PORT OF FORT PIERCE MASTER DEVELOPMENT PLAN

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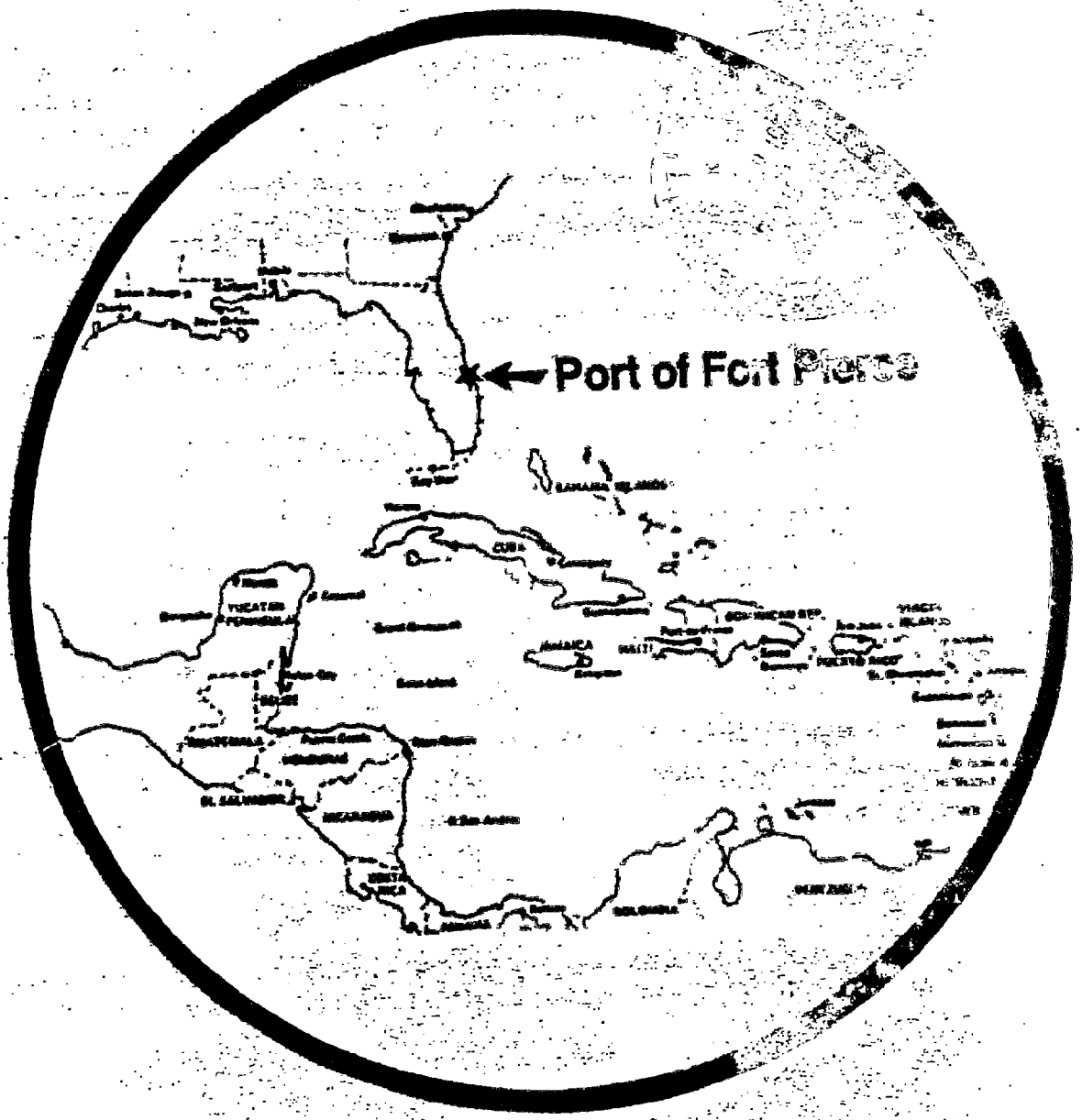
MASTER
DEVELOPMENT PLAN



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CH2M HILL

September 1986

FIGURES

FIGURES

EXECUTIVE SUMMARY

This master development plan responds to the requirement for long term comprehensive planning by local governments within the State of Florida. Due to potential for regional impact from a broad range of port development activities, local governments must prepare port master plans as part of their long term comprehensive plans. Successful completion of such plans should exempt the in-water harbor facilities from Development of Regional Impact (DRI) review.

St. Lucie County is one of the most unemployment-distressed areas in the nation. The Port of Fort Pierce represents a potentially important economic resource for the county. The present port is mostly undeveloped with a 25-foot deep channel serving smaller or partially loaded ships. The Fort Pierce Port and Airport Authority desires to deepen and widen the channel in order to serve the deeper draft vessels that increasingly carry the ocean-going trade. The Governor of Florida has encouraged this proposal by the county, but has insisted on careful planning so that the surrounding economically distressed area can benefit fully from the proposed port improvements. The Board of Engineers for Rivers and Harbors, U.S. Army Corps of Engineers, has recently approved a study to deepen and widen the existing navigation channel from 25 to 28 feet and to make other navigation improvements. An additional concern is that port development activities be accomplished in an environmentally sound manner with minimal adverse effects.

The Fort Pierce Port and Airport Authority has been financially assisted in the preparation of this port development master plan by the Department of Community Affairs (DCA) through a Federal Coastal Zone Management Grant from the Department of Environmental Regulation (DER). The additional matching funds were provided by the Authority and other local interests.

The St. Lucie County economy, current development policies and plans, and the contribution that the port improvement program might make towards the county's development strategy were examined in detail. St. Lucie County is one of the fastest growing areas in the United States. Population increased by nearly 40 percent between 1980 and 1985 with a forecasted continued growth of nearly 60 percent more by the year 2000. Compared to recently experienced growth, this projection may in fact prove to be conservative. The completion of I-95 in late 1987 with the potential for a high speed rail station in the vicinity, approximately two years later, should provide the impetus for additional accelerated growth. In contrast to the population growth being experienced, employment growth was only 20 percent

between 1980 and 1984. The manufacturing sector accounts for only 6 percent of county employment compared to 11 percent for the State of Florida.

Local economic development and comprehensive plan policies were examined for the Treasure Coast Regional Planning Council; St. Lucie, Indian River, and Martin Counties; and for Fort Pierce, Port St. Lucie and Vero Beach. Each local government's adopted comprehensive plan supports diversification of the economic base. The various plans recognize that their particular local economies are dependent upon a few economic sectors, generally construction, tourism/retirement, government, and agriculture. Each supports diversification of the economic base, but not at the expense of the existing economic base. Most reflect the desire to increase or stimulate additional light industrial-type activities and to encourage activities that will moderate cyclical fluctuations. The desired goal of a diversified economic base is well supported among all the local governments. The Treasure Coast Regional Planning Council has adopted policy positions that support diversification of the region's economic base. The Council specifically addressed two policy areas related to economic diversification: expansion of economic opportunities and expansion of imported and exported commodities.

The study area, particularly St. Lucie and Indian River Counties, has experienced unemployment rates that have been substantially higher than those of the State over the past few years. Regional employment is forecast to increase by approximately 450 jobs as a result of the port improvement program. Further, the type of skill/education level of potential opportunities that may develop has a strong relationship to those exhibited in St. Lucie County and the 250 new direct employment jobs would be in high paying job categories.

A forecast was developed for potential commodity flows through an improved port at Fort Pierce and serves as the basis for the conceptual development plan and the estimated economic impacts presented herein. Commodity data analysis focuses on the types of commodities and trading partners of the six Florida ports located on the Atlantic coast. Survey information was obtained from the region's manufacturers, the Florida citrus processors, the Latin American shipping companies, the competing port authorities, and the federal and state officials concerned with economic development in Florida and the Caribbean basin.

Of 75 local industries and manufacturers in the surrounding six-county area, the 40 largest were interviewed. Fourteen indicated that they currently ship or receive goods through Florida ports. A number of companies expressed interest in using the Port of Fort Pierce, if the level of service and cost were at least equivalent to their current ports of use.

Interviewed companies identified the following nine types of cargo with good potential for shipment through the Port of Fort Pierce: plastic pipe, fertilizers, pleasure boats, animal feed, building materials, agricultural products, granite, gypsum, cement. The following five commodity groups had previously been identified by the Treasure Coast Regional Planning Council: sugar and related products, heavy equipment, fuel, consumer products and paper products. The most common need expressed by the region's manufacturers was for regular service to Caribbean countries similar to that provided at the Ports of Palm Beach and Miami. Expanded port facilities at the Port of Fort Pierce would potentially benefit a number of local industries and manufacturers currently involved in foreign trade. Regularly scheduled service to Caribbean countries would appear to serve a larger number of local shippers than would services to Europe, the Middle East, or Asia.

The foreign trade of fresh citrus products includes fresh citrus, citrus concentrate, and citrus pulp and pellets. The export of fresh citrus, especially grapefruit to Japan, is a large potential market for the Port of Fort Pierce. Commercial exports of fresh citrus grapefruit from the Indian River, Martin and St. Lucie County area accounted for 91 percent on average of the State of Florida exports of fresh citrus over the period 1978 through 1983. Yet facilities at the Port of Fort Pierce handled only 23 percent of these exports. Thus, there appears to be an opportunity for nearly tripling fresh citrus exports through the Port of Fort Pierce. There appear to be additional such opportunities associated with the export of citrus pulp and pellets.

Commodity trade data for the Port of Fort Pierce reflects that fresh citrus has been the primary export commodity and aragonite has been the primary import commodity. The major commodity groups expected to move through an improved Port of Fort Pierce are expected to be: imports of Caribbean, South American, and Central American produced commodities, particularly fruits and vegetables; exports of fertilizers, animal feeds, building materials, and consumer products to the Caribbean, South America, and Central America; exports of fresh citrus produced in the region; imports of building materials such as lumber, cement, granite and gypsum; more speculative imports of other commodities may include newsprint, coffee, bananas, iron and steel products, motor vehicles, coal, fertilizers and machinery.

The general cargo market for Florida is estimated by the year 2000 to be about 6 million tons per year compared to approximately 5 million tons currently. A market share of approximately 5 percent of this cargo appears to be a realistic goal for the Port of Fort Pierce in comparison to the market shares of the more established Florida ports. This would result in approximately 300,000 tons per year of

general cargo by the late 1990s. The market for bulk and break-bulk cargo appears to be about 5.6 million tons per year currently, and is not expected to increase significantly. A realistic expectation of about a 5 percent market share would result in a trade of approximately 300,000 tons per year of bulk or break-bulk cargo through the Port of Fort Pierce.

An estimate has been made of the economic impacts of the proposed Port of Fort Pierce improvement program on the surrounding six-county area of St. Lucie, Indian River, Martin, Highland, Glades, and Okeechobee Counties. The economic impacts are categorized as to what the port improvements might contribute to the area in terms of value of output (sales), income (payroll), and employment. The total impacts are a combination of those that are direct, indirect and induced. The direct economic impacts of the proposed port improvement program are: $38.4 million in sales, $7.7 million in payroll, and 309 jobs. Approximately 250 new direct employment jobs are forecast for the region based on current employment estimates. The greatest relative impact is forecast to be employment in the port and terminal service sector. When indirect and induced impacts are included the total resulting economic impacts are $65.7 million in sales, $12.6 million in payroll, and 540 total jobs in the six-county study region of which approximately 450 jobs are new ones.

For the purpose of this plan, the Port of Fort Pierce is considered to consist of mainland between the north and south A1A bridges, shoreward to the Florida East Coast Railroad mainline. Most of the area is currently zoned Marine Industrial and Industrial. Current and planned uses include marine cargo terminals, fruit packing houses, marinas, boatyards, a small tank farm, a park, charter and fishing boat docking, and water front restaurants. Approximately 87 acres of undeveloped land, in private ownership, is the focus of the analysis of port development alternatives. Considering current, projected and potential growth in St. Lucie County and the experience of waterfront areas elswhere in Florida, it is unlikely that the site will remain undeveloped; its use will inevitably determine the future of the Port of Fort Pierce.

The site is well shaped for port development, generally rectangular with extensive waterfront adjacent to the deepwater turning basin, Indian River/Intracoastal Waterway, and Taylor Creek. Based on the economic analysis of this project and evaluation of regional trends, several potential uses appear feasible for one or more of the development sites, including: general cargo terminal, roll-on/roll-off terminal, dry bulk terminal, cruise and charter vessel terminal, boatyard/marina, and multi-use dock for fishing boats, tugs, pilot and police boats. Infrastructure necessary to support port

development is generally in place. Water, sewer and electrical services are provided to the port area by the Fort Pierce Utility Authority. Water and sewer systems are presently operating at about one-half of their rated capacity. Little demand for water and sewer services would be generated by initial development of port facilities. Potential port related electrical demand does not appear to pose any significant demand for local generating capacity. Total increased demand would likely be minimal compared to non-port related increases in residential, commercial and industrial development throughout the general area.

The inland transportation road net serving the port area is in place and considered adequate at present. Potential problem areas do exist along several of the routes which are operating near capacity. There is recognition by both the City and County that these and other traffic problem areas will be exacerbated by overall growth in the area over the next several years, and improvement projects are underway, planned and proposed. The estimated port related traffic generation of less than 20 vehicle trips per development-acre per day appears acceptable.

Having considered the various development alternatives available to the Port of Fort Pierce a phased plan for facilities development was established. Since the Fort Pierce Port and Airport Authority owns no real estate in the Port of Fort Pierce area proper, the first requirement is to acquire the available undeveloped real estate within the port area which is in private ownership. In order for this development plan to succeed it is essential that these undeveloped waterfront properties be brought under public ownership and control to preclude their development for other than port related purposes and to insure the ultimate establishment of a viable, operating port at Fort Pierce. It is recommended that the phased development be accomplished in two five year increments. Within the first five years after approval of this plan a general cargo facility consisting basically of 700 feet of marginal wharf, a RO/RO platform and 20 acres of backland storage area should be established. The estimated Phase 1 cost is $7,770,000. Phase 2 facilities development, to be accomplished during the second five year period, should consist of establishment of an additional 700 feet of marginal wharf, a second RO/RO platform, and an additional 15 acres of backland storage area. The estimated Phase 2 cost is $6,778,000. It is also recommended that a bulk cargo facility be established. Such a facility is not reflected within the recommended phasing plan as it is more dependent upon the timing of the requirement as well as availability of funding. This facility should consist of 550 feet of bulkhead and related improvements. The cost is estimated at $3,105,000. It is planned that the operating tenant would provide paving, infrastructure, and equipment to meet his

specific needs. Additional facilities should be established on the remaining undeveloped port properties in accordance with this master development plan, as requirements occur and funds can be made available. The cost estimates provided are exclusive of land acquisition costs.

The costs of the channel deepening program will be financed jointly by the Fort Pierce Port and Airport Authority and the U.S. Army Corps of Engineers. The responsibility for financing the port improvement program rests with the Fort Pierce Port and Airport Authority. It is specifically recommended that the Phase 1 and 2 General Cargo Terminals and the bulk handling facility be financed by the Fort Pierce Port and Airport Authority. Remaining development of port facilities can be financed by a combination of Authority funding, grant funding, and private investment.

Management of the Port of Fort Pierce falls within the jurisdiction of Fort Pierce Port and Airport Authority, composed of the five county commissioners of St. Lucie County. The majority of U.S. Port Authorities are appointed governing bodies. It would appear to be more in the public interest for Authority members to be appointed to their respective positions in order to provide a single-purposed governing body relatively detached from the pressing demands and other primary responsibilities associated with elected positions. This master development plan recommends this change and suggests either a five or seven member Authority, consisting of members appointed to their positions by the St. Lucie County Commission, the City of Fort Pierce, and the City of Port St. Lucie.

In order to assure that the port development could take place in an environmentally sound manner with minimal adverse effects, a detailed environmental analysis was conducted. The following potential environmental impacts or effects have been addressed: estuarine, hydraulics, dredging/water quality, flooding, seagrasses, wormrock reef, beach and nearshore reef communities, sea turtles, manatees, fishery resources, aquatic bird habitat and others. Appropriate mitigation measures are considered and environmental monitoring guidelines are recommended. Effects of the recommended improvements appear to be minimal at this time.

Adoption and implementation of the proposed Port of Fort Pierce Master Development Plan is recommended. In view of the continued dynamic growth of the St. Lucie County and surrounding area with its attendant ever-changing conditions, it is recommended that this plan be reviewed for consistency on an annual basis by the Fort Pierce Port and Airport Authority and updated as appropriate.

Chapter 1
PLAN PURPOSE

The primary purpose of this port development master plan is to respond to the requirement for long term comprehensive planning by local governments within the State of Florida. In view of the fact that a broad range of port development activities may have substantial regional impact, the 1985 Florida legislature amended Chapter 163, Florida Statutes, to include provisions requiring port master plans as part of local government comprehensive plans. If a port successfully prepares a comprehensive port master plan in compliance with criteria established by the Department of Community Affairs (DCA), then the in-water harbor facilities within the port will be exempt from Development of Regional Impact (DRI) review.

St. Lucie County has recently been designated as one of the most unemployment-distressed areas in the nation. The Port of Fort Pierce represents a potentially important economic resource for the county. At present the port is mostly undeveloped, with a 25-foot-deep channel, and serves smaller or partially loaded ships. The Port Authority desires to deepen and widen the channel so that the port can serve the deeper-draft vessels that increasingly carry the ocean-going trade. The Governor of Florida has encouraged this proposal by the county, but has insisted on careful planning so that the surrounding economically distressed area can fully benefit from the proposed port improvements. The U.S. Army Corps of Engineers has recently completed a study to deepen the existing navigation channel from 25 feet to 28 feet and make other navigation improvements. An additional concern is that port development activities be accomplished in an environmentally sound manner with minimal adverse effects.

In 1985, the DCA entered into an agreement with the Fort Pierce Port and Airport Authority to financially assist the Authority with preparation of a port development master plan. Supporting funding was provided through a Federal Coastal Zone Management Grant from the State of Florida Department of Environmental Regulation (DER). Additional matching funds were provided by the Authority, the St. Lucie County Chamber of Commerce, the Growth Opportunity (GO) Team, Inc., port property owners, and other interests.

Chapter 2
HISTORICAL PERSPECTIVE

The Port of Fort Pierce is a deepwater Port centrally located on Florida's Atlantic Coast. It is situated approximately midway between Port Canaveral, 70 miles north, and the Port of Palm Beach, 60 miles south. The port facilities are limited, largely undeveloped, and primarily in private ownership. A Roll on-Roll off (RO/RO) capability is provided at the City Wharf. The Indian River Terminal Company facilities, while primarily for seasonal citrus operation, can accommodate general and refrigerated cargo. There is also a limited bulk materials handling facility operated by Marcona Ocean Industries.

For the purposes of this plan the Port of Fort Pierce is geographically considered to consist of an area of approximately 163 acres bounded on the north and south by the Highway A1A Bridges, on the west by the Florida East Coast Railroad (FEC) and on the east by the Indian River which is part of the Atlantic Intracoastal Waterway (AIWW). Of the total area approximately 87 acres adjacent to the AIWW and Taylor Creek Waterfronts remain undeveloped and are the subject of the proposed development planning recommended by this Port development master plan.

The AIWW connects Jacksonville to Miami with a federally authorized and maintained channel 12 feet deep and 125 feet wide from Jacksonville to Stuart, 19 miles south of Fort Pierce, and 10 feet deep and 125 feet wide from Stuart to Miami.

Fort Pierce Port is connected to the Atlantic Ocean shipping lanes, a distance of 3 miles, through the Fort Pierce Inlet. The existing Federal Navigation Project provides an entrance channel 350 feet wide by 27 feet deep, an interior channel 200 feet wide by 25 feet deep, and a turning basin 900 feet by 1600 feet by 25 feet deep.

A study of Fort Pierce Harbor was conducted by the U.S. Army Corps of Engineers, Jacksonville District, at the requests of local interests that felt if the harbor were deepened, existing commodities could transit the waterways at greater drafts, thereby resulting in reduced shipping costs. It is believed that deeper harbor depths would enable the Fort Pierce Port to be more competitive with other Florida Ports thereby providing a more economical movement of commodities to and from the Fort Pierce Tributary area. The study was completed in March 1986 by the Jacksonville District and forwarded to the Board of Engineers for Rivers and Harbors with the recommendation that the existing entrance channel be enlarged to a depth of 30 feet and a width of 400 feet, the interior channel be deepened to 28 feet and widened to

250 feet, and the turning basin enlarged to 1,100 feet square and 28 feet deep. It also recommended the provision of an access channel 1,250 feet long, 250 feet wide and 28 feet deep immediately north of the existing terminal area.

The Board concurred in the recommendation of the District Engineer and reporting officers and on June 25, 1986, forwarded their recommendation for approval to the Chief of Engineers, U.S. Army. The Office of the Chief of Engineers subsequently provided copies of the reports to the State of Florida and appropriate Federal Agencies for review and comment prior to forwarding to Congress for Project authorization and funding.

PORT OF FORT PIERCE

MASTER

DEVELOPMENT PLAN

FORT PIERCE PORT AND AIRPORT AUTHORITY

Jim Minix
Chairman

Jack Kreiger
Vice Chairman

R. Dale Trefelner
Commissioner

E. E. Green
Commissioner

Havert L. Fenn
Commissioner

Curtis King
Port and Airport Manager

Eric Rennison
Chairman, Seaport Advisory Committee

Larry K. O'Dell
Project Manager

R. Paul Darst
DCA Project Manager

PREFACE

This report documents the Port of Fort Pierce Master Development Plan prepared for the Fort Pierce Port and Airport Authority by CH2M HILL, a consulting firm of engineers, planners, economists, and scientists. Subconsultants participating in preparation of this report were:

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CONTENTS

TABLES

TABLES

Chapter 3
ECONOMICS

INTRODUCTION

This chapter presents the economic analysis related to the Port of Fort Pierce Master Development Plan. The economic issues include:

- o A demographic overview of the St. Lucie County economy
- o A summary of current regional, county, and city development policies and plans
- o The contribution that the port improvement program might make toward St. Lucie County's development strategy
- o A forecast of potential commodity flow and port users
- o Estimates of the net economic impacts of the recommended port improvements

ST. LUCIE COUNTY ECONOMIC DEVELOPMENT

Introduction

This section presents an overview of the St. Lucie County economy, the current development policy and plans, and the contribution that the port improvement program might make toward the County's development strategy. Information presented in this section was obtained from published sources, primarily a report prepared in 1984 by the Treasure Coast Regional Planning Council, and interviews with local officials familiar with the economic development programs in the study area.

Overview of St. Lucie County Economy

According to the statistics provided by the Growth Opportunity (GO) Team, Inc., St. Lucie County is one of the fastest growing areas in the United States. The GO team is St. Lucie County's economic development organization and was created in 1977 for purposes of industrial and business development.

An example of the tremendous growth experienced in the County is shown in Table 3-1. Population has increased by nearly 40 percent between 1980 and 1985, and this growth is expected to continue with population forecast to increase nearly 60 percent more by the year 2000. As shown in Table 3-1, nearly 5,000 new residents per year are forecast through the

year 2000. Compared to recently experienced growth this projection may in fact turn out to be too conservative. The completion of I-95 in late 1987 and the potential for a high speed rail station in the vicinity approximately two years later should provide the impetus for additional accelerated growth.

Labor force statistics for years 1980 through 1984 are presented in Table 3-2. As shown in this table, employment has grown roughly 20 percent between 1980 and 1984. The manufacturing sector accounts for 6 percent of county employment compared to 11 percent for the State of Florida.

Table 3-1
ST. LUCIE COUNTY
POPULATION STATISTICS
1960-2000

	St. Lucie County		
	Population	Net Increase	Percent Increase
Historical			
1960	39,294	-	-
1970	50,836	11,542	29
1980	87,182	36,346	71
1985	121,416	34,234	39
Projected			
1990	142,800	21,384	18
1995	167,500	24,700	17
2000	191,800	24,300	15

Source: GO Team, Inc., 1986.

Table 3-2
ST. LUCIE COUNTY EMPLOYMENT TRENDS

	1980	1982	1983	1984
Construction	3,573	3,653	4,367	2,189
Transportation, Communication, and Public Utilities	1,554	2,100	2,289	2,461
Wholesale/Retail Trade	6,321	7,566	7,359	8,399
Finance, Insurance, and Real Estate	1,984	1,923	1,885	1,807
Services and Miscellaneous	4,534	6,916	8,654	8,891
Government	1,415	1,817	1,915	2,117
Manufacturing	1,781	2,197	1,924	2,189
TOTAL	21,162	26,172	28,393	28,053

Source: GO Team, Inc., 1986.

The current (1985) St. Lucie County employment data are shown in Table 3-3. These data were obtained from the Florida State Department of Revenue and show the average employment and seasonality characteristics for 1985. As shown in this table, the high seasonality of employment in the agricultural sector and local government sector (which reflects school employment) can be seen readily. Data for the specific industries most likely to be affected, such as water transportation, trucking and warehousing, and transportation services are also shown in this table. Employment in water transportation companies is currently estimated to be 43 persons. These three industries currently account for 724 jobs in St. Lucie County and are currently experiencing an average-to-above-average level of employment range compared to other employment sectors. The bulk of the employment, however, is in trucking and warehousing. The majority of these jobs are likely not water dependent. Compared to the seasonality range for Palm Beach County (7.8 percent), the seasonality range of employment in water transportation firms in St. Lucie County (18 to 52 percent) is currently higher.

Average wage data for the fourth quarter, 1985, are presented in Table 3-4. As shown in this table, the average wage per person employed in the water transportation industry is currently $17,190. This is approximately 17 percent higher than the county private industry average. In comparison, in Palm Beach County the water transportation wage is currently 24 percent higher than the county average.

Comprehensive Plan and Economic Development Policies

The following information concerning local economic development policies was obtained from a report prepared by the Treasure Coast Regional Planning Council in 1984. This information summarizes the local economic development and comprehensive plan policies for the Treasure Coast Regional Planning Council; St. Lucie, Indian River, and Martin Counties; and for Fort Pierce, Port St. Lucie, and Vero Beach.

Each local government's adopted comprehensive plan contains various statements supporting diversification of the economic base. The various plans recognize that their particular local economics are dependent upon a few key economic sectors, generally, construction, tourism/retirement, government, and agriculture. Each supports diversification of the economic base but not at the expense of its existing economic base. Most reflect the desire to increase or stimulate additional light industrial-type activities and to encourage activities that will moderate cyclical fluctuations.

Table 3-3

ST. LUCIE COUNTY

1985 EMPLOYMENT DATA

SIC Code	Category	Average Employment	Ranges Employment Low	Ranges Employment High	Range as a Percent of Average
01-14	Agricultural, Forestry, Fishery, and Mining	5,500	2,300	8,000	104
15-17	Contract Construction	2,300	2,100	2,700	26
20-39	Manufacturing	2,300	2,000	2,600	26
40-49	Transportation, Communication, and Public Utilities	2,000	1,900	2,000	5
50-51	Wholesale Trade	1,200	1,200	1,300	8
52-59	Retail Trade	7,700	7,500	8,300	10
60-67	Finance, Insurance and Real Estate	1,900	1,900	2,000	5
70-89	Services	6,400	6,200	6,600	6
	Federal Government	300	200	300	33
	State Government	1,000	900	1,000	10
	Local Government	4,300	2,900	4,900	47
	TOTAL	34,900			
42	Trucking and Warehousing	337	265	441	52
44	Water Transportation	43	39	48	21
47	Transportation Services	44	41	49	18

Source: State of Florida, 1986.

Table 3-4
ST. LUCIE COUNTY AVERAGE WAGE DATA
FOURTH QUARTER, 1985

SIC Code	Category	Average Employment	Average Wage
42	Trucking and Warehousing	375	$14,510
44	Water Transportation	42	$17,190
47	Transportation Services	43	$11,830
50-51	Wholesale Trade	1,226	$19,210
52-59	Retail Trade	8,041	$10,710
TOTAL COUNTY (private industry)		30,420	$14,750

Source: State of Florida, 1986.

Treasure Coast Regional Planning Council

The desired goal of a diversified economic base is fairly well supported among all the local governments. Further, Treasure Coast Regional Planning Council has adopted policy positions that support diversification of the region's economic base.

The Council has addressed two policy areas related to economic diversification. They support expansion of economic opportunities and expanding the commodities imported and exported. Both phases are set forth in Council's Coastal Zone Management Plan. They are listed under the policy headings of "Economic Development and Ports" and "Water Related Industry."

Economic Development Objective

To ensure that coastal dependent economic uses have adequate opportunity to locate and prosper in the coastal zone.

Economic Development Policy

Based on sound regional economic research, efforts should be undertaken to diversify the region's economic base.

