to the adoption of the comprehensive plan for Tampa Bay, as long as these watershed plans are consistent with the bay plan's objectives. In fact, watershed action plans that address specific basins within the larger bay ecosystem can be an excellent tool for implementing the bay plan.

Goals for habitat restoration and protection are being finalized now. Both local governments and agencies at the local, regional and state level that participated in the development of the habitat master plan will promote these goals and overall strategies in their respective plans. Furthermore, as part of the implementing agreement, the Tampa Bay NEP will secure commitments from these partners to devote a significant percentage of their planned expenditures for habitat restoration and protection along Tampa Bay to these common goals and priority projects.

Integrating the Plan into Existing Environmental Rules & Programs

Charting the Course has been developed in cooperation with the bay area's six largest local governments, and environmental agencies at the local, state and federal levels, to reach consensus on bay restoration goals and strategies. Once government and agency action plans to achieve bay goals are submitted and approved by the Program's Policy Committee, these action plans will be incorporated into state and federal water quality permits addressing direct or point discharges and stormwater management, and become part of local government comprehensive plans.

The Tampa Bay NEP also has coordinated closely with numerous environmental alliances devoted to improving and protecting specific portions of the bay, including the Hillsborough River Greenways Task Force, the McKay Bay initiative, and the Cockroach Bay Aquatic Preserve Management Team. These public-private alliances of environmental and economic stakeholders are excellent models for community-based planning.

A key partner in the Tampa Bay NEP has been the Southwest Florida Water Management District and its Surface Water Improvement and Management (SWIM) Program, which is expected to play an important role in implementing the bay plan. The Tampa Bay NEP also works closely with the Agency on Bay Management (ABM), which serves as the natural resources committee of the Tampa Bay Regional Planning Council. ABM will be spearheading efforts to investigate and make final recommendations to the NEP for several key actions in the habitat restoration and protection action plan.

Results of a Federal Consistency Review, to evaluate and rectify possible inconsistencies among the goals of other federal programs and those established for Tampa Bay, will be included in the final bay plan.

Roles of the Tampa Bay NEP in Overseeing Implementation

The success of the Tampa Bay National Estuary Program ultimately will be measured in bay improvement achieved through implementation of the comprehensive bay management plan. Consequently, a key ingredient for success is defining who should oversee implementation of the plan and what oversight should entail.

The primary oversight roles of the Tampa Bay NEP will be to monitor progress (in implementation and the bay's recovery), assist implementation, continue public outreach and involvement, and help improve data management. Specific efforts associated with these functions are outlined below.

One of the strengths of the Tampa Bay NEP is the precedent-setting alliance of local governments and regulatory agencies represented on the NEP's Policy Committee, which sets overall direction and contributes funding for the Program. In fact, local government and agency partners feel that maintaining this decision-making structure—with regulators and regulated interests working together toward common goals and assisted by scientific and community advisors—is critical to assuring implementation of the plan for Tampa Bay. This bottoms-up approach to environmental management gives all partners a voice in the future of Tampa Bay.

The Policy Committee also is evaluating options for expanding committee membership to broaden representation by smaller local governments and other interests.

The U.S. EPA, which administers the National Estuary Program, has set aside $1.2 million or $300,000 over four years beginning in April 1997 to assist the Tampa Bay National Estuary Program in overseeing implementation of the bay restoration blueprint. This federal contribution requires a 25 percent local match from the communities and agencies now participating in the NEP, a percentage equal to their current contributions.

Oversight Roles

Monitor & Report Progress

- Monitor progress in implementing bay action plans and achieving goals for Tampa Bay
- Produce periodic updates to action plans
- Prepare an annual progress report to policy leaders and the community on progress in charting the course for Tampa Bay
- Produce a biennial bay monitoring report for bay managers

Assist Implementation

- Seek timely implementation of priority actions
- Pursue grants and other funding to support bay restoration
- Direct or coordinate technical investigations and other efforts to assist implementation (especially EPA's Great Waters Program, which is funding research studies of atmospheric deposition to Tampa Bay)

- Provide staff support for the committees of the Tampa Bay NEP, comprised of participating local governments, agencies, and technical and community interests devoted to bay improvement
- Assist in conflict resolution if mediation is needed

Public Outreach and Involvement

- Continue community outreach and involvement efforts, promoting priority issues, progress in charting the course for bay restoration, and bay stewardship and appreciation

Data Management

- Improve public and agency access to bay management data and information, particularly on the Internet

Cost & Financing

Costs associated with individual actions presented in *Charting the Course* are presented in those action summaries. In many cases, these represent the level of effort that an implementing party might anticipate in budgeting these tasks. However, these should not automatically be construed as requirements for new sources of revenues, since some of these initiatives can be accomplished with existing resources or by redirecting current funding allocations to better address the bay's needs.

Additionally, a number of actions seek to improve coordination and planning among local governments and agencies, and may actually result in cost savings for currently funded activities.

In fact, the Tampa Bay National Estuary Program strongly advocates the reallocation or more efficient use of existing resources to carry out recommended actions. A study by the NEP indicates that existing bay-related expenditures at the local, state and federal levels exceed $260 million per year (based on FY94-95 budgets). Of that amount, 65 percent, or roughly $170 million, is devoted to wastewater collection, reuse and treatment—activities that either indirectly or directly benefit the bay, even if they aren't performed solely for the bay's benefit. These activities are funded largely through wastewater utility enterprise funds, created by local governments expressly for these purposes.

The next largest allocation of 13 percent, or nearly $35 million, is expended primarily by local governments and the Southwest Florida Water Management District for stormwater management, including handling and treatment. About half of these programs are financed through stormwater utility funds. The remainder comes from ad valorem taxes, energy utility taxes, permit fees and licenses, pollution trust funds, and state and federal general revenues.

Budgets for habitat restoration, preservation and management total approximately $17 million or nearly seven percent, excluding land acquisition (another four percent). Regulation and enforcement funding, dredging and dredged material management, environmental monitoring and public education comprise the remainder of the expenditures. General revenues, in combination with ad valorem taxes and special fees and licenses, are used to finance these various efforts.

Preliminary analyses indicate that the cost to maintain existing nitrogen loadings to the bay may be relatively minimal over time. However, additional water quality improvements may be necessary to achieve further progress. Offsetting anticipated nitrogen loadings associated with growth may require an overall nitrogen reduction of about 10 percent by the year 2010, or approximately one percent per year. Annual costs to reduce nitrogen loadings are estimated at approximately $100,000 per ton of nitrogen, or about $3 million per year for every percent decline in nitrogen.

Preliminary costs also have been established for habitat restoration, another focal point of the comprehensive plan for Tampa Bay. Those figures suggest existing annual expenditures of approximately $350,000 can be used to restore an optimum balance of habitats for Tampa Bay. That amount is based on restoring about 20 acres of low-salinity tidal marsh habitat per year.

Although costs for meeting other goals have not been fully determined, recommended actions will focus on cost-effective use of existing resources and a clear return on investment. Any additional funds required to restore Tampa Bay will be documented in the action plans submitted by local governments and subject to public consideration to ensure that issues of affordability, accountability, and environmental responsibility are given a fair hearing.

In keeping with this theme, the Tampa Bay NEP advocates the following approach for funding the comprehensive management plan for Tampa Bay:

- Maintain existing levels of expenditures for programs making cost-effective contributions to bay restoration goals;
- Evaluate programs that fall short of these aims and investigate opportunities to redirect resources to accomplish more with public tax dollars;
- Aggressively pursue state and federal funding assistance for environmental improvement;
- Promote public-private partnerships with the potential for bottom-line benefits for the bay and businesses;
- Pursue new funding sources only if strategies above fail to achieve adequate progress toward bay improvement;
- Aggressively pursue permit streamlining for projects advanced in the bay plan, in conjunction with overall regulatory flexibility in areas where a net benefit to the bay can be achieved.

If additional funds are necessary in the future, the Tampa Bay NEP has identified various funding sources for local and state partners to consider. These include three broad categories of revenue sources:

- debt instruments, such as long-term municipal bonds or the state revolving loan fund, which support large projects involving substantial engineering and construction, such as wastewater treatment and reuse facilities and associated pipeline infrastructure;
- recurring sources, such as taxes or user fees, that might be tapped for bay restoration purposes, although this would probably require budget reallocations on the part of local governments, and;

- short-term revenue sources, such as federal, state and private grants, which can provide short-term capital for bay improvement projects. Their long-term availability is uncertain, but these sources have been aggressively and successfully pursued by the Tampa Bay NEP and other agency and local government partners.

Revenue sources are summarized and evaluated in a separate report available from the Tampa Bay National Estuary Program. That report notes that some revenue sources are currently not being used to their full legal capacity. Federal grants and various debt instruments fall into this category. Ad valorem taxes also may apply, since all major local governments currently operate below the maximum millage cap, although the margin is small in some cases. Impact and user fees as a funding mechanism for environmental programs also appear to be under-utilized by local governments.

The report also notes other funding mechanisms that are allowed by law but have never been implemented locally, such as a saltwater fishing license surcharge and a marine fuel surtax. Some of these same revenue sources may even serve as incentives for environmentally responsible behavior, as this chart illustrates:

Funding Source	**Incentive Mechanism**
User fees	When fee based on usage, reduces impact on resource
Anchorage fees	Reduce anchor damage to near-shore areas
Privilege fees	Can be implemented to manage use at public facilities
Stormwater utility fees	May reduce runoff pollution from properties by encouraging on-site retention/stormwater treatment
Impact fees	Reduce septic tanks and package treatment plants
Fines & penalties	Encourage compliance with environmental laws
Marine fuel surtax	Reduce use of marine fuels and associated pollution
Shellfish license fees	Encourage local shellfish management plans.

