MIKE

Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Martin County, Florida

Final Report
September, 1993

Long-Range Dredged Material Management Plan for The Intracoastal Waterway in Martin County, Florida

Prepared for:

FLORIDA INLAND NAVIGATION DISTRICT

by:

R. Bruce Taylor
William F. McFetridge
Michael L. Cochrane

Taylor Engineering, Inc.
9086 Cypress Green Drive
Jacksonville, Florida 32256
(904) 731-7040

TABLE OF CONTENTS

TABLE OF CONTENTS CONT...

LIST OF FIGURES

LIST OF FIGURES CONT...

LIST OF FIGURES CONT...

LIST OF TABLES

LIST OF TABLES CONT...

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to Ms. E. Lynn Mosura, Mr. Peter NeSmith, and Mr. Kirk Stage of Water and Air Research, Inc. for their assistance in the performance of this project.

EXECUTIVE SUMMARY

The identification and permitting of suitable dredged material management areas for the Intracoastal Waterway in Florida have become increasingly difficult. This has resulted from the nature of dredging, the requirements of handling and storing dredged material, and the environmentally sensitive and rapidly developing areas in which these operations are performed. In response to this situation, the Florida Inland Navigation District (FIND) initiated, in 1986, a program of long-range dredged material management. When fully implemented this program will provide a permanent infrastructure of management facilities for all maintenance material dredged from the 374 miles of Intracoastal Waterway channel connecting Fernandina Harbor in Nassau County with Miami Harbor in Dade County.

The FIND's program, executed in close cooperation with the Jacksonville District Corps of Engineers, comprises three main elements: (1) a two-phased plan development and property acquisition element, (2) a facility permitting and construction element, and (3) a facility operation element. Program execution begins with the development of long-range dredged material management plans for the Waterway on a county-by-county basis (Phase I of the planning and property acquisition process). Upon finalization of each plan, Phase II of the planning and property acquisition process begins with site boundary surveys. The process continues with detailed environmental site characterizations, soils testing, topographic surveys, preliminary facilities design and site plans, site operation and management plans, and a summary of expected costs for site development and operation. All of this information is then used for property acquisition and facilities permitting.

This report presents the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Martin County. Similar plan documents have been completed and approved for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties. In addition, comparable plan documents are nearing completion for the Waterway in Flagler and Volusia Counties. Phase II of the plan development and property acquisition program element will develop the site specific documentation described above for the recommended primary sites. Barring unforseen circumstances and changes in conditions at the time of this report, the FIND will then actively pursue acquisition of these sites during Phase II.

The methods used in the development of the long-range dredged material management plan for the Intracoastal Waterway in Martin County are based on those used in the development of previous plan documents for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties. The major tasks performed as part of the present effort were as follows: (1) establishment of the 50-year material

storage requirement within the Martin County project area based on historic maintenance dredging volumes and subsequent examination surveys; (2) evaluation of the remaining or potential storage capacity of existing easements and FIND-owned tracts within the project area; (3) development of a management concept or strategy appropriate to specific engineering and operational requirements, and environmental and land-use constraints; (4) identification of additional candidate sites consistent with the management concept; and (5) evaluation of all candidate sites based on a standard set of criteria. These criteria were developed within the framework of the management concept and reflect engineering, operational, environmental, and land-use considerations.

To begin this process, engineering records at the Jacksonville District Office, U.S. Army Corps of Engineers were reviewed and analyzed to develop estimates for the 50-year maintenance dredging and material storage requirements of the 22 miles of channel within the study area. The analysis showed a projected total storage requirement of 2,728,000 cubic yards of bulked material distributed over four channel reaches. Preliminary assessment was then made of the 39 tracts totalling over 2,300 acres the FIND either owns (14 tracts, totalling 411.02 acres) or holds under perpetual easement (25 tracts, totalling 1747.71 acres). This assessment revealed that only eight tracts met the most basic criteria of reasonable upland acreage and existing or potential road access and thereby showed potential for development and use as dredged material management areas. These eight tracts, grouped to form six sites, were retained as candidate sites for further evaluation.

With the maintenance characteristics and the projected 50-year material storage requirement of the Waterway within the Martin County project area thus established, a management concept was then developed to guide the identification and evaluation of alternative candidate sites consistent with the unique characteristics of the project area and the projected channel maintenance requirements. In this manner, unrealistic and impractical alternatives were eliminated so that the identification of more reasonable alternatives could proceed logically. The principles of the management concept adopted for Martin County are as follows:

(1) In the vicinity of St. Lucie Inlet, material dredged from the Waterway channels will be managed through the use of beach disposal combined with a back-up upland storage capability.

(2) In all other segments of the Waterway, dredged material will be placed in diked upland management facilities having existing or developable road access.

(3) Centralized upland sites will be established in a minimum number of locations per operating reach of the Waterway.

(4) Sites will be operated and maintained as permanent facilities in which dredged material will be actively managed.

Within this framework a total of 12 alternative candidate sites were identified. Each existing and alternative site was then field inspected and evaluated under a standard set of criteria addressing engineering, operational, environmental, and land-use considerations. By this process, eight sites were selected to form a site bank of five primary (first-choice) options and four secondary alternatives. Included among the primary options are three sites which comprise four existing easements. The fourth primary site incorporates placing beach-quality material in a designated beach disposal area near St. Lucie Inlet. The fifth primary site consists of upland property identified as part of the present project and thus is neither owned nor currently held under easement by the FIND.

A vital element in the plan development process was the participation of key federal and state agency representatives, as well as representatives of local government and interested public citizens. At key points during Phase I of the project, a Technical Advisory Committee consisting of representatives from the FIND, the Florida Department of Natural Resources (DNR), the Florida Department of Environmental Regulation (FDER)[1], the Florida Department of Community Affairs (DCA), and the Jacksonville District, U.S. Army Corps of Engineers met with the contractor to monitor work in progress, review technical decisions, and establish project policy for the execution of future tasks. These meetings were supplemented with continuing dialogue with key agency personnel. In addition, a Citizens' Advisory Committee appointed by the Martin County Commission periodically reviewed the specific plan as it developed. Finally, at key stages in the plan development process, the results of all efforts to that point were presented to the Martin County Commission and twice to the general public at Public Information Workshops, the first held in the Stuart City Hall and the second at the Sewalls Point Community Center. At the workshops, comment was actively solicited from representatives of local government, civic groups, and interested citizens. Input and guidance received from all those who participated in the committee meetings and workshops proved invaluable to the successful completion of the project.

---

[1]On July 1, 1993, the Florida Department of Environmental Regulation and the Florida Department of Natural Resources were consolidated into the Florida Department of Environmental Protection. Most of the work on this project was performed before the date of consolidation. Therefore, reference to the two antecedent agencies is retained throughout the remainder of this report.

Experience gained from the earlier long-range dredged material management studies completed for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties has demonstrated the importance of systematic documentation of dredged material management alternatives and the basis upon which these alternatives are evaluated. This Phase I report provides such information for the long-range dredged material management plan for the Intracoastal Waterway in Martin County and documents all work performed under this contract. A companion set of 23 photobase engineering plans summarize pertinent channel and site information. Phase II of this project will develop all of the detailed engineering, environmental, and survey information necessary to design, permit, and construct permanent dredged material management facilities on each of the primary sites selected. Phase II will also address cost considerations associated with these actions and will develop detailed site operation and management plans. A detailed scope of work for Phase II of the project is presented in Section 5.0 of this report.

1.0 INTRODUCTION

This report documents Phase I of a two-phased effort to develop a 50-year plan for the management of maintenance material dredged from Intracoastal Waterway (ICWW or Waterway) channels in Martin County, Florida (Figure 1-1). Phase I focused on the development of basic plan concepts, the definition of long-term dredging requirements, and the identification of suitable management alternatives which satisfy preliminary environmental, engineering, and operational criteria. Phase II will focus on obtaining and documenting detailed site-specific information required for the preparation and submission of permit applications for the primary or first-choice sites identified in Phase I. In addition, Phase II will address the design of site facilities and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities.

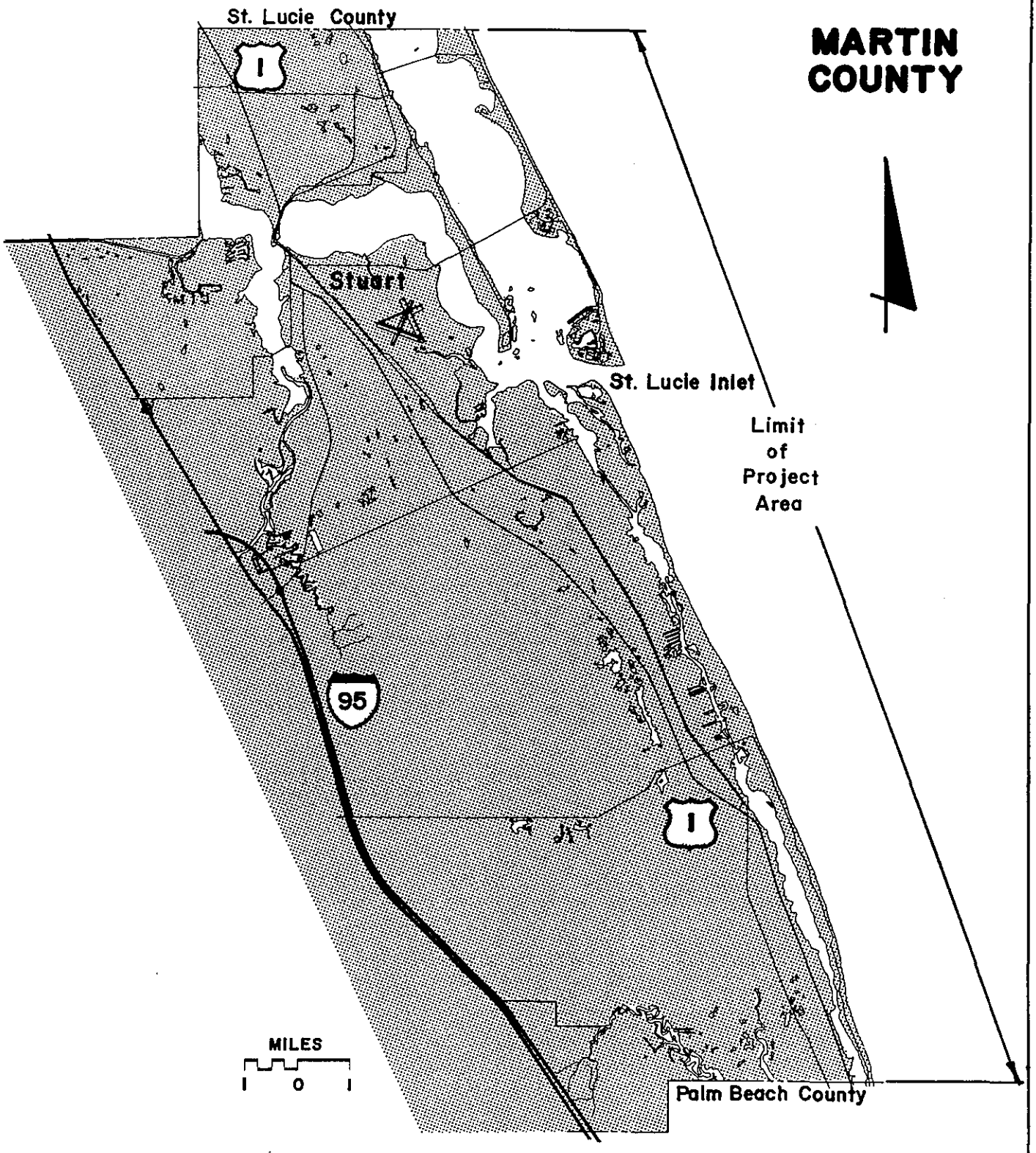
The methods used in the performance of the work reported herein are based on a study (Taylor and McFetridge, 1986) which addressed similar needs of the ICWW within Nassau and Duval Counties, Florida. This earlier effort, performed under the sponsorship of the Florida Inland Navigation District (FIND), served as a pilot study for the FIND's 15-year Atlantic Intracoastal Waterway Maintenance and Management Plan. Phase II of the Nassau-Duval study is now near completion. With the acquisition of seven upland sites, the FIND will construct dredged material management facilities intended to serve the needs of the ICWW within Nassau and Duval Counties for a minimum of 50 years. With minor modification, the same method has more recently been applied to St. Johns, Brevard, and Palm Beach Counties. Phase II is also nearing completion in these counties as well.

Experience gained from these earlier projects has demonstrated the importance of documenting the evaluation process used to identify management alternatives. This report provides such documentation for the long-range dredged material management plan for the ICWW in Martin County.

1.1 Background

Since its formation in 1927, the FIND has served as the state governmental body responsible for maintaining the ICWW channel along Florida's east coast between Fernandina Harbor and Miami. As such, the FIND must provide the U.S. Army Corps of Engineers (COE) with sites suitable for placing material dredged from the authorized federal navigation channel.

Prior to the increased environmental awareness of the 1970's and the recognition by various federal and state regulatory agencies of the value of estuarine wetlands, a short-term economic approach guided



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 1–1
Project Area, Long– Range
Dredged Material Management Plan
Intracoastal Waterway
Martin County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

management of dredged material. Engineering, cost, and operational considerations determined the design and execution of channel maintenance projects. To this end, the Trustees of the Internal Improvement Trust Fund granted to the FIND perpetual easements to significant acreage along the Waterway. A majority of these easements were located entirely within the sovereign waters of the state and included both open water areas and expanses of pristine salt marsh and mangrove wetlands. Additionally, many landowners with holdings adjoining the Waterway sought to improve the development potential of wetlands by granting disposal easements and allowing the unconfined placement of maintenance material. This approach, combined with the desire of the dredging contractor to maximize operational efficiency, resulted in the proliferation of numerous small spoil mounds and islands lining the Waterway.

As a result of society's increased environmental awareness and the scientific knowledge supporting it, the unconfined placement of dredged material within wetland areas is no longer a responsible approach to the maintenance of the ICWW. Neither is it a realistic approach given present-day agency imposed permitting constraints. Current state and federal legislation mandates that all dredging and dredged material management activities satisfy a spectrum of environmental requirements dealing with water quality, habitat protection, threatened and endangered species, and the filling of wetlands. Specific prohibitions against the unconfined placement of dredged material in wetlands are contained in Sections 301 and 404 of the Clean Water Act (33 U.S.C. 403) administered by the U.S. Environmental Protection Agency, Section 10 of the Rivers and Harbors Act administered by the U.S. Army Corps of Engineers, and Chapters 253, 258, and 403 Florida Statutes and Chapters 17-4, 18-20, and 18-21 of the Florida Administrative Code administered by the Florida Department of Environmental Protection[2]. In addition, local county and municipal governments typically address dredge-and-fill issues in local comprehensive planning documents within guidelines established by the state. The long-range implications of these constraints have become more apparent in the ensuing years as existing sites reach capacity and as the identification and permitting of dredged material management sites become increasingly difficult. Moreover, the intensive development pressure being experienced throughout coastal Florida has made the acquisition of additional sites an ever more expensive proposition.

In order to secure its ability to maintain the ICWW within the existing framework of engineering, operational, and environmental constraints, the FIND initiated a 15-year program of long-term planning and

[2]On July 1, 1993, the Florida Department of Environmental Regulation and the Florida Department of Natural Resources were consolidated into the Florida Department of Environmental Protection. Most of the work on this project was performed before the date of consolidation. Therefore, reference to the two antecedent agencies is retained throughout the remainder of this report.

site acquisition to provide a means for accommodating all maintenance material dredged from the Waterway during the next 50 years and beyond. The first program element addressed the needs of the Waterway within Nassau and Duval counties, as discussed in Section 1.0. The program continues, now guided by a prioritization of Waterway segments, county by county, based on each county's need for immediate channel maintenance, as well as on the difficulty of providing appropriate sites within each county. This prioritization, jointly decided upon by the FIND and the Jacksonville District COE, identified three counties — Flagler, Volusia, and Martin — as the third group of counties in need of long-range dredged material management plans. This Phase I report documents the development of the long-range dredged material management plan for the Intracoastal Waterway in Martin County.

1.2 Project Overview

Phase I development of the long-range dredged material management plan for the ICWW in Martin County consists of four components: (1) the determination of projected 50-year channel maintenance and dredged material storage requirements; (2) the formation of an appropriate management strategy or concept for satisfying these requirements; (3) the identification of candidate sites designed to meet the projected storage requirements within the framework of the management concept; and (4) the evaluation of each site based on a set of criteria consistent with the management concept. This report documents each of these plan components.

1.2.1 Advisory Committees and Public Workshops

The prosecution of this project included, by design, a four-tiered involvement of outside reviewers and interested members of the public who commented on the long-range dredged material management plan as it developed. These four sources of input consisted of (1) a Technical Advisory Committee comprising representatives from the Florida Inland Navigation District staff, the Jacksonville District Corps of Engineers, the Florida Department of Environmental Regulation, the Florida Department of Natural Resources, and the Florida Department of Community Affairs; (2) a Citizens' Advisory Committee comprising community representatives appointed by the Martin County Commission; (3) the Board of Commissioners for the FIND; and (4) the general public. The manner in which these groups were involved in the development of the long-range dredged material plan is described below.

The Technical Advisory Committee met with members of the Taylor Engineering staff a total of four times during the course of the project to monitor work in progress, review technical decisions, and establish project policy for the execution of future tasks. The first meeting of the Technical Advisory Committee was held August 13, 1992, at the offices of Taylor Engineering. At this meeting, the Committee reviewed long-term Waterway requirements, the inventory of existing easements and their ability to meet these requirements, the development of the management concept, the preliminary identification of alternative candidate sites, and the establishment of a preliminary site bank consisting of both existing easements which demonstrated some potential for continued use and newly identified alternative sites. The second meeting of the Technical Advisory Committee was held October 7, 1992, at the offices of the DNR in Tallahassee. At this meeting, the Committee reviewed the results of the field inspection of all sites within the preliminary site bank, as well as the preliminary assessment of the preferred alternative sites for each reach of the project area. The last two meetings of the committee were held March 18, 1993, at Taylor Engineering, and on April 16, 1993, at the FDER offices in Tallahassee. In these meetings the committee reviewed the results of the site evaluation process and the selection of the site bank of primary and secondary alternatives. The plan presented in this report reflects the valued contribution of this group.

Immediately following each Technical Advisory Committee meeting, a meeting was held with the Citizens' Advisory Committee. The material discussed and reviewed at these meetings paralleled that covered in the Technical Advisory Committee meetings. Most importantly, additional input was received from the members of the Citizens' Advisory Committee regarding the relative practicality and desirability of developing specific candidate sites as permanent dredged material management facilities. As a result, many valuable suggestions were received and, in many cases, acted upon to the betterment of the final plan. The contributions of these individuals were a key factor in the successful completion of the project.

In addition, a series of presentations and workshops were carried out to inform both the citizens of Martin County and their elected officials of the FIND's intended action. To begin, the staffs of FIND and Taylor Engineering made a presentation to the Martin County Commission on July 14, 1992, to introduce the FIND program of long-range dredged material management for the Intracoastal Waterway and to inform the Commission that a planning effort for the Waterway in Martin County was being initiated. Because the plan developed for Martin County includes a primary site located in St. Lucie County, a similar presentation was made to the St. Lucie County Commission on March 23, 1993, at the St. Lucie County Complex in Ft. Pierce.

To inform the citizens of Martin County and to receive additional input, two Public Information Workshops were held. These two workshops, held at the Stuart City Hall on November 10, 1992, and at the Sewalls Point Community Center on April 26, 1993, presented the work accomplished to date and set forth the direction of the plan at that time. Input received from both the Technical Advisory and Citizens' Advisory Committees was incorporated in the information presented and discussed at the public workshops.

Finally, progress made in the development of the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Martin County was discussed at the regularly scheduled public workshops and Board meetings of the Florida Inland Navigation District. These public meetings are held monthly on a rotating basis in each of the 11 counties comprising the District. During Phase I of the Martin County project, progress reports and updates were presented and discussed by the FIND Board at seven public meetings and workshops. These included the FIND public workshops held in Fernandina Beach (Nassau County) on October 24, 1992, in Stuart (Martin County) on February 20, 1993, and in Ft. Pierce (St. Lucie County) on April 24, 1993, as well as the FIND Board meetings held in Miami (Dade County) on September 17-18, 1992, in Palm Coast (Flagler County) on January 22, 1993, in Jacksonville (Duval County) on July 23-24, 1993, and finally in Ft. Lauderdale (Broward County) on September 9-10, 1993, at which time the plan was formally adopted by the Board.

The constructive and valuable input received from each of the above described sources contributed greatly to the successful completion of the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Martin County.

1.3 Plan Document

The entire planning process is documented in the remaining sections of this report. Section 2.0 describes the establishment of 50-year material management requirements for various reaches of the Waterway. This was accomplished by the use of historic data, and the comparison of projected dredging locations and material storage requirements with the capacities of existing disposal easements. Section 3.0 discusses the management concept, the identification of alternative sites, and the field inspection and initial evaluation of all candidate sites, comprising both existing easements and alternative sites. Section 4.0 describes the final site evaluation process and includes the evaluation criteria used and the formation of the site bank of first- and second-choice options from the list of candidate sites. Finally, Section 5.0 presents a specific scope of work for plan implementation in Phase II.

2.0 50-YEAR MATERIAL STORAGE REQUIREMENT

2.1 Historic Analysis

2.1.1 Methodology

Fifty-year dredging and material storage requirements for the Martin County segment of the Waterway were projected from historic shoaling rates in the Waterway channel. Baseline shoaling rates, in turn, were determined from a detailed analysis of Jacksonville District COE archival records, engineering plans, and survey data related to channel maintenance. These records represent the only available information on patterns of sedimentation within the project area.

Baseline shoaling rates for the various segments of the Waterway in Martin County were derived from two estimated quantities: (1) the estimated volume of material removed from the Waterway channel in all maintenance dredging operations since the present channel project depth was established, and (2) the estimated volume of shoaling which has occurred since the last maintenance operation or which has occurred in areas not covered by later channel maintenance.

The first quantity, the volume of historic maintenance dredging, is derived from COE records, as previously stated. The estimated quantity is based on the analysis of all plans and supporting documents for channel maintenance performed in the Martin County segment of the ICWW since the channel was deepened to its present project depth of 10 feet below Mean Low Water (MLW). Within Martin County, the deepening of the channel was performed in two phases — from Ft. Pierce in St. Lucie County southward to St. Lucie Inlet between early 1961 and early 1962, and from St. Lucie Inlet southward to Jupiter Inlet in Palm Beach County between early 1962 and early 1963.

The volume of material dredged in previous channel maintenance operations is expressed in two forms in the archival records. The first is the pre-dredging estimate, or the design volume, of required dredging. This estimate is obtained by comparing the results of a detailed pre-dredging examination survey of the authorized channel to the project design depth, plus the required advanced maintenance or overdepth dredging. The plan for the dredging operation and the bids of the dredging contractors are based on this estimate. The second estimate is recorded as the pay volume. This estimate determines the amount the dredging contractor is paid for the work. It is based on the comparison of detailed pre- and post-dredging

examination surveys, and therefore closely corresponds to the actual volume of material removed from the channel. Because of past contracting and recording procedures, pay volumes do not always link dredging quantities to specific dredging locations. In those maintenance operations for which the pay volume is unavailable, the pay volume was estimated by multiplying the design volume by a correction factor. The correction factor represents the ratio of pay volume to design volume in those channel maintenance operations for which both quantities are known. The correction factor applied to the Martin County dredging data is 1.1905.

In addition, a second quantity, the estimated volume of recent shoaling, was derived to provide a more complete indication of the patterns of sedimentation. Over an adequate period of record during which channel maintenance is performed regularly or on an "as needed" basis, historic dredging volumes provide a reasonable and reliable indication of sedimentation patterns. In addition to shoaling rates, other unrelated factors often determine the scheduling of channel maintenance. These include contracting procedures, the availability of funding and equipment and, most relevant to the present study, the availability of suitable dredged material management sites. Here, Martin County has benefitted from existing easements that have provided adequate material storage capacity for channel maintenance operations up to the present time. Nevertheless, the calculation of future dredging and material storage requirements includes estimates of current shoaling volumes based on the most recent COE channel centerline survey performed in October, 1987. Not included in the estimate of current shoaling are those shoals identified in the 1987 survey that were later removed in the early 1991 channel maintenance operation performed in the reach immediately opposite St. Lucie Inlet (Cut M-2 through Cut M-7, ICWW mile 244.90 to mile 247.13). The volume dredged in this operation contributed to the total volume of historic dredging described above. Thus, the period of record on which the historic rates of shoaling are based is from early 1961 to early 1991, or 30 years.

The development of plan elements which address the needs of the ICWW in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties has demonstrated that a necessary first step in the analysis of dredging records and survey data is to establish an accurate and consistent system for cross-referencing a particular location along the ICWW to both cut and station (sta), and channel mile. Moreover, such a system must resolve inconsistencies between project descriptions found in older engineering records and those of more recent origin. These inconsistencies were resolved by adopting current designations of channel cut and station and referencing them to ICWW channel mileage. The system is therefore derived from the original navigation project record document which accompanied the establishment of the 10-foot

MLW project depth between 1961 and 1963 and modifications to that document which appeared in succeeding maintenance plans. Consistency with the previous plan elements was maintained by measuring channel mileage from the southern boundary of the Jacksonville Harbor project (ICWW mile 0.0). This system, presented in Table 2-1, was used throughout the remainder of the study.

Inspection of Table 2-1 shows that the ICWW within Martin County comprises 27 straight line segments, or cuts, totalling 22.27 miles. This total includes 25 cuts — designated Cuts M-1 through M-25 — entirely within Martin County. It also includes the Martin County portions of two additional cuts which extend across county lines — 3950 feet of Cut SL-6 to the north of Cut M-1 and 3100 feet of Cut P-1 to the south of Cut M-25. The first, Cut SL-6, begins in St. Lucie County but extends across the county line into Martin County. The portion of Cut SL-6 which lies north of Martin County will be addressed in the development of a dredged material management plan for St. Lucie County. The second, Cut P-1, begins in Martin County but continues southward an additional 5,000 feet into Palm Beach County. The Palm Beach County portion of Cut P-1 has been previously covered in FIND's dredged material management plan for Palm Beach County.

Within this framework, a comprehensive analysis was then conducted of all maintenance dredging occurring in the ICWW in Martin County since 1961. All available sources of dredging information within the Jacksonville District COE were consulted to ensure accuracy, consistency, and completeness. Preliminary sources included the annual Office of the Chief of Engineers (OCE) Reports, previous COE summaries of maintenance dredging within the project area, and interviews with COE personnel. The primary sources of information, however, were archival maintenance plan documents and examination surveys.

The compilation and reduction of historic dredging information from the various preliminary sources was a difficult task. No single source had complete information, and the resolution of inconsistencies among sources was necessary prior to locating dredging plans. This task accomplished, the records then had to be physically located under several filing systems within the district office archives and missing plans recalled from inter-division loan or from alternate storage at the Jacksonville District Dredge Depot. All relevant dredging information was verified by reference to the original plan sheets or microfiche versions of the original engineering drawings. Additional information contained in the dredging plans included shoaling areas and limits of planned dredging (referenced to the existing longitudinal stationing), the estimated dredging volume for each shoal and, in many cases, the location of material placement. This procedure

Table 2-1 Intracoastal Waterway
Martin County, Florida[1]

	End Station (ft)	Length (mi)	MILEAGE 0.0 @ Cut M-1 Sta 0+00	ICWW Mileage 0.0 @ DU-1	0.0 @ FHP[2] AIWW Cut 34
Cut SL-6	412 + 90.26			240.12	262.50
Cut M-1	220 + 02.08	4.17	4.17	244.29	266.67
M-2	33 + 34.0	0.63	4.79	244.91	267.29
M-3	26 + 30.17	0.50	5.29	245.41	267.79
M-4	26 + 16.35	0.50	5.79	245.91	268.29
M-5	61 + 73.96	1.17	6.96	247.08	269.46
M-6	19 + 91.58	0.38	7.34	247.46	269.84
M-7	17 + 48.94	0.33	7.67	247.79	270.17
M-8	28 + 06.82	0.53	8.20	248.32	270.70
M-9	23 + 18.13	0.44	8.64	248.76	271.14
M-10	59 + 24.30	1.22	9.76	249.88	272.26
M-11	54 + 34.86	1.03	10.79	250.91	273.29
M-12	21 + 67.05	0.41	11.20	251.32	273.70
M-13	37 + 24.04	0.71	11.91	252.03	274.41
M-14	33 + 50.67	0.63	12.54	252.66	275.04
M-15	26 + 66.95	0.51	13.05	253.17	275.55
M-16	32 + 93.63	0.62	13.67	253.79	276.17
M-17	26 + 48.46	0.50	14.17	254.29	276.67
M-18	20 + 02.50	0.38	14.55	254.67	277.05
M-19	37 + 93.29	0.72	15.27	255.39	277.77
M-20	70 + 60.76	1.34	16.61	256.73	279.11
M-21	116 + 43.87	2.21	18.82	258.94	281.32
M-22	26 + 52.36	0.50	19.32	259.44	281.82
M-23	21 + 12.35	0.40	19.72	259.84	282.22
M-24	30 + 50.63	0.58	20.30	260.42	282.80
M-25	33 + 36.42	0.63	20.93	261.05	283.43
TOTAL	**110,484.17**		**20.93 mi**		
P-1	81 + 20.77	1.54	22.47	262.59	284.97

[1]Based on data contained in "Control Data, Intracoastal Waterway, Jacksonville to Miami, St. Johns River to Melbourne, 12 ft Project" D.O. File No. 8A-30,014, Jacksonville District, U.S. Army Corps of Engineers (undated).