Ports and Water-Related Industry Objectives

- Stabilization of commodity flows by encouraging diversity of imports, exports, and domestic trade to eliminate dependence on single commodities which are subject to wide supply-and-demand fluctuations (emphasis added).

- Promotion of intraregional, interstate, and international commodity, and passenger trade to increase regional economic activity.

- Encouragement of further employment opportunities within the ports.

Ports and Water Related Industry Policy

- Necessary expansion and modification within major ports is a high priority shoreline use and may sometimes involve tradeoffs of ecologically valuable areas. In such tradeoffs, priority should go to modifications which lower ocean freight cost, thereby increasing the public benefit. However, such tradeoffs should be adequately justified in each port's approved development plan (Chapter 403, Florida Statutes).

- Cooperation among private landowners, port authorities, and local governments should be encouraged, and multiple-use design for new facilities should be considered in order to arrive at viable economic activities that are water dependent to maximize port usage.

- The existing competitive relationships between ports should be maintained and economic growth consistent with regional objectives should be encouraged.

St. Lucie County

Economic Assumptions

- The growth of the resident population will have an expansionary impact on the overall County economy.

- Increased emphasis on tourism is highly probable, and if it occurs a greater demand for coastal sites will be evident.

- Agriculture is and will continue to be one of the most important sectors of the County economy.

Growth Management Objective

To develop a land use pattern and urban structure which will provide ample development opportunity to maintain a viable, balanced economy served by a resident labor force.

St. Lucie Growth Management Policy Plan

The Growth Management Policy Plan was adopted by St. Lucie County in May of 1981. This policy plan is a document that guides public decisions that relate to the future development pattern of St. Lucie County. It is a plan for managed growth that recognizes the many competing demands for finite supply of community resources. The plan recognizes the importance of agricultural development to the county and in that respect, improved port facilities will enhance the viability of existing agricultural development within the county. The plan recognizes that agriculture is and will continue to be one of the most important sectors of the county economy. The agricultural development policy that prime agricultural land, especially citrus, should be preserved for continuing production and benefit to the county economy is supported by development of the port authority.

The plan recognizes that the growth of the resident population will have expansionary impact on the overall county economy. To this end, expanded port facilities will serve as an impetus to employment growth. Industrial development policy is that new industrial development should take place, whenever practical, and planned industrial parks rather than scattered free-standing plants. The development of a port will encourage cluster development of marine-oriented businesses near the terminals.

The coastal zone protection policy that coastal zone resources should be developed and managed in a manner that will provide sustained economic benefits in the long run is consistent with the development of the port terminal and related facilities.

The following land use and development guidelines are provided for ports and water-related industry, marina location and design, and bulkheads, seawalls, and piers.

Ports and Water-Related Industry.

- Port and marine designs should require a minimum of maintenance, utilizing water scouring action to prevent siltation.

- Space needs in port and marina areas should be projected well into the future in order to reserve adequate space.

- Only those industrial activities requiring waterfront locations should be sited at the shoreline.

- Cooperative docking cargo handling and parking areas should be incorporated into port and marine design.

- Port facilities should have effective capabilities to deal with oil spills.

Marina Location and Design.

- Marinas should be located where maximum physical advantages exist and where minimum dredging will be required.

- Dry storage design should be utilized for small crafts.

- Construction should avoid unnecessary damages to wetlands, shellfish beds, and grass beds.

- Marinas with live-aboard craft should be equipped with sewage systems and/or sanitary pump stations.

Bulkheads, Seawalls, and Piers.

- Bulkheads should be located at, or landward of, the mean high water line.

- Sloping revetments, instead of vertical seawalls, should be used in high energy areas to more effectively dissipate wave forces and reduce the effects of bottom scouring.

- Sharp angle turns that collect trash or cause shoaling and flushing problems should be avoided.

- Docks and piers should not obstruct navigation or public use of waters and they should be constructed in a manner that does not restrict water flow.

Indian River County

Economic Assumptions

The existing economic base of the area consists primarily of tourism/retirement, agriculture, and

manufacturing. Local governments can encourage growth in all three areas and selectively emphasize diversification into enterprises that are compatible with the existing economic base and labor force by such methods as zoning for recreational facilities and the promoting of service programs, education and research programs concerning agriculture and agri-business, and programs to encourage new industry.

Increased economic diversification will result in a more stable economic base for the County. In this case, tourism/retirement would probably increase in relative importance, but growth in other economic sectors is necessary for a balanced employment picture and stability in the overall economy of the area. Also, continued interest and effort in agri-business can ensure the economic use of lands which would not be profitably used in another manner for years to come.

Industrial Policy

The industrial policy is to encourage light, nonpolluting industry. Industrial uses shall be located in nodal units such as industrial parks.

Martin County

Goal

Stabilize Economic Base and Enhance Income Opportunities. County development and resource conservation decisions shall contribute to stabilizing the economic base of the County and enhance income opportunities. A selective diversification of the County's economic base shall be directed toward:

- Reducing fluctuations in the County's economy
- Attracting industry providing relatively high salary and wages
- Encouraging clean industry which provides a net contribution to the standards and specifications which shall be adopted by the County
- Conserving and protecting the County's natural resources including water supply, water quality, and agricultural lands with high potential for productivity
- Protecting the quality and stability of established as well as future residential areas

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City of Fort Pierce

Growth Assumption

There appear to be excellent opportunities for diversifying the local economy to offset its historically strong dependence on agriculture. Tourism, industry, and regional urban center development are key areas of potential that Fort Pierce can capitalize on to provide stability and prosperity for its economic structure.

Goals and Objectives

1. Serve as an Urban and Commercial Center for a Four-County Market.

   - o Promote expansion of the city's dominance in the market area
   - o Encourage long-range transportation planning that places Fort Pierce at the hub of the market area's thoroughfare, air, and water transportation network

2. Achieve a Balanced Economy Which Offers Diverse Job Opportunities.

   - o Establish a continuous program for promoting selective commercial and industrial development
   - o Develop port potential as an inducement for industrial growth and to gain increased local economic benefit from the area's agricultural industry

3. Restructure Industrial Development Patterns to Emphasize Port Development, Light Manufacturing in Industrial Parks, and Reduced Industrial Uses in the Commercial Business District.

   - o Promote coordinated development of the port area
   - o Achieve effective buffering between industrial uses and other activities
   - o Improve the visual quality of downtown industrial buildings and sites

Industrial Development Policy.

- o Industrial development should be encouraged in the port area to realize the economic potential of that area.

- Light industrial development should take place in planned industrial parks.

City of Port St. Lucie

Economic Assumptions

The City's employment base is anticipated to remain oriented toward construction with growth in the retail and services and local government sectors in the immediate future.

Over the long-range planning period, the economy is anticipated to diversify based on anticipated population growth and also on the planned expansion of existing and proposed commercial and industrial areas.

Overall Goals for the Comprehensive Plan

Stabilize Economic Base and Enhance Income Opportunities. Development and resource conservation decisions should be directed toward contributing to stabilizing the economic base of the City and enhancing income opportunities. Selective diversification of the City's economic base should be directed toward:

- Expanding the City's economic base while minimizing fluctuations in the City's economy
- Attracting industry providing relatively high salary and wages
- Promoting improved fiscal capacity
- Encouraging industry which provides a net contribution to the City's community facilities and utilities in a manner consistent with standards and specifications that should be adopted by the City
- Conserving and protecting the City's natural resources including water supply and water quality
- Protecting the quality and stability of established as well as future residential areas

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City of Vero Beach

Goal

Stabilize Economic Base. Community development and resource conservation decisions shall contribute to stabilizing the economic base of the community and enhance income opportunities. The role of the City of Vero Beach as the county seat and the center of the retail trade and services, finance, tourism, institutional and cultural facilities, and selective industrial activities should be enhanced. A selective diversification of the community's economic base should be directed toward reducing cyclical fluctuations in areas of economy and enhancing income opportunities while maintaining residential and natural environmental qualities.

Economic Diversification and the Role of Port Development

According to the Treasure Coast Regional Planning Council, the study area, especially St. Lucie County, has a labor force that would compliment the possible employment opportunities that may accompany the port improvement program at the Port of Fort Pierce.

Over the past few years, the study area, and in particularly St. Lucie and Indian River Counties, have experienced unemployment rates that are substantially higher than those of the State. Regional employment is forecast to increase by approximately 450 jobs as a result of the port improvement program. Further, the type of skill/education level of potential employment opportunities that may develop have a strong relationship to those exhibited in St. Lucie County, and the 250 new direct employment jobs are in high paying job categories.

COMMODITY PROJECTIONS

Introduction

A forecast of potential commodity flows at the Port of Fort Pierce is presented in this section. The forecast serves as the basis for the conceptual development plan presented in Chapter 4 and the estimated economic impacts described later in this chapter.

The commodity data analysis focuses on the types of commodities and trading partners of the six Florida ports located on the Atlantic coast (shown in Figure 3-1) for the period 1980 through 1983. The data analysis relies on statistics provided by the U.S. Department of Census, the State of Florida Department of Commerce, and the U.S. Army Corps of Engineers.

The trade forecast method is summarized below.

1. The current regional oceanborne commodity flow is estimated based on published statistics.

2. Trade growth rates are forecast based on industry interviews.

3. Future market shares are estimated for the Port of Fort Pierce for the major commodity groups based on current market shares of other Florida Ports.

4. Future commodity flows are forecast for the Port of Fort Pierce.

Survey information was obtained from the region's manufacturers, the Florida citrus processors, the Latin American shipping companies, the competing port authorities, and the federal and state officials concerned with economic development in Florida and the Caribbean basin.

Survey of Local Industries and Manufacturers

Seventy-five local industries and manufacturers within the six-county study area were identified in the Directory of Florida Industries and by local planning and economic development officials as being engaged in import or export trade. The 40 largest companies were interviewed and 14 said that they currently ship or receive goods through Florida ports. A number of these companies expressed interest in using facilities at the Port of Fort Pierce, provided that level of service and cost is equivalent to their current ports of use.

The nine types of cargo identified by these companies with good potential to be shipped through the Port of Fort Pierce include:

- Plastic pipe
- Fertilizers
- Pleasure boats
- Animal feed
- Building materials
- Agricultural products
- Granite
- Gypsum
- Cement

MAJOR FLORIDA PORT AUTHORITIES

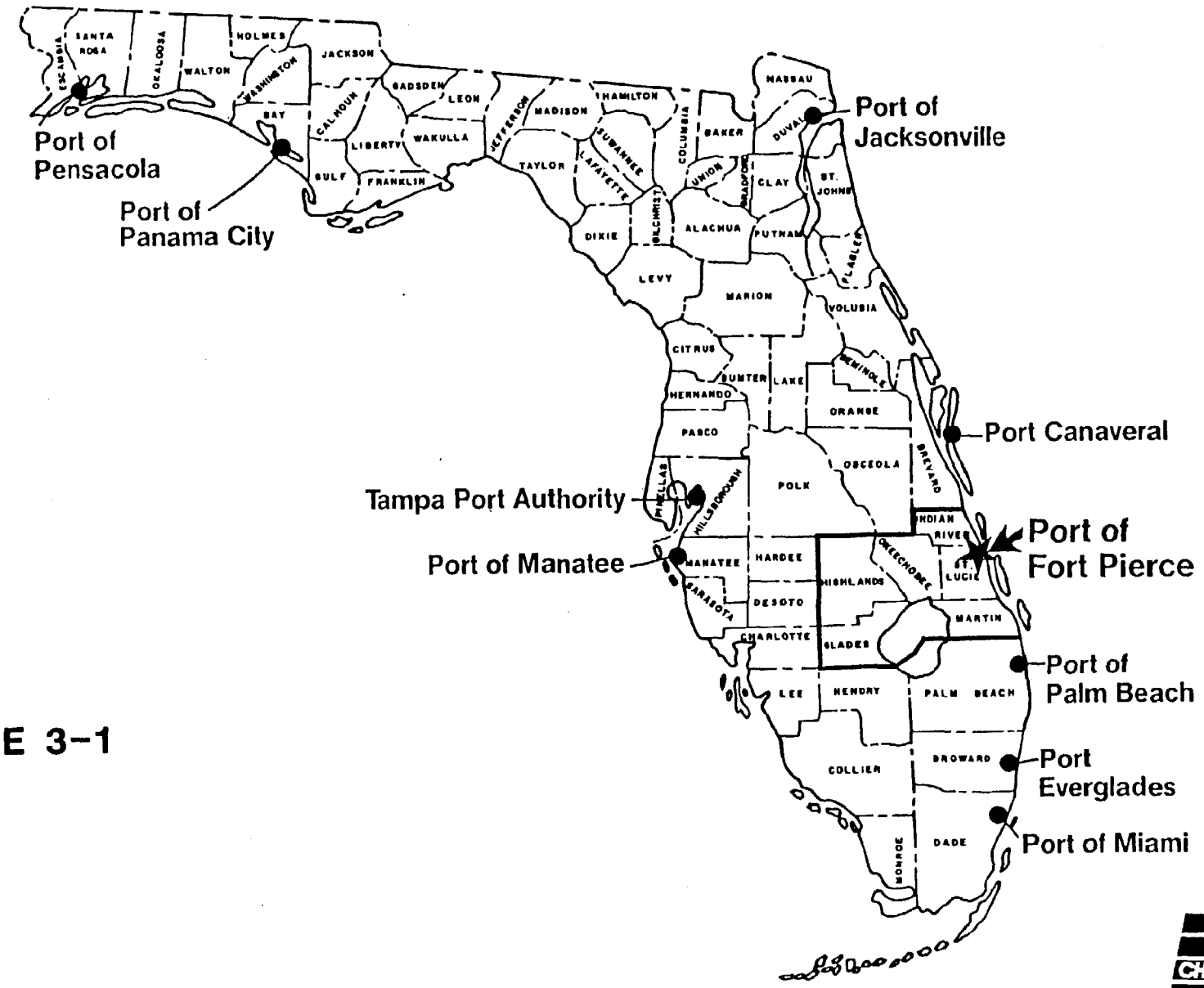

FIGURE 3-1

The following five commodities groups were also identified by the Treasure Coast Regional Planning Council in its study of the Port of Fort Pierce in 1984:

Sugar and related products
Heavy equipment
Fuel
Consumer products (e.g., canned goods)
Paper products (e.g., newsprint)

The most common need expressed by the region's manufacturers was for regular service to Caribbean countries similar to that which is being offered at the Ports of Palm Beach and Miami. A few of the large manufacturing firms also use carriers at the Ports of Miami, Port Everglades, and Jacksonville because of regular service to ports in Europe, the Middle East, and Asia. However, it does not appear that the volume of trade conducted by these large local manufacturers would support regular service by large container ships.

In summary, expanded port facilities at the Port of Fort Pierce would potentially benefit a number of local industries and manufacturers currently engaged in foreign trade. Regularly scheduled service to Caribbean countries would appear to serve a larger number of local shippers than would services to Europe, the Middle East, or Asia.

Florida Citrus Industry Survey

The foreign trade of citrus products includes fresh citrus, citrus concentrate, and citrus pulp and pellets. A telephone survey of the 42 citrus companies listed in the Florida Agricultural Export Directory focused on volume of trade and current ports of use, and the results of the survey and a summary of findings from the U.S. Corps of Engineer study on harbor deepening at the Port of Fort Pierce follows.

- The export of fresh citrus, especially grapefruit to Japan, is a large potential market for the Port of Fort Pierce. Commercial exports of fresh citrus grapefruit from the Indian River, Martin, and St. Lucie County area accounted for 91 percent on average of the State of Florida exports of fresh citrus over the period 1978 through 1983. Yet facilities at the Port of Fort Pierce only handled 23 percent of these exports. Thus, there appears to be an opportunity for nearly tripling fresh citrus exports through the Port of Fort Pierce. The continued containerization of fresh citrus exports may have a major impact on the volume of cargo handled at the Port of Fort Pierce. Local

Fort Pierce exporters believe that the recent factors favoring the economics of containerized shipping of citrus are transitory and that chartered vessels will be able to compete for a large share of the fruit exports produced in the study area.

- Bulk citrus concentrate would probably not be imported at the Port of Fort Pierce due to channel draft limitations and relative distance to juice concentrator plants. Ships carrying Brazilian concentrate currently require 35 feet of draft and are being served at Port Manatee and the Tampa Port Authority.

- Although citrus pulp and pellets are locally produced, they are currently being exported through large bulk terminals at the Tampa Port Authority. Importantly, these products account for only 10 to 15 percent of the total throughput at these facilities; thus, a number of other commodities, such as grains, would need to be handled for a facility to be profitable. Further, the facilities on the Gulf Coast at Tampa are geographically better located for many of these other agricultural commodities than facilities on the Atlantic Coast.

Commodity Flow Data Analysis

This section describes the imports and exports through the six ports on Florida's Atlantic coast. As can be seen in Figure 3-1, the Port of Jacksonville, Port Canaveral, Port of Palm Beach, Port of Port Everglades, and Port of Miami are the major competitors to the Port of Fort Pierce. In addition, privately operated terminals on the Miami River also compete for a more limited range of commodities.

Foreign import trade data are shown in Table 3-5 for 1983, the most recent year for which information is available. As can be seen, a total of 5 million tons of imported commodities are handled at these ports. The 12 leading import commodities are also shown in this table and account for 3.2 million tons, or 64 percent of the import trade. The remaining 1.8 million tons comprise a wide range of commodities (general cargo). As can be seen in this table, the Port of Jacksonville is the leading import port (on tonnage basis) and the Port of Miami is second. The Port of Jacksonville is the leading import port most likely because it is the northernmost port in Florida. Imported cargo traditionally is handled at ports near the final consumer or manufacturing markets, which in this case is the northeastern and north central states.

Table 3-5
FLORIDA-ATLANTIC PORTS
IMPORT TRADE--1983
(TON x 1,000)

	Port of Miami	Miami River	Port Everglades	Port of Palm Beach	Port of Ft. Pierce	Port Canaveral	Port of Jacksonville	Total
Total Import Trade	834	83	983	200	142	370	2,341	4,953
High Tonnage Commodities								
Bananas	75	60						
Coffee	85						85	
Newsprint	62		107			56		
Structural Clay Products	66							
Gypsum			105				852	
Alcoholic Beverages			112					
Lumber			101				88	
Cement			257	177		182		
Prepared Fruit Juice						64		
Iron and Steel Products							67	
Motor Vehicles							459	
Aragonite					133			
Net General Import Trade	546	23	301	23	9	68	790	1,760

Source: United States Army Corps of Engineers, 1985.

Foreign export trade is shown in Table 3-6 for 1983. As can be seen in this table, a total of 5.5 million tons are exported through these ports annually, of which 2.4 million tons (43 percent) are due to nine commodities. Other general cargo commodities account for 3.1 million tons.

General exports outweigh general imports by a ratio of 1.8 to 1. This demonstrates the large trade imbalance characteristic of the Florida general cargo market. Two important impacts are caused by this imbalance. If import trade increases at the ports where exports are much higher than imports (e.g., Miami and Palm Beach), there is likely to be ample existing terminal capacity to handle the increase. Second, facilities need to be designed to take into account this imbalance, and this will result in facilities being larger and more expensive than might otherwise be needed.

The relative market shares for the ports' imports and export trade are shown in Table 3-7. As can be seen in this table, Miami and Miami River terminals account for 42 percent of general cargo trade, Jacksonville 39 percent, Port Everglades 9 percent, and Palm Beach 7 percent.

The shipping companies that were surveyed indicated that perishable agricultural commodities are primarily handled at Florida ports. Other less sensitive agricultural commodities such as bananas, sugar, and coffee can be shipped to ports outside of Florida. The containerization of cargo to Latin American countries is expected to continue according to most persons contacted. Exceptions include some agricultural products and heavy equipment. Interviews with federal and state Caribbean Basin specialists indicated that vegetable and produce exports from the Caribbean region are not expected to increase until the mid 1990s, but that a significant increase is expected at that time. These exports would likely be going to ports in Florida and Louisiana due to perishability.

PORT OF FORT PIERCE TRADE STATISTICS

Commodity trade data for the Port of Fort Pierce are shown in Table 3-8. As can be seen, fresh citrus has been the primary export commodity, and aragonite has been the primary import commodity for the port.

Summary

In summary, the major commodity groups are expected to be:

- Imports of Caribbean, South American, and Central American produced commodities particularly fruits and vegetables

Table 3-6
FLORIDA-ATLANTIC PORTS
EXPORT TRADE--1983
(TON X 1,000)

	Port of Miami	Miami River	Port Everglades	Port of Palm Beach	Port of Ft. Pierce	Port Canaveral	Port of Jacksonville	Total
Total Export Trade	1,301	328	205	497	40	67	3,108	5,546
High Tonnage Commodities								
Iron and Steel			50			54		
Machinery	134							
Molasses				187				
Phosphate Rock							607	
Pulp							84	
Sodium Hydroxide							87	
Fabricated Metal Products							62	
Paper and Paper Board							135	
Fertilizers						996		
Net General Export Trade	1,167	328	155	310	40	13	1,137	3,150
Export/Import Ratio	2.1:1	14.3:1	0.5:1	13.5:1	4.4:1	0.1:1	1.4:1	1.8:1

Source: United States Army Corps of Engineers, 1985.

Table 3-7
FLORIDA-ATLANTIC PORTS
GENERAL CARGO MARKET SHARE

Port	Imports	Exports	Total
Jacksonville	45	36	39
Canaveral	4	-	2
Fort Pierce	1	1	1
Palm Beach	1	10	7
Port Everglades	17	5	9
Miami River	1	10	7
Miami	31	37	35
TOTAL	100	100	100

SOURCE: CH2M HILL, 1986.

Table 3-8
FOREIGN TRADE DATA, 1981-1984
PORT OF FORT PIERCE
(tons)

Commodity	1981	1982	1983	1984
Imports				
Cucumbers	8,414	9,071	6,419	8,089
Aragonite	127,260	69,954	133,690	60,642
Lemons			3	356
Persian Limes		529	2,262	4,114
Grapefruit				848
Peppers		15	87	53
Avacados	67	164	142	
Bait Mackerel			4	
Tomatoes	58			
General Cargo	107	18	154	1,140
TOTAL IMPORTS	135,906	79,751	142,761	75,242
Exports				
Chemical Fertilizer	2,072	3,723	3,697	3,111
Super Phosphate	239	165	219	271
General Cargo	1,765	111	682	740
Citrus	32,784	39,777	35,205	37,802
Citrus Concentrate		201		
Silica Sand	9,547	7,252		
Limerock	800			
Kiln Shell	241			
Eggs	1,917			
TOTAL EXPORTS	49,365	51,229	39,803	41,924
TOTAL TRADE	185,271	130,980	182,564	117,166

Source: Fort Pierce Port and Airport Authority, 1985.

- Exports of fertilizers, animal feeds, building materials, and consumer products to Caribbean, South America, and Central America
- Exports of fresh citrus produced in the region
- Imports of building materials such as lumber, cement, granite and gypsum
- More speculative imports of other commodities may include newsprint, coffee, bananas, iron and steel products, motor vehicles, coal, fertilizers and machinery

Commodity Flow Forecast

The general cargo market for Florida is estimated by the year 2000, to be about 6 million tons per year compared to approximately 5 million tons currently. A market share of approximately 5 percent of this cargo appears to be a realistic goal for the Port of Fort Pierce in comparison to the current market shares of the more established Florida ports. This would result in approximately 300,000 tons per year of general cargo by the late 1990s. Most of this cargo would be handled in containers.

With respect to other commodities, the market for bulk and break-bulk cargos appears to be about 5.6 million tons per year currently, and is not expected to increase significantly (less than 1 percent per year growth). A realistic expectation of about a 5 percent market share would result in a trade of approximately 300,000 tons per year of bulk or break-bulk cargos through the Port of Fort Pierce.

ECONOMIC IMPACTS OF PROPOSED IMPROVEMENT PROGRAM

Introduction

This section presents estimates of the economic impacts of the proposed Port of Fort Pierce improvement program on the surrounding six-county area (St. Lucie, Indian River, Martin, Highlands, Glades, and Okeechobee Counties). The economic impacts are categorized as to what the port improvements might contribute to the area in terms of value of output (sales), income (payroll), and employment.

The direct impact of the port industry is created by the demand for (purchase of) port industry goods and services such as stevedoring, storage, distribution, and pilotage. To provide their services, the port industry firms obtain inputs such as labor, tug boats, cranes, and office equipment. These purchases are measured as the indirect impacts of the port industry; if demand for port services stopped, demand for these services would also cease. In addition to the direct and indirect impacts, the port industry has induced impacts created by the expenditures of direct and indirect payrolls. Payroll income is spent for consumer goods and services including food, clothing, transportation, housing, and entertainment.

Methodology

Economic impact studies have been prepared for a number of ports in Florida including the ports of Port Everglades, Miami, and Palm Beach. This study relies on the impact measurement methodologies developed for the studies prepared for these three ports and updates the key economic indexes to reflect 1986 price and income levels. The assessments prepared for these ports all relied on a method for calculating direct economic impacts that was developed by the U.S. Maritime Administration (MARAD) and on a method for calculating indirect and induced impacts based on the Regional Industrial Multiplier System (RIMS) developed by the Bureau of Economic Analysis (BEA). These methods are considered acceptable for an overview study of the economic impacts for small- and medium-sized port districts. More detailed studies likely would include region specific estimation of industry spending patterns and linkages.

The assessment methods developed for these other ports are also considered reliable because the types of cargoes handled at these ports and potentially at the Port of Fort Pierce are similar. This is important because the MARAD methodology is based on cargo type and tonnage. Each type of cargo is multiplied by a dollar-per-ton output multiplier (adjusted for inflation) that provides an estimate of the total direct

benefits of the port industry (sales or output impact) within the local area for any given year.

Port of Miami Economic Impact Assessments

In 1976 the Port of Miami estimated that its combined cargo handling (1,250,000 tons) and cruise passenger (800,000 passengers) operations contributed a total economic impact in Dade County of between $273 million and $415 million.

The Port of Miami reestimated its economic impact in Dade County in 1979 and found that its cargo handling operation (2 million tons; 85 percent general cargo, 15 percent bulk cargo) resulted in a direct economic impact to the local economy of $139.8 million. When indirect and induced impacts are also included, the total cargo-related economic impact was estimated to be $495 million. As shown in Table 3-9, this economic impact would be equivalent to $506 million at current (1986) price levels.

The Port of Miami's methodology for calculating indirect and induced impacts was to multiply the estimated direct impact times a factor of 1.5. Thus, the total economic impact to the local economy is estimated to be 2.5 times the estimate of direct economic impact.

Table 3-9
PORT OF MIAMI
ECONOMIC IMPACT ASSESSMENT

1979 Cargo Tonnage:[a] 2,100,000 tons

Economic Impact	1979 Dollars (millions)	1986 Dollars[b] (millions)	1986 Dollars Per Ton
Direct	$139.8	$202.3	$ 96
Indirect and Induced	209.7	303.4	144
TOTAL	$349.5	$505.7	$240

[a] 85 percent general cargo; 15 percent bulk cargo.

[b] 1.447 x 1979 dollars (GNP implicit price deflator).

Source: Port of Miami, 1979.
CH2M HILL, 1986.

When expressed in dollars per ton, the Port of Miami estimated the direct impacts of their operation to be $96 per ton of cargo (in 1986 dollars) and indirect and induced impacts to be another $144 per ton of cargo for a total estimate of $240 of economic impact per ton of cargo handled at the port.

Port of Port Everglades Economic Impact Assessments

An input-output study was prepared by the University of Florida in 1976 for the Broward County Board of Commissioners. Estimates of sale, income, and employment impacts for 34 sectors are presented and are based on an input-output model constructed for the Broward County economy in 1976. This study estimates the gross (export or final) sales total impact multiplier to be 2.55, the indirect and induced income multiplier to be 1.63, and the direct employment as a percentage of direct sales multiplier to be one job per $25,200 in sales (1976 dollars). Forty-seven percent of the port sales were estimated to be final (export from county or final consumption within county) sales. Conversely, 53 percent were estimated to be intermediate sales to manufacturers or wholesalers within the county.

This study estimates that the port industry contributed $135 million to the local economy in 1976. The port's services sector also was estimated to result in full-time equivalent employment of more than 2,000 workers.

The Port of Port Everglades reestimated its economic impact on Broward County in 1983 and found its cargo handling operation (1,188,800 tons, excluding petroleum; 70 percent general cargo, 30 percent dry bulk) resulted in a direct economic impact to the local economy of $94.7 million. As shown in Table 3-10, this economic impact would be equivalent to $103.7 million at current (1986) price levels. That study presented a breakdown of the total direct impact estimate into 11 components such as port and terminal expenditures, government charges, labor, and repairs. Like the Port of Miami's method, the Port of Port Everglades' method is based on cargo type and tonnage, and separate estimates are prepared for the port's liquid bulk, dry bulk, containerized cargo, and general cargo operations.