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January 1996

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MONITORING BAY IMPROVEMENT

Monitoring Bay Improvement

Efforts to monitor the bay's health are central to the success of bay restoration efforts, for monitoring enables communities to measure return on investment and helps environmental managers validate or refocus existing strategies for bay improvement.

An effective monitoring program provides the data necessary to assess the status and trends in the health and abundance of the bay's wildlife and habitats. This information allows local governments and agencies to evaluate progress made in the restoration and protection of Tampa Bay. The data also provides insights into the effectiveness of current management strategies, indicating when goals have been met, if actions should continue, or whether more stringent efforts are warranted.

Monitoring the changes caused by management actions in an estuary is not as simple as counting fish or measuring water quality. Estuaries, by their very nature, are dynamic systems. Populations of fish, birds and other organisms fluctuate following natural cycles. Water quality also varies, particularly as seasonal and annual weather patterns change. The task of tracking environmental changes in an estuary can be difficult — and distinguishing changes caused by human actions from natural variations can be even more difficult.

The coordinated bay monitoring program devised by the Tampa Bay NEP in cooperation with local governments is designed to address many of these challenges by building on existing efforts to more fully and clearly assess progress in the bay's recovery.

Tampa Bay benefits from several existing water quality, habitat and fisheries monitoring programs, including an ambient water quality monitoring program operated by the Environmental Protection Commission (EPC) of Hillsborough County since 1974. These programs have contributed significantly to the wealth of knowledge available on the Tampa Bay estuary.

The monitoring design devised by the Tampa Bay NEP builds on this existing foundation. Existing monitoring programs have been standardized and expanded in some areas, and new components — to measure atmospheric deposition, bay sediment chemistry and the health of benthic communities — have been added.

A series of workshops with local government and agency partners helped to define five general monitoring objectives for the water quality, fisheries, benthic and habitat components of the program. These objectives are to:

- estimate the areal extent of the bay that does not provide adequate water quality conditions to support seagrasses and other living resources
- assess the abundance and health of bay fish populations over time
- estimate the areal extent of degraded benthic habitat in the bay and within each bay segment
- estimate the areal extent and quality of seagrasses, mangroves and emergent bay wetlands
- estimate the areal extent of oligohaline (low-salinity) habitat in the bay and its tributaries.

This focus on measuring the areal extent of bay conditions expands upon traditional methods and can dramatically increase the value of information collected. For instance, simply considering the average concentration of dissolved oxygen throughout the bay may appear to indicate that water quality standards have been met. But, in fact, this may not be the case, since water quality in some portions of the bay may still be inadequate — or much better than average. The new approach will indicate how much of the bay, by percentage or number of acres, is not meeting water quality conditions to support seagrass recovery targets. It also allows more effective assessment of trends in cases where some areas decline and others improve but the overall condition does not change.

Another new element in the monitoring program for Tampa Bay is an increased emphasis on communicating information in a standard and more meaningful format. Prior to standardization, monitoring programs used various methods to communicate their results. The monitoring framework has been specifically designed to provide a forum and format for compiling and synthesizing results from major monitoring programs in a single comprehensive document — the Biennial Environmental Monitoring Report.

Monitoring workshops will be held regularly, every second or third year, allowing environmental professionals from various programs to meet and review findings. A separate report will be written for decision-makers at government agencies responsible for the management of the Tampa Bay estuary.

Monitoring Components

The environmental monitoring program for Tampa Bay encompasses five components:

1. Water quality
2. Benthos and sediment chemistry
3. Atmospheric deposition
4. Bay habitats (including seagrasses, emergent wetlands and oligohaline areas)
5. Bay fisheries and wildlife.

Each of these bay monitoring components is summarized below.

Water Quality

While current programs measure trends in water quality over time very effectively, they were not originally designed to provide estimates of the spatial extent of conditions in the bay. Four local governments measure water quality (including nutrients, chlorophyll *a* and other parameters) at 125 stations in Tampa Bay. Those stations were selected to meet the needs of their respective programs and may not entirely satisfy the needs of the bay-wide environmental monitoring program. To truly determine the extent of conditions reported, stations must be randomly selected.

About 70 percent of the 125 stations have been incorporated into a statistically valid bay-wide monitoring design. This design is based upon EPA's Environmental Monitoring and Assessment Program (EMAP) grid, which allows for random station selection. It enables local governments to continue their long-term study at many stations while providing a more rigorous method to evaluate the spatial extent of conditions in specific segments of the bay.

The EPC of Hillsborough County, Pinellas County, Manatee County and the City of Tampa conduct water quality monitoring in the bay. Coordination between team participants includes standardizing collection and analysis methods, sharing and comparison of collected data and collation of all data into biennial monitoring reports. These governments also are participating in the West Coast Regional Ambient Monitoring Program (RAMP), an ongoing program initiated by Tampa Bay and Sarasota Bay NEPs, the Southwest Florida Water Management District (SWFWMD) and local governments to coordinate environmental monitoring data from Tampa Bay to Charlotte Harbor.

Benthic Communities and Sediment Analysis

A new component in Tampa Bay's monitoring program will focus on measuring the quality of bay-bottom sediments and their effects on bottom-dwelling sea life. Collection stations will match those randomly selected for water quality sampling.

The Tampa Bay monitoring program will evaluate the abundance and composition of benthic species found throughout the bay to identify those areas that differ from expected patterns. Since some species of benthos are more sensitive to environmental stress, these areas may indicate impacts from contaminants, habitat alteration or other trauma.

The health and abundance of benthic organisms are indicators of the bay's overall health. If contaminants are present in the water column or sediment, filter-feeding benthic organisms and detritivores can accumulate these contaminants in their tissue. They also are an important link in a food web that supports many forms of marine life, and can therefore pass on accumulated contaminants to other organisms that feed on them.

Dissolved oxygen is another indicator scientists use to gauge the health of the bay's benthic communities. Research in nearby Sarasota Bay indicates that stressed seagrass beds may not support the fish and other aquatic life typically associated with healthy grass beds. The lack of sealife may be a result of low levels of dissolved oxygen during pre-dawn hours, an issue that will be addressed in Tampa Bay as an ele-

ment of the benthic monitoring program.

The bay monitoring program also calls for local governments to monitor levels of contaminants in sediments as part of their assessments. Initial studies indicate that some areas of the bay contain contaminated sediments, but the severity and spatial extent of contamination in these areas are currently unknown. In future years, the effect of contaminants on benthic life also is scheduled to be studied with bioassays that subject test organisms to benthic sediments. Observing the health of benthos exposed to sediment samples in a laboratory will help to indicate toxic sites or areas of healthy benthic communities.

Sediment chemistry and toxicity measurements also are designed to correlate with other monitoring programs and allow comparison of toxicity data across the country.

The EPC of Hillsborough County, Pinellas County and Manatee County are participants in the benthic monitoring program, which was initiated in 1993.

Atmospheric Deposition

Preliminary research indicates that up to 28 percent of nitrogen loading in Tampa Bay, as well as a significant percentage of cadmium, copper and lead, may come from atmospheric deposition.

The Tampa Bay NEP has funded a pilot program to measure nutrient and heavy metal loadings from atmospheric deposition at seven sites in the Tampa Bay watershed. Pesticides (including DDT) and other organic pollutants also are being measured at selected sites. Weekly samples will be monitored for levels of copper, lead, zinc, nitrates and phosphorus. Mercury, which also is associated with atmospheric deposition, is being monitored under a separate program through the Florida Department of Environmental Protection. The pilot program will provide new insights into the distribution of contaminants transported by rainfall and dustfall.

Air and water quality divisions of the EPC of Hillsborough County, Pinellas County and Manatee County, as well as SWFWMD, the Florida Department of Environmental Protection (FDEP) and the Florida Department of Transportation, will be participating in a long-term monitoring program for atmospheric deposition throughout the watershed, in association with EPA's Great Waters initiative.

Bay Habitats

The extent and quality of habitat available for fish and wildlife is critical to maintaining and restoring Tampa Bay. Many species have specific habitat requirements that must be met for their survival.

Among the most vital habitats in Tampa Bay are the seagrass meadows that once covered much of the bay's shallow regions. Ongoing monitoring efforts have demonstrated recovery of seagrasses in some areas of the bay, but more comprehensive monitoring efforts are needed to document the overall health of these existing and recovering grass beds.

SWFWMD maps seagrass beds using aerial photographs taken every two years and verifies the data with field checks gathered from 73 randomly selected sites. The

health of seagrasses in randomly selected areas also will be monitored by measuring density of plants, the number of blades per plant and the relative density of epiphytic algae attached to the grass blades. More frequent sampling may be required if significant declines in seagrass coverage or health are noted in the future.

SWFWMD is responsible for mapping and seagrass quality monitoring. The City of Tampa is conducting more detailed monitoring in Hillsborough Bay.

Oligohaline — or low-salinity — habitats also are critical for fisheries. Located in portions of tributaries where salinities range from zero to 10 parts per thousand, the boundaries of these low-salinity habitats fluctuate with the flow of fresh water in natural cycles. They also have been hard-hit by development along the tributaries and diversions of fresh water to serve the region's potable water needs.

