DOCUMENTING THE ECONOMIC IMPORTANCE OF TAMPA BAY

FINAL REPORT

March 1986

Tampa Bay Regional Planning Council
9455 Koger Boulevard
St. Petersburg, Florida 33702
(813) 577-5151

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DOCUMENTING THE ECONOMIC IMPORTANCE OF TAMPA BAY

A Report to the Tampa Bay Regional Planning Council

and Agency on Bay Management

Financial assistance for this study was provided by a Coastal Management Grant from the Florida Department of Environmental Regulation.

Tampa Bay Regional Planning Council
9455 Koger Boulevard, Suite 219
St. Petersburg, FL 33702
(813) 577-5151

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EXECUTIVE SUMMARY

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the Tampa Bay region. Directly, the presence of Tampa Bay makes possible the port facilities of Tampa, St. Petersburg and Manatee County; ship building and repair firms; commercial and recreational fishing industries; and other marina facilities. Indirectly, the mere presence of the bay attracts industries and businesses, waterfront residential developments, and a myriad of related support industries, and commercial and recreational activities. There is strong evidence that the presence of Tampa Bay has contributed significantly to the rapid growth rate of the region's population and economic base over the past 50 years, and yet, the value of Tampa Bay as a natural resource and cultural amenity has never been fully documented or quantified.

In 1982, the Tampa Bay Regional Planning Council (TBRPC) established the Tampa Bay Management Study Committee. The Committee was charged with the task of identifying critical bay management problems and evaluating potential solutions for those problems. There were 42 issues identified by the Committee, contained in the final Tampa Bay Management Study. Issue number 17 was entitled Documenting the Economic Importance of Tampa Bay. The intent of Issue 17 was to document the overall economic benefits of Tampa Bay to the region.

In 1983, TBRPC established the Tampa Bay Management Steering Committee, which in turn gave rise to the Tampa Bay Management Study Commission, established by the 1984 Florida Legislature. the culmination of the Commission's efforts was a comprehensive study entitled The Future of Tampa Bay, which contained a detailed management strategy for Tampa Bay. The Commission built upon the accomplishments of the previous Study Committee, and the 42 issues identified originally were researched further.

In October 1984, TBRPC obtained a Coastal Management Grant from the Florida Department of Environmental Regulation, to initiate a study with the objective of documenting the importance of the Tampa Bay estuarine system to the economic base of the region (Issue 17), in its static, or present, condition.

A summary of the economic benefits derived from various uses and attributes of Tampa Bay is as follows:

Benefits of Tampa Bay to Shipping and Water-borne Commerce

- Tampa Bay, as a body of water, provides a surface on which transportation can take place. It is estimated that, in 1984, shippers and cosignees that engaged in commerce on bhe bay, via the Port of Tampa, realized an annual savings in transportation related costs of approximately $281 million.

Benefits of Tampa Bay to Sanitary and Electric Services

- Tampa Bay serves as a receiving water body for discharges of treated wastewater from municipal sewage treatment plants. As such, the following has been determined:

  - The costs associated with the alternatives of gulf outfall ($123.5 million), spray irrigation ($164.3 million) and deep-well injection ($1 billion), exceed the present costs associated with the advanced wastewater treatment (AWT) and discharge to Hillsborough Bay, at the City of Tampa's Hookers Point Sewage Treatment Plant.

  - The costs associated with the alternative of secondary treatment and spray irrigation represent an additional $14 million beyond the costs associated with the present AWT and discharge to Channel A, at Hillsborough County's River Oaks Sewage Treatment Plant.

  - In general terms, the cost of wastewater reuse for all seven sewage treatment plants located in north Pinellas County, represents an additional $41 to $48 million beyond the costs associated with secondary treatment levels and surface water disposal.

- Tampa Bay serves as a source of condensor cooling water and as a site for disposal of waste heat, from steam electric power plants located on its shores. As such, the following has been determined:

  - The costs of a closed-cycle cooling system represents an additional $40.5 million beyond the cost associated with the conventional once-through cooling system, presently employed at the Tampa Electric Company, Big Bend Unit IV facility.

  - In general terms, the costs associated with the alternatives of dilution pumps ($12.5 million), "helper" cooling towers ($22.8 million), and off-stream mechanical craft cooling towers ($50 million), exceed the cost associated with the once-through cooling system, presently employed at the Florida Power Corporation, P.L. Bartow Plant.

Benefits of Tampa Bay to Commercial Fishing

- In 1984, approximately 1,952 commercial fishermen plied their trade in Hillsborough, manatee and Pinellas Counties, landing a total of 22.1 million pounds of finfish and shellfish, valued at $19.5 million.

Benefits of Tampa Bay to Waterfront Property Owners

- It was determined that the most valuable attribute or benefit, provided by Tampa Bay, to owners of single-family residential waterfront homes was the water view, followed by the ability to navigate a boat in water close to the home.

Benefits of Tampa Bay to Water-Oriented Recreational Activities

- In 1984, the retail sales reported for motorboats, yachts and marine accessories in Pinellas, Hillsborough and Manatee Counties, was approximately $184 million.

- The total economic value of recreational fishing in the Tampa Bay region is estimated to be $197 million (in 1983 dollars).

- The total annual economic value of saltwater beach activities and boat ramp use, in the Tampa Bay region, is estimated to be $23 million (in 1983 dollars).

Ecological Services of Tampa Bay

- In general terms, Tampa Bay continues to perform the various natural functions indicative of all estuaries, however, its ability to "function naturally" has been stressed by 100 solid years of competing uses.

CHAPTER 1

A. INTRODUCTION

Tampa Bay is the largest open water estuary in the State of Florida, with over 1.6 million people living in the three counties bordering its shores.(1) This population represents a 45 percent increase since 1970. Once the state's most diverse and productive estuarine ecosystem, rapid urban and industrial development have significantly changed the character and ecology of Tampa Bay. For example, recent studies have indicated that 44 percent of the original 25,000 acres of mangrove forests and salt marshes have been destroyed, and 81 percent of the original 76,500 acres of seagrasses have disappeared. This habitat loss has resulted in declining populations of economically important fish and shellfish including a complete collapse of such fisheries as scallops and oysters, and major declines of bait shrimp, spotted seatrout and red drum.

Now the second largest population center in the State of Florida, this rapid urbanization has, however, enhanced the economic benefits of the Tampa Bay area in other ways both for the state, and for the nation as a whole. The Port of Tampa has become the nation's seventh largest port in terms of tonnage transported, and is the third largest U.S. port in terms of foreign exports. Over six million tourists are drawn to the bay area's beaches and waters annually. Tampa Bay is a major aesthetic and recreational amenity, supporting a multitude of water dependent commercial enterprises including a burgeoning boat building industry, waterfront homes, restaurants, hotels and office buildings, an expanding complex of public and private marinas, and numerous recreational activities.

Nevertheless, over the past few years it has become painfully clear to bay area municipal and county governments that the additions of homes and businesses, and accompanying people, dramatically increase the needs of local governments to provide water, new sewage treatment plants, electrical power plants and highways. Because growth and development rarely pay for themselves in the short-term, local governments will increasingly struggle to finance the needs of a surging population. The subsequent strain on the environment has been, and will continue to be, well documented in the adverse impacts on the ecology of Tampa Bay.

Tampa Bay constitutes the central geographic feature most responsible for, both historically and at present, shipping, industrial development, and aesthetic and recreational values that encompass the overall attractiveness of the region to population influx. However, without proper management, and the maintenance of balance between all public and private uses, Tampa Bay is threatening to become a major liability rather than the area's main asset.

Currently, the management of Tampa Bay is fragmented amongst a multitude of federal, state and regional regulatory agencies, as well as 17 local governments bordering the bay (see Figure 1-1). Management is accomplished through the uncoordinated implementation of various monitoring, permitting and regulatory programs. Under the existing management framework, jurisdictions are often overlapping, interests are often conflicting, and no one agency has overview authority for the bay, or manages it as a holistic natural resource. As a result, the management of Tampa Bay has been both wasteful and ineffectual. For these reasons, the Tampa Bay Management Study Commission was created to examine the opportunities for, and the constraints against, developing a unified, comprehensive management strategy for Tampa Bay.

B. HISTORY OF THE TAMPA BAY MANAGEMENT STUDY COMMISSION

In 1968, a conference sponsored by the University of South Florida recommended that no reduction of present bay bottom area or mean bay dimensions below mean high water, and no modification of present bay bottom be allowed, except for the maintenance dredging of existing navigation channels. The group also recommended that limits to municipal wastewater discharges, as well as the establishment of a baywide management committee were necessary. No actions were taken regarding the first conclusion, but a local act of the 1972 Florida Legislature, which was later repealed in 1981, did implement stringent limits on acceptable sewage treatment plant effluent discharges.

In response to growing public concern about the environmental degradation of Tampa Bay, the Legislature passed a local act in 1970 creating the Tampa Bay Conservation and Development Commission. This Commission was to consist of ten members composed entirely of local legislators and other elected officials. The Commission was empowered to undertake studies to ascertain the public interest in Tampa Bay, and to determine the effects of further dredging and filling on navigation, and fish and wildlife resources in the bay. Unfortunately, the Tampa Bay Conservation and Development Commission never convened and the act expired.

In 1982 the first symposium on Tampa Bay was held at the University of South Florida. The Tampa Bay Area Scientific Information Symposium (BASIS) lasted four days and involved topical presentations by 50, invited speakers. Major conclusions of the Symposium were that (1) Tampa Bay should be comprehended and managed, as a single ecological system; (2) the bay is remarkably resistant to environmental challenges; (3) a clear pattern of decline is evident in some measures of ecological condition; and, (4) the management needs of Tampa Bay are relatively clear and, if implemented in a comprehensive and baywide basis, would result in tangible improvements to the bay and its usefulness to people.

It was further concluded that, at the present time, state and federal regulatory agencies, local governments surrounding the bay, and an array of industries and user groups generally carry out their respective activities independently. The effect of bay

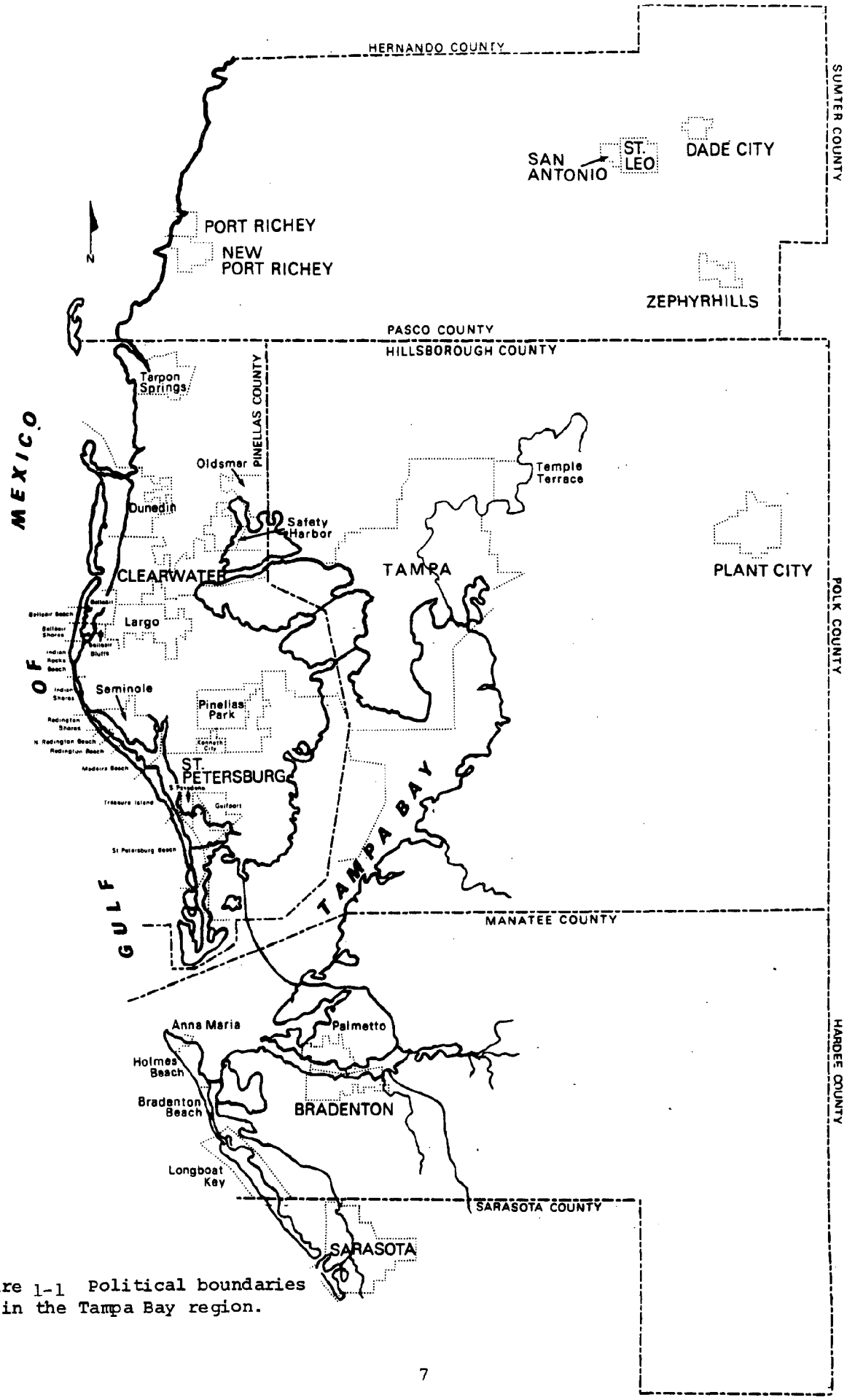


Figure 1-1 Political boundaries within the Tampa Bay region.

management by a multitude of overlaping and often conflicting interests and jurisdictions had thus contributed to a number of environmental and growth management problems in the bay area.

In partial recognition of these problems, BASIS organizers suggested that the Tampa Bay Regional Planning Council (TBRPC) initiate a comprehensive planning study of Tampa Bay from a variety of viewpoints. On May 10, 1982, a motion was passed by the Council to establish the Tampa Bay Management Study Committee. The Committee was charged with the task of identifying critical bay management problems and evaluating potential solutions for those problems. In December 1982, a grant was received from the Florida Department of Environmental Regulation (FDER), through the federal Coastal Zone Management program, to help support Committee activities for one year and to develop a management plan for Tampa Bay.

The Tampa Bay Management Study Committee was composed of representatives from local, regional, state and federal agencies, the academic community and commercial, industrial, recreational and environmental interests. Initially, five subcommittees were formed to specifically address ecological, industrial, institutional, economic and recreational aspects of Tampa Bay. The planning process consisted of five steps: 1) identification of the management boundary; 2) adoption of goals and objectives; 3) identification of major bay management issues; 4) development of bay management guidelines and performance standards; and, 5) identification of existing and potential implementation programs and strategies. In December, 1983, grant funds for this effort expired and the final Tampa Bay Management Study document was published.

Because of the large number and complex nature of the issues affecting Tampa Bay, the Tampa Bay Study Committee could not reach a consensus regarding a recommended strategy to direct a coordinated approach to the management of the bay. As a result, the Committee recommended, and the Council approved, the interim establishment of a 15 to 20 member Tampa Bay Management Steering Committee in October, 1983. The composition of this Committee provided for effective representation from a wide range of Tampa Bay's business, environmental and industrial interests as well as from the local regulatory agencies having jurisdiction over the bay.

During its six-month tenure, the Steering Committee concentrated primarily on a comprehensive survey and review of all entities having management responsibility for Tampa Bay with the objective of documenting all major jurisdictional gaps and overlaps. As a result of this effort, an existing authorities matrix was developed.

Through the efforts of local legislators and key members of the Tampa Bay Management Steering Committee, a special legislative act was introduced and passed during the 1984 session of the Florida Legislature creating the Tampa Bay Management Study Commission, in recognition of the need for a more credible and structured forum within which to proceed. The Commission was to be composed of essentially the same membership as the Steering Committee, and was

to retain many of the members of its predecessor as an adjunct Technical Advisory Committee.

The Commission was granted a one-year mandate to complete the following tasks:

1. Develop a recommended Bay Management Plan and make a formal recommendation to the Tampa Bay Regional Planning Council 30 days prior to the 1985 session of the Florida Legislature.

2. Prepare a preliminary three-to-five year legislative work program to address priority bay management issues in conjunction with ongoing efforts by Congress, the U.S. Fish and Wildlife Service, state agencies, port authorities and other regulatory entities, for submittal prior to the 1985 legislative session.

3. Seek new sources of funding, as well as assist in coordinating existing funded efforts, to implement studies or actions addressing priority bay management issues. Such funding was not to be limited to only funding efforts of the Council, but also essential work by other public and private groups.

4. Monitor proposals falling under the review responsiblities of the Council for compliance with the recommended Bay Mangement Plan.

5. Make specific recommendations to the Council regarding bay management issues that may be identified during the lifetime of the Commission.

In conjunction with these efforts, the Tampa Bay Regional Planning Council procurred a second FDER Coastal Zone Management grant in October, 1984 to support the activities of the Commission. During its one-year tenure, the Commission provided technical commentary and made specific recommendations to the Council, the Florida Department of Environmental Regulation and the U.S. Army Corps of Engineers, regarding two major bay management issues - the Tampa Bay wasteload allocation study, and the proposed deepening of the Alafia River and Big Bend navigation channels.

The culmination of the Commission's efforts was a comprehensive study entitled The Future of Tampa Bay.(2) This study, representing a comprehensive management strategy for Tampa Bay, was presented to the Florida Legislature prior to the 1985 session.

C. PLANNING PROCESS

During the meetings from July, 1982 to March, 1983, the various subcommittees of the Tampa Bay Management Study Committee defined a management boundary system and identified local and regional issues, including many site specific concerns, related to the comprehensive management of Tampa Bay.

A two-fold definition was developed to delineate a proposed management boundary for the Tampa Bay estuarine system. It was unanimously acknowledged that the Tampa Bay estuary could never be comprehensively managed without determining and controlling the impacts of those activities occurring upstream from, or adjacent to, the estuary.

The Tampa Bay estuary includes a connected group of estuaries and second order embayments; its seaward limit is arbitrarily given as a line connecting the barrier beaches of Boca Ciega Bay and Anna Maria Sound; its upstream limit is approximately at the transition of shoreline vegetation from tidal to freshwater forms; and its upland limit is that line above which terrestrial land-forms and vegetation occur. The estuary has a total area of about 398 square miles including all intertidal wetlands. Figure 1-2 depicts the defined management boundaries of Tampa Bay proper. Further, the zones of Tampa Bay proper as defined by Lewis and Whitman (3) are also recognized as the official subdivisions of the bay (see Figure 1-3).

The Tampa Bay watershed includes the uplands and freshwaters contained within the combined watersheds of all rivers and tributaries which flow into Tampa Bay. The watershed has a total area of about 2200 square miles. A summary list of general environmental concerns and management issues was approved at the March 22, 1983, Committee meeting and is shown in Table 1-1.

The major effort of the Committee following the preparation of this list was to further identify and focus upon specific bay management problems. Through the subcommittee meetings a total of 42 specific issues were identified. At the August 30, 1983 Committee meeting the final issues list was approved in priority ranking, as shown in Table 1-2.

The task of the Tampa Bay Management Study Commission was to build upon the accomplishments of the previous committee. The 42 specific bay management issues were reviewed by two subcommittees to determine additional information or research needs and to develop specific recommendations and strategies for rectifying the identified problems. The Science/Engineering Subcommittee reviewed those issues which were more technical in nature and would require particular technical expertise to recommend solutions. The Planning/Management Subcommittee reviewed those issues requiring essentially administrative or political solutions.

In the process of their reviews, the two subcommittees developed a series of issue briefs, one for each identified bay management problem, following a specific format which included the following: issue analysis; identification of relevant laws and statutes; specific bay management objectives and recommendations; work elements; and long-term management alternatives. These issue briefs are contained in the final report, The Future of Tampa Bay.(4)

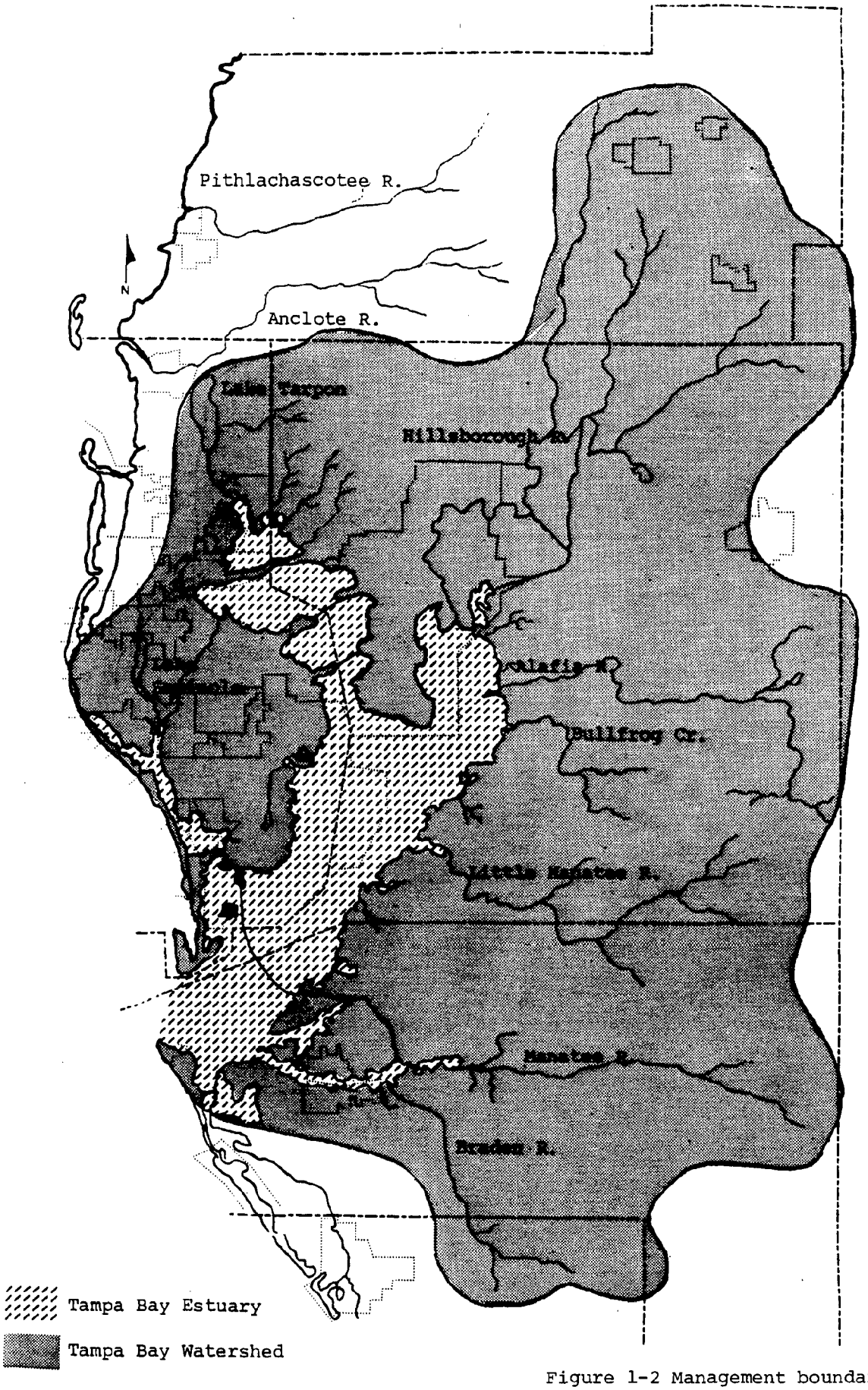


Figure 1-2 Management boundaries of Tampa Bay proper.

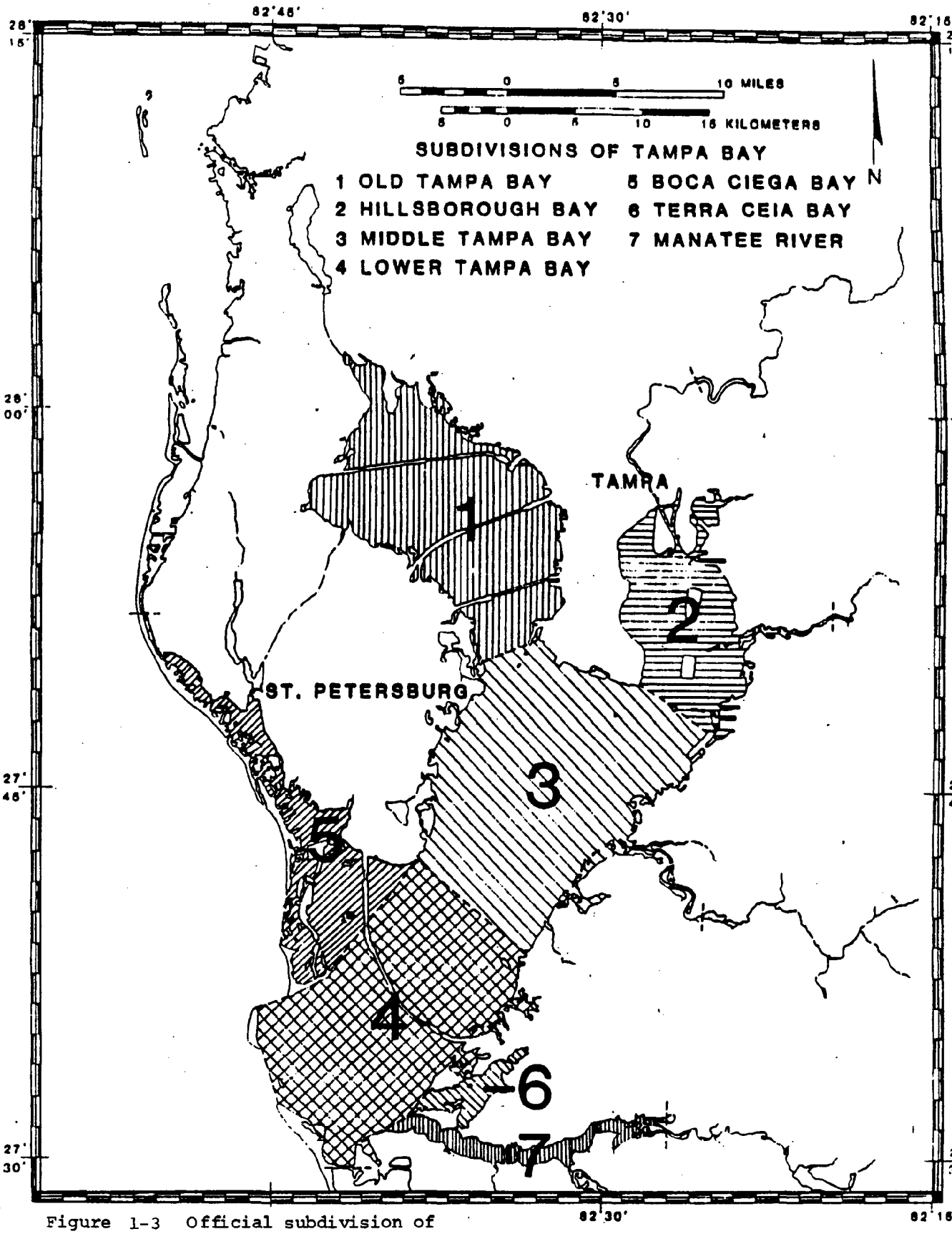


Figure 1-3 Official subdivision of Tampa Bay proper (Lewis and Whitman, 1982).

Table 1-1 List of major concerns and management issues identified by the Subcommittees.

Environmental Concerns:

- Development and Growth
- Industrial, Municipal and Transportation Impacts on Tampa Bay
- Impacts from Changes to Tidal Creeks
- Declining Visual Quality
- Decline in Harvestable Resources
- Habitat Loss and Restoration
- Changes in Bay Circulation
- Loss of Resources Based Recreational Opportunities
- Changes to Species Composition and Community Structure (Excessive Blooms, Mass Mortalities, Reduced Diversity, etc.)
- Loss of Assimilative Capacity
- Long Term Changes in Salinity Patterns
- Changes in Hydrography
- Contamination of Life Forms

Management Issues:

- Intergovernmental Coordination and Jurisdictional Control over Tampa Bay
- Public Participation and Education
- User Conficts and Limits on Activities
- Ownership of Submerged Lands
- Bay Management Alternatives and Implementation Measures
- Public/Visual Access and Shoreline Recreation Facilities
- Funding
- Value of Tampa Bay for Commerce
- Controls on Industry
- Water Quality Management and Violations of Standards
- Wildlife Management
- Management and Acquisition of Public Lands

Table 1-2 Tampa Bay Study Committee Numerical Priority List

1. Funding
2. Loss of Seagrass in Tampa Bay
3. Non-Point Source Discharges Entering Tampa Bay
4. Spoil Disposal and Management of Spoil Islands
5. Hazardous Waste Disposal and Management
6. Enforcement
7. Control of Septage Waste
8. Aquatic Preserves
9. Seagrass, Marsh and Mangrove Habitat Creation
10. Municipal and Industrial Discharges
11. Stronger State Wetlands Regulation
12. Study and Management of Tidal Creeks and Rivers
13. Wasteload Allocation for Tampa Bay
14. Assessment of Fishery Stocks in Tampa Bay
15. Gypsum Decommissioning, Hillsborough County
16. Commercial & Sport Fishing Regulation
*17. Documenting the Economic Importance of Tampa Bay
18. Public Education
19. Urban Waterfront Development and Public Access
20. Load Relief for Major Sewage Treatment Plants
21. Water Quality Improvement for Recreational Uses
22. Stormwater Detention Requirements for Redevelopment
23. Review of Rules and Regulations
24. McKay Bay Management Plan
25. Shellfish Classification
26. Power Plant Entrainment
27. Hendry Fill Restoration Project
28. Contingency Planning for Post-Hurricane Acquisition of Habitat
29. Mitigation Banking
30. Management of Bower Tract and Adjacent Wetlands
31. Management of Passage Key
32. Management and Restoration of Shorelines in Boca Ciega Bay
33. Improvements to Bridge Facilities Crossing Tampa Bay
34. Channel A Restoration
35. Water Quality Improvements Using Tidal Gates and Pumps
36. User Conflicts and Limits on Activities
37. Marina Siting Policy
38. Construction of New Skyway Bridge Pier Protection System
39. Extension of 49th Street (St. Petersburg) Across Tampa Bay
40. Sailboat Launching
41. Odor
42. Manatee River Derelict Train Trestle, Manatee County

D. DEVELOPMENT OF THE ISSUE

Issue 17, entitled "Documenting the Economic Importance of Tampa Bay" was initially identified by the Tampa Bay Management Study Committee and later elaborated upon by the Study Commission. The major recommendation concerning this issue was to obtain funding to undertake a specific natural resource economic study of Tampa Bay. In October 1984, the Tampa Bay Regional Planning Council (TBRPC) obtained Federal Coastal Management funds to initiate a study with the objective of documenting the importance of the Tampa Bay estuarine system to the economic base of the region, in its static condition. With this overall objective, the following tasks were to be completed:

- An export driven economic base model will be developed for the determined study area around Tampa Bay. Export and local service industries will be identified and export multipliers calculated, based on employment data and using primarily the location quotient approach. The economic base model will enable quantification of the short-run impact of various exogenous "shocks" experienced by the study area, such as an influx of new business or tourism.

- Using various methods of economic analysis including opportunity cost calculations, surveys and regression analysis, the net economic benefits derived from various attributes and uses of the bay will be quantified. These attributes and uses include the following:

  1. aesthetic contributions - values of waterfront amenities and benefits to residents and tourists;

  2. water-based recreation - swimming, fishing, boating;

  3. commercial fishing;

  4. shipping, water-borne commerce and transportation;

  5. public and private utilities including municipal sewage treatment services and electric power generating facilities; and

  6. ecological services.

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the numerous municipalities surrounding the bay. Examples of economic entities which are dependent upon the direct utilization of Tampa Bay include; the port facilities of Tampa, St. Petersburg and Manatee County; the ship building and repair firms, and other marina facilities located around Tampa Bay; and the commercial and recreational fishing industries. Indirectly, the mere presence of the bay attracts industries and businesses as well as water-oriented residential developments, restaurants, and a myriad of related support industries and commercial and recreational activities. The rapid growth

rate of the Tampa Bay region's population and business sector over the past 30 years suggests that, historically, the Tampa Bay estuary has contributed significantly to the economic growth and diversity of the region. And yet, the value of Tampa Bay as a natural resource and cultural amenity to the overall economic base of the region has never been documented or quantified.

The environmental quality of Tampa Bay is, intuitively, an important component in the decision making processes of the majority of individuals and industries considering locating and/or operating in the Tampa Bay area. The value of the estuary as a regional economic resource is, however, viewed by various industries and individuals from many different, and often conflicting, perspectives. For example, industries relying upon the availability of a source of water-borne transport may perceive Tampa Bay's value in the same sense that land-based industries would value railroad frontage in determining location decisions. For other firms, industries and even local governments, Tampa Bay is considered to be a convenient receptacle for the inexpensive disposal of treated industrial and urban wastes, or available waterfront space for further development. But for those industries dependent upon the harvest of living resources, or the availability of bay-oriented recreational opportunities, the value of Tampa Bay is perceived to be intimately tied to its ecological health.

The Federal Water Pollution Control Act (Clean Water Act) amendments of 1972 mandated that, wherever possible, water quality is to be suitable for the protection and propagation of fish and wildlife, and to provide for recreation in and on all waters by July 1983. Further, the Act required that all point source pollutant discharges are to be controlled or eliminated by 1985. Local implementation of this Act over the past decade has generally resulted in an overall improvement in the water quality of Tampa Bay. (However, no analyses have ever been attempted to document the impacts of this improvement from an economic analysis perspective on the overall economic framework of the area, or to describe available alternatives in achieving an economic/environmental balance in light of the continuing requirements of the Clean Water Act, as well as other relevant federal and state environmental legislation.)

This document represents the culmination of all study efforts and analyses, aimed at addressing issue number 17, as described in The Future of Tampa Bay.

E. FOOTNOTES

1. Chapter 1 is condensed from a discussion of Tampa Bay and the Tampa Bay Management Study Commission, presented in The Future of Tampa Bay, Tampa Bay Regional Planning Council, 1985.

2. Ibid.

3. Lewis, R. R. and R. E. Whitman. A New Geographic Description of the Boundries and Subdivisions of Tampa Bay, BASIS proceedings, 1982.

4. Ibid. The Future of Tampa Bay.

CHAPTER 2

A. LITERATURE REVIEW

The purpose of the study, "Documenting the Economic Importance of Tampa Bay", is to analyze the present importance of Tampa Bay - a natural resource - to the economic base of the region, in its static condition. A survey of literature focused on locating previous studies that had successfully analyzed the economic impact of estuarine areas and net economic benefits accruing to relatively small regions. The methods outlined below, that emerged from this search, represent an effort to combine the best of analytical techniques with data that was available from other studies, and that which could be generated within the resource constraints of the present study.

1. Economic Base Model

The economic base model used in the present study was chosen over the econometric and input-output models for the following reasons: it lends itself to a forecast period of one to four years; it utilizes aggregative variables such as total employment and income for small regions, where exports are a significant proportion of total regional activity; and it does not require a major research budget.(1)

Funding constraints prevented experimentation with alternative techniques, such as minimum requirements (2) and econometric approaches. A recent comparison of alternative methods concluded that the location quotient approach underestimates the gross basic activity even with data on the four-digit Standard Industrial Classification (SIC) level, however, combining it with the assignment approach may be a pragmatic step in the direction of accuracy.(3) In any case, it compares favorably with using minimum requirements in the case of the present study because minimum requirements in one-half of the sunbelt cities were found lower than location quotients, reflecting insensitivity to trade and services.(4)

2. Shipping and Water-Borne Commerce

The principal approach adopted here was to equate benefits to the cost savings made possible by the availability of water-borne transportation. The structure of exports and imports into the Tampa Bay ports was analyzed with a view to determining the next best alternative mode of transportation for each. Alternatives considered include railroad and truck transportation. Published data was utilized on the private cost of commodity shipments by the alternative modes. The principal study used here was the Economic Impact Assessment of the Port of Tampa, performed for the Tampa Port Authority and completed in 1979.(5)

3. Public Utilities and Municipal Sewage Treatment Services

Many major (public and private) industries derive benefits from locating on Tampa Bay, rather than further inland. Ready accessibility to bay water for discharge of treated effluent from municipal sewage treatment plants, cooling water for electric power generating plants and water-borne transportation are benefits studied by the alternative cost method. The principle sources of information used here are the Central Hillsborough County-Tampa 201 Facility Plan, U.S. Environmental Protection Agency (EPA) Final Environmental Impact Statement for the Tampa Electric Company Big Bend Unit 4, and the Florida Power Corporation Cooling Water Report for the Paul L. Bartow Plant.

4. Commercial Fishing

Economic impact studies of commercial fishing in Florida and the Tampa Bay region were readily available through the Florida Sea Grant College, University of Florida. Fish and shellfish landing trends (6), along with value and volume data (7), were updated using primarily information received from the National Marine Fisheries Service (8).