Table 3-10
PORT OF PORT EVERGLADES
ECONOMIC IMPACT ASSESSMENT

1983 Cargo Tonnage:[a] 1,188,000 tons

Economic Impact	1983 Dollars (millions)	1986 Dollars[b] (millions)	1986 Dollars Per Ton
Direct	$ 94.7	$103.7	$ 87
Indirect and Induced	152.5	167.0	140
TOTAL	$247.2	$270.7	$227

[a]Excluding petroleum; 70 percent general cargo, 30 percent bulk cargo.

[b]1.095 x 1983 dollars (GNP implicit price deflator).

Source: Port of Port Everglades, 1979.
CH2M HILL, 1986.

The Port of Port Everglades' methodology for calculating total economic impact was to multiply the estimated direct economic impact by a factor of 2.61 (as compared to the estimate of 2.5 used by the Port of Miami). Using the port's method, total economic impacts were estimated to be $247.2 million in 1983 or $270.7 million in 1986 dollars.

When expressed in dollars per ton, the Port of Port Everglades estimated the direct economic impact of their operation to be $87 per ton of cargo (in 1986 dollars) and indirect and induced impacts to be another $140 per ton, for a total estimate of $227 of economic impact per ton of cargo handled at the port.

Port of Palm Beach Economic Impact Assessment

The Florida Department of Transportation prepared an economic impact study in 1981 for the Port of Palm Beach. This study surveyed companies within Palm Beach County by mail to identify the economic impact and resulting multipliers of the port industry. As shown in Table 3-11, the port industry was estimated to result in $47 million in direct sales (1979 dollars), over $9 million in direct payrolls, and 560 direct jobs in Palm Beach County. This was based on roughly 950,000 tons of cargo in 1980 (60 percent general

cargo, 40 percent bulk). Including indirect and induced impacts, the total impacts were estimated to be $115 million of total sales (1979 dollars), 1,216 total jobs, and total personal income of $17 million.

Table 3-11
PORT OF PALM BEACH
ECONOMIC IMPACT ASSESSMENT

1979 Cargo Tonnage:[a] 950,000 tons

Economic Impact	1979 dollars (millions)	1986 dollars[b] (millions)	1986 Dollars Per Ton
Direct	$ 47.0	$ 68.0	$ 72
Indirect and Induced	68.2	98.7	104
TOTAL	$115.2	$166.7	$176

[a] 60 percent general cargo; 40 percent bulk cargo.

[b] 1.447 x 1979 dollars (GNP implicit price deflator).

Source: Port of Palm Beach, 1979.
CH2M HILL, 1986.

In its survey of port industry groups, the water transportation industries (SIC 44) were found to account for 62 percent of sales, 74 percent of employment, and 70 percent of payroll of all industries considered port dependent in Palm Beach County. Other industries include freight forwarders, ship chandlers, marine suppliers, and various wholesale trade companies.

Total personal income was calculated on the basis of total direct income times an income multiplier of 1.90. Total sales are based on multiplying total direct sales times separate BEA sales multipliers for the SIC codes. On average, this multiplier is 2.45. Total employment is based on calculating total wages, which is said to be 80 percent of the total income estimate, and then dividing by the average wage for employees for the county.

Summary of Port Impact Assessment Methods

As shown below in Table 3-12, the Ports of Miami, Port Everglades, and Palm Beach have reasonably similar estimates of direct economic impacts when calculated on a per-ton basis.

Table 3-12
COMPARISON OF ECONOMIC IMPACT ASSESSMENT
(1986 dollars per ton)

Economic Impacts	Miami	Port Everglades	Palm Beach
Direct	$ 96	$ 87	$ 72
Indirect and Induced	144	140	104
TOTAL	$240	$227	$176
General Cargo Share (%)	85	70	60

Source: CH2M HILL, 1986.

As expected, the port with the highest economic impact on a per-ton basis is Miami, and it has the highest relative general cargo share. Similarly, the port with the lowest relative general cargo share is Palm Beach, and it has the lowest economic impact on a per-ton basis.

Table 3-13 presents an estimate of general cargo and bulk cargo impacts on a per-ton basis. As shown, the estimates are quite similar for the three ports.

Table 3-13
COMPARISON OF DIRECT ECONOMIC BENEFIT
BY CARGO TYPE
(1986 dollars per ton)

Direct Economic Benefits	Miami	Port Everglades	Palm Beach	Average
General Cargo	$109	$115	$106	$110
Bulk Cargo	23	24	22	23

Source: CH2M HILL, 1986.

Note: Derivation of general cargo direct economic benefit from formula ax + by = c

where a = general cargo benefit per ton
b = bulk cargo benefit per ton (.21 times general cargo benefit from MARAD methodology)
c = average cargo benefit per ton
x = general cargo share of total cargo
y = bulk cargo share of total cargo

For example, the formula for the Port of Miami would be:

$$a\,(.85) + b\,(.15) = 96$$
$$b = .2a$$
$$.85a + .03a = \$96$$
$$.88a = \$96$$
$$a = \$109$$
$$b = \$22$$

The studies reviewed also had similar methods for calculating indirect and induced impacts. The total sales (output) multipliers ranged from 1.71 to 2.61 times direct sales. The total payroll multipliers ranged from 1.63 to 1.90 times direct payroll.

The studies prepared for Ports of Port Everglades and Palm Beach present typical distributions of direct economic impacts into industry sectors. These distributions are shown in Tables 3-14 and 3-15.

Direct Economic Impacts

The direct economic impacts of the Port of Fort Pierce proposed improvement program are presented in Table 3-16.

As shown, $38.4 million in sales, $7.7 million in payroll, and 309 jobs are forecast to result from the Port of Fort Pierce improvement program. Approximately 250 new direct employment jobs are forecast for the region based on current employment estimates. Nearly 83 percent of these direct impacts are the result of the expanded general cargo operations. The remaining 17 percent are due to bulk cargo operations.

The indirect and induced impacts are a significant share of the total impact. For example, $71 of indirect and induced sales are forecast for the six-county area for every $100 in direct port industry sales. Similarly, $63 in additional payroll is forecast for every $100 in port industry payroll, and 75 additional jobs are forecast for every 100 port industry jobs.

In summary, the Port of Fort Pierce improvement program is forecast to result in $65.7 million in sales, $12.6 million in payroll, and 540 total jobs in the six-county study region of which approximately 450 jobs are new.

Table 3-14
PORT OF PORT EVERGLADES
DIRECT ECONOMIC IMPACT DISTRIBUTION

Components	Percent
Port and Terminal Expenditures Pilot, tug hire, line running, dockage	5.6
Government Charges Immigration service, entrance and clearance fees	0.3
Labor Stevedoring, clerking, checking, cleaning, stripping/stuffing, crating	45.9
Repairs	0.3
Supplies Dunnage, doctor, laundry, chandler	9.6
Bunkers Oil, water	1.0
Miscellaneous Vessel Disbursements	1.0
Port Terminal Income Receiving and delivery, handling and storage, demurrage	14.9
Rail and Motor Freight Revenue Credited to Area	11.9
Vessel Crew Expenditures in Area	1.9
Auxiliary Services Steamship agents, foreign forwarders, customhouse brokers, public warehouse companies, marine insurance companies, foreign departments of area banks	7.6

Source: Port of Port Everglades, 1983.

Table 3-15
PORT OF PALM BEACH
DIRECT ECONOMIC IMPACT DISTRIBUTION

	Direct Sales Distribution (percent)	Payroll Share of Sales (percent)
Port Industry		
SIC 44: Water Transportation	62.3	22.5
SIC 47: Transportation Services	1.9	32.8
SIC 42: Motor Freight Warehousing	1.1	16.7
SIC 55: Ship Chandlers	1.4	17.0
Subtotal	66.7	22.6*
Port Dependent Industry		
SIC 50: Wholesale Trade-- Durable Goods	20.7	6.7
SIC 51: Wholesale Trade-- Nondurable Goods	7.0	12.9
Miscellaneous SIC Groups	5.6	47.7
Subtotal	33.3	14.9*
GRAND TOTAL	100.0	20.0*

Source: Port of Palm Beach, 1981.

*Percentage represents an average.

Table 3-16
DIRECT ECONOMIC IMPACTS
PORT OF FORT PIERCE IMPROVEMENT PROGRAM

Components	Sales (Million)	Payroll (Million)	Employment
1. Port and Terminal Services	$24.0	$5.3	200
2. Auxiliary Services	2.9	0.7	34
3. Motor Carriers	3.8	0.6	31
4. Wholesale Trade	4.8	0.5	18
5. Miscellaneous	2.9	0.6	26
TOTAL DIRECT IMPACT	$38.4	$7.7	309

Note: Economic impacts based on assumed cargo throughput of 300,000 tons general cargo and 300,000 tons bulk cargo.

Source: CH2M HILL, 1986.

The greatest relative impact is forecast to be employment in the port and terminal service sector. The 200 jobs that are forecast are double the current (December 1985) six-county employment estimate of 190 for this sector. The 34 jobs in the auxiliary service sectors represent a 20 percent increase over the current employment estimate of 165.

INDIRECT AND INDUCED ECONOMIC IMPACTS

Total economic impacts including the indirect and induced economic impacts of the Port of Fort Pierce proposed improvement program are shown in Table 3-17. The indirect and induced impacts are calculated by applying multipliers to the direct impacts shown in Table 3-16.

Table 3-17
TOTAL ECONOMIC IMPACTS
PORT OF FORT PIERCE IMPROVEMENT PROGRAM

	Direct Impact	Indirect and Induced Impact	Total Impact
Sales ($ million)	$38.4	$27.3	$65.7
Payroll ($ million)	7.7	4.9	12.6
Employment	309	231	540

Source: CH2M HILL, 1986.

Chapter 4
FACILITIES DEVELOPMENT

INTRODUCTION

For purposes of this study, the Port of Fort Pierce is considered to consist of mainland between the north and south A1A bridges, shoreward to the Florida East Coast Railroad mainline, as shown on Figure 4-1. Most of the area is currently zoned Marine Industrial (I-2), with the balance zoned for Industrial use (I-1). Current and planned uses include marine cargo terminals, fruit packing houses, marinas, boat yards, a small tank farm, a park, charter and fishing boat docking, and waterfront restaurants. Approximately 87 acres of undeveloped land, shown in Figure 4-2, is the focus of this analysis of port development alternatives, since this area comprises most of the available and undeveloped port land. Considering current, projected and potential growth in St. Lucie County and the experience of waterfront areas elsewhere in Florida, it is unlikely that the site will remain undeveloped; its use will inevitably determine the future of the Port of Fort Pierce.

DEVELOPMENT ALTERNATIVES

The site is well-shaped for port development, generally rectangular with extensive waterfront adjacent to the deepwater turning basin, Indian River/Intracoastal Waterway, and Taylor Creek. Since it is likely that development will be phased, or by separate interests rather than as a unit, configuration options considered to be feasible for development in terms of tracts are shown below and in Figure 4-3.

Development Site	Area	Waterfront
A	27 ac.	2,400' adj. to deepwater
A1	20 ac.	1,500' adj. to deepwater
A2	7 ac.	900' adj. to deepwater
A2/B	17 ac.	1,350' adj. to deepwater
A/B	37 ac.	2,850' adj. to deepwater
B	10 ac.	450' adj. to deepwater
C	20 ac.	1,120' adj. to AIWW, 850' adj. to Taylor Creek
D	28 ac.	420' adj. to Taylor Creek

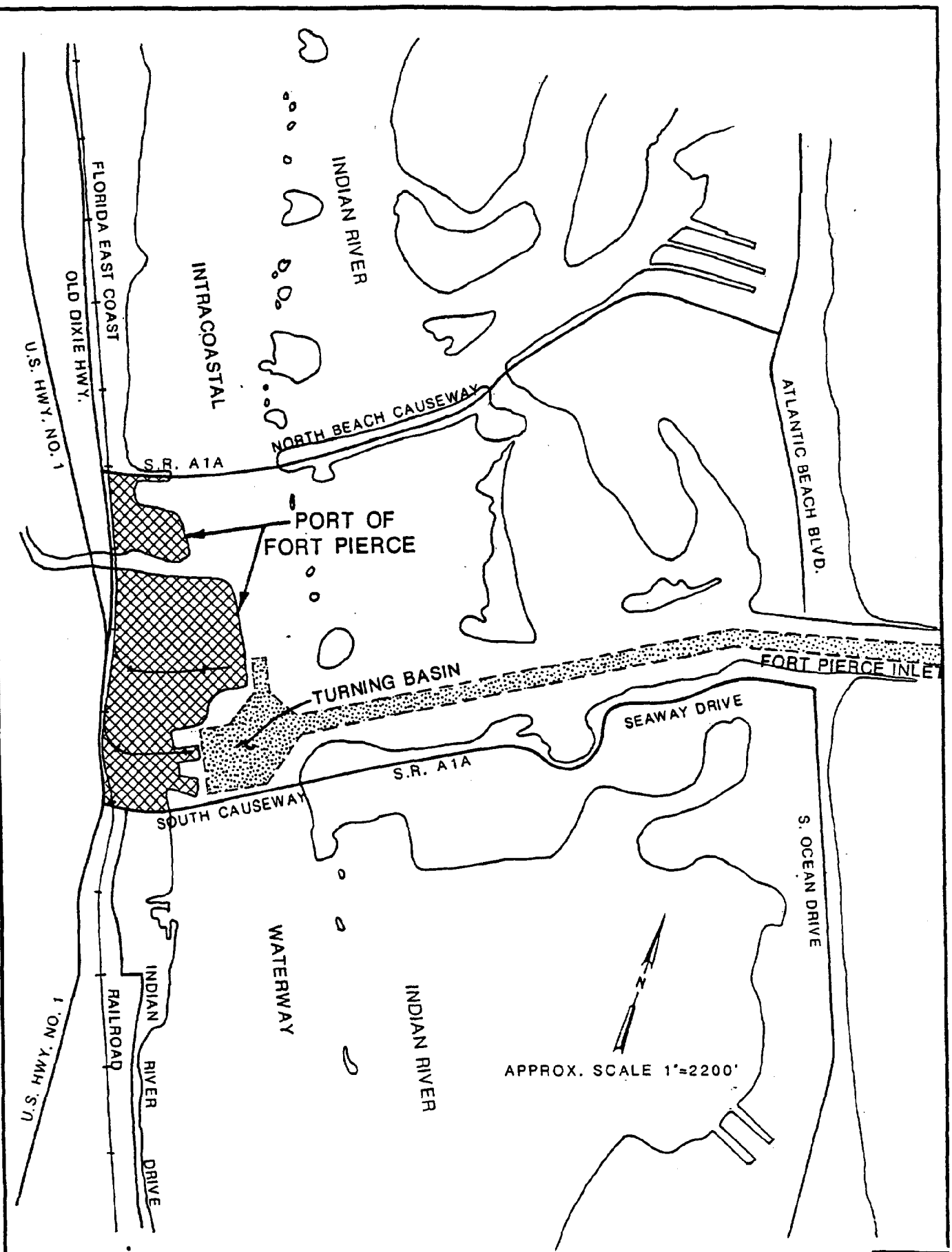

FIGURE 4-1

PORT OF FORT PIERCE

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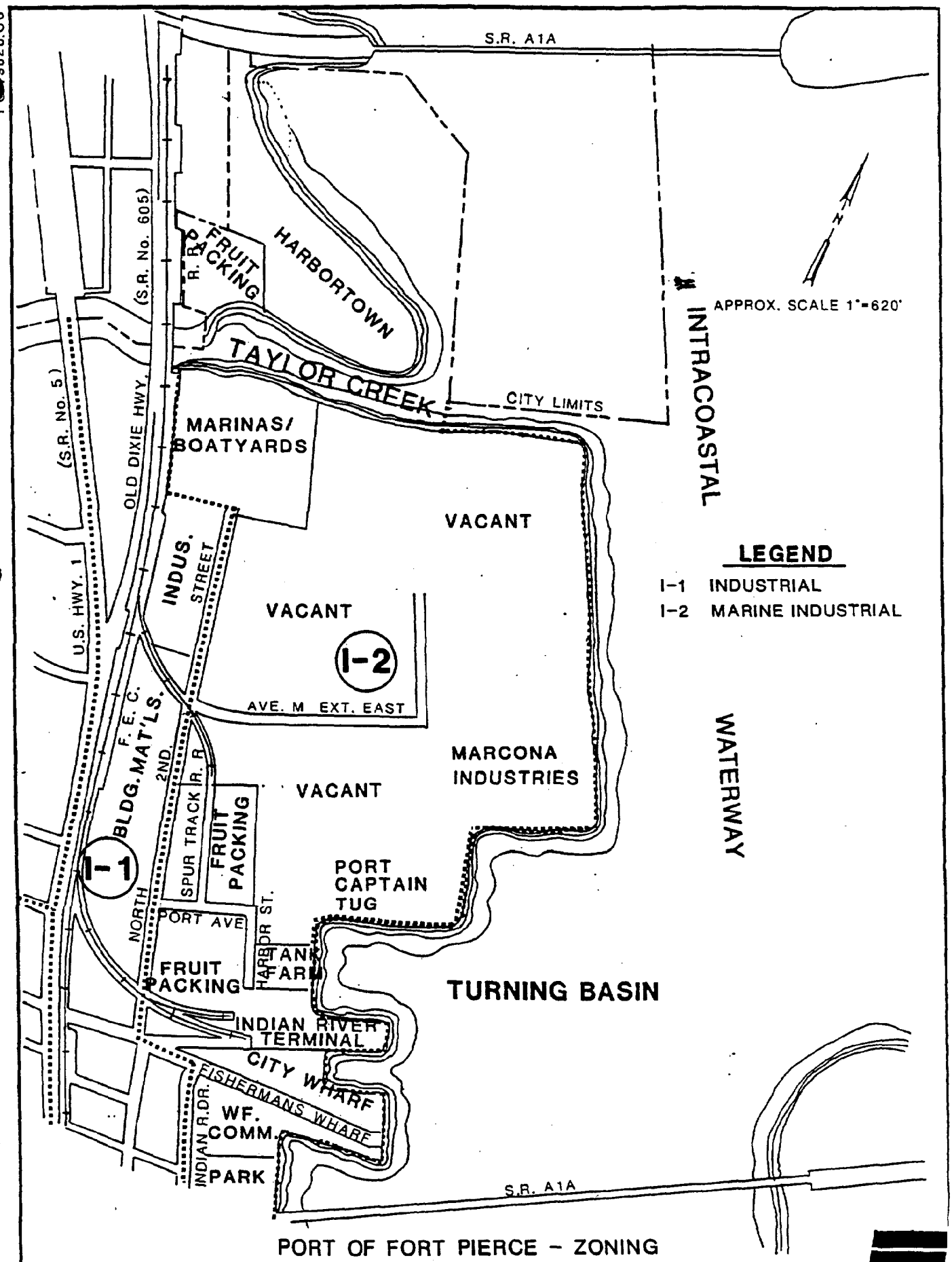

PORT OF FORT PIERCE - ZONING

FIGURE 4-2

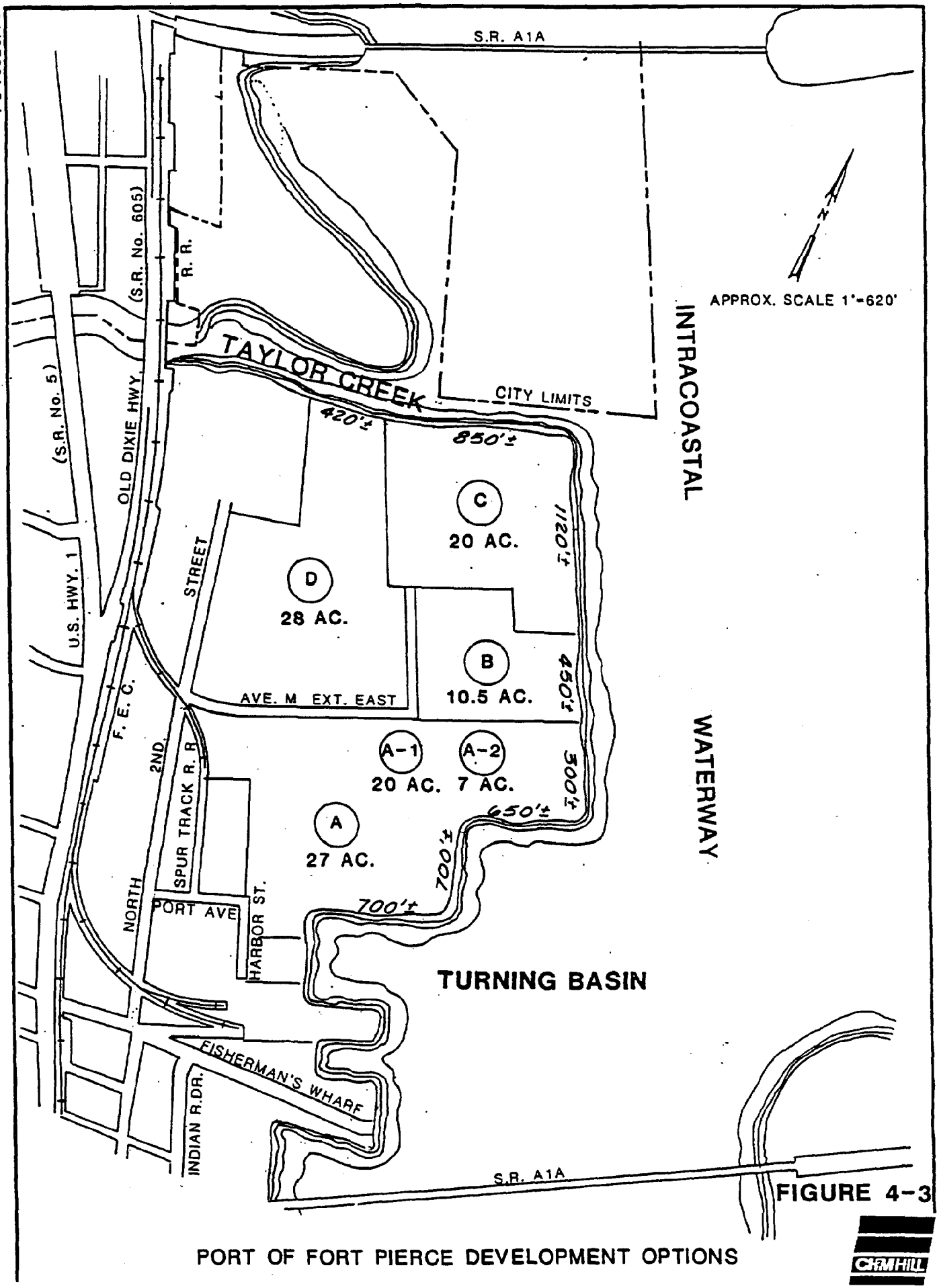

FIGURE 4-3

PORT OF FORT PIERCE DEVELOPMENT OPTIONS

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Sites A1 and A2 comprise site A, sites A2 and B comprise site A2/B, and site A/B consists of sites A and B. Numerous other configurations are also possible, of course, but these appear most feasible based on configuration and present ownership.

Based on the economic analysis performed in the first phase of this project and evaluation of regional trends, several potential uses appear feasible for one or more of the development sites, including:

- o general cargo terminal, with open and/or covered storage;
- o roll-on/roll-off terminal;
- o dry bulk terminal, open storage;
- o cruise and charter vessel terminal;
- o boat yard/marina; and
- o multi-use dock for fishing boats, tugs, pilot and police boats, etc.

Conceptual characteristics of these uses are presented on the accompanying Data Sheets (Figures 4-4 through 4-10).

Comparison of site and use characteristics can be summarized in the following matrix.

Development Site	General Cargo Terminal	Dry Bulk Terminal	Cruise,Charter Terminal	Boatyard Marina	Multi-Use
A	2	2	2	2	2
A1	1	2	2	2	2
A2	4	1	2	2	2
A2/B	3	1	2	2	2
A/B	2	2	2	2	2
B	3	3	3	2	2
C	3	4	1	1	2
D	4	4	4	1	2

1: optimal use of site's characteristics
2: Suitable, but not optimal use of site's characteristics
3: suitable, but competitive disadvantage to other sites
4: not suitable, due to size, waterfront, or location

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DATA SHEET
GENERAL CARGO TERMINAL, OPEN STORAGE

Typical Use:	Building materials, project cargo, heavy equipment
Berth Length:	400 - 500 feet.
Backland:	20 acres minimum
Capacity:	100,000 - 110,000 TPY
Vessel Calls:	50-55 per year, probably irregularly distributed
Vehicle Generation:	200-250 trips per day, peak
Utility Demands:	Minimal; fire protection, electrical power for 2,000 square feet of office space, lighting for 20 acres, water and sewer for 20-25 workers.

TYPICAL GENERAL CARGO TERMINAL, OPEN STORAGE

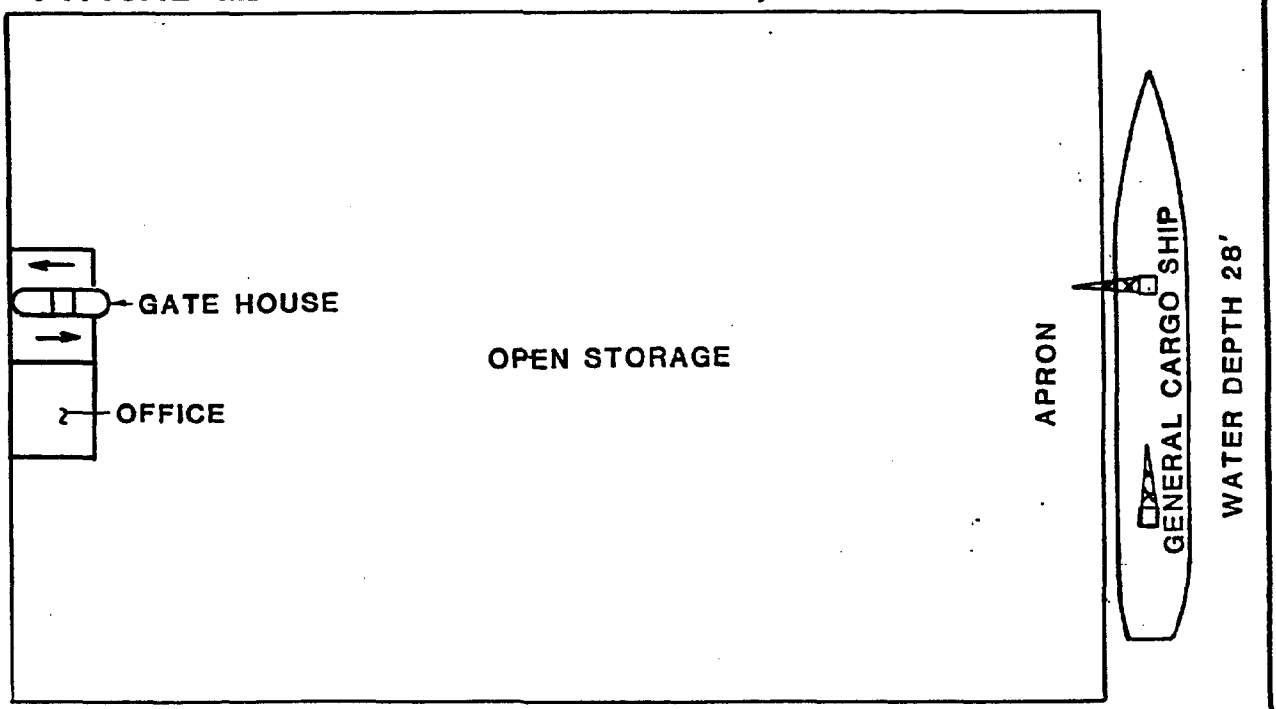

FIGURE 4-4

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DATA SHEET
GENERAL CARGO TERMINAL, COVERED STORAGE

Typical Use:	Foodstuffs, agricultural products; distinguished from breakbulk cargo in that shipments tend to be single commodity, large volume (2,000-2,500 tons per vessel call).
Berth Length:	400-500 feet.
Backland:	6 acres minimum; 80,000-100,000 sf covered storage
Capacity:	50,000 TPY
Vessel Calls:	25-30 per year, probably irregularly distributed
Vehicle Generation:	200-250 trips per day, peak
Utility Demands:	Minimal, unless cold storage is provided; otherwise fire protection, electrical power for 90,000 sf warehouse and 2,000 sf office, lighting for 4 acres, water, and sewer for 20-25 workers.