[2]Fernandina Harbor Project, Fernandina Beach, Florida

established that maintenance within the study area since the establishment of the present 10-foot MLW project depth consisted of nine separate events. Table 2-2 summarizes the results of this analysis.

Table 2-2 also includes the locations and estimated volumes of shoals not yet dredged from the channel. These estimates are based on the results of the most recent channel centerline survey performed in 1987. For consistency, corresponding pay volumes for each area of shoaling are projected from the same design volume to pay volume ratio used in the analysis of historic dredging. The estimated shoaling volumes were then combined with historic dredging volumes to determine projected dredging and material storage requirements. Segments of the ICWW within Martin County which have historically required maintenance or which have recently experienced shoaling are identified in Figure 2-1.

2.1.2 Material Quantities and Locations

Examination of Table 2-2 demonstrates that shoaling within the Martin County segment of the ICWW is highly localized and largely restricted to the St. Lucie Inlet area. The total volume of shoaling throughout the county since the channel was deepened to its present 10 feet is an estimated 751,640 cubic yards (cy). Of this, 667,272 cy, or approximately 89 percent of the total volume of shoaling for the entire Martin County project area, has taken place in the four-mile channel segment centered on the inlet. Demonstrating a persistent pattern of shoaling, this segment of the channel has required nine separate maintenance dredging operations. Relatively rapid and persistent shoaling is characteristic of those areas of the Waterway near tidal inlets, as inlets typically introduce littoral sediments to interior navigation channels. Indeed, experience indicates tidal inlets are the primary source of ICWW channel sediment.

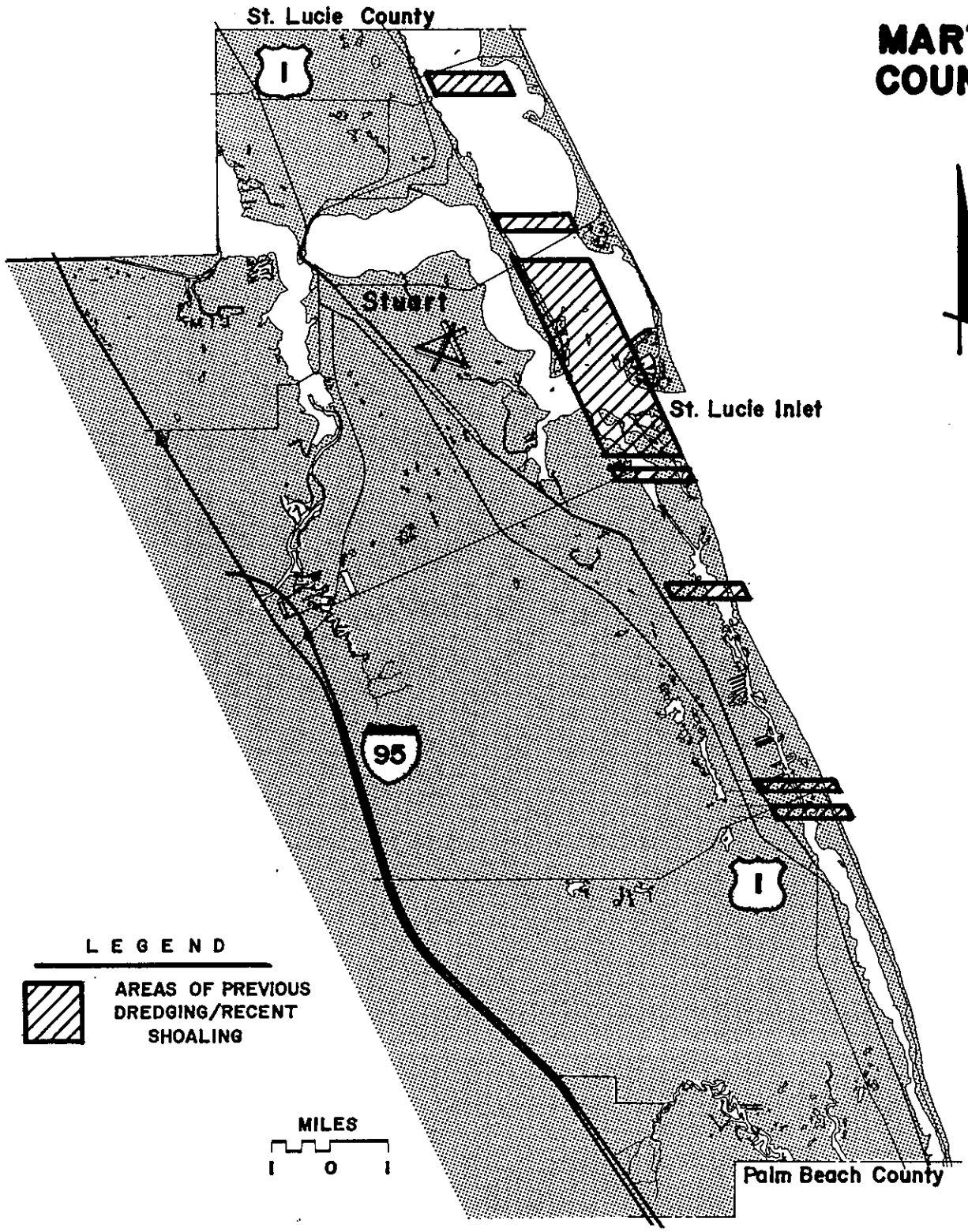
In contrast, within the remaining segments of the Martin County project area, shoaling has been minimal. Outside of the immediate area of the inlet, channel maintenance has been performed only once. In 1963, a breach in the barrier island at Peck Lake caused the formation of a shoal which extended into the adjacent ICWW channel. Approximately 20,000 cy of material was removed from the channel (Cut M-11, ICWW mile 250.60 to mile 250.93) at that time.

Additional, relatively minor shoaling at several locations beyond the immediate area of the inlet was documented in the more recent 1987 channel centerline survey. North of the inlet, two areas of shoaling were identified between the S.R. A1A and Jensen Beach Bridges. The first, with an estimated volume of 19,000 cy, extends from ICWW mile 240.38 to mile 240.71 (Cut M-1, sta 13+50 to sta 31+00). The

Table 2-2 Summary of Historic Maintenance Dredging/Recent Shoaling
Intracoastal Waterway, Martin County
1961-1991

ICWW Mileage From	To	Channel Cut/Sta From	To	Length	Year	Design Vol. (c.y.)	Pay Vol. (c.y.)	Disposal Area
240.38	240.71	M-1/13+50	M-1/31+00	0.33	1987*	19,097		----
242.99	243.27	M-1/151+50	M-1/166+50	0.28	1987*	19,560		----
243.85	245.43	M-1/197+00	M-2/60+00	1.58	1984	49,200		MSA M5
244.90	247.13	M-2/32+00	M-7/9+00	2.73	1991	164,000	195,292	MSA M5
245.01	247.10	M-3/5+50	M-6/1+00	2.09	1970	60,000		TR. 417/TR 420
245.84	246.07	M-4/22+50	M-5/8+50	0.23	1968	10,500	8,818	MSA - 2
246.48	247.50	M-5/30+00	M-7/2+00	1.02	1975	125,000		MSA M5
246.58	246.95	M-5/35+50	M-5/55+00	0.37	1964	25,700		MSA M5
246.61	246.89	M-5/37+00	M-5/52+00	0.28	1963	21,500		MSA M5
246.65	246.93	M-5/39+00	M-5/54+00	0.28	1984	35,100		MSA M5
246.66	246.88	M-5/39+50	M-5/51+00	0.22	1966	8,700		MSA M5
246.68	247.17	M-5/40+50	M-6/4+50	0.49	1968	41,300	43,271	MSA M5
246.70	246.99	M-5/41+50	M-5/57+00	0.29	1972	27,500		MSA M5
247.82	248.06	M-8/1+50	M-8/14+00	0.24	1987*	2,122		----
248.88	248.93	M-10/6+50	M-10/9+00	0.05	1987*	2,662		----
250.60	250.93	M-11/38+00	M-11/55+50	0.33	1963	16,200		MSA 504E
254.56	254.61	M-18/14+00	M-18/16+50	0.05	1987*	3,704		----
255.06	255.15	M-19/20+50	M-19/25+50	0.09	1987*	7,523		----
			TOTAL			**639,368 cy**		
			(est.) Pay Volume			**751,640 cy**		
							(- 30)	
			Dredging Volume/yr			**25,055 cy**		
							(x 50)	
			50-yr Dredging Requirement			**1,252,733 cy**		
							(x 2.15)	
			50-yr Disposal Requirement			**2,693,377 cy**		

* Estimated shoal volumes based on centerline survey "Reconaissance Survey, 10 and 12-foot Project, St. Johns River to Key West" D.O. File No. 8-35, 044, Jacksonville District, U.S. Army Corps of Engineers, July, 1987.



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 2–1
Areas of Historic Maintenance Dredging/ Recent Shoaling
Intracoastal Waterway
Martin County, Florida

PROJECT
REVISION
SHEET
DATE

second shoal, located more than two miles to the south of the first (ICWW mile 242.99 to mile 243.27, Cut M-1, sta 151+00 to sta 166+50), represents approximately 19,500 cy of material.

The 1987 survey also identified four minor shoals south of the inlet. The first two, located at the north and south ends of Great Pocket (Cut M-8, ICWW mile 247.82, and Cut M-10, ICWW mile 248.88), contain an estimated volume of 2,100 cy and 2,700 cy of material, respectively. The second two areas of shoaling were found approximately 5.6 miles farther south, immediately north and south of the Hobe Sound (S.R. 707) Bridge. The northern shoal (Cut M-18, ICWW mile 254.56 to mile 254.61) contains an estimated volume of 3,700 cy of material. The southern shoal (Cut M-19, ICWW mile 255.06 to mile 255.15) represents approximately 7,500 cy. The occurrence of these shoals in areas previously resistent to shoaling suggests that the shoaling pattern within Martin County may be changing, possibly as a result of continuing development along the ICWW, accelerated upland runoff, increased boat traffic, or other less direct factors. One additional shoal was identified by the 1987 survey at the extreme southern end of the Martin County project area (Cut P-1, ICWW mile 261.32 to mile 261.60). This shoal continues the extensive area of shoaling associated with Jupiter Inlet in Palm Beach County. Therefore, the removal of this shoal was considered as part of the dredged material management plan developed for Palm Beach County.

Combining the maintenance dredging quantities and existing shoal volumes for the various segments of the ICWW within the county yields a total county-wide shoaling volume of 751,640 cy for the 30-year period of record (1961-1991). To project the corresponding 50-year maintenance requirement, this figure was then apportioned upward by linear extrapolation (i.e., multiplied by a factor or 50/30, or 1.667). The resulting 50-year projected dredging volume of 1,252,733 cy corresponds to the *in situ* or unbulked volume of anticipated shoaling throughout the county.

To translate the projected 50-year *in situ* volume of shoaling into the volume of storage required to handle the dredged material, the bulking characteristics of the material must be considered. Bulking refers to the expansion of consolidated sediment that occurs as a result of dredging. Hydraulic dredging leads to material bulking by increasing the water content of the dredged material compared to its *in situ*, consolidated state. After dredging and placement in the containment area, the dredged material will begin to consolidate under its own weight. Given appropriate conditions and sufficient time, the material may approach its original pre-dredging volume. The degree to which the material expands (bulks) depends on the physical characteristics of the sediment, as well as its relative consolidation prior to dredging. For this study a factor

of 2.0 was used to account for the increase in volume of the *in situ* shoal material as it is dredged. An additional allowance of 15 percent of the original *in situ* volume accounts for anticipated non-pay volume or unauthorized overdredging. The selection of these conservative values is based upon Jacksonville District, U.S. Army Corps of Engineers experience and recommendation. Multiplying the projected 50-year volume of shoaling by the effective bulking factor of 2.15 yields a projected 50-year material storage requirement of 2,693,377 cy.

2.1.3 Material Quality

In addition to projected material quantities, a dredged material management plan must also consider the chemical and physical properties of the sediment to be dredged. Techniques employed to maintain water quality during dredging and dewatering are highly dependent on sediment chemistry and the physical characteristics of the dredged material (i.e., particle size, specific gravity, etc.). Also, the chemical and physical properties of the dredged material determine its potential for reuse and, therefore, influence the effective life of the site. In a procedure similar to that used to establish historic dredging volumes, all available sediment chemistry and physical data were reviewed. To augment the limited data on Martin County sediments, a program of sediment sampling and analysis was performed specifically for the present planning effort. Both the historic and more recent sediment data are discussed in the following paragraphs.

2.1.3.1 Sediment Chemistry

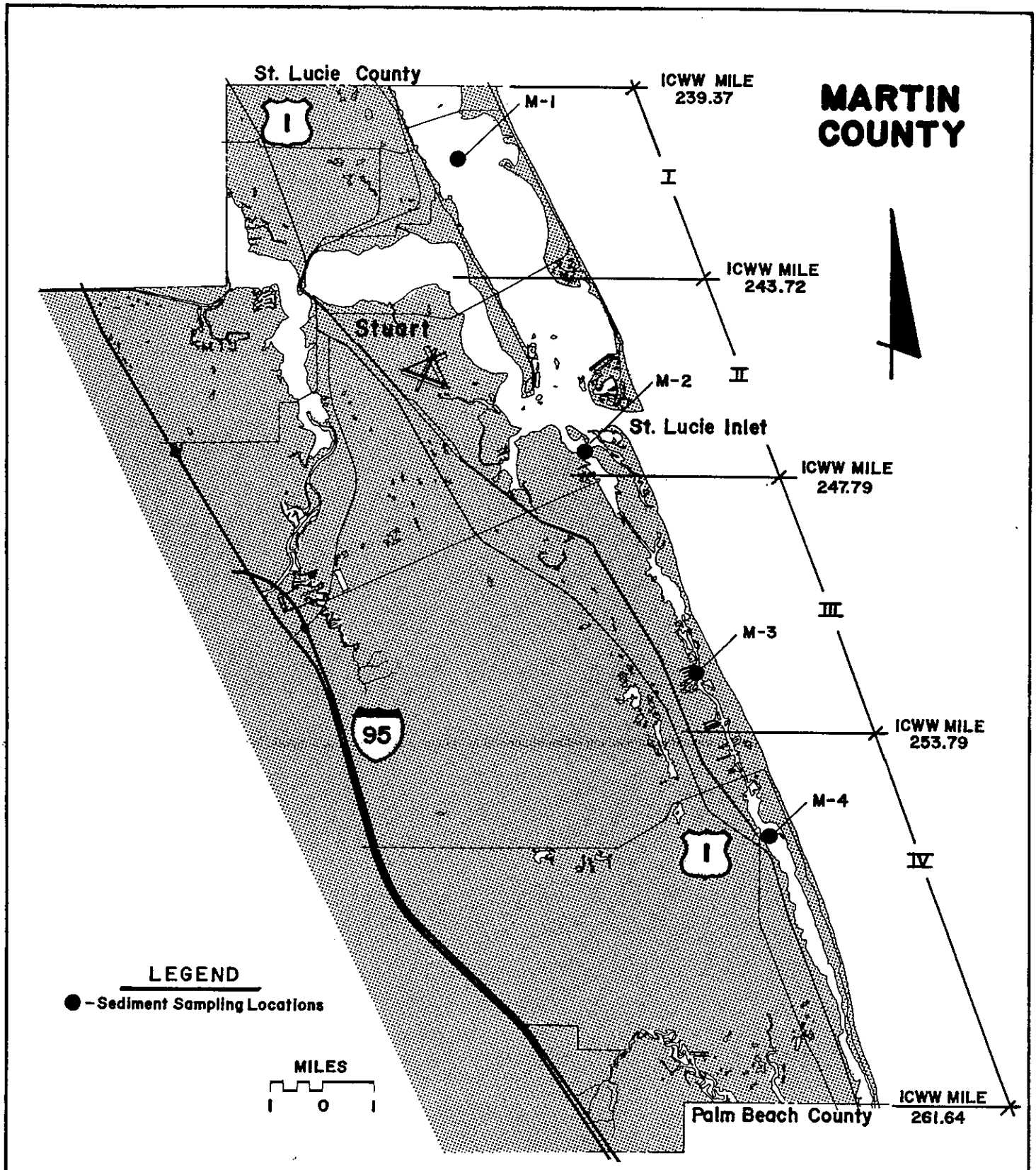
No historic sediment chemistry data for the ICWW channel within Martin County are available. The Jacksonville District COE was not required to analyze sediment chemistry for its earlier channel maintenance operations and thus can provide no sediment chemistry data. Moreover, the 1984 Florida Department of Environmental Regulation (FDER) sediment sampling program, which has provided historic sediment data for other segments of the ICWW, did not sample any locations in the Martin County project area. Therefore, to obtain basic sediment data required for the development of an appropriate dredged material management plan for Martin County, the FIND contracted Taylor Engineering to conduct a preliminary sediment quality assessment. This effort, which addressed both the physical and chemical characteristics of ICWW channel sediments in Flagler, Volusia, and Martin Counties, was completed in April, 1993. The methods used in the performance of this assessment and its findings, including sediment sampling, analytical results, and interpretation, are documented in a separate report (Schropp and Taylor, 1993). Data from this

study which pertain to channel sediment chemistry within the Martin County project area are briefly summarized below.

In January, 1993, samples were taken from four locations throughout the project area, each location centered in the ICWW channel (Figure 2-2). The sampling stations were chosen to characterize "worst case" conditions — that is, at locations where contaminants, if present in the system, would most likely be encountered. Many contaminants, most notably heavy metals, have a strong affinity for fine-grained sediment. Therefore, the stations were located in areas where fine-grained sediments may accumulate. The four stations are as follows: (1) Station M-1, 1.1 miles south of the Jensen Beach Bridge, opposite Ocean Breeze Park (Cut M-1, sta 58+00, ICWW mile 241.23), in an area identified in an earlier study (Trefry *et al.*, 1990) as having fine-grained sediments; (2) Station M-2, at the northern end of Great Pocket, opposite Horseshoe Point (Cut M-7, sta 0+00, ICWW mile 247.46); (3) Station M-3, two miles north of the Hobe Sound Bridge, opposite a series of five residential canals (Cut M-14, sta 20+50, ICWW mile 252.42); and (4) Station M-4, one mile south of the Hobe Sound Bridge at the northern end of Hobe Sound (Cut M-20, sta 21+00, ICWW mile 255.79). Notably, all but Station M-3 are located within or near documented shoals.

The samples were analyzed to determine grain size distribution and to measure a suite of potential pollutants including metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), nutrients, polynuclear aromatic hydrocarbons (PAH), chlorinated pesticides, and polychlorinated biphenyls (PCB). Samples were analyzed using U.S. Environmental Protection Agency or American Public Health Association standard methods. The suite of sediment constituents examined is more extensive than that usually required by the Florida Department of Environmental Regulation (FDER) in support of dredge and fill permit applications. The broader suite of constituents was examined, however, to provide a thorough characterization of sediment chemistry and to identify potential sediment contaminant problems.

The results of sediment chemistry analyses are often difficult to interpret. No sediment quality standards exist comparable to the water quality standards adopted by the Florida Department of Environmental Regulation. The FDER has supported, however, the development of guidance documents to simplify the interpretation of sediment chemistry data. Two procedures detailed in these documents were used to evaluate the ICWW sediment data. The first procedure compares measured chemical constituent concentrations to natural background concentrations. A chemical within its natural range is considered to



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 2–2 Sediment Sampling Locations Dredged Material Management Plan Intracoastal Waterway Martin County, Florida	PROJECT REVISION SHEET DATE

pose no environmental threat. The second procedure compares measured chemical constituent concentrations to concentrations determined to represent hazards to aquatic life.

Application of both methods indicate that the ICWW sediments examined during this project are not contaminated and pose no environmental threat. At each of the four stations, sediment metal concentrations were found to fall within natural ranges. PAHs, PCBs, and pesticides were all below detectable limits. Comparison of the detectable limits to biological effects-based sediment quality guidelines indicate that the tested ICWW sediments pose no threat to aquatic life. In addition, levels of nutrients and oil and grease are typical of normal estuarine sediments and do not indicate any significant contamination.

2.1.3.2 Physical Characteristics

The primary source of physical data used to characterize ICWW channel sediment within the Martin County project area is a series of grab samples and core borings taken by the Jacksonville District COE prior to scheduled maintenance activity. Only since the early 1970's have sediment data been systematically included in maintenance dredging plans prepared by the Jacksonville District. Thus, data of this type are available only for segments of recently dredged channel. This limits data coverage to the area of St. Lucie Inlet.

Within the Martin County project area, two sets of data are available. First, surface samples were taken in January, 1970, at two locations in Cut M-5. This work was done in anticipation of the 1970 maintenance operation. The data from these samples consist only of qualitative descriptions of the sediment. To prepare for the 1991 operation, a second set of data were obtained in September, 1990, at 12 locations in Cuts M-3 through M-6. From these more recent samples, the data consist of individual core boring logs which present qualitative characterizations of the sediment at elevations referenced to MLW. In addition, gradation or sieve analysis results and suspended sediment-time curves are also contained in the data for two core boring locations. The total depth of each boring is typically -17 to -20.5 feet MLW, or 5.0 to 8.5 feet below the maximum depth of dredging. Sediment which enters the channel to form shoals may be qualitatively different from the native material underlying the channel. Therefore, only data which correspond to the material above the depth to which the channel was originally constructed (i.e., -12 feet MLW, or 10 feet, plus 2 feet over-dredging) are considered.

The results of the surface sampling and the core boring logs uniformly characterize the sediments from all locations as very fine to medium sand, light gray to tan in color, with varying minor fractions of silt and shell. This characterization is qualitatively supported by inspection of Site MSA M5 which has received material from this reach since 1963. This site was used most recently in connection with a 1992 maintenance operation performed in the easternmost reaches of the Okeechobee Waterway (OWW) near its intersection with the ICWW. The material dredged from the OWW appears somewhat finer, with a higher silt content, than that occurring in the ICWW. However, material from the ICWW is still evident in the dikes, as well as other portions of the site. The observed character of this material is consistent with previous description, being primarily composed of fine sand, light gray to tan in color, with a noticeable component of shell, both ground and whole.

In addition to the information from the Jacksonville District COE, Schropp and Taylor (1993) provide a second source of sediment data. In this previously cited study, surface samples from the same locations described in Section 2.1.3.1 were analyzed for grain size distribution, as well as chemical components. The resulting grain size distribution curves presented in their report are briefly summarized below.

The mean grain sizes of the four samples range from 0.084 mm to 0.244 mm. As expected, the coarsest sediment was found at Station M-2, the sampling location closest to St. Lucie Inlet. The sediment becomes increasingly finer with increasing distance south of the inlet as progressively lower tidal current velocities allow successively finer sediments to settle out of suspension. The finest sediment was found at Station M-1, south of the Jensen Beach Bridge and north of the S.R. A1A Bridge, thus somewhat isolated from the influence of the inlet. Based on mean grain size, the sediments from the three southern stations (M-2, M-3, M-4) are classified as fine sand under the Wentworth Classification system. Sediment from the remaining station (M-1) is classified as very fine sand under this same system. Under the Unified Soils Classification (USC) system, used by the COE and thereby more common in dredging applications, sediments from all four stations are classified as fine sand. The percentage of each sample classified within the silt-sized fraction under the USC system (i.e., less than 0.074 mm or passing a #200 sieve) is consistent with the pattern established by the mean grain sizes. Station M-1 produced the sediment with the largest fraction of silt-sized particles (34 percent by weight). The remaining three stations each reported a silt content of seven percent or less, with the percentage of silt increasing with distance south of the inlet. The lowest silt content — 2.5 percent — was obtained at Station M-2, the station closest to the inlet.

As noted in the previous section, only Station M-3 is not within or near documented shoals. Material from the three remaining stations thus represents channel sediments to be dredged. Additional sediment quality data will be required to adequately characterize documented shoals which may be specifically scheduled for maintenance during the next dredging cycle. Core borings will be obtained in connection with a detailed examination survey of each shoal before contracting procedures are begun. Sediment chemistry typically is not analyzed unless such data is required to obtain the necessary Water Quality Certificate from the Florida DER.

2.2 Existing Sites

From a review of Jacksonville District COE Real Estate Maps (Drawing No. RE-C 12,214) and FIND real estate aerial basemaps (1986) of the project area, the FIND controls 39 tracts available for dredged material management. These are identified in Table 2-3 and shown in Figure 2-3. The FIND holds 14 of these tracts, totalling 411.02 acres, under fee simple ownership, while it holds the remaining 25 privately or publicly owned parcels, totalling 1747.71 acres, under perpetual easement. One of the latter group — designated P/L 518 — is a dedicated pipeline easement which extends across Jupiter Island from Hobe Sound to the Atlantic Ocean shoreline approximately 1.5 miles north of the Martin-Palm Beach County line. This easement should be retained by the FIND to maintain flexibility in future dredging operations.

A preliminary evaluation of the remaining 38 disposal easements and FIND-owned tracts was then performed. In addition to the COE Real Estate Maps and FIND aerial basemaps, four other resources were used to perform the evaluation. These include: (1) black and white aerial photography of nominal 1" = 800' scale, flown January-December, 1985, for the Jacksonville District COE; (2) 1:24,000 scale (1" = 2,000') color-infrared aerial photography, flown March, 1983, and March, 1984, from the National High Altitude Photography Program of the U.S. Geological Survey (USGS); (3) 1:24,000 scale (1" = 2,000') USGS Topographic Quadrangle Maps, 7.5-minute series; and (4) 1:24,000 scale (1" = 2,000') National Wetlands Inventory maps from the U.S. Fish and Wildlife Service.