Until recently, little effort had been made to quantify the loss of low-salinity habitats, but new studies by regional and state agencies have mapped marshes, mangroves and other wetland vegetation. The studies also are measuring salinity and other parameters in major rivers.

An ongoing project to develop a watershed master plan for habitat restoration and protection will evaluate methods of tracking the extent and quality of oligohaline habitats, as well as marshes and mangroves. A separate study also is underway to determine the effects of changes in freshwater inflows to Tampa Bay, including their effects on fisheries and other aquatic life.

Parties responsible for monitoring oligohaline habitats will be identified as part of an ongoing technical project.

Fish & Wildlife

Both fish and wildlife in the Tampa Bay region have shown steep declines over the past 30 years. Activities to document their resurgence as new bay management practices are implemented are necessary to maintain ongoing support for bay restoration.

The FDEP's Critical Fisheries Monitoring Program, established in 1990, provides the most comprehensive sampling of fisheries in the bay. This program, conducted by FDEP's Florida Marine Research Institute, employs stratified random and fixed-station monitoring to assess the abundance and distribution of the bay's fish and macroinvertebrates.

To monitor potential environmental effects from toxic or hazardous materials, the Tampa Bay NEP has recommended that the program be expanded to document abnormalities in all fish over 75mm long, including tumors, parasites, skeletal malformations and deformities in the gills, mouths and eyes. The largest five fish in each target species also would be analyzed for chemical contaminants.

DEP also monitors the numbers of endangered sea turtles, manatees and bottle-nose dolphins in Tampa Bay with aerial surveys conducted over nearshore waters. Data collected includes location, species, number of adults and calves, and animal behavior.

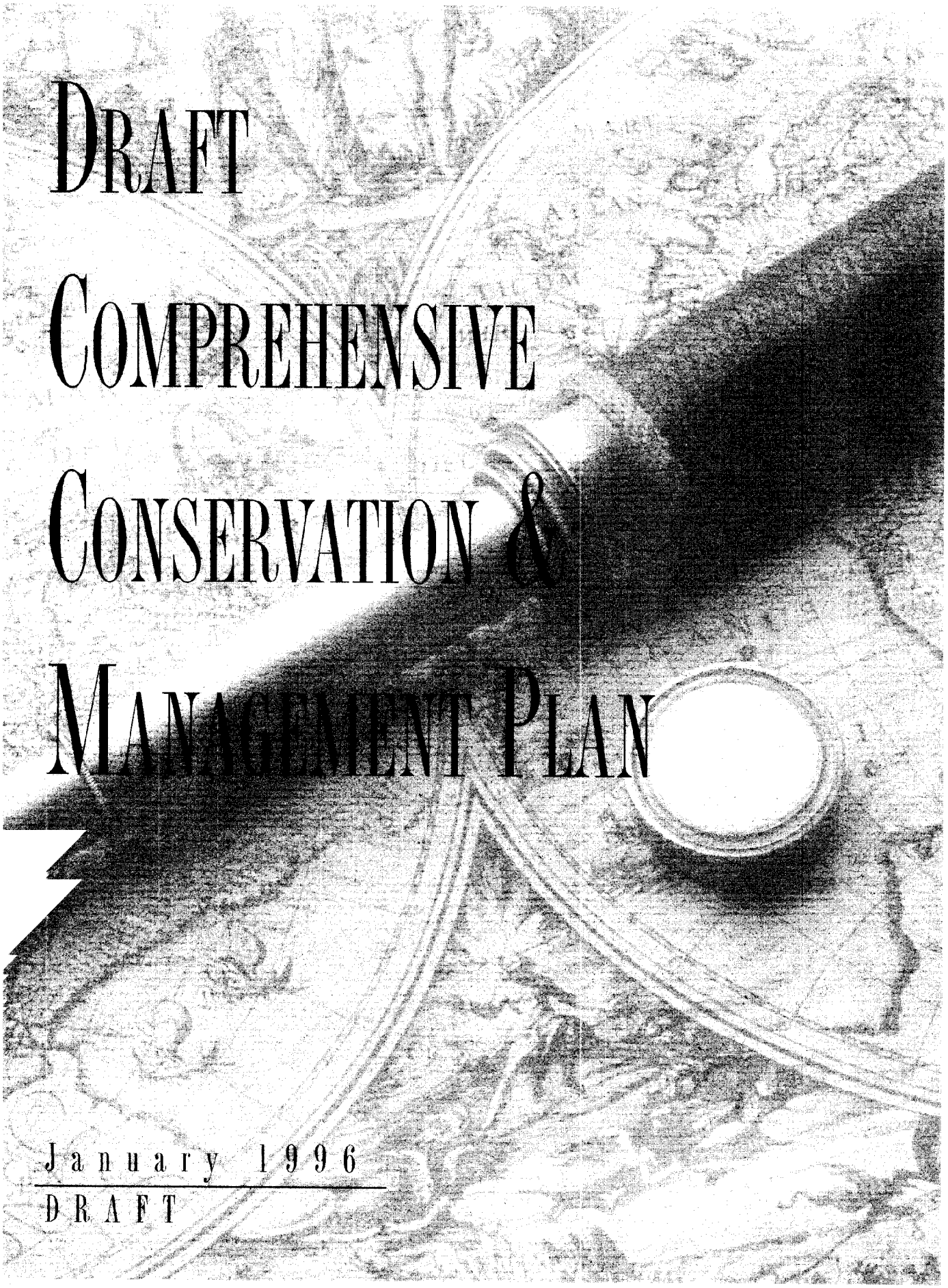
The bay's colonial breeding bird populations are monitored by Audubon Society's Tampa Bay Sanctuaries, which conducts an annual ground survey and census at island

nesting sites in the region. Audubon also sponsors an annual Christmas count fundraiser, dispatching teams of volunteers to various places to note numbers and varieties of birds. Aerial surveys of pelicans and mid-winter surveys of waterfowl are conducted annually by Florida's Game & Fresh Water Fish Commission throughout the state.

Evaluating Progress

Participants in the Tampa Bay monitoring program recognize that monitoring efforts are only as good as our ability to get current and correct data to appropriate managers in a timely manner. A bay monitoring report, to be published every two years beginning in 1996, will compile data from various governmental agencies and communities responsible for monitoring into a common format. One of its objectives is to report progress toward achieving restoration and protection targets set forth in the Comprehensive Plan for Tampa Bay.

The format will include updated environmental data focusing on both status and trends within Tampa Bay and its watershed. The report also will highlight areas where additional management actions may be needed to restore the diverse habitats within the bay and function as an early warning system for local and state governments responsible for maintaining the environmental integrity of Tampa Bay.



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PUBLIC INVOLVEMENT

Public Involvement

A well-crafted community outreach program that enlists and involves diverse interests as partners in bay restoration and protection is a hallmark of all successful National Estuary Programs.

This principle has guided the Tampa Bay National Estuary Program since it was established in 1991. A public opinion poll conducted for the Program found citizens generally were willing to pay more to restore the bay — but wanted assurances that current programs "work smart" to effectively apply existing regulations and resources before adding new mandates. Responses also indicated that citizens didn't fully understand the bay's most pressing problems, or how actions at home impact the health of the bay.

Survey results confirmed the need for diverse public input from the outset of the program in the development of the Comprehensive Conservation & Management Plan for Tampa Bay. Findings also pointed to the need for a broader community outreach campaign to educate and involve the public in pollution prevention and bay stewardship.

These findings became the springboard for a tri-county community outreach program initiated by the Tampa Bay National Estuary Program in 1991. From these three communities, the Tampa Bay Program recruited citizen representatives with diverse perspectives and backgrounds to form a Community Advisory Committee.

This 25-member forum has provided structured input from citizens who share a common interest in a healthy bay that supports both recreation and commerce. Advisors are appointed by the Program's Policy Committee and include community leaders and representatives of homeowner's associations, agriculture, industry, education, fishing, and the environment, who also share their perspectives as citizen-taxpayers. The Committee assists the Program in understanding community concerns. Members also provide information to constituents and help design and execute community outreach programs.

This chapter profiles key elements of the Program's public education and involvement efforts and recommends ways to maximize community participation in the future to continue the positive course of the bay's recovery.

Addressing the Bay's Priority Problems

Priority issues, such as stormwater runoff and seagrass protection, have provided a focal point for educational outreach by the Tampa Bay National Estuary Program.

Studies by the Tampa Bay NEP estimate that stormwater runoff contributes about half of the bay's total nitrogen input and significant amounts of heavy metals and pesticides. Yet, fewer than half of the citizens responding to a public opinion poll on

Tampa Bay in 1991 were able to identify stormwater runoff as a major source of bay pollution.

Even fewer recognized their own potential contribution to stormwater pollution. In fact, while most residents believe businesses are the major source of bay pollution, residences — which far outnumber commercial sites — actually contribute more to the bay's total nitrogen input. And that contribution could grow as more people move into the region.

Yards & Neighborhoods as Pathways to the Bay

Yards and neighborhoods are one of the bay's first lines of defense against pollution in stormwater runoff. Yet many homeowners fail to understand the potential impact of excess fertilizer, pesticides and water used in landscape care on the long-term health of Tampa Bay. The connection may be immediate in a waterfront neighborhood, or gradual, through the flow of stormwater drains, ditches, streams or rivers.