TYPICAL GENERAL CARGO TERMINAL, COVERED STORAGE

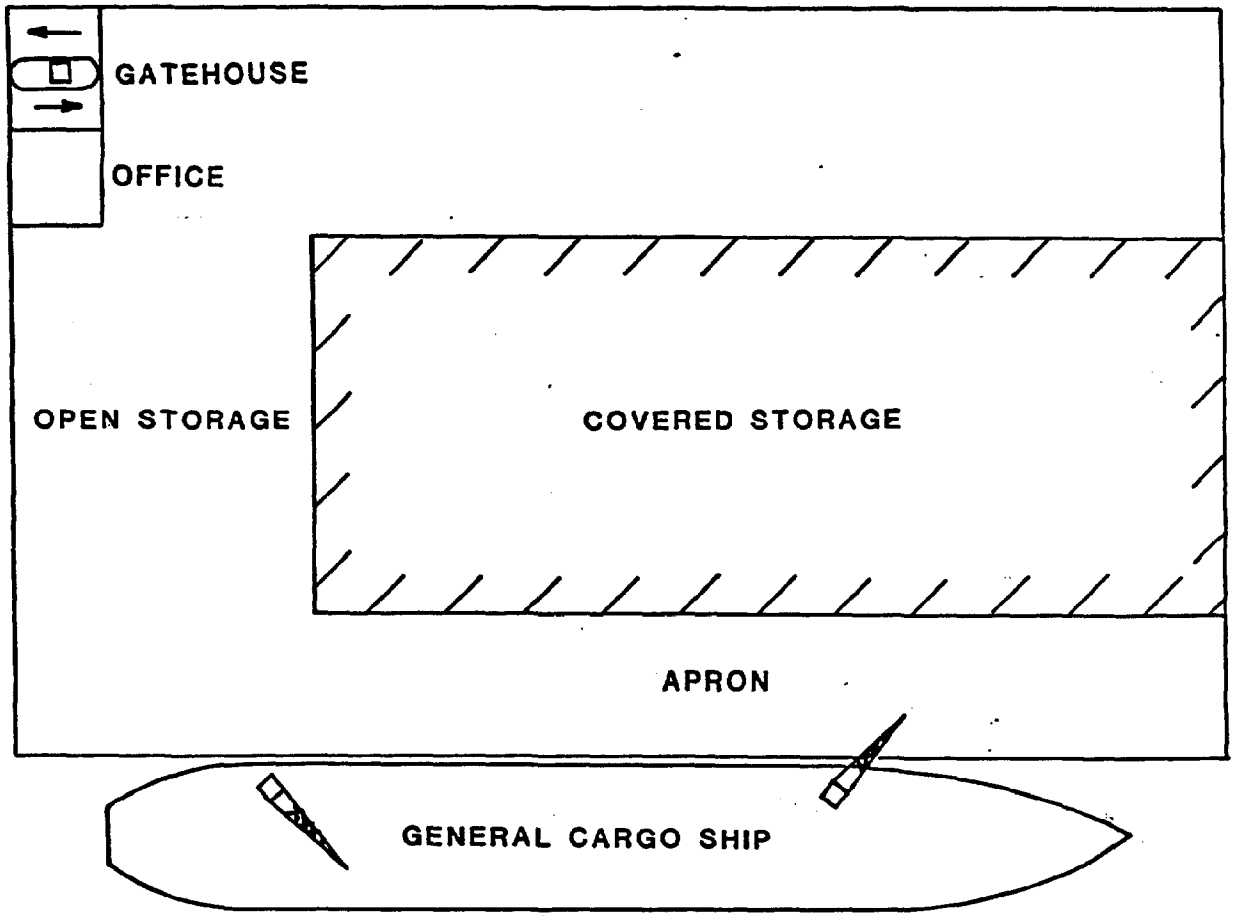

FIGURE 4-5

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DATA SHEET
ROLL-ON/ROLL-OFF TERMINAL

Typical Use:	Any containerized cargoes; loaded trucks; motor vehicles and equipment; possibly some lift-on/lift-off cargoes.
Berth Length:	400-500 feet.
Backland:	20 acres minimum
Capacity:	180,000 TPY
Vessel Calls:	100 per year, mostly regular service
Vehicle Generation:	250-300 trips per day, peak
Utility Demands:	Minimal, unless outlets for refrigerated units are provided; fire protection, electrical for 2,000 sf office, lighting for 20 acres, water and sewer for 40-50 workers.

TYPICAL ROLL-ON/ROLL-OFF TERMINAL

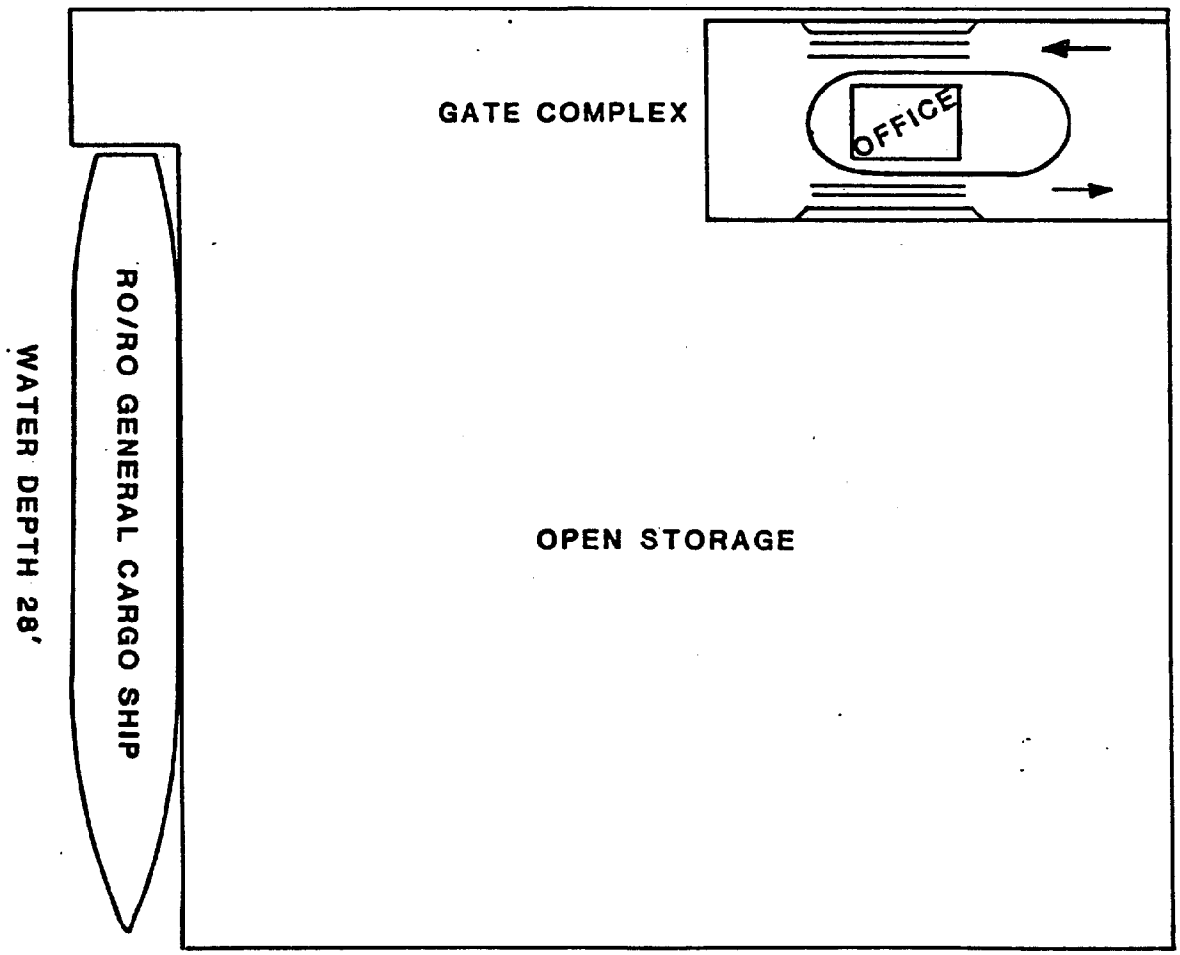
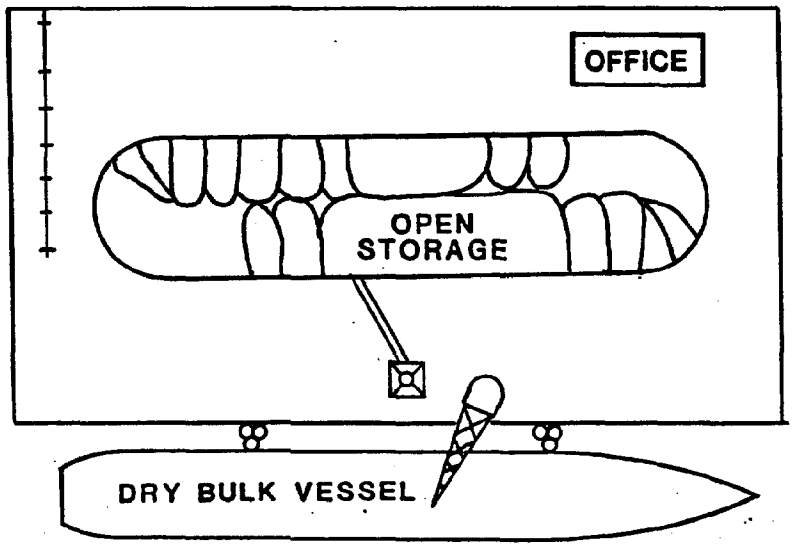


FIGURE 4-6

DATA SHEET
DRY BULK TERMINAL, OPEN STORAGE

Typical Use:	Building materials, salt, chemicals
Berth Length:	400-500 feet
Backland:	8-10 acres
Capacity:	300,000 TPY for unloading terminal; 500,000 TPY for loading terminal
Vessel Calls:	50 per year
Vehicle Generation:	200 trips per day, peak
Utility Demands:	Depends on electrical power demand for equipment; otherwise, fire protection, lighting for 8-10 acres, electrical power for 1,000 sf office, water and sewer for 10-15 workers.

TYPICAL DRY BULK TERMINAL, OPEN STORAGE



WATER DEPTH 28'

FIGURE 4-7

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DATA SHEET
CRUISE VESSEL TERMINAL

Typical Use:	Docking for cruise and charter vessels.
Berth Length:	200-250 feet minimum
Backland:	3-5 acres, minimum
Vehicle Generation:	400-500 trips per day, peak
Utility Demands:	Fire protection; electrical power for 5,000 sf terminal, lighting for 4 acres; water, sewer for terminal; if vessels home-based at this terminal, dockside water, electrical power and sewage pump-out.

TYPICAL CRUISE VESSEL TERMINAL

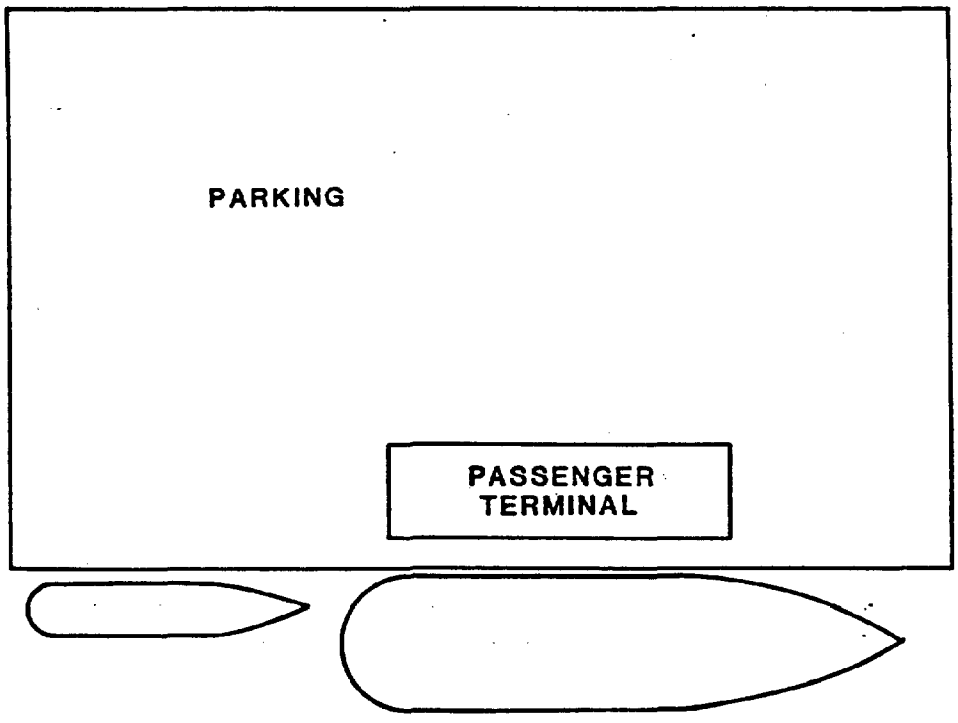

FIGURE 4-8

DATA SHEET
BOATYARD/MARINA

Typical Use:	Docking, storage, service, and repair of recreational vessels.
Backland:	3-5 acres, minimum
Vehicle Generation:	100-200 trips per day
Utility Demands:	Fire protection; electrical power for 200 sf office, storage areas, workshops, ships' store, etc., lighting for 4 acres; water and sewer for 20-30 workers; dockside electrical power, water, sewage pump-out.

TYPICAL BOATYARD/MARINA

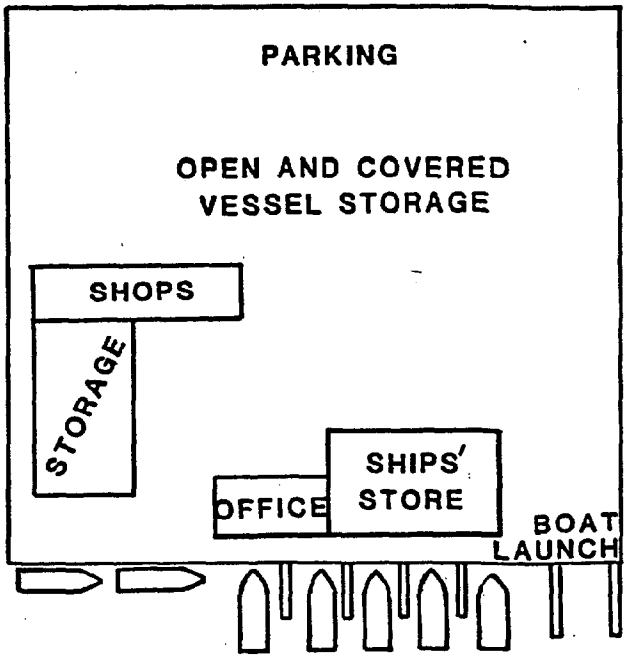

FIGURE 4-9

DATA SHEET
TYPICAL MULTI-PURPOSE DOCK

Typical Use:	Docking of fishing boats, tugs, pilot boats, police boats, etc.
Berth Length:	Varies
Backland:	2-3 acres
Vessel Calls:	Varies
Vehicle Generation:	Varies
Utility Demands:	Fire protection; electrical power for any administrative or security offices; water, sewer for 10-20 workers; lighting as necessary; dockside electrical power, water and sewage pump-out, as necessary.

TYPICAL MULTI-PURPOSE DOCK

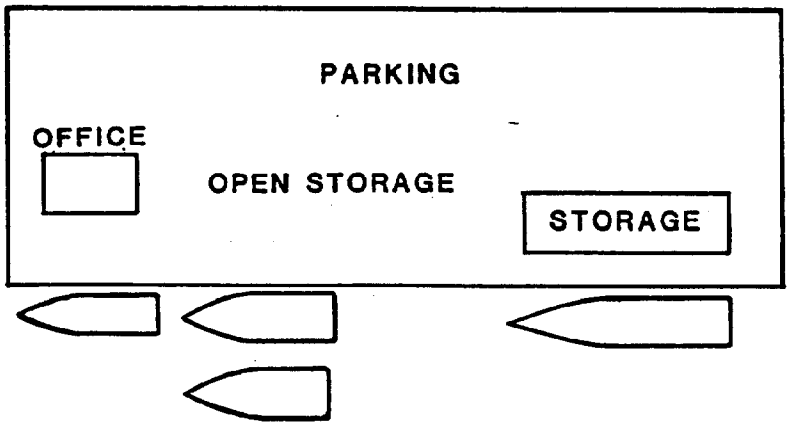

FIGURE 4-10

Predicting which of these uses will occur is as much an art as a science. Based on the experience of other areas in Florida, the Port of Fort Pierce could experience sufficient demand to justify any or all of the uses described, yet each is speculative. It is important, therefore, that the development plan provide flexibility in order to allow responsiveness to potential market opportunities.

In the first phase of this study, a potential port throughput of 300,000 TPY of general cargo was projected. Site A1 appears to have the greatest immediate development potential as a general cargo terminal, due to its configuration and proximity to deepwater. The site also has a rail spur and several potential means of road access. Bulkheading and basic site preparation (clearing, grading, utilities, roads) would allow accommodation of any potential use at the site.

The amount of back-up area available would be a constraint to development of more than one or two berths, depending on the cargo mix. Additional backland which might be available in site D or B could allow expansion to several berths if sufficient demand exists. Conceptual phased development of a general cargo terminal is shown in Figure 4-11, with a terminal capable of accommodating RO/RO and general cargo, with a potential for covered storage. The initial phase would have a capacity of approximately 200,000 TPY, depending on the cargo mix. If additional capacity is needed, further development could add 100,000 to 200,000 TPY.

As the phase one analysis also identified a potential bulk cargo throughput of 300,000 TPY, A2 or A2/B appears the most likely location for a dry bulk terminal, whether the current operation or a replacement. It is assumed that open storage or partial cover by a shed, rather than silo storage, will be used. Such a terminal at site A2/B would have a capacity of 300,000 to 500,000 TPY, depending on commodity and orientation of facility.

Compatible with existing and planned use, development of site D as a boatyard/marina seems potentially feasible and desirable. If a boatyard/marina at the site does not have need for the entire area, other port related uses are possible for the backland.

Site C is well-suited to several uses. As a marine cargo terminal, however, it would be at a disadvantage to site A based on distance to deepwater. With extensive frontage on both Taylor Creek and the Intracoastal Waterway, located adjacent to and opposite recreational boating facilities and the Harbortown development, the site seems more suited for

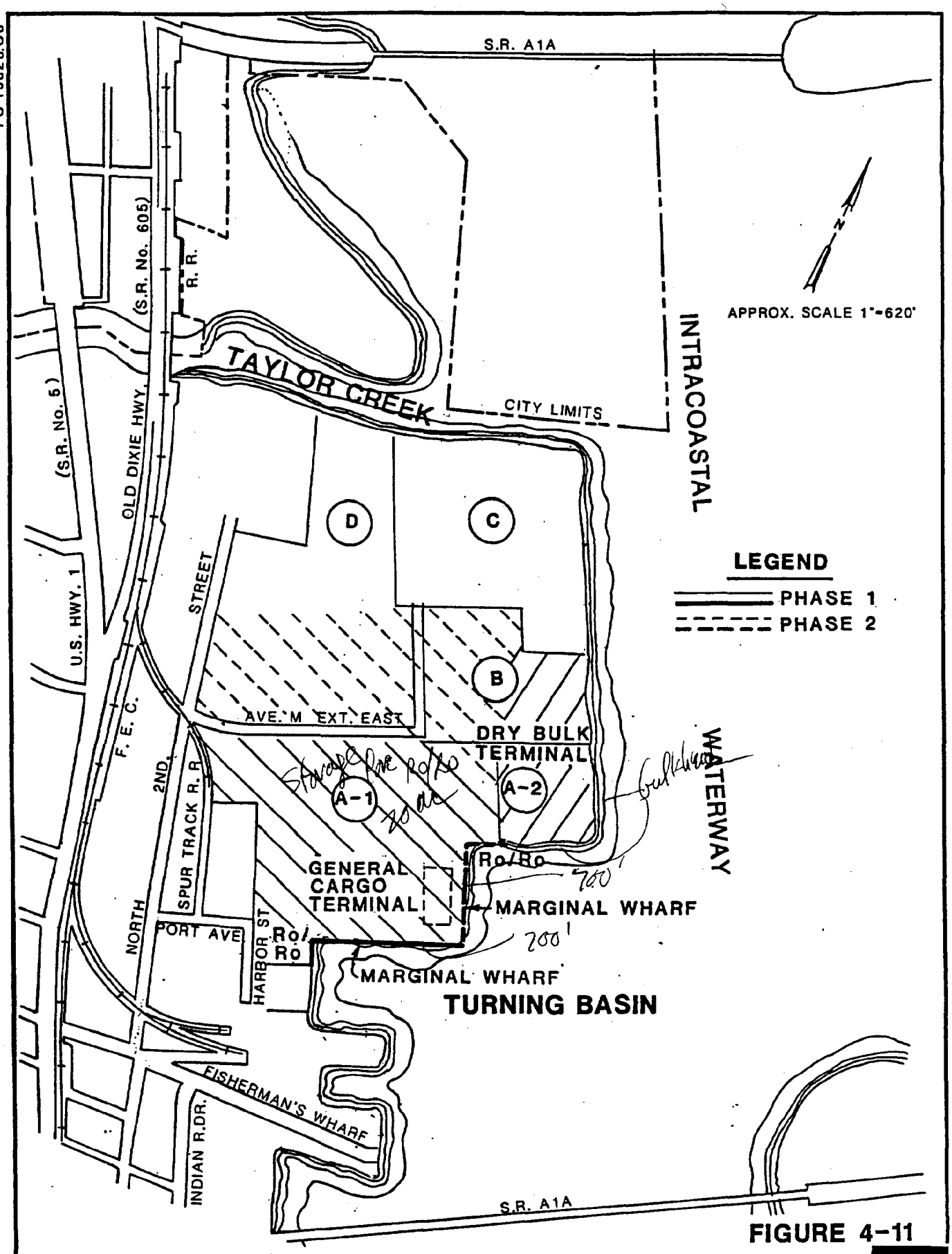

FIGURE 4-11

PORT OF FORT PIERCE CONCEPTUAL DEVELOPMENT
GENERAL CARGO TERMINAL

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waterfront-related commercial than industrial use. Possibilities could include a marina, cruise/charter vessel docking, fishing fleet dock with seafood market, etc. The site has sufficient waterfront and back-up area to support a variety of uses.

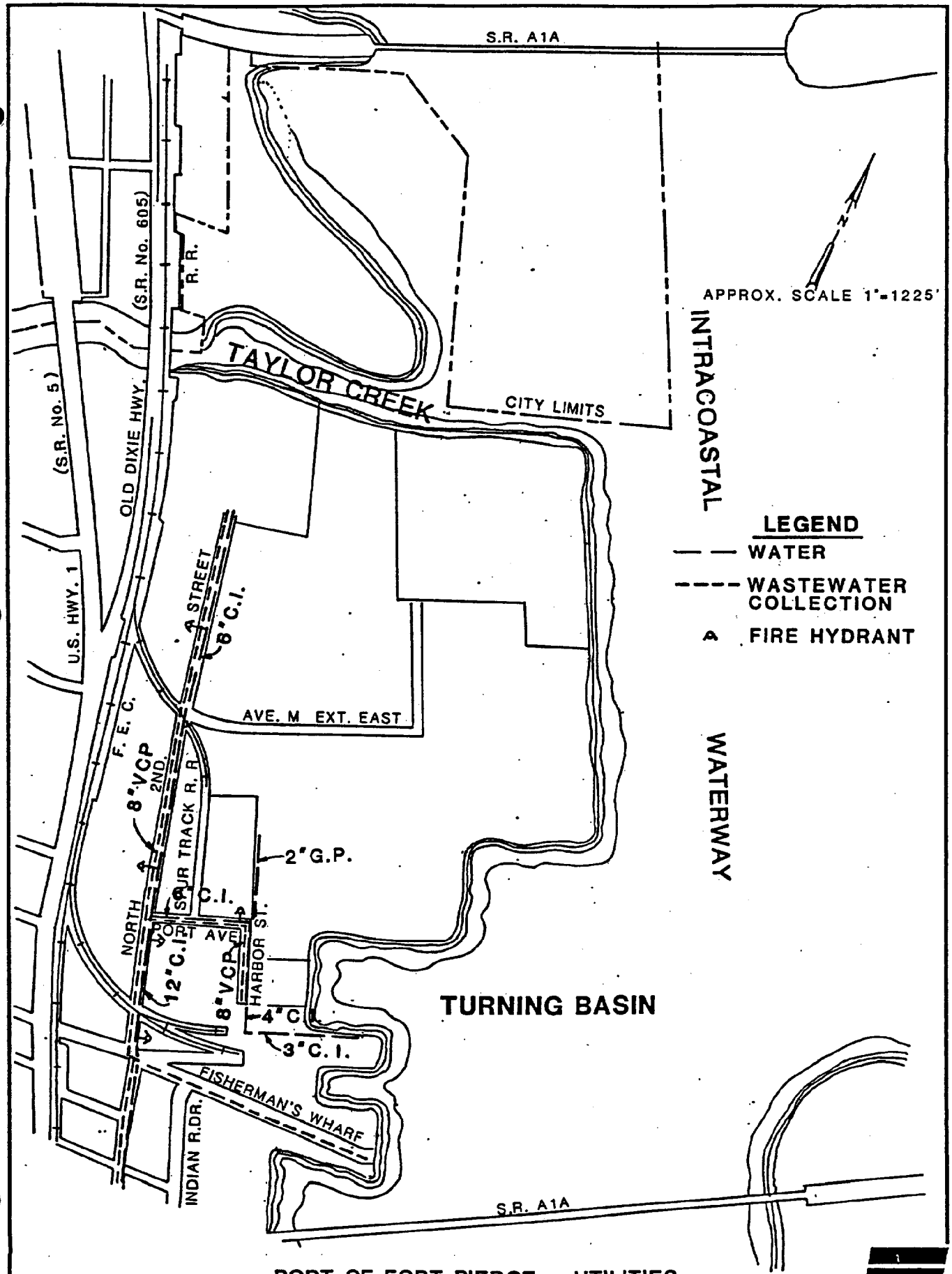
Figure 4-13 presents a potential port development plan to accommodate the discussed mix of uses.

UTILITIES

Infrastructure necessary to support port development is generally in place in Fort Pierce. Water and sewer service are provided to the port area by the Fort Pierce Utility Authority as shown in Figure 4-12. The water system, currently operating at approximately nine million gallons per day (mgd), was recently upgraded to a capacity of 20 mgd and is capable of being upgraded to 30 mgd. Sewer service is currently operating at about half its rated capacity of 9 mgd.

Since it is likely that all local utilities systems will experience significantly increased use over the next several years due to population growth and general economic development, the marginal effects of port development are difficult to assess. Based on the conceptual plan, little demand for water or sewer service would be generated by Phase 1 development of a general cargo terminal at site A1. Major demands from the plan shown would be for vessel services at a cruise/-charter terminal or marina. Total increased demand would likely be minimal compared to increases in residential, commercial and industrial development.

Electrical service to the port area, also from the Fort Pierce Utility Authority, is provided by a three-phase line on N. 2nd Avenue, with a substation nearby. The authority generates power and can also buy from and sell to Florida Power & Light. Potential port-related electrical demand does not appear to pose any significant problems for local generating capacity. As with water and sewer systems, increased energy demand from anticipated non-port related development should be much larger than from any combination of port development. Considering the conceptual plan, minimal electrical service would be needed for Phase 1 general cargo and terminal development. Unless refrigerated storage or outlets are provided, electrical demand from any general cargo terminal would be minimal. Demands from a bulk terminal depend on equipment. Dockside service to vessels at a cruise/charter terminal or marina, and boatyard machinery and equipment would present the only significant demands of port development.