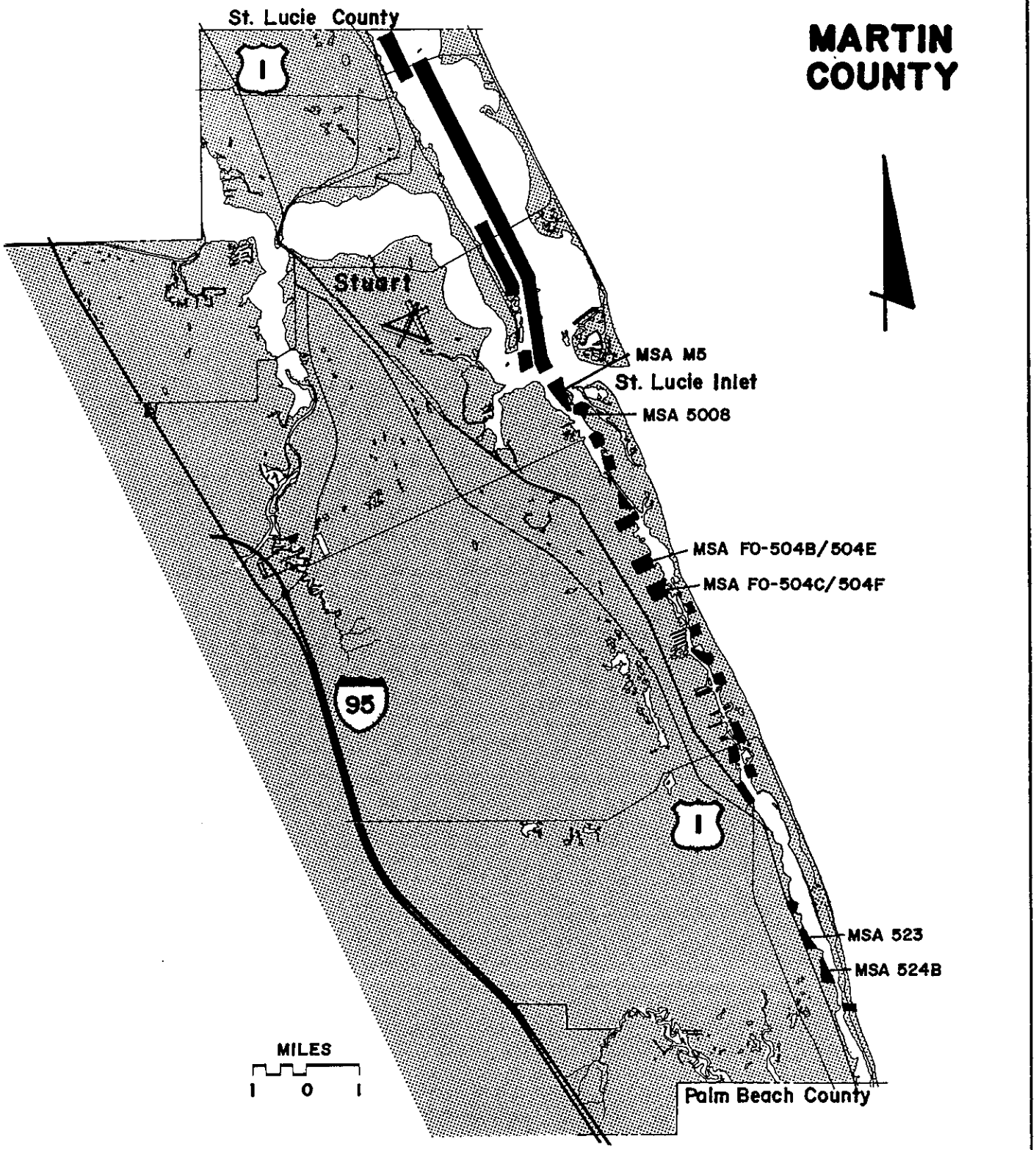
Consideration of the most basic operational and site evaluation criteria eliminated all but eight of these tracts from further consideration. The full range of site evaluation criteria are presented in detail in Section 4.0 and discussed throughout the remainder of this report. However, at this preliminary level of the site evaluation process, two criteria were of primary consideration — (1) that, to the greatest extent possible, the placement of dredged material must be confined to upland areas; and (2) that a site must

Table 2-3 Inventory of Existing Disposal Easements and FIND-Owned Sites
Intracoastal Waterway, Martin County, Florida
(page 1 of 2)

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Total Acreage	Useable Upland Acreage	Containment Capacity (c.y.)	Comments
MSA M-1	415	238.97-239.68	180.00	—	—	Open water, no usable upland
MSA-FO-M1A	N/A	239.21	109.00	—	—	Open water, no usable upland
MSA M-2	417	239.47-246.29	986.86	—	—	Open water, no usable upland
MSA M-3	418	242.65-245.02	325.00	—	—	Open water, no usable upland
MSA M-4	419	246.08	16.52	—	—	Open water, no usable upland
MSA M-5	420	246.74	88.10	14.94	253,161	Major portion open water, contains large spoil island at St. Lucie Inlet, island presently near capacity, no road access
MSA-FO-500B	421	247.52	23.09	7.35	52,477	Disturbed upland area located on a mangrove island east of ICWW channel, no road access
MSA M-5C	9005E	248.15	13.77	—	—	Open water, no usable upland
MSA 501C	9404E	248.61	10.56	—	—	Marsh, mangrove, no usable upland, no road access
MSA-FO-502	431	249.00	5.90	—	—	Insufficent upland acreage
MSA-FO-502C	427	248.90	13.20	—	—	Insufficent upland acreage
MSA-FO-502A	429	249.00	4.30	—	—	Insufficent upland acreage
MSA 503	436	249.40	5.68	—	—	Insufficent upland acreage
MSA 503A	H800E	249.37	2.62	—	—	Insufficent upland acreage
MSA 503B	H801E	249.44	0.50	—	—	Insufficent upland acreage
MSA-FO-504	439	249.84	5.00	—	—	Contiguous easements, contain minimal upland
MSA-FO-504A	440	249.84	8.50	—	—	
MSA-FO-504D	441	249.84	24.50	—	—	
MSA-FO-504E	424	250.59	24.00	—	—	Contiguous easements, 504B contains usable upland. Lies adjacent to residential development accessible by road.
MSA-FO-504B	425	250.59	30.00	10.41	104,694	
MSA-FO-504C	447	251.17	24.20	8.26	59,431	County park presently occupies site
MSA-FO-504F	488	251.17	48.09	—	—	
MSA 505	446	251.32	6.00	—	—	Contains insufficient upland, no road access
MSA 506	449	251.82	6.00	—	—	Marsh, no usable upland
MSA 507	469	252.25	5.77	—	—	Contiguous easements, insufficient upland, no road access
MSA 507A	470	252.25	2.50	—	—	
MSA 508A	471	252.84	4.10	—	—	Contiguous easements, insufficient upland, no road access
MSA 508	472	252.61	9.00	—	—	
MSA 510	486	253.42	6.00	—	—	Insufficient upland on site
MSA 514	487	253.87	6.00	—	—	Insufficient upland, no road access
MSA 516	489	254.67	11.09	—	—	Insufficient upland, no road access

Table 2-3 Inventory of Existing Disposal Easements and FIND-Owned Sites
Intracoastal Waterway, Martin County, Florida
(page 2 of 2)

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Total Acreage	Useable Upland Acreage	Containment Capacity (c.y.)	Comments
MSA 517	499	254.78	16.00	—	—	Marsh, no usable upland
MSA M-6	498	255.11	8.20	—	—	Open water
MSA-FO-519B	502	255.63	7.16	—	—	Insufficient upland on site
MSA 522	505	257.88	10.09	—	—	Insufficient upland on site
MSA 522B	9813E	258.37	7.38	—	—	Open water
MSA 523	507	258.60	14.14	8.47	73,756	Site presently undisturbed, road access available
MSA 524B	508	259.17	15.49	7.72	77,652	Site presnelty undisturbed, road access possible
P/L 518	510	260.13	0.9	—	—	Pipeline easement only, used for beach disposal
			Total		**621,171**	



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 2--3 Existing FIND Easements/ FIND Owned Sites Intracoastal Waterway Martin County, Florida	PROJECT REVISION SHEET DATE

contain sufficient upland area to allow the construction of earthen dikes to dewater and store the dredged material. Examination of Table 2-3 confirms that most of the tracts were eliminated because they contained insufficient contiguous upland area, either as a result of minimal overall acreage (e.g., less than 5 acres) or because the tract consisted primarily of wetlands, most notably mangroves or salt marsh. The eight remaining properties, comprising four perpetual easements and four FIND-owned tracts, therefore exhibit at least some potential for development and use as dredged material management areas.

As identified in Figure 2-3, the eight remaining tracts, combined to form six separate sites, are located south of St. Lucie Inlet. Thus, the segment of the Martin County project area north of the inlet contains no easements or FIND-owned tracts which demonstrate potential for development and continued use. In the remainder of this section, the eight tracts with at least minimal capability to receive dredged material, as well as the 30 tracts eliminated from further consideration, are discussed in more detail.

Southward from the St. Lucie-Martin County line (ICWW mile 239.37) to the intersection of the OWW and the St. Lucie Inlet entrance channel (ICWW mile 246.29), a series of four easements parallel the ICWW channel, alternating between its eastern and western sides. These easements — designated MSA M-1, MSA FO-M1A, MSA M-2, and MSA M-3 — are all 1250 feet wide, total over 10 miles in length, and contain over 1,600 acres. These tracts consist almost entirely of open water, with the only upland consisting of minimal spoil islands (less than two acres) and portions of the Jensen Beach and S.R. A1A Causeways. An additional 16.52-acre open water easement — designated MSA M-4 — is located on the western edge of the channel, opposite the inlet.

Immediately south of the inlet lies easement MSA M5. This 88.10-acre easement contains extensive open water and mangrove areas, but also includes a 25-acre spoil island formed by the deposition of material dredged from the segment of the Waterway near the inlet. Indeed, as discussed in Section 2.1.2, this easement has received almost all of the material dredged from the ICWW in Martin County since the 10-foot project depth was established between 1961 and 1963. This includes almost 200,000 cy of material placed within MSA M5 in a 1991 operation. It has also received additional material from maintenance of the easternmost reach of the Okeechobee Waterway, most recently in 1992. This last operation filled the containment dike, constructed at that time to +30.0 feet NGVD, to capacity. Continued use of this site will require that the dike be built even higher, or that significant material be removed from the site and reused, placed on the beach, or transferred to another permanent storage area.

South of MSA M5 is a 96.0-acre tract under the ownership of the FIND. Only a portion (23.09 acres) of this tract is retained under perpetual disposal easement by the Corps of Engineers. The remaining 76.91 acres, containing primarily mangrove swamp, was conveyed to the FIND by quitclaim deed and is no longer available to the Corps for the purposes of dredged material management. Included in the remaining easement are approximately 10.4 acres of upland created by early channel construction and maintenance activities. However, COE records indicate that this easement has not been used since the channel was deepened to 10 feet in 1961. This is confirmed by the extensive stands of Australian pine which cover the disturbed upland areas of the easement.

Approximately one-half mile south of MSA 500B is a 13.77-acre open water easement. This easement — designated MSA M-5C — is located in an embayment on the eastern edge of Great Pocket adjacent to the public docks at St. Lucie Inlet State Park. Within the next 2.6 miles southward from MSA M-5C to Peck Lake are a series of 10 small easements, ranging from 0.50 acres to 24.50 acres in size. All are predominantly mangrove forest or mixed hardwood wetlands with only minimal scattered upland provided by relic spoil mounds. These mounds, vegetated by mature Australian pine, give no evidence of recent (i.e., post-1963) dredged material placement. Also located along this reach of the Waterway are additional similar spoil mounds not contained within existing easements.

Along the western shore of Peck Lake are four FIND-owned tracts forming two sites, each site containing a pair of contiguous parcels. The two sites are separated by a Planned Unit Development (PUD) known as Loblolly Bay. Each site stretches from the shoreline of Peck Lake westward to Gomez Avenue. The northern block — comprising MSA FO-504B and MSA FO-504E — totals 54.0 acres, of which approximately 33.6 acres are a mixture of mangrove/hardwood wetlands. The majority of these wetlands are contained within MSA FO-504E located to the east of MSA FO-504B. The remaining 20.4 acres are uplands contained almost entirely within MSA FO-504B.

The site south of Loblolly Bay is made up of MSA FO-504C and MSA FO-504F. These parcels, totalling 72.29 acres, are similar to the northern site described above. That is, the more easterly of the pair — MSA FO-504F — is predominantly wetland (mangrove and mixed forested wetland), while the more westerly — MSA FO-504C — is predominantly upland (pine flatwoods). The FIND has provided Martin County conditional use of these properties for a limited passive use park. Partly funded by a grant from the FIND, Peck Lake Park was completed in 1992. The park consists of an unpaved parking area and

restrooms, located in the upland portion of MSA FO-504C, and a boardwalk/self-guided nature trail through the mangrove community located in MSA FO-504F.

From the south end of Peck Lake (ICWW mile 251.17) southward to the north end of Hobe Sound (ICWW mile 254.97) a series of 10 small easements front the Waterway. This area where the ICWW channel was constructed through mangrove swamp is known as the North Jupiter Narrows. Each of these easements contain at least a portion of a small relic spoil mound, typically vegetated by mature Australian pine, Brazilian pepper, or other exotic species. Thus, it appears that these easements may have been last used in the original construction of the Waterway. Because of the limited upland these easements contain, none were considered to possess any potential for long-term use.

Two additional tracts controlled by the FIND are located at the north end of Hobe Sound. The first — MSA M-6 — is an 8.20-acre open water easement east of the channel in a small embayment north of the Jupiter Island Country Club (ICWW mile 255.11). The second — MSA FO-519B — is a 7.16-acre tract owned by the FIND lying between the FEC railway and the western shore of Hobe Sound, immediately south of the Town of Hobe Sound (ICWW mile 255.63). This property, consisting primarily of mangrove and mixed hardwood wetlands, is leased to the Hobe Sound National Wildlife Refuge (NWR) which adjoins the property on the south. Neither property is suitable for development as a dredged material management site.

The next two easements southward are within the boundaries of the Hobe Sound NWR along the western shore of Hobe Sound. The first — MSA 522 — is a 10.09-acre tract located approximately 1.1 miles south of the NWR Administrative and Visitors Center (ICWW mile 257.88) and 200 feet east of the easterly right-of-way line for U.S. Highway 1. The majority of the parcel is mangrove and mixed forested wetland, with only 3.7 acres of upland dominated by a sand pine community. The second easement — MSA 523 — is approximately 0.6 miles to the south of MSA 522 (ICWW mile 258.60), fronting directly on U.S. 1. This 14.14-acre tract is located on a high bluff overlooking Hobe Sound, and thus is predominantly upland. Only a narrow fringe of mangrove is found along the shoreline. An additional open water easement — MSA 522B — lies within Hobe Sound between the two above easements.

The southernmost disposal easement in Martin County — MSA 524B — lies immediately south of the southern boundary of the Hobe Sound NWR (ICWW mile 259.17) on the western shore of Hobe Sound. This 15.49-acre privately owned tract, lying 500 to 1000 feet east of U.S. 1, is dominated by a sand pine

community with a band of coastal scrub cresting the bluff along Hobe Sound. A narrow fringe of salt marsh is found along the shoreline. Notably, several private utility water wells serving Jupiter Island are located between the easement and U.S. 1. An exclusive residential development adjoins the easement on the south.

2.3 Existing Storage Capacity

As discussed above, only eight of the 39 tracts controlled by the FIND were determined to have potential for development and continued used as dredged material management areas. As shown in Figure 2-3, these are MSA M5, MSA 500B, MSA FO-504B, MSA FO-504E, MSA FO-504C, MSA FO-504F, MSA 523, and MSA 524B. Of these, two — MSA FO-504E and MSA FO-504F — are considered only in terms of providing pipeline access to their adjoining upland easements.

To further evaluate these eight easements, an analysis was performed to determine the maximum potential material storage capacity of each. The useable upland area within each contiguous easement tract was determined from tracings made of the 1" = 800' black and white aerials, guided by color-infrared photography, and USFWS wetland inventory maps. Further analysis then established whether the useable upland area could provide adequate material for dike construction and whether the resulting capacity within this area supported further consideration of the site. A set of relationships were developed (APPENDIX C) in which the required volume of dike material, the volume of dike material available on-site, and the resulting storage capacity are expressed in terms of a set of independent variables including dike crest elevation above grade, mean site elevation, depth of excavation, dike side slope, width of dike crest, and required minimum freeboard. During Phase II of the project, dike geometry will be specific to each site. However, for the purposes of this preliminary evaluation, a standard dike geometry was applied to all sites. Selected parameter values are within the range of standard practice for similar sites used for previous maintenance events. These include a 15-foot crest elevation above grade, a 1V:3H side slope, a 12-foot crest width, a 20-foot setback of the interior excavation from the inside toe of the dike, and a minimum freeboard plus ponding allowance of four feet. Calculations were based on a realistic dike configuration (i.e., a three- to five-sided polygon), specific to each site, which utilizes the maximum available upland area as delineated by photo-interpretation. The mean grade elevation for each site was estimated from survey transects, if available, or from USGS Quadrangle maps. In some cases, small upland acreage or low mean grade elevation prevented designing a 15-foot dike without requiring the excavation of the basin interior to an unreasonable depth. Typically, excavation was limited to a very rough estimate of the elevation of the

water table on-site (+2 to +4 feet NGVD). In such cases, the dike height was limited by the available material. The results of the preliminary capacity analysis are presented in Table 2-3.

Comparison of the total estimated capacity of the existing easements and FIND-owned sites (621,171 cy) with the 50-year projected capacity requirement for the Martin County segment of the ICWW (2,693,377 cy, Table 2-2) shows that the existing capacity falls far short of the long-term requirement. As previously noted, the site with the greatest potential capacity — MSA M5 — is located within the segment of the Waterway with the greatest storage requirement — the vicinity of St. Lucie Inlet. However, even in this limited area, the existing capacity does not meet the project's long-term need. Moreover, the continued use of the existing easements may not be the most cost-effective and operationally efficient means of meeting the long-term needs of the ICWW. In the next section, the characteristics of the most appropriate plan — i.e., the "Management Concept," for the Waterway in Martin County — are discussed.

3.0 DREDGED MATERIAL MANAGEMENT ALTERNATIVES

3.1 Management Concept

Inherent in every maintenance dredging operation is a set of guiding principles that reflects the attitudes and constraints of the project sponsor, the project engineer, and the contractor. Historically, these principles (i.e., the "Management Concept") have not been explicitly stated but rather have evolved primarily through the desire to maximize operational efficiency and short-term economy. Thus, prior to the initiation of this program in 1986, minimal consideration was given to environmental issues or, indeed, any long-term goals. Within Florida, including Martin County, this approach resulted in the numerous small mounds and islands now lining the ICWW as the dredging contractor sought to place material as close as possible to the dredging area. For the extensive mangrove-estuarine system of the Intracoastal Waterway in southeast Florida, this concept often led to the unconfined placement of dredged material within mangroves and the loss of estuarine habitat. The effluent from these areas would then return directly to the receiving waters with, perhaps, unacceptably high levels of elutriates and turbidity.

With increased environmental awareness this approach is no longer desirable, nor even possible, given present-day agency reviews and permitting requirements. Concerns about water quality have led to the placement of dredged material within diked areas to increase retention time and ensure that return water quality meets established standards. Wetlands, particularly mangrove swamps, are now recognized as among the most biologically productive ecosystems and resources that must be conserved. However, preservation of mangroves requires acquisition of upland sites and, in a high growth corridor such as that along the ICWW, developmental pressures and land-use conflicts make such acquisitions increasingly difficult and expensive. It has become apparent that these conflicts can only be resolved through long-range planning and the development of a dredged material management concept which addresses both environmental and operational concerns. As such, the management concept constitutes the foundation upon which the management plan is built.

3.1.1 Management Alternatives for Martin County

The central issue guiding the development of a management concept for the ICWW in Martin County is the selection of the most appropriate material management strategy. Four basic alternatives are available for consideration:

- o Ocean Disposal
- o Open Water Disposal (Spoil Island Creation)
- o Beach Disposal
- o Centralized Upland Storage

Each of these is discussed in the following paragraphs with respect to its applicability to the unique requirements of Martin County.

Ocean disposal of material dredged from the ICWW is not a realistic option for the Martin County project area. Ocean disposal requires the transport of dredged material from the dredging site to an authorized offshore disposal area. In the case of Martin County, this operational requirement poses a very costly and difficult task for the following reasons. First, the material must be loaded into barges capable of transiting the relatively shallow depths of the ICWW. These barges must then proceed to St. Lucie Inlet or Jupiter Inlet for passage to sea. Once reaching the inlet the material must then be transferred to deep draft seagoing barges for transport to the authorized disposal area. A review of offshore disposal areas currently authorized by the U.S. Environmental Protection Agency to receive dredged material indicates that the areas closest to the Martin County project area are located northward — 4.4 miles east of Fort Pierce Inlet — or southward — 2.7 miles east of Palm Beach Inlet. Collectively, these requirements render this method of material disposition impractical and prohibitively expensive.

A second management strategy for dredged material is referred to as open water disposal. This particular method of material disposition was perhaps the most widely used approach prior to the evolution of today's environmental regulatory programs addressing wetlands protection. Discussions with representatives of the relevant regulatory agencies have confirmed that this approach carries with it unacceptable environmental impacts in terms the degradation or destruction of wetlands. In addition, the intent of the FIND dredged material management program is to provide a permanent infrastructure of material management facilities. The creation or expansion of open water islands represents a one-time opportunity for material placement and does not lend itself to active material management practices which require upland access for equipment and personnel. As a result, the use of open water disposal was not considered an acceptable dredged material management strategy for Martin County.

The third material management alternative considered for Martin County is beach disposal. Beach disposal — i.e., placing on the beach dredged material compatible with the native beach sands — is an

approach to dredged material management that the State of Florida encourages. The FIND also includes this approach as an essential part of dredged material management for channel reaches which, based on historic data, are likely to contain beach quality sediments. These conditions are most typically encountered in the immediate area of tidal inlets where Waterway shoals are formed primarily by sand driven through the inlet by waves and tides. Such conditions are present within the Waterway channel in the vicinity of St. Lucie Inlet. As discussed in Section 2.1.3, analysis of grab samples and core borings obtained from documented shoals within this reach indicate that the shoal material is predominantly clean, fine sand, light gray to tan in color, with only traces of silt and shell. The degree to which the channel sediment is compatible with the physical characteristics of the native beach material has not been determined. However, because both channel sediment and beach sands are littoral material, a high degree of compatibility is anticipated.

With the specific exception of the use of beach disposal in the immediate area of St. Lucie Inlet, centralized upland storage remains the preferred method of dredged material management in all other areas of the Martin County segment of the Waterway. Upland storage, as used here, is the use of a diked containment area with appropriate outlet flow control structures. The dredged material is pumped in a sediment-water slurry to one end of the containment area, which thus serves as a settling basin within which the dredged sediment settles out of the transporting water. The residual water is then returned to the Waterway via the basin outlet structure and return pipeline.

Upland storage offers a number of significant advantages over the other available methods: (1) upland storage provides an efficient means of dredged material management without the excessive costs of transportation and material re-handling involved with the use of ocean disposal; (2) provided suitable upland sites can be identified, upland storage avoids most wetland impact issues inherent in the use of open water disposal; and (3) unlike beach disposal, the use of upland sites does not depend upon the physical characteristics of the dredged material.

The use of a limited number of centralized upland sites has additional economic, operational, and environmental advantages over the use of a greater number of smaller sites: (1) fewer, larger sites reduce the total acreage required and thereby reduce the total cost of site acquisition; (2) developing and constructing fewer, larger sites is more cost effective than developing and constructing a number of smaller sites; (3) the use of centralized sites allows for improved site security and requires the allocation of fewer operating personnel; and (4) the use of fewer, larger sites reduces the total impact to upland habitat and

allows for improved effluent and stormwater control, as well as the institution of more efficient and comprehensive monitoring procedures.

The use of fewer centralized sites as discussed above also facilitates the active management of these sites as permanent operating facilities. This represents a significant departure from the historic practice of more or less abandoning sites after limited use. Operating sites as permanent facilities allows for the implementation of a suite of management procedures and techniques with long-term operational and environmental benefits. Example management measures include improved detention area design; material handling and processing to increase dewatering efficiency (e.g., mechanical grading, trenching, stormwater control); and the use of natural buffer areas and dike vegetation to improve their appearance. Most importantly, the permanency of the sites implies that ways be explored to remove and reuse the dewatered material. Alternatively, if no market for the material is found, it could be removed and stored in less ecologically sensitive upland areas further inland. Road access, existing or potential, is therefore essential. Sites managed as intermediate processing areas rather than one-time holding facilities will serve the needs of the ICWW in perpetuity. This approach, in combination with effective site management measures, will establish the long-term material management capability required.

In the area of St. Lucie Inlet, upland storage must also provide a needed complement to the preferred method of beach disposal. An upland storage capability must be an integral part of beach disposal for several reasons. First, the ability to place dredged material on the beach is subject to delays produced by regulatory review. It is also highly dependent on the quality of the material. As discussed in Section 2.1.3.2, grab samples and core borings taken in the ICWW channel near the inlet have demonstrated that channel sediments in this area are predominantly sand. This is consistent with this sediment being littoral material introduced through the inlet. However, it is possible that isolated shoals will be encountered which contain sufficient fine-grained sediment to render the material inappropriate for beach placement. The occurrence of such shoals becomes more likely with increasing distance from the inlet. In addition to the above mentioned constraints, the feasibility of beach disposal is influenced by other considerations. These include the compliance of upland property owners, the need for additional material on the beach, and most importantly, restrictions tied to sea turtle nesting. For these reasons it becomes necessary to include an upland storage capability as part of the beach disposal management concept.

3.1.2 Management Concept for Martin County

The preceding discussion leads to the following definition of the dredged material management concept for the Intracoastal Waterway in Martin County:

(1) In the vicinity of St. Lucie Inlet, material dredged from the Waterway channels will be managed through the use of beach disposal combined with a back-up upland storage capability.

(2) In all other segments of the Waterway, dredged material will be placed in diked upland management facilities having existing or developable road access.

(3) Centralized upland sites will be established in a minimum number of locations per operating reach of the Waterway.

(4) Sites will be operated and maintained as permanent facilities in which dredged material will be actively managed.

The dredged material management concept, defined above, provides an essential focus to the planning process by establishing minimum standards and criteria for the identification and evaluation of candidate sites to be used for dredged material management.

3.2 Delineation of Channel Reaches

Having defined the dredged material management concept, it then became possible to define operating reaches of the Waterway. Guided by the fundamental criteria embodied in the management concept, the overall character of the Waterway channel and its surroundings was examined in terms of historic shoaling patterns, sediment quality, projected material storage requirements, material handling and pumping distance constraints, area demographics, and site availability. When considered collectively, the individual constraints imposed by each of these factors dictated the logical segmentation of the channel for the management of dredged material. The channel segments or reaches defined by this process are described below.

Four reaches, ranging from 4.07 miles to 7.85 miles in length, were defined within the Martin County project area. The resulting delineation is summarized in Table 3-1 and presented in Figure 3-1. Table 3-2 organizes the previous summary of historic dredging events and recent shoaling as presented in Table 2-2 by channel reach. Also presented in Table 3-2 are estimates of the historic and projected maintenance dredging volumes. The corresponding 50-year material storage requirements are also included for each reach. As an indication of the relative shoaling rate within each reach, the mean volume of maintenance dredging required annually per channel mile is also included.

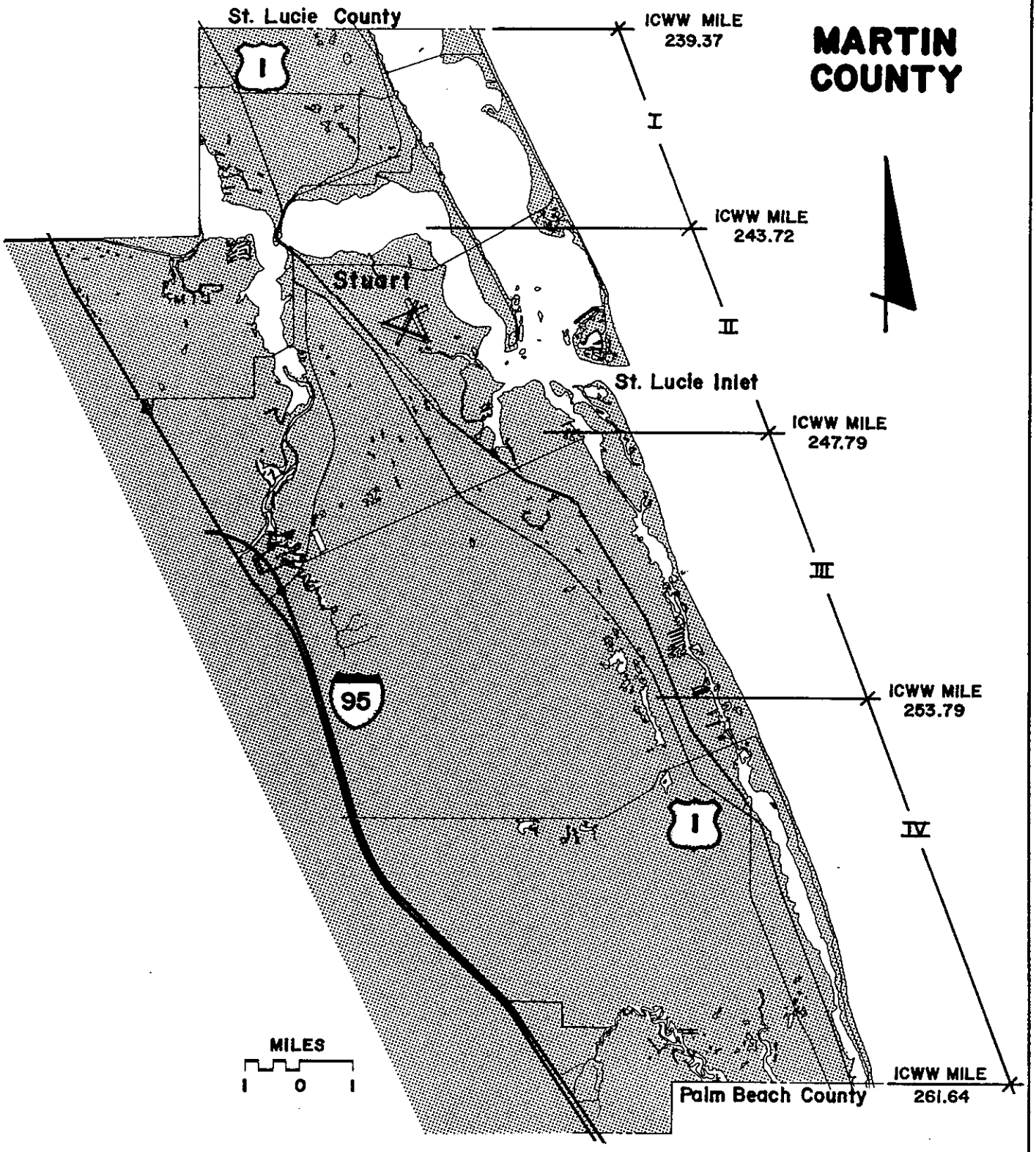
The northernmost reach, Reach I, extends from the St. Lucie-Martin County line (Cut SL-6, sta 373+40, ICWW mile 239.37), 0.75 channel miles north of the Jensen Beach Bridge, southward 4.35 miles to the S.R. A1A Bridge (Cut M-1, sta 190+00, ICWW mile 243.72). This reach covers the northern portion of the project area which the A1A Causeway partially isolates from the sedimentary influence of St. Lucie Inlet. As discussed in Section 2.1.3, the sediment in this reach contains a higher fraction of fine grained material than does that from the immediate area of the inlet, and thus is not suitable for beach placement. The channel in this reach has not been maintained since the 10-foot project depth was established. However, the 1987 channel centerline survey documented two shoals with a total *in situ* volume of 46,021 cy (Figure 3-2). This *in situ* volume yields a 165,000 cy projected 50-year material storage requirement for this reach (i.e., the projected 50-year *in situ* shoaling volume multiplied by a bulking plus over-dredging factor of 2.15).

Reach II encompasses the vicinity of St. Lucie Inlet, extending 4.07 miles from the S.R. A1A Bridge to the vicinity of Great Pocket (Cut M-8, ICWW mile 247.79). As discussed in Section 2.1.2, because of the influence of the inlet this reach experiences the most rapid and persistent shoaling in the Martin County project area (Figure 3-2). Maintaining the authorized channel depth at St. Lucie Inlet over the period 1961-1991 has required nine separate maintenance dredging operations to remove an *in situ* shoal volume of 667,272 cy. This corresponds to a mean dredging frequency of one event every 3.33 years and a mean material storage requirement (i.e., bulked volume) of 239,000 cy per event. The volume of historic dredging yields a projected 50-year material storage requirement for Reach II of 2,391,000 cy. This volume of material represents 89 percent of the projected storage requirement for the entire Martin County project area.