5. Aesthetic Valuation

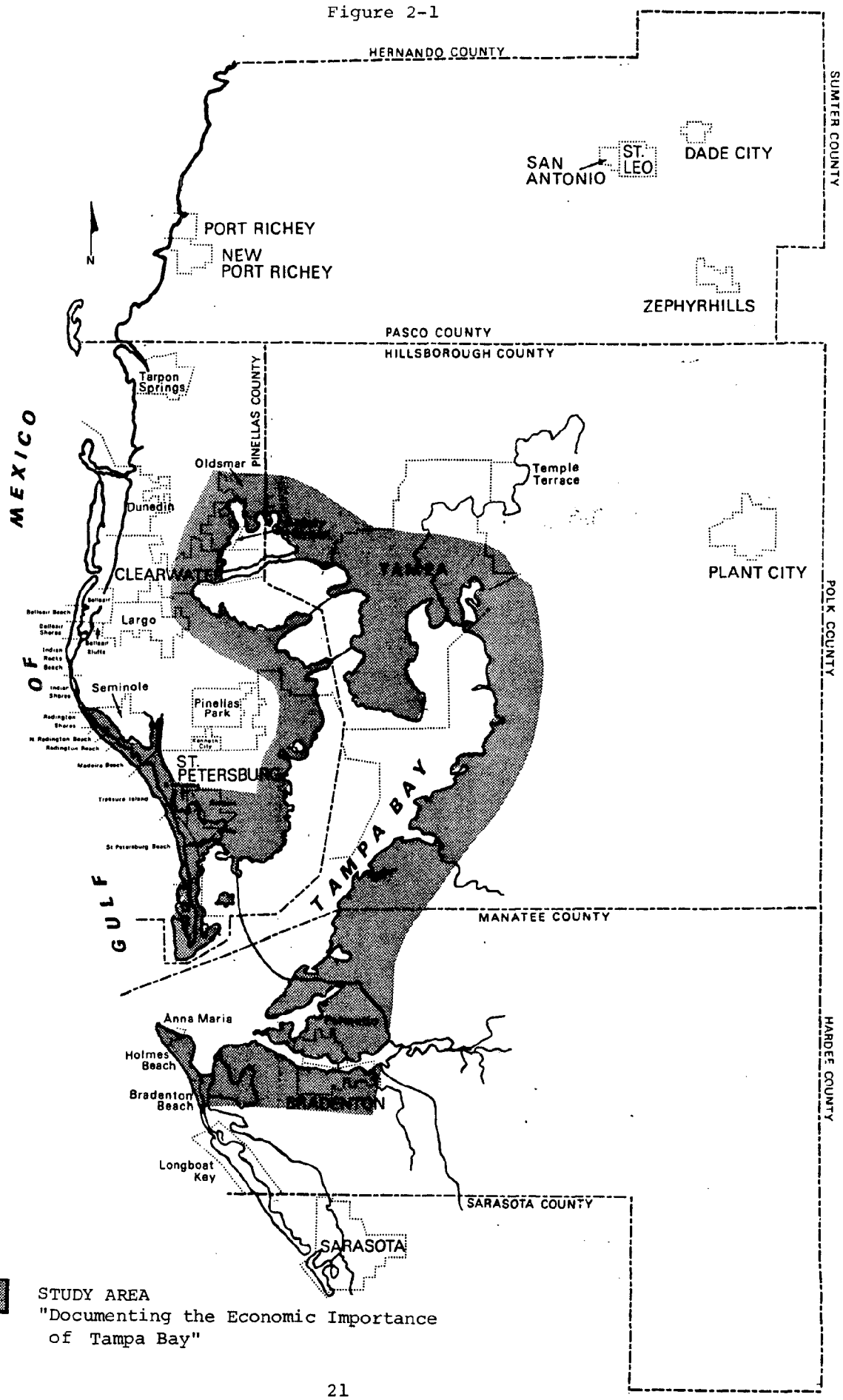
The present study uses, as its base, a model of determination of residential property values developed for Pinellas County. (9) The model was expanded to apply to single-family structures within the study area, with emphasis on neighborhood conditions, local public schools, travel time to the job location, water views, water quality, and recreational benefits. The benefits accruing to property owners, from these neighborhood and environmental amenities, are generalized for the study area as a whole, based on the number of single-family structures.

B. STUDY AREA

The defined study area for this economic study principally includes Hillsborough, Manatee and Pinellas Counties, in that Tampa Bay is bordered by all three counties. It was assumed apriori that most, if not all, of the economic impact resulting from the presence of Tampa Bay would occur in the counties and municipalities that border the bay.

Initially, it was decided that the study area would be defined by census tracts, with proximity to Tampa Bay, in each of the three counties. However, because the economic base model required explicit employment data, necessitating business and industry address locations, it was decided that the study area be defined and identified by U.S. Postal Service zip code zones that have geographic proximity to Tampa Bay. A total of 65 zip code zones were selected and included the following: 28 zones in Hillsborough County; 12 zones in Manatee County; and 25 zones in Pinellas County. Figure 2-1 approximates the study area, based upon the zip code zones

Figure 2-1



STUDY AREA
"Documenting the Economic Importance of Tampa Bay"

shown in Figure 2-2.

C. POPULATION ANALYSIS

As illustrated in Table 2-1, the populations of Hillsborough, Manatee and Pinellas Counties have experienced explosive growth over the past two and one-half decades. Between 1960 and 1980, Hillsborough County has had a population increase of approximately 63 percent; Manatee County 114 percent; and Pinellas County 94 percent. Based upon the projections shown in Table 2-1, between 1980 and 2000, Hillsborough County will have an additional population increase of 22 percent; Manatee County 33 percent; and Pinellas County 25 percent.

In 1980, the total population of Hillsborough, Manatee and Pinellas Counties was 1,523,933. It is estimated that the 1980 population of the study area is 710,152 persons, or 47 percent of the total population of the three counties.

The study area includes the City of Tampa, the county seat of Hillsborough County and the largest city located in the Tampa Bay region. Tampa serves as the legal and financial center of Florida's west coast, as well as the hub of manufacturing and distribution. Also included in the study area are the cities of Palmetto and Bradenton, the latter of which is Manatee County's largest city and also serves as the county seat. Pinellas County's largest city, St. Petersburg, is also included in the study area, as well as portions of eastern Clearwater.

Figure 2-2

TAMPA BAY ECONOMIC STUDY TARGET AREA ZIP CODES

PINELLAS	HILLSBOROUGH	MANATEE
33504	33570	33501
33519	33586	33505
33520	33601	33506
33557	33602	33508
33572	33603	33509
33701	33604	33510
33702	33605	33522
33703	33606	33529
33704	33607	33532
33705	33608	33561
33706	33609	33564
33707	33610	33591
33708	33611	
33711	33614	
33712	33615	
33715	33616	
33731	33619	
33732	33621	
33733	33629	
33736	33673	
33737	33674	
33738	33675	
33739	33677	
33740	33679	
33741	33680	
	33681	
	33686	
	33690	

TABLE 2-1
POPULATION -- HILLSBOROUGH, MANATEE, AND PINELLAS COUNTIES

Year	Hillsborough	Manatee	Pinellas	Totals
1960	397,788	69,168	374,785	841,741
1970	490,265	97,115	522,329	1,109,709
1980	646,960	148,442	728,531	1,523,933
Projected				
1985	700,100	169,700	796,000	1,665,800
1990	752,900	189,300	859,300	1,801,500
2000	856,200	226,000	1,003,100	2,085,300

Source: 1980 U.S. Census and Population Studies Research, College of Business, University of Florida

D. FOOTNOTES

1. Pleeter, Saul, "Methodologies of Economic Impact Analysis: An Overview." Economic Impact Analysis: Methodology and Applications Boston: M. Nijhoff, 1980.

2. Ullman, Edward L. and Michael F. Dacey, Economic Base of American Cities; Revised Edition. University of Washington Press, 1971.

3. Isserman, Andrew M., "The Location Quotient Approach to Estimating Regional Economic Impacts." AIP Journal (January 1977)

4. Ibid.

5. Economic Impact Assessment of the Port of Tampa, for the Tampa Port Authority, by the Transportation Consulting Division of Booz, Allen & Hamilton. (EDA Project Number 04-06-01533, March 1979.)

6. Commercial Fishing Activity and Facility Needs in Florida: Hillsborough, Manatee, Pasco, Pinellas and Sarasota Counties, by Kary Mathis, James C. Cato, et.al. (Gulf and South Atlantic Fisheries Development Foundation, Inc. and Florida Sea Grant Publication 79-4, February 1979.)

7. Landings, Values, and Prices in Commercial Fisheries for the Florida West Coast, by F. J. Prochaska and J. C. Cato. (Florida Sea Grant Publication 75-003, May 1975.)

8. "Florida Landings by Districts," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

9. Hanni, Eila, "Effect of the Enforcement of Residential Land Use Ordinances on Property Values," presented at the Annual Meeting of Western Economists Association, San Francisco, CA, June 18, 1979.

CHAPTER 3
ECONOMIC IMPACT ANALYSIS

A. THE SHAPING OF THE TAMPA BAY REGION'S ECONOMIC BASE

Introduction

Hillsborough County historian Ernest Robinson stated in 1928, "That of all Tampa's attractions to businessmen and investors, the greatest is her port; of all Hillsborough County's attractions, the greatest is her convenient available port on Tampa Bay, and that neither county nor city would have experienced the growth and prosperity which they now enjoy were Hillsborough County an inland county."(1) Robinson goes on to describe Tampa as a city made to fit an opportunity. A short review of the history of Tampa's growth and development, and that of the region surrounding it, makes clear that the Region took advantage of certain opportunities.

Early Settlement

Tampa Bay, thought to provide the best natural harbor on the gulf coast of peninsular Florida, became the object of government attention soon after the United States' acquisition of Florida in 1821. A U.S. military outpost was established at the juinction of the Hillsborough Bay and River in 1824. The Hillsborough River was one of three rivers leading into Tampa Bay which was navigable by large vessels.

Settlers began moving into the area, utilizing adjacent land for agriculture and livestock. The farm and fishing village that grew up outside of the Fort Brooke military reservation became known by the Indian name of Tampa. (2)

Tampa soon became the trade center for the scattered population in the area. The territory around Tampa furnished excellent pasturage, and by the mid-1830s there was a thriving cattle industry. Shipment of cattle was one factor in the early development of Tampa's port, as cattlemen were busy supplying the Cuban market. (3)

An influx of new settlers over the years also contributed to the growth and prosperity of Hillsborough County. Florida became a state in 1845 and, ten years later, Tampa became an incorporated town.

Although the Tampa Bay area was still prospering toward the end of the Civil War, it was obvious that the town of Tampa lacked both railroad connections and adequate harbor channel and berthing facilities. (4) Fort Brooke, now a 256-square mile military reservation, remained the sole reason for the town's existence. However, in 1885, after an enthusiastic Board of Trade was organized, it was

decided that Tampa should develop into a great city. (5) This development of Tampa, from a faded military outpost to a productive metropolis, began with the expansion of the railroad system and solicitation of federal aid to make Tampa a viable port city. Railroads connected to active ports were desirable, as together they would lead to further growth and expansion.

Cigars, Fishing and Phosphate

The expansion of the railroad line into Tampa, and the port, was an indication to the rest of Florida, and the nation, that certain entrepreneurs were confident of Tampa's future. Railroad expansion provided better facilities for the transportation of citrus, cattle, cigars, fish and other agricultural products.

The migration of the cigar industry into Tampa began in 1886, when Vincente Martinez Ybor transferred his facilities and workers from Key West, Florida, after many months of labor trouble. The almost immediate economic success of the cigar industry launched a chain reaction of business developments, which included the establishment of banking institutions to handle the transactions and financial arrangements of the cigar manufacturers.(6) Economic success within the industry also meant an increase in employment, which triggered land improvements, real estate development and various public works projects.

Railroad expansion actually spurred Florida's and the Tampa Bay areas's fishing industry. The waters of Tampa Bay had long been fished to provide for local markets. Mullet and pompano were the most important of a wide range of food fish taken in great abundance from Tampa Bay. Rail transportaion and refrigeration by ice provided the means of satisfying the growing demands for fish and oysters in the northern and western areas of the U.S.

A great demand for phosphate fertilizer developed in this nation around 1875. Land pebble deposits of phosphate were discovered in the Tampa Bay area in 1885, however, no effective attempt was made to exploit the deposits until 1888. The discovery of phosphate dramatically changed the future of Tampa and its port due to its proximity to the most productive mines and its ample and accessible harbor. The railway system which existed when the phosphate boom started enabled Tampa to draw from the mines being opened in the vicinity. In the meantime, harbor improvements begun in 1879 made Tampa accessible to vessels drawing twenty feet of water, and the stage was set for the major expansion of the phosphate trade.

The development of Tampa as a major seaport perhaps got its greatest impetus with the chaos and confusion of the Spanish-American War of 1898. As the United States became involved, Tampa became a focal point, as some 30,000 troops were brought in and readied for shipment to Cuba to wage war. Tampa was a natural concentration point, primarily because it was the nearest mainland port to Cuba, having both rail and water facilities. (7)

St. Petersburg

Agriculture remained the major industry in and around St. Petersburg through the late 1800s. St. Petersburg became a more viable port city with the expansion of the railroad into the city and, in 1888, the construction of a railroad pier to facilitate freight loading and unloading.(8) The pier extended one-half mile into the waters of Tampa Bay, to a point where the the water was twelve-feet deep. St. Petersburg, however, never became a rival port with Tampa, for as Tampa grew as an industrial community, St. Petersburg developed into a tourist town. As transportation into and out of St. Petersburg improved through the early 1900s, tourism slowly began to have a greater influence on the local economy. The "omnipresent" healthy climate attracted the tourists, and the industry slowly developed many sustaining and supporting services and trade establishments to serve both the tourists and area residents. St. Petersburg's resort atmosphere, the Tampa Bay and Gulf beaches, and available residential land gradually attracted retirees and others to settle premanently.

Early 1900s

Further action came on the development of an even deeper-water port at Tampa, in 1905, when Congress appropriated funds to finance the dredging of a twenty-foot channel. This was heralded as the beginning of Tampa's great port development. With the completion of the deepening project, Tampa was able to take advantage of its favorable location with regard to the islands of the Caribbean and parts of Central and South America.(9) The port improvements enabled more tonnage to be handled, and soon Tampa began to capture a large amount of foreign and intracoastal trade. So much traffic began using the port through the early 1900s, that an expansion of Tampa's port facilities was necessary soon after the completion of the original deep-water channel.

During World War I, Tampa became a tremendous shipbuilding center for the U.S. military effort, turning out warships and merchant vessels to be utilized during the campaign. It was an activity that would be repeated two decades later.

Prior to WWI, and beyond, there were but sketchy contacts between Tampa and St. Petersburg, even though the communities lay only twenty miles apart across the waters of Tampa Bay. Few area residents were interested in a tiresome 165-mile trip by train between Tampa and St. Petersburg or an all-day round trip by boat. The construction of the Gandy Bridge during the 1920s linked Tampa to St. Petersburg and the Gulf beaches, and actually triggered St. Petersburg boom, both in the form of tourism and permanent residents.

On the eve of World War II, Tampa's search for a new identity and new direction came to an end as the threat of war literally changed the economic scene. Shipbuilding, troop training and defense spending, in general, provided much needed relief to a battered urban economy. The impact of thousands of soldiers during the war

years and the construction of MacDill Field, a million-dollar complex that helped maintain the nation's B-17 and B-29 Fleets, cannot be overestimated.(10) In addition, the wartime economy lured thousands of civilians to the Tampa Bay area. Employment at the Tampa shipyards reached 16,000, and the payroll soon exceeded $750,000 a week, surpassing that of the cigar industry.

Post-War Development

Tampa's kinetic energy, the product of local, regional and national forces, began manifesting itself in a variety of economic forms. The most important factors in the postwar Tampa economic boom included massive federal appropriations for defense and urban renewal; the development of a diversified economic base; the maintenance of a strong agribusiness sector; the emergence of the area as an important transportation and distribution center; the continuing real estate and construction booms; the maturation and promotion of a tourist/leisure society; and the urban renaissance of downtown Tampa.(11)

In the Spring of 1945, with shipbuilding winding down and the port again looking rundown and neglected, the Tampa Chamber of Commerce pushed for an entity to oversee the Port of Tampa. A local bill, proposed to the Hillsborough County legislative delegation, called for creation of a port authority. The bill required a referendum to gain voters approval in Tampa and the western end of the county. The port plan was endorsed by an overwhelming majority, and thus the Port Authority came into being.(12) One of the major projects facing the five-member Port Authority was the deepening (again) of the 45-miles of ship channels connecting Tampa's harbor with the Gulf of Mexico. Eventually, Congress came through with the money needed to dredge the channels.

In addition to harbor dredging, the Federal government stimulated metropolitan Tampa Bay's growth with appropriations for highways, two interstate expressways and a new international airport.

One of the most important postwar developments in the Tampa Bay area was the coming of the shrimp industry. With the discovery of new shrimp beds off of the coast of Mexico and near the Dry Tortugas, shrimp boat operators who had previously fished off the east coast of Florida needed a large and well equipped port on the lower west coast. Tampa was chosen as the home base for a shrimp fleet which, by the end of 1952, included more than 100 boats. Shrimp boat building and repair yards, as well as shrimp processing firms, were established in response to the needs of the new industry.(13)

Lured by omnipresent sunshine, aggressive promotion, a low tax base, and ample industrial parklands, over eight hundred new businesses have located in Tampa since WWII. The 1970s brought a turnaround as new money stimulated the development of downtown Tampa; while during the 1980s, Tampa's undergoing an urban renais-

sance in which scarcely a week passes without the unveiling of still another skyscraper or financial tower to alter the skyline. (14)

Summary

The geographic location of Tampa has been an important factor in the development of the city and region. Tampa Bay, the largest bay on the Gulf coast of peninsular Florida, also provides the best natural harbor on the west coast of Florida.

The groundwork for making Tampa a major seaport was completed, during the decades prior to the Spanish-American War, due in large measure to the efforts of a few individuals who developed and expanded the railroad transportation system to Tampa and its port. By tying the State of Florida to the rest of the country, the railroads broadened the scope of commercial activity in such a way and to such an extent that the seaports of Florida (Tampa included) were no longer gateways and outlets for Florida alone, but for the country at large.

Tampa's sea connections with other parts of the United States, and with other nations, have depended largely upon improvements in the channel approaches through the harbor and upon development of adequate terminal facilities. It was not until the first major harbor development project was completed in 1908, that straightened and deepened the natural shallow harbor, that Tampa's standing as the leading commercial center of the Florida west coast was significantly strengthened. Successive dredgings were necessary in order for the port to handle increasingly larger ships, while adequate terminal facilities kept pace, in order to handle the larger scale imports and exports. Tampa Bay's history intertwines with that of the railroad, the development of the port, the phosphate industry and early twentieth century technology.

B. ECONOMIC IMPACT ANALYSIS

There are two basic ingredients to economic impact analysis: an estimate of the exogenous or differential stimulus that serves as the direct impact, and a model of the regional economy that will produce estimates of the indirect effects.(15) (The term "indirect effects" is used here in a very general sense and includes induced effects where appropriate. The term "exogenous" refers to external influences, i.e., influences from outside the local economy or study area.) Methodological innovations, resulting from research efforts in recent years, have produced a variety of models that resist categorization.(16) Economic base multipliers are estimated with econometric techniques, input-output models are treated as econometric models, and hybrid models are constructed that may combine elements of economic base, econometric and input-output models.

C. ECONOMIC BASE MODELS - GENERAL

As noted earlier in Chapter 2, the economic base model was chosen to be used in this study, over the alternatives of econometric and input-output models, for the following reasons: it lends itself to a forecast period of one to four years; it utilizes aggregative variables such as total employment and income for small regions, where exports are a significant proportion of total regional activity; and it does not require a major research budget.

To analyze a regional or local economy it is necessary to identify its economic base. The economic base model dichotomizes economic activity in a region into export (exogenous)industries and local service (import) industries.(17) Economic models view the local economy much like a household with a single wage earner. Household income and standard of living can only increase with increases in wages earned by the head. The counterpart to the single wage earner in the economic base model is the export industry. Business and industry within the local economy that cause funds to "flow in" are considered export or exogenous industries. These are firms that sell their products to businesses and households outside the boundaries of the local economy. Tourism facilities and federal and state government are considered to be part of the export industry since they are responsible for money inflows. Local service industries, by contrast, sell their outputs only within the local economy.(18)

Without new "injections" of funds into the local economy, the economy will be stagnant, since local service industries can only respond to changes in local economic conditions. External changes that result in an increase of export activity cause increases in payroll and employment in the export industries, which are then transmitted to the local service sector. Further, the inflow of money causes activity in local services to change by a multiple of the original stimulus as the new influx of funds is spent and respent in the local economy. Re-circulation continues until the leakages in the system, like imports, savings and taxes, exhaust the amount of the initial influx. Similar, though opposite, effects occur in the case of a decrease in export activity.(19)

The chosen economic base model can be characterized as a highly simplified general equilibrium model of a local economy. It assumes that the economy is initially in equilibrium and describes a new equilibrium position after the exogenous change has been transmitted through the system. Prices, wages and technology are assumed constant, supply is perfectly elastic, and no changes are allowed for in the distribution of income or resources.(20)

As a theory of regional growth, economic base models emphasize the "openness" of regional economies; that is, regional trade is considered to be the primary impetus for growth. The high degree of interrelatedness between the local economy and "the rest of the world" is based soley on a demand orientation. Exogenous changes in demand for exports determine regional income and employment changes. In reality, export sales are not the only activity that

responds to exogenous forces, even in the short run. Omission of these other exogenous influences from the model suggests that economic base studies are appropriate primarily for smaller regional economies where exports represent a larger proportion of total regional activity.(21)

The economic base model ignores the supply side of the local economy, implicitly assuming that supply is perfectly elastic. This neglect of supply does not appear to be a serious defect if the region itself is small, relative to the size of the economy. Given the degree of openness of a local economy and the migrational propensity of labor, an elastic supply would not be an unrealistic assumption. Capacity constraints will present problems to the degree that the local infrastructure is not capable of supporting the expansion. If energy, water, transportation facilities, and land for expansion are all at full capacity prior to an increase in demand for exports, then prices would increase rather than the quantity supplied expand.(22)

D. LOCATION QUOTIENTS

To make the economic base model operational, it is necessary to determine how much of the region's total employment is devoted to export activities. A problem exists in that most goods produced in the local economy are typically sold in both local and non-local markets. A number of indirect methods are available to approximate this allocation, and one such method is location quotients.(23)

Employment is the most frequently used unit of measurement for the economic base model. Using employment as the unit of measurement is advantageous because the data are available on a disaggregated basis for the larger local economies. Employment data were obtained for the study area, by three-digit SIC (Standard Industrial Classification), for 1984, from three sources: U.S. Department of Labor, Bureau of Labor Statistics; Florida Department of Labor and Employment Security, Division of Unemployment Compensation; and Contacts Influential Inc., Marketing Information Services, Tampa.

Location quotients compare the concentration of industry employment in a particular region with that of the nation, adjusted for foreign exports. A region that has a greater percentage of its employment concentrated in an industry than does the nation must be producing for export outside the region, since it has more than the average employment required to satisfy its domestic needs.

The location quotient is the ratio of an industry's share of the economic activity (of the economy being studied) to that industry's share of another economy.(24) Assuming that the study area is a region (R) of a nation (N), and that employment (E) is the measure of economic activity, the location quotient for industry "I" may be expressed using the equation shown in Figure 3-1.

If the location quotient for an industry (LQI) is greater than one, it is assumed that the region exports the products of that industry.(25) By contrast, if the location quotient is less than one,

FIGURE 3-1
LOCATION QUOTIENT FORMULA

$$LQI = \frac{EIR}{EIN} \Big/ \frac{ER}{EN}$$

LQI - Location Quotient for industry "I"
R - Region (study area)
N - Nation
E - Employment
I - Industry

FIGURE 3-2
EXPORT EMPLOYMENT FORMULA

$$XIR = \left[\frac{EIR}{EIN} - \frac{ER}{EN}\right] EIN$$

XIR - Export (exogenous) employment for industry "I" within the region (study area)
EIR - Employment Industry Region
EIN - Employment Industry Nation
ER - Employment Region
EN - Employment Nation

it is assumed that the region is not satisfying its domestic requirements and must import the products of that industry.

Location quotients compare the given region to an "average" region of the nation. If a region's industry displays a location quotient greater than one, its export-related employment (XIR) can be calculated using the equation shown in Figure 3-2, relying on the following assumptions (26):

1. Consumer tastes and preferences are the same throughout the nation, implying that per capita consumption, in particular, is identical. (Although per capita income is often a poor proxy for per capita consumption, it is worth pointing out that the per capita income in the Tampa-St. Petersburg MSA is very close to the national average, so this assumption does not appear grossly unreasonable).

2. Production functions for each industry are identical in every region.

3. Local demand is satisfied by local production. (To reduce the distortions caused by "cross-hauling," all primary employment data were collected on the basis of three-digit SIC industries, which represents substantial disaggregation compared to many other studies.)

4. Every region completely satisfies its own domestic needs.

E. THE MULTIPLIER CONCEPT

Economic theory dictates that the rate of growth of a region is determined by its function as an "exporter" outside the region. (27) Sales outside the region channel outside dollars into the region and trigger chain reactions of additional economic activity within the region.

The first activity associated with an outside sale is the direct impact, and the jobs provided because of the sale, and the income generated in the industry. These direct impacts then produce additional economic impacts or indirect impacts. These indirect impacts come in the form of goods and services provided to the export industry by other businesses in the region. Both the direct and indirect impacts then produce additional impacts. This is called "induced" activity and results from spending of employees who earn income in jobs provided in either direct or indirect businesses. These impacts occur in local retail stores, banks, and any other places the wage earner spends his income.(28)

The total impact of an industry results from the simultaneous action of direct, indirect, and induced impacts. Each additional dollar of sales by the basic industry causes a new round of impacts throughout the region. The process of each dollar being respent and causing new impacts is not infinite. At each round of the spending process, some dollars leak out of the regional economy in the form of savings, taxes, profits to stockholders outside the

region, and as payments for goods and services imported from outside the region. The total respending process associated with each additional dollar of sales is called the "multiplier" effect. The multiplier for a particular basic industry is a measure of the total economic activity associated with the initial increase in export sales outside the region. The multiplier will vary with the size of the region and the industry. The more complex the export industry in regard to its demands on other industries for goods and services, the larger the multiplier. The multiplier effect also works in reverse. A decrease in export sales will cause a chain reaction of decreases in economic activity.(29) Most economic multipliers are determined using input-output analysis, econometric techniques, or elements of the economic base. Multipliers generated from these mathematical techniques are usually output, income, and employment multipliers.

F. EMPLOYMENT MULTIPLIER

The location quotient multipliers calculated using the equation shown in Figure 3-1, are employment multipliers. A single employment multiplier, for the study area, is derived from the location quotients by estimating export employment for all industries with location quotients greater than one, summing that employment for all industries, and dividing the sum into the total employment of the region.(30) To the extent that a region imports products from an industry which it also exports, the location quotient will underestimate exports, thereby over-estimating the multiplier.(31)

Once the multiplier has been calculated, the impact on total activity of an anticipated change in export activity can be estimated by multiplying that change times the multiplier.(32)

G. STUDY AREA ECONOMIC BASE MODEL

The results of the economic base model used to analyze the study area's economic activity are illustrated in Appendix A, and summarized in Appendix B. The model utilizes employment data as the unit of measurement in dividing the study area's economic activity into export and import (local service) sectors. The 1984 employment data is presented on a disaggregated basis (three-digit SIC) thereby diminishing the problem in the use of location quotients often referred to as "product-mix" or "crosshauling".(33)

The location quotients presented here are employment multipliers. As noted previously, if the location quotient for an industry is greater than one, it is assumed that the study area exports the products of that industry, whereas, if the location quotient is less than one, it is assumed that the study area imports the products of that industry.

The overall employment multiplier, for the study area, has been calculated at 2.62. This figure is derived from the location quotients, by calculating the export employment for all of the study area's industries with location quotients greater than one

(as shown), summing that employment, and dividing the sum into the total employment of the study area. The multiplier of 2.62 was calculated assigning all public administration to the export (exogenous) sector. (Other industries can be assigned to the exogenous sector in toto, e.g. fertilizer mineral mining, hotel, tourist court and motel employment, reducing the multiplier further.)

H. DISCUSSION

Upon review of the data presented in Appendix A and Appendix B, it is evident that there are numerous export industries within the study area that cause funds to flow in, or in more generic terminology, industries that "drive the local economy." By contrast, there are numerous local service industries identified. The products or services associated with these industries must be imported into the study area because domestic consumption is not being satisfied. Before analyzing the export and import industries which currently serve as the economic base of the study area, it is interesting to note the industries that were historically important in the development of the Tampa Bay Region are still important today.

As noted earlier in this chapter, the industries of primary importance in the development of Tampa, and eventually the region, include (in no particular order) the following: agriculture and livestock; national security; citrus; cigars and fishing; railroad; phosphate; boat building and repair; tourism and general port activities. The importance of geographic proximity to Tampa Bay for most of these industries is evident, e.g. fishing, boat building and port activities necessitate immediate proximity to Tampa Bay.

The economic base model, utilizing 1984 employment data, illustrates the static economic activity within the study area, and in doing so reveals the following export industries: crop services, including citrus grove preparation (SIC 072); commercial fishing (SIC 091); fertilizer mineral mining, including phosphate rock (SIC 147); cigars (SIC 212); boat building and repair (SIC 373); local water transportation and associated services (SIC 445-46); boat dealers (SIC 555); eating and drinking places (SIC 581); and hotels and motels (SIC 701).

The economic base model identifies these industries as being key components of the study area's exogenous sector. In addition to the aforementioned industries, there are still other export industries whose proximity to Tampa Bay is essential. These industries include residential building construction (SIC 152); electric services (SIC 491); and sanitary services (SIC 495). These industries, along with port activities and commercial fishing, are analyzed further in succeeding chapters.

Local service industries identified through the economic base model, by major group (MG), include the following: manufacturing or processing of food products (MG 20); apparel manufacturing (MG 23); manufacturing of furniture and fixtures (MG 25); manufacturing

of machinery (MG 35-36); and security, commodity and life insurance establishments (MG 62-63).

I. FOOTNOTES

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18. Ibid.

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27. Gordon, John; Mulkey, David and Goggin, James. "An Input-Output Analysis of the Broward County Economy with Emphasis on the Impact and Role of the Port Sector," Economics Report, Food and Resource Economics Department, Gainesville, University of Florida, 1980.

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CHAPTER 4

BENEFITS OF TAMPA BAY TO SHIPPING AND WATER-BORNE COMMERCE

A. PORT OF TAMPA

The Port of Tampa has served as a vital transportation link for the West Central Florida region since the early nineteenth century (please see discussion in Chapter 2). The port evolved initially as a gateway for agricultural products flowing to and from Cuba. (1) Improvements to the natural harbor began with the discovery of phosphate in the region and the first Congressional authorization in the 1880s. During the past 100 years, channel dimensions have repeatedly been enlarged, the size of ships calling on the port have increased, and the annual tonnage transiting the port has increased from one million tons in 1920 to 50 million tons in 1980. (2) In the fiscal year 1984-85, the Port of Tampa registered 48,856,924 net tons, making it Florida's number one port.(3)

Part of the port's overall strength is the variety of terminals operating throughout the port and the diversity of cargoes handled through these facilities.(4) Sixteen terminals in Tampa handle inbound and outbound phosphate, fertilizer and related chemical products. In addition, eight terminals handle dry bulk products other than phosphate or phosphate-related chemicals. The primary products handled through these terminals are grain, feed, salt, cement, gypsum and coal.

Eight general cargo terminals are operated in Tampa handling a variety of general cargoes including steel products, bananas, linerboard and citrus products. Three specialized general cargo terminals operate in Tampa handling products that require specialized facilities or facilities developed to serve a particular plant. Eighteen liquid bulk terminals are located in Tampa, almost all of which handle petroleum products, and liquid sulphur.

B. BOOZ, ALLEN & HAMILTON REPORT

During 1978, the transportation consulting firm of Booz, Allen & Hamilton, (Bethesda, Maryland) was retained by the Tampa Port Authority to perform a marketing and economic impact assessment of the Port of Tampa. The principal objective of the study was to determine the role that the Port of Tampa had in the economy of the City of Tampa, Hillsborough County, and other adjacent counties.

The primary direct impact of the port was estimated at approximately $200 million per year. This figure represents a measure of the revenues that flow from the principal port users, e.g. shippers and waterborne carriers. The total direct impact, which represents both the primary direct and the respending of the primary flow of revenue through the local economy, was estimated at approximately $500 million per year. (This figure reflects the use of a multiplier of 2.5. It should be noted that this multiplier is virtually identical with the overall multiplier for the study area, generated

from the economic base model. Please see discussion in Chapter 3). During the fiscal year 1983-84, close to 48 million tons of cargo were handled at the Port of Tampa, making Tampa the seventh largest port in the United States in terms of total tonnage. Table 4-1 identifies the tonnage handled (selected categories) at the port during 1978 and 1984.

C. ECONOMIC IMPACT OF THE PORT OF TAMPA

As noted previously, in 1978, the total direct primary impact of the Port of Tampa was estimated at approximately $200 million per year. One of the methods employed to estimate the primary direct impact associated with activity at the port involved an analysis of a sample of representative ship/barge calls at the port.(5)

Table 4-2 provides a summary of the direct primary impact associated with each ton of the major commodities, handled by ship and barge, for 1978 and 1984. The table also identifies the total annual tonnage of each major commodity, and estimates of the total direct primary impacts during 1978 and 1984. (The total direct primary impact estimates result from multiplying the impact per ton times the total tonnage.)

The table and figures indicate that for 1984, on the average, each ton of cargo contributed $6.42 in direct primary benefits to the local economy. The handling of approximately 45.7 million tons during 1984 contributed approximately $294 million in direct benefits to the port.

D. NET BENEFIT OF THE PORT OF TAMPA

It is generally recognized that there are net economic benefits (consumer surplus) associated with a port such as Tampa. These benefits primarily accrue to the shippers and receivers who use the Port of Tampa. These accruals, over the long run, are in turn passed on to the consumer of the item which may be received or to the owners and employees of firms who ship through the port.

While these benefits could be concentrated in the same geographic area as are the direct benefits, that is Tampa, Hillsborough and Pinellas Counties, they may also be realized in areas further removed from the port area.

One method of estimating net economic benefits relates the cost of operation in question to the next best alternative method of accomplishing the same. This was the method of transportation savings used in the 1978, Booz, Allen & Hamilton Report and updated here.

In the Booz, Allen & Hamilton report (1979) the transportation savings were estimated by making an assumption that the Port of Tampa was not available to shippers and receivers, and thus making it necessary to use an alternative port, such as Jacksonville.

TABLE 4-1
ESTIMATED TOTAL TONNAGE HANDLED
AT THE PORT OF TAMPA
DURING FY 1978 AND FY 1984
(SELECTED CATEGORIES,
IN THOUSANDS OF SHORT TONS)

Category	Total: 1978[1]		Total: 1984[2]	
Phosphate	24,006	50%	23,610	52.0%
Other Dry Bulk	5,689	12	4,192[3]	9.0
Petroleum Products	12,109	25	10,630	23.0
Other Liquid Bulk	5,027	10	6,203[4]	13.5
General Cargo	1,401	3	1,118[5]	2.5
Total	48,232	100%	45,753	100%

1 Booz, Allen & Hamilton Report

2 Tampa Port Authority, 1984 Annual Report

3 Coal and Aragonite Only

4 Includes Sulphur (Liquid), Ammonia (Anhydrous) and Phosphoric Acid

5 Includes Steel Products, Bananas, Meat & Poultry, and other General Cargo

TABLE 4-2
DIRECT PRIMARY IMPACT OF THE PORT OF TAMPA
BY MAJOR COMMODITY GROUP 1978 AND 1984
(DOLLARS AND TONS IN THOUSANDS)

	1978[1]				1984			
Vessel Type	Commodity Group	Direct Primary Impact Per Ton (In Dollars)	Total Tonnage	Total Impact	Commodity Group	Direct Primary Impact Per Ton (In Dollars)[2]	Total Tonnage	Total Impact
Ship	Phosphate	$ 3.17	15,205	$ 48,200	Phosphate	$ 5.11	23,610	$120,647
Barge	Phosphate	3.31	8,801	29,131				
Ship	Other Dry Bulk	1.53	2,500	3,825	Other Dry Bulk	2.56	4,192	10,731
Barge	Other Dry Bulk	1.72	3,189	5,485				
Ship	Petroleum	4.17	5,270	21,976	Petroleum	6.49	10,630	68,988
Barge	Petroleum	4.06	6,839	27,766				
Ship	Other Liquid Bulk	3.87	1,298	5,023	Other Liquid Bulk	6.02	6,203	37,342
Barge	Other Liquid Bulk	3.76	3,729	12,118				
Ship	Steel Products	19.30	367	7,083	Steel Products	30.49	307	9,360
Ship	Bananas	36.28	134	4,862	Bananas	57.32	228	13,068
Ship	Meat & Poultry	31.06	31	963	Meat & Poultry	49.07	19	932
Ship	Other General Cargo	41.23	869	35,829	Other Gen. Cargo	65.14	564	36,738
Total		$ 4.19	48,232	$202,261	Total	$ 6.50	45,753	$297,806

[1] Ibid., Booz, Allen & Hamilton

[2] Includes the following: Dockage and sheddage fees; wharfage; stevedore expenses; terminal and handling charges; agents fees and commissions; tug and pilot expenses; harbormaster fees; fresh water charges; crew spending; inland transportation expenses; and other vessel disbursements. The dollar impacts per ton for [redacted]4, were calculated by adjusting the 1978 figures [redacted]or inf[redacted]on [redacted]sum[redacted]Pric[redacted]ndex [redacted]58% [redacted]d d[redacted]t s[redacted]rate[redacted]ip a[redacted]par[redacted]ove[redacted]s. [redacted]

Table 4-3 illustrates the comparison of transportation savings associated with the Port of Tampa in 1978 and 1984. (The net economic transportation benefits result from multiplying the total tonnage handled for each commodity group times the transportation savings estimates. The 1978 estimates were adjusted for inflation using the producer price index, to derive the 1984 savings estimates.)

The assumptions used include the following:

- It would cost an additional $6.14 per ton to ship phosphate to Jacksonville or Palm Beach by rail.

- It would cost approximately 3.2 cents per gallon to distribute petroleum products from Jacksonville overland to the Tampa area, in lieu of water-borne receipt, and then distribution from the Port of Tampa.

- Other liquid bulk items, and principally sulphur, would incur additional charges of $5/ton, if routed by truck via Jacksonville or Palm Beach.

- General cargo is a heterogeneous commodity group and thus, it is difficult to explicitly estimate a premium for the additional inland transportation requirement to or from Jacksonville, the closest (major) general cargo port. For the purpose of this analysis, an 8.65 cents per ton mile was used as rule-of-thumb. The 1.1 million tons of general cargo was therefore assessed a total transportation premium of $12.0 million for the average additional inland haul of 125 miles.

- Other dry bulk commodities consist primarily of coal and aragonite.

  - It is estimated that a rail shipment of coal from eastern Kentucky to the Tampa area would cost approximately $1.22 per ton more than a barge movement via Cairo, Illinois to Tampa.

  - The aragonite transportation premium assumes a rail haul from Miami to the Tampa area. The cost of this movement is estimated at $6.12 per ton.

Overall, the transportation premium associated with other dry bulk commodities would be approximately $8.2 million if the water-borne shipment to Tampa was not available to the major receivers of these products.

The total transportation savings, hence benefits, associated with the handling of the products that currently use the Port of Tampa, is estimated at approximately $281 million.

TABLE 4-3
INDIRECT TRANSPORTATION IMPACT ASSOCIATED
WITH THE PORT OF TAMPA
(IN MILLIONS OF DOLLARS)

Commodity Group	1978 Transportation Savings [1]	1984 Transportation Savings
Phosphate	$ 78.0	$ 144.9 [2]
Petroleum Products	60.0	85.0 [3]
Other Liquid Bulk	20.1	31.2 [4]
General Cargo	8.8	12.0 [5]
Other Dry Bulk	6.8	8.2 [6]
Total	$ 173.7	$ 281.3

[1] Ibid., Booz, Allen & Hamilton

[2] Producer Price Index (PPI) = 89% Source: U.S. Department of Labor, Bureau of Labor Statistics

[3] Ibid. PPI = 62.6%

[4] Reflects a cost increase of 26%. Source: Ryder/PIE. Nationwide Inc.