PORT OF FORT PIERCE – UTILITIES

FIGURE 4-12

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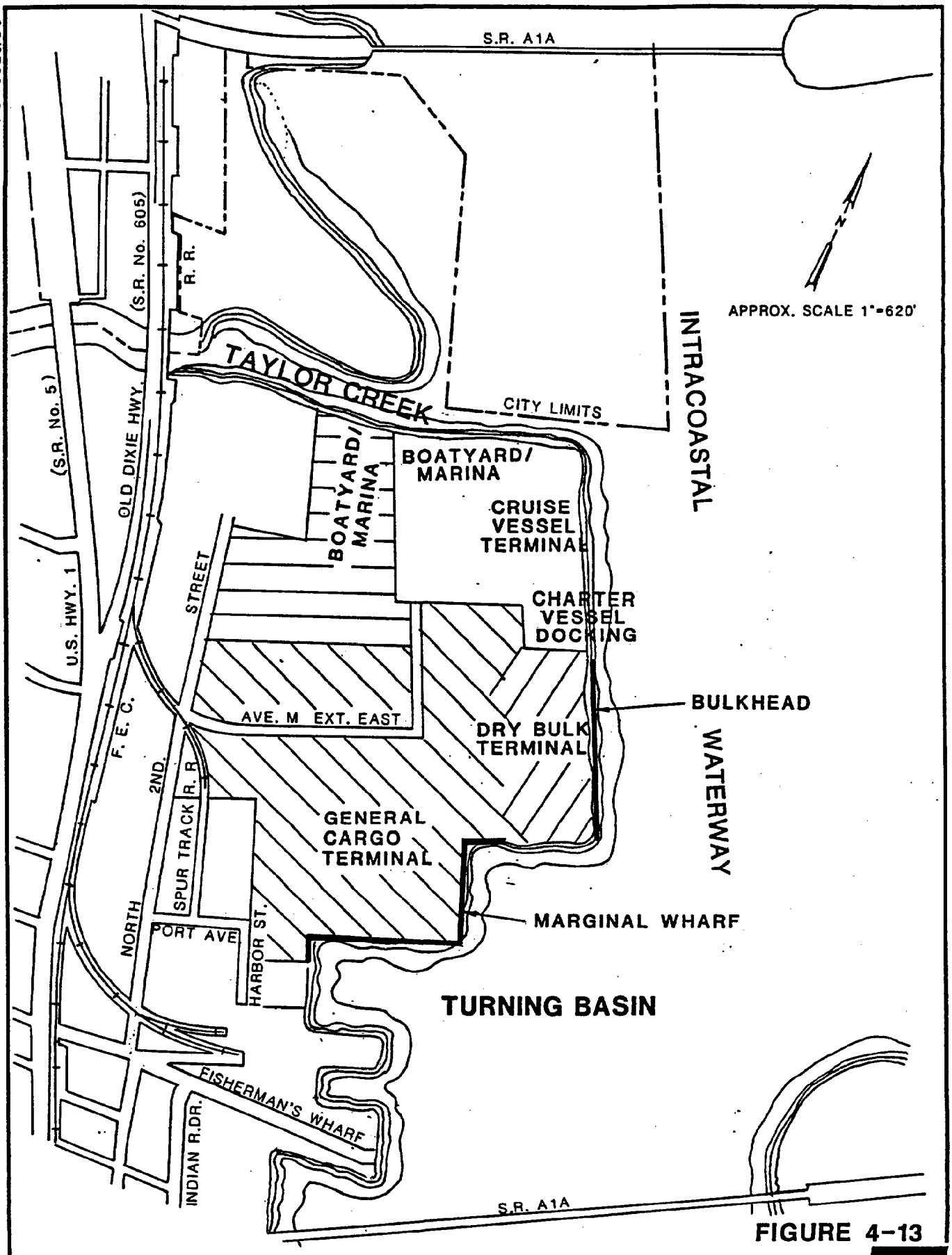

FIGURE 4-13

PORT OF FORT PIERCE CONCEPTUAL DEVELOPMENT MULTIPLE USES

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DEVELOPMENT PHASING

Having considered the various development alternatives available to the Port of Fort Pierce, the next step is to outline a phased development of those facilities which will provide the greatest initial benefit to the port as well as to develop the available real estate to its highest and best use in support of the Port of Fort Pierce.

Since the Fort Pierce Port and Airport Authority owns no real estate in the Port of Fort Pierce proper, the first requirement is to obtain the available undeveloped real estate within the port area which is currently in private owner-ship. The real estate should be acquired by outright direct purchase or, if appropriate, through condemnation by right of eminent domain. In order for this development plan to succeed it is essential that these undeveloped waterfront properties within the port be brought under public ownership and control to preclude their development for other than port related purposes and to insure the ultimate establishment of a viable, operating port at Fort Pierce.

The greatest benefits and return on investment would be provided by initial development of a general cargo facility. It is recommended that this be accomplished in two distinct phases, each within a five year period of time for a total of ten years for both phases.

Phase 1 consists of the development of Site A-1 as indicated in Figure 4-11. This would include 700 feet of marginal wharf, a RO/RO platform, 20 acres of backland storage area, an office and a gate. This site has a rail spur and road access. Utilities are available nearby. This initial development will provide a general cargo facility will an approximate capacity of 200,000 TPY, depending on types and mix of cargo, and should be completed within the first five year period following implementation of this Master Development Plan. Phase 1 facilities cost estimate is $7,770,000.

Phase 2 consists of the development of Site A-2 as indicated in Figure 4-11. This would include an additional 700 feet of marginal wharf, a second RO/RO platform and 15 more acres of backland storage area. Completion of Phase 2 should be scheduled within the second five year period after implementation of this plan. However, these additional facilities may be constructed at an earlier time should the need become apparent and economically justifiable. The Phase 2 facilities development will provide a total general cargo facility capability of 300,000 to 400,000 TPY with an incremental additional cost of $6,778,000.

A potential bulk cargo throughput of approximately 300,000 TPY has also been identified. The estimated cost for such a facility at recommended site A-2/B is $3,105,000 and will provide 550 feet of bulkhead and related improvements. Timing of the establishment of this facility is not contingent upon the phased construction previously discussed, but moreso dependent upon identified need and availability of funding. Therefore such facilities may be provided as required, either as a replacement for or as an addition to the existing private bulk handling operation.

Areas C and D should also be developed for the uses recommended on an as required basis.

COST ESTIMATES

1. General Cargo Terminal

A. Phase 1 (700' marginal wharf, RO/RO platform, 20 acres backland, office and gate)

Clearing & grading: 20 ac @ $5,000/ac =	$ 100,000
Bulkheading: 750 lf @ $3,400/lf =	2,550,000
Cathodic protection system, LS =	55,000
Apron:	
70,000 sf heavy duty @ $4/sf =	280,000
5,000 sf regular @ $3/sf =	15,000
Fenders & bollards: 750 lf @ $450/lf =	337,500
Utilities:	
Distribution cables and conduits =	93,000
40 floodlights @ $1,800 ea =	72,000
Water supply/fire protection systems =	100,000
Roads: 350 lf @ $90/lf =	31,500
Surfacing & drainage:	
10 ac heavy duty @ $110,000/ac =	1,100,000
6 ac regular @ $70,000/ac =	420,000
Office & gate house: 6,000 sf @ $50/sf =	300,000
Dredging: 17,500 cy @ $10/cy =	175,000
SUB-TOTAL	$5,629,000
Contingencies @ 20%	$1,125,800
SUB-TOTAL	$6,754,800
Engineering & surveys @ 15%	1,013,220
TOTAL	$7,768,020
Rounded to	$7,770,000

Notes:
1. Costs of possible covered storage and railroad improvements not included above.
2. Land acquisition costs are not included above.

B. Phase 2 (700' marginal wharf, RO/RO platform, 15 acres backland)

Clearing & grading: 15 ac @ $5,000/ac =	$ 75,000
Bulkheading: 750 lf @ $3,400/lf =	2,550,000
Cathodic protection system, LS =	55,000
Apron:	
60,000 sf heavy duty @ $4/sf =	240,000
5,000 sf regular @ $3/sf =	15,000
Fenders & bollards: 750 lf @ $450/lf =	337,500
Utilities:	
Distribution cables and conduits =	70,000
20 floodlights @ $1,800 ea =	36,000
Water supply/fire protection systems =	75,000
Roads: 250 lf @ $90/lf =	22,500
Surfacing & drainage:	
10 ac heavy duty @ $110,000/ac =	1,100,000
3 ac regular @ $70,000/ac =	210,000
Dredging: 12,500 cy @ $10/cy =	125,000
SUB-TOTAL	$4,911,000
Contingencies @ 20%	982,200
SUB-TOTAL	$5,893,200
Engineering & surveys @ 15%	883,980
TOTAL	$6,777,180
Rounded to	$6,778,000

Notes:

1. Costs of possible covered storage and railroad improvements not included above.
2. Land acquisition costs are not included above.

2. Dry bulk terminal

Bulkheading: 550 lf @ $3,400/lf =	$1,870,000
Fenders & bollards: 550 lf @ $450/lf =	247,500
Cathodic protection system, LS =	40,500
Dredging: 7,500 cy @ $10/cy =	75,000
SUB-TOTAL	$2,233,000
Contingencies @ 20%	466,600
SUB-TOTAL	$2,699,600
Engineering & surveys @ 15%	404,940
TOTAL	$3,104,540
Rounded to	$3,105,000

1.	General cargo terminal	
	A. Phase 1	$ 7,770,000
	B. Phase 2	6,778,000
2.	Dry bulk terminal	3,105,000
	TOTAL	$17,653,000

Notes:

1. No allowance made for covered storage areas or railroad improvements to service the bulk terminal.
2. Land acquisition costs not included above.
3. No allowance made in the above dry bulk terminal estimate for the provision of clearing/grading, paving the apron or backland, drainage, utilities, buildings, lighting, or roads.

Chapter 5
INLAND TRANSPORTATION

The transportation system serving the Port of Fort Pierce is shown in Figure 5-1. Water access is provided by a channel and basin maintained by the U.S. Army Corps of Engineers at a depth of 25 feet below Mean Low Water (MLW). The Intracoastal Waterway, with a minimum depth of 12 feet MLW, follows the Indian River through the port.

Served by the Florida Turnpike and I-95, St. Lucie County is favored with an excellent highway system. For intermodal traffic involving vessel-road interchange, highway is of particular importance to the port.

The port is served by the Florida East Coast (FEC) Railroad. In addition to sidings in the port, a piggyback ramp is located nearby for intermodal service. The FEC provides efficient cargo service between Jacksonville and Miami.

There has been serious discussion of a Fort Pierce stop on the proposed Florida high speed rail line between Tampa, Orlando, West Palm Beach, and Miami.

While there is currently no scheduled service at the St. Lucie County International Airport, plans are proceeding for terminal development. Airport development is recognized as critical to local economic development. As phased development progresses for both the Fort Pierce Port and the St. Lucie County International Airport, serious consideration should be given to establishing both a highway and rail link directly connecting the port and airport. This will assist these two complexes in becoming mutually supporting along with further industrial development in the area.

Figure 5-1 also shows peak season daily traffic volumes for principal local roads serving the port, based on the Fort Pierce Area Transportation Study of December, 1984. Direct access to and from the port is via U.S. 1, a five lane highway already projected to experience increased use and congestion. An alternate local north-south route is 25th Street. Access inland and to the Florida Turnpike and I-95 is via SR-70 (Okeechobee Road - Delaware Avenue), or, I-95, Orange Avenue. Another alternate route to I-95 North is U.S. 1 to Indrio Road to I-95. An alternate routing to the Florida Turnpike is by U.S. 1 South to Virginia Avenue and SR-70 (Okeechobee Road). Access between the seaport and airport would likely be via U.S. 1 - St. Lucie Boulevard. An alternate route could involve Orange Avenue or Avenue D, and 25th Street to St. Lucie Boulevard.

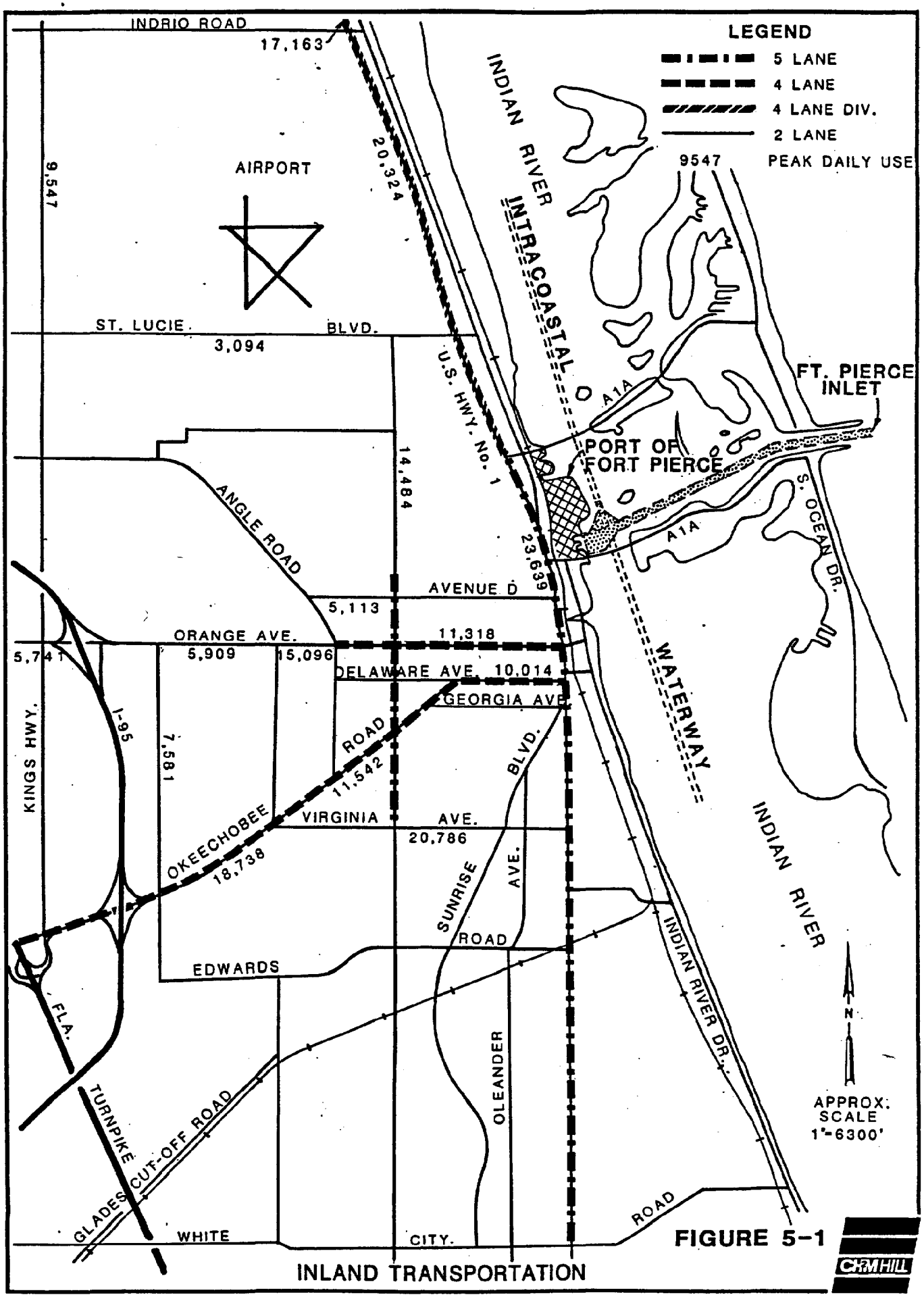

FIGURE 5-1

INLAND TRANSPORTATION

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Potential problem areas exist along these routes. Based on the Transportation Study, several were operating near capacity in 1984, and a portion of Orange Avenue was exceeding capacity. Utilization of segments particularly relevant to port access are shown below, based on the 1984 study.

Segment	% Cap
Orange Ave. between Hartman Rd and 33rd St.	126
U.S. 1 adjacent to the port	82
Okeechobee Rd. between Kings Highway and and Hartman Road	81
U.S. 1 between St. Lucie Blvd. and Indrio Rd	71
Delaware Ave. between Okeechobee Rd. and U.S. 1	67
Okeechobee Rd. between Virginia Ave and 25th St.	63
Orange Ave. between Jenkins Rd. and Hartman Rd.	49
Orange Ave. between 25th St. and U.S. 1	49
St. Lucie Blvd., adjacent to the Airport	32

Also, according to the Transportation Study, Delaware Avenue between Okeechobee Road and 7th Street, Avenue D between U.S. 1 and 7th Street, and St. Lucie Boulevard between U.S. 1 and 25th Street are less than standard widths; Okeechobee Road between Kings Highway and I-95, and U.S. 1 south of Orange Avenue operate at unsatisfactory peak traffic levels, and several intersections along U.S. 1, SR-70, Orange Avenue, and 25th Street were identified as high accident locations.

There is recognition by the City and County that these and other traffic problem areas will be exacerbated by the growth anticipated over the next several years, and several projects are underway, planned or proposed. Based on the conceptual plan, Phase 1 development of a general cargo terminal at site A2 would likely generate minimal traffic, 350 to 450 trips per day, relative to the capacity of 29,000 trips per day of US. 1 adjacent to the port. The complete port development concept shown in Figure 5 would generate 1,000 to 1,500 trips per day, a level which could create problems on local access roads. As it appears likely that Fort Pierce and St. Lucie County will experience considerable non-port traffic increases over the next several years, and considering that use of the undeveloped site for some purpose is a near certainty, however, traffic generation of less than 20 vehicle trips per development acre appears acceptable.

XII-C
6

Chapter 6
FINANCING ALTERNATIVES

INTRODUCTION

This chapter of the report discusses financing alternatives for the Port of Fort Pierce channel deepening and port improvement program. The channel deepening program will be financed jointly by the Fort Pierce Port and Airport Authority and the U.S. Army Corps of Engineers. The port improvement program likely will be financed by the Port and Airport Authority.

CHANNEL DEEPENING PROGRAM

The U.S. Corps of Engineers has estimated that the channel deepening project will cost $6,424,000 of which $224,000 would be the non-federal local cost based on traditional cost-sharing policies. The non-federal costs of $224,000 have been further defined as being composed of $120,000 for additional beach fill placement costs and $104,000 for maintaining adequate depths in berthing areas and local access areas serving terminals and all lands, easements, and rights-of-way necessary for the project.

PORT IMPROVEMENT PROGRAM

The recommended Port improvement is estimated to cost a total of $17,653,000. Incremental costs are as follows:

Facility	Timing	Est. Cost
General Cargo Terminal		
Phase 1	0-5 Years	$ 7,770,000
Phase 2	5-10 Years	$ 6,778,000
Dry Bulk Terminal	As Required	$ 3,105,000
	Total	$17,653,000

It is recommended that these costs be financed by the Fort Pierce Port and Airport Authority, as required, in order to provide the basic Port facilities considered essential for a viable port operation. These improvements would be provided for sites A (A-1 and A-2) and B.

The option of attracting private financing for additional improvements and the operation of the proposed facilities at those sites should be explored.

Similarly, consideration should be given to the use of private financing and development of Sites C and D for utilization in accordance with the recommendations of this Master Development Plan.

During the interim between acquisition of port properties and the development of port facilities the Authority owned and undeveloped real estate should be temporarily leased in order to generate revenues to assist in defraying the costs of land aquisition and debt service on borrowed funds.

As regards the financing of the Authority sponsored and funded port improvements the following options are available:

- o State or Federal Grants and Loan Guarantees
- o Revenue Certificates
- o General Obligation Bonds

With respect to grant financing for port improvements, the availability of particular grants changes from year to year and is often tied to the exact nature and components of the project. The types and availability of grants should be identified as the projects become more imminent. Economic Development Administration (EDA) funding should be pursued for port projects. Coordination with the City of Fort Pierce in applying for roadway improvement grants should also be pursued. The availability of Small Business Administration (7a) loan guarantee program for private development should also be identified.

The Port Authority does have the authority to issue revenue certificates, payable solely from revenue derived from operating or leasing the projects. These certificates are not backed by the county taxing authority and are limited to interest rates not exceeding 7 percent per annum. The ability to finance improvements at the Port of Fort Pierce backed by the revenues of the Port and Airport Authority is not considered realistic at this time because of the lack of a revenue history at the Port and Airport Authority. Rather, revenue certificates would be likely financing mechanisms after the Port Authority has established itself either as an ongoing concern that, through its business activities, can support further expansions or can obtain a financial guarantee from a prospective tenant.

The most feasible financing method will be general obligation bond financing. The Port and Airport Authority does have taxing powers within St. Lucie County to levy upon all of the real and personal taxable property within the county a special tax to pay the interest and principal of a general obligation bond. The issuance of bonds is contingent upon county voter approval and is limited to interest rates at or below 7 percent per annum.

In addition, there is a special tax, known as a maintenance tax, not exceeding 3 mills on the dollar per annum to be used for the maintenance, operation, promotion, enlargement, and administrative purposes.

The use of general obligation bond financing is recommended for acquisition of the required port properties and for the initial development of port facilities. These funds could be supplemented by levying a maintenance tax within the authorized taxing district. Additional funding for subsequent development of port facilities could come from the private sector. Furthermore, the potential for financial assistance from grant funded programs should be explored in detail for additional funding assistance opportunities.

Chapter 7
PORT MANAGEMENT PLAN

Management of the Fort Pierce Port falls within the jurisdiction of the Fort Pierce Port and Airport Authority as previously established by Florida Statutes known as the Fort Pierce Port and Airport Authority Act. The governing body is composed of the five county commissioners of St. Lucie County and meets twice monthly on a regular basis.

The Authority is empowered "to construct, improve, or develop airports, heliports and other air terminals and such buildings, structures, roads, alleyways, railroad loading and unloading facilities and any other development of land as the Authority shall determine to be necessary and proper in the performance of the duties and purposes of this act [chapter]; and to enact, adopt and establish by resolution, rules and regulations for the complete exercise, jurisdiction and control over such areas". Additionally, the Authority "may construct, maintain and improve the Fort Pierce Harbor and inlet between the Indian River and the Atlantic Ocean connecting with said harbor, and navigable waterways connected therewith, and also construct, improve and maintain such jetties, revetments, slips, wharves, docks, warehouses, terminals and other works in connection with such inlet, harbor and waterways as may be owned or controlled by Fort Pierce port and airport authority. The construction, maintenance and improvements of such inlet, harbor, waterways and slips, wharves, docks, warehouses and terminals connected therewith are hereby found and declared to be for public purposes and to be necessary for the use of shipping and other transportation and for the extension of commerce of the state and of the authority, and also to be necessary for the maintenance of the health of the inhabitants of the territory embraced in the authority and for the convenience, comfort and welfare of the authority and the inhabitants hereof."

The Authority has taxation powers within St. Lucie County for airport and port purposes and may issue bonds for the acquisition, construction, reconstruction or improvement of facilities. The Authority has the power to own, hold and acquire real property by direct purchase and the right by eminent domain to condemn lands, easements or other property needed for the Authority's purposes.

At present the Authority owns no lands within the area which is considered by this plan to be the Port of Fort Pierce geographical area. With the exception of the City Wharf the individual properties within the Port area are in private ownership with major portions undeveloped. This plan recommends aquisition of designated properties, either by direct purchase or condemnation, with subsequent phased development of port facilities.

The governing body of a port can take many forms. In some cases it is a combined Airport and Port Authority, such as at Fort Pierce. Others are in fact integral administrative divisions of a state, county or municipal government. In the majority of cases U.S. Port Authorities are rather independent, single purpose entities with the appearance of being self-sustaining and autonomous public bodies.

The Fort Pierce Port and Airport Authority is rather unique in that it is in fact the St. Lucie County Commission acting in an alternate capacity. A recent analysis of 105 U.S. Port Authorities by the American Association of Port Authorities revealed that 66 are appointed, 27 are elected and nine have no governing bodies whatsoever. Only three, two in Florida and one in Louisiana, have the County Commission, by law, constituting the Port Authority Board.

The enabling legislation that establishes the Fort Pierce Port and Airport Authority provides the requisite authority to accomplish those actions essential for establishing, operating and maintaining a port and airport with related facilities. However, it would appear to be more in the public interest for Authority members to be appointed to their respective positions, as is the case with the great majority of U.S. Ports Authorities. This would provide a single-purposed governing body of individuals with a specific vested interest in promoting the growth and orderly development of the port and airport while remaining relatively detached from the pressing demands of other primary responsibilities and the political pressures which accrue to elected positions due to the realities associated with the requirements to satisfy a constituency.

In view of the foregoing it is recommended that legislation be initiated and enacted during the next following legislative session to change the procedure for designating individual Authority Board Members from the present system to an appointed system. Initial appointments should be for staggered terms of office to preclude a complete change of all members at the same time, thereby assuring continuity of the Board's direction and focus.

While the sources and methods of appointment may vary considerably, the following model is one recommended approach for a five member Board.

Board Member	Area Of Representation	Method Of Appointment	Term Of Office (Initial)
1	Fort Pierce	City Council	2 Yrs.
2	Port St. Lucie	City Council	2 Yrs.
3	County-at-Large	County Commission	3 Yrs..
4	County-at-Large	County Commission	3 Yrs.
5	County-at-Large	County Commission	4 Yrs.

The composition of this model Board provides the opportunity for the three governments within St. Lucie County to have their views represented.

An alternative, but similar model, would increase the Board representation to seven members with the following suggested composition:

Board Member	Area Of Representation	Method Of Appointment	Term Of Office (Initial)
1	Fort Pierce	City Council	2 Yrs.
2	Port St. Lucie	City Council	2 Yrs.
3	County-at-Large	County Commission	2 Yrs.
4	County-at-Large	County Commission	3 Yrs.
5	County-at-Large	County Commission	3 Yrs.
6	County-at-Large	County Commission	4 Yrs.
7	County-at-Large	County Commission	4 Yrs.

The second model provides greater representation to the County-at-Large and affords the opportunity for a wider range of perspectives. It further enhances the opportunity to constitute a quorum at Authority meetings.

The responsibility for the day-to-day operations, maintenance, planning and development of port and airport activities and facilities is delegated to the Port and Airport Manager. The ongoing major expansion and continuing development of the St. Lucie County International Airport demands the full and undivided attention of this key individual. It is recommended that an additional position be authorized for a full-time Assistant Port Director and filled expeditiously. This position would be responsible for Port development activities and accountable directly to the Port and Airport Director. Since the phased development of essentially a new port at Fort Pierce will require considerable attention and full-time availability for coordination of port related activities, it is essential for the individual directly responsible to be unencumbered with other responsibilities. As the port expands and becomes a viable operation serious consideration should then be given to the establishment of a minimum port staff consisting of a Port Director, an Assistant for Marketing and clerical assistance. This operational staff should be located within the port complex in close proximity to the waterfront facilities.

Because of the natural relationship between the Port and Airport it is recommended that the two facilities remain under the singular control of one governing agency, in this case the Fort Pierce Port and Airport Authority. This will further facilitate and enhance the capability for mutually supporting industrial development and common bonds such as the establishment and operation of a Foreign Trade Zone.

VI

Chapter 8
ENVIRONMENTAL ANALYSIS SUMMARY

PROJECT DESCRIPTION

Proposed improvements to Fort Pierce Harbor include the U.S. Army Corps of Engineers (USACE) inlet improvements plan and the local port facilities improvements plan. The USACE plan recommends an entrance channel 400 feet wide and 30 feet deep from the open ocean to between the jetties and 250 feet wide and 28 feet deep to the turning basin. The recommended turning basin is 1,100 feet^2 and 28 feet deep with a north access channel 1,250 feet long, 250 feet wide, and 28 feet deep. Unsuitable materials (450,000 yard^3) will be disposed of offshore; suitable sand (250,000 yard^3) will be placed on the shoreline south of the inlet to widen the beach. Suitable material (250,000 yard^3) will be placed in an existing borrow pit in the Indian River to convert 12 acres of deep-water habitat to shallow-water habitat. The recommended port facility improvements plan includes (Phase 1) construction of a general cargo terminal (750 lineal feet of bulkhead and dredging 17,500 yard^3 of material) and (Phase 2) continued general cargo terminal enlargement (750 lineal feet of bulkhead and dredging 12,500 yard^3 of material) and construction of a dry bulk terminal (550 lineal feet of bulkhead and dredging 10,500 yard^3 of material).

Affected Environment

The existing inlet facilities consist of a 200-foot wide, 27-foot deep entrance channel and a 200-foot wide, 25-foot deep channel to the turning basin. The turning basin is 1,600 feet by 900 feet and 25 feet deep, and a 500-foot channel exists on the north side of the basin. Inlet jetties have modified the barrier islands by preventing natural sand movement. Causeways connecting the mainland to the barrier islands frame the inlet proper and constrict tidal flow into the Indian River. The Indian River is a shallow lagoonal estuary paralleling the coast behind barrier islands.

Water column physiochemical properties in the inlet area are dependent on oceanic tidal flow and freshwater inflow from Taylor Creek, C25 canal. Tidal currents account for 93 percent of the variance in current flow. Periodic, large discharges of freshwater from Taylor Creek and strong tidal influence result in large changes in water quality parameters within the inlet area. Taylor Creek has been shown to be a source of high nutrient levels and contributes waters with a high tannin-induced color. Moore Creek and the Fort Pierce sewage treatment plant outfall are also potential sources of pollution.

According to results of USACE core borings, the existing turning basin contains silt in the upper layers; the existing channel is predominantly sand. From other studies, sediment samples from near the discharge of Taylor Creek and Moore Creek have been found to contain high levels of total DDT and PCB residues.