From Great Pocket southward to the Martin-Palm Beach County line, only a single maintenance dredging operation has ever been performed. Two reaches have been designated within this 13.85-mile

Table 3-1 Dredged Material Management Channel Reaches, Intracoastal Waterway, Martin County, Florida

Reach	From	To	Length (mi)
1	Martin/St. Lucie Co. Line ICWW Mile 239.37 Cut SL-6/sta 373+40	SR A1A Bridge ICWW Mile 243.72 Cut M1/sta 190+00	4.35
2	SR A1A Bridge ICWW Mile 243.72 Cut M1/sta 190+00	Vic. of Great Pocket ICWW Mile 247.79 Cut M8/sta 0+00	4.07
3	Vic. of Great Pocket ICWW Mile 247.79 Cut M8/sta 0+00	Vic. of Hobe Sound ICWW Mile 253.79 Cut M17/sta 0+00	6.00
4	Vicinity of Hobe Sound ICWW Mile 253.79 Cut M17/sta 0+00	Martin/Palm Bch. Co. Line ICWW Mile 261.64 Cut P1/sta 31+00	7.85
		TOTAL	**22.27**



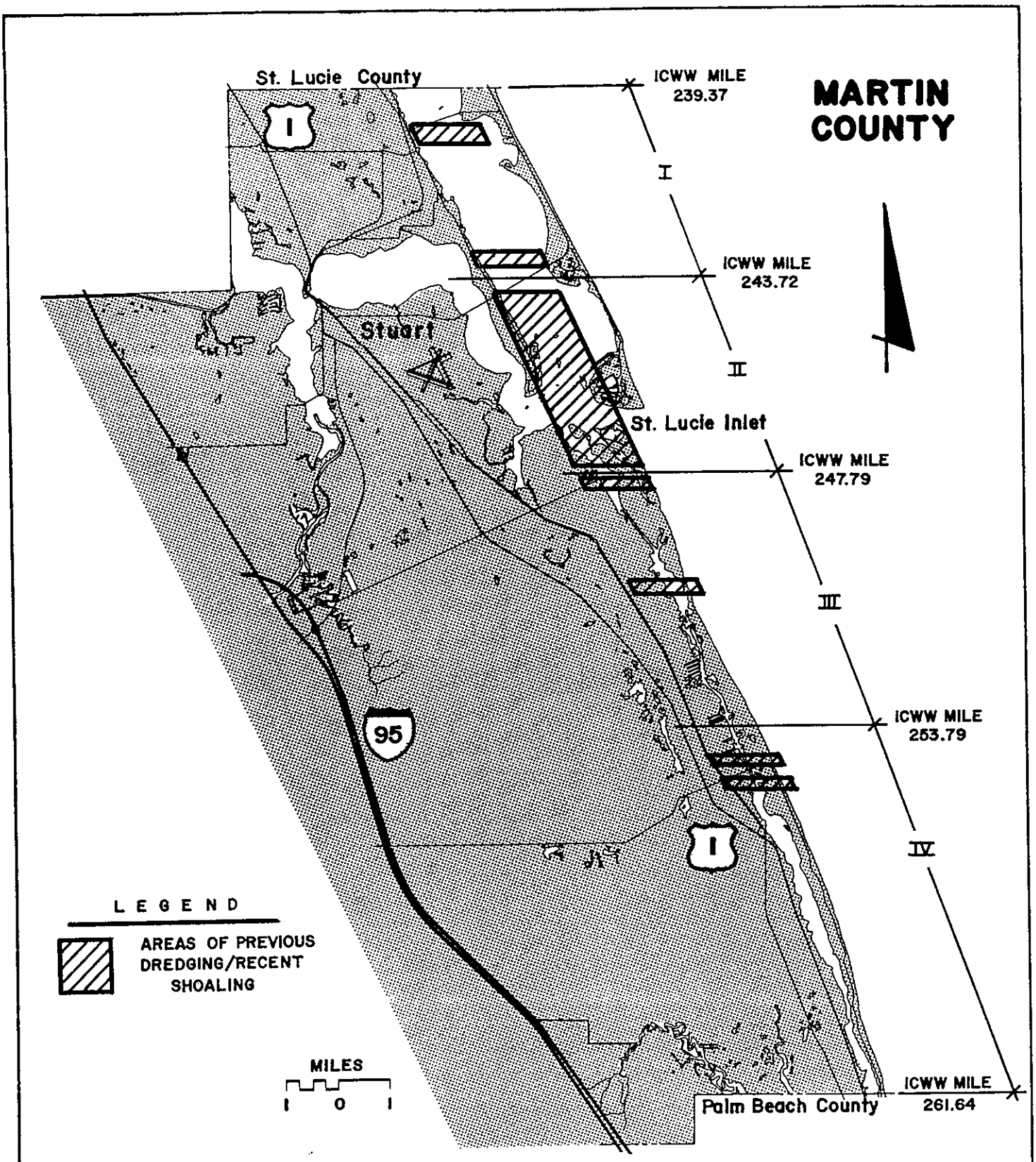
TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 3–1 Dredged Material Management Channel Reaches Intracoastal Waterway Martin County, Florida	PROJECT REVISION SHEET DATE

Table 3-2 Summary of Historical Maintenance Dredging/Recent Shoaling by Channel Reach
Intracoastal Waterway, Martin County
1961-1991

Reach	Previous Maintenance/Recent Shoaling: To From ICWW Mileage	From Cut/Sta	To Cut/Sta	Length (mi)	Year	Design Vol (cy)	Pay Vol** (cy)	Reach Summary: Total Vol (cy)	Vol/Yr (cy)	Vol/Yr/Mi (cy)	50-yr Unbulked Vol (cy)	50-yr Storage Req't (cy)
I: Martin/St. Lucie Co. Line to SR A1A Br. ICWW Mile 239.37 to 243.72	240.38 - 240.71	M-1/13+50	M-1/31+00	0.33	1987*	19,097	(22,735)					
	242.99 - 243.27	M-1/166+50	M-1/166+50	0.28	1987*	19,560	(23,286)					
								46,021	1,534	352	76,702	164,909
II: SR A1A Bridge to Vic. of Great Pocket ICWW Mile 243.72 to 247.79	243.85 - 245.43	M-1/197+00	M-2/60+00	1.58	1984	49,200	(58,573)					
	244.90 - 247.13	M-2/32+00	M-7/9+00	2.73	1991	164,000	195,292					
	245.01 - 247.10	M-3/5+50	M-6/1+00	2.09	1970	60,000	(71,430)					
	245.84 - 246.07	M-4/22+50	M-5/8+50	0.23	1968	10,500	8,818					
	246.48 - 247.50	M-5/30+00	M-7/2+00	1.02	1975	125,000	(148,813)					
	246.58 - 246.95	M-5/35+50	M-5/55+00	0.37	1964	25,700	(30,596)					
	246.61 - 246.89	M-5/37+00	M-5/52+00	0.28	1963	21,500	(25,596)					
	246.65 - 246.93	M-5/39+00	M-5/54+00	0.28	1984	35,100	(41,787)					
	246.66 - 246.88	M-5/39+50	M-5/51+00	0.22	1966	8,700	(10,357)					
	246.68 - 247.17	M-5/40+50	M-6/4+50	0.49	1968	41,300	43,271					
	246.70 - 246.99	M-5/41+50	M-5/57+00	0.29	1972	27,500	(32,739)	667,272	22,242	5,465	1,112,120	2,391,058
III: Vic. of Great Pocket to Vic. of Hobe Sound ICWW Mile 247.79 to 253.79	247.82 - 248.06	M-8/1+50	M-8/14+00	0.24	1987*	2,122	(2,526)					
	248.88 - 248.93	M-10/6+50	M-10/9+00	0.05	1987*	2,662	(3,169)					
	250.60 - 250.93	M-11/55+50	M-11/55+50	0.33	1963	16,200	(19,286)					
								24,981	833	139	41,635	89,515
IV: Vic. of Hobe Sound to Martin/Palm Bch. Co. Line - ICWW Mile 253.79 to 261.64	254.56 - 254.61	M-18/14+00	M-18/16+50	0.05	1987*	3,704	(4,410)					
	255.06 - 255.15	M-19/20+50	M-19/25+50	0.09	1987*	7,523	(8,956)					
								13,366	446	57	22,277	47,895

* Estimated shoal volumes based on centerline survey "Reconaissance Survey, 10 and 12-foot Project, St. Johns River to Key West" D.O. File No. 8-35, 044, Jacksonville District, U.S. Army Corps of Engineers, July, 1987.

** ( ) Estimate based on Pay Vol = 1.1905 (Design Vol); Section 2.1



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 3–2
Areas of Historic Maintenance Dredging/ Recent Shoaling, by Reach
Intracoastal Waterway
Martin County, Florida

PROJECT
REVISION
SHEET
DATE

channel segment. The first, Reach III, extends southward 6.00 miles from Great Pocket (Cut M-8, sta 0+00, ICWW mile 247.79) to the vicinity of the Town of Hobe Sound (Cut M-17, sta 0+00, ICWW mile 253.79). The 1987 survey identified two minimal shoals at the northern end of this reach (total estimated *in situ* volume, 4,800 cy). However, the projected storage requirement primarily reflects the removal, in 1963, of approximately 19,000 cy of material from a 0.33-mile stretch of Cut M-11 (ICWW mile 250.60 to mile 260.93). Combining this volume of historic dredging with the volume of recent shoaling yields a projected 50-year storage requirement for Reach III of 90,000 cy.

Reach IV continues southward 7.85 miles to the Martin-Palm Beach County line (Cut P-1, sta 31+00, ICWW mile 261.64). As stated above, no channel maintenance has been performed in this reach. However, two minor shoals were documented in the 1987 survey. The first, located in Cut M-18 (ICWW mile 254.56), has an estimated *in situ* volume of 4,410 cy. The second, located in Cut M-19, 0.5 miles south of the first, contains an estimated volume of 8,956 cy. This results in a projected 50-year storage requirement of approximately 48,000 cy.

3.3 Identification of Candidate Sites

Defining the management concept and delineating logical channel reaches provided the means to evaluate existing easements with respect to the long-term needs of the Waterway in Martin County. As discussed in Section 2.3, the storage capacity of the existing sites (621,171 cy) falls far short of the projected 50-year requirement (2,693,377). Review of existing sites with respect to the established channel reaches shows that significant deficits in storage capacity remain in Reaches I and II. In the remaining two reaches — Reaches III and IV — existing sites may provide an adequate, if not ideal, management capability.

First, existing easements within Reach I are almost entirely open water, and thus possess no realistic potential for long-term use. In contrast, within Reach II, the reach with the highest projected material storage requirement, existing easements are found which possess the greatest potential storage capacity — MSA M5 and MSA 500B. Nevertheless, the existing capacity of these two easements (305,638 cy) represents only 13 percent of the long-term requirement for Reach II. However, when these easements are evaluated in terms of providing the needed upland staging area required to complement beach disposal, their continued use becomes more realistic. Still, the use of the existing island-based easements, the larger of which — MSA M5 — is presently at or near capacity, will require the removal of material to achieve the

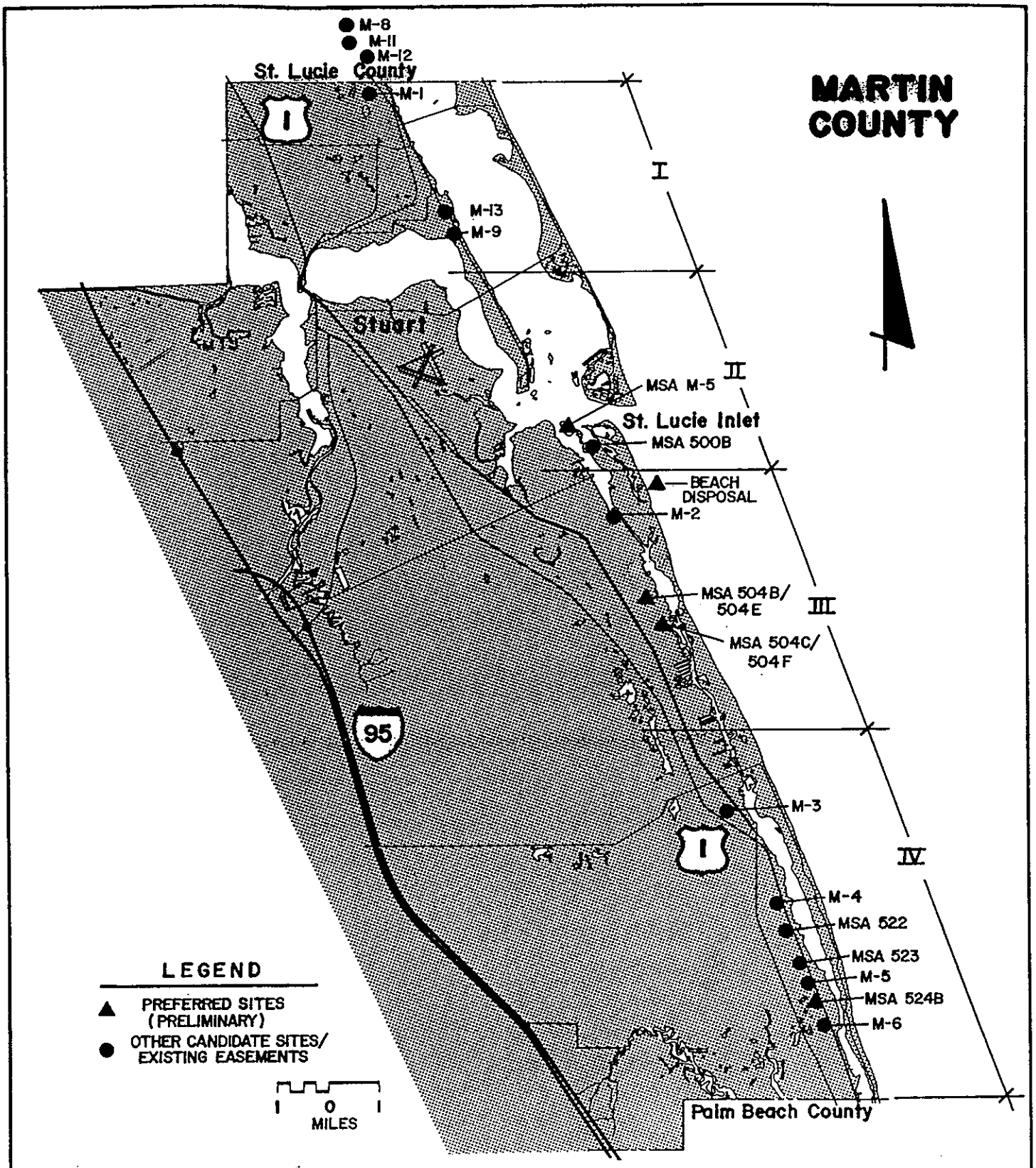
desired storage capacity. This may not be the most efficient plan to meet the needs of this high maintenance reach.

In contrast, existing easements or FIND-owned sites within both Reach III and Reach IV were found to possess sufficient potential capacity to meet their respective long-term storage requirements. However, because their of limited acreage which reduces their ability to provide an optimal buffer, it is not clear that the existing sites represent the best available management alternative for these reaches. Therefore, to meet established program criteria, as well as to provide flexibility in the development of a plan most appropriate to the specific needs of all four reaches within the Martin County project area, identification and evaluation of additional alternative sites was necessary.

The process began with the identification of all areas within reasonable distance of the ICWW with the potential to satisfy the requirement of centralized material storage within uplands with existing or potential upland road access to meet the demands of ongoing site management. Also considered was the degree to which the area had been previously disturbed by land clearing, logging, agriculture, or mining. Additional environmental considerations, such as the quality of existing habitat or the diversity of vegetation, were not included in the initial site identification. However, these factors were considered in the final site evaluation and are discussed in Section 4.1. In some instances adjacent land-use conflicts (such as adjoining high-density residential development) or operational limitations (such as excessive overland pipeline access) eliminated sites from further consideration.

Preliminary identification and evaluation of the sites was accomplished through the use of the black and white aerial photographs (1" = 800' nominal scale), color infrared photography, and USFWS Wetlands Inventory maps described in Section 2.2. A total of 12 alternative candidate sites — or from one to six sites within each reach — were selected. Of these, seven resulted from the first round of site identification. The remaining five alternative candidate sites were identified during the site inspection process, the Technical Advisory meetings, the Citizens' Advisory Committee meetings, or other collateral contacts. All 12 alternative candidate sites, as well as the eight existing easements having potential for continued use, are shown in Figure 3-3.

Tracings were made from the 1" = 800' black and white aerials of the initial delineation of useable upland area of each site. An initial determination of the maximum disposal capacity of each site (as described in Section 2.3) was then made based on the most efficient, realistic dike configuration attainable



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 3–3
Candidate Sites
Dredged Material Management Plan
Intracoastal Waterway
Martin County, Florida

PROJECT
REVISION
SHEET
DATE

within the delineated upland. This was done to ensure that each site possessed potential capacity appropriate to each respective reach requirement. Within each reach, the total potential capacity of the candidate sites greatly exceeded the corresponding material storage requirement. The overages in capacity were retained to provide the greatest flexibility prior to final site selection. Also, subsequent field inspection of the sites would likely result in total elimination of some sites and reduction of the usable acreage of others. The site inspection procedure is discussed in the following section.

3.4 Site Inspections

Field inspections of the eight existing easements with potential for future use were performed during July, 1992. Inspections of the seven alternative candidate sites initially identified were performed during September - October, 1992. Inspection of the remaining five sites, identified later in the site evaluation process, was completed in January, 1993. The basic objectives of the field inspections, each conducted by a biologist and an engineer, were to document and evaluate the environmental characteristics and the existing and adjacent land-use of each site and to assess its general suitability for site development. Specific objectives included preliminary delineation of wetlands and the initial assessment of vegetation communities, habitat, and environmental constraints including the presence of protected wildlife. Also noted during the site inspections were site topography, general soil conditions, existing or potential road access, possible pipeline routes, and obvious archeological features, if present. In addition, a video camera was used to record significant features of each site and to document the on-site and adjacent land-use at the time of the inspection.

Within each site, ecological conditions were assessed by combined aerial photographic interpretation and ground-truthing as necessary to identify and map vegetation communities. Aerial coverage included the same resource materials discussed in Section 2.2, specifically, 1985 1" = 800' black and white photography, 1984 1" = 2,000' color infrared photography, and in some cases, 1986 blueline aerials at a scale of 1" = 400'. In addition to pedestrian surveys, ground-truthing was carried out using 4-wheel-drive vehicles accessing adjacent roads or on-site dirt roads and trails. Dominant or significant photographic signatures were identified on aerials and visited by truck or on foot. Maps were prepared in the field by drawing on acetate overlays on the 1" = 800' black and white aerial photographs. Other sources of information, such as USGS 7.5' quadrangles and U.S. Fish and Wildlife Service Wetland Inventory Maps and soils surveys, were checked to aid in the interpretation of site conditions. Observations of significant wildlife species were

also noted when encountered on-site. These included the presence or sign of wildlife species protected by the state or federal government.

Following each site inspection, the original site tracings were modified to exclude sensitive areas. The most common modification was to withdraw from areas possessing wetland or transitional vegetation. Specifically excluded were mangrove or other wetland or transitional areas contiguous with the ICWW or its tributaries. Because of this latter consideration which establishes the jurisdiction of DER permitting, all drainage features were examined for evidence of this contiguity. Isolated wetlands or drainage features still within the permitting jurisdiction of the COE and the South Florida Water Management District (SFWMD) were excluded where feasible. However, if the exclusion of a minimal isolated wetland made an otherwise viable site unusable, some wetland impacts may be unavoidable.

A second analysis of maximum potential storage capacity was then performed for each site based on its field-verified configuration. Results of this analysis are presented in Table 3-3. Again, the combined potential capacity of the remaining easements and the FIND-owned tracts and the newly identified candidate sites exceeds the material storage requirement for each reach. During the final site evaluation, described in the following section, the site acreages are reduced such that their capacities match the reach requirements.

Table 3-3 Candidate Sites, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Martin County (page 1 of 2)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
I North County Line to SR A1A Bridge ICWW Mile 239.37 to 244.29	M-8	235.53	34.35	14.89	34.35	191,400	8.70	N/A	N/A	aka McArthur Tract, lies between Indian River Dr. (SR 707) and FEC R.R. R/W
	M-1	239.12	65.90	12.91	41.84	165,500	6.98	Residental, low density	PUD	Site now developed, bounded on the east by Savannas State Preserve
	M-9	242.46	107.84	N/A	N/A	N/A	3.89	Residental, low density, Estate density	PUD	Site at north edge of Seawalls Point, developed or remnant groves slated for imminent development
	M-11	237.18	16.20	N/A	N/A	N/A	7.73	Residential, low density	N/A	aka Boswick property, recently added to Savannas State Preserve
	M-12	238.87	68.47	13.61	68.47	174,600	5.27	Residential, low density	PUD	aka Savanna Dunes, possible addition to Savannas State Preserve, possible joint site management (DNR/FIND)
	M-13	241.90	79.93	9.13 + 7.99	53.72	124,900	2.53	Residential, low density/ Commercial	Public Instit.	Former F.I.T. campus, now abandoned, site divided into two parcels by Sewalls Point Road
II SR A1A Bridge to Vicinity of Great Pocket ICWW Mile 244.29 to 247.79	MSA M5	246.78	88.10	14.94	25.40	251,200	2.58	Public Conservation	N/A	Esmt. mostly open water, contains large spoil island at St. Lucie Inlet, last used Spring 1992 (OWW), now at or near capacity
	MSA 500B	247.20	96.00	7.45	10.40	73,900	3.00	Public Conservation	N/A	Esmt. mostly mangrove/open water, site is disturbed upland area on mangrove island
	Beach Disposal	-----	-----	-----	-----	----	-----	-----	---	Location and size of fill section will be specific to each dredging event, details to be addressed in Phase II

Table 3-3 Candidate Sites, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Martin County (page 2 of 2, continued)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Require Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
III Vic. of Great Pocket to Vic. of Hobe Sound ICWW Mile 247.79 to 253.79	M-2	248.37	1095.3	10.00	36.45	99,900	5.56	Residential, estate density	R-2	Majority of site remains un-developed, possible C.A.R.L. tract
	MSA FO-504B	250.59	30.00	10.46	22.80	104,700	3.26	Conservation	N/A	Lies adjacent to residential development, accessible by road
	MSA FO-504C	251.18	24.20	8.26	24.20	59,400	4.11	Recreation/ Conservation	N/A	County park (passive use) presently occupies site
IV Vicinity of Hobe Sound to South Co. Line ICWW Mile 253.79 to 261.64	M-3	255.60	137.8	6.94	20.72	49,800	5.92	General	R-3	Adjacent to municipal well field, patable water treatment plant
	M-4	256.74	71.40	8.63	22.98	49,300	4.12	Conservation	PS	Within Hobe Sound National Wildlife Refuge (NWR)
	MSA 522	257.88	10.09	N/A	N/A	N/A	4.82	Conservation	PS	Insufficient upland, Hobe Sound National Wildlife Refuge
	MSA 523	258.70	14.14	8.47	14.14	73,800	5.17	Conservation	PS	Within Hobe Sound NWR
	M-5	258.87	58.20	6.94	30.36	49,800	5.34	Conservation	PS	Within Hobe Sound NWR
	MSA 524B	259.17	15.49	7.72	15.49	77,700	5.51	Conservation	R-1	Adjacent to Hobe Sound NWR
	M-6	259.94	14.73	N/A	N/A	N/A	N/A	Residential Estate	R-3	Site has been developed as "Indian Hills" subdivision

4.0 ESTABLISHMENT OF SITE BANK

The final evaluation of the eight existing easements and FIND-owned tracts and the 12 newly identified candidate sites was accomplished by assessing the ability of each site to satisfy a standard set of evaluation criteria. Through this process a group of eight sites was selected to form a site bank serving the four reaches of the Intracoastal Waterway channel within the Martin County project area. The site bank consists of five primary (first-choice) sites and four secondary (second-choice) alternatives for the long-term management of dredged material removed from ICWW channels. One primary site — Site MSA M5 in Reach II — also serves as a secondary alternative under a different management approach.

4.1 Evaluation Criteria

A standard set of criteria was used to perform the final site evaluation. However, no matrix analysis was performed to quantify the relative merits of each evaluation criterion. Although such an approach is sometimes useful, it was deemed inappropriate in this case. Rather, the sites received a holistic evaluation which allowed for some subjectivity. In evaluating a site, each criterion was then given more or less weight based on the effect the specific information pertinent to that criterion had on the overall suitability of the site. The remaining portions of Section 4.0 describe the evaluation procedure, including the specific evaluation criteria used and the final bank of primary and secondary sites compiled via this procedure.

Each site was evaluated by its ability to satisfy criteria in three broad areas:

- o Engineering/Operational Considerations
- o Environmental Considerations
- o Socioeconomic or Cultural Considerations

Individual criteria considered in each of these areas are described below.

4.1.1 Engineering/Operational Considerations

Capacity — The primary objective of the Phase I planning effort was to identify suitable dredged material management sites of adequate capacity to meet the projected 50-year material storage requirements

of the Waterway in the Martin County project area. Therefore, the potential capacity of a site was a fundamental site evaluation criterion. In keeping with the management concept which emphasized centralized sites, all alternative sites were selected and existing sites were retained based on their ability to provide the required capacity with a minimum number of sites. Typically, one site possessing sufficient capacity was selected to serve each reach. However, as will be discussed, within Reach II, the reach encompassing St. Lucie Inlet, two sites have been designated as primary. Site MSA M5 is intended to provide only a back-up confined upland disposal capability to the preferred strategy of beach disposal. Thus, Site MSA M5 is not required to possess the full projected 50-year storage requirement for this reach.

Adequate Dike Material — Closely related to site capacity is the availability of adequate dike material on-site to construct the containment basin as employed in the preliminary capacity analysis (APPENDIX C). As discussed in Section 2.3, small upland acreage or low mean grade elevation sometimes precludes the construction of a 15-foot dike without excavating the basin interior to an unreasonable depth. In such cases, the dike height was limited to that which could be constructed from the material above a reasonable depth of excavation. An insufficient on-site supply of dike material can be circumvented by one of two methods: (1) trucking in additional material from off-site sources or (2) using dewatered dredged material to build the dike in increments to its ultimate design elevation. However, the expense of obtaining and transporting material from off-site sources and the possibility that the dewatered dredged material may be unsuitable for dike construction make an adequate on-site supply of material preferable.

Pumping Distance — Pumping distance from the area to be dredged to the area of placement is also a criterion affecting the suitability of a site. Although booster pumps can significantly extend pumping distance, the increase is achieved only through a significant reduction in dredging efficiency and a corresponding increase in operating costs. In discussions with representatives of the Jacksonville District COE, a pumping distance of three to six miles was determined to be a preferred limit for efficient operation. However, should extraordinary circumstances require increased distances, 10 miles was established as the absolute maximum pumping distance acceptable to the COE. Therefore, selecting a site requiring the shortest possible pumping distance must be balanced with the need to keep the total number of sites to a minimum.

Pipeline Access — A site affording the greatest ease of pipeline access from the Waterway, as well as the return of effluent to the Waterway, is also preferred. Apart from the potential for environmental impacts to sensitive mangrove or other wetlands (discussed in Section 4.1.2), difficult pipeline access adds

to mobilization-demobilization costs and reduces operating efficiency. Examples of pipeline access difficulties include extensive marsh crossings, significant elevation changes, or the crossing of road or railroad rights-of-way. Moreover, difficult pipeline access may require the costly acquisition of additional pipeline easements.

Upland Access — Upland access with existing or potential road service is desirable for initial site construction and is required if the site is to be managed as a permanent operating facility, as intended. Notably, existing or potential upland road access was a requirement for the identification of new candidate sites.

Soil Properties — On-site soil properties (e.g., load bearing capacity, resistance to piping, etc.) and the depth of the water table below grade are additional factors included as criteria for site evaluation. However, these determinations require field testing not included in the initial phase of the project. Therefore, data supporting on-site soil properties and geohydrology will be obtained during Phase II. Observations made during Phase I field inspections revealed no obvious areas of concern.

4.1.2 Environmental Considerations

The environmental criteria used for site evaluation are intended to minimize adverse impacts to sensitive estuarine and upland areas, within the constraint of providing suitable sites to serve the needs of the Waterway. The resulting criteria may be organized under two categories reflecting the desire to restrict the placement and storage of dredged material to upland sites only: (1) criteria for the avoidance of wetland areas to the greatest extent possible and (2) criteria for minimizing unavoidable impacts to upland areas.

Wetland Impacts — Avoidance of wetlands, a primary consideration throughout the site selection process, has largely been achieved by use of USFWS Wetlands Inventory maps and color-infrared photography. However, where a question remained or where avoidance of isolated or transitional wetland areas would have precluded the use of a site, several specific criteria were used to weigh the relative success in minimizing wetland impacts.

Mangroves and all wetland areas exhibiting salt water characteristics, particularly those judged to be contiguous with state waters, are recognized by all state and federal agencies to be an extremely valuable resource. Therefore, the degree to which a site succeeds in eliminating impacts to the salt marsh is

obviously a crucial criterion in site selection. Closely related to this is the sometimes unavoidable impact caused by pipeline access to the site. If no other avenue is available (e.g., floating the pipeline in a tidal creek), crossing the mangroves may be required. This practice, a necessary consideration in site selection, was minimized wherever possible.