[5] PPI = 73% Source: U.S. Department of Labor, Bureau of Labor Statistics

[6] Ibid. PPI = 75%

E. FOOTNOTES

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CHAPTER 5
BENEFITS OF TAMPA BAY TO SANITARY AND ELECTRIC SERVICES

A. INTRODUCTION

Currently, Tampa Bay is used as a receiving water body for treated wastewater and industrial effluent discharges. It also serves as an ideal site for electric power generating plants, due in part to the need for large quantities of cooling water. The economic base model, presented in Chapter 3, identifies both sanitary services (SIC 495) and electric services (SIC 491) as part of the exogenous sector. The geographic proximity of these two industries to Tampa Bay results in several economic benefits, which are outlined within this chapter. Case studies are presented for both Hillsborough and Pinellas Counties, involving sanitary and electric services.

In September 1984, the Florida Department of Environmental Regulation presented a draft of the Tampa Bay 205(j) Water Quality Impact Study. The Tampa Bay estuarine system was studied for the purpose of considering water quality impacts of point and nonpoint source discharges to the Bay.(1) The study was completed as a cooperative effort between various agencies and with a number of contractors. Dissolved oxygen (DO) and nutrient concentrations in Tampa Bay were studied as parameters to define nutrient or chlorophyll a target concentrations in Tampa Bay and to consider the impacts of point and non-point sources relative to the targets.

When finalized, the Tampa Bay Water Quality Impact Study may play a critical role regarding future point and non-point source discharges to the Tampa Bay estuary.

B. WASTEWATER DISPOSAL

Tampa Bay is presently experiencing a number of water quality problems. In particular, there is a periodic depletion of the dissolved oxygen (DO) resources and associated fish kills. There has been a disappearance of grassbeds in the area. Seasonal algal blooms are also encountered. Taken together, these problems appear to be associated with nutrient enrichment of the bay system. Therefore, the primary concern in the study of Tampa Bay Water Quality Impact Study was the nutrient load from point and non-point sources (2).

Municipal and industrial wastewaters enter Tampa Bay directly or via its tributaries at over 188 points around the Bay.(3) Hillsborough Bay receives the heaviest loadings of both municipal and industrial wastes, while Old Tampa Bay receives substantial loadings of predominatly municipal wastes. Relatively smaller amounts of municipal and industrial wastes are discharged into the middle and lower segments of Tampa Bay proper, however, Boca Ciega Bay has been severely impacted by municipal discharges.

In 1972, the Florida State Legislature passed what was known as the Wilson-Grizzle Bill (Section 403.086(1)(b), Florida Statutes). This bill stipulated that no domestic wastewater disposal facility constructed after 1972, could discharge any waste into Old Tampa Bay, Tampa Bay, Hillsborough Bay, Boca Ciega Bay, St. Joseph Sound, Clearwater Bay, Sarasota Bay, Little Sarasota Bay, Roberts Bay, Lemon Bay, or Punta Gorda Bay, in addition to any bay, bayou or sound "tributary thereto" without providing at least advanced wastewater treatment (AWT). In essence, the area covered by the bill included all saline coastal bodies of water from the Anclote Keys south to Charlotte Harbor.

Advanced wastewater treatment, as defined in the Florida Administrative Code, Chapter 17-6, limited the annual average effluent concentration to 5 milligrams per liter (mg/l) of 5 day biochemical oxygen demand (BOD5) and total suspended solids; 3 mg/l total nitrogen; and 1 mg/l total phosphorus. This requirement was not based on site-specific water quality determinations, but was made in an attempt to reverse what was perceived by many to be deteriorating water quality in the area. No relief mechanism was provided other than a statutory variance.

In 1980, the Legislature modified the Wilson-Grizzle Bill such that the FDER could grant relief for facilities if the applicant initiated a request for such relief and then demonstrated that AWT was not required to protect water quality. The modified Wilson-Grizzle Bill also expanded the "affected area" to include all freshwater tributaries which flow into the original Wilson-Grizzle area. This area was defined hydrologically as the Peace River and Tampa Bay Basins.

In July 1981, the Legislature repealed the statute requiring AWT for domestic wastewater treatment facilities constructed after 1972. The statute was replaced with a mandate requiring the Department to specify wasteload allocations on a case-by-case basis for domestic point sources. Also required was a survey on the overall impact of existing non-point sources discharging into the waters of the original Wilson-Grizzle area.

In 1982, the surface waters of Tampa Bay received domestic effluent from 49 permitted sources which included facilities with design treatment capacities ranging from 10,000 to 60 million gallons per day.(4) Domestic point sources in 1984 discharged 71.01 billion gallons of effluent to Tampa Bay and its associated tributaries as compared to 61.75 billion gallons in 1982, a 15% increase in total annual flow. This increase can generally be attributed to rapid population growth, higher than average rainfall and associated infiltration problems with collection systems.

There are currently 23 industries which are permitted to discharge directly into Tampa Bay waters according to Department of Environmental Regulation National Pollutant Discharge Elimination System (NPDES) permit files. In addition, there are 116 industries which are permitted to discharge into the tributaries of Tampa Bay.(5)

It is difficult to predict future trends as many unknown factors will come into play. As local governments move toward the implementation of approved 201 Facility Plans, fewer plants will discharge directly to surface waters of the bay. Alternative effluent disposal practices such as deep-well injection, spray irrigation and percolation ponds will become more commonplace. In addition, the level of treatment in regional plants will continue to improve. However, counteracting these positive actions is an increasing trend toward the construction of numerous small (<0.1 MGD capacity) "package plants" in developments not served by existing sewer systems. This trend will result in an overall increase in the number of point source discharges to be monitored, and an overall decrease in level of treatment.

PL 92-500 Planning Processes

Public Law 92-500, known as the Federal Water Pollution Control Act Amendments of 1972, was enacted by the ninety-second Congress of the United States of America on October 18, 1972. The stated objective of this act is to "restore and maintain the chemical, physical and biological integrity of the Nation's waters." The national goals and policies established by PL 92-500 include the following: "...it is the National Policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State..."

In keeping with this policy, PL 92-500 expanded existing and created new planning processes to be carried out by the States. Plans required to be prepared under this act are: Section 303(e) - Basin Plans; Section 208 - Areawide Waste Treatment Management Plans; and Section 201 - Facility Plans.

The 201 Facility Plan is concerned primarily with developing a specific project, or projects, for the collection, treatment and disposal of wastewaters generated in the 201 Planning Area. It is specific in that it includes the treatment and disposal of wastewaters generated in the 201 Planning Area. It is also specific in that it includes the treatment plant sites, sizes, types of processes, methods of effluent and sludge disposal, interceptor sewer routings and other steps necessary for constructing the project.

1. Hillsborough County

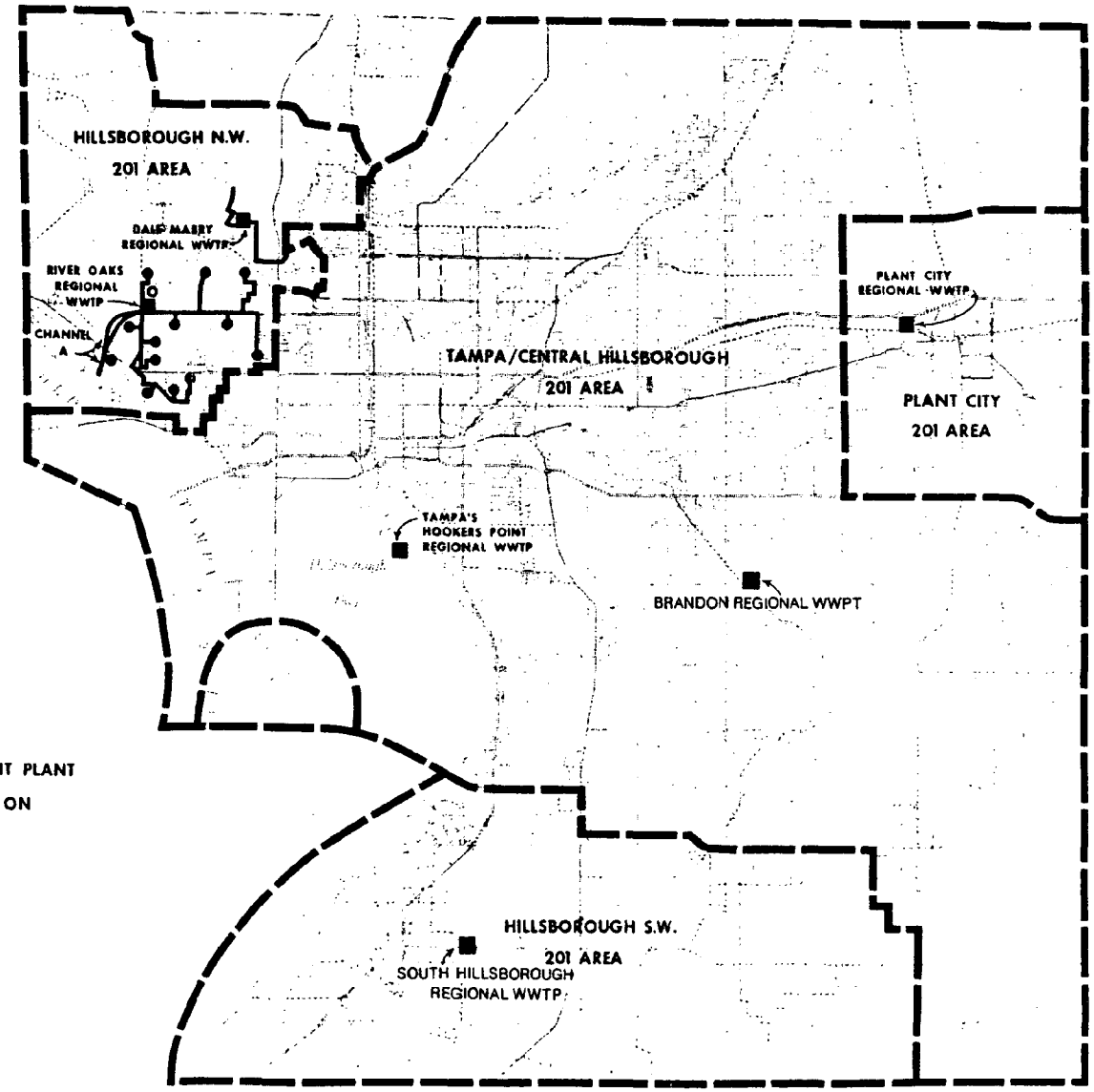
Hillsborough County contains four wastewater treatment service districts: Hillsborough Northwest, Plant City, Central Hillsborough-Tampa and Hillsborough Southwest (see Figure 5-1). Hillsborough Northwest also treats wastewater from a small area in the neighboring Pasco County. The wastewater treatment - disposal systems of the Central Hillsborough-Tampa and Hillsborough Northwest areas are examined here.

Figure 5-1

LEGEND

- 201 BOUNDARY
- REGIONAL WWTP
- MAJOR TRANSMISSION LINES
- MAJOR PUMPING STATION
- o EFFLUENT STORAGE POND

SOURCE: TBRPC, 1978



N

0 1 2 3 4
SCALE IN MILES

NOTE: WWTP-WASTEWATER TREATMENT PLANT

FACILITIES SHOWN ARE BASED ON ULTIMATE YEAR 2000 NEEDS

HILLSBOROUGH COUNTY

WASTEWATER TREATMENT SERVICE DISTRICTS

a. Central Hillsborough-Tampa

The preponderance of the wastewater originating within the Central Hillsborough County - Tampa 201 Planning Area is conveyed to and treated at the Hookers Point Sewage Treatment Plant, operated by the City of Tampa. Hookers Point is an Advanced Wastewater Treatment (AWT) Facility with a current design capacity of 60 MGD. Effluent disposal is by discharge to Hillsborough Bay.

Alternatives

Presently, the Hookers Point facility disposes of approximately 50.3 MGD sewage effluent by discharge to Hillsborough Bay. Alternatives, considered within the 201 Facility Plan, for treatment and disposal of effluent, are summarized as follows:

Secondary Effluent: Treat effluent to secondary levels and dispose by deep-well injection, spray irrigation or by deep-water outfall in the Gulf of Mexico.

Advanced Waste Treatment (AWT) Effluent: AWT treatment and disposal by discharge to Hillsborough Bay with potential reuse of all or part of the effluent.

Costs

Preliminary estimated comparative costs for the secondary treatment alternatives and disposal options are summarized in Table 5-1, which includes 1979 dollar estimates and 1984 dollar estimates.

The preliminary estimated costs for the Advanced Waste Treatment of effluent alternative, with disposal by discharge to Hillsborough Bay, are summarized in Table 5-2.

The Selected Alternative

The selected alternative for the Tampa Service Area - the preferred alternative - comprises expansion and improvements to the wastewater collection systems and the Hookers Point AWT plant, with disposal by discharge of treated wastewater to Hillsborough Bay.(6) The selected alternative was the AWT series treatment with packed towers, with the facilities for the removal of phosphorus. The Hookers Point facility continues to be expanded to provide capacity for current and estimated (future) wastewater quantities, through the year 2000. New and improved facilities at Hookers Point include units for methane generation and energy recovery, and improvements to some of the original process units. This preferred alternative (AWT), with discharge to Hillsborough Bay, is the most cost effective and environmentally sound, as required to meet water quality standards.(7)

TABLE 5-1
SECONDARY TREATMENT ALTERNATIVES AND DISPOSAL OPTIONS

	Alternative Project	See Figure	Preliminary Estimated Comparative Costs[1] Thousand Dollars (1979)		Estimated Comparative Costs Thousand Dollars (1984)[3]	
			(Capital)	(EAC[2])	(Capital)	(EAC)
S-1	Spray Irrigation (no crop recovery)	5-2	$ 297,864	$ 28,574	$ 378,287	$ 36,288
S-1	Spray Irrigation (crop recovery)	5-2	297,864	19,905	378,287	25,279
S-2	Gulf Outfall (Route No. 1)	5-3	203,932	18,648	258,993	23,682
S-2	Gulf Outfall (Route No. 2)	5-3	187,033	17,277	237,532	21,942
S-3	Deep Well Injection	5-4	886,783	86,074	1,126,214	109,314

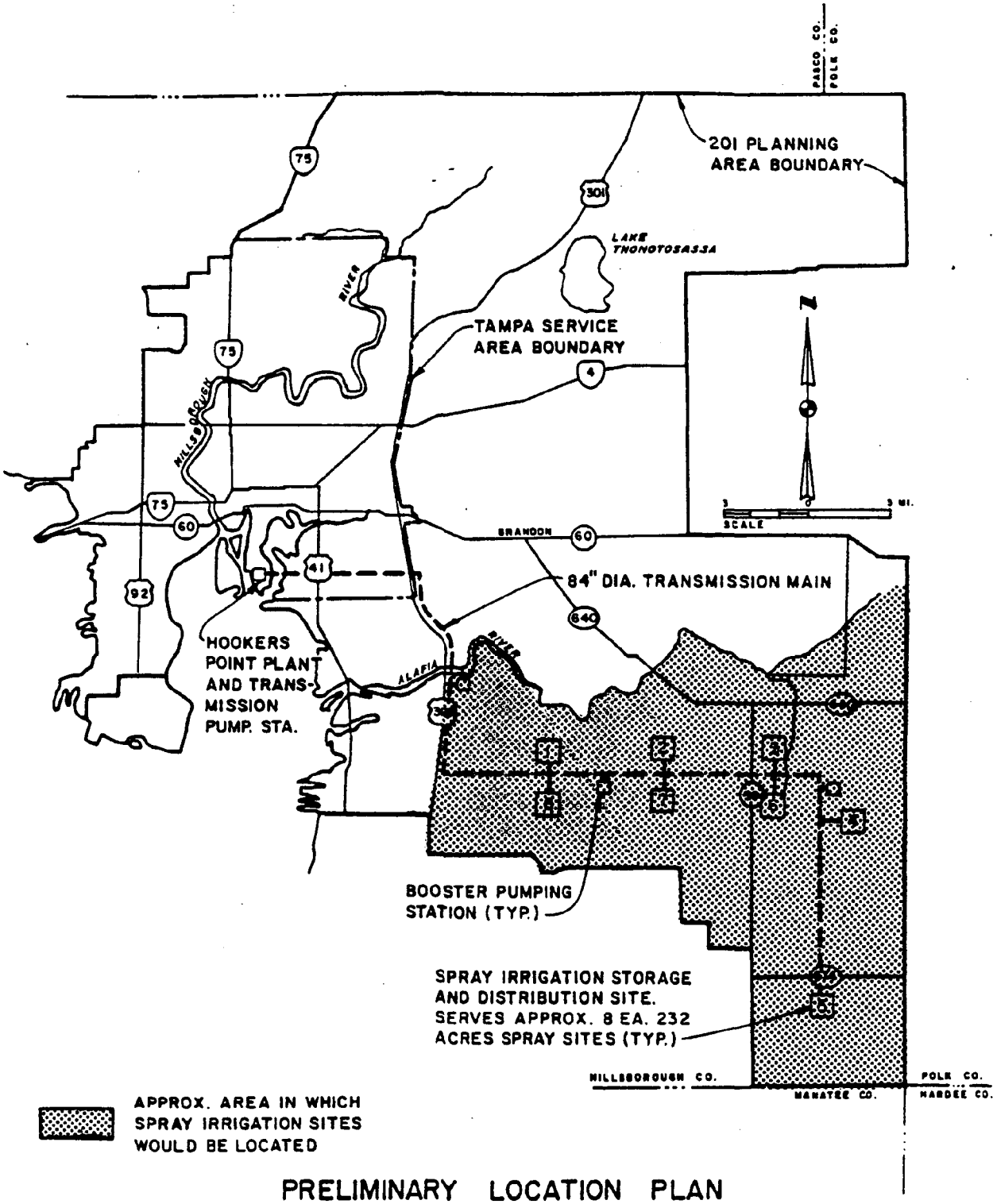
[1] Source: Central Hillsborough County - Tampa 201 Facilities Plan
[2] Equivalent Annual Cost
[3] U.S. Department of Commerce, Composite (Construction) Cost Index, 1985 Adjustment for Inflation (+27%)

TABLE 5-2
ADVANCED WASTE TREATMENT ALTERNATIVE

Alternative Project	See Figure	Thousand Dollars (1979) (Capital)	(EAC)
Series Treatment w/packed towers (w/o P-rem) [1]	5 - 5	$ 66,897	$ 15,792
*Series Treatment w/packed towers (w/P-rem) [2]	5 - 5	67,723	17,448

[1] Without facilities for removal of phosphorus
[2] With facilities for removal of phosphorus
* Selected Alternative

Figure 5-2

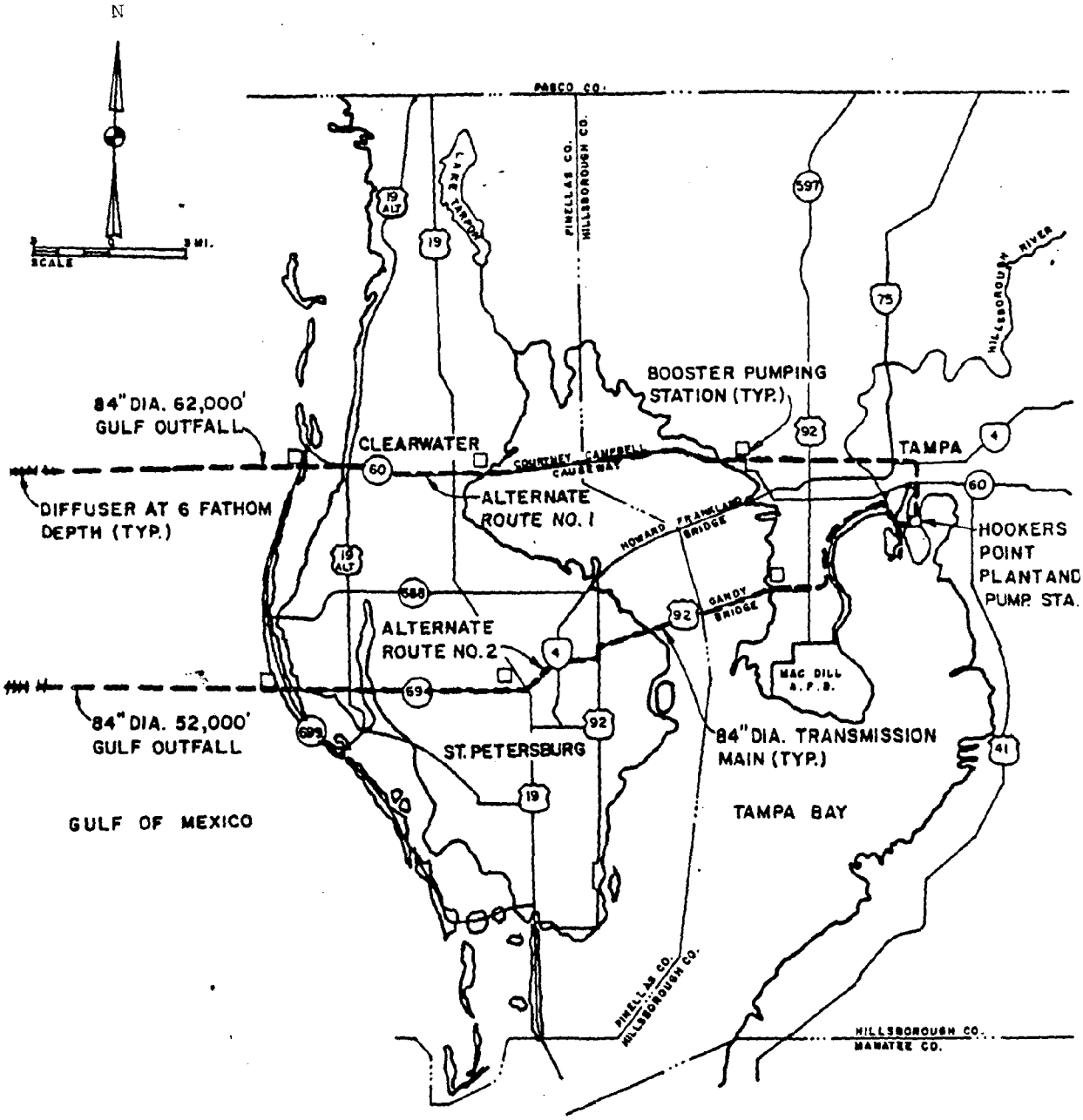


PRELIMINARY LOCATION PLAN
ALTERNATE S-1, SPRAY IRRIGATION
SECONDARY TREATMENT

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-3

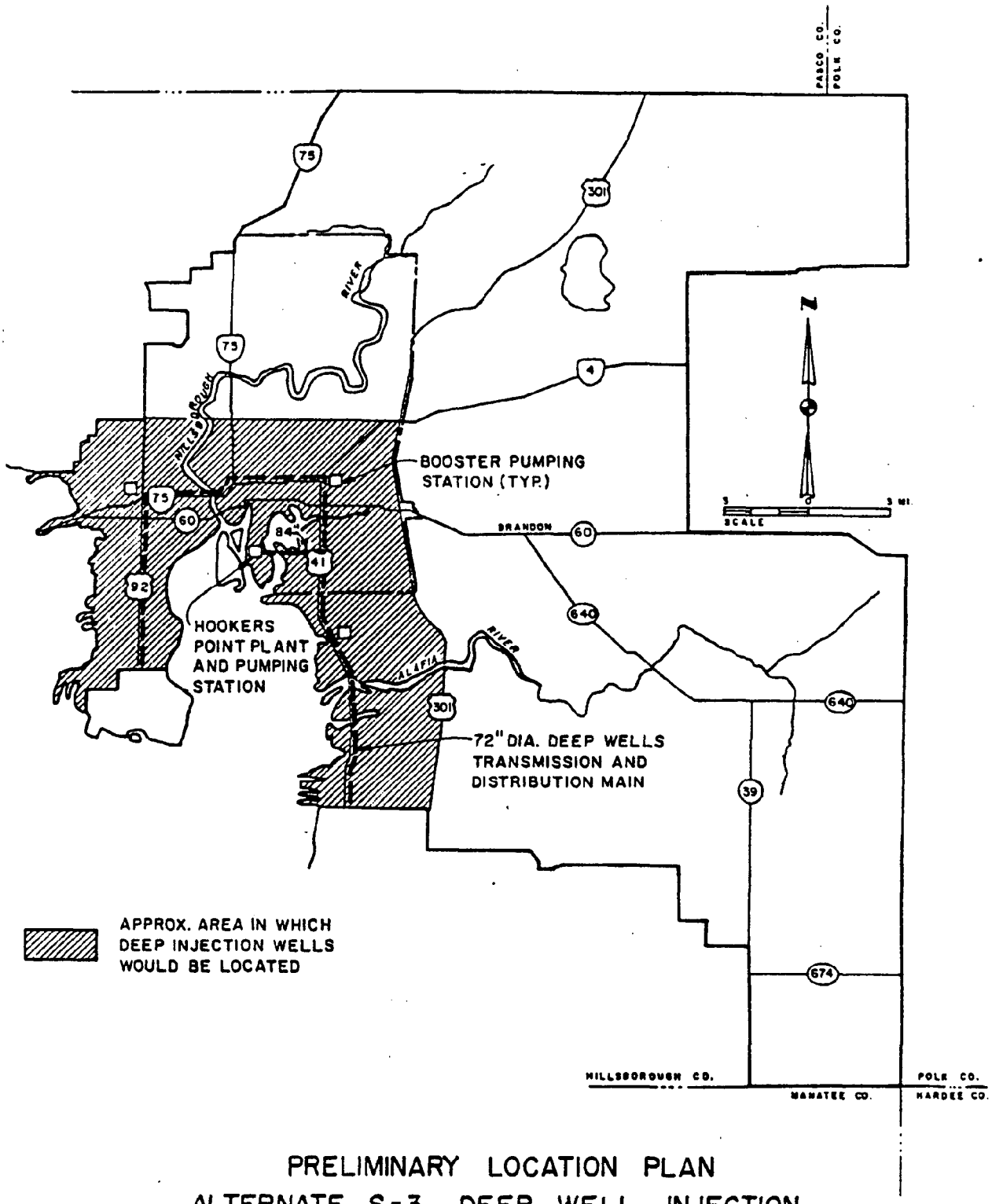


PRELIMINARY LOCATION PLAN
ALTERNATE S-2, GULF OUTFALL
SECONDARY TREATMENT

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY – TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-4

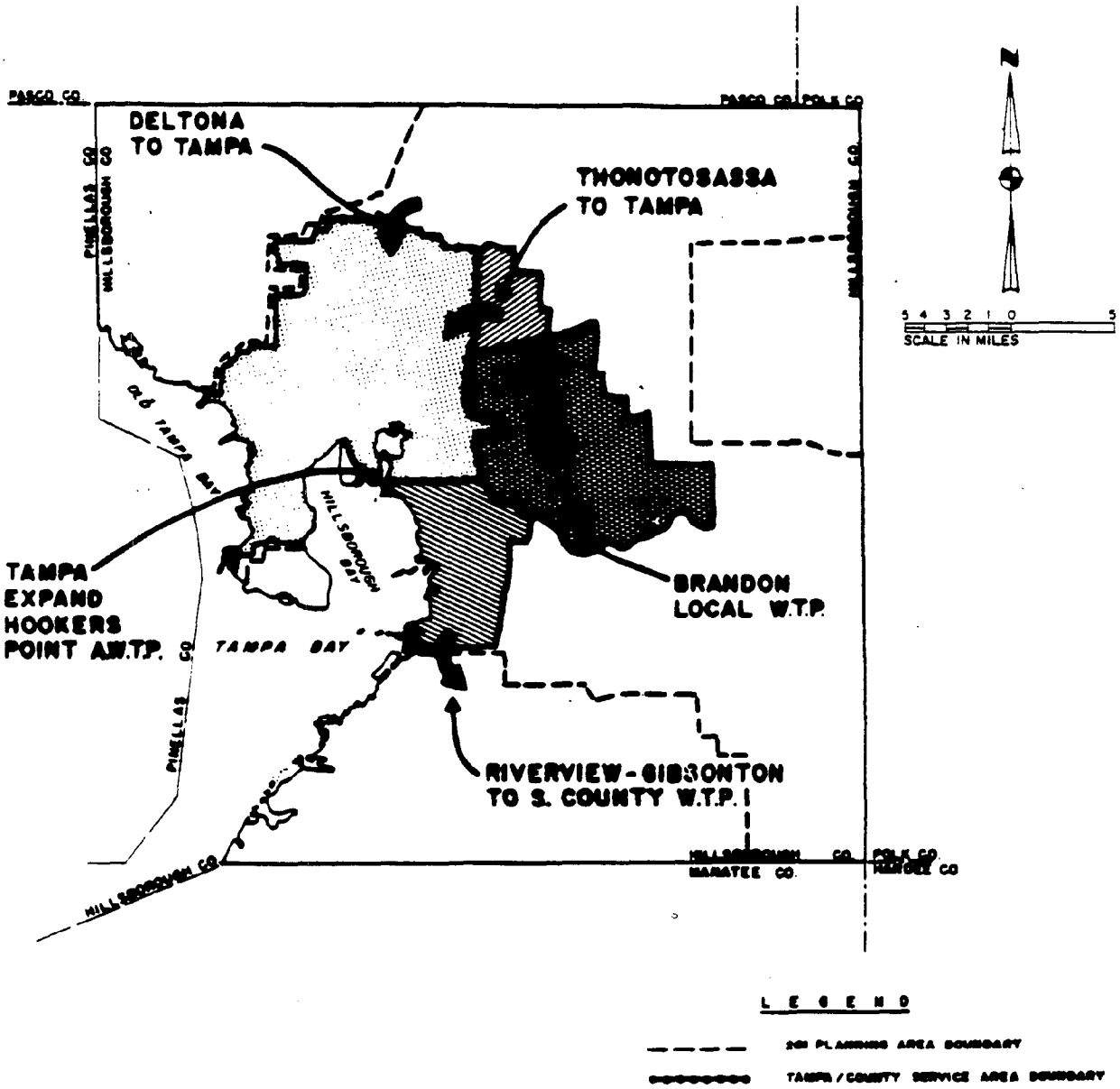


PRELIMINARY LOCATION PLAN
ALTERNATE S-3, DEEP WELL INJECTION
SECONDARY TREATMENT (FILTERED EFFLUENT)

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY – TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-5



SELECTED PLAN

Actual costs, to date, for the AWT alternative, are in the range of $114 million (8). When compared to the capital costs associated with the three secondary treatment and disposal alternatives, (estimated in 1984 dollars) the AWT alternative is by far the most cost effective method of sewage treatment and disposal.

Comparative costs of the AWT alternative and the three secondary treatment and disposal alternatives are summarized as follows:

- Gulf Outfall (Route No. 2) would be double the cost of the AWT alternative, costing an additional $123.5 million to implement.

- Gulf Outfall (Route No. 1) would cost an additional $145 million to implement.

- Spray irrigation, with and without crop recovery, would be over three times the cost of the AWT alternative, costing an additional $164.3 million to implement.

- Deep well injection would be a staggering ten times the cost of the AWT alternative, costing an additional $1 billion to implement.

b. Hillsborough Northwest

The Hillsborough Northwest 201 Planning Area is situated north of Old Tampa Bay and the City of Tampa (please refer back to Figure 5-1). A listing of the treatment facilities currently serving the area, including the degree of treatment provided, method of recovered water reuse, and current operating situation, is given in Table 5-3.

The Northwest Area is currently experiencing difficulty meeting wastewater demands.(9) The area is served by three major treatment plants. The River Oaks AWT Facility, located in the southern portion of the area is overloaded. The design capacity is 4.7 mgd, while the most recent records show up to 6.0 mgd sometimes flowing through the plant. After less than AWT treatment the recovered water is discharged into Channel A, a man-made water course constructed to alleviate flooding. Wastewater discharged into Channel A ultimately enters the waters of Tampa Bay (Figure 5-6). The Florida Department of Environmental Resources (FDER) allows such a discharge as long as certain wastewater treatment criteria are met, however, because the facility is overloaded, these limits are not currently being met.

To improve this situation, the County is in the process of expanding the River Oaks AWT facility to 10.0 mgd. The expansion is under construction and is expected to be completed in January 1988. It must be emphasized that FDER has restricted the total future recovered water flow to Channel A to that quantity that will produce no more poundage than legally allowed

TABLE 5-3
SUMMARY OF COUNTY-OWNED WASTEWATER TREATMENT FACILITIES
HILLSBOROUGH COUNTY, FLORIDA
(Northwest Area)

Facility	Treatment	Design Capacity (mgd)	Reuse Method	Comments
NORTHWEST AREA				
1. River Oaks	AWT	4.67	Surface Water Discharge	Influent flow currently exceeds capacity; EPA administrative order issued; loading in violation of permit
2. River Oaks Interim	Secondary	1.0	Spray Irrigation (Pasture)	Plant to be taken offline with River Oaks expansion
3. Tampa Suburban	AST	0.75	Spray Irrigation (Urban)	Limited by reuse capacity. Current activities to complete Rocky Point Golf Course connection scheduled by January 1986
4. Dale Mabry	AST	4.5	Spray Irrigation (Urban) & Surface Water Discharge	30-month TOP issued 10/85 to remove discharge to Brushy Creek can be operated at 5 mgd for short term; local golf course irrigation limited to 3 mgd.
5. Sun Lake Park	Secondary	0.07	Evaporation/ Percolation Pond	Marginal performance record; TOP pending
6. Van Dyke	AST	2.5	Spray Irrigation (Urban)	Currently under construction with operational start-up scheduled for Spring 1986

Notes: Treatment Levels: Secondary (90% removal), Advanced Secondary Treatment (AST), Advanced Waste Treatment (AWT, nutrient removal)

Source: Hillsborough County Wastewater Master Plan, November 1985

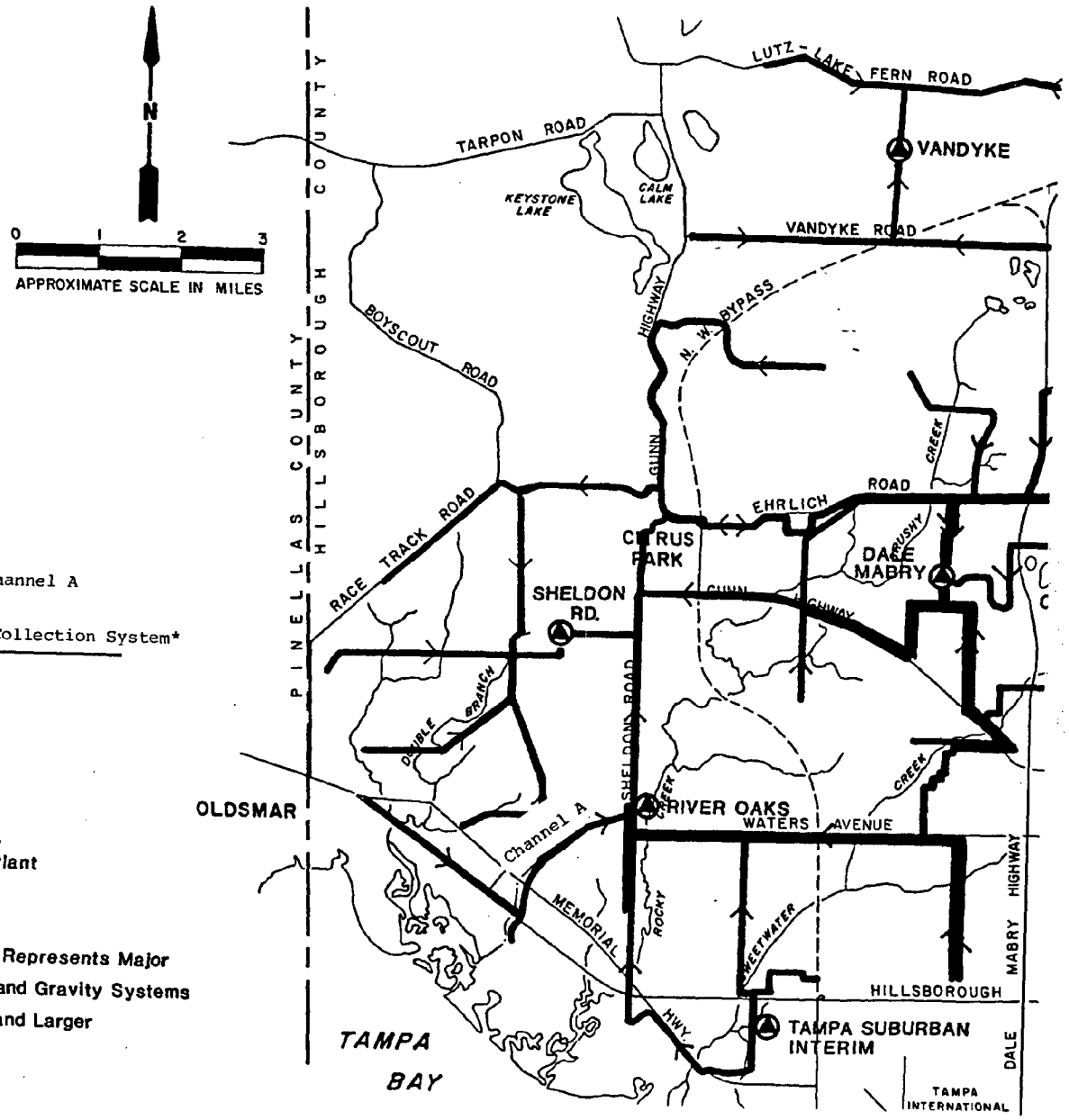


Figure 5-6
Relative Location of Channel A

LEGEND

Existing Collection System*

Wastewater Treatment Plant

* NOTE:
Collection System Shown Represents Major Wastewater Force Mains and Gravity Systems Generally 12" Diameter and Larger

now, which because of the improved level of AWT, should be about 7.5 mgd. As the plant flow increases beyond this amount, other means of recovered water use must become available.

The River Oaks Interim Plant is located on the same site as the River Oaks AWT Plant. The 1.0 mgd interim facility was provided to relieve some of the capacity demands on the AWT facility. Although the plant is operating reasonably well, two upcoming events will shape its future. First, the site itself is so small that expansion of the AWT plant will require dismantling the interim plant. For this reason, the construction schedule has been modified so that limited treatment from expanded facilities will be available to replace the treatment capacity lost as the interim facility is taken off-line. Second, the current recovered water spray irrigation site (owned by U.S. Home) is going to be developed, so a new site must be found.