The inlet with its strong tidal influence serves as a conduit for transfer of various materials and organisms between the lagoon and the coastal/continental shelf area. The unique plant communities--including seagrass beds, mangroves, and salt marshes--and their associations form the basin for high productivity in the Indian River Lagoon. Extensive seagrass beds are found where there is sufficient light penetration and a suitable substrate exists. Halodule wrightii (shoalgrass) and Syringodium filiforme (manatee grass) are the dominant species. The inlet area contains the large, shallow-water, densely vegetated Jim Island seagrass bed and several less densely vegetated areas. Several variations of mangrove communities exist within the lagoon; the dominant type is the shoreline fringe community. Impoundment of mangroves for mosquito control has resulted in the loss of functional tidal exchange within most of the mangrove areas in the Indian River. A large mangrove impoundment exists in the northeast corner of the inlet area. Mangroves, which are not cold tolerant, are near their northern limit within the Indian River Lagoon and are replaced within the intertidal zone by salt marsh plants. Several small areas of Spartina alterniflora (cordgrass) exist within the inlet area.

Major coastal habitats in the inlet area are beaches and reefs. The surf zone beach is dominated by animal species capable of living in a turbulent, high-energy environment and utilized as feeding ground for many surf-zone birds. Several species of sea turtles use the beaches for nesting. Nearshore reefs of Pleistocene limestone form discontinuous bands paralleling the shoreline. The polychaete worm, Phragmatopoma lapidosa, forms colonies of wormrock that cover the basal limestone in areas. The wormrock reefs have been shown to form the basis for a complex marine community. A wormrock reef has developed east of Dynamite Point within the inlet but appears to be experiencing die-back and erosion at the present time. Several other limestone ledge systems occur farther offshore, forming hard ground for attachment of algae, sponges, ascidians, some scleractinian corals, and octocorallian soft corals, and habitat for motile invertebrates and fishes. Reefs composed of Oculina varicosa, a branching scleractinian coral, have been located in depths of 165 to 330 feet off the inlet.

The seagrass beds contain the richest fish fauna within the lagoon. Most of the species found within seagrass beds are juveniles, demonstrating the role of seagrass beds as nursery areas for local fishes. Nearly 50 percent of the fishes recorded within the inlet area are normally associated with offshore reefs. These fishes are either mature and leave the lagoon or make temporary offshore spawning migrations. Important commercial fishery species exist within the inlet and offshore areas. The lagoonal habitat is used by many birds for rookery areas and/or feeding and nesting habitat. In addition, several endangered or threatened species exist within the Indian River Lagoon. The Indian River is Critical Habitat for the manatee, and sea turtles use the ocean beaches as nesting habitat and the lagoon as developmental habitat.

Assessment of Impacts

The USACE feasibility document (USACE, 1986) identifies several effects of impacts from the Federal channel improvement project:

- effects of estuarine hydraulics
- effects of dredging on water quality
- flooding effects
- direct effects on seagrasses
- effects of construction-generated turbidity on seagrass
- effects on the inlet wormrock reef
- effects on beach and nearshore reef communities
- effects of dredging on sea turtles
- effects of beach disposal on sea turtles
- effects on manatees
- effects on other endangered species
- effects on fishery resources
- effects on aquatic bird habitat
- effects on ocean dumping
- effects on Indian River disposal
- secondary impacts

As proposed, the federal project is expected to have minimal direct impact on valuable fish and wildlife habitat. However, the U.S. Fish and Wildlife Service (USFWS) has raised concern about the potential for expansion of a zone of no seagrass growth in the Jim Island seagrass bed due to channel widening. Also, secondary effects linked to the operation of a port facility in this area have potential to result in long-term degradation of fish and wildlife habitat. However, no known direct losses of vegetated habitat are anticipated to result from the proposed port facility modification project.

Mitigation Plan

The basic objective of mitigation is to maintain the functional and reproductive capacity of fish and wildlife resources of the area while accommodating necessary economic growth that is clearly in the public interest. The USFWS has developed a prioritized definition of mitigation for planning purposes. Both the proposed federal and local projects are expected to have minimal direct effects on valuable fish and wildlife habitats, but unpredictable primary and secondary effects may occur, making mitigation measures desirable. The goal of port development and mitigation plan should be the same as the general goal put forth by the Aquatic Preserve Management Plan--to ensure the maintenance of habitats in an essentially natural condition, and to restore and enhance those habitats that are not in a natural condition. The proposed federal project includes two mitigation measures: 1) placement of sand on the beach south of the inlet, followed by planting with beach grasses; and 2) the placement of dredged material in the Causeway Island borrow pit, followed by planting with shoalgrass. A recommended alternative mitigation measure is to open impounded mangrove areas to tidal flushing. The local port authority should enlarge upon the mitigation measures recommended for the federal project. The concept of mitigation "banking" is discussed in relation to long-term benefits to the environment and the port.

Environmental Monitoring Guidelines

Recommended guidelines for each aspect of channel and port facility improvement are discussed. Environmental concerns involved with dredging include: 1) quality of dredge material and potential for resuspension of pollutants; 2) turbidity resulting from dredging operations; 3) direct removal of important habitats; and 4) potential for collision of boats and barges with manatees. Adequate testing of the dredged material prior to dredging is needed. Maintenance of the State standards for turbidity, using a mixing zone of 150 meters (492 feet) from the work area, should be ensured through frequent monitoring to protect adjacent valuable fish and wildlife resources. Primary and secondary port development effects on adjacent fish and wildlife resources should be monitored through frequent surveys of those resources. Avoidance of manatees moving through the port area during construction should be made a dredging contract provision. Dredged material disposal sites should be monitored for, at minimum, maintenance of State standards for turbidity. Recommendations are made for monitoring programs for the proposed mitigation/revegetation projects.

PROJECT DESCRIPTION

The proposal for improvements to Fort Pierce Harbor includes a plan for inlet improvements by the U.S. Army Corps of Engineers (USACE) and a plan for locally sponsored port facility improvements. As recommended by the USACE feasibility report (May 1986) and the Board of Engineers for Rivers and Harbors, the proposed inlet improvement project (Figure 8-1) includes modification of the entrance channel to a 400-foot width and a 30-foot depth, widening of the interior channel to a 250-foot width and a 28-foot depth, and enlarging the existing turning basin to an 1,100 foot^2 area and a 28-foot depth. Also, an access channel extending north from the turning basin will be 1,250 feet long, 250 feet wide, and 28 feet deep (Figure 8-1). As recommended by CH2M HILL, the proposed modifications to port facilities (Figure 8-2) include (Phase 1) construction of a general cargo terminal and (Phase 2) continued enlargement of the general cargo terminal and construction of a dry bulk terminal.

The USACE project would involve dredging approximately 506,000 yards^3 and 450,000 yards^3 of sand and silt, respectively, from the channels and turning basin. This excavation will result in conversion of 20 acres of shallow-water habitat to deep-water habitat (28 feet). About 256,000 yards^3 of predominantly sand (with some silt) will be placed in an existing dredged pit south of Causeway Island to convert approximately 12 acres of deep-water habitat to shallow-water habitat. Any remaining suitable sand would be placed on the beaches south of the inlet to form a planned project beach 50 feet wide and about 2,500 feet long. All remaining silt material will be disposed of at the U.S. Environmental Protection Agency (EPA) interim- approved offshore disposal site 5.5 miles east-southeast of the inlet. Port facility improvements involve construction of a marginal wharf with 750 lineal feet of bulkhead and dredging of 17,500 yd^3 of material to connect the wharf with the proposed Federal project. Phase 2 involves enlarging the marginal wharf with 750 lineal feet of bulkhead and dredging an additional 12,500 yards^3. Construction of the dry bulk terminal in Phase 2 involves 550 lineal feet of bulkheading and 10,500 yards^3 of dredging. Phase 2 dredging will connect the marginal wharf for the proposed federal project. Currently, there are no data concerning the type of material to be excavated for port facilities improvements. Depending on the quality, the material can be used in the Causeway Island borrow pit or on the beach south of the inlet. If the material contains predominantly silt, it must be disposed of at the EPA interim-approved offshore site.

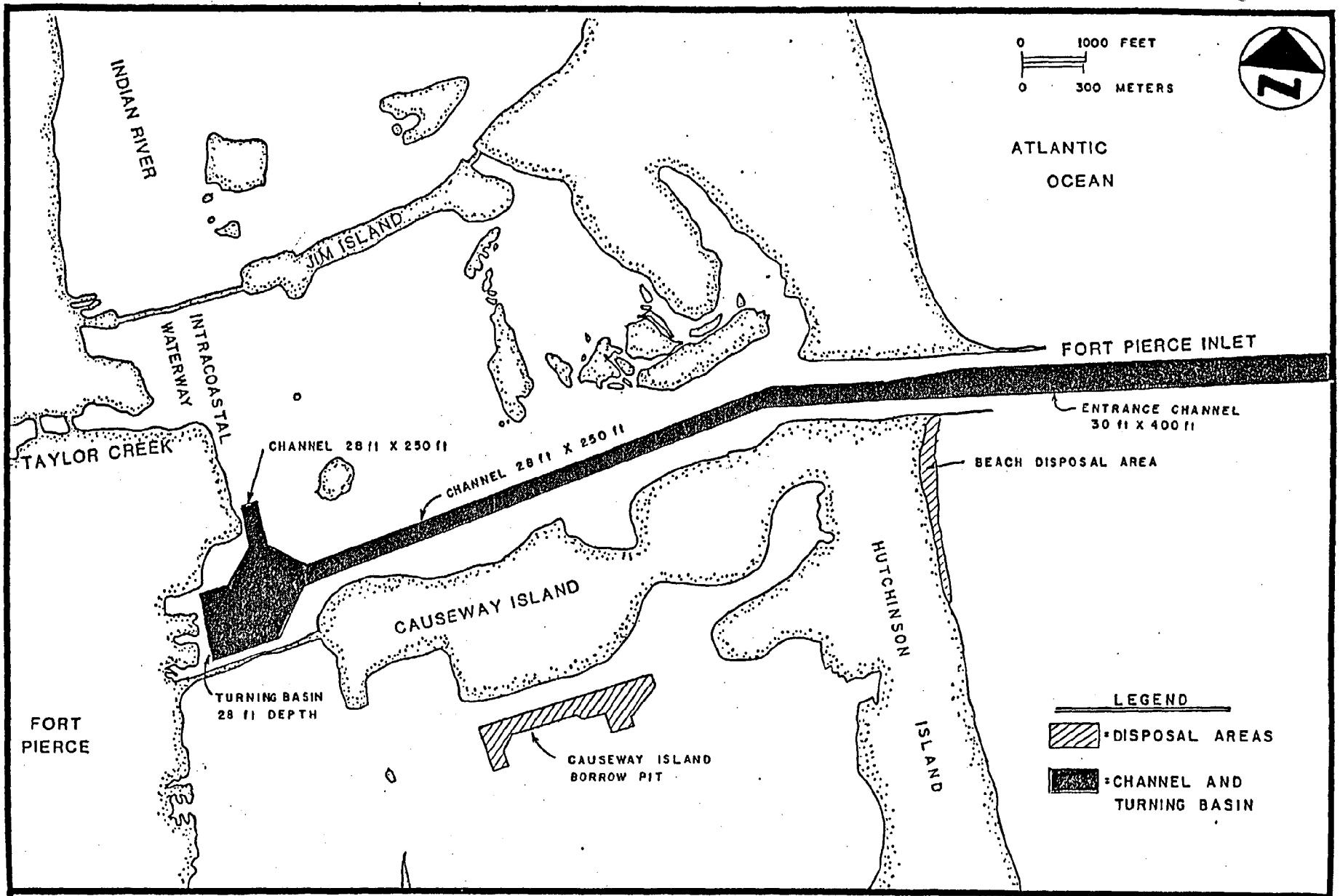

FIGURE 8-1 PROPOSED CHANNEL IMPROVEMENT PROJECT RECOMMENDED BY THE U.S. ARMY CORPS OF ENGINEERS.

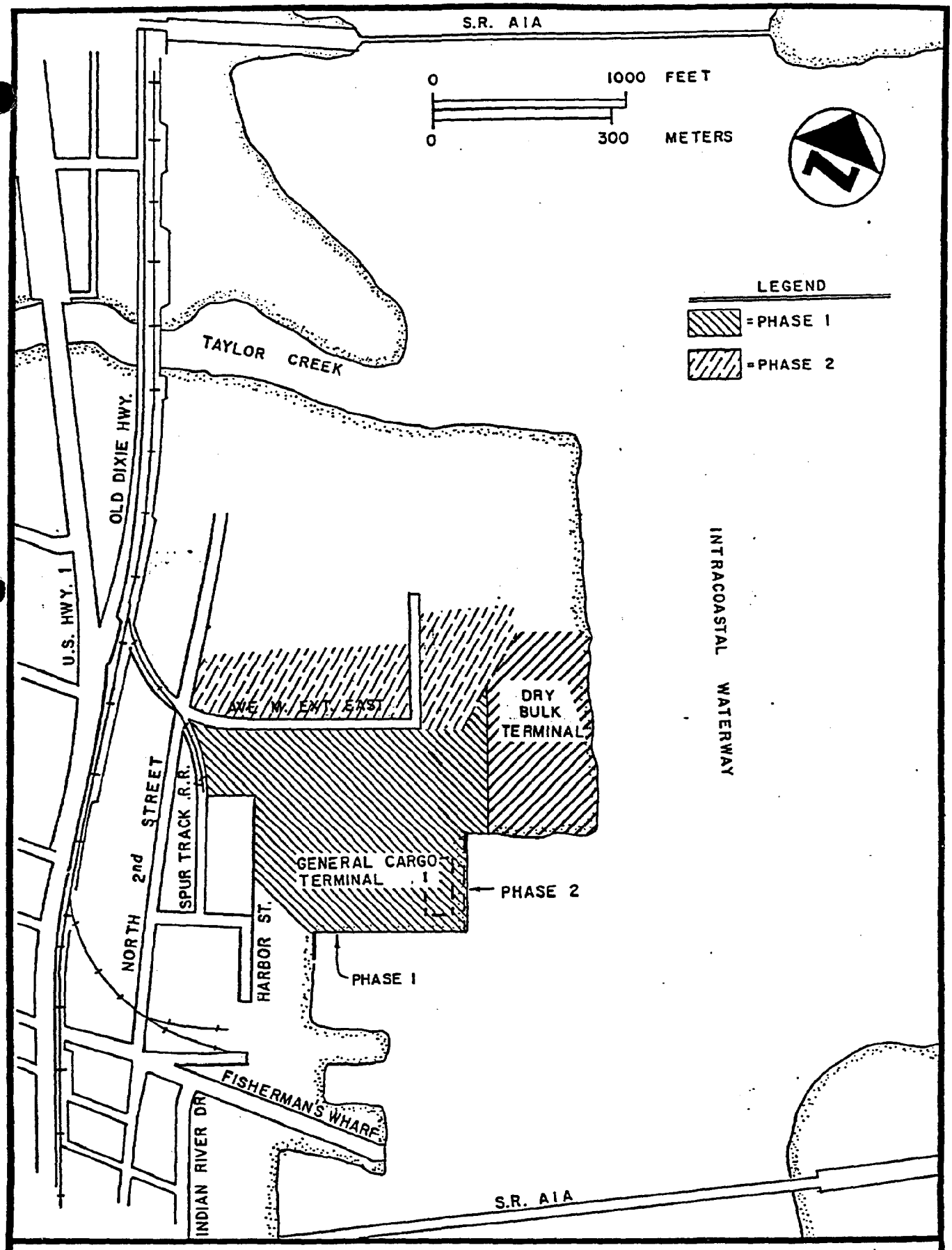

FIGURE 8-2 PROPOSED PORT FACILITY IMPROVEMENTS RECOMMENDED BY CH_2M HILL.

AFFECTED ENVIRONMENT

PHYSICAL CONDITIONS

The area of concern for this study includes the Fort Pierce Inlet, the beaches adjacent to the inlet, the Indian River, and the Atlantic Ocean immediately offshore of the inlet (Figure 8-1). The Florida Sea Grant Program's Glossary of Inlets Report #2 (Walton, 1974) contains a history of inlet modifications undertaken to obtain the existing inlet configuration. The existing facilities (Figure 8-3) consist of a channel 350 feet wide starting about 1.2 miles offshore at the 27-foot isobath (MLW) and tapering to 200-foot wide inside the barrier island. The 200 feet wide channel continues west for 1.3 miles to a 1,600-foot by 900-foot turning basin. Channel depth is maintained at 27 feet from the eastern terminus through the jetties. The remainder of the channel and the turning basin has a design depth of 25 feet (MLW). A 500-foot by 1,300-foot channel exists on the north side of the basin. A slip has been excavated north of this and west of the Atlantic Intracoastal Waterway (AIWW) at the aragonite facility.

The existing jetties (1,800 feet on the north; 1,200 feet on the south) have caused significant modifications to the barrier island shoreline. Along the east coast of Florida, the movement of sand is predominantly north to south with the longshore current. The jetties have effectively prevented this natural movement of sand, causing accretion of sand on the north side of the inlet and erosion of sand on north Hutchinson Island.

Causeways connecting the mainland to the barrier islands essentially frame the inlet area proper. Approximately one mile to the north of the channel, there is a 1,900-foot low-clearance bridge across the AIWW and a 400-foot bridge spanning Jim Channel. To the south, adjacent to the channel, a 1,900-foot high-clearance bridge connects the mainland to Causeway Island and Hutchinson Island. The causeways constrict tidal flow north and south between the inlet area and the Indian River.

The Indian River is a shallow lagoonal estuary paralleling the coast behind a series of barrier islands extending from Ponce de Leon Inlet south to Jupiter Inlet. The average depth of the lagoon is 4.6 feet, with maximum depth occurring in dredged channels, harbors, and borrow areas. The AIWW was dredged along the Indian River, with much of the dredged material from waterway construction deposited on either side of the channel, forming numerous spoil islands and shallow shoals. The AIWW is 12 feet (MLW) deep north of Fort Pierce Inlet and 10 feet (MLW) deep south in Miami.

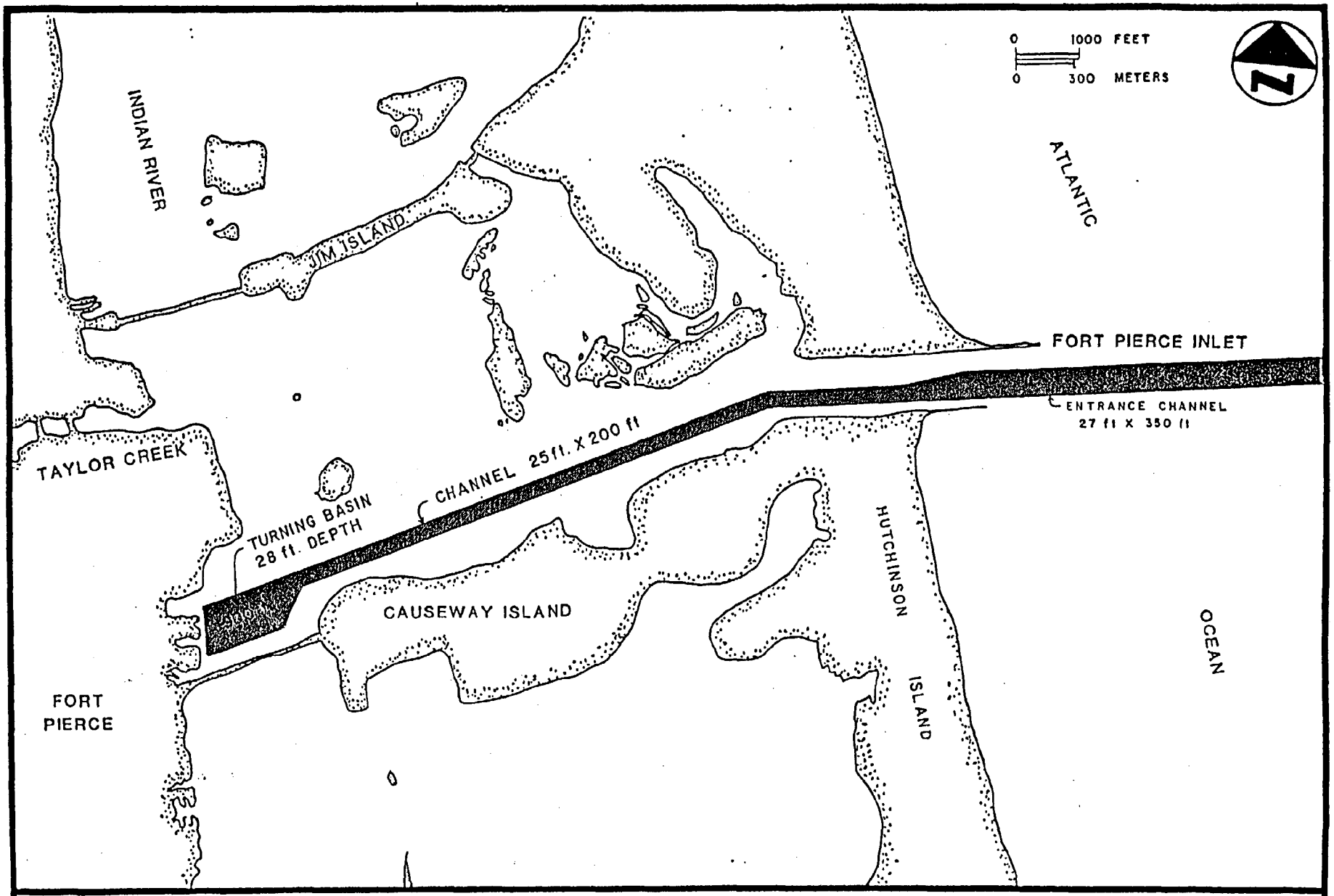

FIGURE 8-3 EXISTING CHANNEL AND TURNING BASIN AT FORT PIERCE HARBOR.

WATER QUALITY

Water Column

Water column physicochemical properties within the inlet area proper are dependent on tidal flow between the Atlantic Ocean and the Indian River and freshwater inflow from Taylor Creek, the C25 canal. Hydrographic studies of Harbor Branch Foundation (Briel, 1974; von Zweck et al., 1974; Gibson, 1975; von Zweck and Richardson, 1980) show circulation within the inlet is predominantly tidally driven; tidal constituents account for 93 percent of the variance in current flow. This tidal influence, coupled with periodic discharges of freshwater from Taylor Creek (Figure 8-4), can result in large changes in salinity (3 to 36 ppt) and other water quality parameters. The tidal waters from the Indian River can cause the introduction of turbid waters to the inlet area and immediately offshore and, if substantial mixing of the surface/bottom waters occurs, can cause elevated levels of orthophosphate-phosphorus. Taylor Creek has been identified as a source of pollution to the inlet area (USACE, 1986). The creek has been modified so that it now functions primarily as a drainage channel between the St. Johns Watershed area and the inlet. Discharge of water is controlled through a structure located approximately one mile upstream of the port area. For the period 1971-1974, mean monthly discharge averaged 243 feet^3 second^{-1} and ranged from 4 to 1,036 feet^3 second^{-1}. The creek/canal receives runoff from agricultural and urban sources and has been shown to contain high levels of nutrients (nitrogen and phosphate) (FDER, 1984, 1985). Large discharges of water from the creek/canal are accomplished by tannin-induced-column color changes. Other potential sources of water pollution within the study are Moore Creek (Figure 8-4)--a source of pollution related to urban runoff discharging approximately 2,000 feet south of the south causeway bridge--and Fort Pierce sewage treatment plant outfall (Figure 8-4)--a source of secondarily treated wastewater discharging immediately south of the south causeway.

Sediments

In 1979, 14 core borings were taken within the study area by the USACE. Generally, sediment grain size within and around the existing turning basin was silt in the upper layers. The bottom along most of the existing channel is predominantly sand, underlain in places with limestone rock.

Wang, et al. (1980); (Wang, 1983) investigated the chlorinated pesticides (DDT, malathion, and parathion) and polychlorinated biphenyls (PCBs) in sediment samples near sewage and power plant outfalls, freshwater tributary

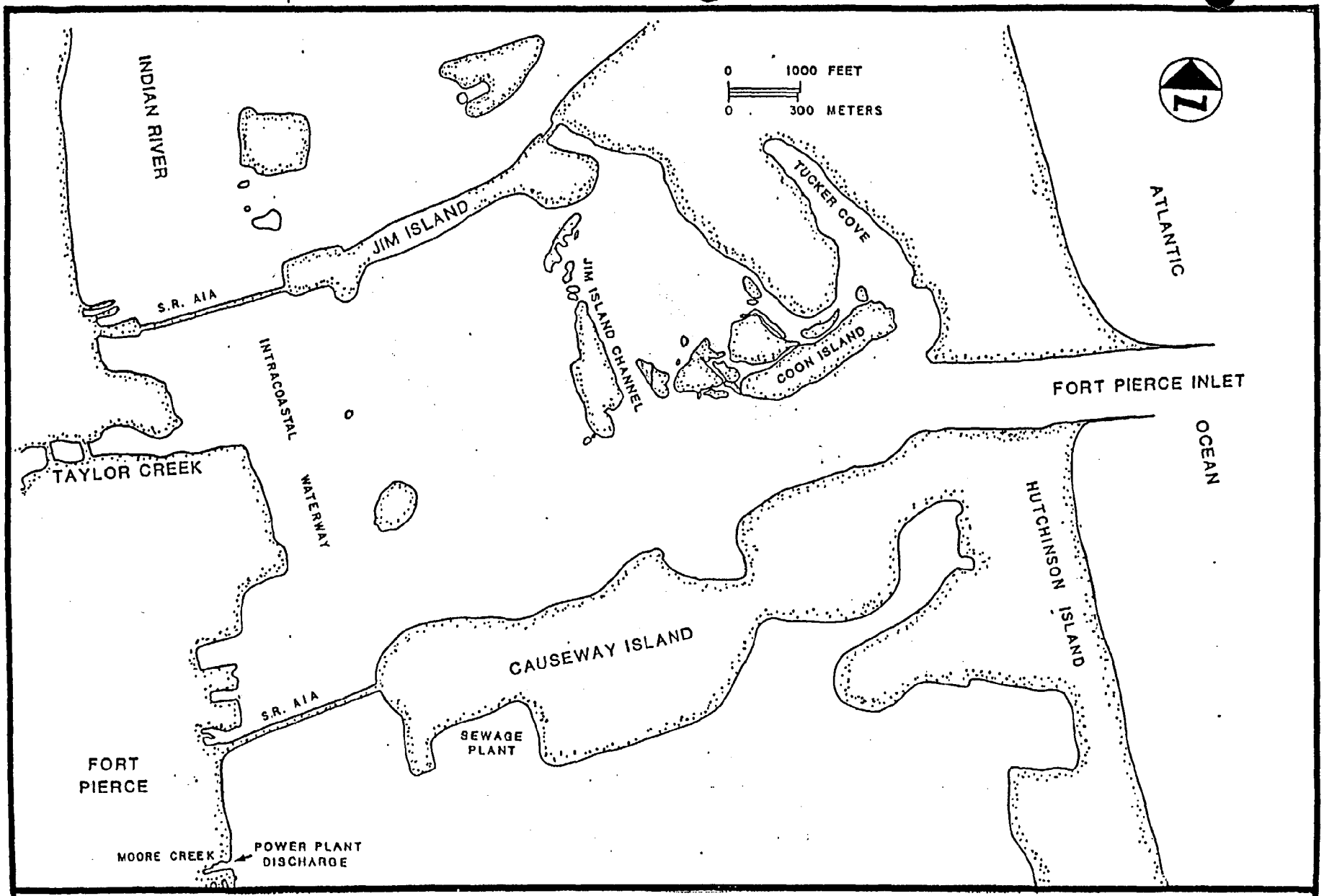

FIGURE 8-4WATER INPUTS AND POLLUTION SOURCES IN THE FORT PIERCE INLET AREA.

discharges, and agricultural runoff within the Indian River. Taylor Creek had the highest total DDT and PCBs level within the Indian River. Residues ranged from 0.96 to 19.9 ppb total DDT (average 10 ppb) and from 20 to 630 ppb PCBs. Moore Creek had relatively high levels of DDT and PCBs residues with DDT ranging from 1.90 to 81.0 ppb and PCBs ranging from 39 to 278 ppb. For comparison, residues from near the Fort Pierce sewage outfall ranged from not detectable to 17.0 ppb total DDT and from not detectable to 11.1 ppb PCBs. Generally, the samples from Taylor Creek were higher by a factor of 12 and 10 for DDT and PCBs respectively, than those from five other sampling locations extending north to Vero Beach.

BIOLOGICAL CONDITIONS

Several types of habitats occur in the vicinity of the inlet. For the discussion below, they are grouped into lagoonal habitats and coastal and continental shelf habitats. As depicted in Figure 8-5, the inlet serves as a conduit for transfer of various materials between the lagoon and the coastal/continental shelf area.