Isolated freshwater wetlands, also a valuable biological community, can afford a system of filtering runoff and recharging groundwater supplies. Nevertheless, such wetlands receive less protection under DER permitting criteria. However, such wetlands are under the jurisdiction of the COE and the South Florida Water Management District (SFWMD). The presence of these isolated wetlands was considered in the evaluation of a particular site, and their disruption was avoided wherever possible. Experience gained in previous plan development efforts suggests that the sacrifice of small, isolated areas possessing wetland vegetation may be acceptable if required to provide an adequate containment area. However, mitigation may be required to offset such impacts, if incurred. Somewhat independent of the extent of an interior wetland is the quality of the habitat it may afford or the unusual vegetation it may support. Thus, the quality of impacted wetlands was also a criterion of site selection and will affect any mitigation which may be required.

Upland Impacts — The use of uplands for the development of dredged material management areas minimizes impacts to wetlands. However, upland site development requires the removal of existing upland vegetation and habitat within the footprint of the containment basin, as well as along the associated pipeline access route and the access and perimeter service roads. Again, the quality of the impacted uplands can vary widely, and therefore assessments of the relative ecological value of the existing upland communities are useful site evaluation criteria. Specific assessments include the quality of habitat; the presence or potential presence of threatened or endangered species; the uniqueness, maturity, and aesthetic quality of the existing vegetation (e.g., mature hardwood canopy vs. second-growth saplings); and the extent to which a site was disturbed by previous human activities (e.g., clearing, logging, drainage, etc.).

Buffer Area — Also considered was the ability of a site to provide a buffer of undisturbed vegetation outside the containment area while still maintaining adequate storage capacity. Primarily, the buffer acts as a visual barrier. However, other potential benefits include the preservation of areas of particular environmental value such as maritime hammock, coastal scrub, or transitional wetlands which could otherwise fall to development. Moreover, the preservation of a buffer region within a dedicated conservation easement may facilitate the permitting required for site construction by mitigating the impacts of site development.

Archeological Value — While not strictly an environmental consideration, the relative archeological value of each site was an evaluation criterion. Phase I of the project does not include a formal archeological survey of each candidate site. However, during the preliminary inspection of each candidate site, obvious evidence of early habitation or other cultural resources (e.g., shell middens) was noted. The presence of a documented archeological site, common to upland regions within the study area, is being investigated only for the final site bank of primary and secondary alternatives. A request for a records search of the Florida Master File of historical and archeological sites and the National Register of Historical Places has been forwarded to the Division of Historical Resources, Florida Department of State, to identify potential conflicts. This search has not yet been completed. The presence of a verified archeological or historical site may necessitate a formal site survey or documentation effort prior to containment area construction. However, the discovery of such a site may not preclude the use of an otherwise viable management area.

Groundwater Conditions — The final environmental evaluation criterion, groundwater conditions, addresses the possibility that local groundwater supplies may be impacted as a direct result of site development and operation. As discussed in Section 2.1.3, all existing data indicates that the Waterway channel sediments in Martin County are not contaminated and do not pose an environmental threat. In addition, the sediment to be dredged will undergo further analysis, including elutriate testing, before each future dredging operation. Should elevated levels of contaminants be identified, permitting procedures will require taking appropriate measures to ensure these contaminants remain sequestered with the dredged material. Therefore, contamination of local groundwater by materials contained in channel sediments is not anticipated.

The primary source of potential impacts to local groundwater is salt — specifically, saltwater mixed with the sediment and pumped from the Waterway to the site. Saltwater will be held in the containment area only during the relatively short and infrequent periods of active dredging and dewatering. Nevertheless, specific safeguards against the occurrence of saltwater contamination of the local shallow aquifer are an essential part of the design and operation of each site. In addition, each site will include a comprehensive program of groundwater monitoring before, during, and after each dredging operation. These safeguards, addressed in detail in the site-specific documentation developed during Phase II, minimize the possibility of saltwater contamination. However, the possibility that saltwater may enter the local shallow aquifer cannot be totally eliminated except by extremely costly methods. Therefore, the relative isolation of a site, both in terms of its hydrology and its geographic separation from adjacent development, was a criterion in site

evaluation. As such, this criterion is closely related to adjacent land use, an issue addressed in the following section.

4.1.3 Socioeconomic or Cultural Considerations

Land Use — The third major category of site evaluation criteria considers the socioeconomic issues of on-site or adjacent land use, current comprehensive plan and zoning designations, local governmental jurisdictions, and site ownership. Every effort was made during the initial identification of new candidate sites to select areas of suitable existing on-site land use. For obvious reasons, areas of minimal development were preferred. Moreover, areas previously disturbed by clearing, excavation, timber harvesting, or draining were given priority because of their reduced environmental value. Managed timberlands or other agricultural areas were not excluded from consideration, however. Similarly, existing adjacent land use was an important consideration. The objective was to select areas isolated from existing residential or, in some cases, commercial or retail development.

Because of the rapid pace of development in some areas, available aerial photography often did not accurately depict current on-site or adjacent land use. In several cases, field inspections revealed on-site residential or commercial development which required site reconfiguration or abandonment. Adjacent land-use conflicts were not so easily resolved, and in areas with limited upland acreage, such conflicts may remain. To the maximum extent possible, these conflicts were reduced by a buffer zone to separate the containment area from residential or commercial development.

Zoning and Comprehensive Plans — In addition to field inspection of each site, on-site and adjacent land use was also investigated through the determination of existing zoning (county or municipal) and comprehensive plan future land-use designations. The present long-range planning effort, because it is being performed in support of a federal navigation project, is not subject to local zoning regulations. Moreover, the provision for dredged material management areas has not been addressed in local comprehensive plans. In many cases, comprehensive plans have not even recognized pre-existing dredged material disposal easements. This oversight is now being corrected by legislation. Notwithstanding the lack of clear guidelines in this matter, the FIND intends to recognize and address community concerns embodied in zoning and comprehensive planning laws. Thus, in the identification of new sites and the evaluation of existing easements, priority was given to those areas designated for industrial or agricultural uses.

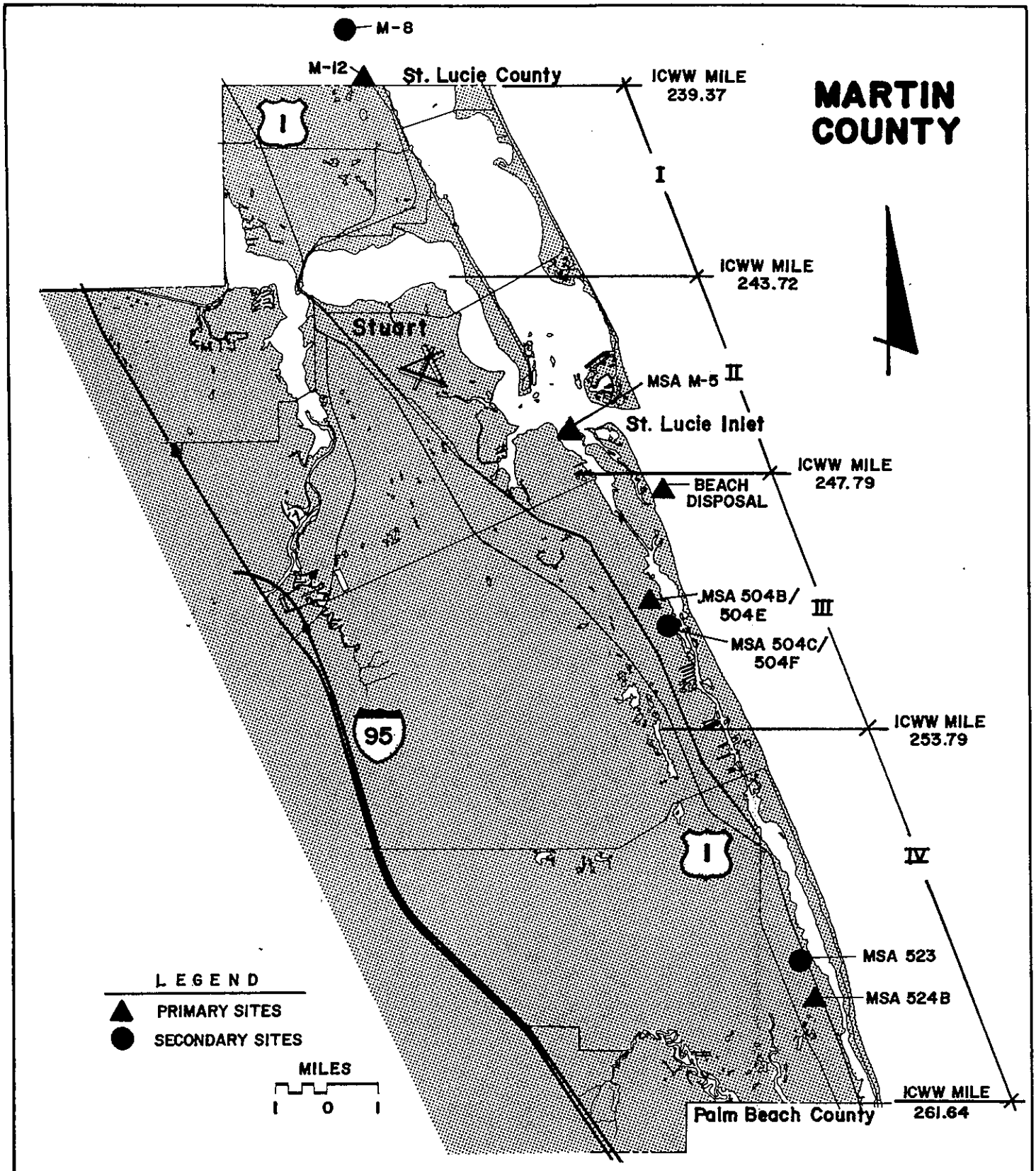
Property ownership — Property ownership was investigated and established for primary and secondary sites to obtain authorized access to these sites required for the more detailed Phase II plan implementation effort. In addition, site ownership and recorded parcel boundaries were considered in the establishment of site boundaries and, when appropriate, to reduce the number of individual property owners involved. Property ownership information for all primary and secondary sites is presented in Appendix D.

4.2 Site Bank

Following the final evaluation of all candidate sites, a total of eight sites were selected to form the site bank to serve the four reaches of the Intracoastal Waterway channel within the Martin County project area. These sites are identified in Figure 4-1. Of these, five sites represent primary or first-choice options. Four sites provide secondary dredged material management alternatives should use of one or more of the primary sites prove not to be feasible. As mentioned earlier, one primary site — Site MSA M5 in Reach II — also serves as a secondary alternative under a different management approach.

Each of the four channel reaches within the Martin County project area has been assigned at least one primary and one secondary site. As their names imply, these eight sites represent the five best and four second-best alternatives after consideration of all engineering, operational, environmental, and socioeconomic factors influencing site selection. In each case, both the primary and secondary sites are well suited to serve the requirements of their designated channel reach.

Detailed information for each primary and secondary site in the site bank is presented in Appendix A. For each site, a data summary sheet outlines significant information on site location and reach parameters. Other site characteristics listed include acreage requirements, preliminary site capacity, and additional operational considerations such as access easement requirements and land use designations. In addition, Appendix A presents a map of each site showing the initial site boundaries (tied to geographic landmarks) and major vegetation communities and land-use categories under the FLUCFCS (Florida Land Use, Cover and Forms Classification System, Florida Department of Transportation, 1985) as verified by field inspection. Approximate acreages of each vegetation and land-use category are presented in tabular form. Finally, narratives accompanying each site summarize pertinent characteristics including general physiographic and environmental conditions, vegetative communities, and observed plant species typical of these communities. Appendix B presents similar information for the candidate sites not selected for the site bank.



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

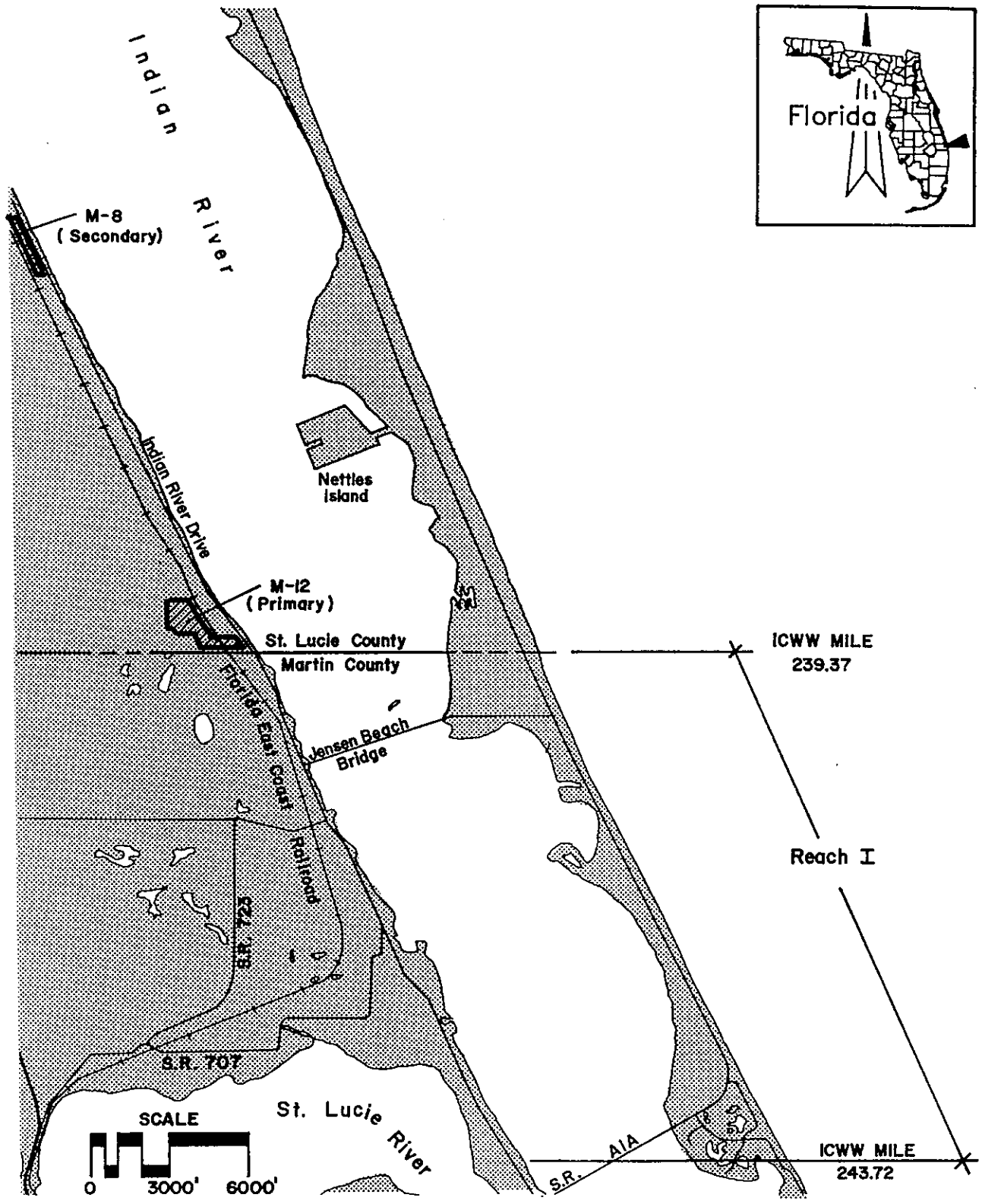
Figure 4–1
Site Bank, Long– Range
Dredged Material Management Plan
Intracoastal Waterway
Martin County, Florida

PROJECT
REVISION
SHEET
DATE

In the remainder of this section the key factors which led to the selection of the individual sites comprising the site bank are discussed, as well as the considerations which influenced the designation of the selected sites as either primary or secondary alternatives.

Within Reach I, Site M-12 has been designated the primary site, while Site M-8 has been designated the secondary site. Site locations are shown in Figure 4-2. Site M-12, also known as the Savanna Dunes property, was selected as the primary site for this reach for several reasons. First, the site is the only undeveloped upland property adjacent to Reach I of sufficient acreage to provide both the required storage capacity and an adequate buffer area. Although the site is in St. Lucie, not Martin County, its location immediately north of the county line results in a reasonable maximum pumping distance of 5.27 miles. Second, the western portion of the site, in which the containment area will likely be constructed, is largely isolated from adjacent development by state lands (the Savannas State Preserve) on the north and west, and by the FEC railroad on the east. An adequate buffer can be provided to separate the site from the low density mixed residential/commercial area to the south. Third, large areas of the site have been previously disturbed by the mining of sand and the unrestricted access of off-road vehicles. Thus, although the northern and western portions of the site contain some limited areas of coastal scrub, the containment basin can be located such that the impacts of site development on this community are minimal. Finally, Site M-12 is located close to the Waterway and, if the eastern parcel of the site is purchased, affords direct pipeline access to the site. However, to reach the containment basin in the western parcel, the pipeline will be required to cross both Indian River Drive (S.R. 707) and the FEC railroad right-of-way.

The secondary site for Reach I, Site M-8, is a realistic management alternative should use of Site M-12 prove not to be feasible. Like the primary site, Site M-8 is a somewhat disturbed site of sufficient size to provide the required capacity. It is also largely isolated from adjacent development by the FEC railroad and the Savannas State Preserve to the west, and by Indian River Drive and the Indian River to the east. An adequate buffer can be provided on the north and south to separate the containment area from adjacent residences. Moreover, use of Site M-8 would require the acquisition of less acreage than included in the primary site. However, one important consideration renders Site M-8 less desireable than the primary site. That is, Site M-8 is located over 3.8 channel miles north of the St. Lucie-Martin County line, and thus would involve a significantly greater pumping distances than would Site M-12. Because of its location, and the very limited available acreage in this segment of the Waterway, Site M-8 may more appropriately be considered in the development of a dredged material management plan for the Waterway in St. Lucie County, scheduled to begin in October, 1994.



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

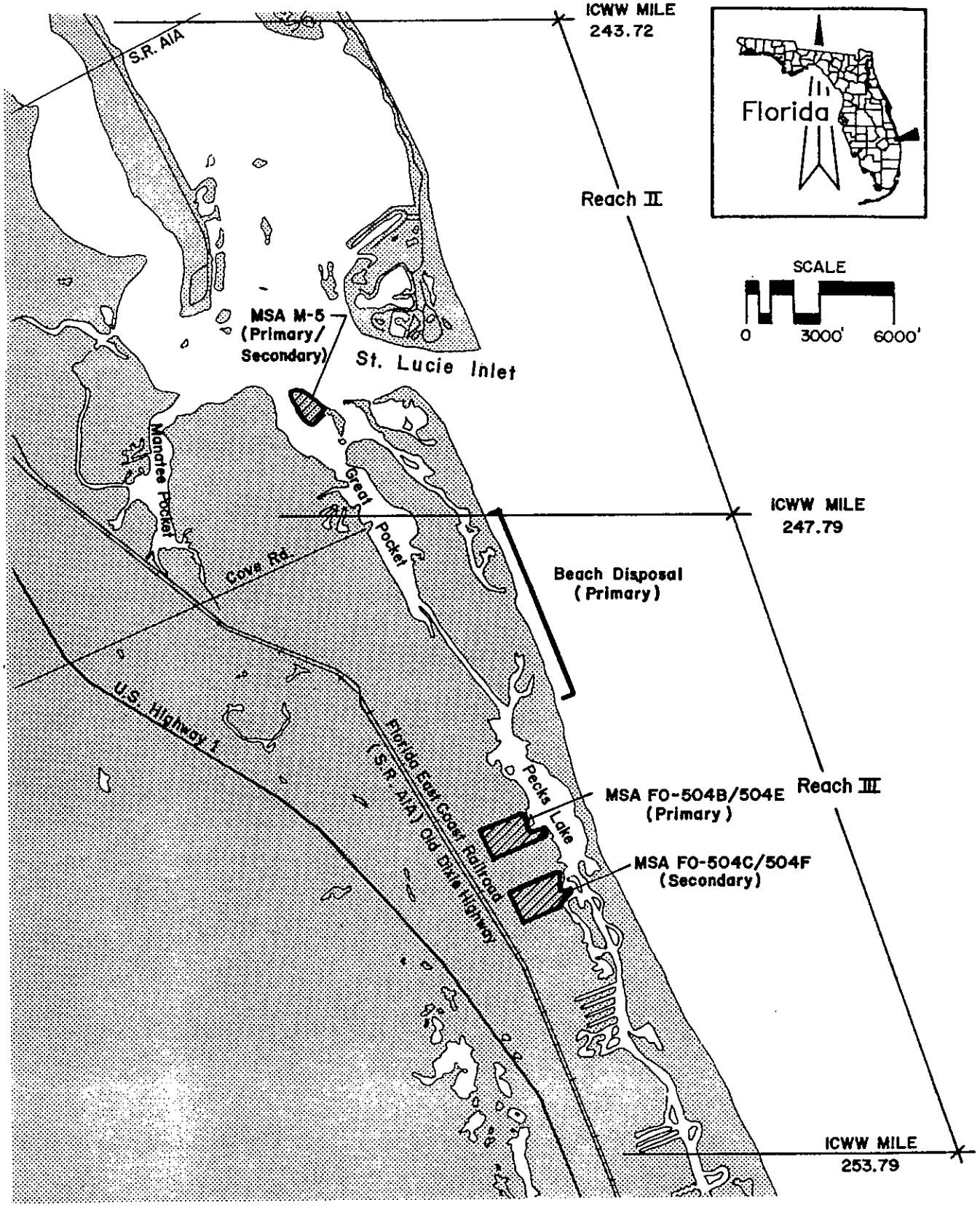
Figure 4–2
Location Map
Primary and Secondary Sites
Reach I
Martin County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

Within Reach II, the reach encompassing St. Lucie Inlet, the primary means of dredged material management will be beach disposal, combined with an upland storage capability to be provided by Site MSA M5. As discussed in Section 3.1, beach disposal is the most appropriate strategy for this reach of the Waterway because of the large quantities of beach-quality sediment driven through the inlet and deposited in the ICWW channel. In this respect, returning channel sediments to the beach south of the inlet may mitigate inlet-related erosion of downdrift beaches. Specific design considerations (e.g., location, length of fill section, design profile, etc.) will be addressed in Phase II of the project. The beach disposal area identified in Figure 4-3 represents only one possible placement location.

However, as also discussed in Section 3.1, in addition to the quality of the dredged material, the feasibility of placing material dredged from Waterway channels on the beach is determined by other factors which may place restrictions on the timing of beach disposal operations. Moreover, unforeseen events or continued urbanization of the inlet area may produce shoals containing material incompatible with native beach sands. Therefore, to provide for the continued maintenance of the Waterway under all conditions, the plan for Reach II incorporates a conventional confined upland placement capability. The redevelopment and continued use of MSA M5, the major existing spoil island south of the inlet (Figure 4-3), will provide this contingency. Much of the material now stored on the island may eventually be transferred to the beach, thereby regaining site capacity.

The site selected to serve as the primary site for Reach III is MSA FO-504B. MSA FO-504C will serve as the secondary alternative for this reach. Site locations are shown in Figure 4-3. The two sites are very similar in several respects. Both are owned by the FIND, thus the use of either site will not require the acquisition of any additional acreage. Both are centrally located within the reach, and similarly situated with respect to the Waterway and to adjacent residential development. As discussed in Section 2.2, both the primary and the secondary alternatives are the upland portion of a pair of FIND-owned sites. The wetland portion of each pair — MSA FO-504E and MSA FO-504F — provides pipeline access to the primary and secondary sites, respectively. However, two important considerations make MSA FO-504B the preferred alternative. First, only Site MSA 504B can provide the full 50-year projected storage capacity for the reach. The secondary site — Site MSA 504C — can only provide 66 percent of the needed capacity, and thus its use would require that material be removed from the site before the end of the optimal 50-year service period. Second, as also discussed in Section 2.2, the secondary site has recently been developed by Martin County as Peck Lake Park, with the cooperation and financial assistance of the FIND. Use of the secondary site would thus involve the removal of the park's restroom facilities and parking lot, thereby



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 4–3
Location Map
Primary and Secondary Sites
Reaches II and III
Martin County, Florida

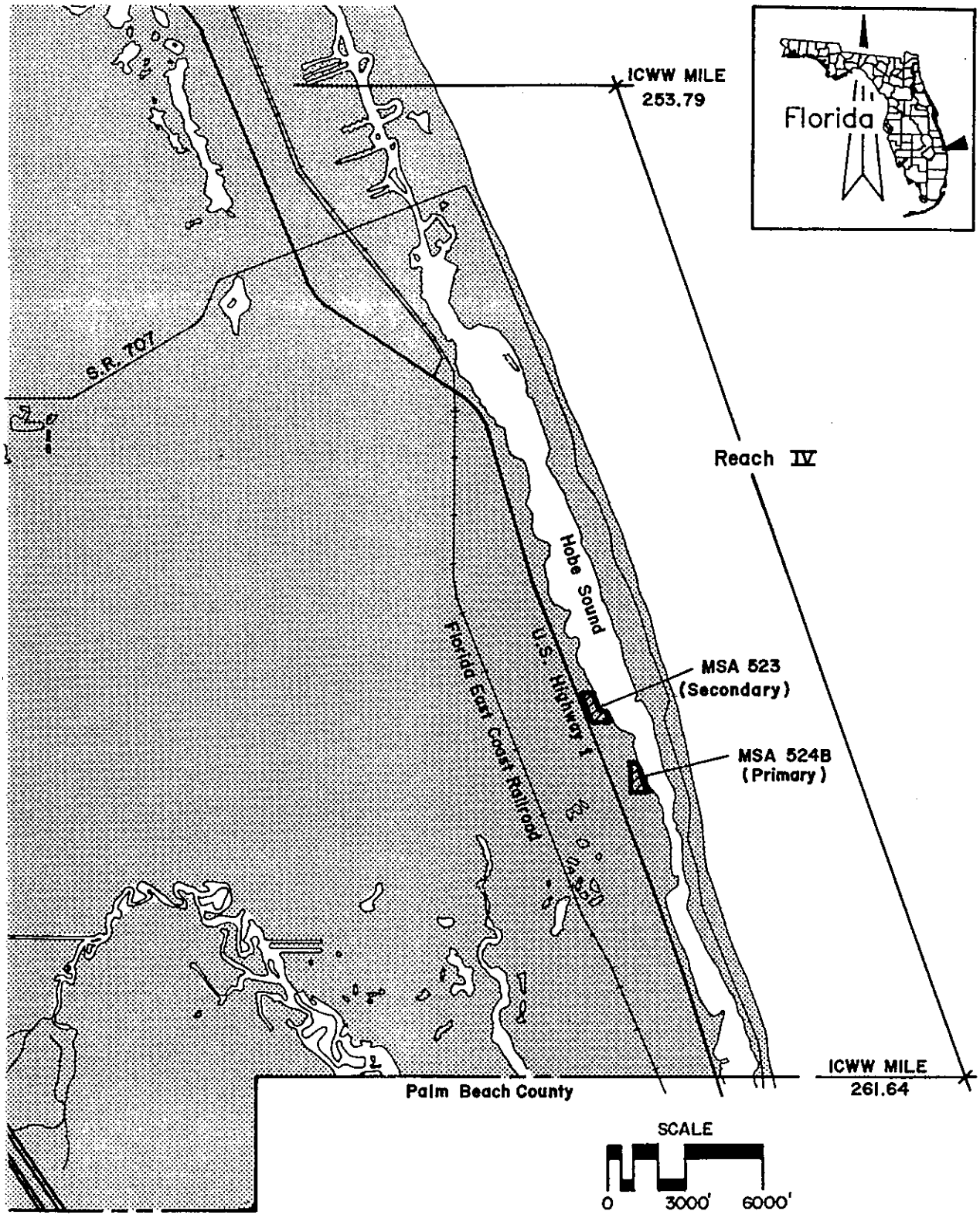
PROJECT	
REVISION	
SHEET	
DATE	

limiting access to the boardwalk/nature trail located primarily in MSA FO-504F. In contrast, the primary site — MSA FO-504B — is undeveloped and its use for dredged material management would involve no such impacts.

Similarly, within Reach IV, both the primary site — MSA 524B — and the secondary alternative — MSA 523 — are comparable on most evaluation criteria. Both are located in the southern portion of the reach (Figure 4-4) and thus require similar pumping distances to serve all of Reach IV. The sites are nearly equal in acreage, and very comparable in terms of environmental characteristics and physiography. Each can provide sufficient capacity for the projected 50-year storage requirements of Reach IV. However, Site MSA 523 is located within the boundaries of the Hobe Sound National Wildlife Refuge, whereas MSA 524B is located immediately south of the Refuge boundaries. The use of Site MSA 523 as a dredged material management area would effectively divide the Refuge in half, thereby making the continuing operation of the site significantly more cumbersome than the operation of Site MSA 524 outside of the Refuge.

Preliminary acreage requirements, storage capacities, and operational factors for each site in the site bank are summarized in Table 4-1. The final determination of these parameter values will be made during Phase II of the project. However, the preliminary estimates presented here are felt to be both realistic and conservative. In each case, material storage capacities of the primary sites are sufficient to meet the projected 50-year requirements of the reach to be served. However, in Reach II the secondary site — MSA M5 — is intended to provide only a back-up upland containment capability to the preferred method of beach disposal and thus is not designed to provide the full 50-year required capacity. And in Reach III, the limited acreage of the secondary site MSA FO-504C requires the acceptance of a reduced capacity, and therefore a reduced interval during which the dredged material must be removed for reuse or transfer to a permanent storage facility. Notably, this situation would only be encountered should the use of the primary site for this reach prove impossible for reasons which cannot be foreseen at this time.