In September of 1985, an additional interim plant was placed in operation on the site of a former plant, called Tampa Suburban Utilities. This 0.75 mgd steel tank facility is presently only operating at about 0.25 mgd because land is not available to spray irrigate the additional recovered water. The 0.25 mgd is irrigating the adjacent Rocky Point Golf Course.

The FDER operating permit for the Northwest Area's Dale Mabry Advanced Secondary Treatment (AST) plant (formerly known as the Carrollwood Village Plant) expired in January 1985. The Plant is supposed to provide recovered water to local golf courses for irrigation, with an infrequent emergency discharge allowed to Brushy Creek. In fact, discharge to Brushy Creek has been almost continuous because the capacity of the golf courses is about 3.0 mgd, while the plant is operating at 4.2 mgd. In October 1985, FDER issued a 30-month Temporary Operating Permit (TOP) which requires the County to either discontinue the discharge to Brushy Creek or demonstrate to FDER that the discharge does not adversely affect Brushy Creek. In the meantime, recovered water flow to Brushy Creek may continue as long as the plant's maximum treated quantity does not exceed 5.0 mgd and the high quality of the water is maintained.

Finally, a review of the list of "permitted but not connected" commitments for the Dale Mabry Facility appear to exceed the 5.0 mgd limit by 1.0 mgd or more. While this added flow will not show up immediately, plans must be made now for both its treatment and the reuse of the recovered water it creates.

In an agreement with four developers in 1984, the County authorized the private construction of a 1.5 mgd treatment plant centered among the four developments between Lutz-Lake Fern Road and Van Dyke Road. The developers will be repaid for the plant by receiving credit on future capacity fees. The plant is to be operational in March 1986 and will be operated and maintained by the County. The developers have agreed to take back all recovered water created by the plant and use it within the development's boundaries.

Hillsborough Northwest 201 Facility Plan

From the preceding discussion it is apparent that Hillsborough County is faced with an emergency in its Northwest area. Simply stated, the facilities construction for treatment and recovered wastewater reuse have not kept pace with the growth that the area has experienced. Briefly, the Hillsborough Northwest 201 Facilities Plan, revised in 1979, called for only two wastewater treatment plants to serve the area: The River Oaks and Dale Mabry Plants. Both plants required spray irrigation as the preferred "effluent disposal" program. The estimate of expansion costs, and construction and land costs for the River Oaks effluent disposal system, was $30.5 million.(10) In 1984 dollars, this figure would increase to approximately $38.8 million.(11)

Master Plan

Solutions for the northwest area are controlled or influenced by numerous factors, one of the most important of which is the fact that the River Oaks AWT plant expansion to 10.0 mgd will not be completed until 1988, and the newly granted Dale Mabry TOP also expires in 1988.

The short-term program for the Northwest calls for three aggressive recovered water reuse programs. First, developments in the area must follow a "take-back" program which the County intends to establish as mandatory through the passage of an ordinance. It will require that lawn and parkway irrigation systems be constructed within all new developments for irrigation with recovered water.

Second, for the Dale Mabry plant, a wet weather recovered water discharge to Brushy Creek must be pursued. EPA has already issued a draft federal permit which authorizes such a seasonal discharge, and FDER has indicated a willingness to listen. Both agencies require further analysis of the water quality situation before such discharge can be approved.

Finally, numerous wetlands dot the northern and western portions of the area. Currently available statewide draft rules from FDER (in response to the Warren B. Henderson Wetlands Act of 1984) indicate that with sufficient monitoring, 1 inch/week of recovered water (258 acres/mgd) will be allowed to be distributed to wetlands. Some wetlands are being studied in anticipation of this reuse potential. It is important to note here that the draft rule presently implies the purchase of wetlands before use. Since the wetlands augmentation program is so critical to the short- and long-term programs, the County must explore all proper legal means to obtain the use of the wetlands at minimal cost.

In the long-term plan, recovered water is seen as becoming a valuable commodity. The recent water restrictions caused by drought are expected to happen again. Continually available

recovered water for lawn sprinkling and golf course irrigation is, and will be, an attractive selling feature in developments. New "take-back" ordinances, described earlier, will also require it. As the demand for potable water increases with the population, industrial reuse will be a necessity because regulatory agencies will require its consideration prior to groundwater sources being approved or renewed. Therefore, a major goal of the long-term plan is to provide for a recovered water distribution system to be sure that there is a place for the water to go and that, whenever possible, it serves a conservation purpose when it gets there.

Once the River Oaks expansion is complete, no further expansion will be possible there, due to the severely limited size of the site. The River Oaks Facility will have to rely on all aspects of recovered water reuse: wetlands augmentation, take-back programs and golf course irrigation. In addition, there will be continued discharge into Channel A.

Estimated costs for the River Oaks Facility expansion, which includes an interim irrigation relocation, pump station and force main construction and flow equalization, are in the range of $24.9 million.(12)

Summary

The existence of a major wastewater treatment facility, River Oaks, adjacent to Channel A, made this stream a logical receiving waterway. However, in an attempt to discontinue surface water discharge the Northwest 201 plan called for disposal of effluent by land application, e.g. spray irrigation. The estimated cost for expansion and associated construction, in 1984 dollars, was $38.8 million. The current situation with the River Oaks Facility, however, is one of expansion to 10.0 mgd and the utilization of a variety of wastewater reuse systems, in addition to continued discharge to Channel A. The estimated cost for this expansion and associated construction is $24.9 million.

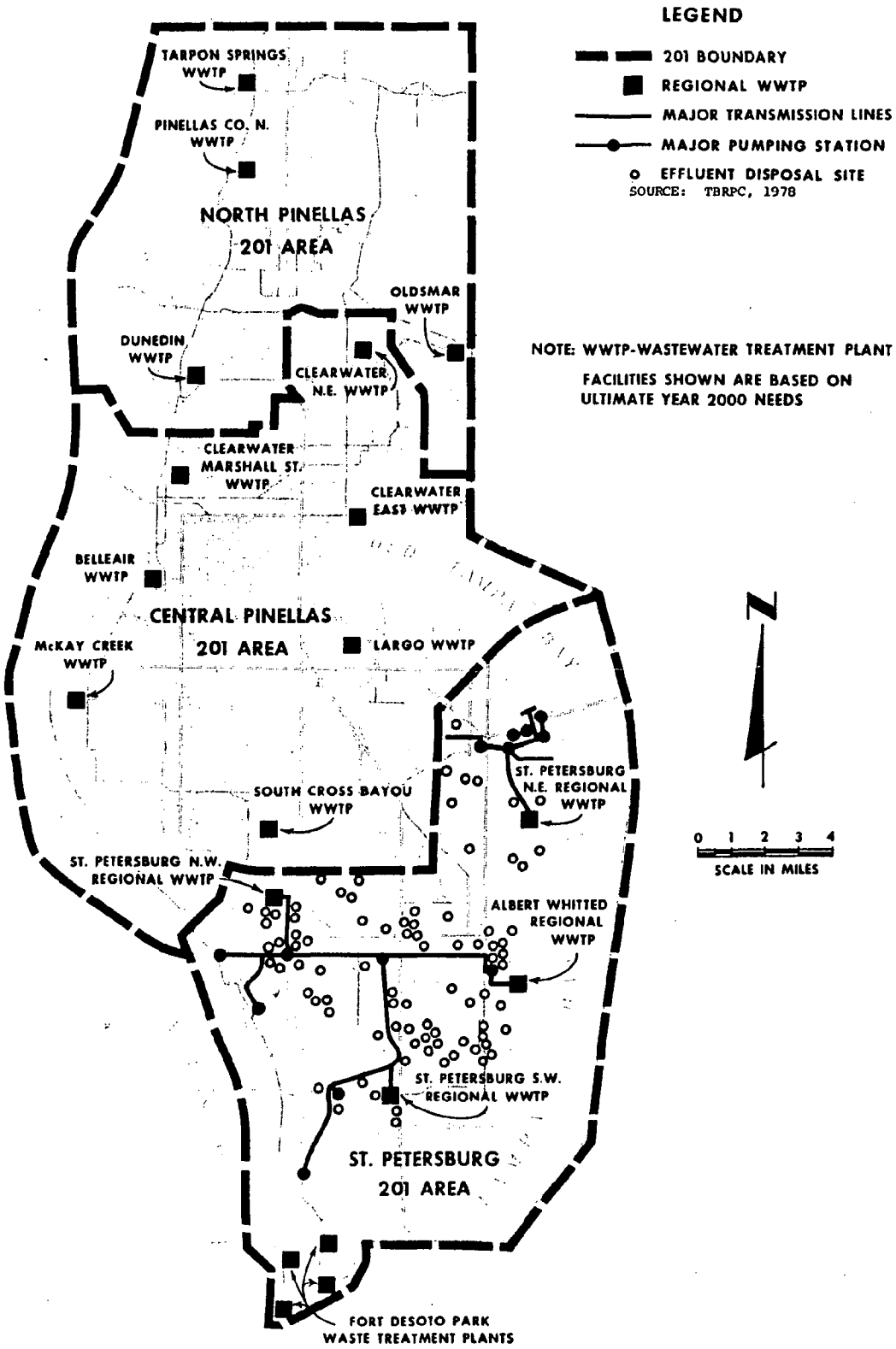
The employment of surface water discharge at the River Oaks Facility results in a cost-savings of approximately $14 million.

2. Pinellas County

There are three 201 Planning Areas in Pinellas County: North Pinellas, Central Pinellas and the City of St. Petersburg (see Figure 5-7).

Pinellas County is the most developed and populated area in the Tampa Bay Region. The County is served by 15 regional wastewater treatment facilities, concentrated mostly along Tampa Bay and the Gulf of Mexico.

Figure 5-7



PINELLAS COUNTY 201 PLANNING AREAS

The 201 planning process for the City of St. Petersburg has already been completed. St. Petersburg has achieved the most cost-effective plan for wastewater treatment and recycling system. All of the effluent will be used for spray irrigation with the deep well injection as a back-up system. However, many of the other facilities in Pinellas County discharge their effluent to surface waters. The wastewater treatment-disposal systems of the North Pinellas area and the City of St. Petersburg are examined here.

a. North Pinellas County

The Environmental Impact Statement (EIS) for North Pinellas County, Florida addresses alternative wastewater treatment-disposal systems and the potential impacts of these systems. (13) The study area for the EIS includes the northern half of Pinellas County including all of the City of Clearwater and locations within the county north of Clearwater as shown on Figure 5-8.

Facilities planning for the EIS Study Area was accomplished through the North Pinellas County 201 Plan (which included areas within the county north of the City of Clearwater: Dunedin, Oldsmar, Tarpon Springs and unincorporated areas) and the Central Pinellas County 201 Plan (which included the cities of Clearwater and Safety Harbor and areas further south). Recommendations of the 201 plans are summarized in Table 5-4. All existing nearshore surface water discharges were to be replaced by several deep well injection and spray irrigation alternatives. A Gulf outfall was also recommended as both a primary and a back-up disposal method.

Review of the facilities plans raised substantive questions concerning the disposal options of deep well injection and a Gulf outfall, lack of wasteload allocations to area surface waters and the impact of sewering the environmentally sensitive area east of Lake Tarpon.

Based upon the concerns raised in the 201 Plans and through the review and scoping processes, the following issues were identified as the major elements of the EIS:

- Development and evaluation of wastewater disposal alternatives for the numerous municipal wastewater treatment facilities;

- Development and evaluation of wastewater management alternatives for the developing area east of Lake Tarpon;

- Evaluation of the environmental effects and costs associated with the disposal of wastewater through a Gulf outfall; and

- Evaluation of water conservation and wastewater reuse in light of existing groundwater supply limitations in the study area.

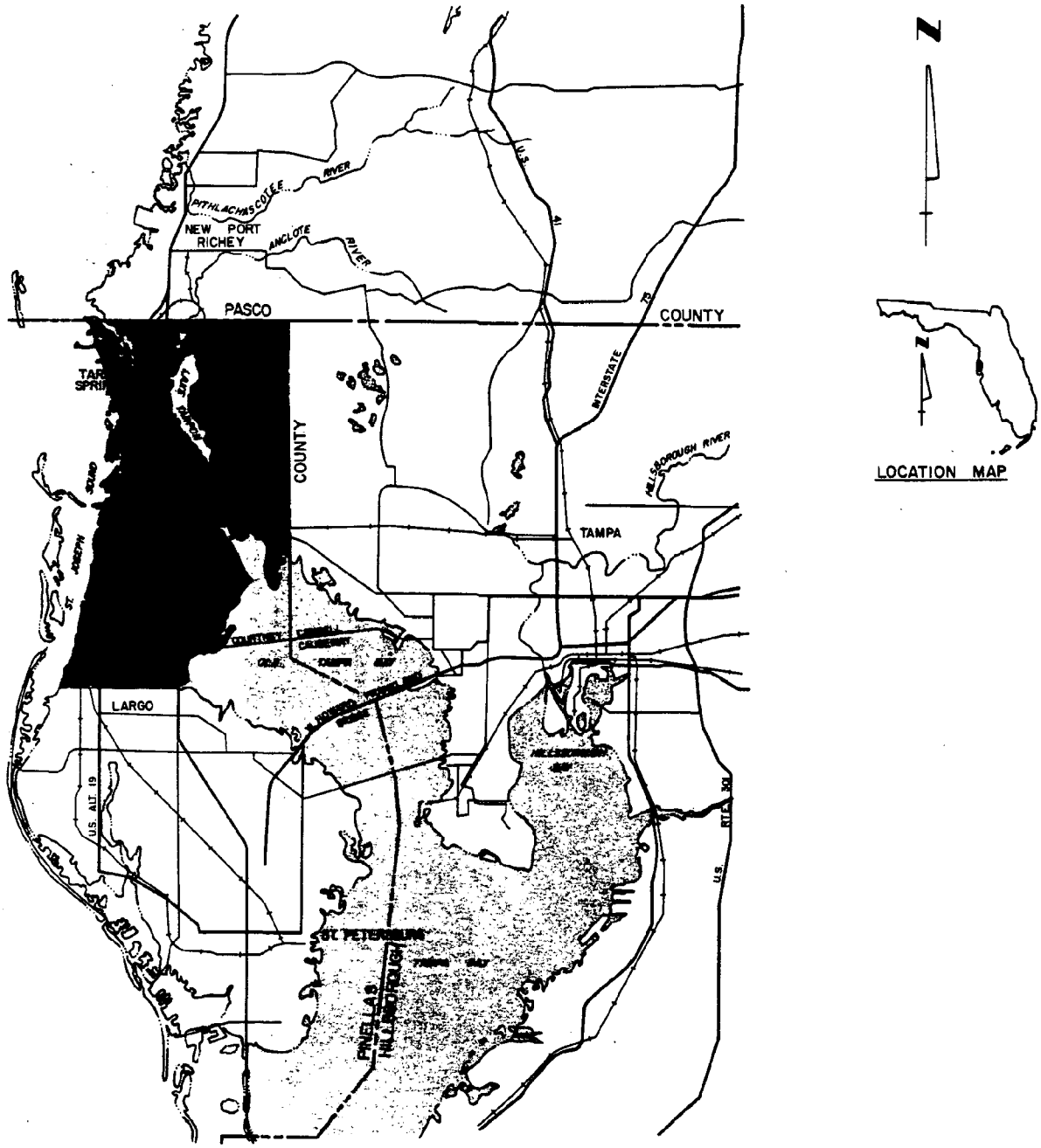


Figure 5-8

NORTH PINELLAS COUNTY, FLORIDA
ENVIRONMENTAL IMPACT STATEMENT

STUDY AREA

5 0 5 10

SCALE IN MILES

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

TABLE 5-4
PINELLAS COUNTY
201 PLAN RECOMMENDATIONS

Service Area	1984 Capacity (MGD) / 1984 Flow (MGD)	Year 2000 Projected Flows (MGD)	Current Wastewater Treatment Levels	Effluent Disposal: Current Method	Effluent Disposal: Method Recom. in 201 Plan
Clearwater					
East Plant	5.0 / 5.3	5.3	Secondary plus effluent filtration	Discharge to Old Tampa Bay, 650 ft. from shore	Deep-well injection near the treatment plant
Northeast Plant (1)	8.0 / 4.6	12.0	Secondary (with filters being installed)	Effluent discharged through East Plant's out fall	Deep-well injection near East Plant in combination with East Plant
Oldsmar					
Oldsmar Plant	1.0 / 0.75	4.5 (2) -7.5 (2)	Secondary with nitrification	Evap./perc. ponds	Spray irrigation as primary method; perc. ponds as backup method
Safety Harbor					
Safety Harbor	0.35 / 0.11	Redirect flow to Clearwater N.E. Plant	Secondary	Redirect flow to Clearwater N.E. Plant	Redirect flow to Clearwater N.E. Plant

(1) Includes Safety Harbor's flows
(2) Includes 3.5 MGD from unsewered area east of Lake Tarpon

Source: EPA, Environmental Impact Statement, North Pinellas County, Florida September 1985

Development and Evaluation of Alternatives

Six basic wastewater disposal alternatives were evaluated for the existing municipal facilities:

- Discharge to coastal waters (Old Tampa Bay, Clearwater Harbor-St. Joseph Sound or the Anclote River);
- A Gulf outfall extending from Clearwater Beach Island, Honeymoon Island or the mainland north of Honeymoon Island;
- Deep well injection at the Marshall St. Plant or south of the study area possibly at the county's McKay Creek Wastewater Treatment Plant and injection site;
- Slow rate (spray irrigation) or rapid rate (rapid infiltration) land application;
- Wastewater reuse of nonpotable wastewater for irrigating recreational or other open land areas and industrial cooling service water; and
- The No Federal Action (no-action) alternative.

Cost Analysis

(a) Tampa Bay Subarea Cost Summary

The Old Tampa Bay Subarea involves facilities (Oldsmar, Clearwater Northeast, and Clearwater East) with proposed discharges to Upper Old Tampa Bay (north of the Courtney Campbell Causeway) or Lower Old Tampa Bay (south of the causeway). The general findings of the cost analysis are summarized below:

- The individual service area disposal options with a surface water discharge treated to secondary levels with no outfall extension are least costly;
- Regional and sub-regional options are more costly than individual options;
- A sub-regional alternative combining all facilities for a discharge to Lower Old Tampa Bay at secondary treatment levels is the least costly non-individual service area option;
- Reuse plus secondary treatment and filtration is cost competitive with regional Gulf outfall and deep well injection options; and
- The regional Gulf outfall option (with secondary treatment and with the outfall located four miles offshore from Honeymoon island) is cost competitive with the regional deep-well injection option.

Conclusions

In the absence of approved wasteload allocations for area surface waters (except the Anclote River), EPA could not select a preferred alternative for wastewater disposal for all of North Pinellas County. The EIS must instead be viewed as providing input to the Florida DER in their wasteload allocation decisions and to local agencies for their wastewater management decisions. The identification of the most cost effective, environmentally sound disposal alternative that would be eligible for EPA funding can not be accomplished until the wasteload allocation process is completed.

The alternatives involving discharge into Old Tampa Bay, Clearwater Harbor and St. Joseph Sound can undergo no further screening by EPA at this time. Additional definitive decisions can not be made until wasteload allocations for those water bodies are available.

Recommendations

- **Wastewater Reuse**

  The wastewater reuse alternatives for each service area were identified as the environmentally preferred disposal alternative. Reuse is the only management option that responds to the area's surface water quality problems while addressing ground water supply limitations. **In general terms, the cost of waste-water reuse represents an additional $41 to $48 million beyond the costs associated with surface water disposal options at AWT and secondary treatment levels, respectively for all seven treatment plants.**

  These costs do not recognize any value for the recycled wastewater or the reduced costs associated with lesser needs for potable supplies.

- **Old Tampa Bay Subarea**

  In the absence of wasteload allocations for this subarea, numerous alternatives remain viable for the Clearwater East, Clearwater Northeast and Oldsmar service areas. The information from the EIS process is available to the state for use in their decisions. Upon completion of the wasteload allocation process, the most cost-effective environmentally sound option for funding eligibility can then be selected.

- **Remaining Alternatives**

  Wasteload allocations for Old Tampa Bay and Clearwater Harbor-St. Joseph Sound are in the process of being developed. The selected treatment level for each body of water could be as minimal as secondary wastewater treatment or as stringent as not allowing any wastewater discharge.

Therefore, all of the screened alternatives listed in Table 5-5 for the Clearwater East, Clearwater Northeast and Oldsmar service areas remain under consideration.

b. City of St. Petersburg

The St. Petersburg 201 planning area is located in the southern part of Pinellas County between Tampa Bay and the Gulf of Mexico (refer back to Figure 5-7).

The City of St. Petersburg is currently served by four existing municipal wastewater treatment plants, plus four package treatment plants at Fort DeSoto Park. The following are the wastewater facilities that serve the St. Petersburg 201 planning area:

1. Albert Whitted Wastewater Treatment Plant (6.4 MGD)
2. Northeast Wastewater Treatment Plant (16.0 MGD)
3. Northwest Wastewater Treatment Plant (20.0 MGD)
4. Southwest Wastewater Treatment Plant (20.0 MGD)
5. Fort De Soto Park Wastewater Treatment package plants (0.134 MGD)

In response to PL 92-500 and the Wilson-Grizzle Bill, the City of St. Petersburg conducted extensive research in the spray irrigation of treated effluent. Numerous spray irrigation sites throughout the city were selected. The testing and monitoring results showed that the soils did not present constraints for effluent disposal on land, however, there were isolated instances of sites that were poorly drained and had a high water table.

In 1977, the St. Petersburg City Council adopted the concept of zero discharge of treated wastewater to surface waters of Tampa Bay, via wastewater reuse.

The primary objective of the St. Petersburg 201 Facility Plan, completed in 1978, was to consolidate treatment plant service areas where it proved to be most cost-effective. The alternative chosen was a four plant configuration utilizing only the St. Petersburg plants, plus the Fort DeSoto Park package wastewater treatment plants.

Currently, three of the City's four wastewater treatment plants supply water to the effluent distribution system. At the present moment, all of the effluent from the Albert Whitted Plant is discharged to Tampa Bay, however, it is scheduled to be tied to the effluent distribution system before 1987, thereby interconnecting completely the four regional treatment plants.

Effluent disposal is accomplished through spray irrigation, with a deep-well injection back-up. The spray irrigation system consists of a complete secondary water main of 100-miles, carrying effluent to the four quadrants of the City. Excess effluent not used for irrigation is injected via deep wells into a brine

TABLE 5-5
WASTEWATER DISPOSAL ALTERNATIVES

Individual Alternatives

City of Clearwater East Service Area

- Continue existing discharge to Old Tampa Bay south of the Courtney Campbell Causeway
- Discharge to Old Tampa Bay at different location south of Causeway
- Discharge to Old Tampa Bay north of Causeway
- Distribution of reusable wastewater to parks, golf courses and other lands for nonpotable uses

City of Clearwater Northeast Service Area

- Resume former discharge which flows into Possum Branch (and subsequently to Old Tampa Bay)
- Discharge directly to Possum Branch
- Discharge to Safety Harbor
- Discharge to Old Tampa Bay north of Causeway
- Discharge of reusable wastewater to parks, golf courses and other lands for nonpotable uses.

Source: EPA, Environmental Impact Statement, North Pinellas County, Florida, September 1985

City of Oldsmar Service Area

- Discharge to Safety Harbor
- Discharge to Mobbly Bay
- Discharge the Old Tampa Bay north of Courtney Campbell Causeway
- Combine with Higgins Power Plant cooling water and effluent prior to discharge to Old Tampa Bay
- Distribution of reusable wastewater to parks, golf courses and other lands for nonpotable uses

Source: EPA Environmental Impact Statement, North Pinellas County, Florida, September, 1985

zone a thousand feet below the ground. An impermeable layer of rock and clay over-laying the brine zone prevents vertical migration of the effluent, eliminating the possibility of contaminating groundwater.

Construction costs of the wastewater reuse system is estimated at approximately $48 million. The City of St. Petersburg's share of this total is estimated at approximately $9.6 million, or 20 percent of the total cost.(14)

C. POWER PLANT SITINGS

There are six power generating plants existing along the shores of Tampa Bay (Figure 5-9). The three plants owned by Florida Power Corporation are the A.W. Higgins Plants located near Oldsmar on Old Tampa Bay, the P.L. Bartow Plant located south of Gandy Bridge in Pinellas County and the Bayboro Plant located adjacent to Bayboro Harbor in St. Petersburg. The three plants owned by Tampa Electric Company are the Hooker's Point Station in Tampa, the Gannon Station, also located adjacent to Hillsborough Bay and the Big Bend Station located south of the Alafia River.

Power plants are sited along the bay partly due to the need for large quantities of cooling water. While it is not necessary to site a power plant on the bay, large quantities of water are necessary and not easily obtained from other sources.

In an effort to examine the economic benefits derived from location along Tampa Bay, two "case studies" are presented. The first case study examines the Tampa Electric Company's Big Bend Unit 4 electric generating plant, and the second study examines Florida Power Corporation's Cooling Water Report for the Bartow Plant.

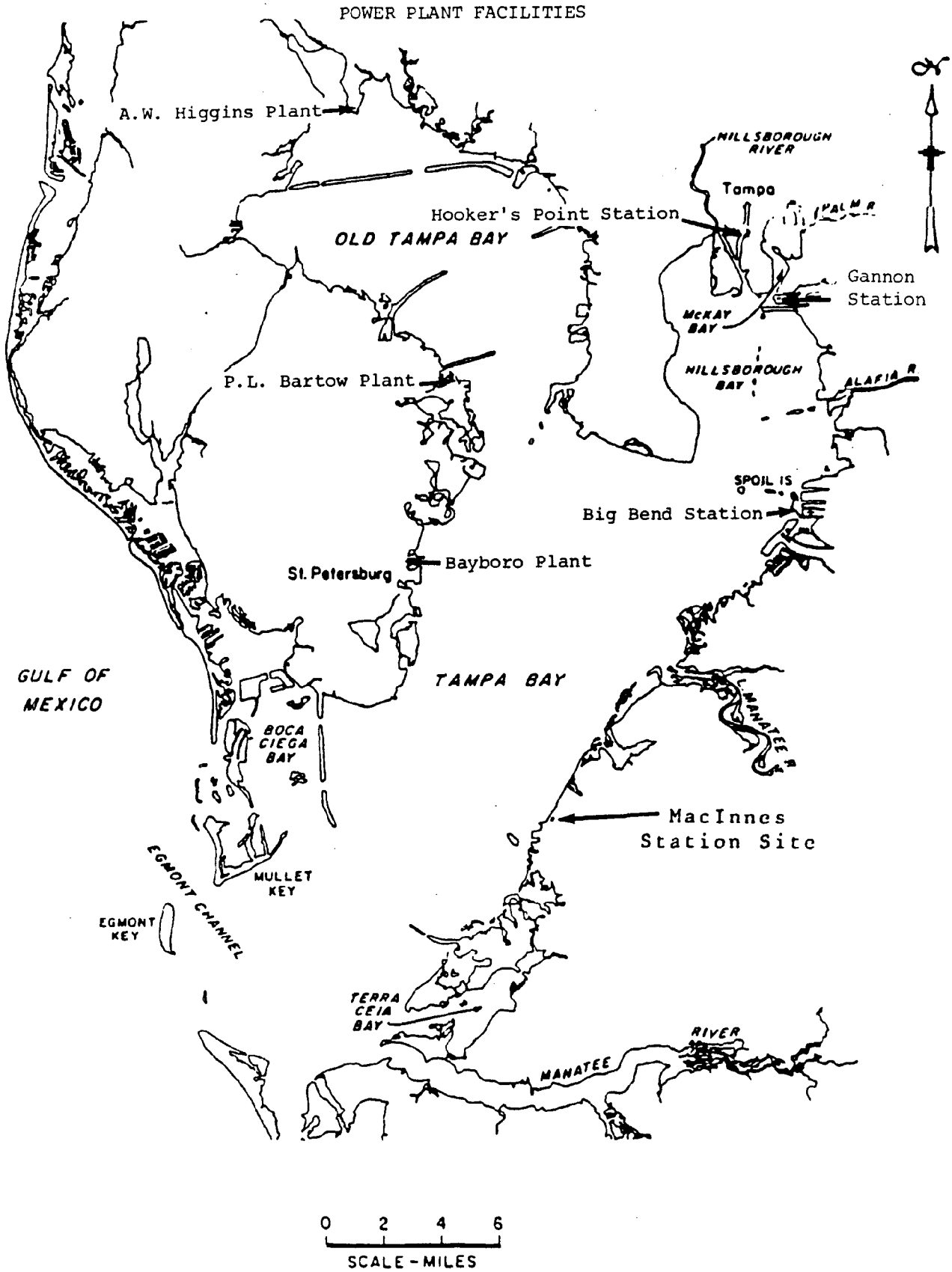
1. Big Bend Unit 4

Tampa Electric Company (TECO), a company which is principally engaged in the generation and sale of electricity, serves an area of nearly 1900 square miles on the central west coast of Florida, including all of Hillsborough County and parts of Pasco, Pinellas, and Polk Counties. TECO serves approximately 316,000 customers; TECO's service area is shown in Figure 5-10.

TECO produces electricity in three wholly owned power plants located on or near the eastern shores of Tampa Bay. The units in these plants have a generation capability mix of approximately 65 percent coal, 29 percent No. 6 low-sulfur oil, and 6 percent No. 2 low-sulfur oil. The energy produced from these plants has a generation mix of approximately 80 percent coal, 19 percent No. 6 fuel oil, and 1 percent No. 2 low-sulfur oil.

Hookers Point Station is the oldest of TECO's three power plants. It is located just southeast of the Tampa business district on Hookers Point, fronting the Seddon Ship Channel.

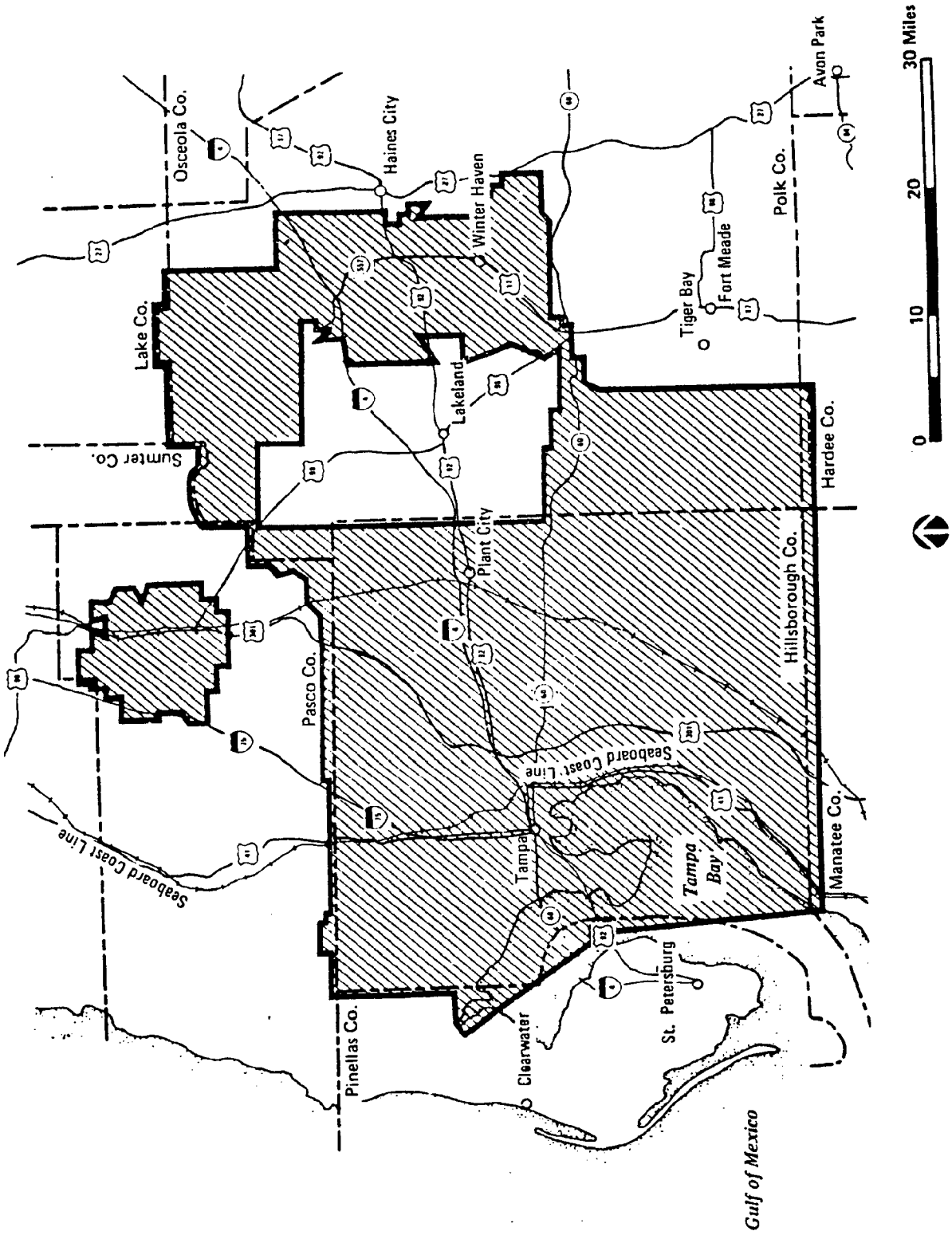
Figure 5-9
POWER PLANT FACILITIES



Source: Florida Power
Florida Power and Light
Tampa Electric Company

THE TAMPA BAY SYSTEM

FIGURE 5-10



Service Area: Tampa Electric Company

Gannon Station is 6 miles south of Tampa. The six units at this site originally burned coal. To comply with environmental requirements, the first four units were converted to No. 6 low-sulfur oil in 1975 and 1976. Units 5 and 6 burn low-sulfur coal. An additional 14-megawatt gas turbine, which burns No. 2 low-sulfur oil, is also located at Gannon Station. TECO converted the first four units back to coal, beginning in 1983.

Big Bend, located 10 miles south of Tampa, is TECO's newest power plant. The three existing units burn coal. One 14-megawatt and two 65-megawatt gas turbines, which burn No. 2 low-sulfur oil, are located just north of Big Bend Station.

During the early 1980s, TECO proposed to construct and operate a 417 MW (net) capacity coal-fired steam electric generating plant at the existing 1675 acre Big Bend complex in Hillsborough County. Because the operation of Big Bend Unit 4 would require a National Pollutant Discharge Elimination System (NPDES) permit, the project was subject to the provisions of the National Environment Policy Act (NEPA). Consequently, an Environmental Impact Statement (EIS) was prepared.

The EIS contains information and data related to the need and purpose for the Big Bend Unit, alternative sites and plant systems, affected environment and environmental consequences, and monitoring programs.

Big Bend Unit 4 began commercial service during the first quarter of 1985. The unit and supporting facilities are located on approximately 230 acres at TECO's Big Bend complex. Unit 4 was constructed directly adjacent to the existing three units and will be operational for approximately 30 years.

Cooling System Alternatives

Cooling alternatives evaluated for Unit 4 included (1) once-through cooling with conventional and fine mesh screens, (2) cooling towers, and (3) cooling ponds. Cooling water sources considered included Hillsborough Bay, saline groundwater, freshwater (groundwater and surface water), and treated municipal wastewater (15).

Cooling system evaluation was a major issue in the NEPA process. Prior to commencement of the EIS, EPA Region IV had found that operation of Units 1, 2, and 3 was entraining significantly great numbers of eggs and larvae of fish and shellfish so as to adversely effect the aquatic ecosystem of Hillsborough Bay. Subsequently, modifications to the conventional once-through systems (shutting off the dilution pumps) were instituted to reduce the entrainment impacts. These impacts were reduced by approximately 36% with no substantial and unacceptable thermal impact on the aquatic resources of Hillsborough Bay.

Use of Hillsborough Bay as a source of cooling water in conjunction with conventional screens on the once-through cooling intake struc-

ture was judged to be an unacceptable alternative for Unit 4 because the entrainment and impingement losses for Units 1-4 would be potentially adverse.

EPA's tentative determination was that once-through cooling with fine mesh screens on the Units 3 and 4 intake structures would not result in unacceptable adverse entrainment impacts from the Big Bend complex. EPA tentatively determined that thermal impacts to be associated with operation of Units 1-4 would not cause an unacceptable adverse impact.

The other major cooling system alternative considered was a cooling tower for Unit 4. With this alternative, entrainment impacts and thermal impacts would be less severe. However, salt drift associated with operation of the cooling tower could potentially cause an adverse impact on the agricultural industry adjacent to the complex. A mechanical draft cooling tower would cost $40 million more than the fine mesh screen option.(16)

Cooling ponds were not a viable alternative since the required land was unavailable at the Big Bend complex and at other sites. Use of freshwater for cooling purposes is inconsistent with the water management policies of the Southwest Florida Water Management District. Freshwater is becoming a critical resource in Florida and provisions for its distribution and utilization are structured toward more essential needs.

A potential source of cooling water considered in the analysis was treated municipal wastewater. Because the water would need to be transported in a pipeline for approximately 6 miles, it was judged to be a less viable alternative economically and potentially environmentally (cooling towers would be needed) than the once-through cooling with fine mesh screens alternative. There would be no entrainment/impingement impacts associated with this alternative.

The Selected Alternative

The two types of systems that were considered most feasible for application in the project were once-through cooling and closed-cycle cooling (cooling towers). Several different design alternatives for each type of system were examined carefully from the point of view of impacts on the site and its environs. Table 5-6 shows a comparison of the principal potential impacts of each major alternative considered.

The alternative chosen was once-through cooling with fine-mesh screens on Units 3 and 4, with no dilution. Unit 4 was equipped with a fine-mesh screen and Unit 3 was retrofitted, to reduce the entrainment and impingement losses of marine organisms. Unit 4 was constructed with a condensor independent of Units 1, 2, and 3, but is cooled by water withdrawn from Hillsborough Bay via the existing intake channel. Operation of Unit 4 will require approximately 347 million gallons of cooling water per day and will increase the total cooling-water requirements of Big Bend Station to 1388 million gallons per day.