To publicize these concepts and to enlist residents in pollution prevention, the National Estuary Programs of Tampa Bay and Sarasota Bay, and the Florida Cooperative Extension Service established the Florida Yards & Neighborhoods (FY&N) Program in 1991. Experts from county extension services, which administer the program, teach residents techniques to reduce runoff pollution and enhance their environment by improving home and landscape management. The program promotes the establishment of Florida Yards, which emphasize native and other beneficial plants that blend beauty and environmental benefits. The program also emphasizes least-toxic techniques for landscape maintenance to reduce pesticides in runoff to the bay.

In 1994, the West Coast Regional Water Supply Authority joined the FY&N founding partners in a move to expand the program's outreach to neighborhoods and individual residents in Hillsborough, Pinellas, Pasco and Manatee counties. Neighborhoods accepted into the program participate in an extended effort to learn and apply environmental landscaping techniques and other pollution prevention practices. To advance these concepts, the FY&N program has produced a number of learning tools and materials. These include:

- the Florida Yards & Neighborhoods Handbook — a citizens' comprehensive guide to creating and maintaining an environmentally beneficial Florida yard;
- the Florida Yardstick — an interactive poster that asks homeowners "Does Your Yard Measure Up?" and provides a self-test and actions to measure progress in implementing environmental landscaping concepts. Homeowners who tally sufficient points can have their yard certified as a Florida Yard;
- educational slide programs and the FY&N Newsletter, a publication designed to stimulate and educate program participants.

Actions presented in *Charting the Course* seek to expand these efforts to reach more people by enlisting retailers, developers and landscaping professionals, as well as other non-profit educational groups, to promote FY&N concepts. Local governments also are called upon to lead by example by landscaping and maintaining public properties in accordance with these environmental principles. These groups can help stimulate consumer demand for Florida Yards that are less maintenance-intensive, result-

ing in reduced pesticides and fertilizers in runoff to the bay.

Educating Boaters to Protect Seagrasses

Seagrass protection has been another educational priority of the Tampa Bay Program. Studies estimate that roughly one-third of the bay's seagrasses are moderately to heavily scarred as a result of propeller scarring by boats that cut through shallow grass flats or dredge their way free after running aground. Prop scars produce sandy trenches that may stay barren for years. Intense scarring at several bay locations, including Weedon Island Preserve, Cockroach Bay and Ft. DeSoto Park, has led to boating restrictions and an increased emphasis on boater education. Other sections of the bay also have sustained damage and remain vulnerable to damage from propellers.

To promote protection of seagrasses and other vital bay habitats, the Tampa Bay NEP and the Florida Department of Environmental Protection (FDEP) published a Boater's Guide to Tampa Bay in 1992. While bay stewardship is the central theme of the guide, the guide's strength is that it features information that boaters want in a handy format that invites use. The guide's focal point is a 34" x 22" color chart of Tampa Bay that identifies ship channels, seagrasses, aquatic preserves, reefs and public boat ramps. The chart's flip side features profiles and illustrations of native habitats, manatees and birds of the bay. It folds to 9" x 4" (standard road map-size for easy on-boat storage) and is available in both water-resistant and recycled stocks.

More than 80,000 Boater's Guides have been distributed in Hillsborough, Pinellas and Manatee counties through marine patrol units, marinas, tax collector's offices, local agencies and special events. A companion Boater's Guide to Charlotte Harbor has since been produced by FDEP, which hopes to use the Tampa Bay guide as a model for statewide implementation.

To further seagrass protection, the Tampa Bay NEP also produced a series of high quality interpretive signage for installation at more than a dozen high-use boat ramps and waterfront parks along the bay. The set includes a master sign featuring a map of the Tampa Bay estuary, which highlights seagrass areas. The accompanying text suggests ways for boaters to avoid impacts to seagrasses and other shallow marine habitats. Smaller companion signs in the series profile topics ranging from mangroves and seagrasses to the brown pelican and manatee.

Enlisting Volunteers for Bay Improvement

The Tampa Bay NEP also has been instrumental in supporting volunteer efforts for bay restoration and protection. In 1993, the Program helped establish a Bay Conservation Corps under the direction of Tampa BayWatch, a non-profit bay stewardship group. Since then, BayWatch has introduced more than 1,000 adults and students to the wonders of Tampa Bay through dozens of salt marsh plantings, bird island and coastal cleanups, storm drain stenciling projects, and an innovative coastal wetland nursery program (see profile in Community Partnerships below). The organization serves as a clearinghouse, matching interested volunteers with hands-on activities around the bay sponsored by various agencies and communities.

Each year, the Tampa Bay NEP and Tampa BayWatch host the Great Bay Scallop Search, in which teams of volunteers don snorkels, masks and fins to comb the bay's

grassbeds in search of the elusive bay scallop. The scallop disappeared from Tampa Bay in the 1960s when the bay was badly polluted. Recent studies have documented the bay's improving water quality and emerging seagrass recovery, rekindling hope that scallops can again thrive in Tampa Bay. Experimental stocking efforts are underway.

Developing Community Partnerships for Bay Restoration

A Bay Grants program established by the Tampa Bay National Estuary Program in 1992 has been an important catalyst in developing community partnerships for bay restoration. Since 1992, the NEP has awarded small grants totalling more than $50,000 to more than a dozen organizations, schools and communities for projects to educate and involve diverse interests in bay restoration and protection. These initiatives have leveraged the talents and resources of many varied organizations, maximizing the community's and the bay's return on investment. Profiles of our community partners and their projects for bay improvement are provided below.

- *Tampa Bay Docents* — A grant from the Tampa Bay NEP helped The Florida Aquarium establish a Bay Docents program in 1992 to train interested volunteers to lead weekend BayWalks on Tampa Bay at Tampa's McKay Bay Nature Park and Weedon Island Preserve in Pinellas County. The Program has trained more than 30 guides and introduced hundreds of children and adults to the bay's coastal ecosystems. To become a BayWalk guide, volunteers complete a nine-week class and field course conducted by The Florida Aquarium, and commit to leading a minimum of six BayWalks per year. The BayWalks on Tampa Bay Program has now become an ongoing component of the Aquarium's outreach curriculum, and is serving as a model for other NEPs and communities.

- *Operation BayWorks* — This project by Hillsborough County assists businesses in developing pollution prevention plans and implementing best management practices to reduce stormwater runoff. Nearly 100 businesses from targeted industry sectors, including landscape maintenance, construction and automotive repair, are participating in the pilot program. Participants receive pollution prevention workbooks designed specifically for their industries, along with instructional and promotional literature. This program blueprint will be evaluated for implementation in other watershed counties.

- *Coastal Wetland Nursery Program* — This project, directed by Tampa BayWatch, enlists high school ecology clubs in cultivating wetland plants for coastal restorations. Grants assistance from the Tampa Bay NEP enabled development of an operations guide for culturing mangrove and salt marsh vegetation and the construction of a wetland nursery at St. Petersburg's Lakewood High School, which produced more than 2,000 salt marsh plants. The idea is taking root at other bay area schools and BayWatch eventually hopes to produce about 75,000 salt marsh plants each year to aid in local restorations.

- *Eco-Landscaping for Businesses* — Businesses are beginning to understand the bottom-line benefits of Florida landscapes that feature native and other beneficial drought-tolerant plants that demand less water, fertilizer and pesticides. The bay- and cost-saving message is the central theme of an educational and

promotional campaign led by the Tampa Audubon Society in cooperation with the Florida Association of Environmental Professionals, Westshore Alliance, Lewis Environmental Services and the Tampa Bay National Estuary Program. A $4,500 grant from the Tampa Bay NEP to the Tampa Audubon Society assisted in the development of a corporate "pitch" brochure and slide presentation that features cost-benefit analyses for interested parties. The group hopes to target large commercial developments where landscape modifications may be cost-effective; another target is urban and landscape designers involved in planning new commercial projects.

- *Least-Toxic Pest Controls* — The effectiveness of natural predatory insects as an alternative to pesticides was tested in a six-month trial using various ornamental crops, under the direction of the Manatee County Cooperative Extension Service. Results showed important cost and labor savings, in addition to environmental benefits associated with reduced pesticide use. Workshops also were conducted to promote least-toxic pest management techniques to nurserymen and growers.

- *Emerson Point Restoration* — Volunteers under the direction of the Manatee County Soil & Conservation District teamed up to restore severely damaged mangroves and salt marshes at this key conservation site. The project also produced a plant and conservation guide to Emerson Point and neighboring Terra Ceia Aquatic Preserve.

- *Egmont Key Seagrass Protection* — Navigational buoys were installed by the Egmont Key Alliance at this popular coastal barrier island to deter boat traffic from heavily scarred seagrass beds. Interpretive signage on the island educates boaters about the importance of protecting these vital cornerstones of the bay ecosystem.

- *Model Florida Yard Landscaping Demonstration* — This project by Hillsborough County's Public Utilities Department involved the design and installation of a low-maintenance Florida landscape and interpretive signage at northwest Hillsborough's Austin Davis Library, where visitors can learn about and view bay-friendly landscape concepts that can be applied at home.

- *Shell Key Bird Nesting Protection* — The St. Petersburg Audubon Society received a $500 grant from the Tampa Bay NEP to develop an educational sign for installation at this important bay bird nesting site to enlist visitors in protecting the island's feathered inhabitants.