In Table 4-1, the containment area for each site represents the acreage within a realistic dike configuration necessary to contain the stated material storage capacity for that site. For all sites the required dike configuration lies wholly within the initial site acreage. The total required area corresponds to the required containment area, plus an appropriate buffer surrounding the diked containment basin. Notably, the limited acreage of the four existing easements or FIND-owned sites which were selected as the primary and secondary sites for Reaches III and IV require a reduction in buffer width below the optimal 350 feet.



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 4–4
Location Map
Primary and Secondary Sites
Reach IV
Martin County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

Table 4-1 Site Bank, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Martin County

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
I North County Line to SR A1A Bridge	M-8 Secondary	235.53	34.35	14.89	34.35	191,400	8.70	N/A	N/A	aka McArthur Tract, lies between Indian River Dr. (SR 707) and FEC R.R., 3.8 channel miles north of St. Lucie/Martin County line
ICWW Mile 239.37 to 244.29	M-12 Primary	238.87	68.47	13.61	68.47	174,600	5.27	Residential, low density	PUD	aka Savanna Dunes, possible addition to Savannas State Preserve, possible joint site management (DNR/FIND), immed. north of county line
II SR A1A Bridge to Vicinity of Great Pocket	MSA M5 Primary/ Secondary	246.78	88.10	14.94	25.40	251,200	2.58	Public Conservation	N/A	Esmt. mostly open water, contains large spoil island at St. Lucie Inlet, last used Spring 1992 (OWW), now at or near capacity
ICWW Mile 244.29 to 247.79	Beach Disposal Primary	-----	----	----	----	----	----	----	—	Location and size of fill section will be specific to each dredging event, details to be addressed in Phase II
III Vic. of Great Pocket to Vic. of Hobe Sound	MSA FO-504B/504E Primary	250.59	30.00	10.46	22.80	104,700	3.26	Conservation	N/A	Lies adjacent to residential development, accessible by road
ICWW Mile 247.79 to 253.79	MSA FO-504C/504F Secondary	251.18	24.20	8.26	24.20	59,400	4.11	Recreation/ Conservation	N/A	County park (passive use) presently occupies site
IV Vicinity of Hobe Sound to South Co. Line	MSA 523 Secondary	258.70	14.14	8.47	14.14	73,800	5.17	Conservation	PS	Within Hobe Sound NWR
ICWW Mile 253.79 to 261.64	MSA 524B Primary	259.17	15.49	7.72	15.49	77,700	5.51	Conservation	R-1	Adjacent to Hobe Sound NWR

In addition, because of the natural isolation of Site MSA M5, the secondary site for Reach II, only a minimal buffer was considered in calculating the specified storage capacity.

The total required primary site acreage for the 22.27 miles of Waterway channel within the Martin County project area is approximately 132 acres. This includes 47 acres of active containment area and 85 acres of buffer. Of the total required area of 132 acres, approximately 64 acres are contained in three existing easements. Not represented in these totals is the beach disposal area designated as a primary site for Reach II. In the corresponding total secondary site requirement of 98 acres, 47 acres are containment area and 51 acres are buffer. Included in the secondary set of management alternatives, 64 of the 98 acres are contained in three existing easements.

5.0 RECOMMENDED SCOPE OF WORK: PHASE II

Task I: Preparatory Documentation

The purpose of this task is to obtain all of the information and authorizations necessary to facilitate the detailed documentation of site conditions and facilities design in Task II and to document public record information concerning land use and zoning restrictions, taxes and assessed values, easements, and property ownership. This will be done for all primary and secondary sites subject to property acquisition proceedings. Specific sub-tasks are outlined below.

A. Public Information — From county tax rolls and related public records, verify and update, as necessary, site ownership and tax information including parcel size, boundaries, and assessed value. This information will be provided to the FIND at the earliest possible date to facilitate the FIND obtaining from all relevant property owners appropriate written permission as required for site access, survey work, field testing, and data collection.

B. Zoning — Verify and update, as necessary, existing zoning classification and permitted uses under that classification.

C. Other Site Encumbrances — Identify other restrictions which may limit the use of the site such as local or regional planning constraints, rights-of-way, easements, adjacent property constraints, or potential damages to adjacent properties.

D. Site Reconfiguration — Modify site boundaries, as necessary. Eliminate unusable or unnecessary acreage and finalize site configuration for performance of boundary survey.

Task II: Site Conditions

Obtain necessary engineering and environmental site information required for preliminary engineering design and permitting of primary sites only as modified by results of Task I. Tasks A, B, C, and D below are not applicable to the beach disposal area designated to serve Reach II. Specific requirements of this site are addressed in Sub-task II-E.

A. Boundary Survey — Provide boundary survey of each primary site. Provide boundary surveys for additional pipeline and road access easements as required. Document results of each survey in sufficient detail to support legal and engineering actions required for acquisition of the site, as well as acquisition of additional easements under consideration by the FIND, and for site development for the purposes of dredged material management. Provide final boundary survey drawings, written legal descriptions, and other supporting documents to the FIND for each site. Reference boundary information for each site and additional easement to the Florida State Plane Coordinate System.

B. Engineering Topographic Survey — Provide site topographic information necessary for site planning, permitting, and design purposes. Reference horizontal and vertical control of data to established bench marks and reference all elevations to NGVD.

C. Subsurface and Soils Survey — This task will be performed by the Jacksonville District, U.S. Army Corps of Engineers.

1. Soils Survey — By means of core borings and analysis, document site soil characteristics including boring logs, grain size distributions, specific gravity, organic content, Atterberg limits (where appropriate), shear strength, compaction, and consolidation.
2. Groundwater — Obtain groundwater table elevations at a sufficient number of locations to provide estimates of on-site water table potential surface elevations referenced to NGVD.

D. Environmental Survey — Perform field survey and data collection efforts to provide the following:

1. Detailed documentation of site vegetation communities, including species frequencies of occurrence, and the delineation of wetlands and transitional areas using state approved methods.
2. Detailed documentation of on-site animal species, including endangered or threatened species, and pertinent habitat information.

3. Documentation of existing vegetation communities and species habitats along proposed pipeline access and return drainage routes.
4. Documentation for a Phase I Site Environmental Assessment for concerns related to hazardous waste.

E. Beach Disposal Area (Reach II) — Obtain necessary engineering and environmental site information required for preliminary engineering design and permitting. No boundary survey will be provided for the project area. Work elements within this task will include the following:

1. Analyze existing beach profile data obtained from Jacksonville District, Corps of Engineers and Florida DNR, Division of Beaches and Shores to evaluate historic beach profile geometry and background erosion rates.
2. Define beach disposal project area.
3. Preform preliminary material compatibility analysis using newly acquired samples of native beach material and existing data on historic shoal material in Reach II Waterway channels.
4. Locate and characterize all existing public access points, bulkheads, revetments, and stormwater outfalls within the project area.
5. Perform field survey and data collection to provide documentation of environmental conditions (species present, frequency of occurrence, pertinent habitat information, endangered or threatened species) within project area, adjacent nearshore regions, and along proposed pipeline routes.
6. Review existing information to determine possible impact of project on sea turtle nesting.

Task III: Preliminary Design and Analysis

With data obtained from Task II, develop site documentation and complete preliminary design necessary to prepare permit drawings. Tasks III-A and III-B below are not applicable to the beach disposal area designated to serve Reach II. Specific requirements of this site are addressed in Sub-task III-C.

A. Environmental — With information obtained from Task II-D, prepare the following:

1. Detailed site maps showing vegetation communities, species locations and habitats, revised usable boundaries, and wetland areas.
2. Detailed written text supporting (1) above.
3. Specific mitigation measures as required.
4. Archeological site locations as recorded in published records available from the Division of Historical Resources, Florida Department of State.
5. Recommended pipeline access and return water routes.
6. Phase I Site Environmental Assessment Report.

B. Engineering - With information obtained in Task II, prepare the following:

1. Site Capacity Analysis — Recalculate estimated site capacity and dike material requirements.
2. Site Topographic Map.
3. Engineering Report on Subsurface and Soils Conditions — Prepared by Jacksonville District, U. S. Army Corps of Engineers.
4. Preliminary design calculations and permit drawings of:
   - o Location/Reach Map
   - o Site Plan
   - o Pipeline Access and Return Routes
   - o Inlet Works
   - o Outlet Works
   - o Dike Section
   - o Internal Structures
   - o Equipment Ingress and Egress Features
   - o Vegetation and Buffer Area Plan
   - o Site Drainage Plans.
5. Detailed written text supporting (1) - (4) above.

C. Beach Disposal Area (Reach II)

1. Engineering — With information obtained in Sub-task II-E, prepare the following:

   a. Preliminary design calculations and permit drawings of:
      - o Location Map
      - o Site Plan
      - o Typical Section(s)
      - o Pipeline Access Routes
      - o Locations of Public Access, Bulkheads, Revetments, Outfalls

   b. Compatibility analysis of fill with native beach material

   c. Projected performance of beach fill

   d. Detailed written support of (a) - (c) above.

2. Environmental — With information obtained in Sub-task II-D, prepare the following:

   a. Evaluation of environmental conditions within beach disposal project area, adjacent nearshore areas, and along proposed pipeline routes

   b. Evaluation of project impacts on beach and nearshore habitats, with special emphasis on sea turtle nesting

   c. Detailed maps of project area, adjacent nearshore regions, and proposed pipeline routes showing species and habitat location, vegetation communities, rock outcroppings, documented turtle nesting sites and other pertinent habitat information

   d. Detailed written text in support of (a) - (c) above.

D. Agency Coordination — Obtain from pertinent state and federal agencies a preliminary statement on the acceptability of the proposed site plans based on the site engineering narrative, permit drawings, environmental report, and preliminary delineation of agency jurisdiction.

Task IV: Site Management Plans

Prepare a site management plan for each primary site in the Site Bank as modified by Task I. Tasks A, B, and C below are not applicable to the beach disposal area designated to serve Reach II. Specific requirements of this site are addressed in Sub-task IV-D. Each plan will address the following:

A. Design Features — Brief description of all site design features as they relate to the long-term operation of the site and the management of dredged material.

B. During-Dredging Procedures

1. Outlet Operations
2. Inlet Operations
3. Ponding Depth
4. Material Distribution
5. Monitoring

C. Post-Dredging Procedures

1. Dewatering
2. Surface Water Management
3. Material Handling/Reuse
4. Monitoring

D. Beach Disposal Area (Reach II) — The site management plan for the beach disposal area will address the long-range implications of the site — specifically, the assessment of project performance — and the continuing modifications in project design and operational criteria in response to project performance.

Task V: Cost Considerations

For all primary sites, evaluate the following cost considerations:

A. Site Improvement Costs

B. Site Operation Costs

C. Site Maintenance Costs

Task VI: Documents and Deliverables

Prepare and submit the following project documents for each primary site:

A. Site boundary survey with legal description, with additional boundary surveys of pipeline and road access easements as required. A boundary survey is not to be performed for the beach disposal area designated to serve Reach II.

B. Site topographic survey, with additional topographic surveys of pipeline and road access easements as required.

C. Permit drawings and accompanying engineering narrative.

D. Subsurface and soils report prepared by Jacksonville District, U. S. Army Corps of Engineers (not applicable to beach disposal area, Reach II).

E. Environmental Report.

F. Phase I Site Environmental Assessment Report.

G. Site Management Plan.

H. Cost Report.

REFERENCES

Schropp, S.J., and Taylor, R.B. (1993). *Sediment Quality in the Intracoastal Waterway in Volusia, Volusia, and Martin Counties, Florida*. Taylor Engineering, Inc., Jacksonville, FL.

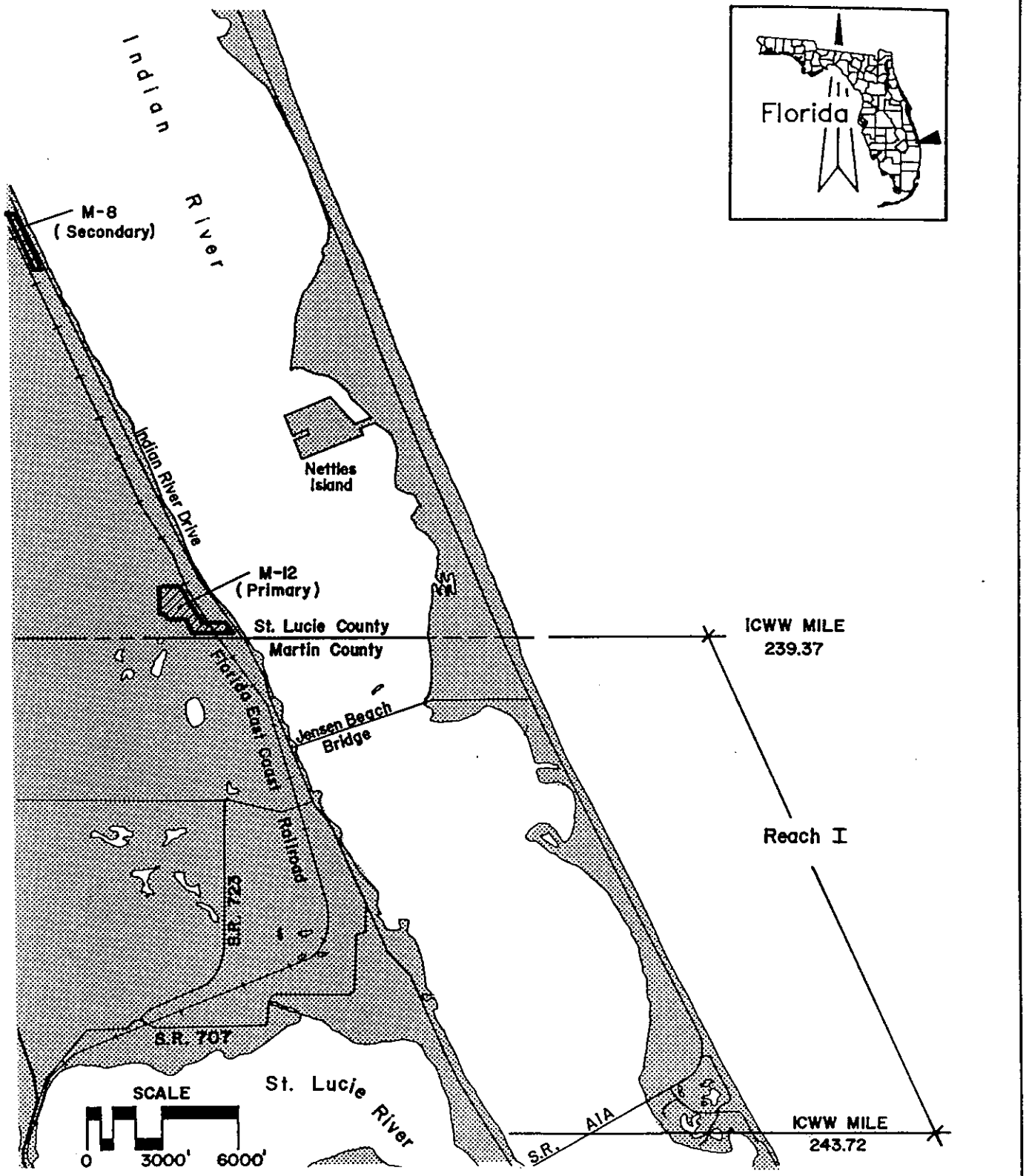
Taylor, R.B., and McFetridge, W.F. (1986). *Long-Range Dredged Material Management for the Intracoastal Waterway in Northeast Florida*. Taylor and Divoky, Inc., Jacksonville, FL.

Trefry, J. H., S. Metz, R. P. Trocine, N. Iricanin, D. Burnside, N. Chen, and B. Webb. (1990). *Design and operation of a muck sediment survey*. Special Publication SJ 90-SP3. St. Johns River Water Management District, Palatka, Florida.

APPENDIX A

Site Bank

(Primary and Secondary Sites)



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure A–1 Location Map Primary and Secondary Sites Reach I Martin County, Florida	PROJECT REVISION SHEET DATE

SITE M-8 DATA SUMMARY SHEET

I General Location

St. Lucie	(Martin Co.) I	Indian River
County	**Reach #**	**Waterbody Name**
29/36S/41E	165,000 cy	<200 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Martin/St. Lucie Co. Line (mi 239.37) to Vic. of SR A1A (mi 261.64)		235.53
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

34.35 ac	14.89 ac	34.35 ac	300/300/200/100 ft
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+30.0 ft NGVD	191,390 cy	<200 ft	N/A
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
8.70 mi	12 ft	None Required	Savannahs State Preserve/ S.F. Residential
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Indian River Drive (SR 707)	9.53 ft	None	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-8 is located in St. Lucie County approximately 3.2 miles north of the St. Lucie/Martin County line. It is bordered on the west by the Florida East Coast Railroad right-of-way and on the east by Indian River Drive (S.R. 707). The property is locally known as the "McArthur Tract." A single residence (110) is located near the center of the site on Indian River Drive. No wetland plant communities exist on this site.

A herbaceous rangeland (310) dominates the northwestern portion of the property. Vegetation there includes wiregrass (*Aristida* sp.), bracken fern (*Pteridium aquilinum*), and several species of cactus including prickly pear (*Opuntia* sp.). Much of this area lacks ground cover. Cabbage palm (*Sabal palmetto*) and sand live oak (*Quercus geminata*) trees are scattered throughout the area. A few sand and long leaf pines (*Pinus clausa* and *P. palustrus*) also grow there. Several inactive gopher tortoise (*Gopher polyphemus*) burrows were discovered in this area during the field visit. A small xeric oak community (421), containing sand live oak, lies near the center of the site within the herbaceous rangeland.

The northeastern portion of the site shows evidence of past disturbance. It contains a highly diversified mixture of hardwood species (439) including cabbage palms, Brazilian pepper (*Schinus terebinthifolius*), Carolina laurel cherry (*Prunus caroliniana*), guava (*Guava* sp.), and ash (*Fraxinus* sp.). Mother-in-law-tongue (*Sansevieria* sp.) dominates the understory in parts of this community.

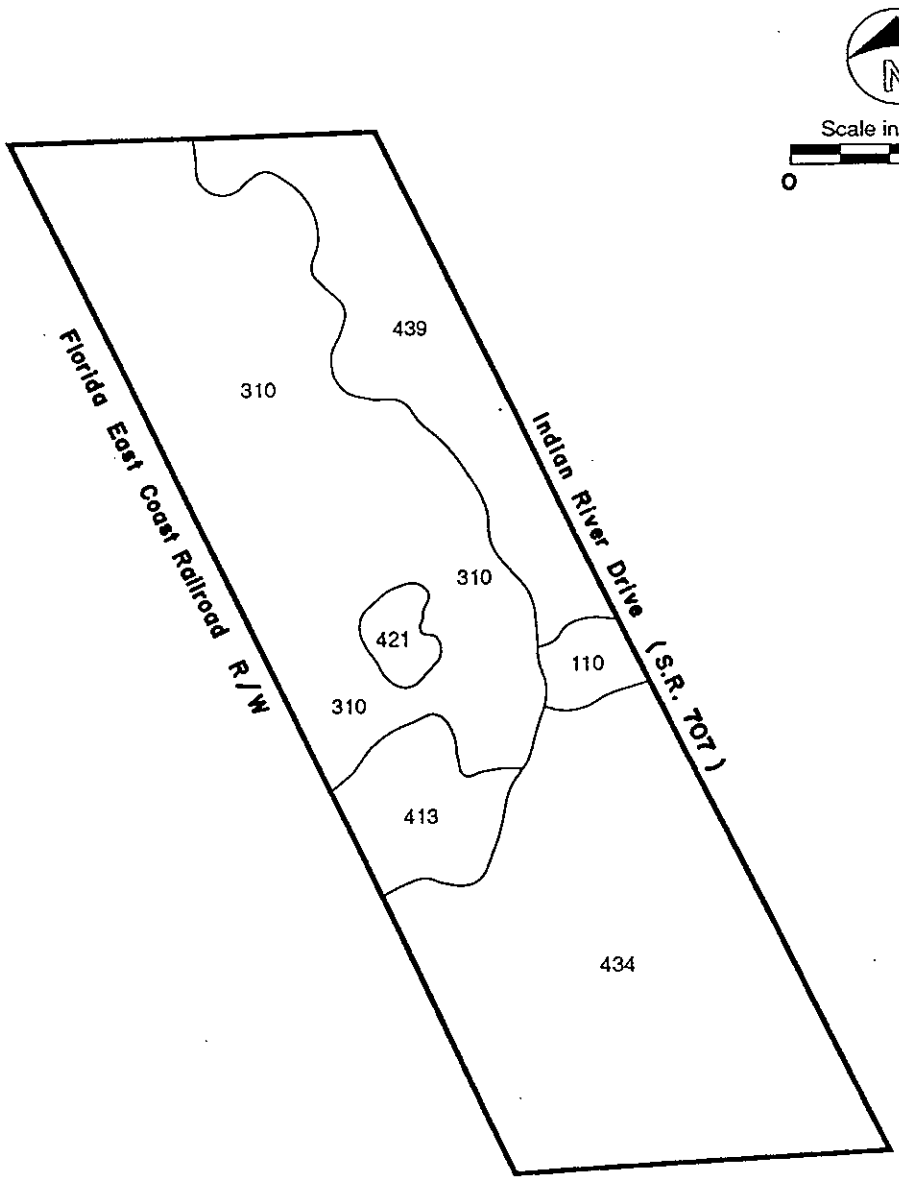
A small sand pine community (413) is located near the center of the western site boundary. Large (24" diameter at breast height - dbh) sand pines which dominate this area are probably a seed source for the seedlings and saplings found on the site. Sand live oak and myrtle oak (*Quercus myrtifolia*) form the community's understory.

The southern portion of the site is dominated by a hardwood conifer mix (434) community. It contains sand pine, sand live oak, greenbriar (*Smilax* spp.) and saw palmetto (*Serenoa repens*).

Table A-1 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-8, Martin County, Florida

Map ID No.	Name	Approximate Acreage
110	Residential Low Density	0.6
310	Herbaceous Rangeland	13.6
413	Sand Pine	1.8
421	Xeric Oaks	0.5
434	Hardwood/Conifer Mixed	12.8
439	Other Hardwoods	5.1
Total		**34.4**

Source: WAR, 1993



LEGEND

110	Residential, Low Density
310	Herbaceous Rangeland
413	Sand Pine
421	Xeric Oak
434	Hardwood/Conifer Mixed
439	Other Hardwoods

Figure A–2
Vegetation and Land Use of Site M–8
St. Lucie County, Florida

SITE M-12 DATA SUMMARY SHEET

I General Location

St. Lucie	(Martin Co.) I	Indian River
County	**Reach #**	**Waterbody Name**
9,10/37S/41E	165,000 cy	<200 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Eden (unincorp.)	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Martin/St. Lucie Co. Line (mi 239.37) to SR A1A Bridge (mi 244.29)		238.87
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

68.47 ac	13.61 ac	68.47 ac	300/300/100/300
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+30.0 ft NGVD	174,651 cy	<200 ft	Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.70 mi	12.0 ft	None Required	Residential (various densities), Conservation (Savannahs State Preserve)
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Indian River Drive to County Line Road	6.63 ft	W: Freshwater Marsh	E: Freshwater marsh, Reservoir, Mixed Wetland Hardwoods
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-12 is located in St. Lucie County, immediately north of the St. Lucie/Martin County line. The property was partially cleared during an effort to develop it as a residential subdivision. However, development ceased before any structures were built and the property was left vacant. The property is divided by the Florida East Coast Railroad right-of-way. Only the portion of the site west of the railroad is of sufficent area to host a dredged material containment basin.

A longleaf pine-xeric oak (412) community occupies much of the western portion of the site. It has been significantly disturbed by off-road vehicle usage. Tree species include longleaf pine (*Pinus palustris*), sand live and myrtle oak. The ground cover includes wiregrass (*Aristida* sp.) and prickly-pear cactus (*Opuntia* sp.). Bromeliads, including wild pine (*Tillandsia* spp.), are present in the oak trees and on the ground. Signs of fire were evident within this community at the time of the site visit.

A coastal scrub (322) community is located on the western edge of the property. A portion of this community has been burned. Dominant plant species include sand live and myrtle oaks (*Quercus geminata* and *Q. myrtifolia*) and cabbage palm (*Sabal palmetto*). Ground cover consists of wire grass (*Aristida* sp.) and rusty lyonia (*Lyonia ferruginea*).

An area of hardwood-conifer mix (434) is located in the southwestern portion of the site. Dominant tree species there include sand pine (*Pinus clausa*) and sand live oak (*Quercus geminata*). Brazilian pepper and red bay (*Persea borbonia*) are also present but to a lesser extent. A scrub jay was observed in this community during the site visit. The scrub jay is listed by state and federal agencies as threatened. A mixed hardwood community (438) is located along the western edge of the railroad right-of-way. Trees in this community include scrub hickory (*Carya floridana*) and sand live oak. The ground cover is mostly leaf litter although prickly-apple cactus (*Cereus* sp.) is present in some areas.

A large borrow pit (742) is located in the southwestern corner of the site. It contains a variety of grasses and herbaceous species. Excavation depth varies from 10 to 25 feet. The deepest parts of the pit contained standing water at the time of the site visit. Plants in the flooded area are not wetland species, indicating that water is not present for any significant length of time.

A freshwater marsh (641) is located on the western edge of the property. Dominant vegetation is emergent and includes cattails. Cabbage palms, Brazilian pepper, and melaleuca (*Melaleuca quinquenervia*) vegetate the marsh within the property limits.

The portion of the site east of the railroad contains a variety of upland communities including herbaceous rangelands (310), coastal scrub (322), and cabbage palm (428). Several types of wetlands also exist there including hardwoods wetlands (617), freshwater wetlands (641), a reservoir (534), and an area of wetland/oil and gas storage (600/140).

The herbaceous rangelands vegetation consists primarily of grasses associated with land disturbance brought about by property development. The wetland areas east of the railroad includes a reservoir of less than 10 acres (534). Most of this pond is open water with margins containing cattails (*Typha* sp.) and primrose willow (*Ludwigia peruviana*). It was probably a storm retention pond for the abandoned development. The wetlands oil and gas storage area (600/140) is a low quality wetland containing an abandoned above-ground storage tank. It consists of a depression with cabbage palm overstory and swamp fern (*Blechnum serrulatum*) ground cover. The mixed wetland hardwood (617) is a cabbage palm wetland with Brazilian pepper (*Schinus terebinthifolius*). The ground cover is dominated by swamp fern. A freshwater marsh (641) receives overflow from the reservoir and connects to an off-site wetland (to the north) and to a roadside ditch (to the south). Dominant species are swamp fern and primrose willow.

Table A-2 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-12, St. Lucie County, Florida

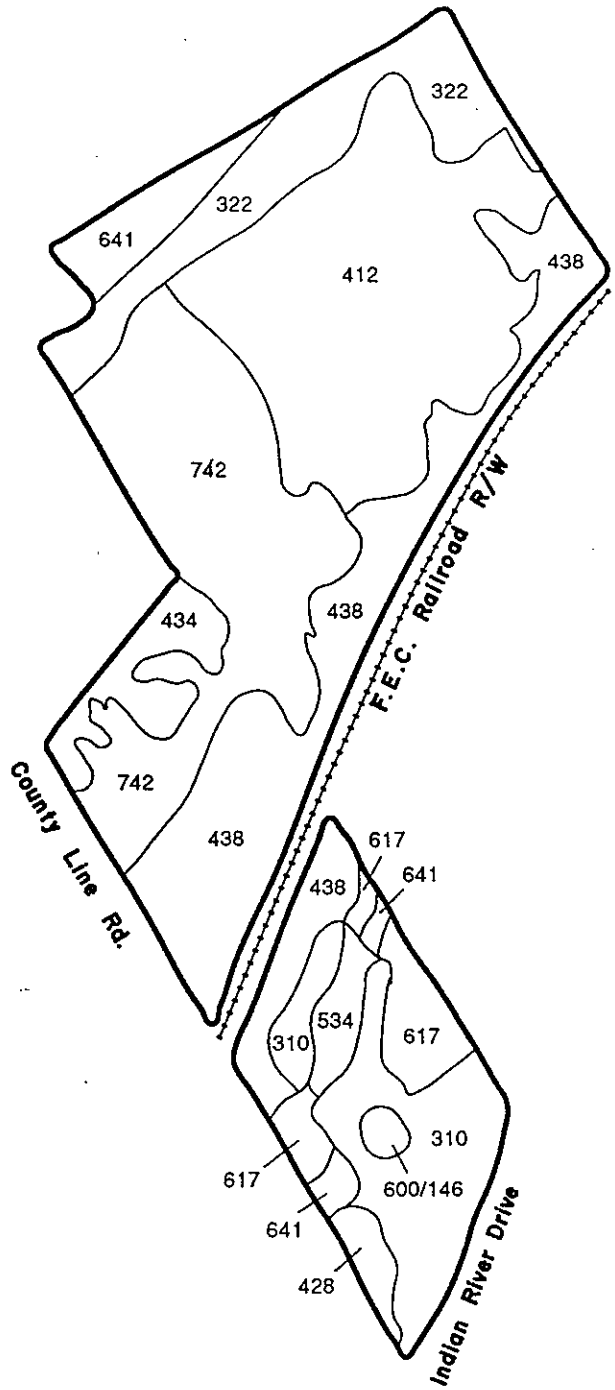
Map ID No.	Name	Approximate Acreage
310	Herbaceous Rangeland	7.6
322	Coastal Scrub	8.3
412	Longleaf Pine-Xeric Oak	19.8
428	Cabbage Palm	0.9
434	Hardwood-Conifer Mixed	2.8
438	Mixed Hardwoods	17.4
534	Reservoirs	1.3
600/146	Wetlands/Oil and Gas Storage	0.4
617	Mixed Wetland Hardwoods	2.9
641	Freshwater Marshes	3.2
742	Borrow Areas	16.0
Total		**80.6**

Source: WAR, 1993

2/22/93
93-5209/Martin Addtl.