Table 5-6 Comparison of the major environmental impacts of the principal alternatives for waste-heat rejection

Alternative	Thermal impacts	Entrainment impacts	Impingement impacts	Salt drift impacts	Fogging	Land requirements
1. Once-through cooling for Units 1-4, conventional screens, no dilution	Area of the warmest portions of the plume larger than that of any other alternative	Large numbers of organisms entrained (approximately 33% more than present entrainment with Units 1-3)	Impingement rates about 33% higher than present levels with Units 1-3	None	Occasional fogging of water areas into which discharge plume flows; some increase in area over existing situation with Units 1-3	Considered as base condition for this analytical table
2. Same as Alternative 1, but with dilution	Overall plume larger than that of any other alternative, but area of warmest temperatures smaller than that of Alternative 1	More organisms entrained than with any other alternative because of additional organisms introduced into thermal plume by dilution	Approximately the same as Alternative 1	None	About the same as Alternative 1	Commitment of small additional area adjacent to existing dilution system for third pump
3. Once-through cooling for Units 1-4, fine-mesh screens on Units 3 and 4, no dilution	Same as Alternative 1	Numbers of organisms entrained about the same as for existing Units 1-3	Impingement rates somewhat below present levels	None	Same as Alternative 1	Commitment of some small additional area in intake canal
4. Same as Alternative 3, but with dilution	Same as Alternative 2	Entrainment rate somewhat lower than with Alternative 2	Approximately the same as Alternative 3	None	Same as Alternative 2	Commitments as for Alternatives 2 and 3 combined
5. Once-through cooling for Units 1-4, fine-mesh screens on all units, no dilution	Same as Alternative 1	Lowest entrainment rate of all once-through alternatives; rate below that of existing system on Units 1-3	Lowest impingement rate of any of the once-through alternatives	None	Same as Alternative 1	Commitments of small area intake canal beyond that needed for Alternative 3
6. Same as Alternative 5, but with dilution	Same as Alternative 2	Numbers entrained greater than for Alternative 5 because of additional organisms introduced into thermal plume by dilution flow	Approximately the same as Alternative 5	None	Same as Alternative 2	Commitments as for Alternatives 2 and 5 combined
7. Saltwater cooling towers for Unit 4	Very small increase in size of thermal plume over present situation with Units 1-3	Very small increase in numbers entrained over present situation with Units 1-3	Very small increase in numbers impinged over present situation with Units 1-3	Largest quantities of salt released into air than with any cooling-tower alternative considered	Some fogging in area of the tower; no increase in sea fogging over present situation with Units 1-3	Large commitment of additional land areas to the south of discharge canal near mangrove area
8. Brackish-water cooling towers for Unit 4	Same as Alternative 7	None	None	Somewhat smaller quantities of salt released than in Alternative 7	Same as Alternative 7	Same as Alternative 7
9. Freshwater cooling towers for Unit 4	Same as Alternative 7	None	None	Lowest quantities of salt released of any cooling-tower alternative considered	Same as Alternative 7	Same as Alternative 7

There were two types of closed-cycle heat rejection systems considered for Big Bend Unit 4. They were a natural draft wet-cooling tower and a concrete, circular mechanical draft wet-cooling tower with multiple fans. The latter was selected as the preferred closed-cycle system, primarily on the basis of economics. The capital and performance costs associated with the natural-draft closed cycle system was established to be approximately $22 million more than those of the mechanical-draft system.

In either case, a closed-cycle system for Big Bend Unit 4 would have been substantially more expensive than the chosen alternative of a once-through system. Table 5-7 provides a summary of the cost comparison between the once-through system alternative and the closed-cycle cooling system.

The alternative chosen specified constructing a 417 MW facility at the Big Bend complex. A once-through cooling system with fine mesh screens on the Units 3 and 4 intake structures would be employed, and Hillsborough Bay would serve as the source of cooling water as well as the point of discharge.

When the cost comparison between the once-through system and the closed-cycle cooling system is considered, as illustrated in Table 5-7, it is apparent that, from a purely economic perspective, the former alternative is economically preferable. The actual total costs incurred with the installation of a once-through cooling system with fine-mesh screens are in the range of $11.3 million (17). The next best alternative, e.g. construction of a cooling tower, would result in costs over five times that of a conventional once-through system, or nearly $52 million.

2. Florida Power Corporation, P.L. Bartow Plant

In November 1976, the U.S. Environmental Protection Agency (EPA) issued an NPDES permit for Florida Power Corporation's (FPC) P. L. Bartow Plant, a 494.4 MW (nameplate), three-unit electric generating station, located on Weedon Island on Tampa Bay.(18)

The conditions of the permit required FPC to submit to EPA for approval of a detailed implementation schedule to provide offstream cooling facilities in lieu of the existing once-through cooling water system and, furthermore, to implement this schedule after approval.

In December 1976, FPC requested an adjudicatory hearing regarding certain provisions of the NPDES permit. One of these was the provision requiring offstream cooling facilities.

Off-Stream Cooling Alternatives

An evaluation of the technical feasibility of four potential cooling water alternatives was performed for the Bartow Plant. The alternatives included: (1) dilution pumps, (2) auxiliary or "helper" cooling towers, (3) off-stream mechanical draft cooling tower, and (4) Ecolaire Oriented Spray Cooling System.

TABLE 5-7
COSTS OF USING ONCE-THROUGH COOLING WITH FINE-MESH SCREENS
AND A MECHANICAL-DRAFT COOLING TOWER AT BIG BEND STATION
(Thousands of Dollars, 1985)

Costs	Once-through Cooling With Fine-mesh Screens		Cooling Tower
	*Units 3 & 4	Units 1 & 2	
Capital	$ 8,690	$ 6,460	$ 31,373
Revenue Requirements			
Operating Cost Penalties	520	520	19,256
Operation and Maintenance	1,005	1,005	1,173
TOTAL	$ 10,215	$ 7,985	$ 51,802

Source: U.S. EPA Final Environmental Impact Statement. Tampa Electric Company Big Bend Unit 4, January 1982
* Chosen Alternative

1. Dilution Pumps

This alternative considered the use of dilution water flow to decrease the discharge water temperature during peak unit loads in the summer months. Two half-capacity dilution pumps would be installed in the in-take water structure to pump cold water into the discharge canal, thereby reducing the discharge temperature of the water entering Tampa Bay.

The capital costs included an amount for canal preparation which would include some excavating of the existing discharge canal, to allow proper flow of the dilution water into the discharge canal. The operating costs were based on operating only during the summer months, as needed, to provide supplemental cooling during peak load and peak ambient conditions. Maintenance costs were included.

In 1979 dollars, the total capital investment for the dilution pumps was $9,840,000, the total annual operating cost was $70,800, and the total annual cost $1,578,000.

2. "Helper" Cooling Towers

Another supplemental cooling arrangement was to utilize a "helper" cooling tower to decrease the discharge temperature during peak load and peak ambient conditions. The "helper" cooling tower was to be operated during the summer to limit the discharge temperature to a predetermined value.

The "helper" cooling tower is sized so that a 95°F discharge temperature would be maintained based on a 92°F inlet water temperature, a 79°F wet bulb temperature, and all three units at full load. One round mechanical draft tower with 12 fans was considered in this alternative. From a cooling water system design viewpoint, the location along the existing discharge canal was relatively ideal; however, it was abnormally close to four (4) existing combustion turbine peaking units.

The operating costs were based on operating the cooling tower during the summer months only, as needed, to decrease the discharge water temperature.

In 1979 dollars, the total capital investment for the "helper" cooling tower was $17,963,000, the total annual operating cost was $441,000, and the total annual cost $3,195,000.

3. Off-stream Mechanical Draft Cooling Towers

Several significant plant site construction modifications would have been required if offstream mechanical draft cooling towers were to be installed. The major changes would have included: (1) the excavation and modification of the existing circulating water piping, (2) the relocation of the circulating water pumps, (3) the excavation, placement, and backfill of new circulating water piping to the cooling towers, and (4) the excavation and construction of the cooling towers and foundation.

The most advantageous arrangement for offstream cooling towers was two round, mechanical draft towers, one for Units 1 and 2, and one for Unit 3.

The cooling towers would be the counterflow fill type so that they could be partitioned into sections. One tower would service Units 1 and 2 and the other tower would service Unit 3 only. The tower that services Units 1 and 2 would be partitioned into two sections and sized to handle the heat load and water flow from each unit. A section could be isolated, as required, if Unit 1 was operating but Unit 2 was not. Separate cooling tower booster pumps, piping, and distribution systems would be designed for each section of that tower.

In 1979 dollars, the total capital investment for the offstream cooling towers was $39,188,000, the total annual operating cost was $3,044,000 and the total annual cost $9,052,000.

4. Oriented Spray Cooling System

The use of an Ecolaire Oriented Spray Cooling System (OSCS) was also evaluated. The OSCS functions like a cooling tower -- but without a stack, roof, or walls. The system produces its own airflow through a circular arrangement of patented spray trees. Each spray tree consists of a vertical riser pipe with a series of horizontal branch pipes and spray nozzles. The momentum and heat transfer between the sprayed water drops and the surrounding air draws cool air from around the periphery through the fill section to cool the water. The air then exits up from the center of the system as a warm plume. The ability of the system to induce airflow through the spray fill area permits consistent performance regardless of ambient wind conditions.

Based upon the design parameters, Ecolaire proposed a system consisting of four octagonal modules, each 420 feet in diameter. A 420-foot spacing would also have been required between each of the modules. Therefore, the minimum dimensions of the OSCS basin which would be capable of cooling the water for the three units would be 420 by 2,940 feet. Since the area for a system of that size was not available at the Bartow Plant, the OSCS was not considered further.

Conclusion

The adjudicatory hearing requested by FPC, regarding the provision requiring offstream cooling facilities, was never held, largely because of the lack of local opposition to the existing system of once-through cooling. However, the study, as presented, indicated that modification of the existing once-through cooling water system at the Bartow Plant was (is) technically feasible. Table 5-8 illustrates the capital costs associated with three of the four potential cooling water alternatives. The Oriented Spray Cooling System was the only alternative for which capital costs were not provided.

TABLE 5-8
OFFSTREAM COOLING FACILITIES OPTIONS

Option	Capital Cost 1979 Dollars	Capital Cost 1984 Dollars[1]
Dilution Pumps	9,840,000	12,497,000
"Helper" Cooling Towers	17,963,000	22,813,000
Offstream Mechanical Draft Cooling Towers	39,188,000	49,768,000

Source: Florida Power Corporation "Cooling Water Report for the Paul L. Bartow Plant," Environmental and Licensing Affairs, December 1980

[1]U.S. Department of Commerce, Composite (Construction) Cost Index, 1985. Adjustment for Inflation (+27%)

The Bartow Plant is approximately 30 years old, with Units 1, 2, and 3 having commenced commercial operation in 1958, 1961, and 1963, respectively. As new generating units are placed into the service in the FPC system, the use of the Bartow Plant will decrease accordingly.

In view of the age of the Bartow Plant, the expected decrease in use, and costs involved (as illustrated in Table 5-8), FPC did not consider it appropriate to make any modifications to the existing once-through cooling water system. The capital costs associated with the next best available alternatives range from $12.5 million to nearly $50 million (in 1984 dollars). The location of the Bartow Plant on Tampa Bay and the ability to utilize the once-through cooling system results in a cost savings of many millions of dollars.

Transportation Savings

The location of the Bartow, Bayboro and Higgins power plants on Tampa Bay also results in a transportation cost savings for the Florida Power Corporation (FPC). The Bartow facility serves as a "port of entry" for ocean-going vessels, which transport residual and distillate oil, the principle source of fuel for the three facilities. The oil is brought into the Bartow facility and then dispersed to the Higgins and Bayboro plants, by barge, resulting in a transportation cost savings when compared to the next best available alternative of transporting by truck. In addition to these facilities, the FPC Anclote River Power Plant, located on the Anclote River in southwestern Pasco County, also receives residual oil from the Bartow Plant, via a pipeline. Due to the Anclote Plant's location, in an environmentally sensitive area, no channel dredging or excavation has been permitted, thus eliminating the use of a barge or similar vessel to bring in the oil. Again, truck transportation would be the next best available alternative.

Table 5-9 illustrates the cost savings associated with transporting oil by barge, truck and pipeline. The Suwannee River facility is a land-locked power plant located in northern Florida, near Lake City. The residual and distillate oil, both used at the facility, are brought in by truck from the Port of Jacksonville.

The water-borne transportation cost of barging oil into the Bartow plant is considered to be zero, in that such cost is included in the original purchase price of the oil. The costs associated with barging oil to the Higgins and Bayboro facilities, in 1985, range from $.42 per barrel to $.45 per barrel, respectively. The cost associated with moving oil from the Bartow Facility to the Anclote Plant, in 1985, is $.41 per barrel. The cost associated with the truck transportation of residual and distillate oil to the Suwanee River Facility, in 1985, was $1.22 and $1.08, respectively. The transportation cost projections for 1986 are similar.

TABLE 5-9
FLORIDA POWER TRANSPORTATION COSTS (Projected)
RESIDUAL AND DISTILLATE OIL

Fuel	Facility	1985 (June-December) Transportation $/barrel	1986 (January-March) Transportation $/barrel
Residual	Bartow	0.00	0.00
Residual	Higgins	.42 (A)	.44 (A)
Residual	Suwannee River	1.22 (B)	1.29 (B)
Distillate	Bayboro	.45 (A)	.48 (A)
Distillate	Suwannee River	1.08 (B)	1.14 (B)
Residual	Anclote	.41 (C)	.43 (C)

Notes: Bartow is the site of origination
(A) Fuel transported by barge
(B) Fuel transported by truck
(C) Fuel transported by pipeline

Source: Florida Power Corporation

In 1984, FPC barged approximately 4.6 million barrels of oil to the Bartow Plant, for consumption at the Bartow Facility, and distribution to the Higgins Plant (by smaller barges) and the Anclote Plant (via the pipeline). Without the Bartow Plant's location on Tampa Bay, that amount of fuel would have to be transported by other means. The next best available alternatives are rail and truck transportation. Because rail facilities are not present at any of these facilities, the next best alternative for transportation would be by truck. Using a truck delivery cost of $1.15 per barrel, as an estimate, the terminal facility at the Bartow Plant resulted in a transportation cost savings of $5.3 million in 1984. (19)

D. FOOTNOTES

1. Florida Department of Environmental Regulation, 1984, "Tampa Bay 205(j) Water Quality Impact Study."

2. Ibid.

3. Tampa Bay Regional Planning Council, 1983. "Tampa Bay Management Study". TBRPC, St. Petersburg, FL.

4. Ibid.

5. Tampa Bay Regional Planning Council, 1985. The Future of Tampa Bay. TBRPC, St. Petersburg, FL.

6. Smith and Gillespie, et. al., 1980. Central Hillsborough County - Tampa, 201 Facility Plan.

7. U.S. Environmental Protection Agency, 1983. Record of Decision of the Final Environmental Impact Statement for Proposed Wastewater Facilities for Central Hillsborough - Tampa.

8. Morriss, J. P. Personal Communication. City of Tampa, Sanitary Sewer Department, Tampa, FL, December 11, 1985.

9. Hillsborough County Wastewater Master Plan, November 1985.

10. U.S. Environmental Protection Agency, July 1979, Hillsborough County, Florida. Northwest Area 201 Facilities Plan.

11. U.S. Department of Commerce, Composite (Construction) Cost Index, 1985. Adjustment for Inflation (+27%).

12. Ibid. Hillsborough County Wastewater Master Plan, Table 4-3.

13. This discussion of Pinellas County wastewater facilities is condensed from the following document: U.S. Environmental Protection Agency, 1985. Final Environmental Impact Statement. North Pinellas County, Florida. Wastewater Facilities.

14. Greer, Glenn, Personal Communication. City of St. Petersburg Public Utilities Department, January 20, 1986.

15. U.S. Environmental Protection Agency, 1982. Final Environmental Impact Statement. Tampa Electric Company. Big Bend Unit 4.

16. Ibid.

17. Autry, A.S. Personal Communication. Tampa Electric Company, Department of Environmental Affairs, Tampa, FL, December 9, 1985.

18. Florida Power Corporation, 1980. Cooling Water Report for the Paul L. Bartow Plant.

19. Wieland, K.H. Personal Communication. Florida Power Corporation, St. Petersburg, FL, December 19, 1985.

CHAPTER 6
BENEFITS OF TAMPA BAY TO COMMERCIAL FISHING

A. INTRODUCTION

The commercial fishing industry is an important source of income and employment along Florida's extensive coastline, including Tampa Bay. Tampa Bay serves as a nursery and habitat area for many commercially valuable species of fish (finfish) and shellfish. The economic base model, presented in Chapter 3, identifies commercial fishing (SIC 091) as a basic export or growth sector for the Tampa Bay region. A six-year trend, 1979 to 1984, will be analyzed in this chapter.

Population Growth

As referred to earlier in this study, all four counties within the Tampa Bay region have experienced explosive population growth in the past two decades (see Table 2-1).

Population growth and accompanying residential and recreational development have put heavy pressure on waterfront property used by the fishing and seafood industry. Docking space has been converted from commercial to recreational use as the number of pleasure boats has increased in the region.

Boat Registrations

The number of commercial boats registered in Hillsborough, Manatee, Pasco and Pinellas Counties has increased somewhat over the past six years, however, the figures remain far below the number of commercial vessels registered in the mid-to-late 1960s. The number of commercial boats reached a high of 4,339 in 1965-66, then generally declined (Table 6-1). Pinellas County currently has the largest number of commercial boats registered with 1,456 while Pasco County has the fewest with 289 (Table 6-2). Commercial boat registration data for 1981-82 was not available.

B. FLORIDA WEST COAST VOLUME AND VALUE OF COMMERCIAL LANDINGS

The west coast of Florida represents a region that provides a major percentage of the state's total production of finfish and shellfish. Counties included in the west coast are Escambia, Santa Rosa, Okaloosa, Walton, Holmes, Washington, Bay, Jackson, Calhoun, Gulf, Gadsden, Liberty, Franklin, Leon, Wakulla, Taylor, Dixie, Levy, Citrus, Hernando, Pasco, Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, Lee, Collier, Jefferson, and Monroe.

TABLE 6-1
COMMERCIAL BOATS REGISTERED ANNUALLY
TAMPA BAY REGION

Year	Commercial Boats Registered
1979-80	2,974
1980-81	2,444
1981-82	N/A
1982-83	2,945
1983-84	3,030
1984-85	3,260

Source: Florida Department of Natural Resources, Bureau of License and Motorboat Registration.

TABLE 6-2
COMMERCIAL BOATS REGISTERED
BY COUNTY

Year	Commercial Boats Registered			
	Hillsborough	Manatee	Pasco	Pinellas
1979-80	791	388	299	1,496
1980-81	575	331	254	1,284
1981-82	N/A	N/A	N/A	N/A
1982-83	714	474	272	1,485
1983-84	718	534	301	1,477
1984-85	942	573	289	1,456

Source: Florida Department of Natural Resurces, Bureau of License and Motorboat Registration

Landings in the 30-county area averaged approximately 117 million pounds for the six-year period, 1979-1984. Landings have ranged from a minimum of 108 million pounds in 1979, to a maximum of slightly more than 139 million pounds in 1981. (Table 6-3) west coast landings have shown an increase of approximately five percent over the last six years.

Finfish landings for the six-year period averaged 64 million pounds or 55 percent of the total landed. Shellfish landings averaged 53 million pounds or 45 percent of the total.

Total value of landings on the west coast has averaged approximately $106 million. Total value has ranged from approximately $86 million in 1980, to $119 million in 1981. (Table 6-3) Value of shellfish landings for the six-year period, averaged $72 million, or 70 percent of the total value. Value of finfish landings averaged $34 million or 30 percent of the total.

C. TAMPA BAY REGION VOLUME AND VALUE OF COMMERCIAL LANDINGS

Landings in the four-county area have averaged approximately 26 million pounds for the six-year period 1979-1984. (For reporting purposes, landings for Pasco County are combined with Citrus County.) Landings have ranged from a minimum of approximately 23 million pounds in 1979, to a maximum of slightly more than 29 million pounds in 1982. (Table 6-4)

Finfish landings for the six-year period averaged 19 million pounds, or 72 percent of the total landed. Shellfish landings averaged 7 million pounds or 28 percent of the total.

Total value of landings in the Tampa Bay region averaged approximately $20 million. Total value has ranged from $13 million in 1979, to $25 million in 1983. (Table 6-4)

Value of finfish landings for the six-year period averaged $10 million, or 51 percent of the total value. Value of shellfish landings averaged slightly less than $10 million or 49 percent of the total.

Landings in the Tampa Bay region averaged approximately 23 percent of the total Florida West Coast landings over the six-year period. Finfish landings averaged 30 percent, while shellfish landings averaged approximately 14 percent of the Florida West Coast landings.

Total value of landings in the Tampa Bay region averaged approximately 19 percent of the total value of landings for the Florida west coast, over the six-year period. Value of finfish landings averaged approximately 30 percent, while value of shellfish landings averaged approximately 13 percent of the Florida west coast value of landings.

Based on the average for the six-year period, 1979-1984, Pinellas County landed the largest percentage (36) of the four counties in the Tampa Bay region. Manatee, Citrus-Pasco, and Hillsborough Counties landed 27, 21 and 16 percent, respectively.

TABLE 6-3
FLORIDA WEST COAST LANDINGS AND VALUE
OF FINFISH AND SHELLFISH, 1979-1984
(In million pounds and million dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	53.2	55.3	108.5	$ 20.8	$ 70.0	$ 90.8
1980	62.5	51.9	114.4	27.2	58.6	85.8
1981	75.4	63.7	139.1	38.1	80.9	119.0
1982	70.4	46.1	116.5	40.4	73.4	113.8
1983	61.9	47.3	109.2	37.2	75.7	112.9
1984	60.0	54.0	114.0	37.4	74.3	111.7

Source: U.S. National Marine Fisheries Service

TABLE 6-4
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN THE TAMPA BAY REGION
(Citrus-Pasco, Hillsborough, Manatee, Pinellas Counties)
1979-1984
(In million pounds and million dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	17.4	5.3	22.7	$ 6.7	$ 6.7	$ 13.4
1980	17.1	6.2	23.3	8.1	7.1	15.2
1981	21.1	7.4	28.5	10.7	8.7	19.4
1982	21.9	7.5	29.4	11.9	10.9	22.7
1983	18.3	10.0	28.3	11.2	13.9	25.1
1984	19.7	8.0	27.7	12.0	11.0	23.0

Source: U.S. National Marine Fisheries Service

The largest percentage of finfish landings for the six-year period was by Manatee County (36), while Pinellas, Hillsborough and Citrus-Pasco Counties averaged 35, 16 and 12 percent, respectively.

The largest percentage of shellfish landings was by Citrus-Pasco Counties (42), while Pinellas, Hillsborough and Manatee Counties averaged 37, 19 and 2 percent, respectively, for the six-year period.

Pinellas County was also responsible for the largest percentage in value of landings for the region. The value of Pinellas County landings averaged 53 percent of the regional total, while Hillsborough, Citrus-Pasco, and Manatee Counties averaged 17, 16, and 14 percent, respectively.

Citrus-Pasco Counties

Citrus-Pasco Counties landings for the six-year period, 1979 - 1984, averaged 56 percent shellfish and 44 percent finfish, or 3.1 million pounds and 2.4 million pounds, respectively, for a total average of 5.5 million pounds. In 1984, the counties landed 66 percent shellfish and 34 percent finfish, or 3.7 million pounds and 1.9 million pounds, respectively, for a total of 5.6 million pounds.

Total value of landings in Citrus-Pasco for the six-year period, averaged $3.1 million, with $2.3 million in shellfish and $800 thousand in finfish, or 75 percent and 25 percent, respectively. In 1984, the value of landings totaled $3.4 million, with $2.8 million in shellfish and $600 thousand in finfish, or 81 percent and 19 percent, respectively. (Table 6-5)

Hillsborough County

Hillsborough County landings for the six-year period, 1979 - 1984, averaged 68 percent finfish and 32 percent shellfish, or 3.0 million pounds and 1.4 million pounds, respectively, for a total average of 4.4 million pounds. In 1984, the county landed 71 percent finfish and 29 percent shellfish, or 2.9 million pounds and 1.2 million pounds, respectively, for a total of 4.1 million pounds. (Table 6-6)

Total value of landings in Hillsborough County for the six-year period, averaged $3.3 million, with $2.2 million in shellfish and $1.1 million in finfish, or 68 percent and 32 percent, respectively. In 1984, the value of landings totaled $3.0 million, with $2.4 million in shellfish and $600 thousand in finfish, or 79 percent and 21 percent, respectively. (Table 6-6)

Manatee County

Manatee County landings for the six-year period, 1979 - 1984, averaged 98 percent finfish and 2 percent shellfish, or 7.0 million pounds and 100 thousand pounds, respectively, for a total average of 7.1 million pounds. In 1984, the county landed 98 percent finfish and 2 percent shellfish, or 8.3 million pounds and 200 thousand pounds, respectively, for a total of 8.5 million pounds. (Table 6-7)

TABLE 6-5
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN CITRUS-PASCO COUNTIES
1979-1984
(In thousand pounds and thousand dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	2,797	2,225	5,022	$ 732	$ 1,292	$ 2,024
1980	2,202	2,515	4,717	744	1,633	2,378
1981	2,654	2,706	5,360	987	1,971	2,959
1982	2,890	3,038	5,928	978	2,470	3,449
1983	2,189	4,529	6,718	708	4,017	4,724
1984	1,922	3,740	5,662	664	2,831	3,495

Source: U.S. National Marine Fisheries Service

TABLE 6-6
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN HILLSBOROUGH COUNTY
1979-1984
(In thousand pounds and thousand dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	2,684	1,189	3,873	$ 917	$ 1,856	$ 2,773
1980	3,307	1,382	4,689	1,447	1,826	3,273
1981	2,476	1,076	3,552	1,071	1,498	2,569
1982	4,642	1,796	6,438	1,566	2,798	4,364
1983	2,130	1,815	3,945	841	3,264	4,105
1984	2,958	1,185	4,143	647	2,449	3,096

Source: U.S. National Marine Fisheries Service

TABLE 6-7
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN MANATEE COUNTY
1979-1984
(In thousand pounds and thousand dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	5,962	91	6,053	$ 1,698	$ 225	$ 1,924
1980	4,462	127	4,589	1,440	225	1,665
1981	8,719	169	8,888	3,025	318	3,343
1982	6,862	168	7,030	2,518	368	2,886
1983	7,453	198	7,651	3,054	457	3,511
1984	8,375	182	8,557	2,978	396	3,374

Source: U.S. National Marine Fisheries Service

Total value of landings in Manatee County for the six-year period, averaged $2.7 million, with $2.4 million in finfish and $400 thousand in shellfish, or 73 percent and 27 percent, respectively. In 1984, the value of landings totaled $3.3 million, with $2.9 million in finfish and $400 thousand in shellfish, or 88 percent and 12 percent, respectively. (Table 6-7)

Pinellas County

Pinellas County landings for the six-year period, 1979 - 1984, averaged 71 percent finfish and 29 percent shellfish, or 6.8 million pounds and 2.7 million pounds, respectively, for a total average of 9.5 million pounds. In 1984, the county landed 69 percent finfish and 31 percent shellfish, or 6.5 million pounds and 2.9 million pounds, respectively, for a total of 9.4 million pounds. (Table 6-8)

Total value of landings in Pinellas County for the six-year period, averaged $10.4 million, with $5.7 million in finfish and $4.7 million in shellfish, or 55 percent and 45 percent, respectively. In 1984, the value of landings totaled $13 million, with $7.7 million in finfish and $5.3 million in shellfish, or 59 percent and 41 percent, respectively. (Table 6-8)

D. SPECIES LANDINGS AND VALUES IN THE TAMPA BAY REGION, 1979-1984

Finfish

Major species of finfish commonly caught in Tampa Bay waters include drum, flounder, mullet, sea trout, and sheepshead. (Table 6-9)

Drum landings for the six-year period averaged 179 thousand pounds, with an average value of $60 thousand. Landings of drum fluctuated from a low of 81 thousand pounds in 1980, to a high of 256 thousand pounds in 1984. Value of drum fluctuated from a low of $36 thousand in 1980, to a high of $111 thousand in 1981.

Flounder landings for the six-year period averaged 24 thousand pounds, with an average value of $12 thousand. Landings of flounder fluctuated from a high of slightly less than 40 thousand pounds in 1983, to a low of slightly less than 14 thousand pounds in 1984.

Mullet landings for the six-year period averaged approximately seven million pounds, with an average value of $1.5 million. Landings of mullet fluctuated from a high of 8.5 million pounds in 1981, to a low of approximately four million pounds in 1984. Value of mullet fluctuated from a high of slightly less than two million dollars in 1981, to a low of approximately one million dollars in 1984.

Sea trout landings for the six-year period averaged 186 thousand pounds, with an average value of $125 thousand. Landings of sea trout fluctuated from a high of 280 thousand pounds in 1979, to a low of 93 thousand pounds in 1983. Value of sea trout fluctuated from a high of approximately $154 thousand in 1979, to a low of $70 thousand in 1983.

TABLE 6-8
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN PINELLAS COUNTY
1979-1984
(In thousand pounds and thousand dollars)

	POUNDS			DOLLARS		
Year	Finfish	Shellfish	Total	Finfish	Shellfish	Total
1979	5,933	1,829	7,762	$ 3,366	$ 3,336	$ 6,702
1980	7,101	2,207	9,308	4,498	3,415	7,913
1981	7,255	3,441	10,696	5,597	4,947	10,544
1982	7,481	2,499	9,980	6,784	5,226	12,010
1983	6,530	3,439	9,969	6,605	6,121	12,726
1984	6,466	2,949	9,415	7,706	5,323	13,029

Source: U.S. National Marine Fisheries Service

TABLE 6-9
SPECIES LANDINGS & VALUES (FINFISH)
IN THE TAMPA BAY REGION, 1979-1984
(HILLSBOROUGH, MANATEE & PINELLAS COUNTIES)

	Drum (Black & Red)		Flounder		Mullet (Black & Silver)		Sea Trout (Spotted, White)		Sheepshead	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
1979	91,592	$ 37,508	26,788	$ 10,952	8,010,614	$1,477,935	280,751	$ 153,824	15,495	$ 3,353
1980	81,224	36,167	24,309	13,258	7,721,027	1,514,425	192,368	118,267	21,152	3,848
1981	264,055	111,214	20,718	11,325	8,506,019	1,977,725	218,312	147,641	34,750	7,370
1982	191,899	96,768	18,226	11,507	7,253,156	1,615,140	169,643	121,226	37,762	10,255
1983	100,030	63,104	39,882	17,141	4,026,223	1,196,145	93,272	70,542	11,883	3,622
1984	255,948	18,821	13,981	8,415	3,872,946	1,162,426	161,169	136,655	33,045	9,942

Source: U.S. National Marine Fisheries Statistics

Sheepshead landings for the six-year period averaged approximately 26 thousand pounds, with an average value of only six thousand dollars. Landings of sheepshead fluctuated from a high of approximately 38 thousand pounds in 1982, to a low of approximately 12 thousand pounds in 1983. Value of sheepshead fluctuated from a high of $10 thousand in 1982, to a low of approximately four thousand dollars in 1983.

These five major species accounted for approximately 42 percent of the finfish landed over the six-year period, and 18 percent of the value. In 1984, these species accounted for approximately 24 percent of the total finfish landed and 12 percent of the total value. Offshore species, which include snapper and grouper, account for a larger percentage of the three-county volume and value of finfish.

Shellfish

Major species of shellfish commonly caught in Tampa Bay waters include clams, blue crabs (hard), stone crabs, oysters and bait shrimp. (Table 6-10)

Hard clam landings for the six-year period averaged 141 pounds, with an average value of only $419. There were no reports of landings of hard clams in 1979, 1980 and 1984.

Blue crab (hard) landings for the six-year period averaged 185 thousand pounds, with an average value of approximately $61 thousand. Landings of blue crab fluctuated from a high of 278 thousand pounds in 1982, to a low of 143 thousand pounds in 1984. Value of blue crab fluctuated from a low of $35 thousand in 1979, to a high of approximately $89 thousand in 1982.

Stone crab landings for the six-year period averaged 50 thousand pounds, with an average value of $84 thousand. Landings of stone crab fluctuated from a low of 14 thousand pounds in 1981, to a high of approximately 100 thousand pounds in 1984. Value of stone crab fluctuated from a low of $16 thousand in 1981, to a high of $213 thousand in 1984.

Oyster landings for the six-year period averaged six thousand pounds, with an average value of approximately seven thousand dollars. Landings of oysters fluctuated from a high of 14 thousand pounds in 1981, to a low of 132 pounds in 1982. There were no landings of oysters reported for 1979. Value of oysters fluctuated from a high of approximately $16 thousand in 1981, to a low of $167 in 1982.

Bait shrimp landings for the six-year period averaged approximately 82 thousand pounds, with a value of approximately $158 thousand. Landings of bait shrimp fluctuated from a low of 45 thousand pounds in 1981, to a high of approximately 117 thousand pounds in 1984. Value of bait shrimp fluctuated from a low of $77 thousand in 1980, to a high of $245 thousand in 1984.

TABLE 6-10
SPECIES LANDINGS & VALUES (SHELLFISH)
IN THE TAMPA BAY REGION, 1979-1984
(HILLSBOROUGH, MANATEE & PINELLAS COUNTIES)

	Clams (Hard)		Crabs (Blue, Hard)		Crabs (Stone)		Oysters		Shrimp (Bait)	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
1979	-	$ -	169,065	$ 35,506	17,392	$ 24,202	-	$ -	113,501	$ 181,813
1980	-	-	148,739	37,193	27,933	40,568	13,731	14,637	47,311	77,161
1981	225	684	222,621	62,901	14,351	15,721	14,351	15,721	45,545	85,548
1982	70	158	278,395	88,994	67,368	92,663	132	167	105,330	211,686
1983	128	416	150,482	54,480	71,786	116,238	2,939	3,479	61,540	144,446
1984	-	-	143,326	49,802	98,928	213,319	219	399	116,745	245,322

Source: U.S. National Marine Fisheries Statistics

These five major species accounted for approximately 7.5 percent of the shellfish landed in Hillsborough, Pinellas and Manatee Counties over the six-year period, and 4.2 percent of the value. In 1984, these species accounted for approximately 8.3 percent of the total shellfish landed and 6.3 percent of the total value.

Summary

A total of 22.1 million pounds of fish, valued at $19.5 million, were landed in Hillsborough, Manatee and Pinellas Counties in 1984. Pinellas County accounted for approximately 43 percent of the total landings in 1984, and 67 percent of the total value. Approximately 80 percent of the pounds landed in 1984 were finfish, while shellfish accounted for 42 percent of the total value of landings.

Fishermen

As illustrated in Table 6-11, a total number of 1,952 commercial fishermen plied their trade during 1984, in Hillsborough, Manatee and Pinellas Counties. This represented ten percent of all fishermen in Florida.

Processing

As illustrated in Table 6-12, the Tampa Bay region had a total of 46 seafood processing and wholesaling plants in 1984, with an average monthly employment of 200 persons. Data for Manatee County was not available.

TABLE 6-11
SALTWATER PRODUCTS LICENSES ISSUED
1984

County	No. of Licenses Issued
Hillsborough	519
Manatee	328
Pinellas	1,105
Total	1,952
Florida	19,275

Source: Florida Department of Natural Resources, November 1985

TABLE 6-12
TAMPA BAY REGION
SEAFOOD PROCESSING AND WHOLESALING PLANTS
1984

County	No. of Establishments	Average Monthly Employment
Hillsborough	30	133
Pinellas	10	43
Pasco	6	24
Manatee	N/A	N/A
Total	46	200

Source: Florida Department of Labor and Employment Security

CHAPTER 7
BENEFITS OF TAMPA BAY TO WATERFRONT PROPERTY OWNERS

A. INTRODUCTION

The various uses and attributes of Tampa Bay are a source of many benefits to local residents and tourists alike. In this chapter, an attempt will be made through the use of a survey, to document the value of an aesthetic attribute (water view) and benefits that are provided by Tampa Bay, to owners of private, single-family residential waterfront homes.

In general terms, it is the presence of the bay that enhances the value and desirability of the homes and neighborhoods located on the bay. The benefits (services) accruing to waterfront property owners that will be considered, are as follows: aesthetic value of the waterfront vista or view; swimmability of the water close to the home; fishability of the water close to the home; navigability of the water close to the home; and suitability of the water close to the home for various water sports and activities.

Like any freely accessible body of water, the Tampa Bay estuary is considered a public good. Individuals cannot be excluded from enjoying its services because it is difficult or impossible to collect fees for the benefits it provides. Thus, the services of the estuary, such as navigability and fishability, cannot be purchased in the market place. They are complementary to access to the estuary. There are private and public accesses to the estuary. In this chapter, the complementarity of access by private waterfront homes is the basis for the estimates of these services.

B. METHODOLOGY

It has been determined that a number of studies exist on property values which attempt to incorporate valuation of beneficial and detrimental neighborhood and environmental externalities. One such study uses, as its base, a model of determination of residential property values, developed for Pinellas County.(1) It was decided that the methodology of this study would be applied to single-family residential, waterfront structures, located within the economic study area. Emphasis would be placed on neighborhood conditions, local public schools, water views, water quality and travel time to job locations. Based upon the previous study, the variables shown in Figure 7-1 were chosen. A questionnaire was designed to measure the aesthetic value and services, as perceived by owners of waterfront homes.

The property appraisers from Hillsborough, Manatee and Pinellas Counties were contacted in July 1985, and asked to provide information and data pertaining to 1984 sales of waterfront homes. After numerous discussions and meetings, it was determined that only Pinellas County could provide the requisite information in a timely and inexpensive manner. (The information requested is as follows: Property address; 1984 sale price; effective square footage; year built; presence of a

FIGURE 7-1

VARIABLES

price	price of property in dollars
area	effective square footage as defined by Property Appraiser's Office
age	age of home in years
pool	1 if has a pool, 0 if not
dock	1 if has a dock, 0 if not
block	1 if concrete block construction, 0 if not
canal	1 if on canal, 0 if not
ciega	1 if on Boca Ciega Bay, 0 if not
Tbay	1 if on Tampa Bay, 0 if not
mTax	1984 tax rate for the property
zone	allowed housing density per acre
parcel2	parcel number in batch2
clean1	cleanliness of neighborhood rated excellent
clean2	cleanliness of neighborhood rated good
clean3	cleanliness of neighborhood rated fair
clean4	cleanliness of neighborhood rated poor
maint1	road, street maintenance rated excellent
maint2	road, street maintenance rated good
maint3	road, street maintenance rated fair
maint4	road, street maintenance rated poor
chacond1	change in condition of houses rated excellent
chacond2	change in condition of houses rated good
chacond3	change in condition of houses rated fair
chacond4	change in condition of houses rated poor
chacond5	dont know change in condition of houses
schools1	condition of local public schools rated excellent
schools2	condition of local public schools rated good
schools3	condition of local public schools rated fair
schools4	condition of local public schools rated poor
schools5	dont know condition of schools
parcel3	parcel number in batch3
watview1	neighborhood waterview rated excellent
watview2	neighborhood waterview rated good
watview3	neighborhood waterview rated fair
watview4	neighborhood waterview rated poor
watdn	waterview not rated
swim1	neighborhood swimming conditions rated excellent
swim2	neighborhood swimming conditions rated good
swim3	neighborhood swimming conditions rated fair
swim4	neighborhood swimming conditions rated poor
swimdn	swimming conditions not rated
fish1	neighborhood fishability rated excellent
fish2	neighborhood fishability rated good
fish3	neighborhood fishability rated fair
fish4	neighborhood fishability rated poor
fishdn	fishability not rated
navigat1	neighborhood water navigability rated excellent
navigat2	neighborhood water navigability rated good
navigat3	neighborhood water navigability rated fair
navigat4	neighborhood water navigability rated poor
navigdn	navigability not rated

pool and/or dock; concrete block or other construction; and, location of water frontage. Zoning densities were obtained from the Pinellas County Department of Planning and from the respective local government. Millage rates, levied for 1984 taxes, were obtained from the office of the Pinellas County Tax Collector.)