A special community partnership between the Tampa Bay NEP and The Florida Aquarium was formed in 1995 to support the development of the Florida Landscapes gardens at the entrance to the Aquarium. This living exhibit features a mosaic of native habitats, from beaches and wetlands to wildflower gardens, with interpretive signage that emphasizes the beauty and environmental benefits of landscaping with native plants. Funding from the Tampa Bay NEP also will support educational programs at the Aquarium and off-site at various bayside venues.

Outreach to Schools

While many NEP programs have targeted adults, the Program also recognizes the value of fostering an environmental ethic among students who represent the future decision-makers.

Through partnerships with school districts in Hillsborough, Pinellas and Manatee counties and The Florida Aquarium, the Tampa Bay NEP has sponsored field trips and workshops for several thousand students and hundreds of instructors. The Program also has participated in the development of classroom materials focusing on the Tampa Bay estuary for incorporation into core curriculums and supported field trips.

Junior high and high school students participated in outdoor learning labs at Cockroach Bay, McKay Bay, Emerson Point and Weedon Island. The NEP targeted younger schoolchildren with performances by the Marine Gang, a group of costumed sea creatures whose creative mix of music and theater bring the bay to life on stage. With support from the Tampa Bay NEP, the Marine Gang introduced more than 65,000 elementary school students to the wonders of the estuary and kid-friendly concepts for pollution prevention. The Marine Gang is administered through the Museum of Science & Industry (MOSI), which continues to offer this program to schools thanks to funding from the Southwest Florida Water Management District.

Teacher's workshops sponsored by the Tampa Bay NEP have provided an additional opportunity for educational impact by bringing instructors in touch with the bay and supplying them with resources to take back into the classroom.

Charting the Course for Tampa Bay

COMMUNITY INVOLVEMENT IN THE DEVELOPMENT OF THE PLAN FOR TAMPA BAY

The Tampa Bay NEP has brought together diverse sectors of the community as partners in the development of the plan for Tampa Bay. This effort began in 1991 with the establishment of the Community Advisory Committee and has continued into 1996 with increasingly focused efforts to expand public participation in the plan's review and finalization. In 1993, the Tampa Bay NEP began publishing a series of bay issues briefs — on topics ranging from stormwater pollution and habitat loss to dredging and spill prevention — that outlined various management options to address the bay's priority problems. These briefs were the springboard for a series of meetings with the NEP's technical and community advisory committees and key community groups to discuss and improve management options and then rank strategies for bay improvement.

As part of this initiative, the Community Advisory Committee hosted a series of focus groups in 1994 with students, seaport interests, farmers and homeowners to invite groups with diverse perspectives and interests in the bay to contribute to the emerging action plans for bay restoration. These focus groups have helped strengthen community investment in the work of the National Estuary Program and assisted the Program in better understanding and anticipating the concerns of key constituent groups.

A preliminary outline of the action plans for Tampa Bay was developed from this process and released for review by the Tampa Bay Management Conference in January 1995. Further research and more than 200 responses from technical and citizen reviewers were instrumental in shaping the draft of *Charting the Course,* which is now presented for full community review.

In conjunction with its release, the Tampa Bay NEP is sponsoring a series of industry briefings and community forums to further enlist participation from specific audiences who may be affected by the plan and who may be able to assist in crafting effective strategies with broad-based support. More formal Town Meetings, which also will fulfill legal requirements for public hearings, will be conducted in February 1996 to present and discuss the draft plan with the community.

The Tampa Bay NEP also has hosted an occasional series of point-counterpoint forums on bay topics of key concern such as the public referendum to 1994's Ban-The-Nets, and mitigation banking, the practice of pooling credits from on-site wetland impacts for the purposes of off-site mitigation.

The Program also has examined a series of complex bay issues through its quarterly newsletter, *Bay Guardian,* which is distributed to policy leaders, citizens and other bay advocates and interested parties.

Planning for the Future

The Tampa Bay National Estuary Program will complete the Comprehensive Conservation & Management Plan (CCMP) for Tampa Bay in 1996, and through an intergovernmental agreement with participating communities and agencies, begin implementation of this strategic blueprint for bay restoration and protection. As attention shifts from planning to implementation, the focus of public involvement and education also will shift to address long-term, but vitally important, needs. Future outreach to the community should seek to:

- foster continued community support for bay restoration and implementation of the CCMP by continuing to educate citizens on bay issues and publicize the bay's progress and needs;
- improve public faith in the ability of bay managers and organizations dedicated to the bay's restoration and protection to "work smart" to leverage resources, avoid duplication and focus on priorities;
- maximize direct opportunities for public involvement in bay restoration and environmental improvement.

These objectives for community outreach and education are part of a public affairs blueprint the Community Advisory Committee of the Tampa Bay NEP will finalize in 1996. The committee's recommendations will help guide the Tampa Bay NEP as it oversees implementation of the bay master plan, and may call for:

- continuation of the quarterly newsletter *Bay Guardian* to spotlight the state of the bay and progress in the bay's recovery; aggressive efforts to publicize bay issues in the media to inform and educate the public;

- continued advocacy of bay restoration and protection efforts in cooperation with other public policy and interest groups; continued efforts to educate the public on topical issues affecting the bay;
- efforts to support and enhance environmental organizations that enlist and effectively utilize volunteers, such as Tampa BayWatch, The Florida Aquarium, Florida Native Plant Society and the National Audubon Society. This represents an ongoing commitment and emphasis of the Tampa Bay NEP to utilize and promote existing organizations that are specifically organized to conduct outreach and educational programs rather than relying solely on in-house programming that may be duplicative;
- annual "spotlight on solutions" field trips targeted to and co-sponsored by various audiences with regulatory and natural resource interests. For example, a field trip co-sponsored by a local alliance of developers might target urban designers and showcase exemplary commercial landscapes that enhance the environment and substantially reduce the need for fertilizer, pesticide and water use, and provide resources and cost-benefit analyses for implementing these bay-friendly and corporate image-enhancing ideas at other commercial sites. Public field trips to bay restoration sites and parks, and visits by boat over the waterways also might be offered in cooperation with The Florida Aquarium;
- annual progress reports to the community on *Charting the Course* for Tampa Bay, in conjunction with an existing organization such as the Agency on Bay Management and its annual published State of the Bay report, and companion written progress report summaries for local legislators and policy leaders;
- a graphic-and-text state of the bay environmental index to be published on an occasional basis in partnership with one of the bay area's daily newspapers.

These are among the ideas that will be evaluated as the Tampa Bay National Estuary Program continues its efforts to build strong advocacy for bay restoration and provide interested citizens with a more personal and direct opportunity to improve and protect the bay.

Early Action

Since its inception, the Tampa Bay National Estuary Program has demonstrated its commitment to improving Tampa Bay by investing in early action projects designed to jumpstart restoration efforts and build a community consensus for the bay's recovery. To this end, the Tampa Bay NEP has secured almost $1 million in matching grants and federal funds to support a wide variety of restoration and outreach projects.

These diverse projects have allowed researchers to test new techniques and concepts for reducing pollution and restoring degraded habitats; identify and fill in gaps in current protection programs; and educate bay area citizens about threats facing the bay — and how they can help overcome them.

Several of these key early action initiatives are summarized below:

Cockroach Bay Restoration

This secluded inlet on Tampa Bay's eastern shore harbors some of the most productive mangrove forests and seagrass meadows in the entire bay system. However, the long-term health of this area has been jeopardized by intensive alteration of its upland fringe, primarily from agricultural and mining operations.

The Tampa Bay NEP, together with regional and state agencies providing matching funds, secured $700,000 in federal grants to assist in the restoration of this area — $300,000 from the Coastal America Program and $400,000 in grants under Section 319(h) of the federal Clean Water Act. The effort is part of a $2.3-million restoration directed by the Southwest Florida Water Management District's Surface Water Improvement & Management (SWIM) Program, in cooperation with Tampa Bay NEP and more than a dozen other public- and private-sector partners. Hillsborough County spent $2.1 million to purchase the restoration site.

The 500-acre project is the largest saltwater restoration of its kind conducted in Florida. The project is unique in its multi-faceted focus on creating a mosaic of habitats, including brackish and freshwater marshes, grass beds, oyster and live-bottom reefs, salt barrens, and upland pine and hardwood forests. In addition, the project will provide much-needed treatment of stormwater runoff from the surrounding farmlands by building a treatment pond in which runoff will be filtered before being discharged naturally to a restored stream bed leading to the bay.

Extensive removal of exotic vegetation such as Brazilian pepper already has been accomplished, and construction of the stormwater improvements is scheduled to begin in December 1995.

Bay Scallop Recovery

The bay scallop was once a common resident of Tampa Bay, but virtually disappeared in the mid-1960s. Many scientists blame declining water quality for the scallop's demise and speculate that the dramatic improvements now occurring in the bay's health may offer hope for restoring bay populations of these sensitive mollusks.

The Tampa Bay NEP has contributed more than $130,000 to research aimed at pinpointing the water quality conditions necessary to support bay scallops and to aggressively restock suitable bay segments with scallops. That effort, directed by the University of South Florida, has so far raised more than one million juvenile scallops in laboratories, using strips of artificial turf that mimic the seagrasses to which the scallops cling in the wild. Hundreds of thousands of these juvenile scallops have been released in lower Tampa Bay, and monitoring is underway to determine whether these exploratory transplant efforts can help bring back a sustainable scallop population.