Scale in Feet

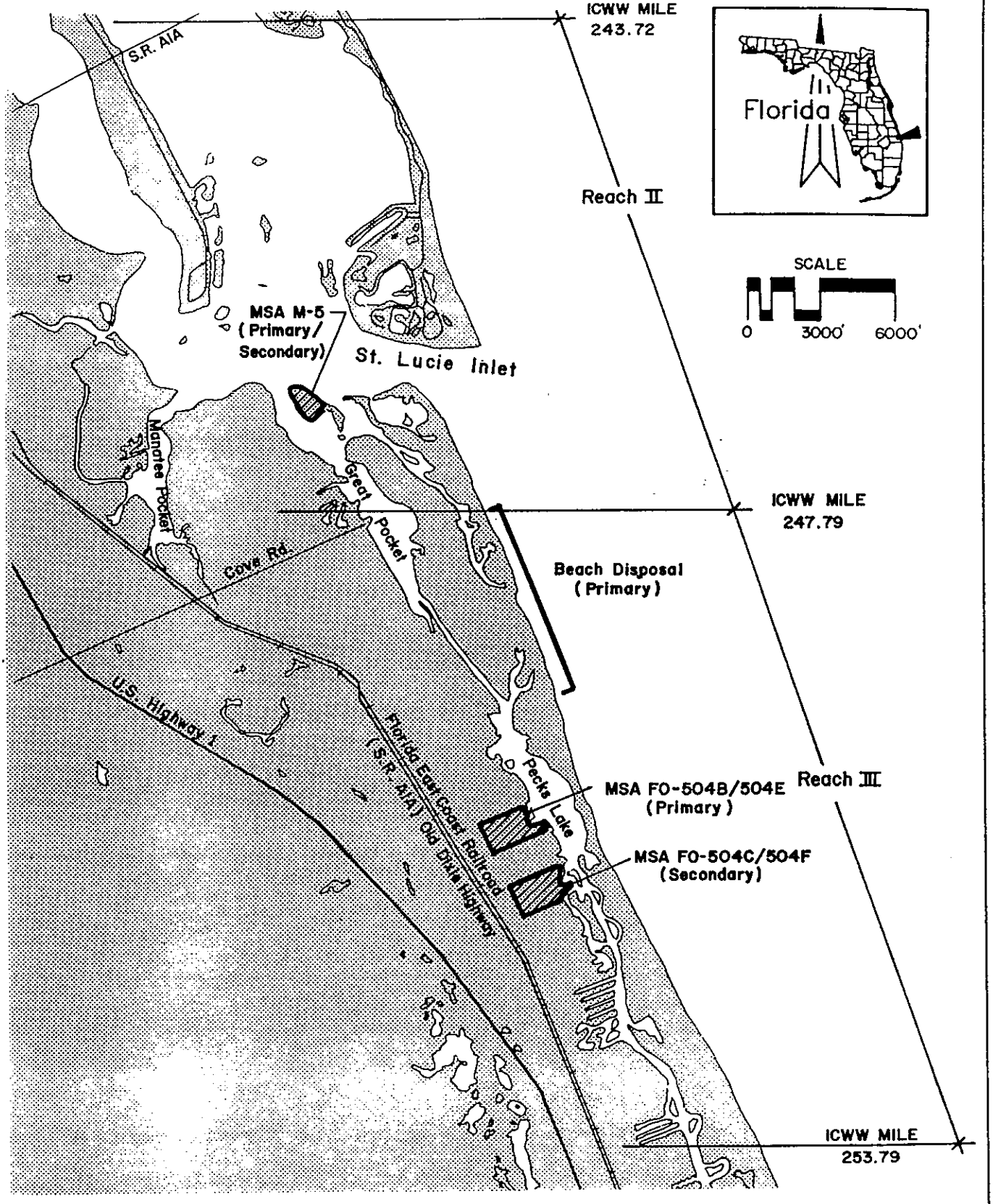
0 600



LEGEND

310	Herbaceous Rangeland
322	Coastal Scrub
412	Longleaf Pine-Xeric Oak
428	Cabbage Palm
434	Hardwood-Conifer Mixed
438	Mixed Hardwoods
534	Reservoirs
600/146	Wetlands/Oil and Gas Storage
617	Mixed Wetland Hardwoods
641	Freshwater Marshes
742	Borrow Areas
	Railroad

Figure A–3
Vegetation and Land Use of Site M–12
St. Lucie County, Florida



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure A–4
Location Map
Primary and Secondary Sites
Reaches II and III
Martin County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

SITE MSA M5 DATA SUMMARY SHEET

I General Location

Martin	II	St. Lucie Inlet/Great Pocket (ICWW)
County	**Reach #**	**Waterbody Name**
20/38S/42E	2,423,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	3.50 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. A1A Bridge (mi 244.29) to Great Pocket (mi 247.79)		246.78
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

88.1 ac	14.94 ac	25.40 ac	Minimal Upland Buffer
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
	253,161 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.58 mi	15 ft	No Upland Access	Open Water/Public Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
None	9.29 ft	Mangrove Swamp, Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA M-5 is an existing FIND easement located near at St. Lucie Inlet. The site is a functioning dredged-material storage site (743) and contains a diked containment basin. It presently filled to capacity and continued use would require the removal of material from within or expansion of the basin. The last use of the site occurred in 1991 and at the time of the site visit in 1992, little or no vegetation had yet re-established within the basin. This site will provide a staging/storage area for beach disposal operations.

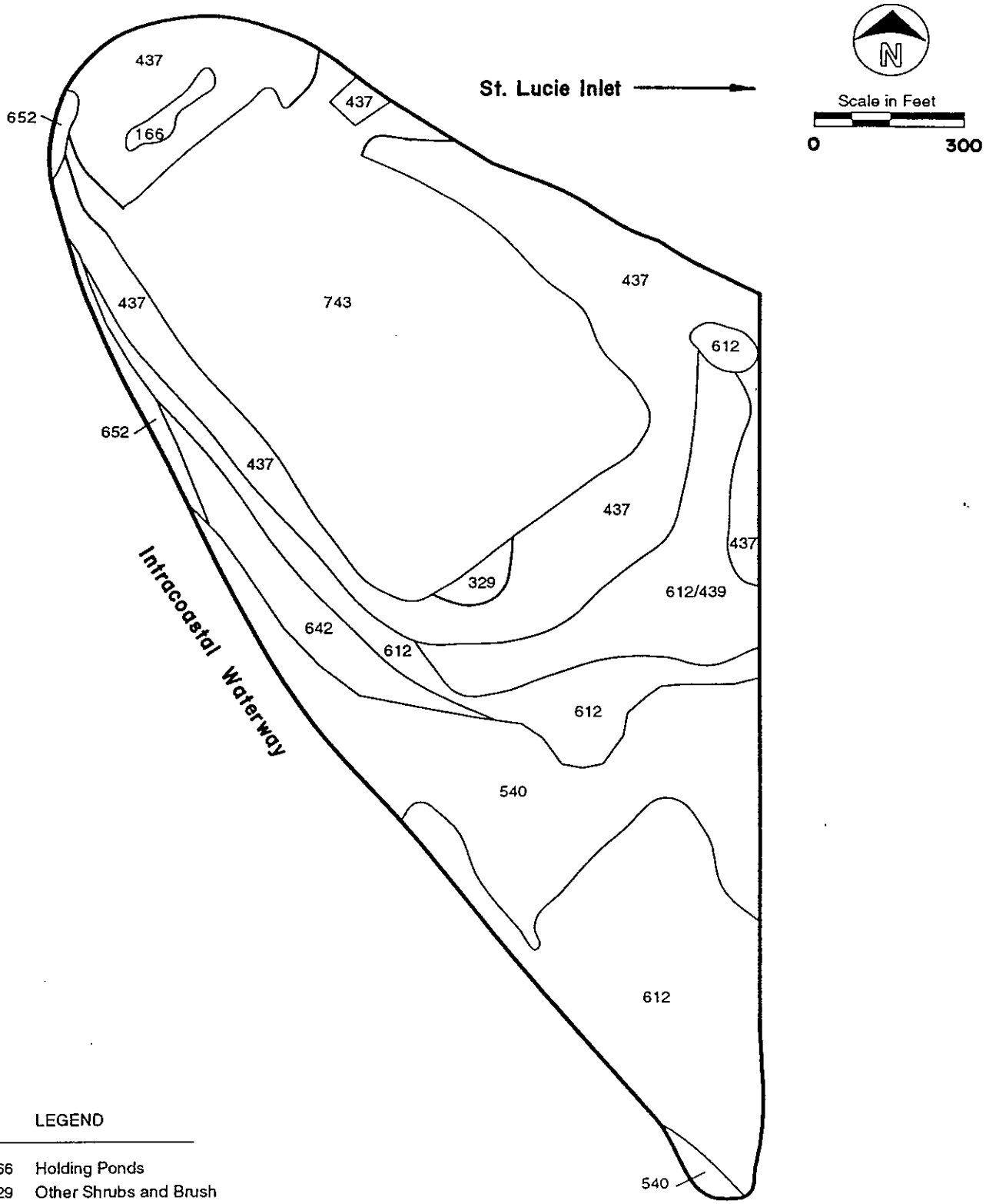
Portions of the site outside of the existing dikes hosts Australian pine (437) (*Casuarina equisetifolia*) stands of two different ages. The young trees are about 30 feet tall and range in size from 2 to 5 inches diameter at breast height (DBH). Trees in the older stand range in diameter from 4 to 10 inches DBH reach a height of 50 feet. Other species in the community include Brazilian pepper (*Schinus terebinthifolius*) and a few cabbage palms (*Sabal palmetto*). Understory vegetation is sparse and consists of weed species. A small area of disturbed vegetation (329) occurs along the southern border of the spoil area. The Australian pines in this area are dead and the understory is dominated by herbaceous and weedy species.

Wetlands on site consist of mixed and pure stands of mangrove swamp. Tidal flooding provides high soil moisture content which in turn supports red mangrove (*Rhizophora mangle*) growth. Though Australian pines have invaded the mangrove in the southeastern potion of the site, pure, or near pure, stands of red and black mangroves (*Avicennia germinans*) are abundant.

Table A-3 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA M5, Martin County, Florida

Map ID No.	Name	Approximate Acreage
166	Holding Ponds	0.2
329	Other Shrubs and Brush	0.2
437	Australian Pine	10.3
540	Streams and Waterways	5.9
612	Mangrove Swamps	8.0
612/439	Mangrove Swamps/Other Hardwoods	3.0
642	Saltwater Marsh	1.5
652	Shorelines	0.5
743	Spoil Area	14.7
Total		**44.3**

Source: WAR, 1993



LEGEND

166	Holding Ponds
329	Other Shrubs and Brush
437	Australian Pine
540	Streams and Waterways
612	Mangrove Swamps
612/439	Mangrove Swamps/Other Hardwoods
642	Saltwater Marsh
652	Shorelines
743	Spoil Areas

Figure A–5
Vegetation and Land Use of MSA M5
Martin County, Florida

SITE MSA FO 504B/504E DATA SUMMARY SHEET

I General Location

Martin	III	Peck Lake (ICWW)
County	**Reach #**	**Waterbody Name**
Gomez Grant/38-39S/42E	90,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	6.0 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Great Pocket (mi 247.79) to Hobe Sound (mi 253.79)		250.59
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

60.9 ac	10.46 ac	22.80 ac	200/200/<1500/200 ft
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
< +5.0 ft NGVD	104,694 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.26 mi	10 ft	None Required	Residential PUD, Recreation/Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Gomez Ave.	5.1 ft	Mangrove Swamp, Mixed Wetland Hardwood	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA FO 504B/504E is an existing FIND-owned dredged material management area located on the western shore of Peck Lake. It lies immediately north of Loblolly Pines, a mixed-density residential development. The upland portion of the site consists of pine flatwoods (411), other pines (419), disturbed land (740), Australian pine (437), and Brazilian pepper (422). Most of the uplands contain a mixture of slash and sand pine (*Pinus elliottii* and *Pinus clausa*). Shrub species include sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia*), and rosemary (*Ceratiola ericoides*). Pine flatwoods are found in more mesic upland areas. Slash pine (*Pinus elliottii*) predominate there, but loblolly bay (*Gordonia lasianthus*) are also present in small numbers. Ground cover consists of saw palmetto (*Serenoa repens*), tarflower (*Befaria racemosa*), and fetterbush (*Lyonia lucida*).

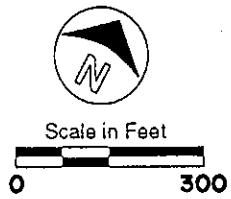
Two disturbed portions of the site have been cleared and are utilized for storage and burning of waste building materials and landscaping debris. Brazilian pepper (*Schinus terebinthifolius*) dominates the margins of these areas. Australian pines (*Casuarina equisetifolia*) dominate old dredged material disposal areas and portions of the site's shoreline.

The wetlands on site include mixed wetland hardwoods (617), wetland forested mixed (630), and mangrove swamp (612) communities. The mixed wetland-hardwoods have cabbage palm (*Sabal palmetto*) with swamp bay (*Persea palustris*), Carolina willow (*Salix caroliniana*), and red maple (*Acer rubrum*). Leather fern (*Acrostichum* sp.) is found in the understory, while cattail (*Typha* sp.) dominates the open canopy areas. The mixed wetland-hardwoods is a disturbed area which was used as a dredged material placement site. Mangroves are found in portions of the mixed wetland-hardwood community along with Brazilian pepper and Australian pine. In the mangrove community (612), white mangroves (*Laguncularia racemosa*) are present in areas that are seldom inundated whereas the red mangroves (*Rhizophora mangle*) grow in frequently inundated areas.

Table A-4 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA FO-504B and FO-504E, Martin County, Florida

Map ID No.	Name	Approximate Acreage
411	Pine Flatwoods	3.1
419	Other Pines	10.4
422	Brazilian Pepper	6.0
437	Australian Pine	4.5
612	Mangrove Swamps	11.7
617	Mixed Wetland Hardwoods	18.5
630	Wetland Forested Mixed	3.4
740	Distrubed Land	3.3
	Total	**60.9**

Source: WAR, 1993



LEGEND

411	Pine Flatwoods
419	Other Pines
422	Brazilian Pepper
437	Austalian Pine
612	Mangrove Swamps
617	Mixed Wetland Hardwoods
630	Wetland Forested Mixed
740	Disturbed Land

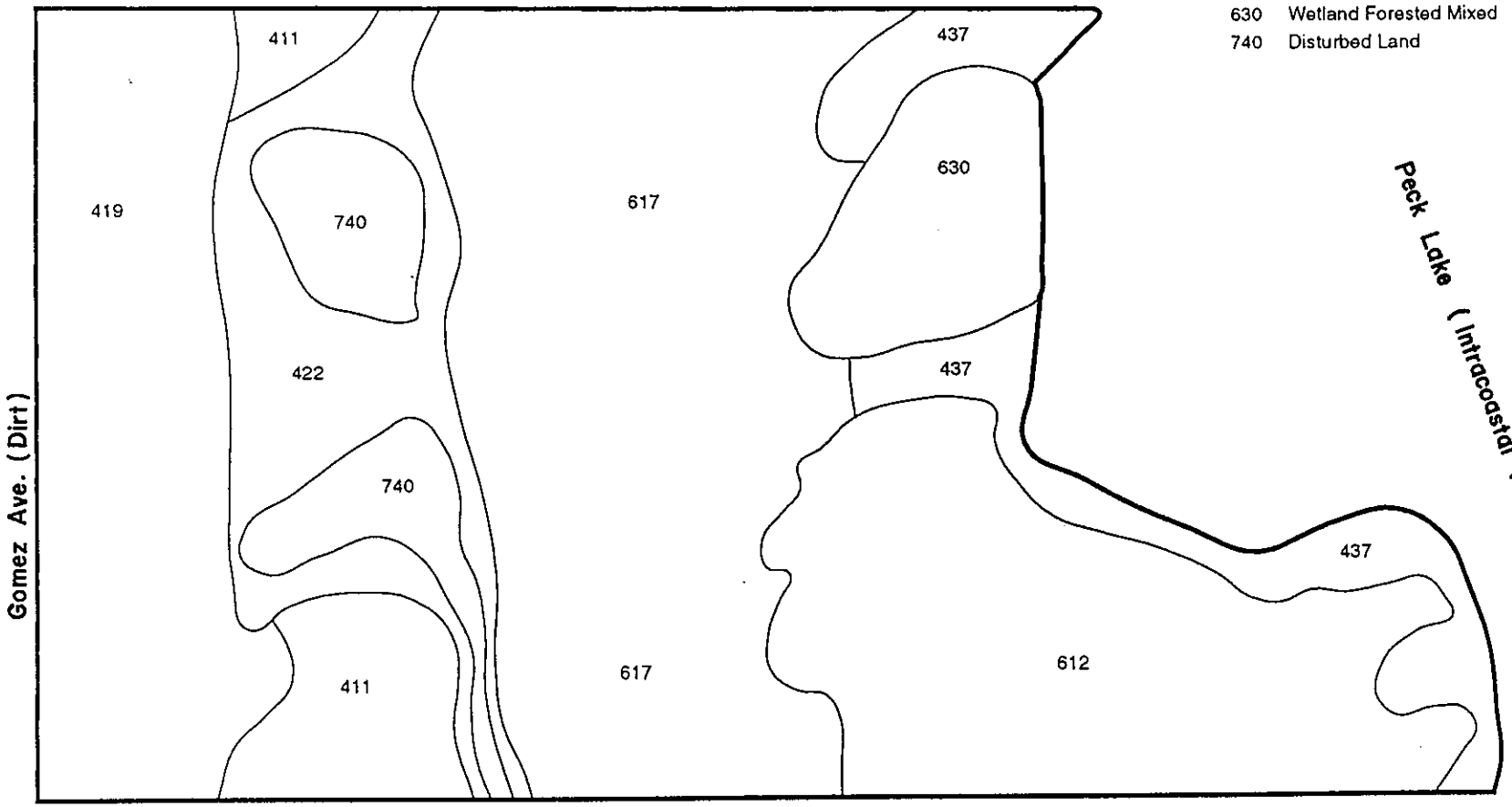


Figure A–6
Vegetation and Land Use of
MSA FO–504B/ MSA FO–504E
Martin County, Florida

SITE MSA FO 504C/504F DATA SUMMARY SHEET

I General Location

Martin	III	Peck Lake (ICWW)
County	**Reach #**	**Waterbody Name**
Gomez Grant/39S/42E	90,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	6.0 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Great Pocket (mi 247.79) to Hobe Sound (mi 253.79)		251.18
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

72.3 ac	8.26 ac	24.20 ac	200/200/< 1850/200 ft
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
< +5.0 ft NGVD	59,431 cy	None Required	Recreation/Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.67 mi	8 ft	None Required	Residential PUD
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Gomez Ave.	4.11 ft	Mangrove Swamp, Wetland Forested Mixed	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA FO 504C/504F is an existing FIND-owned property. Much of the site has been developed as Peck Lake Park and contains restroom facilities, a parking lot, picnic facilities, and a boardwalk that extends to the site shoreline. Only the western portion of the site is suitable for construction of a containment basin.

The western portion of the site contains an upland vegetated by pine flatwoods (411). Slash pines (*Pinus elliottii*) dominant this area but gallberry (*Ilex glabra*), saw palmetto (*Serenoa repens*), rusty lyonia (*Lyonia ferruginea*), and bracken fern (*Pteridium aquilinum*) are also present. A portion of the pine flatwoods community has been cleared for roads and picnic shelters associated with the park. The eastern edge of the pine flatwoods contains live oak (*Quercus virginiana*) and wax myrtle (*Myrica cerifera*). Several areas of Australian pine (*Casuarina equisetifolia*) are found on old dredged material storage sites (437) adjacent to Peck Lake.

The aerial photographs used as a base source for site vegetation mapping were taken prior to the construction of the park facilities. Therefore, roads and other facilities are not depicted on the vegetation map.

Vegetation in the eastern portion of the site consists of a freshwater forested wetland (630) and mangrove swamp (612). The wetland forest is located adjacent to the upland portion of the site. Dominant species include sweet bay (*Magnolia virginiana*), red maple (*Acer rubrum*), cabbage palm (*Sabal palmetto*), and wax myrtle (*Myrica cerifera*). The understory consists of swamp and leather fern (*Blechnum serrulatum* and *Acrostichum* sp.). The mangrove swamp, which is dominated by red mangrove (*Rhizophora mangle*), is adjacent to an Australian pine community (437) along the ICWW.

Table A-5 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA FO-504C and FO-504F, Martin County, Florida

Map ID No.	Name	Approximate Acreage
411	Pine Flatwoods	32.7
437	Australian Pine	3.6
612	Mangrove Swamps	11.7
630	Wetland Forested Mixed	24.3
Total		**72.3**

Source: WAR, 1993

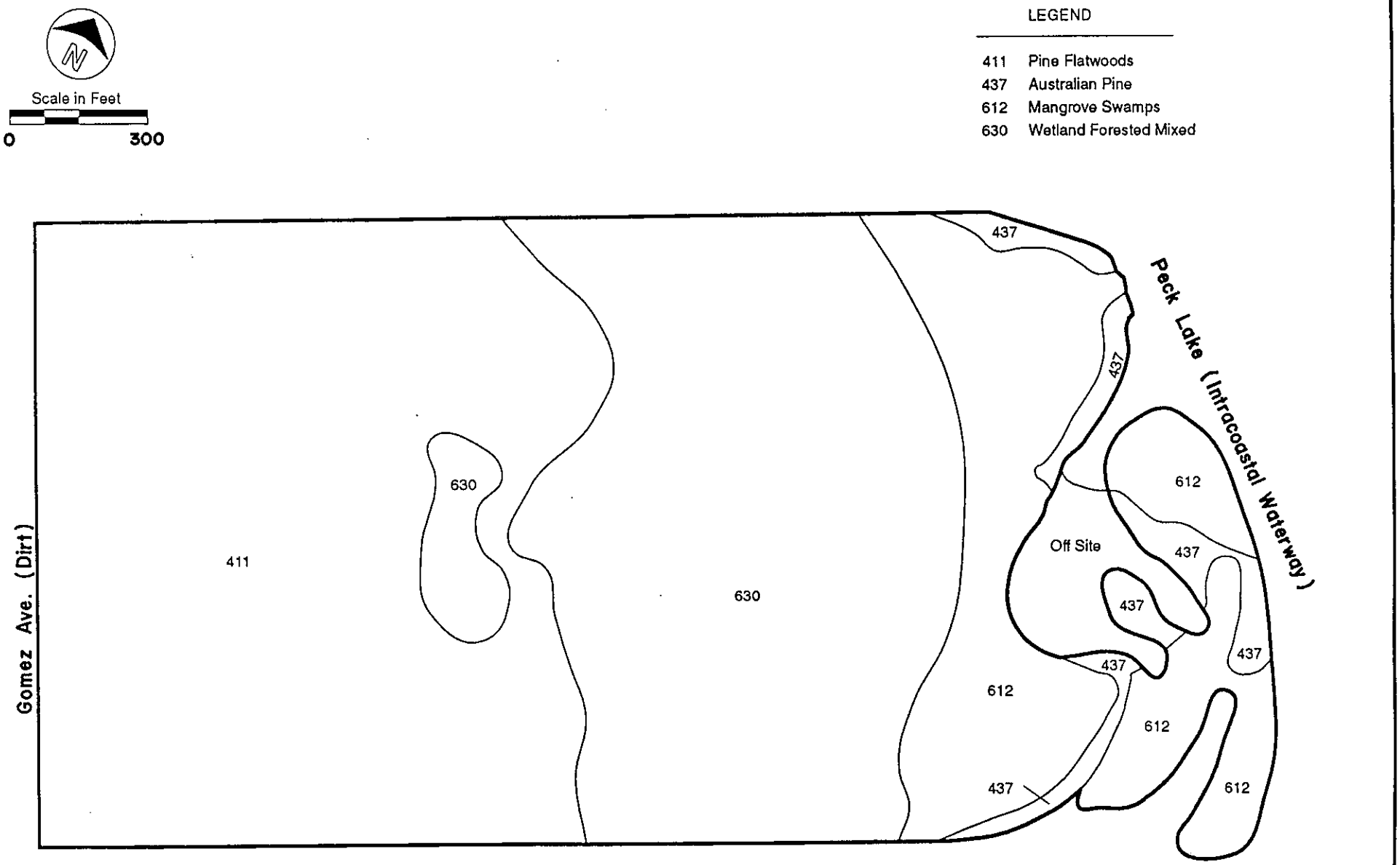
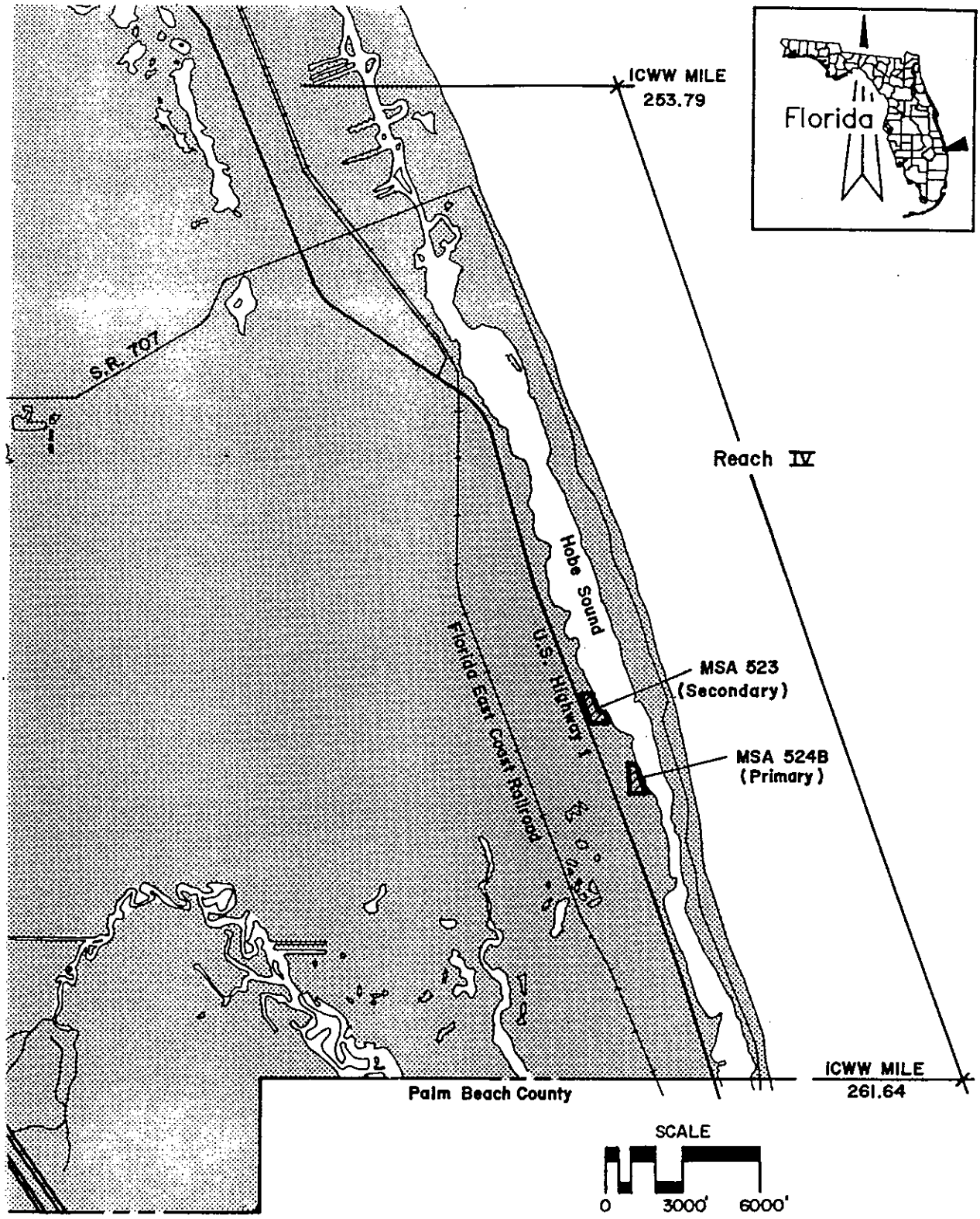


Figure A–7
Vegetation and Land Use of
MSA FO–504C/ MSA FO–504F
Martin County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure A–8 Location Map Primary and Secondary Sites Reach IV Martin County, Florida	PROJECT REVISION SHEET DATE

SITE MSA 523 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound
County	**Reach #**	**Waterbody Name**
12/40S/42E	48,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Hobe Sound (mi 253.79) to Mar/P.B. Co. Line (mi 261.64)		258.70
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

14.14 ac	8.47 ac	14.14 ac	50/50/100/>80 ft
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
>+25.0 ft NGVD	73,756 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.17 mi	9.0 ft	None Required	Public Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. Highway 1	7.76 ft	Mangrove Swamp/Shoreline	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 523 is located on the western shore of Hobe Sound within the Hobe Sound National Wildlife Refuge. Upland portions of the site are dominated by a sand pine community (413). The understory consists of sand live oak (*Quercus geminata*), rosemary (*Ceratiola ericoides*), prickly-pear cactus (*Opuntia* sp.), and wiregrass (*Aristida* sp.).