Lagoonal Habitats

Several unique plant communities (seagrass, beds, mangroves, and salt marshes) and their associations are the basis for the high productivity of the Indian River lagoon.

Wherever light penetration is sufficient and suitable substrate is available, extensive seagrass beds are found within the lagoon (Figure 8-6). Seagrasses are submerged flowering plants that stabilize sediments; entrap silt; recycle nutrients; provide shelter, habitat, and substrate for animals and other plant forms; provide important nursery grounds; and are important direct food sources (FDNR, 1984; Zieman, 1982). Five species of seagrass are found within the Indian River lagoon: Halodule wrightii (Shoalgrass), Syringodium filiforme (manatee grass), Thalassia testudinum (turtle grass), Halophila engelmanni, and Halophila johnsonii. Shoalgrass and manatee grass are the dominant species (Thompson, 1976). Within the lagoon, seagrass beds are found in the dense beds near inlets, in bands along the western shoreline, and in scattered patches on the eastern shoreline of the lagoon. Seagrass coverage and diversity appears to vary seasonally, annually, and possibly over longer cycles. Two seagrass mapping studies have been conducted within the lagoon (Thompson, 1976; Haddad, 1985) documenting 6,859 and 7,054 acres of seagrass, respectively.

Drift algae have been shown to be an important component of seagrass systems within the Indian River. The abundance of the unattached, free-drifting macroalgae varies seasonally.

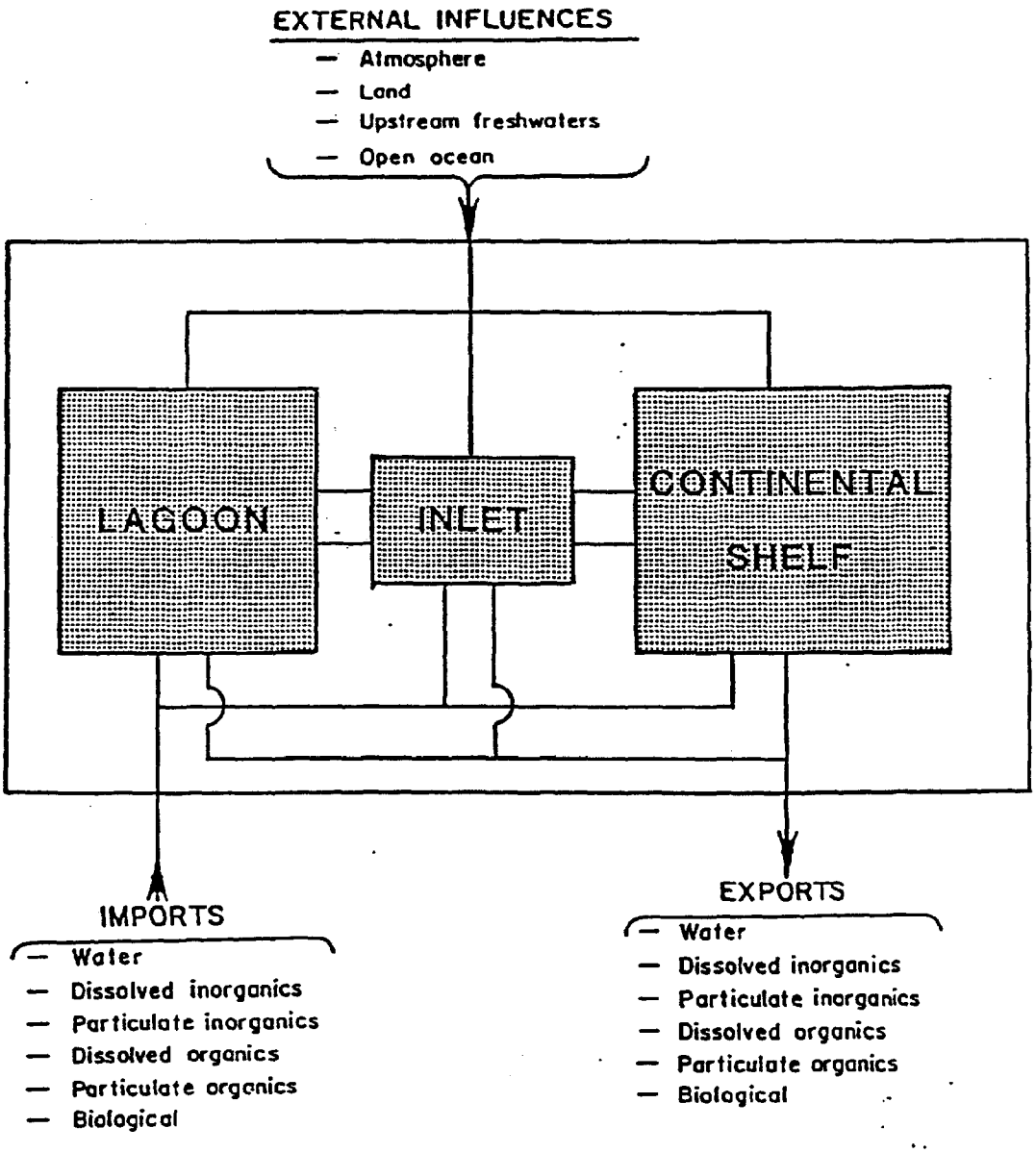

FIGURE 8-5 SIMPLIFIED REPRESENTATION OF THE LAGOON/INLET/SHELF SYSTEM (FROM: DARNELL AND SONIAT, 1979).

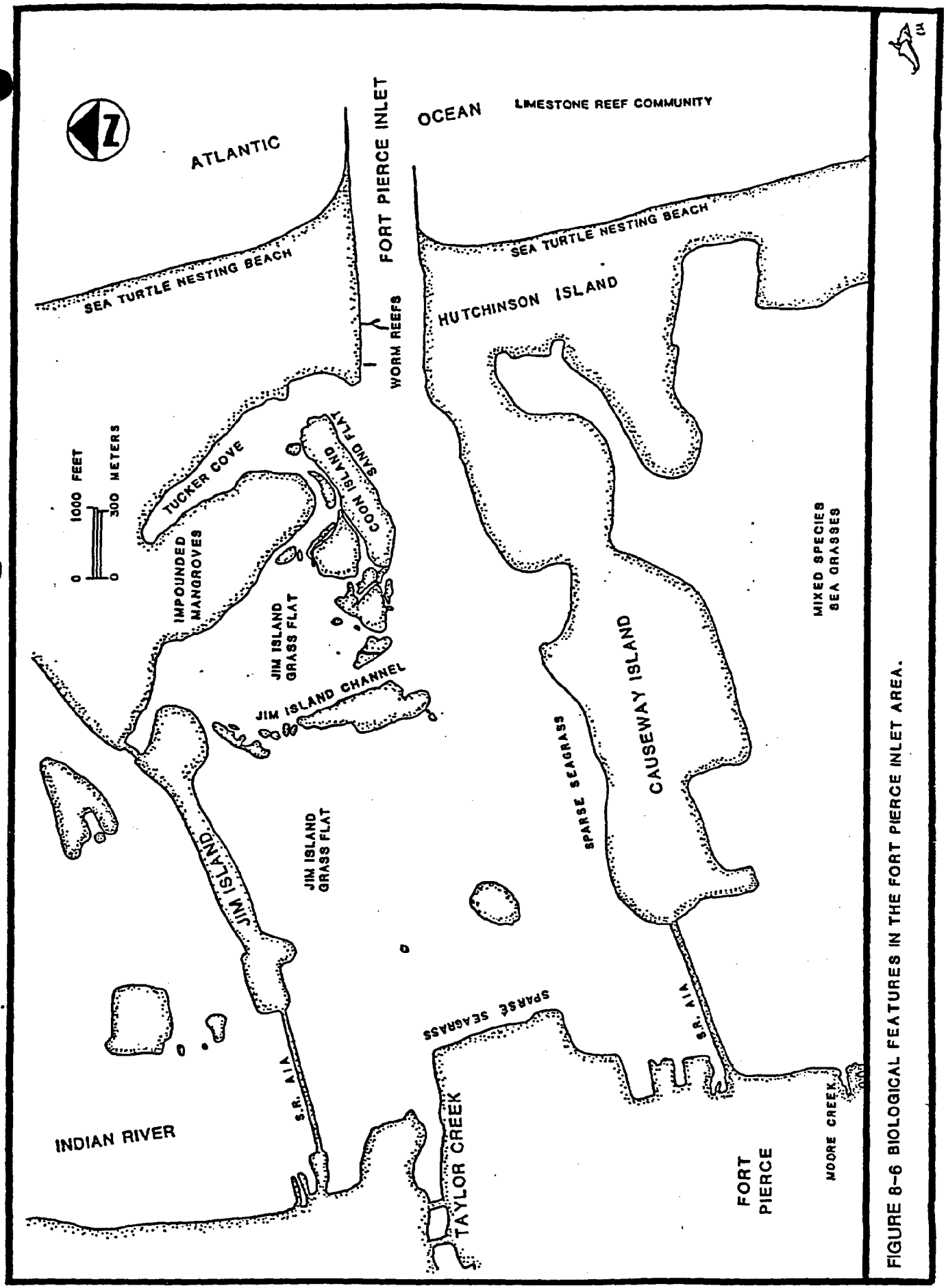

FIGURE 8-6 BIOLOGICAL FEATURES IN THE FORT PIERCE INLET AREA.

The floating mats form substrate, refuge, and food for numerous invertebrates, algae, and fish (Benz et al., 1979; Kulczycki et al., 1981).

Seagrass and drift algae habitat exists within the inlet areas proper. A large, shallow-water, densely vegetated seagrass bed exists south of the north causeway and Jim Island (Figure 8-6). The vegetated portion of this flat is approximately 290 acres; 200 acres west of Jim Channel and 90 acres east of the channel. There are other small, less densely vegetated seagrass beds within the inlet area, e.g., the shallow area between the navigation channel and Causeway Island and the area west of the AIWW and both north and south of Taylor Creek (Figure 8-6).

Mangroves form a dominant vegetational association along undeveloped shorelines within the lagoon. Three species are found: Rhizophora mangle (red mangrove)--the dominant, both in and near the water at low tide level; Avicennia germinans (black mangrove)--generally inland of, but sometimes mixed with red mangroves; and Laguncularia racemosa (white mangrove)--generally at or above high tide, but also mixed with black mangroves. There are many variations of mangrove communities within the lagoon; the dominant variation is the shoreline fringe community. The mangrove species have various root structures, i.e., prop roots and pneumatophores, and extensive underground root mats that capture and stabilize sediment, control erosion, sequester and recycle nutrients and minerals from the anaerobic soil substrate, and form habitat for marine and estuarine organisms both attached to the root system and free living (Odum et al., 1982). The production of leaf litter by the mangrove canopy has been shown to be a basis of the detrital food chain of the estuary (Heald and Odum, 1970).

Historically, wide bands of mangrove forest have occurred on either side of the lagoon. Some of these have been lost through dredging and filling operations associated with residential and commercial development. However, the greatest impact on the mangrove community within the lagoon has resulted from the construction of impoundment dikes for mosquito control. Haddad (1985) estimated that of the total 7,900 acres of mangroves in the lagoon, 6,064 acres (76 percent) are impounded. Impounding prevents functional exchange between the mangroves and the estuary. A large mangrove impoundment exists south of the eastern end of the north causeway within the inlet area (Figure 8-6).

Salt marsh communities are also found within intertidal areas of the lagoon. Mangroves, which are not cold tolerant, are near their northern range limit at the Indian River lagoon, where they begin to be replaced within the intertidal zone by salt marshes. The dominant marsh species are

Spartina alterniflora (smooth cordgrass) within the intertidal zone and Batis martima (saltwort), Salicornia virginica (glasswort), Distichlis spicata (salt grass), and Borrichia fructescens (sea ox-eye) above high tide level. Functions attributed to salt marsh communities include recycling nutrients, contributing to estuarine productivity, and providing shelter and habitat to a variety of animal life. Small areas of cordgrass can be found within the inlet area proper: about 6 acres south of Jim Island, a fringe along Coon Island, and a fringe along the western shore of the lagoon just north of Taylor Creek (Figure 8-6).

Coastal and Continental Shelf Habitats

Major coastal habitats in the inlet area are beaches and reefs. The beaches in the inlet area are typical of young, emergent shoreline found along Florida's east coast. During recent times, the beach was built from material cut from the sea floor by wave action and to a lesser extent by deposition of sand from southward-moving currents (Carroll, 1981). The occurrence of accretion and erosion trends of the beach near the inlet has been discussed previously. The surf zone of the beach is dominated by animal species capable of living in a turbulent, high-energy environment, e.g., Emerita talpoida (sand crab) and Donax variabilis. Many surf-zone birds such as semipalmated plover, piping plover, Wilson's plover, black bellied plover, ruddy turnstone, willet, American knot, least sandpiper, semipalmated sandpiper, sanderling, common terns, least terns, royal terns, black skimmers, herring gulls, and ring-billed gulls feed upon these molluscs, crustaceans, and other invertebrates at low tide. Several species of sea turtles utilize the beaches for nesting (Figure 8-6) (further discussion of turtles is contained within the Endangered or Threatened Species section.

Nearshore reefs or hard ground areas exist both north and south of the inlet (Figure 8-6) (USACE, 1986). The reef structure is primarily limestone formed in the Pleistocene epoch. The hard-ground area occurs in approximately 10- to 20-foot depths and extends from 150 feet out to 2,000 feet offshore, forming a discontinuous outcrop that parallels the shoreline with ledges up to 6 feet in relief. In some areas, Phragmatopoma lapidosa, a polychaete worm, forms colonies of wormrock that can completely cover the basal limestone. These reef building worms need wave action and/or turbulence to suspend sand needed for tube building and to bring food. Worm reefs form the basis for a complex marine community with a diverse flora and fauna (Kirtley, 1971; Gore et al., 1978). Gilmore (1977) collected 105 fish species in association with these reefs; numerically dominant were two demersal species, the hairy blenny and molly miller, and three semi-demersal species, the spottail

pinfish, porkfish, and sailor's choice. Most of the other species occur occasionally in the nearshore reefs but are more common to the offshore reefs. A wormrock reef has developed on the north side of the inlet just east of Dynamite Point (Figure 8-6). It extends approximately 180 feet from shore, then bifurcates into east and west branches 150 feet and 190 feet in length, respectively. This wormrock appears to be dying back and eroding at the present time (1986, Eric Rennison, personal communication, Fort Pierce Port and Airport Authority). The reef is used for an interpretive nature program by the personnel at the adjacent Fort Pierce Inlet State Recreation Area.

Further offshore, other limestone ledge systems with vertical relief up to 15 feet are known to parallel the coastline in discontinuous patches at depths of approximately 45, 60, and 90 feet (USACE, 1986). These reefs and the shallow (10- to 20-foot contour) reefs are similar in flora and fauna. The hard ground provides attachment area for algae, sponges, ascidians, some scleractinian corals, and octocorallian soft corals, and habitat for motile invertebrates and fishes. Very little scleractinian coral grows on these reefs, except for small coralla of Oculina varicosa and isolated colonies of siderastraeid and montastraeid corals. Gilmore (1977) report 223 fish species, of which 191 (86%) are Caribbean reef fishes. The reef ledges form shelter for many primary reef fishes (i.e., pomadasyids, chaetodontids, pomacentrids, serranids, labrids). Many of the juvenile fishes associated with the reef school or hide within the relief or growth. Reefs have also been located in depths of 165 to 330 feet off Fort Pierce Inlet (Reed, 1980). These reefs are composed of Oculina varicosa, a branching scleractinian coral that forms massive contiguous colonies.

Fishes and Fisheries

Gilmore (1977; Gilmore et al., 1983) has recorded 685 fish species from the Indian River and the coastal area immediately offshore. Within the seagrass beds, 208 fish species were collected, representing the richest fish fauna within the lagoon. Of these species, 181 (87 percent) were found in this habitat primarily as juveniles (e.g., serranids, lutjanids, sciaenids, and pomadasyids), demonstrating the role of seagrass beds as nursery areas for local fishes. These juveniles become the adult snappers and groupers that support the popular and highly productive commercial/sport fishery on the offshore reefs. Gilmore (1977) recorded 275 species within the inlets; 129 (47 percent) are normally associated with offshore reefs. These are the fishes that make periodic migrations to or from the Atlantic or the lagoon. These fishes are either maturing and leaving the lagoon nursery grounds for adult feeding grounds offshore or

are making temporary offshore spawning migrations. Commercial fisherman fish that inlet area for striped and white mullet, blue fish, black and red drum, spotted and silver seatrout, and sheepshead. Offshore fisheries include the semidemersal species such as grey, red, and scamp grouper; several species of grunt; and lane and mutton snapper. During the 4-year period between 1976 and 1979, an average of 68,200 lbs of grouper and 47,500 lbs of snapper was landed each year at Fort Pierce. In 1976, St. Lucie County ranked seventh among 30 counties in commercial fish landings. Offshore pelagic species include dolphin, king and Spanish mackerel, and amberjack.

Birds

Many birds utilize the lagoonal habitats for rookery areas and/or feeding and resting habitat including migratory or wintering gulls, terns, shorebirds, and wading birds. The Indian River lagoon has the largest wintering population of ospreys outside of Everglades National Park (USACE, 1986). The Aquatic Preserves Management Plan for the Indian River (FDNR, 1984) lists the birds generally associated with each major habitat within the lagoon.

Endangered or Threatened Species

Table 8-1 lists the species of the Indian River lagoon area that are classified as endangered, threatened, or of special concern. The U.S. Fish and Wildlife Service has designated most of the Indian River as Critical Habitat for the manatee. Critical Habitat, in this instance, is defined as the area that includes the physical and biological features essential to the conservation of the species and that may require special management consideration or protection. During the winter months, manatees congregate around the warm water discharge of the Fort Pierce power plant just south of the south causeway bridge. Because of this concentration, the FDNR has designated the area within a half-mile radius of the power plant (except the AIWW) to be an idle speed zone, and between one-half and one mile (including the AIWW) to be a minimum wake zone for all boats between November 15 and March 31. During the spring and summer, the manatees disperse, but have been seen grazing on seagrass in the inlet area or traversing the inlet throughout the remainder of the year (USACE, 1986).

Sea turtles nest on the ocean beaches outside of the inlet and develop within the Indian River lagoon. Nesting season extends from May through September, with peak nesting during June and early July. Previous data indicate that, on the average, there would be approximately 266 loggerhead turtle

Table 8-1

SPECIES OF THE INDIAN RIVER LAGOON AREA THAT ARE CLASSIFIED AS ENDANGERED, THREATENED, OR OF SPECIAL CONCERN (FROM FDNR, 1984).

ENDANGERED	
Reptiles	
Atlantic green turtle	(*Chelonia mydas mydas*)
Atlantic hawksbill turtle	(*Eretmochelys imbricata imbricata*)
Atlantic Ridley turtle	(*Lepidochelys kempii*)
Leatherback turtle	(*Dermochelys coriacea*)
Atlantic salt marsh snake	(*Nerodia fasciata taeniata*)
Birds	
Wood Stork	(*Mycteria americana*)
Peregrine falcon	(*Falco peregrinus*)
Mammals	
West Indian manatee	(*Trichechus manatus*)
THREATENED	
Reptiles	
Atlantic loggerhead turtle	(*Caretta caretta caretta*)
Birds	
Eastern brown pelican	(*Pelecanus occidentalis carolinensis*)
Bald eagle	(*Haliaeetus leucocephalus*)
American kestrel	(*Falco sparverius paulus*)
Roseate tern	(*Sterna dougallii*)
Least tern	(*Sterna albifrons*)
SPECIES OF SPECIAL CONCERN	
Fishes	
Common snook	(*Centropomus undecimalis*)
Rivulus	(*Rivulus marmoratus*)
Reptiles	
American alligator	(*Alligator mississippiensis*)
Birds	
Little blue heron	(*Florida caerulea*)
Snowy egret	(*Egretta thula*)
Louisiana heron	(*Hydranassa tricolor*)
Reddish egret	(*Dichromanassa rufescens*)
Roseate spoonbill	(*Ajaia ajaja*)
American oystercatcher	(*Haematopus palliatus*)

(Caretta caretta caretta) nests on the 2.7 miles of beach south of Fort Pierce Inlet. Minor green turtle (Chelonia mydas mydas) and leatherback (Dermochelys coriacea) nesting has also been reported along this stretch of beach. Ehrhart (1983) captured 205 loggerhead and 199 green turtles within Indian River lagoon and found virtually all of the green turtles and 95 percent of the loggerhead turtles to be immature. This demonstrates that the lagoon is a developmental habitat for these species.

ASSESSMENT OF IMPACTS

Potential environmental impacts of the proposed Federal channel improvement project have been presented in the Environmental Impact Statement in the USACE feasibility document (USACE, 1986). The following effects or impacts were identified and discussed:

Effects on Estuarine Hydraulics. The proposed project would slightly increase (approximately 1 percent) the volume of tidal waters entering and leaving the estuary. This would cause a slight (approximately 0.1 inches) increase in tidal range and a slight increase in current velocities in the inlet area. Tidal volumes extending north and south into the Indian River from the inlet area are limited by the causeways.

Effects of Dredging on Water Quality. Water column contamination may occur during dredging of potentially polluted sediments from the turning basin. Information from Wang (1983) and Wang et al. (1980) suggests that Taylor Creek is a source of sediment contaminated with PCB and DDT residue. Adequate testing of the turning basin sediment has not yet been conducted.

Flooding Effects. Portions of the land within the proposed port facilities are below the 100-year floodplain elevation. The land elevation should be raised to minimize flooding impacts.

Direct Effects on Seagrasses. Increasing the channel width will not directly affect seagrasses. However, as suggested by the U.S. Fish and Wildlife Service (USFWS) (Carroll, 1981), lack of seagrass beds near the channel could indicate that seagrass growth within some distance from the channel is limited by wave action, current, or some other factor. Proposed channel expansion may expand this zone of no seagrass growth by up to 50 feet.

Effects of Construction-Generated Turbidity on Seagrasses. The USACE has a policy of meeting State standards within a defined mixing zone of 150 meters (495 feet) extending from either side of the top of channel slope. The Jim Island seagrass beds are 1,000 feet from the proposed project, well outside of the mixing zone. If policy and State standards are maintained, no construction-generated turbidity damage will occur from the proposed project.

Effects on the Inlet Wormrock Reef. Expansion of the inlet will result in the loss of approximately 50 feet of the wormrock growing within the inlet. Proximity of the existing south shore to the channel forces the proposed dredging to occur on the north side of the channel and into

the existing wormrock reef. Further study is required to predict the significance of this project related impact.

Effects on Beach and Nearshore Reef Communities. Pumping of dredged beach quality material onto the beach south of the inlet may create turbidity in nearshore waters during discharge. An assessment of the nearshore community that could be affected is required before this impact can be evaluated. The benefits of potential loss of this habitat must be weighed against the potential increase in erosion protection.

Effects of Dredging on Sea Turtles. A slight potential exists for entrainment of sea turtles in the hydraulic dredge during channel construction.

Effects of Beach Disposal on Sea Turtles. The placement of sand on beaches during sea turtle nesting season (May through September) has potential for reducing reproductive success of the individuals using the beach as nesting habitat. Sand overburden placed on an existing nest may smother the eggs, prevent hatchlings from emerging, or shift the sex ratio to favor development of males. Preferably, placement of fill on the beach should be scheduled to avoid turtle nesting season. The alternative is to relocate nests during the filling operation. Experience has shown that relocation can be successful if done within 12 hours of oviposition. There is some concern about the suitability of dredged beach sand as a medium for turtle nesting. The USACE Waterways Experimental Station is currently studying the relationship between sea turtle nesting success and sand characteristics in Florida. Further study of nesting requirements and the quality of material to be dredged from the inlet is required. However, the existing eroded condition of the beach south of the inlet currently affords little opportunity for nesting.

Effects on Manatees. The potential exists for manatees to become injured by movements of boats and barges during the dredging operation. To avoid this problem, the USACE has required by provision to the contract that the dredging contractor instruct personnel about the presence of manatees, engage in measures to avoid collisions, and be held responsible for any manatee harmed, harassed, or killed as a result of project construction.

Effects on Other Endangered Species. There are no identifiable effects of the channel dredging operation on other endangered species.

Effects on Fishery Resources. Any destruction and loss of seagrass beds due to channel dredging may result in a decline in catch rate of fishering species dependent on

seagrass beds during some phase of their cycle (Carroll, 1981). As previously stated, uncertainty exists as to whether or not the seagrass beds will be affected by channel dredging. Dredging-related turbidity may also interfere with spawning migrations of snook, channel bass, spot, shrimp or other species which use the inlet to migrate to and/or from the Indian River lagoon. These migrations occur at different times throughout the year; therefore, dredging at any time may impact certain species.

Effects on Aquatic Bird Habitat. Channel dredging will cause no identifiable impacts on aquatic bird habitat within the inlet area.

Effects of Ocean Dumping. Studies of the EPA interim-approved dredged disposal site off Ft. Pierce inlet are currently being conducted. Delineation of the bottom type and community will aid in determination of potential impacts from dredged material disposal.

Effects of Indian River Disposal. The proposed plan includes deposition of approximately 256,000 yd^3 into an existing submerged borrow pit south of Causeway Island to convert 12 acres of deep-water habitat to shallow-water habitat. If successful, this action would increase the productivity and habitat quality of the site. Sixteen acres of the site would remain as deep-water habitat. Adequate measures to prevent turbidity (siltation curtains) are required during the fill operation to minimize spread of silty material onto adjacent seagrass beds.

Secondary Impacts. These impacts involve the effects linked to the operation of a port facility within this area--for example, impacts associated with increased ships and shipping, larger ships, different commodity movements, new industry attracted to the port area, greater development, etc. Carroll (1981) lists the following as secondary impacts that have occurred in other Florida ports and that are likely to occur with port expansion in Ft. Pierce:

1) Long-term turbidity, siltation, and erosion problems may result as indirect effects of dredging and spoil disposal. The potential exists for impacts to seagrass beds and nearshore reefs.

2) Increases in the number and/or size of vessels using the port can cause an increased potential for boat/manatee collisions.

3) Larger vessels with large wakes may cause erosional damage to nearshore and submerged habitats.

4) Increases in the number and/or size of vessels will result in a greater potential for spills of petroleum products or chemicals that would be devastating to the nearshore and submerged habitats within the port area.

5) Initial port expansion typically brings impetus for further expansion. Further expansion could bring further primary and secondary impacts on fish and wildlife resources.

6) Industrial expansion in the port area and increased vessel traffic may result in long-term effects due to chronic pollutant release into the lagoon from terminal runoff, transfer operations, and ship discharges. This could affect the nearshore and submerged habitats and egg, larval, and adult stages of fish and shell fish using these habitats.

According to the USFWS, primary and secondary project-related impacts will result in long-term degradation of fish and wildlife resources in the area.

The proposed local modifications to the port facilities as previously described in the Project Description section, include dredging 45,500 yd^3 of material for channel construction and construction of 2,050 lineal feet of bulkhead in two phases. Without a field survey, a complete investigation of the quantity or quality of intertidal and submerged habitat proposed to be destroyed by dredging and bulkhead construction is not possible. There is no mention in the literature of vegetated intertidal or submerged habitat within this area. Therefore, there are no known direct losses of vegetated habitat due to the proposed local port facility modification project.

The same options for disposal of dredged material that were discussed for the Federal channel improvement project exist for the local port facility project. The most suitable options are disposal within the Causeway Island borrow area or offshore disposal within the EPA interim-approved disposal site. The use of either of these options depends upon the quality of the material within the proposed dredging area. Adequate vibracore sampling should be performed to assess the feasibility of the options. The other option available within the port area is upland disposal, i.e., the use of the dredged material to backfill behind the proposed bulkheads to bring the area to grade above floodplain elevation.

MITIGATION PLAN

Mitigation is a legal concept that has been used in a variety of contexts. The use of the concept involved in connection with environmental pertubations and permitting is very recent. The USFWS, the agency commenting to the USACE concerning environmental matters during federal permit processing, has developed a definition of mitigation contained within the USFWS mitigation policy (USFWS, 1981):

1) avoiding the impact altogether by not taking a certain action or parts of an action;

2) minimizing impacts by limiting the degree or magnitude of action and its implementation;

3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and

5) compensating for the impact by replacing or providing substitute resources or environments (USFWS, 1981).

The order in which these actions are listed indicates the priority of their implementation--i.e., avoidance is preferred to minimizing impacts, etc. Compensation should be used only after all other alternatives have been exhausted.