A computer printout was received from the Pinellas County Property Appraiser in August, 1985. The printout contained information on approximately 530 waterfront homes sold in 1984. It was immediately evident that the majority of homes were located in the southern half of Pinellas County. Subsequently, a decision was made to record data and survey only those homes located in southern Pinellas. The original sample size consisted of 265 properties (50 percent of the total sold in 1984), however 17 properties had to be omitted, as there was either incomplete data or they were located outside of the original economic study area. The data base, consisting of 248 waterfront properties, included the following communities: Treasure Island; St. Petersburg Beach/Pinellas Bayway/Bayway Isles; South Pasadena; Broadwater/Maximo Point; Madeira Beach; North Redington Beach and Redington Shores; Shore Acres/Snell Isle/Venetian Isles; Gulfport; Coquina Key/Tropical Shores; and Riviera Bay/Sunlit Cove/Tanglewood/Harbor Isle (Figure 7-2).

A survey of homeowners was undertaken, of those individuals who purchased their waterfront home during 1984. The questionnaire contained ten questions pertaining to the quality of the neighborhood and local public schools, water views, water quality and the average travel time to the job location (Figure 7-3). A letter, shown in Figure 7-4, was mailed to approximately 265 addresses, identified by the Pinellas property appraiser. The letter requested the homeowners' cooperation in participating in the survey.

The interviewing began on Thursday, October 3, 1985, and was completed on Saturday, October 12, 1985. The times that the interviewing took place ranged from 1:00 p.m. until dusk on weekdays, and 11:00 a.m. until 6:00 p.m. on weekends. There was a minimum of two attempts made to contact the residents, usually on different days but in some cases, at different times on the same day. If, after a second attempt, the residents were either not at home or were not interested in participating, then a neighbor was interviewed. If the home was obviously vacant (and often times up for sale), then a neighbor was interviewed immediately. In all cases of neighbor interviews, the neighbor's home was also a waterfront home, located on the same side of the street, within two or three houses. In instances of an incorrect address or the inability to locate a home, then a neighbor was interviewed in the approximate location of the address given. In all instances the questions and choices of response were read aloud, and in no instance were residents under the age of 18 interviewed. The survey was well received, and there were few cases of uncooperative homeowners.

FIGURE 7-2

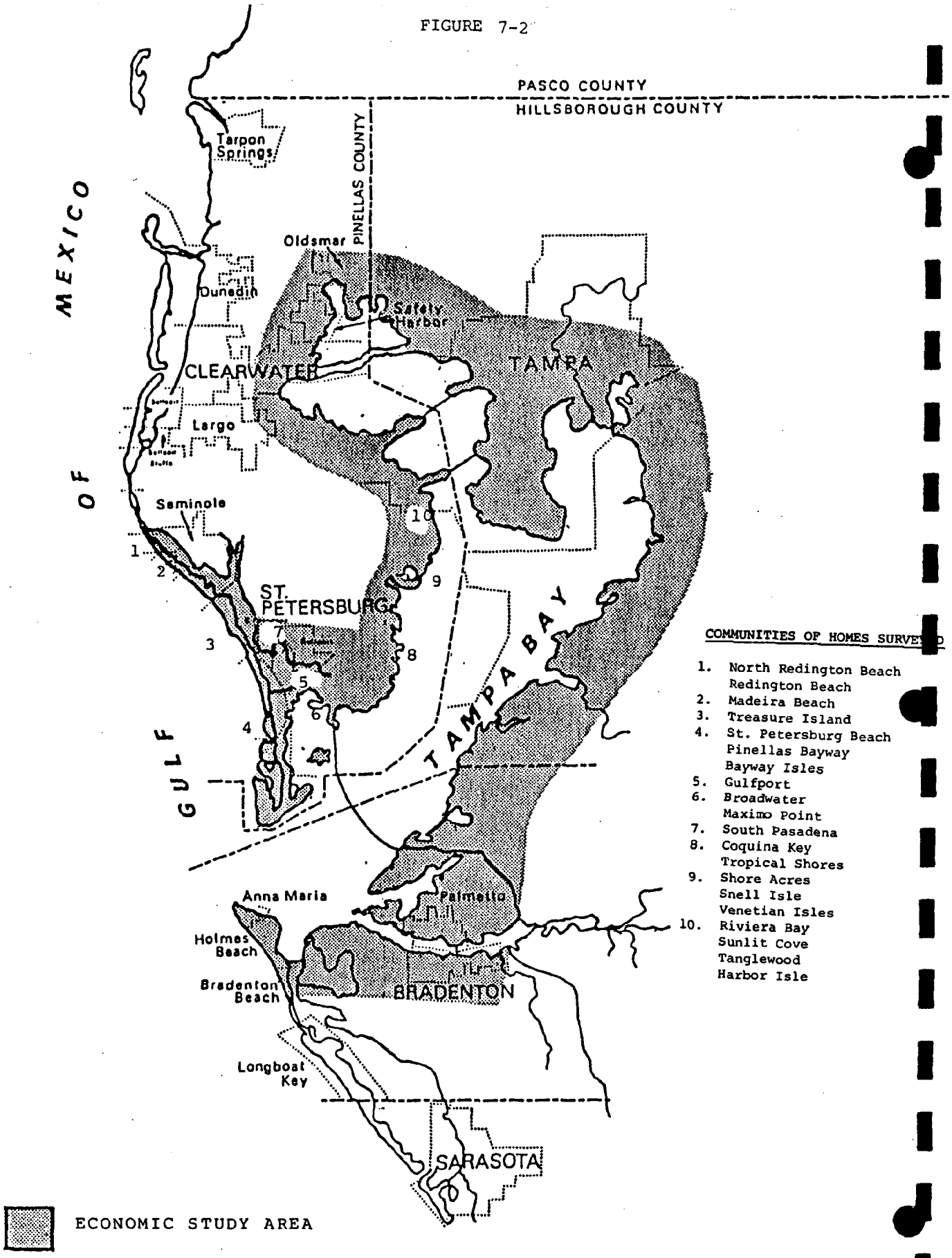

PASCO COUNTY
HILLSBOROUGH COUNTY
PINELLAS COUNTY
GULF OF MEXICO
Tarpon Springs
Oldsmar
Dunedin
Safety Harbor
CLEARWATER
TAMPA
Largo
Seminole
ST. PETERSBURG
TAMPA BAY
Anna Maria
Holmes Beach
Bradenton Beach
Palmetto
BRADENTON
Longboat Key
SARASOTA
1
2
3
4
5
6
7
8
9
10
COMMUNITIES OF HOMES SURVEYED
1. North Redington Beach
Redington Beach
2. Madeira Beach
3. Treasure Island
4. St. Petersburg Beach
Pinellas Bayway
Bayway Isles
5. Gulfport
6. Broadwater
Maximo Point
7. South Pasadena
8. Coquina Key
Tropical Shores
9. Shore Acres
Snell Isle
Venetian Isles
10. Riviera Bay
Sunlit Cove
Tanglewood
Harbor Isle
ECONOMIC STUDY AREA

FIGURE 7-3

DATE _____

PARCEL # _____

INTERVIEW ADDRESS _____

NEIGHBORHOOD/SUBDIVISION _____

	Excellent	Good	Fair	Poor	Don't Know
1. How do you rate the week-to-week cleanliness of your neighborhood's roads, streets and alleys?	1	2	3	4	5
2. How do you rate the basic structural maintenance of your neighborhood's roads, streets and alleys?	1	2	3	4	5
3. How do you rate the change in conditions of houses in your neighborhood, within the past three years?	1	2	3	4	5
4. How do you rate the quality of the local public schools?	1	2	3	4	5
5. How do you rate your water view?	1	2	3	4	5
6. How do you rate the swimmability of the water close to your home?	1	2	3	4	5
7. How do you rate the fishability of the water close to your home?	1	2	3	4	5
8. How do you rate the navigability of the water close to your home?	1	2	3	4	5
9. How do you rate the suitability of the water close to your home for other water sports?	1	2	3	4	5
10. What is the average travel time to the job location (by car) by the head of household?	_____ (minutes)				

FIGURE 7-4

tampa bay regional planning council

9455 Koger Boulevard
St. Petersburg, FL 33702-2491
(813) 577-5151 Tampa 224-9380
Suncom 586-3217

Officers

Chairman
Mr Joseph McFarland

Vice Chairman
Commissioner
Westwood H Fletcher Jr

Secretary-Treasurer
Councilman William Vannatta

Executive Director
Bruce R Belrose

Representatives

City of Bradenton
Councilwoman Saundra Rann

City of Clearwater
Commissioner James L Berfield

City of Dade City

City of Dunedin
Commissioner Donald R Shaffer

City of Gulfport
Commissioner George Prigun

Hillsborough County
Mr Alexander S Byrne
Mr Joe Chillura, Jr
Mr Joseph McFarland
Mr Robert W Saunders, Sr
Commissioner Pickens C Talley

City of Largo
Mayor George C McGough

Manatee County
Commissioner
Westwood H Fletcher Jr
Ms Patricia M Glass

City of New Port Richey
Councilman Robert G Prior

City of Oldsmar
Mayor Grace F Williams

City of Palmetto
Mayor Robert E Hunt

Pasco County
Mr Philip Mishkin
Commissioner Sylvia Young

Pinellas County
Mr Conrad Bansbach, Jr
Ms Beth Emerson
Commissioner George C Greer
Reverend Preston Leonard
Mr Michael Zagorac, Jr

City of Pinellas Park
Councilman William Vannatta

City of Safety Harbor
Mayor Alton Dettmer

City of St. Petersburg
Councilman Dean Staples

City of St. Petersburg Beach
Commissioner Bruno Falkenstein

City of Sarasota
Commissioner Kerry Kirschner

City of Tampa
Councilman Thomas Vann

City of Tarpon Springs
Commissioner Charles Roberts

City of Temple Terrace
Councilman John King

September 30, 1985

Dear Resident:

The Tampa Bay Regional Planning Council (TBRPC) is currently undertaking a study entitled Documenting the Economic Importance of the Tampa Bay Estuarine System.

The data base for this study consists of 265 residential waterfront properties in Pinellas County, sold in 1984. The properties were chosen on the basis of a random sample. This sample includes the property you occupy.

We are requesting your cooperation in participating in an interview within the next two weeks by TBRPC staff members. The interview is short and should not take more than five minutes of your time. Your willingness to answer six to nine questions about your household, neighborhood and immediate proximity to Tampa Bay would be greatly appreciated. The interview will take place some time between 4:00 p.m. and dusk.

If more information or clarification is necessary, please do not hesitate to contact Rick MacAulay of the TBRPC staff, at 577-5151.

Again, your interest and cooperation are appreciated.

Sincerely,

Bruce R. Belrose
Executive Director

BB/pb

Enclosure

C. RESULTS

A summary of the property data and information collected on the 265 waterfront properties sold in southern Pinellas County in 1984, is as follows:

- The 1984 mean sale price was approximately $130,000, and the median sale price $122,000 (Figure 7-5);
- The mean effective square footage and age of home are 2,125 square feet and 22 years respectively;
- Approximately 36 percent of the waterfront homes had a swimming pool, and 76 percent had a dock. Approximately 92 percent of the homes were of concrete block construction; and
- Approximately 53 percent of the homes were identified as being located on a canal, 36 percent on Boca Ciega Bay, and 11 percent on Tampa Bay.

The results of the 248 waterfront properties surveyed are illustrated in Figure 7-6. A summary of the results is as follows:

- Approximately 93 percent of the homeowners surveyed stated that their water view was either excellent or good;
- Approximately 68 percent of those interviewed stated that the swimmability of the water close to their home was either fair or poor, while three percent were not sure;
- Approximately 51 percent of those interviewed stated that the fishability of the water close to their home was either fair or poor, while four percent were not sure;
- Approximately 85 percent of those interviewed stated that the navigability of the water close to their home was either excellent or good;
- Approximately 58 percent of those interviewed stated that the suitability of the water close to their home for water sports was either fair or poor; and
- The mean average travel time to the job location, by car, by the head of the household was 21 minutes.

D. DISCUSSION

An attempt was made, through the use of a survey and questionnaire, to document the value of an aesthetic attribute (water view) and benefits accruing to owners of residential waterfront property along Tampa Bay and Boca Ciega Bay, in southern Pinellas County. In addition to the water vista, the benefits accrued by property owners, considered in this chapter, include swimming, fishing, and the ability to navigate and engage in water sports in water close to their home.

FIGURE 7-5

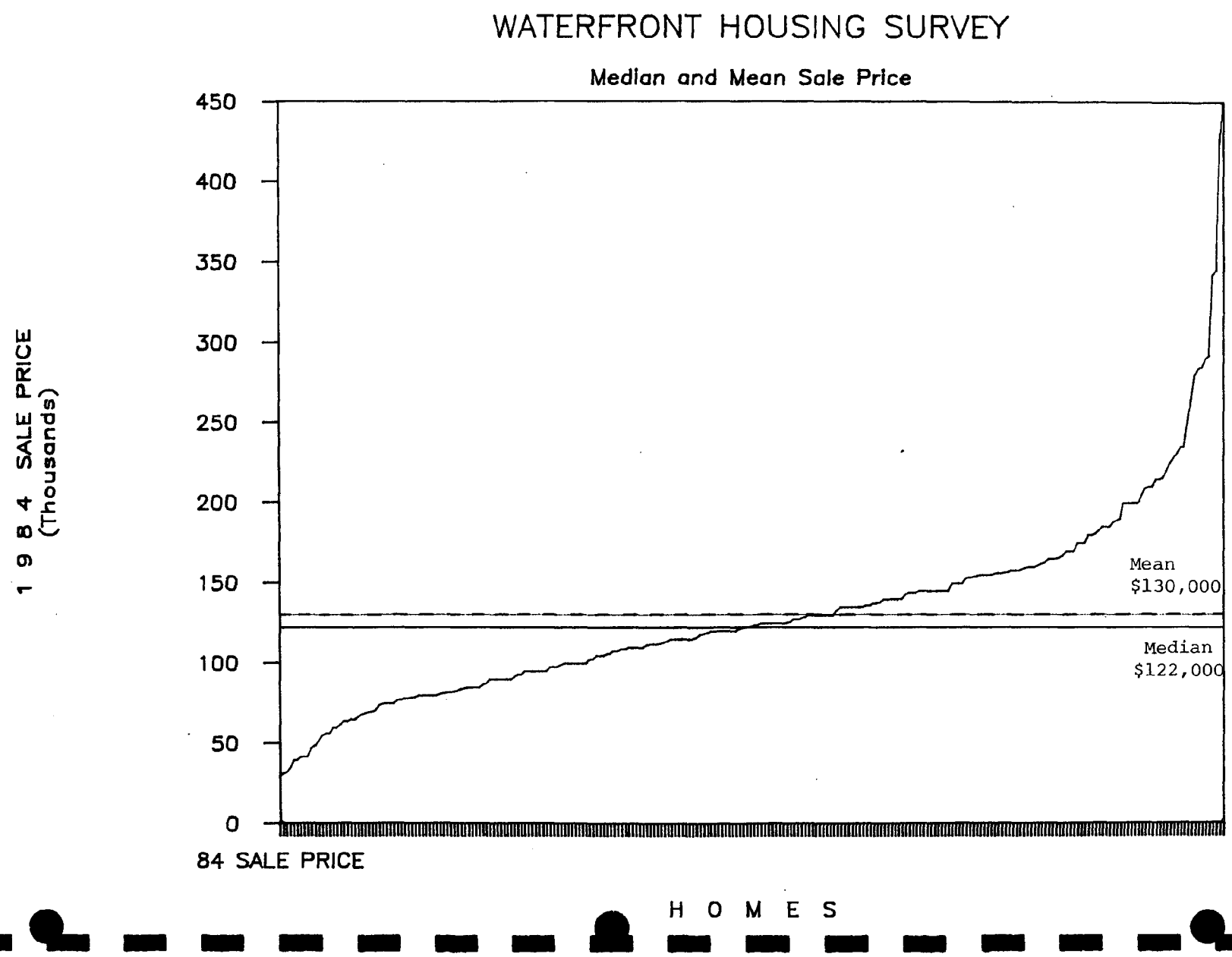
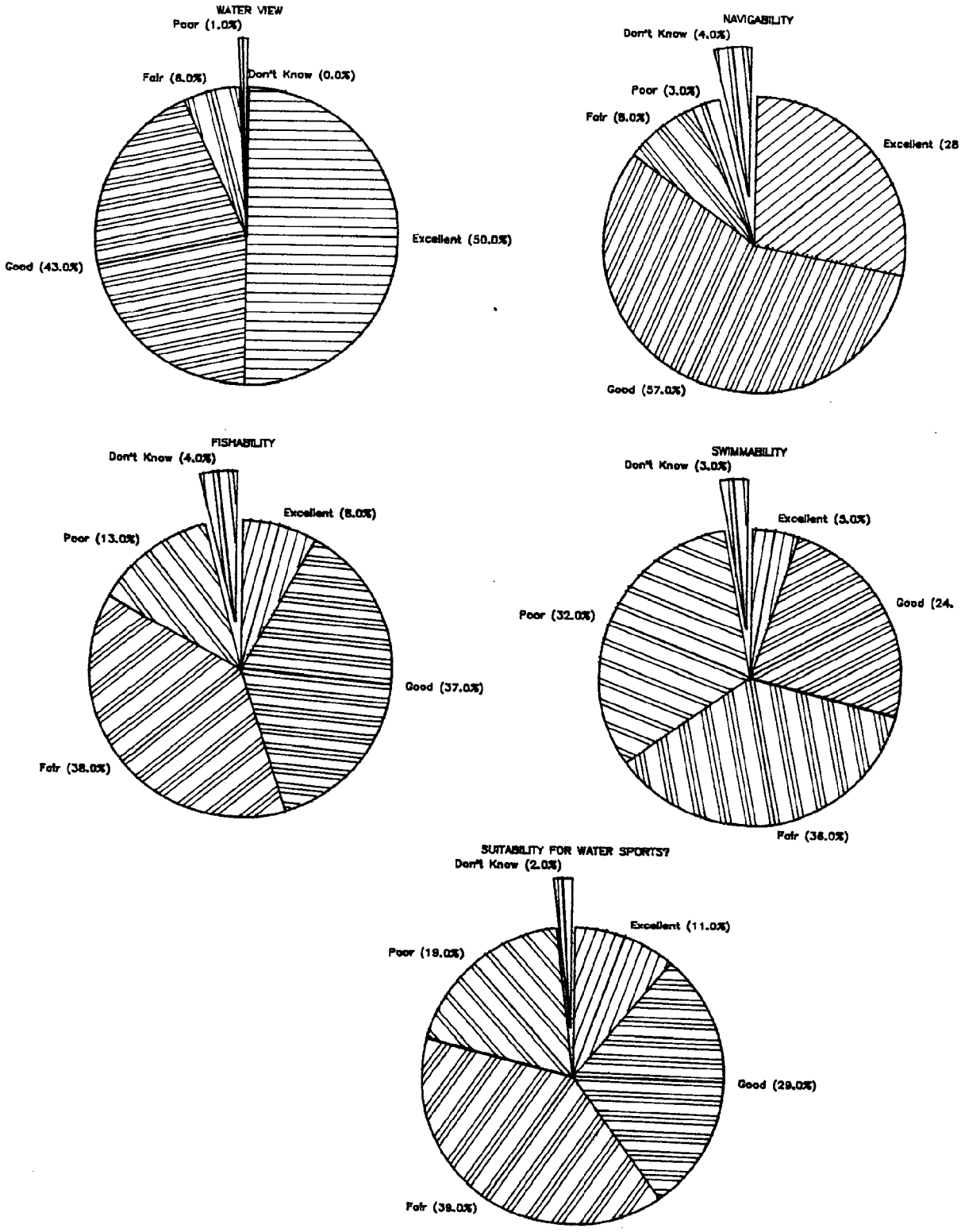

WATERFRONT HOUSING SURVEY
Median and Mean Sale Price
1 9 8 4 SALE PRICE
(Thousands)
450
400
350
300
250
200
150
100
50
0
Mean
$130,000
Median
$122,000
84 SALE PRICE
H O M E S

FIGURE 7-6

VALUE OF WATER VIEW AND BENEFITS

PROVIDED BY TAMPA BAY



Of the total respondents, 93 percent rated their water view as excellent or good, perhaps indicating the importance of the view in their consideration to purchase waterfront property. Only six percent of those homeowners surveyed rated their water view fair and one percent poor.

The next most highly rated benefit was the ability to navigate a boat in the water close to the home, followed by the benefits of being able to fish and swim in the water close to the home. It appears that the lowest rated benefit accrued by owners of waterfront property dealt with the suitability of engaging in water sports in the water close to the home. The results of this survey seem to suggest that individuals will purchase homes on the water primarily for the view, and secondarily for access.

In general terms, owners of single-family, residential waterfront homes are willing to pay considerably more, as evidenced by the survey results, which found the median 1984 sale price to be $122,000 and the mean sale price to be $130,000, whereas the average 1984 purchase price for a home in Hillsborough and Pinellas Counties was approximately $69,800.(2)

Although the analysis contained in this chapter addresses residential waterfront property surveyed in southern Pinellas County, it is likely that these same findings hold true for such property located in both Hillsborough and Manatee Counties.

E. FOOTNOTES

1. Hanni, Eila, "Effect of the Enforcement of Residential land Use Ordinances on Property Values", presented at the Annual Meeting of Western Economists Association, San Francisco, CA, June 18, 1979.

2. Board of Realtors: Tampa, St. Petersburg, Bradenton, 1984.

CHAPTER 8
BENEFITS OF TAMPA BAY TO WATER-ORIENTED RECREATIONAL ACTIVITIES

A. INTRODUCTION

The uses and attributes of Tampa Bay discussed and illustrated in previous chapters have included shipping and water-borne commerce, electric and sanitary services, commercial fishing and benefits associated with waterfront home ownership. One of the obvious uses of Tampa Bay, and one which requires further study because of a present lack of information, is that of recreation. Although recreational benefits are difficult to quantify, the following analysis will attempt to identify the potential magnitude of the recreational benefits associated with Tampa Bay.

The economic value, and thus benefits, of recreation-related uses and attributes of Tampa Bay, described in this chapter, include boating, saltwater fishing, beach activities and saltwater boat ramp use.

B. RECREATION SURVEY

On May 10, 1982, the Tampa Bay Regional Planning Council (TBRPC) established the Tampa Bay Study Committee. The Study Committee was charged with the task of identifying critical bay problems and evaluating potential solutions for those problems. (1) Initially, five subcommittees were formed to specifically address ecological, industrial, institutional, economic and recreational aspects of Tampa Bay.

The goal established by the Recreation Subcommittee was to maximize current and future recreational benefits for Tampa Bay area residents, with due concern for the environment. (2) It was decided that a recreation survey would be employed, to assess the current level and areas of recreational use on Tampa Bay. (3)

There were 95 sites selected, initially, for surveying in Pinellas, Hillsborough and Manatee Counties. The sites included restaurants, parks, beaches, piers and marinas. Due to budget and personnel constraints, only 29 sites were surveyed: 27 sites in Pinellas County and one each in Hillsborough and Manatee Counties. Figure 8-1 illustrates the sites that were surveyed in June and July, 1984.

Approximately 1,358 interviews were conducted utilizing the questionnaire shown in Figure 8-2. The surveyors attempted to interview only those adults who stated that they were Tampa Bay area residents, however, individuals who were seasonal residents were also interviewed.

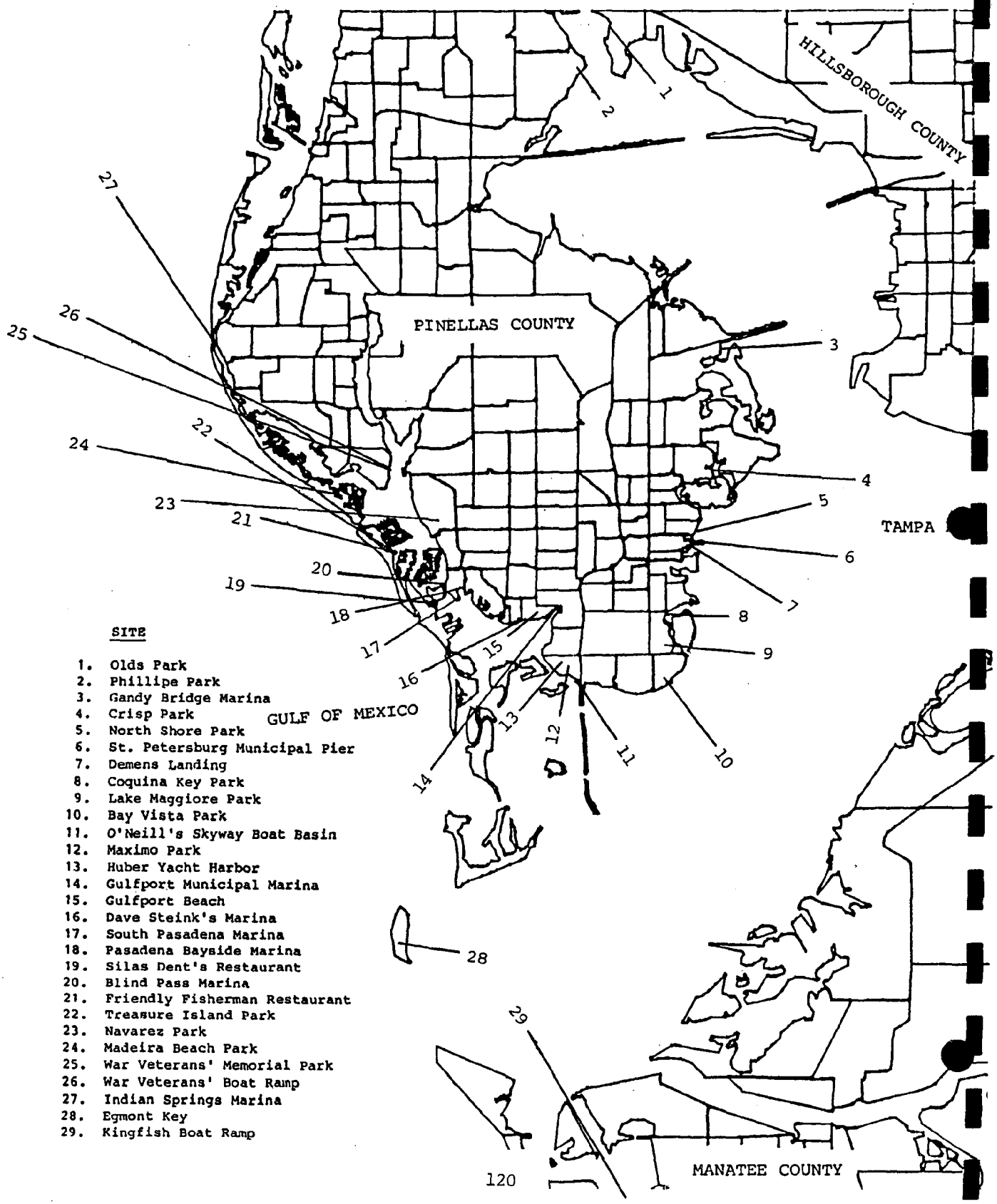
Analysis

The results of the survey are shown in Figure 8-3. The recreational activities demonstrating the highest participation rates included the following: viewing sunsets or other scenic amenities; swimming; dining

FIGURE 8-1

TAMPA BAY RECREATION STUDY

Survey Sites



SITE

1. Olds Park
2. Phillipe Park
3. Gandy Bridge Marina
4. Crisp Park
5. North Shore Park
6. St. Petersburg Municipal Pier
7. Demens Landing
8. Coquina Key Park
9. Lake Maggiore Park
10. Bay Vista Park
11. O'Neill's Skyway Boat Basin
12. Maximo Park
13. Huber Yacht Harbor
14. Gulfport Municipal Marina
15. Gulfport Beach
16. Dave Steink's Marina
17. South Pasadena Marina
18. Pasadena Bayside Marina
19. Silas Dent's Restaurant
20. Blind Pass Marina
21. Friendly Fisherman Restaurant
22. Treasure Island Park
23. Navarez Park
24. Madeira Beach Park
25. War Veterans' Memorial Park
26. War Veterans' Boat Ramp
27. Indian Springs Marina
28. Egmont Key
29. Kingfish Boat Ramp

Figure 8-2

TAMPA BAY
RECREATION SURVEY

Site_____
Activity_____
Day of week_____ Date_____
Time_____

Background Information:
Sex_____ Marital Status_____ Number in household_____

Age
_____15 and under
_____16-20
_____21-25
_____26-30
_____31-35
_____36-40
_____41-45
_____46-50
_____51-55
_____56-60
_____61-65
_____66 and older

What city do you live in?_____ Zip Code_____
How long have you lived there?_____years
Last previous residence_____(city/state) Zip Code_____

How many times per year do you engage in the following activities on or along Tampa Bay?

	Times/year		Times/year
Boating			
Motorboating	_____	Nature study	_____
Racing	_____	Picnicking	_____
Sailing	_____	Scuba diving	_____
Waterskiing	_____	Shellfishing	_____
Other (Please specify) _____	_____	Swimming	_____
		Viewing sunsets or other scenic amenities	_____
Camping	_____		
Dining at restaurants on Tampa Bay	_____	Visiting historical/ archaeological sites	
Fishing	_____	Other (specify) _____	_____
Swimming	_____		

Do you feel that the following facilities are adequate for your needs?

Boating	YES	NO	DO NOT USE
Boat ramps	_____	_____	_____
Pumpout facilities	_____	_____	_____
Gasoline facilities	_____	_____	_____
Diesel facilities	_____	_____	_____
Marina slips on a permanent basis	_____	_____	_____
Marina slips on a transient basis	_____	_____	_____
Restaurants with docking facilities	_____	_____	_____
Camping facilities	_____	_____	_____
Fishing			
Bait and tackle shops	_____	_____	_____
Piers	_____	_____	_____
Other (Please specify) _____	_____	_____	_____
Picnic areas	_____	_____	_____
Restaurants with a scenic view of Tampa Bay	_____	_____	_____
Other (Please specify) _____	_____	_____	_____

Please describe any difficulties you have had with any of the above mentioned facilities.

Figure 8-3

TAMPA BAY
RECREATION SURVEY

Site_____
Activity_____
Day of week_____ Date_____
Time_____

Background Information:
Sex_____ Marital Status_____ Number in household_____

Age
_____15 and under
_____16-20
_____21-25
_____26-30
_____31-35
_____36-40
_____41-45
_____46-50
_____51-55
_____56-60
_____61-65
_____66 and older

What city do you live in?_____ Zip Code_____
How long have you lived there?_____years
Last previous residence_____(city/state) Zip Code_____

How many times per year do you engage in the following activities on or along Tampa Bay?

Boating	Times/year		Times/year
Motorboating	34.0	Nature study	29.2
Racing	0.7	Picnicking	22.1
Sailing	9.2	Scuba diving	4.1
Waterskiing	6.1	Shellfishing	6.4
Other (Please specify)	1.9	Swimming	83.6
		Viewing sunsets or other scenic amenities	93.0
Camping	4.6	Visiting historical/ archaeological sites	6.0
Dining at restaurants on Tampa Bay	52.8	Other (specify)	19.4
Fishing	40.1		

Do you feel that the following facilities are adequate for your needs?

Boating	YES	NO	DO NOT USE
Boat ramps	72.23	27.77	
Pumpout facilities	63.72	36.28	
Gasoline facilities	80.60	19.40	
Diesel facilities	69.40	30.60	
Marina slips on a permanent basis	63.03	36.97	
Marina slips on a transient basis	60.0	40.00	
Restaurants with docking facilities	50.49	49.51	
Camping facilities	67.33	32.67	
Fishing			
Bait and tackle shops	87.07	12.93	
Piers	78.59	21.41	
Other (Please specify)			
Picnic areas	81.80	18.20	
Restaurants with a scenic view of Tampa Bay	76.65	23.35	
Other (Please specify)			

Please describe any difficulties you have had with any of the above mentioned facilities.

at restaurants on Tampa Bay; fishing; and motorboating. In all instances the identified recreation facilities were perceived to be adequate for the needs of the respondents.

The Tampa Bay Recreation Survey was successful in identifying the nature of recreational activities engaged in, and the frequency, of use.

C. RECREATIONAL BOATING

As illustrated in Table 8-1, the number of recreational (pleasure) boats registered in Pinellas, Hillsborough and Manatee Counties has shown a significant increase between 1979 and 1985 (20 percent, 18 percent and 15 percent respectively). In 1985, Pinellas County had the largest number of pleasure boats registered, with 34,541, while Hillsborough County was a close second with 33,447 boats registered.

In Chapter 3 of this study, through the use of an economic base model, many export industries were identified, i.e., industries within the local economy that cause funds to flow in and "drive" the economy. Two such industries were Ship and Boat Building and Repairing (SIC 373) and Boat Dealers (SIC 555). These industries satisfy local consumption of their respective product or service and sell their excess to additional businesses and residences outside the boundaries of the local Tampa Bay economy, thus injecting funds and stimulating local economic conditions. In 1984, the retail sales reported for motorboats, yachts and marine accessories, in Pinellas, Hillsborough and Manatee Counties, was approximately $184 million. (4)

Boating related activities, undertaken on Tampa Bay, include sailing, snorkeling, scuba diving, swimming, water skiing and sport fishing. Quality of available activities and accessibility are two major factors that can affect recreational boating. (5) Factors affecting the quality of available activities or the desirability to undertake such activities include the boater's perception of water quality, water clarity, and scenic amenities. Access to the water and boating facilities is also an important factor in the use of Tampa Bay for recreational boating. In general, boaters gain access to Tampa Bay in three ways: public and private boat ramps; individual slips (residential or marina); and marina launching facilities.

There are 47 public and private marinas located within the boundaries of Tampa Bay. (6) This figure does not include private facilities located on the premises of condominiums, residential communities, and private clubs, etc., which are not available to the public. Marinas that are open to the public provide approximately 3,562 wet and 1,310 dry slips, respectively. (Figure 8-4 illustrates the relative location of marinas along Tampa Bay.)

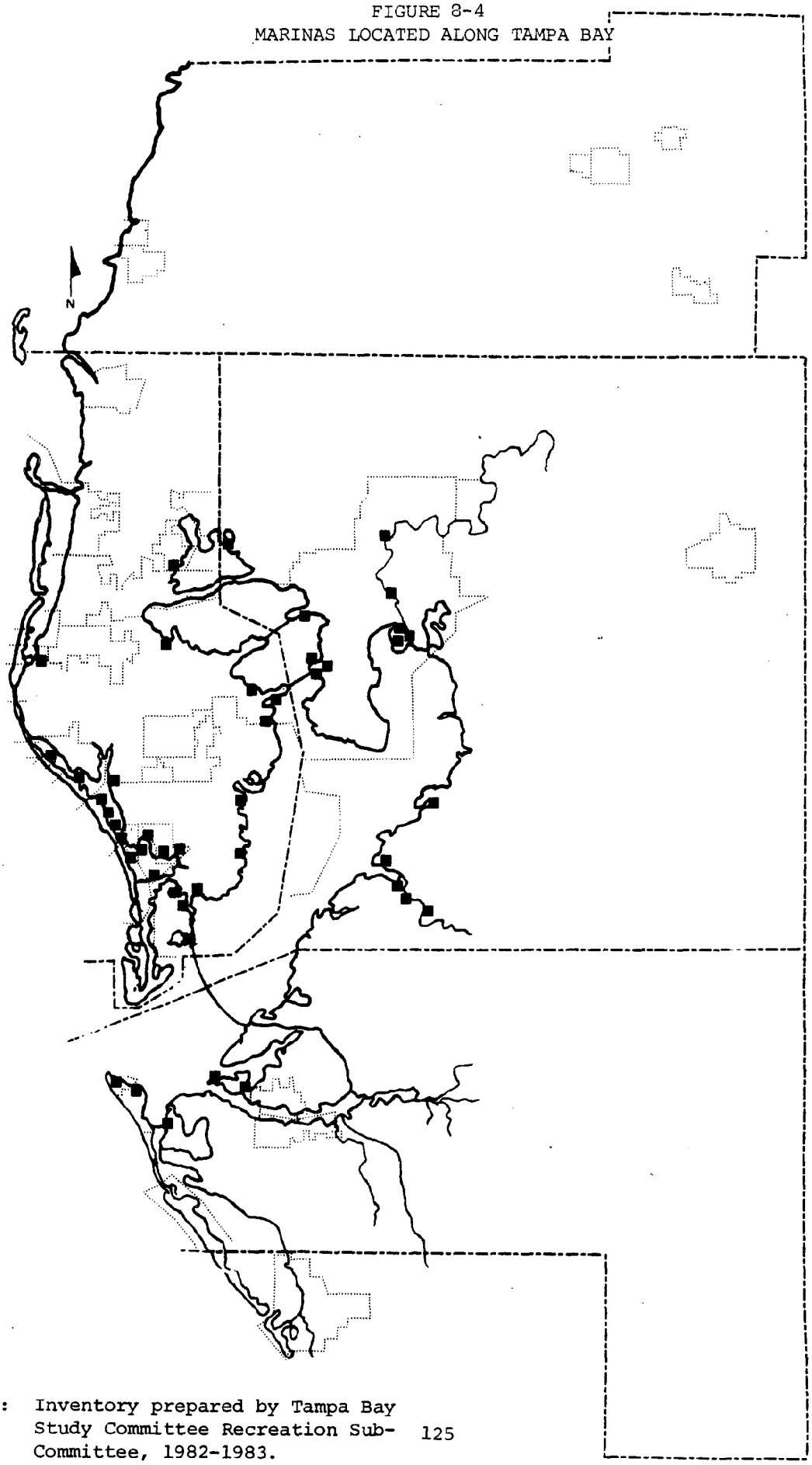
In addition to marinas, there are numerous boat launching facilities located along the shores of Tampa Bay. A large portion of recreational boaters, particularly those with smaller boats, use boat ramps. Factors determining use of boat ramps include proximity to residence,

TABLE 8-1
PLEASURE BOATS REGISTERED

YEAR	HILLSBOROUGH	MANATEE	PINELLAS
1979-80	28,394	9,641	28,707
1980-81	29,041	9,902	29,741
1981-82	29,086	9,942	29,871
1982-83	30,040	10,237	30,599
1983-84	30,945	10,808	31,907
1984-85	33,447	11,067	34,541

Source: Florida Department of Natural Resources, Bureau of License and Motorboat Registration

FIGURE 8-4
MARINAS LOCATED ALONG TAMPA BAY



Source: Inventory prepared by Tampa Bay Study Committee Recreation Sub-Committee, 1982-1983.

proximity to destination point, quality of ramp and facilities available at the ramp. (The economic value of saltwater boat ramp use will be discussed later.)