Gandy Shoreline Alternatives

Construction of vertical seawalls along the bay's borders has destroyed much of the bay's sloping fringe of ecologically valuable mangroves and salt marshes. This project, financed with $65,000 from the Tampa Bay NEP, tested different techniques for "softening" seawalls along the industrialized southeast shoreline of the approach to the Gandy Bridge. Funds from the Tampa Bay NEP were matched with about $150,000 from partners in the Bay Area Environmental Action Team (BAEAT), including SWIM, which directed the project.

The project evaluated structurally sound and environmentally friendly alternatives to seawalls that enhance habitat values while still providing protection of upland properties. The techniques were tested on an existing seawall extending along 1,200 linear feet of the Gandy Bridge approach, in an area subject to heavy boat wakes and erosion. The methods evaluated included: lowering the elevation of the original seawall to create a gentler slope and installing riprap to allow tidal flushing and pools for juvenile fish; planting salt marsh grass behind the riprap to stabilize the shoreline; adding riprap to both ends of a remnant seawall offshore to provide habitat for oysters and crabs and to create a small lagoon behind the structure; and installing "MacBlox," cement blocks with scalloped contours and multiple openings that provide more surface areas for oysters, barnacles and fish to utilize.

Information gleaned from this project, which was completed in 1993, gave officials insight into how to design more ecologically benign shoreline stabilization structures. Techniques evaluated by the project are now being recommended by regulatory officials for commercial and residential use.

In addition to the seawall studies, the project also restored the littoral marsh and mangrove habitat upland of the seawall, constructed a boardwalk, and installed signs describing the restoration and the seawall alternatives demonstrated there.

Pepper Busters Brochure

Brazilian pepper is the most invasive and persistent of the exotic plants to gain a toehold along Tampa Bay. This tall shrub, sometimes called Florida holly because of its red berries, quickly moves into disturbed shoreline areas, strangling mangroves and

forming a dense monoculture that provides little ecological benefit and is extremely difficult to eradicate.

The Tampa Bay NEP funded a $3,000 project by the Cockroach Bay Aquatic Preserve Management Team (CAPMAT) and its South Hillsborough Pepper Patrol to create an illustrated brochure explaining the environmental hazards of this plant and how to get rid of it. It also explained the importance of preserving native plant communities. This popular brochure, one of the first of its kind written for the general public, is widely distributed by county and state environmental agencies, county extension agents and public libraries.

Assessment of Management Efforts to Protect Seagrass

Propeller scarring of seagrass beds in Tampa Bay is widespread and impairs the ability of these underwater meadows to protect against erosion and provide habitats for marine life. This project, financed in part with $14,000 from the Tampa Bay NEP, enabled Pinellas County to assess the extent of seagrass scarring in one area of the bay through aerial mapping and interpretation and to evaluate various methods of protecting those seagrasses from further damage.

The site chosen for the project encompassed 420 acres of severely scarred seagrass around Fort DeSoto Park in Pinellas County, in a large embayment called Boca Ciega Bay. Scarred areas were mapped in March and October 1993, and again in October 1994. Mapping will continue annually for three more years.

After examining results of the baseline survey, two protection zones were established in the seagrass beds. Signs were posted restricting boating access in one area except at high tide, while motor boats were completely prohibited in the second area. The losses were virtually the same for both the closed and restricted-access areas, indicating that signs alone may be effective deterrents to seagrass scarring and that complete closures may not be necessary to reduce propeller scarring.

This project is providing important information about what protective measures are effective in reducing seagrass scarring, and may help bay managers develop uniform, easily recognizable guidelines that can be implemented throughout not only the bay, but also the entire state.

Data-Sharing Through GIS

Tampa Bay is among the most well-studied waterways in the nation, yet valuable information from research and monitoring projects is not always shared among bay managers. This is often because the data bases and formats used by one agency are incompatible with those of another.

Maps are a particularly important and visible management tool, with their ability to relate a vast amount of information, including land uses, natural resources, drainage patterns, pollution sources and political boundaries. This project, supported with nearly $20,000 from the Tampa Bay NEP, enabled the Environmental Protection Commission (EPC) of Hillsborough County to create a comprehensive, readily retrievable data base for the bay based on computer-generated maps utilizing

Geographic Information System (GIS) technology.

Cockroach Bay was selected as a testing ground for this innovative approach. Officials with the EPC compiled information about Cockroach Bay from various sources and imported those files into their data banks. They then produced GIS maps that synthesized the information in a format compatible with other agencies, government organizations and research institutions. These techniques will be expanded bay-wide, providing across-the-board information that will result in less duplication and promote greater cooperation among bay managers in the future.

Seabird Rescue Initiative

Although Tampa Bay has largely been spared the damaging effects of major oil spills, those that have occurred have pointed to the need for a trained corps of volunteers to rescue and rehabilitate injured wildlife, especially seabirds.

In conjunction with the Pinellas Seabird Rehabilitation Center and the Tampa Bay Regional Planning Council, the Tampa Bay NEP contributed $7,500 to finance the organization and training of nearly 100 citizen-volunteers to assist in seabird rescue efforts, in addition to the production of a volunteer training manual. Beginning in October 1991, the volunteers attended several seminars featuring leading wildlife rehabilitators; the group also received rescue kits, nets and communication equipment.

In August 1993, more than 330,000 gallons of oil and jet fuel were spilled in the bay when two barges and a tanker collided near the Sunshine Skyway Bridge. The seabird rescue teams put their training to good use, rescuing and treating 371 birds at a temporary "hospital" at Fort DeSoto Park. Eventually 318 birds, or 85 percent, were recovered and released — an extraordinary success rate when compared to similar efforts in other regions. The advance planning, organization and chain-of-command structure demonstrated by this network serves as a model for similar groups throughout the nation.

Emerson Point Project

Emerson Point is a historically and ecologically rich coastal area at the mouth of the Manatee River. The cultural resources of the 195-acre site include American Indian mounds and middens that were studied by researchers with the Smithsonian Institution, and the remains of a 19th century plantation. Natural resources include extensive hardwood hammocks, mangroves and salt marshes, as well as colorful and rare live-bottom reefs in the shallow waters offshore.

The Tampa Bay NEP provided $50,000 to Manatee County to aid in the protection and restoration of this area, which was purchased by the state in 1991 and is now managed by the County as Emerson Point Park. The project focuses on providing public access to the site for education and recreation, while preserving its unique cultural and natural attributes. Work includes removal of exotic vegetation, excavation and stabilization of the Indian mounds and plantation, and the construction of boardwalks and trails for public access. Signs will be posted to describe the land, its human and natural history, and resident wildlife, and plans are now underway to develop a county environmental education center on the site to teach schoolchildren about this priceless ecological and historical heritage.

REFERENCES, STATE OF THE BAY

1. K. Haddad, *Habitat Trends and Fisheries in Tampa and Sarasota Bays,* NOAA Estuary of the Month, Tampa and Sarasota Bays: Issues, Resources, Status and Management, Seminar Series No. 11, 1989.
2. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.
3. Coastal Environmental, Inc., *Physical Impacts to Habitats in Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #03-93, May 1994 (shoreline modifications).

   A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995 (seagrass losses).
4. K. Haddad, *Habitat Trends and Fisheries in Tampa and Sarasota Bays,* NOAA Estuary of the Month, Tampa and Sarasota Bays: Issues, Resources, Status and Management, Seminar Series No. 11, 1989 (1982 emergent wetland acreage, proportional estimates).

   A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995 (1990 emergent wetland acreage).
5. Florida Department of Environmental Protection, Marine Research Institute, unpublished data; personal communication, Brad Weigle, 1995.
6. R.R. Lewis, K.D. Haddad, and J.O.R. Johansson, *Recent Areal Expansion of Seagrass Meadows in Tampa Bay, Florida: Real Bay Improvement or Drought-Induced?,* Proceedings, Tampa Bay Area Scientific Information Symposium 2 - The Watershed (BASIS 2), 1991 (1950 and 1982 seagrass acreage estimates).

   A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995 (1950 and 1990 seagrass acreage estimates).
7. Coastal Environmental, Inc., *Physical Impacts to Habitats in Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #03-93, May 1994.
8. C.R. Goodwin, *Tidal flow, Circulation, and Flushing Changes Caused by Dredge and Fill in Tampa Bay,* Florida, U.S. Geological Survey Water-Supply Paper 2282, 1987.
9. R.R. Lewis, K.D. Haddad, and J.O.R. Johansson, *Recent Areal Expansion of Seagrass Meadows in Tampa Bay, Florida: Real Bay Improvement or Drought-Induced?,* Proceedings, Tampa Bay Area Scientific Information Symposium 2 - The Watershed (BASIS 2), 1991 (1982 seagrass acreage estimates).

   Tom Ries, Southwest Florida Water Management District, SWIM, unpublished data; personal communication, 1994 (1992 seagrass acreage estimates).