The basic objective of mitigation is to maintain the functional and reproductive capacity of the fish and wildlife resources of the area while accommodating necessary economic activity that is clearly in the public interest. In this discussion of mitigation alternatives, it will be presumed that the proposed federal and local projects combined are the minimum possible projects required to stimulate regional economic development in the Fort Pierce area. That is, most impacts have already been minimized through project design; remaining impacts are essentially unavoidable. Thus, compensatory measures are the main type of mitigation option available.

Both the proposed federal and local projects are expected to have minimal direct effects on valuable fish and wildlife habitat (e.g., seagrass beds and mangroves). However, both projects have the potential for primary and secondary impacts to port-area habitats. Examples of these are as follows: 1) yet unknown effects from direct removal of wormrock reef during channel construction; 2) potential for expansion of the zone of no seagrasses northward into the

Jim Island seagrass bed after channel construction; 3) potential phased expansion of port facilities northward into the documented sparse seagrass area north of the proposed port facilities (Carroll, 1981; USACE, 1986); and 4) potential for manifestation of the secondary impacts identified in the previous Assessment of Impacts section.

As the port development plan is formulated with the goal of simulating regional economic development, the mitigation plan should be based on regional goals of improving fish and wildlife habitat in the Indian River lagoon. The port area directly affects the health of the lagoon by acting as a conduit between the lagoon and Atlantic Ocean for water and migratory animals. In addition, the port area contains valuable fish and wildlife habitat. The general goal put forth by the Indian River Lagoon Aquatic Preserve Management Plan (FDNR, 1984) is to ensure the maintenance of habitats in an essentially natural condition, and to restore and enhance those habitats that are not in a natural condition. This is an adequate goal for mitigation actions for any permissible development project within the preserves and surrounding areas.

The recommended federal project includes two mitigatory measures, both of which would repair past anthropogenic damage due to inlet and causeway construction. One is to place approximately 500,000 $yard^3$ of sand on the beaches south of the inlet to form a beach 50 feet wide and about 3,500 feet long. Beach grasses would be planted in a strip 25 feet wide extending the project length to stabilize the beach and reduce problems associated with wind-blown fine material. This is a sound use of dredged material to increase potential turtle nesting habitat. The second mitigation measure is to place approximately 256,000 $yard^3$ of excavated sand with some silt into the borrow pit south of Causeway Island. The plan proposes conversion of 12 acres of this pit to shallow-water habitat of the same elevation as the surrounding seagrass beds. The area will then be revegetated using Halodule wrightii (shoalgrass) shoots as recommended by Fonseca (1981). The feasibility report recommends planting on 10-inch centers to gain an expected 64 percent to 80 percent coverage within 50 days.

A recent review of past mitigation projects (Dial and Deis, 1986) concludes that success of seagrass revegetation projects has been unpredictable; seagrass revegetation is still experimental. Close monitoring would be required to guarantee that the proposed seagrass planting project becomes an adequate, successful mitigation action.

An alternative mitigation measure was described in the EIS (USACE, 1986). The USFWS suggested a plan to provide tidal flushing of mangrove areas impounded for mosquito control

north of the inlet. As described in the Lagoonal Habitats section, totally impounded areas provide essentially no contribution to the lagoon in terms of fishery habitat and nutrient exchange, although they provide habitat for shore and wading birds. The impoundment immediately north of Coon Island is managed by St. Lucie County Mosquito Control District for partial flushing through a tide gate during mosquito nonbreeding season (December to mid-February). The Jack Island State Preserve impoundment is similarly managed with three gates. North of these sites are several large, totally impounded areas in private ownership. These could be candidates for installation of tide gates to allow flushing when compatible with mosquito control practices. This would at least partially restore the benefits of these areas to the estuary lost due to part mosquito control practices.

The local port authority should consider enlarging upon any of the proposed mitigation actions for its project. Approximately 36 acres is available for filling at the Causeway borrow pit site. The alternative option of purchasing and managing impounded areas is also available. Both of these options should be considered to mitigate for the proposed port facility improvements. Another option is to form a mitigation bank for present and future development activity. The use of mitigation banking requires coordination among the Federal, State, and local environmental agencies but can benefit both the environment (by ensuring that there is a long-term loss of habitat) and the port (by making future permits easier to acquire).

ENVIRONMENTAL MONITORING GUIDELINES

The expansion and improvement of Fort Pierce Harbor and port facilities is a complex of individual projects involving dredging, dredged material disposal, and potential mitigation/revegetation projects. Recommended guidelines for each aspect will be discussed individually.

Environmental concerns involved with dredging include the following: 1) quality of material removed and potential for resuspension of pollutants; 2) turbidity resulting from dredging operations; 3) direct removal of important habitats; and 4) potential for collision of boats and barges with manatees. In 1981, the USACE attempted to test the quality of sediment within the turning basin, but detection limits of test methods used by the USACE laboratory were above maximum allowable concentrations by State standards for pollutants of concern (silver, mercury, PCBs, DDT derivatives, and phenols). Information from Wang et al. (1980) and Wang (1983) suggests that Taylor Creek and Moore Creek are potential sources of PCB and DDT contamination. Adequate testing for these pollutants in the turning basin and port facility improvement area is needed. Water-column contamination is unlikely because these compounds are adsorbed on the silt and clay fraction of bottom sediment and are highly insoluble in water. However, elutriate testing and toxicity testing using solid-phase bioassays should be conducted on all potentially contaminated sediments.

As stated in the Assessment of Impacts section, the USACE intends to control construction-generated turbidity within a mixing zone extending 150 meters (492 feet) from the top of the channel slope on either side according to State standards, which require that turbidity during dredging not exceed 29 Nephelometric Turbidity Units (NTU). If this standard is maintained, there should be no damage to the sensitive habitats within the port area or lagoon. Maintaining this standard should be a requirement of the dredging contract and will require frequent monitoring (minimum twice daily during operation) at the border of the defined mixing zone. Siltation curtains, if used, should surround the dredging operation-- not the biological features being protected (e.g., Jim Island seagrass beds). Siltation curtains used incorrectly could prevent movement of water and organisms through the area intended to be protected. A similar mixing zone [150 meters (492 feet) from the dredging equipment (cutterhead, clam bucket, etc.)] should be maintained and monitored for the local port facility improvement project.

The destruction of important habitats, either directly (due to dredging operations) or indirectly (due to changes in

inlet dynamics), needs to be monitored for both short- and long-term impacts. The wormrock reef within the inlet will be reduced in length by this project. Baseline studies of the importance of this structure and seasonal and long-term changes need to be conducted to predict the effect of the removal of a portion of the reef. The other habitats (e.g., Jim Island seagrass beds) should be monitored using a combination of aerial and diver surveying to determine their size and structure before and after the project.

As mentioned in the Assessments of Impacts section, a provision will be added to the dredging contract for the federal project in an attempt to prevent collision of boats and barges with manatees. Elaborate manatee monitoring programs have been designed for dredging in Fort Lauderdale Harbor, but typically, contractor awareness and responsibility is enough to prevent collisions. A similar provision should be added to the dredging contract for local port facility improvements.

The dredged material disposal sites should be monitored for turbidity in the same fashion as the dredging operation. State standards require maintenance of a mixing zone of 150 meters (492 feet) around the end of the pipe. Disposal within the Causeway Island borrow pit should be performed in a manner that does not allow material to leave the disposal area and smother existing seagrass beds. Use of siltation curtains around the disposal pipe may be an effective means of reducing and containing dredged material, but frequent monitoring will be required to monitor the effectiveness of the curtains. If the dredged material proposed to be placed on the beach is compatible with existing beach sand [pre-dredging sediment cores as contained within the Feasibility Report (USACE, 1986) can confirm compatibility], there should be no problem maintaining mixing zone standards with beach disposal. However, monitoring of project-related turbidity, existing benthic sand and hard-ground communities, and recovery of these communities after disposal should be conducted.

All of the proposed mitigation/revegetation projects are experimental in nature; there is no guarantee of success. Therefore, each proposed project should be monitored with intent to gain information on the success or failure of the project for use in evaluating the present project and planning future projects. Table 8-2 lists the goals and monitoring requirements of the recommended mitigation measures.

TABLE 8-2

GOALS AND MONITORING REQUIREMENTS OF RECOMMENDED MITIGATION MEASURES.

Mitigation Measures	Goal	Monitoring Requirements
Placement of dredged material on beach south of inlet and planting of beach grasses for beach stabilization	Creation of a "natural" beach without disturbance to turtle nesting or existing biological features	1) Baseline data on "natural" beach, including seasonal data on biological features 2) Pre-, during-, post-project monitoring of impacts related to dredged material placement (e.g., turbidity effects) 3) Turtle nesting (species, numbers and location) nest relocation studies (sex and survivorship) 4) Monitor planted beach vegetation for vegetative success and beach stabilization
Placement of fill in Causeway Island borrow pit and revegetation with seagrass	Creation of a functioning seagrass bed with no disturbance to existing seagrass	1) Baseline data on existing area seagrasses (density, species composition, and animal use 2) Monitoring of filling operation for turbidity and sediment movement 3) Monitoring of planted seagrasses for planting unit success, vegetative growth, and animal use
Placement of tide gates in mosquito impoundment dikes	Restoration of functional exchange between the lagoon and the impounded intertidal mangroves	1) Baseline data from existing intertidal mangrove forests to understand goals for opening impounded areas (partially in literature) 2) Monitoring of the opened impoundment for movement of nutrients, detritus, animals, etc. between the mangroves and estuary

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PORT OF FORT PIERCE MASTER DEVELOPMENT PLAN ADDENDUM

Prepared for
Fort Pierce Port and Airport Authority

Prepared by
CH2M HILL Southeast, Inc.
November 1986

EXECUTIVE SUMMARY

(Insert on page ES-6, EXECUTIVE SUMMARY, as a separate paragraph between the fourth and fifth paragraphs.)

This Master Development Plan is in accordance with local land use regulations and the proposed State of Florida Criteria. The port area is zoned Marine Industrial and Industrial and is recognized as a marine related and oriented area. Local economic development policies support further development of port related activities, particularly as they relate to diversification of the economic base.

Chapter 2
HISTORICAL PERSPECTIVE

(Insert on page 2-1, Chapter 2, HISTORICAL PERSPECTIVE, between first and second paragraph.)

The Port of Fort Pierce has its origins in the creation of the Fort Pierce Inlet, a manmade opening through the land barrier between the Atlantic Ocean and the Indian River at which construction commenced in 1920. To provide the necessary funding the Florida Legislature, by a Special Act dated December 9, 1918, had established a taxing district comprised of approximately 65 percent of St. Lucie County and titled the Fort Pierce Inlet District. The District was specifically empowered to sell bonds to finance construction of the inlet and to satisfy the bond obligations through real property taxation revenues.

Bond issues were authorized and sold between 1921 and 1927 for a total of $1,850,000. Additional funds were provided by the City of Fort Pierce. Between 1920 and 1935 the inlet was opened, protective jetties were constructed and the channel and turning basin were excavated. The harbor was authorized as a Federal Project in 1935 and completed to its present project dimensions in 1938.

The Fort Pierce Inlet District was abolished by the Florida Legislature on July 1, 1947 with the simultaneous creation of the Fort Pierce Port Authority. It retained essentially the same authority with the addition of the legal right to acquire and lease real estate.

The Fort Pierce Port Authority was superceded by the Fort Pierce Port and Airport Authority by Special Act of the Florida Legislature on May 29, 1961, effective July 1, 1961, and remains in being to date.

Little documented history is known to exist of the earliest actual shipping from the Port of Fort Pierce. However, it is presumed to have commenced shortly after construction of the Fort Pierce Inlet and continues to this day. It is known that the original Indian River Terminal facilities were constructed prior to World War II and that during that war the Federal Government assumed control of the Port for use as a military amphibious base. Since that time the ownership and operation of port facilities have primarily been of a private enterprise nature.

Chapter 8
ENVIRONMENTAL ANALYSIS SUMMARY

(Insert on page 8-22, Chapter 8, ENVIRONMENTAL ANALYSIS SUMMARY, at the end of first paragraph (Paragraph beginning on page 8-21, titled Effects on the Inlet Wormrock Reef).)

The protection and growth of the wormrock reef outside of navigation channels is more a matter of maintaining existing natural conditions than of externally created influences. In order for the wormrock reefs to form and grow in any location, a source of larvae, a place for the larvae to attach, and a constant source of food and sand particles is required. Since wormrock currently exists within the inlet, sufficient sources of larvae, food and sand must currently exist. Expansion of the reef could possibly be accomplished by placing more material for attachment, such as rock riprap, in the area, and severely restricting activity, such as small vessel traffic, in the immediate vicinity. The future of the wormrock reef is more dependent upon the continual existence of larvae, food and sand. As such the expansion of the entrance channel should not change any of these factors for the wormrock reef outside of navigation channels.

ENVIRONMENTALLY SENSITIVE ECONOMIC DEVELOPMENT AND DIVERSIFICATION PLAN AND IMPLEMENTATION PROGRAM FOR APALACHICOLA, FLORIDA

DER Contract NO. CM - 153

Prepared by Lacy Bullard, Contractor
under a Grant from the Department of Environmental Regulation, State of Florida under the Coastal Zone Management Act of 1972 as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration

The following is a synopsis of what I have been able to accomplish under the above referenced grant contract, giving the current status of projects initiated.

- I was successful in securing a $40,000. Title I grant through the Private Industry Council to train up to 40 disadvantaged workers to produce specialty quilts as a cottage industry. This was a new concept in job training, but because it would have allowed workers to be trained in a skill allowing them to work at home without the need for expenses like transportation, clothing and child care, it was well suited to the local population element it was designed to employ.

Unfortunately, following protracted and complicated negotiations, the Tallahassee based group desiring to produce and market the quilts rejected the grant funds. The group felt that the complex monitoring requirements imposed by the grant administrators, and the demands for exact individual performance and production projections for the trainees involved were unrealistic and perhaps impossible, given the pioneering nature of the project and the relatively small amount of funds in question.

- I personally lobbied(in Atlanta, Georgia and Washington, D.C.) Economic Development Administration (EDA) personnel, helping to move forward the City of Apalachicola grant request for funds to construct environmentally sound commercial docking facilities for shrimp and fishing boats at Scipio Creek boat basin. This grant was awarded and the project, scheduled to begin within the next few months, will create an estimated 30-60jobs over time.

- I originated and helped develop a proposal for the State of Florida under the C.A.R.L. program to purchase approxomately 12 historic properties along the Apalachicola river front within the downtown area. These properties, in various states of disrepair, would be leased back to private enterprise for development to fit into a plan compatible with seafood harvesting and related traditional uses of the wharf area. This would allow the upgrading of the area to greatly increase the tax base, while creating tourist-related activities (in museums, acquarium, shops restaurants, etc.) to complement, rather than overwhelm and displace, authentic waterfront character.

The project design, involving Department of Environmental Regulation, Department of Natural Resources, Northwest Florida Water Management District, Department of Community Affairs, Apalachicola National Estuarine Research Reserve, Bureau of Historic Preservation, City of Apalachicola, Franklin County and private citizens, is now complete and ready for submission by staff to the C.A.R.L. Committee and Governor and Cabinet for listing and priority ranking.

The Working Waterfront, in addition to the spinoff effect of such urban revitalization, would produce a minimum of 20 new jobs in restoration and construction necessary to rehabilitate the historic buildings - a process which would continue over a period of several years. The newly created retail outlets, museums, food and service establishments would provide employment for some 50 people, at a minimum, and thanks to the mild climate of Apalachicola, these would for the most part be year-round rather than seasonal in nature.

Although the ultimate effects of the new tax laws are not yet well known, it is the general concensus that historic preservation projects, with their still favorable tax-credit structure, will continue to be attractive to investors. Given a growing population of residents and tourists in the coastal areas of northwest Florida, Apalachicola with its wealth of architecturally interesting historic structures and innate charm should be a prime location for such private investment.

- Recognizing the historic and architectural quality of the community of Apalachicola, I organized and helped incorporate Apalachicola Restoration Crafts, Inc., a group whose purpose is to establish and operate a school offering training in the crafts and techniques necessary to authentically rehabilitate historic structures. The President of ARC,Inc. is Dr. Frederick Humphries, President of Florida A&M University, and it is likely that the school will function primarily under the Florida A&M umbrella, with classes tailored to the special needs of various groups like architects, contractors, etc.

The school will be housed in the 1900 Mary Star of the Sea Convent building in the city's historic district. Currently, ARC is involved in fund-raising to purchase the building, in conjunction with a local bank and the Florida Trust for Historic Preservation. Some $36,000 in matching money has been raised and grants applied for to begin restoration of the building and fund program and publications for students.

The successful establishment of the school will not only provide economic stimulus to the local economy by bringing in students from around the southeast, but will produce a trained labor force able to handle local/regional demand for restoration professionals.

- As stated above, the Working Waterfront will inspire related tourist industry. At present, an Apalachicola resident is firmly committed to investing $50,000 of private capital toward the purchase and operation of a steamboat or paddlewheeler to serve in a combined tour boat/dinner cruise operation. Negotiations are now in progress to locate a suitable craft, additional investors, and potential contract users to make the investment more attractive.

- I have secured a Tallahassee investor who is interested in locating a wholesale nursery for native coastal plant species in the Apalachicola area. The City of Apalachicola may provide land for this operation, charging only nominal lease fees, in order to bring in new jobs. The initial figures show 6-10 new jobs in the first year or two, growing to double that within 4 years. If financing can be arranged on favorable terms, such a nursery could be in operation within a year's time.

Further efforts to attract and develop economic investment to Apalachicola and the surrounding area include a conference on the subject planned for February 5-7, 1987 at Apalachicola.

Planning for this conference has been extensive, and continues. Details are related in the Final Work Product: Draft of Report to Serve as Basis of Conference, submitted September 29, 1986 under the terms of the DER Contract NO. CM - 153.

Geographic Information System Applications in the Coastal Zone Management Area of the Suwannee River

INTRODUCTION

Environmental policy and management decisions should be be based on the examination and interplay of many different factors which bear upon a particular issue. Decisions concerning the preservation of wetlands, for example, must be based upon evaluation of a wide range of instituional, political, economic and environmental data. Maps and their associated data stored within automated geographic information systems (GIS) are potentially powerful tools which can enable land managers to deal more effectively with such complex issues.

The purpose of this project was to organize mapped planning data for the lower Suwannee River 100-year floodplain area below Fannin Springs by means of an automated GIS. This data can now be used to create maps and reports on existing conditions and, perhaps most importantly, to establish a base line from which changes in envionmental conditions can be monitored and evaluated. The maps created for the project will be made available to other federal, state, regional and local agencies. The greatest power of the data base from which the maps were created lies in the abiltity to manipulate the data in ways that will meet the specific needs of individual agencies.

This project was not intended to demonstrate the full range of capabilities of the GIS. Rather the objective has been to intended to demonstrate the potential of the GIS in helping to make rational resource management decisions. The maps were derived from existing maps and from new data collected specifically for the project.

GENERAL CHARACTERISTICS OF THE STUDY AREA

The lower Suwannee River and its estuary is a major natural resource which is still in a relatively unspoiled condition. As the river approaches the Gulf of Mexico it meanders across the coastal plain with such a gentle slope that tidal influence extends 34 miles upstream to Fannin Springs. The 100-year floodplain spreads out from about a mile wide near Fannin Springs to about five miles at the mouth covering a total of about 75 Square miles. The lower Suwannee includes critical habitat for several rare and endangered species including manatees, sturgeons and Bachman's warblers. This stretch of the river supports a regionally important freshwater sport fishery for bass, bream and catfish. The saltwater fishery, centering on redfish and sea trouth, is even more significant, drawing anglers from throughout the country to the Suwannee River esturary and supporting a thriving fishing guide and marina business near the mouth of the river. The importance of a healthy shoreline and floodplain for maintaining the productivity of a river and its estuary has been established in the case of the Appalachicola River and would apply as well to the Suwannee River. Preserving the lower Suwannee System is important both environmentally and economically.

Much of the 100-year floodplain below Fannin is wetland and most of the rest is timberland covered with pine. Subdivision and riverside development are increasing. Fanning Springs is only 35 miles from Gainesville and the area is becoming more popular for retirees. Therfore, continuing development pressure can be anticipated. Much of the development is taking place on the banks of the river where several problems are created. For example, clearing and bulkheading along the bank decreases fish habitat and productivity. Increased boat activity is dangerous to Manatees. Roads serving riverside developments frequently require expensive repairs after floods. Septic tank systems sometimes fail during floods, creating problems. Access by road to houses in the floodplain is cut off for extended periods of time by high water. Guiding development so as to preserve the lower Suwannee, its estuary and the surrounding floodplain as a productive system that will not impose costly burdens for taxpayers is a function that requires readily available data of the type prepared for this project.

THE GEOGRAPHIC INFORMATION SYSTEM AS A PLANNING AND MANAGEMENT TOOL

Maps have always been basic to all forms of scientific investigation, planning and regulatory programs. However, there are problems associated with using traditional maps these include:

1. Comparing data from maps of different scales.

2. Interpreting the relationship of two or more types of differing data.

3. Map is one of a kind, not reproducible.

4. The limited number of spatial data sets that can be compared.

5. The inability to assign more than one value or meaning to a line or point.

A GIS can overcome these problems and convert traditional maps into dynamic management tools. A geographic information system is a multilayered, georeferenced data base that can be used for exploration, inventory, update, evaluation, problem solving and forcasting of events in an area. It consists of multiple geographically registered data sets, associated files, and various data analysis functions. Georeferenced means that the spatial location of points, lines and areas in the data sets are indentified and labeled.

The terms GIS and spatial may be new terms to many, the use of spatial information is familiar to anyone who has ever used a map of any kind. In private life, goverment and business, the use of maps is a common function. A GIS merely takes the maps that people are accustomed to using, such as a road map and puts them into a computer. The maps are entered into the computer through a process called "digitizing". The most common way of digitizing is by hand-tracing all the lines on a map with a special piece of equipment called a digitizer. When it is time to draw the maps a device called a plotter is used. The plotter mechanically moves pens acrosss

paper based on the information in the computer thereby recreating the map from the data that was "traced" (digitized) .

Anything that can be put on a map can be put into the system. It then provides an effective means of developing, manipulating, modelling and presenting the data base. The data can be in point, line, cell, or polygon format and the character of the data can take any form such as soils, vegetation, landuse, landownership, demographic data and political boundaries. The GIS becomes a useful evaluation tool when you begin to relate various files or overlay them within the system to explore data interrelationships. For example, a complex combination might include hydrology, slope, aspect, vegetation, and elevation to determine wildlife habitat. Water quality might be inferred from soils, slope, geology, precipiation and land use.

Maps can drawn at different scales and with different shading patterns to highlight different types of information. Several individual maps may be combined to form a different map with new information.

OVERVIEW OF GEOGRAPHIC DATA BASE SYSTEM CHARACTERISTICS

1. Graphical and non-graphical data can be stored together.

2. All graphical entities, such as lines, symbols, curves, and polygons can have non-graphical information associated with them. For example, a line may be the map symbol for a road. The line forming the road could have information attached to it on the type of road, its width, the annual traffic count and the last time it was paved or graded.

3. For a graphical entity tabular information can be generated in report form. For example, a polygon such as a parcel of land could have a report printed out giving the total number of acres by individual land use, soil types, geology, population, and number of water wells.

4. Map data may be put into the map at any scale and then reproduced at any other scale designated. For example, a map put into the computer at 1: 50,000 could be reproduced at a scale of 1: 24,000.

5. Polygon "overlay" can be created. This is a useful analysis technique used to discover data interrelationships. For example, mapped information on soils, slope, vegetation, and rainfall, can be combined to reveal area with erosion problems. Data on land use floodplain area, and evelvation could be combined to determine specific managment policies.

6. Other combinations that could be used with the overlay technique include the use of data on hydrology, slope, vegetation, and elevation to determine wildlife habitat. Water quality could be inferred from soils, slope, geology, pricipitation, and land use. The combinations that can be developed depend on the availability of source data and the complexity of analysis required.

7. Map updating: The natural resource base is not static. Natural change and the activities of man result in physical variations on the environment both above and below the land. Maps and tabular data must be updated to reflect these changes. In the past this has been a slow and tedious process. So slow that most people are accustomed to working with out-of-date maps.

Computerized graphics have reduced the map updating problem. With the system it is not necessary to redraw the entire map to make changes. The map is simply displayed on a screen and additions and deletions are made automatically.

DESCRIPTION OF MAP PRODUCTS

SOILS :

data source:

Purpose: Soil data has a variety of applications, one of the most important is determining whether an area or specific site is suitable for a septic system. Soils data can also be used in combination with other types of data to perform many types of land suitability analyses. The data use in this report is very general. The soils data base should be updated when more detailed soils information becomes available.

VEGETATION:

DATA SOURCE: 1:12,000 color infrared. 1983, SCS. Interpretation by SRWMD.

PURPOSE: Vegetation is a major indicator of the ecology of an area. Vegetation is closely keyed to soils types and wildlife habitat. The removal of the natural vegetation can in many cases result in water quality and quantity problems, erosion, and the reduction of fish and wildlife populations. The predominant vegetation type in the the study area is wetlands. The destruction of wetlands is harmful from both a hydrologic and environmental point of view.

LAND USE:

DATA SOURCE: 1:12,000 color infared SCS maps, 1983. Interpretation by SRWMD.

PURPOSE: Land use data is needed to determine the existing patterns of development within an area. By knowing existing land use, future land use needs can be forecasted and land allocated for those uses through the comprehensive planning process. Using the forcasts the trend of development patterns can be determined and the collocation of incompatible land uses avoided.

LAND OWNERSHIP:

SOURCE: Tax Tapes 1985-1986-

PURPOSE: Land ownership data is needed as part of the revenue function of local governments. The GIS is an ideal tool for tax assessors who must keep track of changes in land ownership. Once the data base has been created, the data can be easily updated. Land ownership data is also useful in regulatory programs, land

acquisition programs and in planning for services related to water, sewer, fire and police protection.

TOPOGRAPHY:

SOURCE: USGS 1:24000, 7.5 minute quad sheets .

PURPOSE: Land elevation above mean seal level (msl) can be used in combination with many types of data to calculate runoff, to determine how much of an area may be covered with water in a flood event and to determine how high a structure must be built to avoid flooding.

FLOODPLAIN:

DATA SOURCE: SRWMD information in combination with USGS 1:24000, 7.5 minute quad sheets.

PURPOSE: The 100-year floodplain forms the project boundary. The floodplain is a environmentaly fragile area, which is valuable as a wildlife habitat and as a natural storage area for flood waters. The fact that flooding within this area is not an uncommon phenonmenon, would indicate that special standards should be required for this area including limited filling, special precautions in the design of septic systems and wells and the elevation of structures above flood waters.

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VEGETATION:

DATA SOURCE: 1:12,000 color infrared. 1983, SCS. Interpretation by SRWMD.

PURPOSE: Vegetation is a major indicator of the ecology of an area. Vegetation is closely keyed to soils types and wildlife habitat. The removal of the natural vegetation can in many cases result in water quality and quantity problems, erosion, and the reduction of fish and wildlife populations. The predominant vegetation type in the the study area is wetlands. The destruction of wetlands is harmful from both a hydrologic and environmental point of view.

LAND USE:

DATA SOURCE: 1:12,000 color infared SCS maps, 1983. Interpretation by SRWMD.

PURPOSE: Land use data is needed to determine the existing patterns of development within an area. By knowing existing land use, future land use needs can be forecasted and land allocated for those uses through the comprehensive planning process. Using the forcasts the trend of development patterns can be determined and the collocation of incompatible land uses avoided.

LAND OWNERSHIP:

SOURCE: Tax Tapes 1985-1986-

PURPOSE: Land ownership data is needed as part of the revenue function of local governments. The GIS is an ideal tool for tax assessors who must keep track of changes in land ownership. Once the data base has been created, the data can be easily updated. Land ownership data is also useful in regulatory programs, land

acquisition programs and in planning for services related to water, sewer, fire and police protection.

TOPOGRAPHY:

SOURCE: USGS 1:24000, 7.5 minute quad sheets .

PURPOSE: Land elevation above mean seal level (msl) can be used in combination with many types of data to calculate runoff, to determine how much of an area may be covered with water in a flood event and to determine how high a structure must be built to avoid flooding.

FLOODPLAIN:

DATA SOURCE: SRWMD information in combination with USGS 1:24000, 7.5 minute quad sheets.

PURPOSE: The 100-year floodplain forms the project boundary. The floodplain is a environmentaly fragile area, which is valuable as a wildlife habitat and as a natural storage area for flood waters. The fact that flooding within this area is not an uncommon phenonmenon, would indicate that special standards should be required for this area including limited filling, special precautions in the design of septic systems and wells and the elevation of structures above flood waters.