D. RESIDENT AND TOURIST WATER-RELATED RECREATIONAL DEMANDS

Table 8-2 contains information regarding 1983 estimates of resident and tourist water-related recreational demands in Pasco, Hillsborough, Pinellas and Manatee Counties, based on surveys conducted by the Florida Department of Natural Resources (FDNR), Divison of Recreation and Parks. (7) The benefits associated with recreational fishing can be analyzed in far greater detail than those accruing from other types of recreational activities, such as picnicking, canoeing, nature study, etc. For this reason, the following analysis will first assess the economic impacts associated with recreational fishing alone, using Florida-specific estimates of user willingness to pay for saltwater fishing, (8) and then assess the economic impacts associated with other forms of recreation, using the unit day approach. (9) Both methods will be used in an effort to demonstrate the magnitude of the economic impacts associated with recreation in the Tampa Bay area, subject to the limitations of the available data and methodology.

The economic value of recreational fishing includes both the direct gross expenditures by anglers and the perceived value to the user. The former includes such expenditures as travel cost and fishing equipment, while the latter is a measure of user willingness to pay for the right to fish. For saltwater fishing in Florida, gross expenditures are estimated to be $58.25 per day for tourists and $16.44 per day for residents, where the difference between tourist and resident estimates is due to larger expenditures associated with travel and supplies. Both resident and tourist anglers have the same estimated saltwater recreational fishing user value of $36.56 per day. Consequently, the total annual economic value of recreational fishing in the Tampa Bay area is estimated to be $197 million (in 1983 dollars), as shown in Table 8-3.

The preceeding analysis indicates that the Tampa Bay area has a substantial value as a recreational resource for saltwater fishing alone. Although there is no such well-developed methodology by which to estimate the economic value of other types of water-related recreation, there is a fundamental procedure which is commonly used: the unit day approach. This type of evaluation is based on the users willingness to pay for various outdoor recreational activity with an average estimated economic value of $2.95 per day. As shown in Table 8-4, the total annual economic value of other recreational activities in the Tampa Bay area is estimated to be $23 million (in 1983 dollars).

E. SUMMARY

The economic benefits of recreation-related uses and attributes of Tampa Bay described in this chapter, include boating, saltwater fishing, beach activities and saltwater boat ramp use. It should be noted that the recreation uses and attributes of Tampa Bay, not presented here include the following: restaurants offering a scenic view of Tampa Bay; sporting goods sales and service; bait and tackle

TABLE 8-2
RECREATION DEMAND FOR SPECIFIED SALT-WATER RELATED
RECREATIONAL ACTIVITIES IN THE TAMPA BAY REGION, 1983

DEMAND (user occasions)			
SALTWATER BEACH ACTIVITIES	SALTWATER FISHING (NON-BOAT)	SALTWATER FISHING (BOAT)	SALTWATER BOAT RAMP USE
6,882,109	1,863,668	1,314,007	844,515

Notes: Demand figures include both resident and tourist demand. A "user occasion" is defined as one person doing one thing one time. These figures are region-wide, which would include Pasco County, and probably overestimate the true recreation demand of Tampa Bay.

Source: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.

TABLE 8-3
ECONOMIC VALUE OF SALTWATER FISHING
IN THE TAMPA BAY AREA (in 1983 dollars)

	Demand (user occasions)			Economic Value (in 1983 dollars)		
	Saltwater Fishing (Non-Boat)	Saltwater Fishing (Boat)	Total Saltwater Fishing	Annual Gross Expenditures 1	Annual User Value 2	Total Annual Economic Value
Tourists	452,326	240,471	692,797	$ 40,355,425	25,328,658	65,684,083
Residents	1,411,342	1,073,536	2,484,878	40,851,394	90,847,139	131,698,533
					TOTAL:	$197,382,616

Notes: 1 Estimated Gross Expenditure of $58,25/day for tourists.
Estimated Gross Expenditure of $16.44/day for residents.

2 Estimated saltwater fishing user value of $36.56/day for tourists and residents.

Sources: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.
Bell, 1979.

TABLE 8-4
ECONOMIC VALUE OF OTHER RECREATIONAL ACTIVITIES
IN THE TAMPA BAY AREA (in 1983 dollars)

Demand (user occasions)		
Saltwater Beach Activities	Saltwater Boat Ramp Use	Total Annual Economic Value 1 (in 1983 dollars)
6,882,109	844,515	$ 22,793,540

Notes: 1 Estimated Average Outdoor Recreation User Value of $2.95/day

Sources: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.
U.S. Water Resources Council, 1979

shop sales; boat rentals and charters; sportfishing tournaments; sailing school courses; boating safety and diving instruction courses; and miscellaneous travel expenses, equipment rental and admittance fees.

The information necessary to calculate the economic impacts of the aforementioned uses and attributes of Tampa Bay is not presently available, hence, a precise evaluation of the economic benefits of Tampa Bay to water-oriented recreational activities cannot be calculated at this time.

Therefore, the true recreational value of Tampa Bay would be far greater than the figures in this chapter indicate. The important point of this analysis is that the (recreational) economic value of Tampa Bay is significant to the region's economy.

F. FOOTNOTES

1. Tampa Bay Regional Planning Council, 1983, Tampa Bay Management Study.

2. Ibid. p. 3.

3. Mente, Ronald F. "Tampa Bay Recreation Survey" Tampa Bay Study Committee, 1984.

4. Florida Department of Revenue, 1984 Retail Sales By Category.

5. Tampa Bay Regional Planning Council, 1983, Tampa Bay Management Study.

6. Ibid. p. 31.

7. Methodology and information used in the preparation of this discussion is largely condensed from the following: Economic Impact Statement for the Proposed Revisions of Chapter 17-3.041, F.A.C. Sarasota Bay and Lemon Bay Outstanding Florida Waters (OFW) Designations.

8. Bell, Frederick W., Recreational Versus Commercial Fishing in Florida: An Economic Impact Analysis, Florida State University, Tallahassee, Florida, 1979.

9. U.S. Water Resources Council, Procedures For Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning, Federal Register, Vol. 44, No. 102, Washington, D.C. 1979.

CHAPTER 9
ECOLOGICAL SERVICES OF TAMPA BAY

A. INTRODUCTION

Estuarine Ecology

The intertidal and submerged wetlands of Tampa Bay perform many natural functions having intrinsic value. The value of the estuary as a regional economic resource is, however, viewed by various industries and individuals from many different, and often conflicting perspectives. For example, industries relying upon the availability of a source of water-bound transport may perceive the bay's value in the same sense that land-based industries would value railroad frontage in determining location decisions. For other firms, industries and even local governments, the bay is considered to be a convenient receptacle for the inexpensive disposal of industrial and urban wastes or available space for further development.

The environmental quality of the bay is intuitively an important component in the decision making processes of the majority of individuals and industries considering locating and/or operating in the Tampa Bay area. But for those industries dependent upon the harvest of living resources, or the availability of bay-oriented recreational opportunities, the value of the bay is perceived to be intimately tied to its ecological health.

Of all bodies of water, estuarine systems offer the greatest diversity in water composition. An estuary is defined as a semi-enclosed coastal body of water with an open access to the ocean, that is measurably diluted by the influx of freshwater.(1) Freshwater mixing with salt water creates unique chemical and physical environments each of which supports different communities of organisms particularly suited to that type of water.

According to Taylor (2), the recorded diversity and abundance of macro-invertebrate marine life in the Tampa Bay estuary is not exceeded by any other estuary between Chesapeake Bay and the Laguna Madre of Texas. The richness of Tampa Bay marine life has been attributed to the geographic position of the estuary between temperate and subtropical waters.(3) Another contributing factor to the diversity and abundance of Tampa Bay marine life is that salinity is typically in the range of 25-35 ppt over most of the estuary, without the wide fluctuations and significant vertical stratification that characterize many other estuaries. As a result of the stability of the salinity regime, many ocean species can co-exist with typical estuarine species.

The importance of rivers and creeks to estuaries has been documented by studies throughout the world. Rivers and lesser streams import freshwater, foodstuffs, sediments, minerals and nutrients to estuaries and provide critical habitat, refuge, feeding and breeding grounds for the early life history stages of marine and estuarine life forms. Rivers and lesser tributaries flowing to Tampa Bay vary greatly in

condition. Historical and anecdotal evidence exist to show that these streams were immensely productive estuarine zones. Modern data on relatively pristine rivers and creeks support this view.

The Tampa Bay estuary and contiguous coastal waters serve as home, feeding ground and/or nursery for more than 270 species of resident, migrant and commercial fishes of the Gulf of Mexico that utilize estuaries at some time in their life cycle. The most critical use of Tampa Bay, for numerous species, is as a protected nursery area for larval and juvenile stages. The protective function arises from the generally greater osmoregulatory capabilities of younger marine fishes, shallow depths and protective cover. Reduced salinities in estuarine waters tend to exclude larger marine restricted fishes that otherwise prey on young juveniles and larvae. The nursery function is developed from the high primary productivity of estuaries which provide a ready source of food.

Dredging, filling, commercial and residential development have contributed significantly to the loss of live bay bottom. Boca Ciega Bay for example, has lost 22 percent of bay bottom through dredging and filling to create finger canals and increase the number of structures having water frontage. These "dead-end" finger canals severely restrict the mixing of the water, degrading the water quality in the canal. The loss of live bay bottom also eliminates the nursery function of the area affecting the recruitment of juvenile fish and other equally important marine organisms.

Tampa Bay is a naturally shallow body of water, having an average depth of about 12 feet (4), and a maximum natural depth of about 90 feet in Egmont Channel, at the mouth of the bay. Approximately 90 percent of the bay bottom is less than 22 feet in depth.(5) Despite the relative shallow nature of Tampa Bay, the estuarine ecosystem provides excellent resiliency to man-made and natural destructive forces.

The resiliency potential of estuaries is aided by the vigor of the rhythmic and turbulent circulation pattern which continuously and endogenously renews the supply of water, food larvae, nutrients and other essential elements of any small damaged area. This assists in recovery and protects long-term net stability patterns of the estuarine system.

The substantial buffering capacity of estuaries, usually operating through the carbonate system, is another element which resists changes imposed on estuaries. The capacity of seawater to assimilate and/or dilute toxic pollutants has been well documented. The potential is not so great as the buffering capacity of the open ocean, but it is greater than most rivers, and is enormously important in the estuaries where pollution is received, as in Tampa Bay.

Many species have biological characteristics or adaptations which provide special advantages in estuarine survival. These characteristics usually protect the species against natural violence in estuaries, and they are often helpful in resisting terrigenous forces. Simon (6) believes that such resilence exists because of natural stress factors, such as red tide, which favor organisms that recover quickly.

Such long-term periodic stresses as hurricanes, droughts, and red tide may, in effect, pre-adapt the benthic community to other stresses that originate from man's activities (e.g. slime spills, shell dredging, thermal and industrial effluent).

Habitat

The importance of mangrove forests, salt marshes, and seagrass beds to coastal and estuarine ecosystems has been well documented over the past two decades. As primary producers, these species of wetland vegetation provide the foundation of coastal and estuarine food webs; both as direct sources of nutrition and as generators of detrital particles. Secondary to their role as primary producers, coastal and estuarine wetlands provide protection and habitat for such organisms as shrimp, crabs, scallops and juvenile fishes. Also, wetland vegetation provides necessary substrate for the attachment of organisms that are major food sources for many economically important species of finfish.

In addition to their contributions to the biology of the marine ecosystems, coastal and estuarine wetlands play an important role in modifying the geologic and hydrographic characteristics of the area. Acting as baffles, roots and leaves reduce the velocity of water over the bottom causing suspended particles to settle out and become trapped at the base of the plants. In this way mangroves, marshes, and seagrasses reduce turbidity, increase sedimentation rates, stabilize sediments, and attenuate wave action on adjacent shorelines. The binding and stabilization characteristics of these habitats are documented by reports of some coastal marshes and seagrass meadows surviving the destructive scouring forces of coastal storms and hurricanes in the Gulf states.

The mangrove forest community exists near the beginning of the estuarine wetland zone. Mangroves share commensal communities of associated flora and fauna commonly attached to the root system. General consensus of opinion is that mangroves, particularly red mangroves, through their ability to trap sediments, act as land stabilizers rather than land builders.(7) Localized environmental factors such as soil salinity and tidal flushing, determine zonation patterns among mangrove species.

Salt prairies and marshes provide habitat for a variety of fish and wildlife, in addition to the specialized vegetation that occurs in this extremely sensitive zone. Salt barrens, because of the hypersaline soil water, are generally devoid of vegetation. As this soil water slowly leaches from the surface and is diluted by rainwater, salt flats (prairies) and meadows (marshes) may form. These rapidly changing physiochemical conditions caused by tides, evaporation, and freshwater runoff result in unique and sporadic assortment of vegetation. In general, the moderate to high salinity marshes support more marine invertebratae (snails, mussels, polychaetes) than do the low salinity marshes.(8) Other important invertebrate groups include amphipods, benthic forminiferans, insects and their larvae.

Additionally, marshes attract numerous wading birds (herons and egrets), other more transient birds (red winged blackbird, marsh hawk), mammals (rabbits, raccoons), and some reptiles (alligators, szat marsh snake).

Seagrass beds are widely recognized as one of the most productive benthic habitats encountered in estuarine and nearshore waters. Seagrasses play at least four roles in the ecology of an estuary: (1) habitat; (2) food source; (3) nutrient buffer; and (4) sediment trap. Seagrasses serve as a fisheries habitat including: nurseries for juvenile stages of some fish species; refuge for mating blue crabs, other invertebrates, and finfish; a substrate for epiphytic plants and animals; and habitat for all fauna subsisting directly on seagrasses and its epiphytes or detritus derived from them.

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the numerous municipalities surrounding the bay. Now the second largest population center in Florida, this rapid urbanization has transformed the Tampa Bay area into a major economic asset both to the state, and to the nation as a whole. Tampa Bay constitutes the central geographic feature most responsible for both historic and present shipping, industrial development, aesthetic, and recreational values that encompass the overall attractiveness of the region to population influx. The rapid growth rate of the region's population and business sector over the past 30 years confirms that the mere presence of Tampa Bay has contributed significantly to the economic growth and diversity of the region.

B. WATER QUALITY "INDEPENDENT" USES OF TAMPA BAY

Shipping and Water-Borne Commerce

Examples of economic entities which are dependent upon the direct utilization of Tampa Bay would include the port facilities of Tampa, St. Petersburg and Manatee County; ship building and repair firms as well as other marina facilities located around the bay; and the commercial and recreational fishing industries. Indirectly, the mere presence of the bay attracts industries and businesses such as water-oriented residential developments, restaurants, and a myriad of related support industries and commercial and recreational activities that would exist without consideration of the water quality.

The direct and indirect economic impacts associated with the port activities on and along Tampa Bay are considerable. The primary direct impact of the Port of Tampa is estimated at $298 million per year. This figure represents a measure of the revenues that flow from the principal port users. Another primary impact concerns the total direct employment associated with port activities. The primary indirect impact associated with Tampa Bay port activities is the transportation savings that the users of the ports realize by routing their shipments via Tampa Bay ports in lieu of some other port or mode of transportation.

Tampa Bay is one of the country's key commercial waterways, utilizing Florida's largest open water estuary. Including all contiguous wetlands the total area of the bay is about 398 square miles, representing an average volume within the bay of 116 billion cubic feet.(9) The numerous ports and supporting facilities located within Tampa Bay directly benefit from the bay system. Goods and services economicallly can be transported across great distances and in large volumes, by the water transport system. The natural shape of Tampa Bay provides shelter and easy access for deep draft ocean-going vessels. The port of Tampa has become the nation's seventh largest port in terms of tonnage transported, and is the third largest U.S. port in volume of foreign exports.

During the past 100 years, channel dimensions in Tampa Bay have repeatedly been enlarged, allowing larger ships to call on the ports, resulting in a dramatic increase in the annual tonnage transiting the port. The deepening of Tampa's shipping channels has resulted in a tremendous economic impact. Dredging is a critical component of the port operations that provide a necessary transportation link which major portions of the region's economy depend upon. The shallow natural depth of Tampa Bay has required the dredging of well in excess of 100 million cubic yards of material to create and maintain the large port infrastructure in place today. Disposal practices, historically, have resulted in large-scale changes in shoreline and benthic topography, and are commonly viewed as major contributors to the loss of natural habitats and changes in water quality which the bay has experienced.

The ports located on Tampa Bay realize approximately $281 million in transportation savings. This, however, is not without cost. There is a need for maintenance dredging to keep the ports operating. It is imperative that the dredge spoil is placed in an area where it will result in minimal damage to the fragile ecological systems. Dredging can result in physical alteration, turbidity problems, and resuspension of sediments which can affect seagrasses and other types of highly productive emergent and submergent vegetation. The loss of this vegetation results in a loss of habitat available for nursery utilization and subsequently affecting the adult populations of finfish and shellfish, not only in the bay, but in Gulf populations as well.

Electric and Sanitary Services

Currently, the vast quantities of water existing in Tampa Bay are utilized as a receiving body for treated wastewater and industrial effluent discharges, as well as a source of cooling water for electric power generating facilities located on the bay.

It has been documented in this study that the least costly method of wastewater disposal involves the ultimate disposal of treated wastewater to surface waters of Tampa Bay. The next best available alternatives include wastewater reuse via spray irrigation, deep-well injection and a gulf outfall, or a combination of each of these. Wastewater treatment with discharge into Tampa Bay may be the least costly and economically preferable method, however, it is perhaps the most costly

regarding the ecological health of the bay due to the contribution of excessive nutrients and fecal coliform, resulting in closure of public beaches, shellfishing areas and eutrophication within the bay.

It has also been documented in this study that the use of bay water as a cooling source for electric power generating plants located along Tampa Bay results in both economic and environmental impacts. Cooling system alternatives available to both the Florida Power Corporation and the Tampa Electric Company include the conventional once-through cooling system, cooling towers and cooling ponds. The least costly and economically preferable system is that of once-through cooling. However, there are environmental impacts associated with both the intake of water from Tampa Bay and the ultimate discharge into the Bay.

The vast quantities of water contained within Tampa Bay provides an easily accessible cooling water source (and reservoir). The most economical way of condensing steam to be returned to the boilers, in the electrical power production process, is achieved using an open-cycle cooling system which passes water from the environment through the condensor element and discharges it back into the environment at an elevated temperature. Although the discharges of "waste" heat into the subtropical Tampa Bay estuary results in demonstrable impacts, perhaps a greater problem results from the capture and inclusion of planktonic eggs and larvae of fish and shellfish in the cooling water of power plants. This process termed "entrainment", usually leads to high rates of mortality for those organisms involved. Mortality results from thermal stresses, chemical stresses (associated with biocides used to prevent fouling of the cooling system), physical stresses (associated with pressure changes) and other impacts and abrasions during passage through the cooling system. Assuming a 100 percent mortality rate for all entrained organisms, and adjusting for estimated natural mortality rates of estuarine fish eggs and larvae, it can be estimated that power plant entrainment is responsible for annually removing approximately three billion harvestable adults from the commercial and recreational fisheries of Tampa Bay.(10)

Historically, the diluting potential of bay waters has been taken for granted in the design of stormwater systems. In the past, stormwater drainage systems were designed to remove the potential floodwaters as quickly as possible. In effect, this was accomplished by channeling runoff directly into Tampa Bay and tributaries without the benefit of pretreatment. Urban and agricultural stormwater runoff have been identified as the major sources of water pollution in Tampa Bay, with the former apparently predominating.(11) Due to the highly urbanized character of the study area, and the slow natural flushing rates in portions of the estuary, stormwater runoff pollution presents a particularly intractable problem for Tampa Bay.

Stormwater runoff and municipal discharge are major contributors of nutrients into the water column. This addition of nutrient rich material can result in a eutrophication problem in the bay. This nutrient rich condition can trigger algal blooms which will cause fish kills, shade out submergent plants, and create unpleasent odors in the bay.

C. WATER QUALITY "DEPENDENT" USES OF TAMPA BAY

Benefits of Tampa Bay to Waterfront Property Owners

In general terms, the presence of Tampa Bay enhances the value and desirability of the homes and neighborhoods located on the bay. It appears that owners of single-family, residential waterfront property are willing to pay more for their home, primarily for the water view, and secondarily for the ease of access to the bay and ability to navigate a boat close to their home.

The intrinsic value of Tampa Bay is closely associated with water quality. A waterfront home on Tampa Bay would not be as valuable if the bay water were to deteriorate or be degraded. The value of property fluctuates in relation to its geographic proximity to Tampa Bay and tributaries. Valuations of land adjacent to water will vary according to proposed land use and zoning densities. However, it is generally accepted that property values increase with water frontage or direct access to the bay.

In addition to residential property values, commercial and office space located on or near the waters of Tampa Bay generally demand a higher price per square foot. Again, the environmental amenity offered is largely one of a water view. Some examples of waterfront development that preclude higher prices in terms of owning, leasing or utilizing include: highrise, waterfront office space; hotel, motel, and tourist court establishments; and restaurants, and other eating and drinking places.

Water-Oriented Recreational Activities

The recreation-related uses of Tampa Bay include boating, fishing, saltwater beach activities and boat ramp use. These activities have a tremendous impact on the region's economy. As documented earlier in this study, the retail sales reported for motorboats, yachts and marine accessories in Pinellas, Hillsborough and Manatee Counties was approximately $184 million in 1983. The total economic value of recreational fishing in the Tampa Bay region is estimated at $197 million.

The recreational benefits of Tampa Bay are directly linked to water quality and aesthetic benefits. The alteration of the system beyond its ability to recover will cause significant degradation, resulting in a decline in tourism, boating, and recreational activities in general. The bay could become a major liability rather than an asset.

Commercial Fishing

The commercial fishing industry is an important source of income and employment in the Tampa Bay region. A total of 1,952 commercial fishermen plied their trade during 1984 in Hillsborough, Manatee and Pinellas Counties, which represents ten percent of all commercial fishermen in Florida. A total of 22.1 million pounds of fish, valued at $19.5 million, were landed in Hillsborough, Manatee and Pinellas Counties in 1984.

Historically, Tampa Bay has been one of the state's most productive fishery habitats. Prior to the turn of the century, sturgeon were still fished commercially. The bay supported thriving scallop and oyster fisheries up until about the early 1950s. Those fisheries have since collapsed completely primarily due to overfishing, water quality degradation and habitat loss. Tampa Bay still supports reasonably productive fisheries for spotted seatrout, red and black drum and mullet. Of special concern are spotted seatrout and red drum which constitute the bulk of the recreational finfish landings in Tampa Bay.

Commercially and recreationally valuable macroinvertebrates within the Tampa Bay estuary include the following: pink shrimp, stone crab, blue crab, oyster, bay scallop, southern quahog, sunray venus clam, and squid.(12) Currently, the most valuable fishery is the pink shrimp.

Both commercial and recreational fisheries are affected by a loss of habitat. With 90 percent of the commercially and recreationally valuable species being estuarine dependant, any loss of saltmarsh shoreline (development activities) or seagrass beds (dredging, water quality) will contribute to the decline of fishery stocks. This trend can be slowed through the acceptance of the value of these habitats and efforts to restore this valuable area where possible.

D. SUMMARY

Tampa Bay is the largest open water estuary in the State of Florida, with over 1.6 million people living in the three counties bordering its shores. This population represents a 45 percent increase since 1970. Once the state's most diverse and productive estuarine system, rapid urban and industrial development have significantly changed the character and ecology of Tampa Bay. Recent studies have indicated that 44 percent of the original 25,000 acres of mangrove forests and salt marshes have been destroyed, and 81 percent of the original 76,500 acres of seagrasses have disappeared. This habitat loss has resulted in declining populations of economically important fish and shellfish including a complete collapse of fisheries, scallops and oysters, and major declines for bait shrimp, spotted seatrout and red drum.

Presently, Tampa Bay continues to perform the various natural functions indicative of all estuaries, however, the ability of the bay to "function naturally" has been stressed by 100 solid years of competing uses. Although the Tampa Bay estuary has great resiliency and recovery potential through the natural systems, it takes many years for the system to recover. Tampa Bay is being stressed through stormwater runoff, wastewater discharge, dredging activities, development and habitat loss, faster than the system can recover naturally. In order for Tampa Bay to remain an economic resource, it must be allowed to function as a natural resource.

E. FOOTNOTES

1. Pritchard, D.W. "What is an Estuary? Physical Viewpoint" in G.E. Lauff, Ed., Estuaries (Washington, D.C.: American Association for the Advancement of Science, Publication No. 83, 1967).

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APPENDIX A

APPENDIX A

Study Area Economic Base Model

*1 SIC CODE	*2 E INDUSTRY BY REGION MONTH 1	*3 E INDUSTRY BY REGION MONTH 2	*4 E INDUSTRY BY REGION MONTH 3	*5 CONTACTS INFLUENTIAL DATA	*6 AVERAGE MONTHLY E IR	*7 E INDUSTRY NATIONAL MONTH 1	*8 E INDUSTRY NATIONAL MONTH 2	*9 E INDUSTRY NATIONAL MONTH 3	*10 AVERAGE MONTHLY E IN	EIR/EIN	*11 ER/EN	*12 LQI	*13 XIR
016	1487	3076	3500	46	2733.6667	71205	71089	82013	74769	0.036561498304	0.003637972	10.0499678382	2461.659162695
017	96	147	158	43	176.66667	121151	116039	128315	121835	0.001450048563	0.003637972	0.398587095649	-266.565612037
018	539	596	629	603	1191	102600	105246	115409	107751.67	0.011053193299	0.003637972	3.038284597797	799.0024890153
024	149	149	156	0	151.33333	26349	26190	26192	26243.667	0.005766470641	0.003637972	1.585078488741	55.85961742068
072	340	647	503	0	496.66667	65340	61738	62383	63153.667	0.007864415368	0.003637972	2.161758275228	266.9154163266
074	320	329	339	17	346.33333	81035	80772	81911	81239.333	0.004263123774	0.003637972	1.17184083828	50.78693998385
075	68	77	76	9	82.666667	37425	37541	38215	37727	0.002191180498	0.003637972	0.602308290395	-54.5830906171
076	164	143	245	0	184	98979	89982	84388	91116.333	0.002019396449	0.003637972	0.55508855788	-147.478639558
078	1089	1126	1100	88	1193	137198	138821	154219	143412.67	0.008318651537	0.003637972	2.286618007561	671.2687812066
091	137	129	141	0	135.66667	13814	13753	13201	13589.333	0.009983320251	0.003637972	2.744199556852	86.22905695351
138	34	31	33	3	35.666667	354100	350800	347400	350766.67	0.00010168203	0.003637972	0.027950198351	-1240.41253028
147	N/A	N/A	N/A	1113	1113	21200	21300	21300	21266.667	0.052335423197	0.003637972	14.38587980079	1035.632469101
152	1846	1871	1849	872	2727.3333	480600	475900	478300	478266.67	0.005702536939	0.003637972	1.5675044922	987.4127481577
153	292	261	260	11	282	59500	59800	61500	60266.667	0.00467920354	0.003637972	1.286212197679	62.75157387807
154	2077	2065	2068	834	2904	469000	465000	471000	468333.33	0.006200711744	0.003637972	1.704442008401	1200.216600103
161	589	596	584	184	773.66667	174100	174100	189500	179233.33	0.004316533383	0.003637972	1.186521988531	121.6208772543
162	2513	2458	2438	537	3006.6667	509600	505500	513300	509466.67	0.005901596441	0.003637972	1.622221658715	1153.241365313
171	3310	3321	3303	477	3788.3333	514400	510500	505900	510266.67	0.007424222629	0.003637972	2.040758779147	1931.997654642
172	655	680	708	73	754	119600	119700	118300	119200	0.006325503356	0.003637972	1.738744532766	320.3537766526
173	2198	2238	2210	841	3056.3333	413800	409000	408700	410500	0.007445391799	0.003637972	2.04657772768	1562.945961822
174	2122	2191	2258	104	2294.3333	308600	320200	315100	314633.33	0.007292086026	0.003637972	2.004437275153	1149.706179481
175	557	561	579	11	576.66667	123000	120500	120600	121366.67	0.004751441912	0.003637972	1.306068969047	135.1381713625
176	945	913	908	237	1159	154700	156900	147500	153033.33	0.007573513396	0.003637972	2.081795593209	602.2690684039
177	470	478	479	6	481.66667	96300	101200	102100	99866.667	0.004823097463	0.003637972	1.325765535753	118.3545623186
178	56	56	57	0	56.333333	15200	14900	15300	15133.333	0.00372246696	0.003637972	1.023225933455	1.278695358026
179	1495	1506	1508	497	2000	340900	341100	346500	342833.33	0.005833738454	0.003637972	1.603568960791	752.7820449867
201	86	91	88	78	166.33333	345500	343200	345900	344866.67	0.000482312005	0.003637972	0.132577174336	-1088.28183075
203	146	356	250	3093	3343.6667	201900	207600	204900	204800	0.016326497396	0.003637972	4.487802233261	2598.610068144
204	36	32	32	83	116.33333	131500	130600	129200	130433.33	0.000891898799	0.003637972	0.24516375585	-358.179438467
205	405	395	377	77	469.33333	213700	212700	212800	213066.67	0.002202753442	0.003637972	0.605489443067	-305.797164328
208	N/A	N/A	N/A	751	751	221500	221000	222400	221633.33	0.003388479471	0.003637972	0.931419971278	-55.2957883212
209	946	1010	1013	407	1396.6667	162500	161100	163700	162433.33	0.008598399343	0.003637972	2.363514649827	805.7388013502
212	585	645	674	0	634.66667	5600	5500	5400	5500	0.115393939394	0.003637972	31.71930674175	614.6578224686
232	N/A	N/A	N/A	725	725	334100	337700	343300	338366.67	0.002142646045	0.003637972	0.588967215164	-505.96834821
233	600	440	601	138	685	391800	402300	401100	398400	0.00171937751	0.003637972	0.472619818097	-764.367914275
239	291	289	288	54	343.33333	176800	178800	180800	178800	0.001920208799	0.003637972	0.527824010831	-307.136001688
243	807	840	837	107	935	211200	211400	216400	213000	0.004389671362	0.003637972	1.206626042427	160.1120337837
245	274	320	330	161	469	66000	67800	70900	68233.333	0.006873473376	0.003637972	1.889369680325	220.7690662215
249	86	88	102	18	110	79500	80300	82200	80666.667	0.001363636364	0.003637972	0.374834244585	-183.463048238
251	215	221	222	67	286.33333	288400	292600	293200	291400	0.000982612674	0.003637972	0.270099045	-773.771611997
254	60	73	69	3	70.333333	63200	63300	63700	63400	0.00110935857	0.003637972	0.30493875979	-160.314070695
264	127	129	126	325	452.33333	217100	219200	220000	218766.67	0.002067651988	0.003637972	0.568352965505	-343.53360286
265	310	313	451	433	791	193200	194000	194900	194033.33	0.004076619138	0.003637972	1.120574733596	85.11222983642
271	3507	3467	3586	187	3707	435900	437100	437100	436700	0.008488664987	0.003637972	2.333351040598	2118.297770673
272	435	442	437	97	535	101600	102200	102800	102200	0.005234833659	0.003637972	1.43894294154	163.1992950831
273	14	16	15	19	34	99800	101000	101700	100833.33	0.000337190083	0.003637972	0.092686285934	-332.828810298

(* See Description Attached)

(N/A-Not Available)

1 SIC CODE	2 E INDUSTRY BY REGION MONTH 1	3 E INDUSTRY BY REGION MONTH 2	4 E INDUSTRY BY REGION MONTH 3	5 CONTACTS INFLUENTIAL DATA	6 AVERAGE MONTHLY E IR	7 E INDUSTRY NATIONAL MONTH 1	8 E INDUSTRY NATIONAL MONTH 2	9 E INDUSTRY NATIONAL MONTH 3	10 AVERAGE MONTHLY E -IN	EIR/EIN	11 ER/EN	12 LQI	13 XIR
274	182	198	196	11	203	53800	54200	55000	54333.333	0.003736196319	0.003637972	1.026999838231	5.336872467505
275	1378	1384	1397	925	2311.3333	451900	454300	459200	455133.33	0.005078365314	0.003637972	1.395933165932	655.571159512
279	117	125	124	18	140	45700	45800	45900	45800	0.003056768559	0.003637972	0.840239791355	-26.6191025949
284	140	129	139	64	200	143800	144800	145700	144766.67	0.001381533502	0.003637972	0.379753782218	-326.657032438
285	110	110	111	106	216.33333	59800	60200	60900	60300	0.003587617468	0.003637972	0.986158714609	-3.03635851102
287	195	188	290	120	344.33333	60400	61200	62200	61266.667	0.005620239391	0.003637972	1.54488267001	121.446935539
289	39	39	40	29	68.333333	91300	91500	91700	91500	0.000746812386	0.003637972	0.205282628182	-264.541074689
295	2	1	48	65	82	22400	23200	23700	23100	0.00354978355	0.003637972	0.975758985903	-2.03714563191
306	43	56	59	21	73.666667	130100	131500	132800	131466.67	0.000560344828	0.003637972	0.154026715447	-404.605342529
307	791	787	768	264	1046	521100	530300	536000	529133.33	0.001976817437	0.003637972	0.543384505253	-878.972077577
321	N/A	N/A	N/A	393	393	16200	16000	15800	16000	0.0245625	0.003637972	6.751701830583	334.792453242
322	N/A	N/A	N/A	183	183	100099	101500	101200	100933	0.001813083927	0.003637972	0.498377692363	-184.191394808
325	N/A	N/A	N/A	178	178	36600	36800	37900	37100	0.004797843666	0.003637972	1.318823811136	43.0312509548
327	350	340	379	358	714.33333	176300	179300	185500	180366.67	0.003960450933	0.003637972	1.088642598115	58.16450935889
329	42	42	43	376	418.33333	116800	118200	119000	118000	0.00354519774	0.003637972	0.974498445667	-10.9473240072
331	N/A	N/A	N/A	194	194	343800	345900	347900	345866.67	0.000560909792	0.003637972	0.15418201194	-1064.25313575
341	N/A	N/A	N/A	353	353	60300	61100	61700	61033.333	0.005783724741	0.003637972	1.589821268949	130.9624622626
342	24	25	21	6	29.333333	145000	145800	146900	145900	0.000201050948	0.003637972	0.055264572197	-501.446733667
344	1659	1719	1641	216	1889	434700	435200	438500	436133.33	0.004331244268	0.003637972	1.190565693706	302.3592879539
345	6	6	6	8	14	91300	92300	93400	92333.333	0.000151624549	0.003637972	0.041678320337	-321.906051083
347	134	135	137	3	138.33333	98400	99700	101100	99733.333	0.001387032086	0.003637972	0.381265224271	-224.493708125
349	287	290	292	258	547.66667	222500	224200	225700	224133.33	0.00244348602	0.003637972	0.671661640133	-267.724050835
352	26	27	26	30	56.333333	114600	117900	119600	117366.67	0.000479977279	0.003637972	0.131935408631	-370.643275281
353	100	102	102	44	145.33333	261400	265400	270200	265666.67	0.000547051443	0.003637972	0.150372650525	-821.154474295
354	195	200	206	107	307.33333	297300	301000	303000	300433.33	0.001022966826	0.003637972	0.281191531386	-785.634622771
355	238	233	243	67	305	164200	165000	165800	165000	0.001848484848	0.003637972	0.508108642659	-295.265325942
356	134	129	133	117	249	264600	267000	271000	267533.33	0.000930725143	0.003637972	0.255836281066	-724.278688083
357	170	162	164	32	197.33333	492300	494700	495500	494166.67	0.000399325464	0.003637972	0.109765962934	-1600.43100143
359	524	511	519	0	518	255800	257900	261100	258266.67	0.002005678885	0.003637972	0.551317895107	-421.566817253
366	198	203	199	193	393	593200	593700	598100	595000	0.000660504202	0.003637972	0.181558368554	-1771.59314506
367	857	870	878	654	1522.3333	635700	648800	660300	648266.67	0.002348313451	0.003637972	0.645500752269	-836.042436146
369	N/A	N/A	N/A	563	563	159000	159600	160400	159666.67	0.003526096033	0.003637972	0.96924779821	-17.8628103562
371	123	122	128	294	418.33333	833300	852100	863000	849466.67	0.000492465861	0.003637972	0.135368250575	-2672.00233663
372	90	91	96	75	167.33333	581500	588200	591000	586900	0.000285113875	0.003637972	0.078371658946	-1967.79224118
373	2618	2952	2928	63	2895.6667	196700	201700	203600	200666.67	0.014430232558	0.003637972	3.966559901416	2165.647017743
379	84	87	85	0	85.333333	48100	49500	50800	49466.667	0.001725067385	0.003637972	0.474183842206	-94.6249987269
381	N/A	N/A	N/A	378	378	77600	77700	78600	77966.667	0.004848225737	0.003637972	1.33267275672	94.35947527699
391	44	44	44	0	44	52400	52500	52600	52500	0.000838095238	0.003637972	0.230374316672	-146.9935128
394	212	220	224	3	221.66667	108800	113400	116800	113000	0.001961651917	0.003637972	0.539215830706	-189.424132312
395	125	124	126	0	125	33100	33000	33300	33133.333	0.003772635815	0.003637972	1.03701627023	4.461871921901
399	240	241	239	277	517	123700	125200	126500	125133.33	0.004131592968	0.003637972	1.135685854531	61.76847806321
401	N/A	N/A	N/A	510	510	361400	364300	366200	363966.67	0.001401227219	0.003637972	0.385167160385	-814.100423023
411	598	588	586	69	659.66667	77700	80200	80300	79400	0.008308144416	0.003637972	2.283729826579	370.8117158799
412	139	134	132	18	153	39700	39200	38600	39166.667	0.003906382979	0.003637972	1.073780482785	10.51277616523
413	N/A	N/A	N/A	162	162	39400	36800	36400	37533.333	0.00431616341	0.003637972	1.18642029103	25.45479656344
421	1290	1276	1263	2093	3369.3333	1141400	1148700	1160800	1150300	0.002929090962	0.003637972	0.805143971851	-815.425481402
422	274	260	254	342	604.66667	86300	85200	84700	85400	0.007080405933	0.003637972	1.946250980079	293.9838858457
445	391	373	368	200	577.33333	27400	27000	27900	27433.333	0.021044957473	0.003637972	5.784805206828	477.5316437878
446	508	572	578	330	882.66667	99200	97100	101500	99266.667	0.008891873741	0.003637972	2.444184436146	521.537345322
452	74	75	76	3	78	400700	402800	404900	402800	0.000193644489	0.003637972	0.053228696103	-1387.37498963
458	89	89	89	137	226	56600	57000	57300	56966.667	0.0039672323	0.003637972	1.090506649547	18.75688039691
471	95	97	98	257	353.66667	55600	57100	57500	56733.333	0.006233842538	0.003637972	1.713548949686	147.2724071205
472	495	490	495	211	704.33333	155400	157200	160500	157700	0.004466286197	0.003637972	1.227685809467	130.6252005994
481	41	41	41	4210	4251	999300	994400	99100	697600	0.00609375	0.003637972	1.675040530488	1713.[illegible]3096135