   Doug Robison, Coastal Environmental, Inc., personal communication, 1995 (percentage of change between 1982 and 1992).
10. Florida Department of Environmental Protection, Marine Research Institute, *Scarring of Florida's Seagrasses: Assessment and Management Options,* FMRI Technical Report TR-1, 1995.
11. J.N. Ehringer, *Results of Analysis of Prop Scar Damage at the Fort Desoto Aquatic Habitat Management Area 1992/1993,* Tampa Bay National Estuary Technical Publication #05-94, August 1994.
12. Penny Hall, Florida Department of Environmental Protection, Marine Research Institute, unpublished data; personal communication, 1995.
13. Tom Ries, Southwest Florida Water Management District, SWIM; personal communication, 1995.
14. R.R. Lewis, III, and E.D. Estevez, *The Ecology of Tampa Bay, Florida: An Estuarine Profile,* U.S. Fish & Wildlife Service Biological Report 85(7.18), September 1988.
15. Coastal Environmental, Inc., *Physical Impacts to Habitats in Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #03-93, May 1994.
16. Lewis Environmental Services, Inc., *Hard Bottom Mapping of Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-94, 1994.

17. R.R. Lewis, III, and E.D. Estevez, *The Ecology of Tampa Bay, Florida: An Estuarine Profile,* U.S. Fish & Wildlife Service Biological Report 85(7.18), September 1988.

18. Tampa Bay National Estuary Program and Florida Marine Research Institute, *Boaters Guide to Tampa Bay,* 1993.

19. A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995

20. Ibid.

21. Ibid.

22. Based on information from LANDSAT Ground Cover Database; Jim Beever, Florida Game & Freshwater Fish Commission, personal communication, 1995.

23. A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995

24. Dames & Moore and Mote Marine Laboratory, *Impact of Freshwater Flow Variations in the Manatee River,* Tampa Bay National Estuary Program Technical Publication #09-94, December 1994.

25. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Current and Historical Freshwater Inflows to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #01-94, July 1995.

26. Landings data from the National Marine Fisheries Service and the Florida Department of Environmental Protection; personal communication, Martha Norris, 1995. Landing data includes bluefish, black drum, flounder, jack crevalle, whiting, Spanish mackerel, menhaden, mullet, sea trout, sheepshead, and gray snapper. Some fish landed in Manatee County may have been caught in Tampa Bay, but those harvests cannot be segregated from catches in Sarasota Bay. Regardless, the inclusion of Manatee landings does not change the percent declines noted here.

27. Ibid.

28. Ibid.

29. Florida Department of Environmental Protection, Marine Research Institute, unpublished data; personal communication, M. Norris, 1994.

30. Coastal Environmental, Inc., *Distribution of Selected Fish Species in Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #05-92), May 1992.

31. Based on the National Shellfish Sanitation Program Guidelines; Brian Pierce, Florida Department of Environmental Protection, Bureau of Marine Resource Regulation and Development, personal communication, October 1995.

32. Tampa Bay Regional Planning Council, *The Future of Tampa Bay,* 1985.

33. Richard Paul, National Audubon Society, Tampa Bay Sanctuaries, unpublished data; personal communication, 1995.

34. Ibid.

35. Florida Department of Environmental Protection, Marine Research Institute, unpublished data; personal communication, Brad Weigle, 1995.

36. J.L. Simon and S.K. Mahadevan, *Benthic Macroinvertebrates of Tampa Bay,* Proceedings, Tampa Bay Area Scientific Information Symposium (BASIS), 1985.

37. E.R. Long, D. MacDonald, and C. Cairncross, *Status and Trends in Toxicants and the Potential for Their Biological Effects in Tampa Bay, Florida,* NOAA Technical Memorandum NOS OMA 58, June 1991.

38. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

39. City of St. Petersburg, unpublished data, 1995.

40. Environmental Protection Commission of Hillsborough County, *Surface Water Quality Report,* 1992-1994, 1995.

41. A. Janicki and D. Wade, *Estimating Critical Nitrogen Loads for the Tampa Bay Estuary: An Empirically Based Approach to Setting Management Targets,* Tampa Bay National Estuary Program Technical Publication #03-95, April 1995.

42. L.K. Dixon and J.R. Leverone, *Light Requirements of Thallassia testudinum in Tampa Bay, Florida,* Prepared for Southwest Florida Water Management District SWIM Program, May 4 1995.

43. A.J. Janicki, D.L. Wade, and D.E. Robison, *Habitat Protection and Restoration Targets for Tampa Bay,* Tampa Bay National Estuary Program Technical Publication #07-93, June 1995.

44. A. Janicki and D. Wade, *Estimating Critical Nitrogen Loads for the Tampa Bay Estuary: An Empirically Based Approach to Setting Management Targets,* Tampa Bay National Estuary Program Technical Publication #03-95, April 1995.

45. L.K. Dixon and J.R. Leverone, *Light Requirements of Thalassia testudinum in Tampa Bay, Florida,* Prepared for Southwest Florida Water Management District SWIM Program, May 4, 1995.

46. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

47. Roger Johansson, City of Tampa Sanitary Sewers Department; personal communication, 1994.

48. Versar, Inc., and Coastal Environmental, Inc., *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs,* Tampa Bay National Estuary Program Technical Publication #01-95, June 1995.

49. E.R. Long, D. MacDonald, and C. Cairncross, *Status and Trends in Toxicants and the Potential for Their Biological Effects in Tampa Bay, Florida,* NOAA Technical Memorandum NOS OMA 58, June 1991.

50. Ibid.

51. E.R. Long, D.A. Wolfe, R.S. Carr, K.J. Scott, G.B. Thursby, H.L. Windom, R. Lee, F.D. Calder, G.M. Sloane, and T. Seal, *Magnitude and Extent of Sediment Toxicity in Tampa Bay, Florida,* NOAA Technical Memorandum NOS ORCA 78, June 1994.

(PELs are based on "effects range median" (ERM) as cited in this report.)

52. McCain, B.B., D.W. Brown, T. Hom, M.S. Myers, S.M. Pierce, T.K. Collier, J.E. Stein, S-L. Chan, U. Varanasi, *Chemical Contaminant Exposure and Effects in Four Fish Species From Tampa Bay, FL,* Estuaries. Journal of the Estuarine Research Federation, IN PRESS.

53. E.R. Long, D.A. Wolfe, R.S. Carr, K.J. Scott, G.B. Thursby, H.L. Windom, R. Lee, F.D. Calder, G.M. Sloane, and T. Seal, *Magnitude and Extent of Sediment Toxicity in Tampa Bay, Florida,* NOAA Technical Memorandum NOS ORCA 78, June 1994.

54. Hillsborough County, unpublished data; personal communication, Jack Merriam, 1995.

55. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

56. Versar, Inc., and Coastal Environmental, Inc., *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs,* Tampa Bay National Estuary Program Technical Publication #01-95, June 1995.

57. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

58. Ibid.

59. Ibid.

60. A.S. Patwardhan and A.S. Donigian, Jr., *Assessment of Nitrogen Loads to Aquatic Systems,* Prepared by Aqua Terra Consultants for the Office of Research and Development, U.S. Environmental Protection Agency, 1994.

61. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

62. Tampa Bay National Estuary Program, unpublished data based on Sept. 26, 1995 letter from Hopping, Green, Sams & Smith to Buck Oven, Florida Power & Light, regarding supplemental nitrogen deposition analyses and nitrogen loads from all sources estimated by TBNEP.

63. D. Fisher, J. Ceraso, T. Mathew, and M. Openheimer, *Polluted Coastal Waters: The Role of Acid Rain,* Environmental Defense fund, New York, New York, 1988.

64. L.K. Dixon, *Literature Compilation and Data Synthesis for Atmospheric Deposition in the Tampa Bay Watershed,* Prepared for the Tampa Bay National Estuary Program by Mote Marine Laboratory, Technical Report #370, March 1994.

65. D. Fisher, J. Ceraso, T. Mathew, and M. Openheimer, *Polluted Coastal Waters: The Role of Acid Rain,* Environmental Defence Fund, April 1988.

66. Versar, Inc., and Coastal Environmental, Inc., *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs,* Tampa Bay National Estuary Program Technical Publication #01-95, June 1995.

67. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

68. Ibid.

69. Ibid.

70. Versar, Inc., and Coastal Environmental, Inc., *Chemical Contaminants in the Tampa Bay Estuary: A Summary of Distributions and Inputs,* Tampa Bay National Estuary Program Technical Publication #01-95, June 1995.

71. Owen Ayres and Associates, Inc., *An Estimate of Nutrient Loadings from Wastewater Residuals Management and Onsite Wastewater Treatment Systems in the Tampa Bay Watershed,* Southwest Florida Water Management District, April 1995.

72. Hans Zarboch, Coastal Environmental, Inc.; personal communication, 1995.

73. Tom Cardinale, Environmental Protection Commission of Hillsborough County; personal communication, 1995.

74. G.W. Jones and S.B. Upchurch, *Origins of Nutrients in Ground Water Discharging from Lithia and Buchhorn Springs,* Southwest Florida Water Management District, 1993.

75. H. Zarbock, A.J. Janicki, D.L. Wade, D. Heimbuch, and H. Wilson, *Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida,* Tampa Bay National Estuary Program Technical Publication #04-94, May 1994.

76. Greiner, *Tampa Port Authority Dredged Material Management Plan,* DRAFT REPORT, Tampa Port Authority, September 1994.

77. Ibid.

78. Ibid.

79. Tampa Port Authority, *1994 Fiscal Year Annual Cargo Report,* 1994.

80. Trustee Council, *Natural Resource Damage Assessment Strategy, Tampa Bay, Florida for the Bouchard BARGE 155, Maritrans BArge OCEAN 255, and MV BALSA 37 Collission and Spill, 10 August 1993,* 1994.