1	2	3	4	5	6	7	8	9	10		11	12	13
SIC CODE	E INDUSTRY BY REGION MONTH 1	E INDUSTRY BY REGION MONTH 2	E INDUSTRY BY REGION MONTH 3	CONTACTS INFLUENTIAL DATA	AVERAGE MONTHLY E IR	E INDUSTRY NATIONAL MONTH 1	E INDUSTRY NATIONAL MONTH 2	E INDUSTRY NATIONAL MONTH 3	AVERAGE MONTHLY E IN	EIR/EIN	ER/EN	LQI	XIR
483	454	436	501	806	1269.6667	225800	226800	227400	226666.67	0.005601470588	0.003637972	1.53972353077	645.0597542612
489	90	89	87	417	505.66667	143300	143900	145600	144266.67	0.00350508317 9	0.003637972	0.963471817527	-19.171379935
491	N/A	N/A	N/A	4472	4472	432300	431200	431600	431700	0.010359045634	0.003637972	2.84747836609	2901.487629035
492	N/A	N/A	N/A	131	131	170200	169600	169500	169766.67	0.000771647359	0.003637972	0.212109226957	-486.606324247
495	194	220	188	312	512.66667	54100	53800	54000	53966.667	0.009499691167	0.003637972	2.611260345845	316.3374620807
501	1229	1229	1231	418	1647.6667	408700	409400	410700	409600	0.004022623698	0.003637972	1.105732551042	157.553469661
502	477	530	488	254	752.33333	117200	119100	117800	118033.33	0.006373905676	0.003637972	1.752049287453	322.9314102704
503	636	639	647	1113	1753.6667	193100	194400	196300	194600	0.009011647825	0.003637972	2.477107750185	1045.717379222
504	151	152	146	30	179.66667	72000	72600	73200	72600	0.002474747475	0.003637972	0.680254740172	-84.4500767479
505	451	448	459	296	748.66667	128400	129200	130100	129233.33	0.005793139025	0.003637972	1.592409052826	278.5194608731
506	715	723	714	837	1554.3333	452400	454300	459100	455266.67	0.003414116269	0.003637972	0.938466974544	-101.913903378
507	843	838	814	428	1259.6667	240400	241600	242500	241500	0.005216011042	0.003637972	1.433769009721	381.0965077876
508	3187	2912	2989	4264	7293.3333	1348600	1360200	1369900	1359566.7	0.00536445436	0.003637972	1.474572878395	2347.268313292
509	494	440	460	586	1050.6667	190400	190500	192200	191033.33	0.005499912755	0.003637972	1.511807471441	355.6928115203
511	299	314	304	644	949.66667	167600	168000	169700	168433.33	0.0056382	0.003637972	1.549829195995	336.91097
512	136	137	141	82	220	157300	155900	156200	156466.67	0.0014061	0.003637972	0.386492915166	-349.2213
513	104	113	116	127	238	172000	173800	174800	173533.33	0.0013715	0.003637972	0.376994257519	-393.3094
514	2538	2576	2575	2014	4577	695100	697600	701200	697966.67	0.0065576	0.003637972	1.802548327247	2037.817
515	20	19	20	39	58.666667	145600	143000	143900	144166.67	0.0004069	0.003637972	0.111858049713	-465.8076
516	172	166	165	317	484.66667	124900	124700	125300	124966.67	0.0038784	0.003637972	1.066079649309	30.041473
517	367	380	381	379	755	210000	209000	208600	209200	0.003609	0.003637972	0.992032632657	-6.063674
518	465	449	444	894	1346.6667	148100	148400	148700	148400	0.0090746	0.003637972	2.494404586605	806.79167
519	909	932	1059	423	1389.6667	392300	397200	400200	396566.67	0.0035042	0.003637972	0.963241356219	-53.03163
521	398	413	544	195	646.66667	323900	323300	328500	325233.33	0.0019883	0.003637972	0.546545234494	-536.523
523	185	180	177	131	311.66667	61800	60600	61200	61200	0.0050926	0.003637972	1.39984393811	89.0228
525	343	346	353	387	734.33333	149800	149300	150300	149800	0.0049021	0.003637972	1.347479342683	189.36518
526	231	235	227	190	421	42400	43800	51900	46033.333	0.0091455	0.003637972	2.513913666433	253.53204
527	60	59	59	66	125.33333	25900	26800	27800	26833.333	0.0046708	0.003637972	1.283904294495	27.714427
531	575	571	585	5569	6146	1941600	1825700	1825400	1864233.3	0.0032968	0.003637972	0.906218604231	-636.0281
533	66	68	65	1256	1322.3333	206900	198700	199900	201833.33	0.0065516	0.003637972	1.800896441613	588.06938
539	24	24	23	38	61.666667	119000	115800	115200	116666.67	0.0005286	0.003637972	0.145292892901	-362.7634
541	1121	1114	1132	3592	4714.3333	2291800	2278900	2276000	2282233.3	0.0020657	0.003637972	0.567807244685	-3588.367
542	103	95	91	41	137.33333	56500	56700	56600	56600	0.0024264	0.003637972	0.666960658209	-68.57586
543	87	95	92	3	94.333333	22100	20700	20900	21233.333	0.0044427	0.003637972	1.221202515324	17.087068
544	16	17	19	23	40.333333	21000	25300	23600	23300	0.001731	0.003637972	0.475826780679	-44.43141
545	117	123	193	169	313.33333	37100	37000	37000	37033.333	0.0084608	0.003637972	2.325704223826	178.60712
546	307	303	305	366	671	142400	144100	144500	143666.67	0.0046705	0.003637972	1.283829029828	148.34474
549	57	57	56	74	130.66667	34600	34000	33500	34033.333	0.0038394	0.003637972	1.055360928926	6.8543641
551,2	2772	2782	2801	785	3570	790700	798000	803500	797400	0.0044771	0.003637972	1.230644660551	669.08139
553	476	477	457	786	1256	279000	269800	273000	273933.33	0.0045851	0.003637972	1.260333395761	259.43829
554	1693	1717	1705	400	2105	566900	566800	566100	566600	0.0037151	0.003637972	1.021212723069	43.72525
555	233	232	225	121	351	23100	23400	24600	23700	0.0148101	0.003637972	4.070984580427	264.78007
556,559	85	81	77	57	138	24500	24900	25200	24866.667	0.0055496	0.003637972	1.52546483453	47.535771
557	82	89	86	26	111.66667	25500	27000	29600	27366.667	0.0040804	0.003637972	1.121611198778	12.107509
561	94	96	112	241	341.66667	120000	114900	114000	116300	0.0029378	0.003637972	0.807539143536	-81.42944
562	476	509	537	1366	1873.3333	345900	338300	340800	341666.67	0.0054829	0.003637972	1.507138406519	630.35968
564	15	18	14	44	59.666667	34800	30200	30300	31766.667	0.0018783	0.003637972	0.516298445322	-55.89957
565	121	113	118	255	372.33333	182100	174400	174000	176833.33	0.0021056	0.003637972	0.578773278443	-270.9813
566	170	175	170	460	631.66667	211600	205300	206600	207833.33	0.0030393	0.003637972	0.83543649595	-124.4251
569	169	171	169	282	451.66667	48900	48700	49100	48900	0.0092365	0.003637972	2.538924978658	273.76985
571	1292	1292	1399	815	2142.6667	373900	371900	374800	373533.33	0.0057362	0.003637972	1.576761244934	783.76298
572	146	142	147	209	354	80800	79700	78000	79500	0.0044528	0.003637972	1.223987042695	64.781252
573	274	270	286	344	620.66667	180200	184600	185200	183333.33	0.0033855	0.003637972	0.930588484556	-46.29481
581	10150	10400	10633	8436	18830.333	4855600	4864600	4966400	4895533.3	0.0038464	0.003637972	1.057301097233	1020.5217
591	757	759	775	891	1654.6667	523200	521100	519400	521233.33	0.0031745	0.003637972	0.872607665209	-241.5654
592	222	220	227	266	489	122400	122200	120600	121733.33	0.004017	0.003637972	1.104180395193	46.137582
593	284	292	306	15	309	70100	70500	70900	70500	0.004383	0.003637972	1.204786380467	52.522997
594	1850	1888	1947	1193	3088	667900	649400	645300	654200	0.0047203	0.003637972	1.297500216046	708.03893
596	164	175	183	269	443	255400	256500	256000	255966.67	0.0017307	0.003637972	0.475730504978	-488.1995
598	69	75	112	144	229.33333	109600	109100	107700	108800	0.0021078	0.003637972	0.579400646041	-166.478

1 SIC CODE	2 E INDUSTRY BY REGION MONTH 1	3 E INDUSTRY BY REGION MONTH 2	4 E INDUSTRY BY REGION MONTH 3	5 CONTACTS INFLUENTIAL DATA	6 AVERAGE MONTHLY E IR	7 E INDUSTRY NATIONAL MONTH 1	8 E INDUSTRY NATIONAL MONTH 2	9 E INDUSTRY NATIONAL MONTH 3	10 AVERAGE MONTHLY E IN	EIR/EIN	11 ER/EN	12 LQI	13 XIR
599	1129	1135	1139	469	1603.3333	280900	295600	286000	287500	0.0055768	0.003637972	1.5329453048 1	557.41648
602	3295	3295	3338	5364	8673.3333	1516700	1514800	1516600	1516033.3	0.0057211	0.003637972	1.572598923874	3158.047
604,605	N/A	N/A	N/A	440	440	49500	49700	50300	49833.333	0.0088294	0.003637972	2.427020393031	258.70774
612	265	266	264	1301	1566	305300	306200	308100	306533.33	0.0051087	0.003637972	1.404283318229	450.84042
614	503	515	521	564	1077	206000	207200	209100	207433.33	0.005192	0.003637972	1.427177019314	322.36341
615	143	137	136	160	298.66667	36600	36100	36600	36433.333	0.0081976	0.003637972	2.253349383731	166.12323
616	79	82	75	477	555.66667	88300	89200	91200	89566.667	0.0062039	0.003637972	1.705330738854	229.82567
621	339	337	327	797	1131.3333	270900	274600	276500	274000	0.004129	0.003637972	1.134960396377	134.5291
628	50	48	53	103	153.33333	60200	60800	61600	60866.667	0.0025192	0.003637972	0.692464869514	-68.09788
631	238	273	266	6	265	541200	540800	540000	540666.67	0.0004901	0.003637972	0.134727721697	-1701.93
632	20	19	20	317	336.66667	148800	150100	151100	150000	0.0022444	0.003637972	0.616949401087	-209.0291
633	21	19	18	0	19.333333	470900	469800	470800	470500	4.109E-05	0.003637972	0.011295040644	-1692.332
636	164	161	167	201	365	43700	44100	44600	44133.333	0.0082704	0.003637972	2.273352706961	204.44418
641	3267	3654	3373	6904	10335.333	493200	496800	497500	495833.33	0.0208444	0.003637972	5.729667964753	8531.5057
651	2068	2089	2105	763	2850.3333	480400	476900	474800	477366.67	0.005971	0.003637972	1.641285938128	1113.6869
653	1223	1240	1307	1192	2448.6667	371400	374700	377600	374566.67	0.0065373	0.003637972	1.796971669065	1086.0037
654	31	31	34	115	147	25000	25500	26000	25500	0.0057647	0.003637972	1.584593394755	54.231722
655	606	606	685	546	1178.3333	113900	112000	114100	113333.33	0.0103971	0.003637972	2.857927372682	766.02988
671	250	264	260	36	294	72200	72100	71700	72000	0.0040833	0.003637972	1.122420321284	32.06604
679	42	41	42	96	137.66667	31600	31300	31500	31466.667	0.004375	0.003637972	1.202593201376	23.191825
701	3371	3851	3868	4292	7988.6667	1098100	1114800	1148700	1120533.3	0.0071293	0.003637972	1.959702771754	3912.1981
702	37	39	42	3	42.333333	12900	13000	13300	13066.667	0.0032398	0.003637972	0.890550067491	-5.20283
703	46	54	57	38	90.333333	14500	14600	15500	14866.667	0.0060762	0.003637972	1.670225535287	36.248821
721	1051	1068	1083	825	1892.3333	354600	352700	352200	353166.67	0.0053582	0.003637972	1.472850342714	607.523
722	37	37	38	203	240.33333	50600	53400	52800	52266.667	0.0045982	0.003637972	1.263949997365	50.188681
723	1098	1118	1145	376	1496.3333	304600	304800	305800	305066.67	0.0049049	0.003637972	1.348261958286	386.50944
724	63	64	69	27	92.333333	22800	22700	22900	22800	0.0040497	0.003637972	1.113177332602	9.3875792
725,9	154	182	205	282	462.33333	173800	186500	192600	184300	0.0025086	0.003637972	0.689557613749	-208.1448
726	174	176	180	197	373.66667	72200	72500	73400	72700	0.0051398	0.003637972	1.412832361295	109.18613
731	588	602	598	434	1030	173600	174900	174900	174466.67	0.0059037	0.003637972	1.622801677931	395.29521
732	336	331	315	325	652.33333	76700	76400	77400	76833.333	0.0084902	0.003637972	2.333783596002	372.81584
733	805	824	750	637	1430	152900	153200	154600	153566.67	0.0093119	0.003637972	2.559645177911	871.32882
734	1843	1935	1883	1063	2950	568000	571700	574000	571233.33	0.0051643	0.003637972	1.419544988828	871.86932
736	3214	3656	3349	1000	4406.3333	726700	734100	764800	741866.67	0.0059395	0.003637972	1.632646557358	1707.4434
737	1838	1814	1843	1127	2958.6667	451700	455700	459600	455666.67	0.0064931	0.003637972	1.784799624691	1300.9642
739	5027	5050	5150	2260	7335.6667	1596900	1609500	1623300	1609900	0.0045566	0.003637972	1.252510499981	1478.8961
751	232	236	235	1398	1632.3333	127000	128300	130000	128433.33	0.0127096	0.003637972	3.493588762531	1165.0965
753	1689	1714	1794	404	2136.3333	385800	392500	398600	392300	0.0054457	0.003637972	1.496895199761	709.15705
754	379	396	417	9	406.33333	74200	79900	80200	78100	0.0052027	0.003637972	1.430118761029	122.20775
762	377	368	390	283	661.33333	86000	85700	86000	85900	0.0076989	0.003637972	2.116254702838	348.83157
763,9	719	732	743	331	1062.3333	181800	182600	184900	183100	0.0058019	0.003637972	1.594825427806	396.22072
764	93	105	104	3	103.66667	23300	23900	24500	23900	0.0043375	0.003637972	1.192290051813	16.719144
781	18	18	18	26	44	98800	100000	103100	100633.33	0.0004372	0.003637972	0.120185342417	-322.1012
782	N/A	N/A	N/A	40	40	10400	10400	10500	10433.333	0.0038339	0.003637972	1.053847077427	2.0438289
783	51	50	63	81	135.66667	98600	96200	98500	97766.667	0.0013877	0.003637972	0.381437189	-220.0057
791,9	1562	1594	1538	251	1815.6667	484700	494600	516700	498666.67	0.003641	0.003637972	1.000844181497	1.5314594
792	274	312	332	44	350	89900	92500	94900	92433.333	0.0037865	0.003637972	1.040830754887	13.730152
793	296	298	304	87	386.33333	105200	107000	107200	106466.67	0.0036287	0.003637972	0.997445582177	-0.989384
794	1035	995	1853	386	1680.3333	58300	60000	61200	59833.333	0.0280836	0.003637972	7.719566832487	1462.6614
801	4494	4030	4041	451	4639.3333	880300	885500	887600	884466.67	0.0052453	0.003637972	1.441832445854	1421.6687
802	1489	1478	1472	174	1653.6667	424200	423100	423200	423500	0.0039048	0.003637972	1.073334884494	112.98566
803	161	158	166	21	182.66667	27900	28100	28400	28133.333	0.0064929	0.003637972	1.784755787012	80.318397
804	463	463	466	269	733	144800	147000	150900	147566.67	0.0049672	0.003637972	1.365388983098	196.15665
805	2184	2163	2196	723	2904	1126200	1127600	1131900	1128566.7	0.0025732	0.003637972	0.707310459227	-1201.694

1	2	3	4	5	6	7	8	9	10		11	12	13
SIC CODE	E INDUSTRY BY REGION MONTH 1	E INDUSTRY BY REGION MONTH 2	E INDUSTRY BY REGION MONTH 3	CONTACTS INFLUENTIAL DATA	AVERAGE MONTHLY E IR	E INDUSTRY NATIONAL MONTH 1	E INDUSTRY NATIONAL MONTH 2	E INDUSTRY NATIONAL MONTH 3	AVERAGE MONTHLY E IN	EIR/EIN	ER/EN	LQI	XIR
806	11347	11138	11057	886	12066.667	3016300	3013700	3012400	3014133.3	0.0040034	0.003637972	1.100437908768	1101.335
807	520	544	543	234	769.66667	109500	109800	110000	109766.67	0.0070118	0.003637972	1.927404591195	370.33864
808	834	847	847	519	1361.6667	182500	183900	185600	184000	0.0074004	0.003637972	2.034200094253	692.27988
809	774	805	840	267	1073.3333	101500	102800	103900	102733.33	0.0104478	0.003637972	2.871864361495	699.59238
811	3072	3081	3076	759	3835.3333	617100	623900	628200	623066.67	0.0061556	0.003637972	1.692034774239	1568.6344
821	18729	18934	18890	56	18907	341500	346200	346500	344733.33	0.0548453	0.003637972	15.07578837478	17652.87
822	2101	2136	2193	905	3048.3333	735100	826000	830200	797100	0.0038243	0.003637972	1.051212055758	148.50611
824	89	90	89	144	233.33333	57300	58900	60400	58866.667	0.0039638	0.003637972	1.089552164327	19.178068
823,829	173	173	169	424	595.66667	65400	66300	67300	66333.333	0.0089799	0.003637972	2.468380819365	354.34788
832	787	806	862	423	1241.3333	272400	278800	282300	277833.33	0.0044679	0.003637972	1.228131173379	230.58354
833	606	591	597	131	729	197300	198800	202400	199500	0.0036541	0.003637972	1.004443043384	3.2246514
835	900	918	957	470	1395	311000	314200	317500	314233.33	0.0044394	0.003637972	1.220288847598	251.82803
836	1030	1060	1070	52	1105.3333	256000	256000	257400	256466.67	0.0043099	0.003637972	1.184685374359	172.31487
839	733	749	742	161	902.33333	224400	226000	226800	225733.33	0.0039973	0.003637972	1.098783156232	81.121861
861	342	345	340	107	449.33333	84900	85700	86700	85766.667	0.005239	0.003637972	1.440093840835	137.31663
862	54	54	50	53	105.66667	37900	37800	37900	37866.667	0.0027905	0.003637972	0.76704636788	-32.09119
863	309	288	324	144	451	134300	137100	136900	136100	0.0033137	0.003637972	0.910875673468	-44.12794
864	1202	1158	1129	249	1412	302600	316000	318000	312200	0.0045227	0.003637972	1.243204246614	276.22524
866	48	48	47	111	158.66667	859500	858000	856600	858033.33	0.0001849	0.003637972	0.050830247585	-2962.834
869	369	362	361	0	364	66000	67500	67700	67066.667	0.0054274	0.003637972	1.491885005286	120.01337
881	845	851	823	0	839.66667				0		0.003637972	0	0
891	1651	1650	1662	1628	3282.3333	581700	583400	589100	584733.33	0.0056134	0.003637972	1.542998550933	1155.09
893	997	1010	1028	1243	2254.6667	382000	392200	392900	389033.33	0.0057956	0.003637972	1.593074979813	839.37442
899	72	84	93	14	97	0	20900	21000	13966.667	0.0069451	0.003637972	1.909060329222	46.189662
912	5513	5643	5710	0	5622	N/A	N/A	N/A	0	-	0.003637972	0	5622
913	8626	8464	8460	0	8516.6667	N/A	N/A	N/A	0	-	0.003637972	-	8516
921	699	712	729	0	713.33333	N/A	N/A	N/A	0	-	0.003637972	-	713
922	1824	1843	1876	0	1847.6667	N/A	N/A	N/A	0	-	0.003637972	-	1847
931	355	390	404	0	383	N/A	N/A	N/A	0	-	0.003637972	-	383
951	38	39	39	0	38.666667	N/A	N/A	N/A	0	-	0.003637972	-	38
953	36	34	38	8	44	N/A	N/A	N/A	0	-	0.003637972	-	44
962	81	82	81	0	81.333333	N/A	N/A	N/A	0	-	0.003637972	-	81
971	9	3	4	0	5.3333333	N/A	N/A	N/A	0	-	0.003637972	-	5

ECONOMIC BASE MODEL COLUMN DESCRIPTION

Column	Heading	Description
1	SIC CODE	Standard Industrial Classification (SIC) code for establishments found within the study area. The three-digit code represents the type of activity in which the establishments are engaged.
2	EMPLOYMENT/INDUSTRY BY REGION, MONTH 1	Florida Department of Labor and Employment Security. Study area employment totals for January 1984.
3	EMPLOYMENT/INDUSTRY BY REGION, MONTH 2	Florida Department of Labor and Employment Security. Study area employment totals for February 1984.
4	EMPLOYMENT/INDUSTRY BY REGION, MONTH 3	Florida Department of Labor and Employment Security. Study area employment totals for March 1984.
5	CONTACTS INFLUENTIAL DATA	Contacts Influential International Corp. Marketing Information Services 3500 East Fletcher Ave., Suite 423 Tampa, FL 33612 The figures shown represent the average annual employment, in 1984, for those establishments with headquarters located outside of the study area, and those establishments otherwise not included in the Florida Department of Labor and Employment Security employment totals.
6	AVERAGE MONTHLY EIR	The derivation is as follows: $\frac{\text{EIR, Month 1 + EIR, Month 2 + EIR, Month 3}}{3}$ + Contacts Influential (CI) Data
7	EMPLOYMENT/INDUSTRY BY NATION, MONTH 1	U.S. Department of Labor, Bureau of Labor Statistics. National employment totals for January 1984.
8	EMPLOYMENT/INDUSTRY BY NATION, MONTH 2	National employment totals for February 1984.
9	EMPLOYMENT/INDUSTRY BY NATION, MONTH 3	National employment totals for March 1984.

Column	Heading	Description
10	AVERAGE MONTHLY EIN	The derivation is as follows: $\frac{\text{EIN, Month 1} + \text{EIN, Month 2} + \text{EIN, Month 3}}{3}$
11	ER/EN	$\frac{\text{Total Employment Region (Study Area)}}{\text{Total Employment Nation}}$ $\frac{333,391}{91,637,000} = .0036379$
12	LQI	Location Quotient for Industry "I". The derivation is as follows: $\frac{EIR}{EIN} / \frac{ER}{EN}$
13	XIR	Exogenous or Export Employment. The derivation is as follows: $XIR = \left[\frac{EIR}{EIN} - \frac{ER}{EN}\right] EIN$

APPENDIX B

APPENDIX B

Summary of Study Area
SICs by Major Group

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 01. Agricultural production - crops				
016	Vegetables and Melons		10.	2462
017	Fruits and Tree Nuts	.39		0
018	Horticulture Specialties		3.0	799
MAJOR GROUP 02. Agricultural production--livestock				
024	Dairy Farms		1.5	56
MAJOR GROUP 07. Agricultural services				
072	Crop Services		2.1	267
074	Veterinary Services		1.1	51
075	Animal Services	.60		0
076	Farm Labor and Management	.55		0
078	Landscape and Horticulture Services		2.2	671
MAJOR GROUP 09. Fishing, hunting, and trapping				
091	Commercial Fishing		2.7	86
MAJOR GROUP 13. Oil and gas extraction				
138	Oil and Gas Field Services	.02		0
MAJOR GROUP 14. Mining of nonmetallic minerals				
147	Chemical and Fertilizer Mineral Mining		14.	1036
MAJOR GROUP 15. Building construction				
152	Residential Building Contractors		1.5	987
153	Operative Builders		1.2	63
154	Nonresidential Building Contractors		1.7	1200

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 16. Construction other than building construction				
161	Highway and Street Construction		1.1	122
162	Heavy Construction		1.6	1153
MAJOR GROUP 17. Construction--special trade contractors				
171	Plumbing, Heating, Air Conditioning		2.0	1932
172	Painting and Decorating		1.7	320
173	Electrical Work		2.0	1563
174	Masonry, Tile Setting		2.0	1150
175	Carpentering		1.3	135
176	Roofing and Sheet Metal		2.0	602
177	Concrete Work		1.3	118
178	Water Well Drilling		1.0	1
179	Misc. Special Trade		1.6	753
MAJOR GROUP 20. Food and kindered products				
201	Meat Products	.13		0
203	Canned and Preserved Fruits and Vegetables		4.48	2599
204	Grain Mill Products	.02		0
205	Bakery Products	.60		0
208	Beverages	.93		0
209	Misc. Food Preparations		2.36	806
MAJOR GROUP 21. Tobacco manufactures				
212	Cigars		31.	615

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 23. Apparel from fabrics				
232	Men's and Boy's Clothing	.58		0
233	Women's Outerwear	.47		0
239	Misc. Fabricated Textile	.52		0
MAJOR GROUP 24. Lumber and wood products				
243	Millwork		1.2	160
245	Wood Buildings & Mobile Homes		1.8	221
249	Misc. Wood Products	.37		0
MAJOR GROUP 25. Furniture and fixtures				
251	Household Furniture	.27		0
254	Fixtures and Partitions	.30		0
MAJOR GROUP 26. Paper and allied products				
264	Paper Products	.56		0
265	Paper Boxes & Containers		1.1	85
MAJOR GROUP 27. Printing and publishing				
271	Newspapers: Publishing		2.3	2118
272	Periodicals: Publishing		1.4	163
273	Books	.09		0
274	Misc. Publishing		1.0	5
275	Commercial Printing		1.3	656
279	Service Industries for Printing	.84		0

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 28. Chemical and allied products				
284	Soap and Cosmetics Preparations	.37		0
285	Paint and Varnish Products	.98		0
287	Agriculture Chemicals		1.5	121
289	Misc. Chemical Products	.20		0
MAJOR GROUP 29. Petroleum refining and related industries				
295	Paving and Roofing Materials	.97		0
MAJOR GROUP 30. Rubber and miscellaneous products				
306	Rubber Products	.15		0
307	Misc. Plastic Products	.54		0
MAJOR GROUP 32. Stone, clay, glass, and concrete products				
321	Flat Glass		6.7	335
322	Glassware	.49		0
325	Clay Products		1.3	43
327	Concrete and Plaster Products		1.0	58
329	Misc. Nonmetallic Mineral Products	.97		0
MAJOR GROUP 33. Primary metal industries				
331	Steel Products	.15		0
MAJOR GROUP 34. Fabricated metal products				
341	Metal Cans and Containers		1.5	131
342	Hardware	.05		0
344	Fabricated Structural Metal Products		1.1	302
345	Screw Machine Products	.04		0

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
347	Metal Services	.38		0
349	Misc. Fabricated Metal Products	.67		0
MAJOR GROUP 35. Machinery				
352	Farm and Garden Machinery	.13		0
353	Construction Machinery	.15		0
354	Metal Working Machinery	.28		0
355	Special Industry Machinery	.50		0
356	General Industrial Machinery	.25		0
357	Office & Computing Machines	.10		0
359	Misc. Machinery Machines	.55		0
MAJOR GROUP 36. Electrical and electronic machinery				
366	Communication Equipment	.18		0
367	Electronic Components	.64		0
369	Misc. Electrical Equipment	.96		0
MAJOR GROUP 37. Transportation equipment				
371	Motor Vehicles & Equipment	.13		0
372	Aircraft and Parts	.07		0
373	Ship & Boat Building & Repairing		3.9	2166
379	Misc. Transportation Equip.	.47		0
MAJOR GROUP 38. Measuring, analyzing, and controlling equipment				
381	Engineering & Scientific Instruments		1.3	94

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 39. Miscellaneous manufacturing industries				
391	Jewelry and Silverware	.23		0
394	Toys and Sporting Goods	.53		0
395	Office Supplies		1.0	4
399	Misc. Manufactures		1.1	62
MAJOR GROUP 40. Railroad transportation				
401	Railroads	.38		0
MAJOR GROUP 41. Local and suburban transit				
411	Local Transportation		2.2	371
412	Taxicabs		1.0	10
413	Intercity Highway Transportation		1.1	25
MAJOR GROUP 42. Motor freight transport and warehousing				
421	Trucking, Local & Long Distance	.80		0
422	Public Warehousing		1.9	294
MAJOR GROUP 44. Water transportation				
445	Local Water Transportation		5.7	477
446	Water Transportation Services		2.4	521
MAJOR GROUP 45. Transportation by air				
452	Noncertified Air Transportation	.05		0
458	Air Transportation Services		1.0	19

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 47. Transportation services				
471	Freight Forwarding		1.7	147
472	Arrangement of Transportation		1.2	131
MAJOR GROUP 48. Communication				
481	Telephone Communication		1.6	1713
483	Radio & Television Broadcasting		1.5	445
489	Communication Services	.96		0
MAJOR GROUP 49. Electric, gas, and sanitary services				
491	Electric Services		2.8	2901
492	Gas Production and Distribution	.21		0
495	Sanitary Services		2.6	316
MAJOR GROUP 50. Wholesale trade--durable goods				
501	Motor Vehicles & Automotive Equip.		1.1	157
502	Furniture and Home Furnishings		1.7	323
503	Lumber and Construction Materials		2.4	1046
504	Sporting Goods and Toys	.68		0
505	Metals and Minerals		1.5	278
506	Electrical Goods	.93		0
507	Hardware and Plumbing Equipment		1.4	381
508	Machinery Equipment and Supplies		1.4	2347
509	Misc. Durable Goods		1.5	356

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 51. Wholesale trade--nondurable goods				
511	Paper and Paper Products		1.5	337
512	Drugs and Sundries	.38		0
513	Apparel and Notions	.37		0
514	Groceries and Related Products		1.8	2038
515	Farm-Product Raw Materials	.11		0
516	Chemicals and Allied Products		1.0	30
517	Petroleum and Petroleum Products	.99		0
518	Beer, Wine and Distilled Beverages		2.4	807
519	Misc. Nondurable Goods	.96		0
MAJOR GROUP 52. Building materials, hardware, mobile home dealers				
521	Lumber and Other Building Materials	.54		0
523	Glass and Paint Stores		1.3	89
525	Hardware Stores		1.3	189
526	Retail Nurseries & Garden Stores		2.5	253
527	Mobile Home Dealers		1.2	28
MAJOR GROUP 53. General merchandise stores				
531	Department Stores	.90		0
533	Variety Stores		1.8	588
539	Misc. General Merchandise Stores	.14		0
MAJOR GROUP 54. Food Stores				
541	Grocery Stores	.56		0
542	Meat Markets	.66		0
543	Fruit and Vegetable Stores		1.2	17

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
544	Candy and Nut Stores	.47		0
545	Dairy Products		2.3	179
546	Retail Bakeries		1.2	148
549	Misc. Food Stores		1.0	7
MAJOR GROUP 55. Automotive dealers, service stations				
551,2	New and Used Car Dealers		1.2	669
553	Auto Supply Stores		1.2	259
554	Gasoline Service Stations		1.0	44
555	Boat Dealers		4.0	265
556,9	Recreation & Utility Trailer Dealers		1.5	47
557	Motorcycle Dealers		1.1	12
MAJOR GROUP 56. Apparel and accessory stores				
561	Men's and Boy's Clothing	.80		0
562	Women's Clothing Stores		1.5	630
564	Children's & Infant's Wear Stores	.51		0
565	Family Clothing Stores	.57		0
566	Shoe Stores	.83		0
569	Misc. Apparel and Accessories		2.5	274
MAJOR GROUP 57. Furniture and home furnishings				
571	Furniture Stores		1.5	784
572	Household Appliance Stores		1.2	65
573	Radio, Television & Music Stores	.93		0
MAJOR GROUP 58. Eating and drinking places				
581	Eating and Drinking Places		1.0	1020

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 59. Miscellaneous retail				
591	Drug Stores	.87		0
592	Liquor Stores		1.1	46
593	Used Merchandise Stores		1.2	52
594	Misc. Shopping Goods Stores		1.2	708
596	Nonstore Retailers	.47		0
598	Fuel and Ice Dealers	.57		0
599	Retail Stores		1.5	557
MAJOR GROUP 60. Banking				
602	Commercial Banks		1.5	3158
604,5	Trust Companies		2.4	259
MAJOR GROUP 61. Credit agencies				
612	Savings and Loans		1.4	451
614	Personal Credit Institutions		1.4	322
615	Business Credit Institutions		2.2	166
616	Mortgage Bankers and Brokers		1.7	230
MAJOR GROUP 62. Security and commodity brokers				
621	Security Brokers and Dealers		1.1	134
628	Security and Commodity Services	.69		0
MAJOR GROUP 63. Insurance				
631	Life Insurance	.13		0
632	Medical Service & Health Insurance	.61		0
633	Fire, Marine & Casualty Insurance	.01		0
636	Title Insurance		2.2	204

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 64. Insurance Agents				
641	Insurance agents		5.7	8531
MAJOR GROUP 65. Real Estate				
651	Real Estate Operators		1.6	1114
653	Real Estate Agents		1.7	1086
654	Title Abstract Offices		1.5	54
655	Subdividers & Developers		2.8	766
MAJOR GROUP 67. Holding and other investing offices				
671	Holding Offices		1.1	32
679	Misc. Investing		1.2	23
MAJOR GROUP 70. Hotels, and other lodging places				
701	Hotels and Motels		1.9	3912
702	Rooming & Boarding Houses	.89		0
703	Camps and Trailer Parks		1.6	36
MAJOR GROUP 72. Personal services				
721	Laundry Services		1.4	607
722	Photographic Studies		1.2	50
723	Beauty Shops		1.3	386
724	Barber Shops		1.1	9
725,9	Shoe Repair, & Misc. Services	.68		0
726	Funeral Services		1.4	109

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 73. Business services				
731	Advertising		1.6	395
732	Credit Reporting & Collection		2.3	373
733	Mailing & Reproduction Services		2.5	871
734	Services to Buildings		1.4	872
736	Personnel Supply Services		1.6	1707
737	Computer Services		1.7	1301
739	Misc. Business Services		1.2	1479
MAJOR GROUP 75. Automotive repair, services				
751	Automotive Rentals		3.4	1165
753	Automotive Repair		1.4	709
754	Automotive Services		1.4	122
MAJOR GROUP 76. Miscellaneous repair services				
762	Electrical Repair Shops		2.1	349
763,9	Watch, Clock, Misc. Repair		1.5	396
764	Furniture Repair		1.1	17
MAJOR GROUP 78. Motion pictures				
781	Motion Picture Production	.12		0
782	Motion Picture Distribution		1.0	2
783	Motion Picture Theaters	.38		0

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 79. Amusement and recreation services				
791,9	Dance Halls, Studios, Misc. Amusement Services		1.0	1
792	Producers and Entertainers		1.0	14
793	Bowling and Billiard Establishments	.99		0
794	Commercial Sports		7.7	1463
MAJOR GROUP 80. Health services				
801	Offices of Physicians		1.4	1422
802	Offices of Dentists		1.0	113
803	Offices of Osteopathic Physicians		1.7	80
804	Offices of Other Health Practitioners		1.3	196
805	Nursing and Personal Care Facilities	.70		0
806	Hospitals		1.1	1101
807	Medical and Dental Labs		1.9	370
808	Outpatient Care Facilities		2.0	692
809	Health and Allied Care Services		2.8	700
MAJOR GROUP 81. Legal services				
811	Legal Services		1.6	1569
MAJOR GROUP 82. Educational services				
821	Elementary and Secondary Schools		15.	17,653
822	Colleges and Universities		1.0	148
824	Vocational Schools		1.0	19
823,9	Libraries and Educational Services		2.4	354

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMEN
MAJOR GROUP 83. Social services				
832	Individual and Family Services		1.2	231
833	Job Training Services		1.0	3
835	Child Day Care Services		1.2	252
836	Residential Care		1.1	172
839	Social Services		1.0	81
MAJOR GROUP 86. Membership organizations				
861	Business Associations		1.4	137
862	Professional Organizations	.76		0
863	Labor Organizations	.91		0
864	Civic and Social Associations		1.2	276
866	Religious Organizations	.05		0
869	Membership Organizations		1.4	120
MAJOR GROUP 88. Private households				
881	Private Households	N/A	N/A	N/A
MAJOR GROUP 89. Miscellaneous services				
891	Engineering & Architectural Services		1.5	1155
893	Accounting Services		1.5	839
899	Miscellaneous Services		1.9	46

		LQI IMPORT	LQI EXPORT	EXPORT EMPLOYMENT
MAJOR GROUP 91-97. Public administration				
912	Legislative Bodies	-	-	5622
913	Executive & Legislative Combined	-	-	8516
921	Courts	-	-	713
922	Public Order & Safety	-	-	1847
931	Finance & Taxation	-	-	383
951	Environmental Quality	-	-	38
953	Housing & Urban Development	-	-	44
962	Transportation	-	-	81
971	National Security	-	-	5
		TOTAL EXPORT EMPLOYMENT		127,323

TAMPA BAY REGIONAL PLANNING COUNCIL STAFF

Bruce R. Belrose	Executive Director
Julia E. Greene	Asst. Director, Planning & Policy Development
Manny L. Pumariega	Asst. Director, Administration & Finance
Sheila C. Benz	Asst. Director, Policy Management
Mary G. Wiser	Director, Public Information

Douglas E. Robison	Program Manager
Michael J. Perry	Program Manager
JoAnn Finley	Program Manager
* Richard W. MacAulay	Project Manager
Peter A. Clark	Project Manager
R. Marshall Flynn	Planner
Patricia J. Boss	Secretary
Bruce R. Gaul	Graphics Production Manager
Clark H. Allard	Pressman

Technical assistance was provided, in part, by Dr. Eila Hanni, Ph.D., Associate Professor of Economics, University of South Florida

* Responsible for Report Preparation

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