81. Jane Urquhart-Donnelly, Florida Department of Environmental Protection, Division of Law Enforcement, Bureau of Emergency Response; personal communication, March 1994.

82. United States Coast Guard, Marine Safety Office, Tampa, Florida, unpublished data; personnel communication, 1994.

83. Chapter 376, Florida Statutes, Pollutant Discharge Prevention and Control Act (as amended, 1992).

84. U.S. Public Law 101-380, Oil Pollution Act of 1990 (OPA 1990).

85. Chris Rossbach, Florida Department of Environmental Protection, Division of Law Enforcement, Bureau of Emergency Response; personal communication, September 1995.

GLOSSARY

ALGAE - simple plants that grow in aquatic environments. Excess nutrients may accelerate the growth of algae, resulting in an algal bloom.

ATMOSPHERIC DEPOSITION - refers to materials discharged to the atmosphere from natural sources and anthropogenic (manmade) sources, such as automobiles, power plants and industries that fall on the surface of water or land in rainfall or as dry particles.

BENTHOS - the community of animals living in and on the bottom sediments of a body of water.

CRUSTACEANS - a group of mostly aquatic invertebrates with a hard, jointed shell (exoskeleton); examples include crabs, lobsters and shrimp.

DETRITUS - small particles of organic matter, largely derived from the decomposition of vegetation; an important food source for many small marine animals.

DREDGE-AND-FILL - commonly refers to the removal of bottom sediments (dredging) to construct and maintain canals and ship lanes, and the use of dredged material (spoil) as fill for development.

ECOSYSTEM - the system of ecological relationships between organisms (plants and animals) and their physical and chemical environment; a functional unit that includes both the organisms and their nonliving surroundings.

ESTUARY - a partially enclosed body of water where fresh water from rivers and streams mixes with salt water from the sea.

EUTROPHIC - refers to water that is rich in nutrients such as nitrogen and phosphorous, but often deficient in dissolved oxygen. Excess nutrients promote the growth of algae; as the algae dies and decomposes, it depletes the water of oxygen. Eutrophication occurs naturally in many bodies of water, but can be accelerated by pollution.

EXOTIC - refers to non-native plants and animals that have been introduced (accidentally or intentionally) to a region. Some exotic species establish and grow quickly, crowding out native species.

HABITAT - the sum of environmental conditions in a place where a plant or animal lives.

INVERTEBRATES - animals without backbones; examples include insects, worms, crustaceans, mollusks and sponges.

MANGROVES - a salt-tolerant tropical or subtropical tree that grows near the shoreline. Mangroves provide food and habitat for many types of wildlife, stabilize shorelines and filter pollutants that run off the land.

MARSH - a wetland where the dominant plants are grasses and sedges, as opposed to a swamp, where woody plants like shrubs and trees are the dominant vegetation.

MOLLUSKS - a group of invertebrates including clams, snails, oysters, conchs and other soft-bodied animals. Most mollusks have a thick, hard outer shell; squid and octopus are exceptions.

NON-POINT SOURCE POLLUTION - refers to pollution that comes from many sources and cannot be traced to one specific point, such as pollution from stormwater runoff and the atmosphere.

OLIGOHALINE - refers to water with a very low salinity (salt content), ranging from 0.5 to 10 parts per thousand (ppt). Freshwater is characterized by salinity of less than 0.5 ppt; seawater contains about 35 ppt.

PHYTOPLANKTON - free-floating aquatic plants and plant-like organisms, usually algae; an important food source for many animals.

POINT-SOURCE POLLUTION - refers to pollution that comes from a specific source or point of origin, such as a discharge pipe or outfall.

RUNOFF - water from rain or irrigation that flows over land. Runoff often carries pollutants such as oils, fertilizers and pesticides and is frequently a major component of non-point-source pollution.

SALT MARSH - a marsh growing in the intertidal and upper coastal zone, where salt water from the sea has a strong influence on the types of plant life. Salt marshes are important wetland habitats for many kinds of fish and wildlife.

SEAGRASSES - true flowering plants (not grasses) that grow underwater in shallow bays and estuaries. Seagrass meadows provide food and refuge for many marine animals.

SHELLFISH - a generic term that includes both crustaceans and mollusks, especially those used for food. The term finfish, by contrast, refers to true fishes.

SPOIL - sediments removed during dredging. Spoil may be deposited underwater or on islands created specifically for spoil disposal.

TOXIC - poisonous or directly harmful.

TURBIDITY - cloudiness of water from suspended material or particles. As the cloudiness increases, so does the turbidity; low turbidity indicates clear water and may be associated with good water quality.

WASTEWATER TREATMENT - processes that help remove solids, nutrients and other pollutants from water before it is discharged or reused.

WATER COLUMN - an inclusive term, covering the area that extends from the bottom sediments to the surface, for the water in a lake, estuary or ocean.

WATERSHED - the geographic region that drains into a particular stream, river or body of water. The Tampa Bay watershed covers more than 2,200 square miles in six counties.

WETLAND - land where the water table is usually at or near the surface. Some wetlands contain water year-round; others may remain relatively dry for months, becoming moist only during periods of heavy rain. Wetlands are vital habitats for many species of plants and animals; they are protected by local, state and federal regulations.

ZOOPLANKTON - free-floating aquatic animals ranging in size from microscopic, single-celled organisms to large jellyfish. Zooplankton are an important source of food for many types of fish and animals.

ACRONYMS

ACOE	ARMY CORP OF ENGINEERS
ACP	AREA CONTINGENCY PLAN
AWT	ADVANCED WASTEWATER TREATMENT
BEMR	BIENNIAL ENVIRONMENTAL MONITORING REPORT
BMP	BEST MANAGEMENT PRACTICE
CARL	CONSERVATION AND RECREATION LANDS
CCMP	COMPREHENSIVE CONSERVATION & MANAGEMENT PLAN
CERCLIS	COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY INFORMATION
CFMP	CRITICAL FISHERIES MONITORING PROGRAM
CIP	CAPITAL IMPROVEMENT PROGRAM
DDT	DICHLORODIPHENYL-TRICHLOROETHYLENE
DGPS	DIFFERENTIAL GLOBAL POSITIONING SYSTEM
DHRS	(Florida) DEPT. OF HEALTH AND REHABILITATIVE SERVICES
ELM	ENVIRONMENTAL LANDSCAPE MAINTENANCE
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPC	ENVIRONMENTAL PROTECTION COMMISSION (HILLSBOROUGH COUNTY)
ERP	ENVIRONMENTAL RESOURCE PERMIT
FAC	FLORIDA ADMINISTRATIVE CODE
FADS	FLORIDA ATMOSPHERIC DEPOSITION SYSTEM
FCES	FLORIDA COOPERATIVE EXTENSION SERVICE
FDEP	FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
FDOT	FLORIDA DEPARTMENT OF TRANSPORTATION
FERC	FEDERAL ENERGY REGULATORY COMMISSION
FGFWFC	FLORIDA GAME AND FRESH WATER FISH COMMISSION
FMRI	FLORIDA MARINE RESEARCH INSTITUTE
FPC	FLORIDA POWER CORPORATION
FPL	FLORIDA POWER & LIGHT
FWPCA	FEDERAL WATER POLLUTION CONTROL ACT
FY	FISCAL YEAR
FY&N	FLORIDA YARDS AND NEIGHBORHOODS
GPS	GLOBAL POSITIONING SYSTEM
IMC	IMC-AGRICO
LTMS	LONG-TERM MANAGEMENT STRATEGY
MGD	MILLION GALLONS PER DAY
MSSW	MANAGEMENT AND STORAGE OF SURFACE WATERS
NOAA	NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
NOEL	NO OBSERVABLE EFFECTS LEVEL
NOx	NITROGEN OXIDES
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
NPL	NATIONAL PRIORITIES LIST
O & M	OPERATING AND MAINTENANCE (BUDGET)
OSDS	ON-SITE DISPOSAL SYSTEMS
PAH	POLYNUCLEAR AROMATIC HYDROCARBONS
PCB	POLYCHLORINATED BIPHENYLS
PEL	PROBABLE EFFECTS LEVEL
PORTS	PHYSICAL OCEANOGRAPHIC REAL-TIME SYSTEM
PRTF	POLLUTION RECOVERY TRUST FUND
RCRA	RESOURCE CONSERVATION & RECOVERY ACT
SWFWMD	SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SWIM	SURFACE WATER IMPROVEMENT AND MANAGEMENT PROGRAM (SWFWMD)
TBNEP	TAMPA BAY NATIONAL ESTUARY PROGRAM
TBRPC	TAMPA BAY REGIONAL PLANNING COUNCIL
TECO	TAMPA ELECTRIC COMPANY
TKN	TOTAL KELDAHL NITROGEN
TN	TOTAL NITROGEN
TPA	TAMPA PORT AUTHORITY
TSS	TOTAL SUSPENDED SOLIDS
USACOE	UNITED STATES ARMY CORPS OF ENGINEERS
USDOT	UNITED STATES DEPARTMENT OF TRANSPORTATION
USEPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
USF	UNIVERSITY OF SOUTH FLORIDA
UST	UNDERGROUND STORAGE TANKS
VTS	VESSEL TRACKING SYSTEM
WAFR	WASTEWATER FACILITY REGULATION DATABASE
WCRWSA	WEST COAST REGIONAL WATER SUPPLY AUTHORITY
WWTP	WASTEWATER TREATMENT PLANT

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