The shoreline of the site contains a mixture of mangrove swamp (612) and sparse mixed vegetation (652). The mangrove community is a mixture of red and black mangrove (*Rhizophora mangle* and *Avicennia germinans*). Other portions of the shoreline contain scattered sea grape (*Coccoloba uvifera*), Brazilian pepper (*Schinus terebinthifolius*), and railroad vine (*Ipomomea pes-capre*).

Table A-6 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 523, Martin County, Florida

Map ID No.	Name	Approximate Acreage
413	Sand Pine	13.1
612	Mangrove Swamps	0.5
652	Shorelines	0.5
	Total	**14.1**

Source: WAR, 1993

1/28/93
92-5149-3/Martin

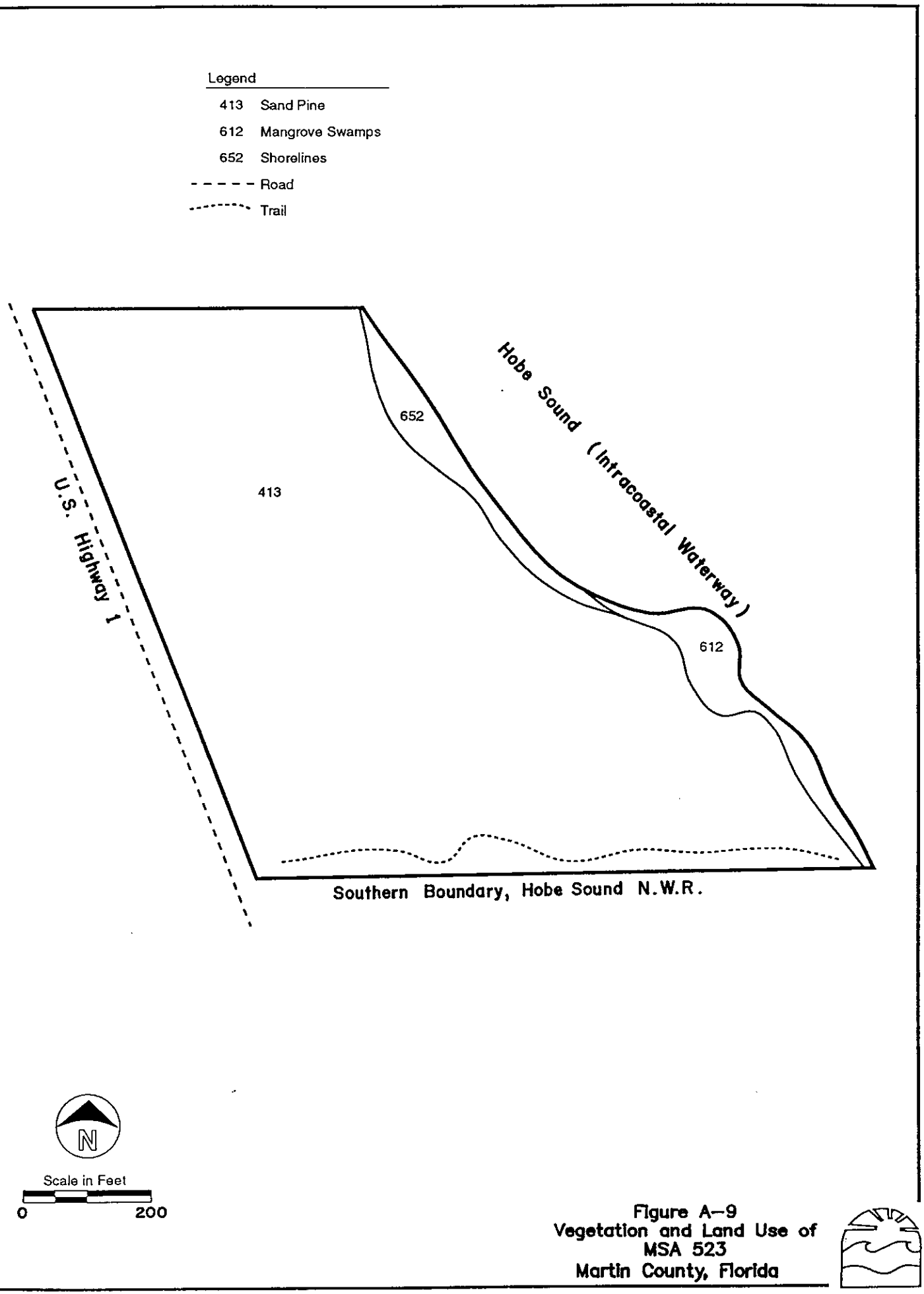


Figure A-9
Vegetation and Land Use of
MSA 523
Martin County, Florida

SITE MSA 524B DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound (ICWW)
County	**Reach #**	**Waterbody Name**
12/40S/42E	48,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Hobe Sound (mi 253.79) to Mar/P.B. Co. Line (mi 261.64)		259.17
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

15.49 ac	7.72 ac	15.49 ac	100/100/>70/50 ft
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+25.0 ft NGVD±	77,652 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.51 mi	10.0 ft	>520 ft from U.S. 1	Public Conservation/ Residential Estate
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. Highway 1	8.0 ft	Salwater Marsh/Shoreline	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 524B is located on the western shore of Hobe Sound immediately south of the Hobe Sound National Wildlife Refuge. Sand pine (413) and coastal scrub (322) communities vegetate the site's uplands. The sand pine community, located in the western portion of the site, is dominated by sand pine (*Pinus clausa*) and myrtle oak (*Quercus myrtifolia*). Understory species include rosemary (*Ceratiola ericoides*), prickly-pear cactus (*Opuntia* sp.) and saw palmetto (*Serenoa repens*). The scrub oak community is located on a bluff near the eastern edge of the site. Vegetation there consists of sand live oak (*Quercus geminata*), myrtle oaks, deer moss (*Cladonia* sp.) and greenbriar (*Smilax* sp.).

The site's shoreline is vegetated by saltwater marsh and other species (642/652). Australian pine (*Casuarina equisetifolia*) and Brazilian pepper (*Schinus terebinthifolius*) are among the species present there. Other shoreline species include sea grape (*Coccoloba uvifera*), cordgrass (*Spartina* sp.) and sea oxeye daisy (*Borrichia frutescens*). Red and white mangrove (*Rhizophora mangle* and *Laguncularia racemosa*) grow at the water's edge in the areas where sand beach is not the dominant feature.

Table A-7 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 524B, Martin County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	3.7
413	Sand Pine	10.3
642/652	Saltwater Marsh/Shoreline	1.5
	Total	**15.5**

Source: WAR, 1993

1/28/93
92-5149-3/Martin

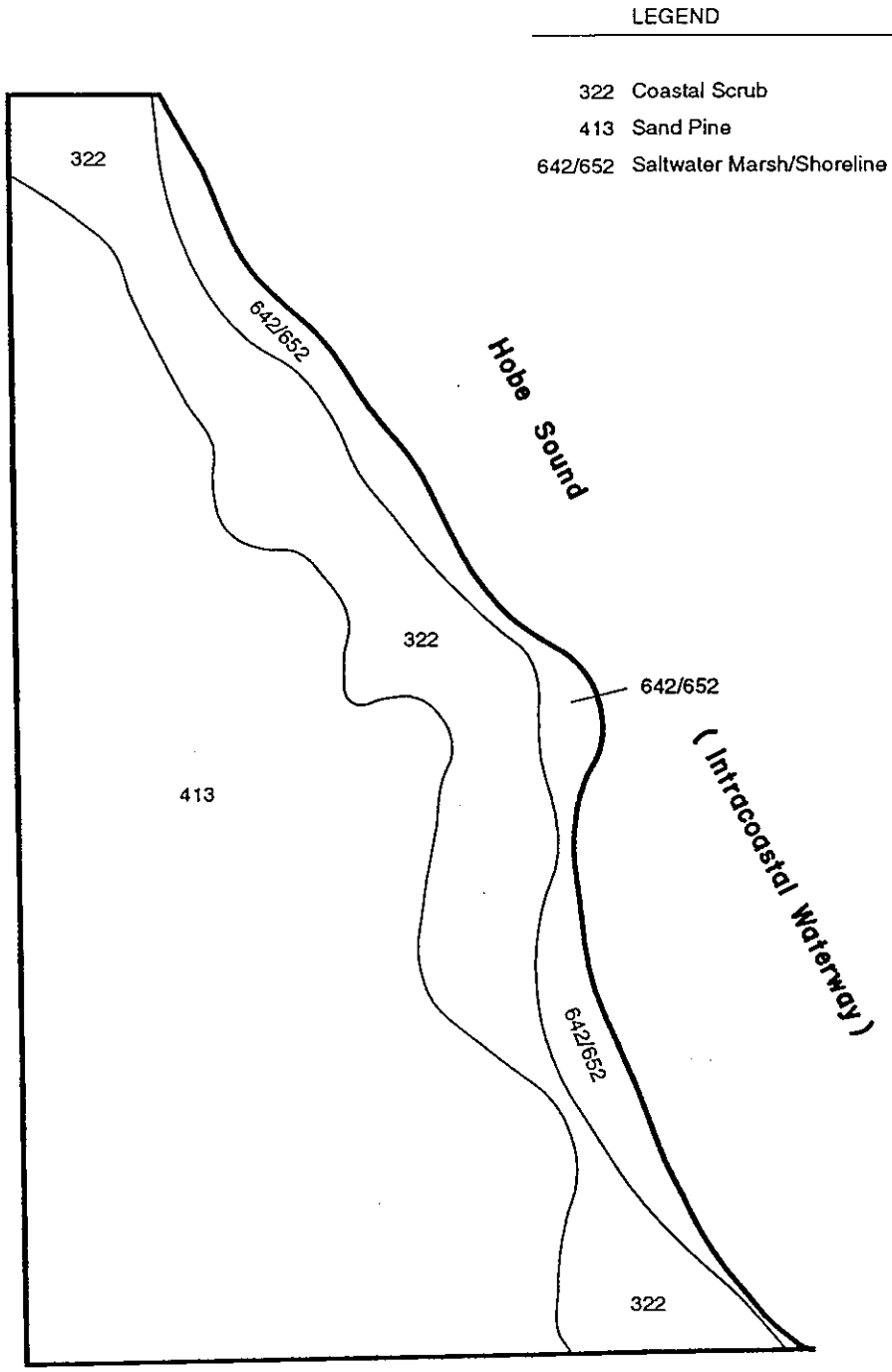
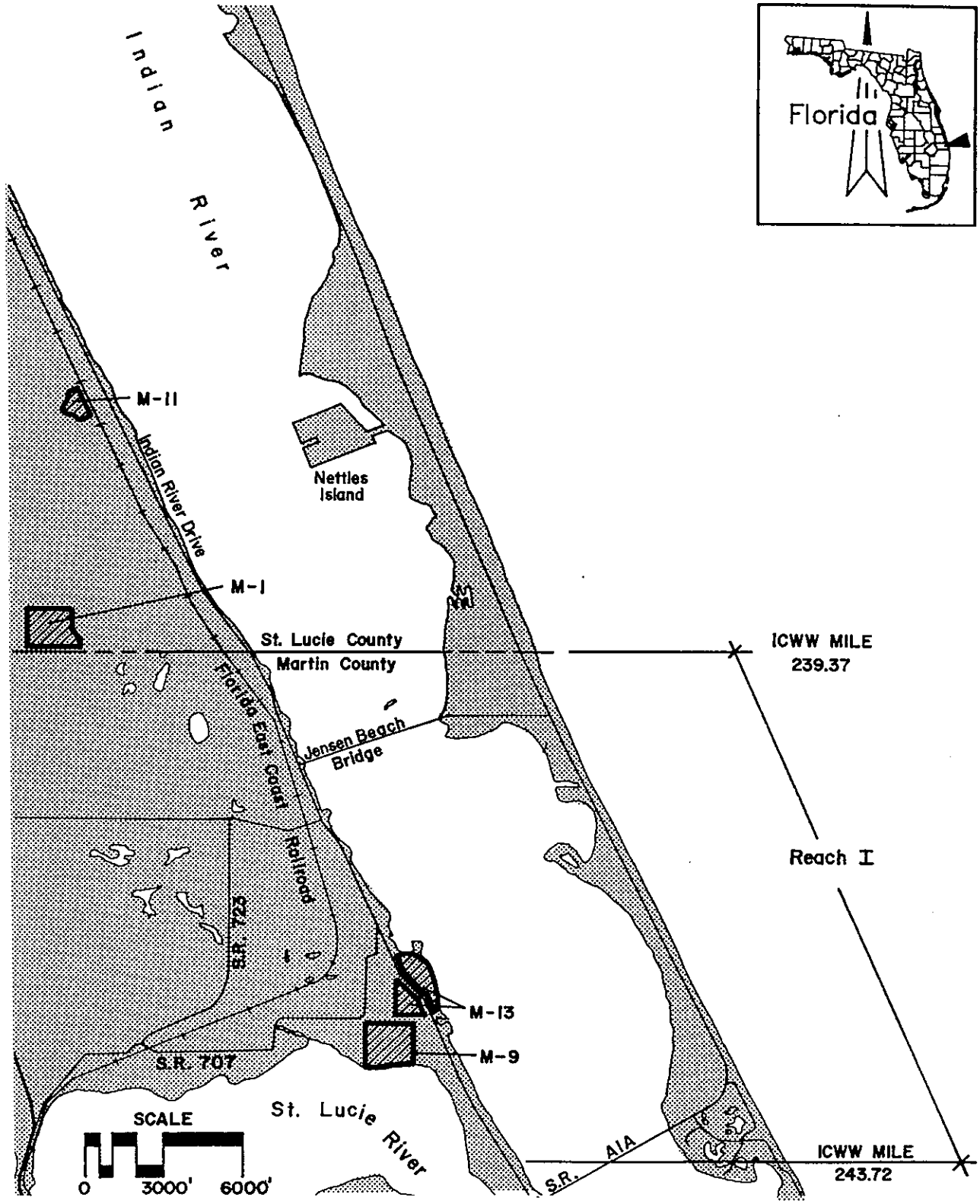


Figure A–10
Vegetation and Land Use of
MSA 524B
Martin County, Florida

APPENDIX B

Other Candidate Sites



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure B–1 Location Map Candidate Sites, Reach I Martin County, Florida	PROJECT REVISION SHEET DATE

SITE M-11 DATA SUMMARY SHEET

I General Location

St. Lucie	(Martin Co.) I	Indian River
County	**Reach #**	**Waterbody Name**
5/37S/41E	165,000 cy	1000 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Martin/St. Lucie Co. Line (mi 239.37) to SR A1A Bridge (mi 244.29)		237.18
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

16.20 ac	N/A	N/A	N/A
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
	N/A	1000 ft	Residential, Low-Density/Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
	N/A	None Required	Same
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Riverview Drive	N/A	Open water, wetland hardwood forest, freshwater marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

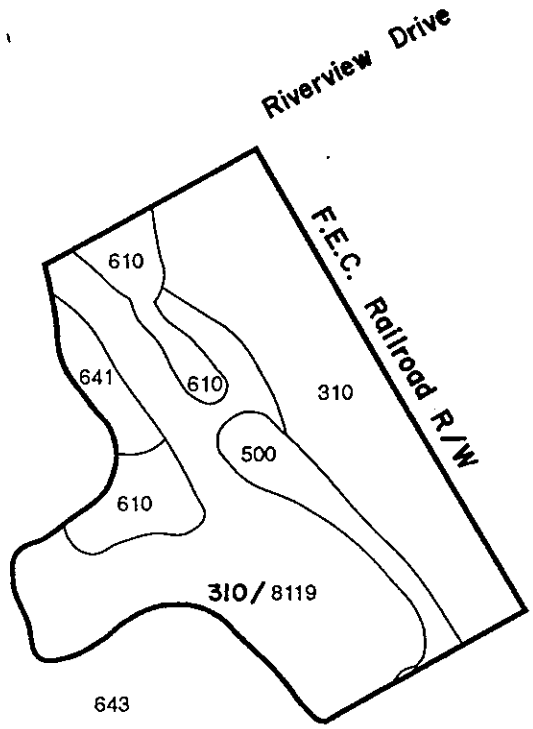
Site M-11 is located in St. Lucie County approximately two miles north of the St. Lucie/Martin County line. The site is part of a tract recently added to the Savannahs State Preserve. On-site uplands consist of a herbaceous rangeland (310) and an abandoned airstrip (8119). Dominant species include broomsedge (*Andropogon* sp.), wiregrass (*Aristida* sp.), prickly-pear cactus (*Opuntia* sp.), and Bermuda grass (*Cynodon* sp.). Sand pine (*Pinus clausa*) and sand live oak (*Quercus geminata*) are also present there. The airstrip was constructed of material dredged from an adjacent borrow pit (500). Vegetation on the old runway includes broomsedge and other grasses.

A wetland hardwoods community (610) lies in the northern portion of the site. It is dominated by a cover of cabbage palm (*Sabal palmetto*) and wax myrtle (*Myrica cerifera*). The understory is made up primarily of swamp fern (*Blechnum serrulatum*). A freshwater marsh (641) is located near the site's northwest corner. Vegetation in this wetland consists primarily of swamp fern but broomsedge also grows there. On-site wetlands and the wetland margins of the upland communities were flooded at the time of the field visit.

Table B-1 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-11, St. Lucie County, Florida

Map ID No.	Name	Approximate Acreage
310	Herbaceous Rangeland	5.8
500	Water	1.1
610	Wetland Hardwood Forests	1.8
641	Freshwater Marshes	0.8
8119	Abandoned Airport	6.7
Total		**16.2**

Source: WAR, 1993



LEGEND

310	Herbaceous Rangeland
500	Water
610	Wetland Hardwood Forests
641	Freshwater Marshes
643	Wet Prairies
8119	Abandoned Airport

Figure B–2
Vegetation and Land Use of Candidate Site M–11
St. Lucie County, Florida

SITE M-1 DATA SUMMARY SHEET

I General Location

Martin	I	Indian River (ICWW)
County	**Reach #**	**Waterbody Name**
8/37S/41E	165,000 cy	1.06 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Port St. Lucie	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
N. County Line (mi 239.37) to S.R. A1A (mi 244.29)		239.12
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

65.9 ac	12.91 ac	41.84 ac	300 ft minimum all sides
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+15 ft NGVD	165,507 cy	1.06 mi	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
6.98 mi	12 ft	None Required	Public Conservation, Residential
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Green River Parkway	5.57 ft	Streams & Waterways Freshwater Marsh	Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

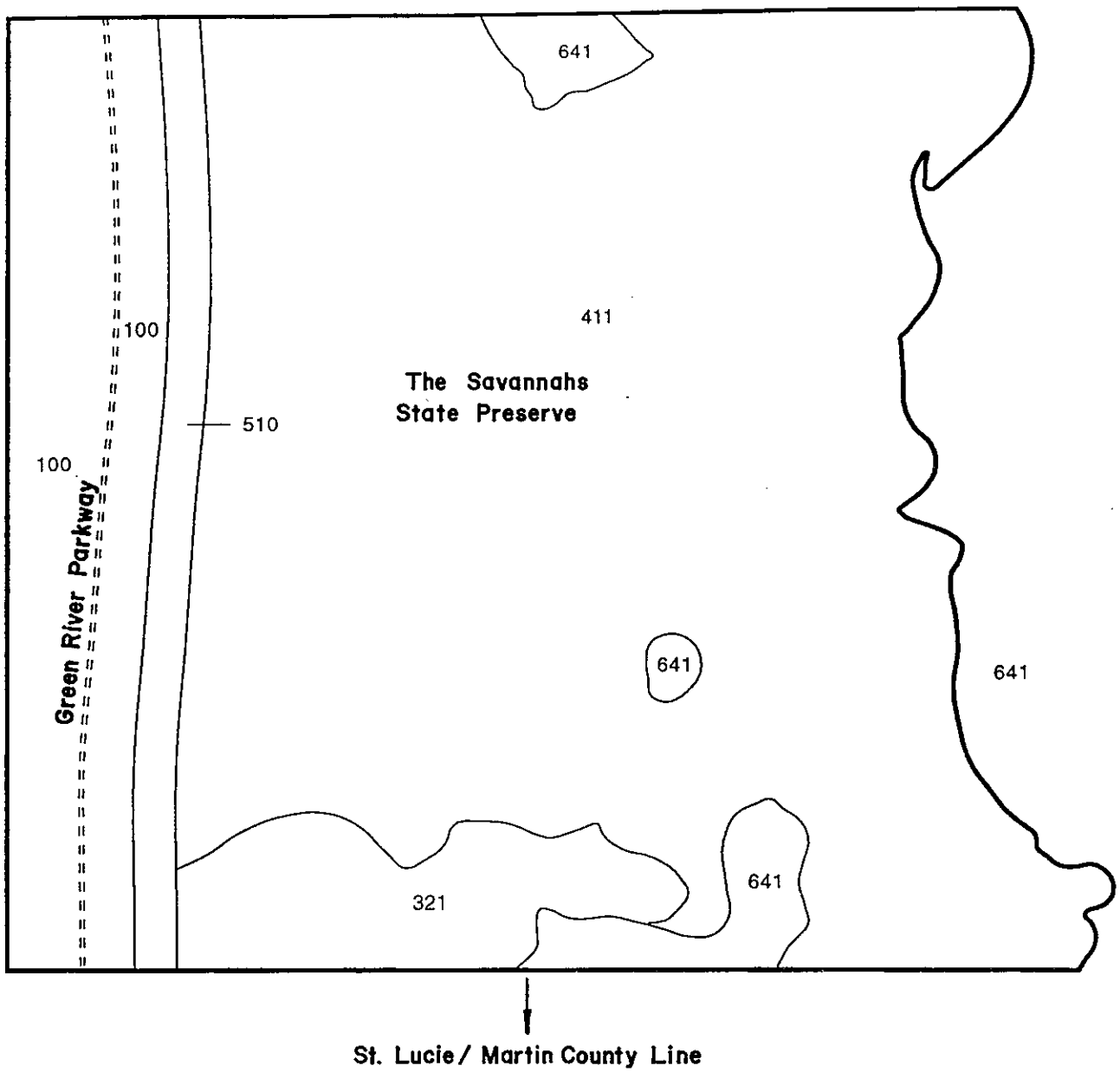
Site M-1 is located in St. Lucie County just north of the St. Lucie/Martin County line. Most of the site lies within the Savannahs State Preserve. The western part of the site, which lies outside of the preserve, contains single-family residential development (100). A large canal (510) separates the developed part of the site from the preserve land. A pine flatwoods community (411) occupies most of the site's undeveloped acreage. A palmetto prairie (321) lies near the southwestern site corner. Two freshwater marsh systems (641), one on north end and the other on south end of the site, extend into the adjacent properties. A large freshwater marsh system borders the site to the east. A smaller, isolated herbaceous wetland (641) is located in the center of the site.

Table B-2 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-1, St. Lucie County, Florida

Map ID No.	Name	Approximate Acreage
100	Urban and Built-Up	9.6
321	Palmetto Prairie	4.3
411	Pine Flatwoods	46.7
510	Streams and Waterways	2.9
641	Freshwater Marsh	2.4
	Total	**65.9**

Source: WAR, 1993

1/26/93
92-5149-3/Taylor-Martin



LEGEND

100	Urban and Built-Up
321	Palmetto Prairie
510	Streams and Waterways
411	Pine Flatwoods
641	Freshwater Marsh
= = =	Road

N

Scale in Feet

0 295

Figure B–3
Vegetation and Land Use of Candidate Site M–1
St. Lucie County, Florida

SITE M-13 DATA SUMMARY SHEET

I General Location

Martin	I	Indian River
County	**Reach #**	**Waterbody Name**
26/37S/41E	165,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Jensen Beach	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Martin/St. Lucie Co. Line (mi 239.37) to SR A1A Bridge (mi 244.27)		241.90
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

79.93 ac	E: 9.13 ac W: 7.99 ac	E: 31.23 ac W: 25.49 ac	100 - 300 ft
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+10.0 ft NGVD	E: 66,411 cy W: 58,522 cy	None Required	Low Density Residential/ Commercial (Public Institution)
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.53 mi	E: 8.0 ft W: 8.0 ft	None Required	Mixed Residential/ Commercial
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Sewall's Point Road	E: 5.42 ft W: 6.42 ft	Mangrove Swamp	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-13 is located in the City of Jensen Beach. The site encompasses the former campus of the Florida Institute of Technology. Sewalls Point Road runs diagonally from northwest to southeast through the center of the property. All of the college's buildings and infrastructure are still present on site. According to the Florida Land Use, Cover and Forms Classification System, this portion of the site is classified as "urban land in transition without positive indicators of intended activity" (193).

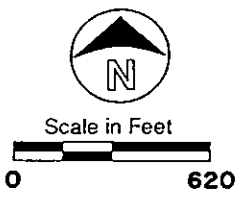
Lawn grasses, ornamental plants and citrus trees continue to flourish on the campus grounds although other plant communities are also present on the property. A pure stand of melaleuca (*Melaleuca quinquenervia*) exists near the campus entrance. A herbaceous rangeland (310) exists outside the campus complex in the northern portion of the site. Vegetation there includes grasses, sedges, Brazilian pepper (*Schinus terebinthifolius*), and cabbage palms (*Sabal palmetto*). A small cabbage palm (428) hammock exists in the southeastern property corner. This area, formerly maintained as a park, hosts a ground cover of lawn grasses. An area of mixed hardwoods (438) lies along the western edge of the property. This area is a remnant native plant community surrounded by the campus grounds. Dominant tree species within this area include sand live and myrtle oak (*Quercus geminata* and *Q. myrtifolia*), cabbage palms, and scrub hickory (*Carya floridana*). Brazilian pepper trees are also present in the disturbed portions of this community.

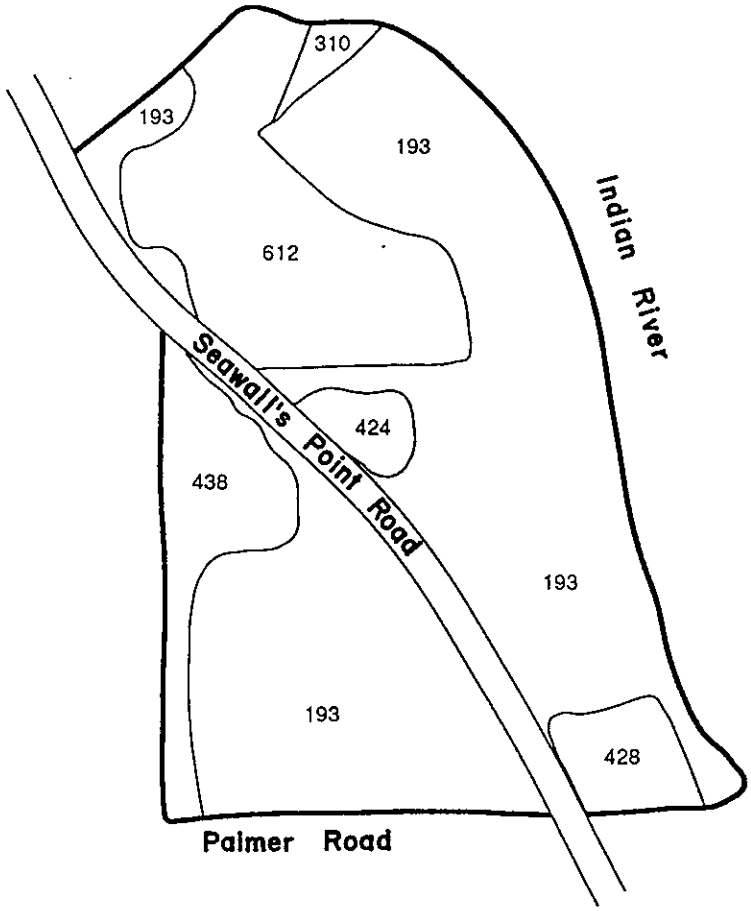
A large mangrove community (612) inhabits the northwestern property corner. It is surrounded by parking lots and portions of the campus but receives regular tidal flushing. Some dieback of red mangroves (*Rhizophora mangle*) is evident in this area.

Table B-3 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-13, Martin County, Florida

Map ID No.	Name	Approximate Acreage
193	Urban Land in Transition without Positive Indicators of Intended Activity	52.6
310	Herbaceous Rangeland	0.9
424	Melaleuca	1.6
428	Cabbage Palm	3.0
438	Mixed Hardwoods	6.4
612	Mangrove Swamps	15.4
	Total	**79.9**

Source: WAR, 1993





LEGEND

193	Urban Land in Transition without Positive Indicators of Intended Activity
310	Herbaceous Rangeland
424	Melaleuca
428	Cabbage Palm
438	Mixed Hardwoods
612	Mangrove Swamps
	Paved Road

Figure B–4
Vegetation and Land Use of Candidate Site M–13
Martin County, Florida

SITE M-9 DATA SUMMARY SHEET

I General Location

Martin	I	Indian River
County	**Reach #**	**Waterbody Name**
26,35/37S/41E	165,000 cy	1100 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Jensen Beach/Sewall's Point	4.92 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Martin/St. Lucie Co. Line (mi 239.37) to SR A1A Bridge (mi 244.29)		242.46
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

107.8 ac	N/A	N/A	N/A
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
> +25.0 ft NGVD	N/A	< 1100 ft	Residential, Low-Density/Estate Density
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.89 mi	N/A	None Required	Same
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Sewall's Point Drive to Palmer Road	N/A	None	Reservoirs
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

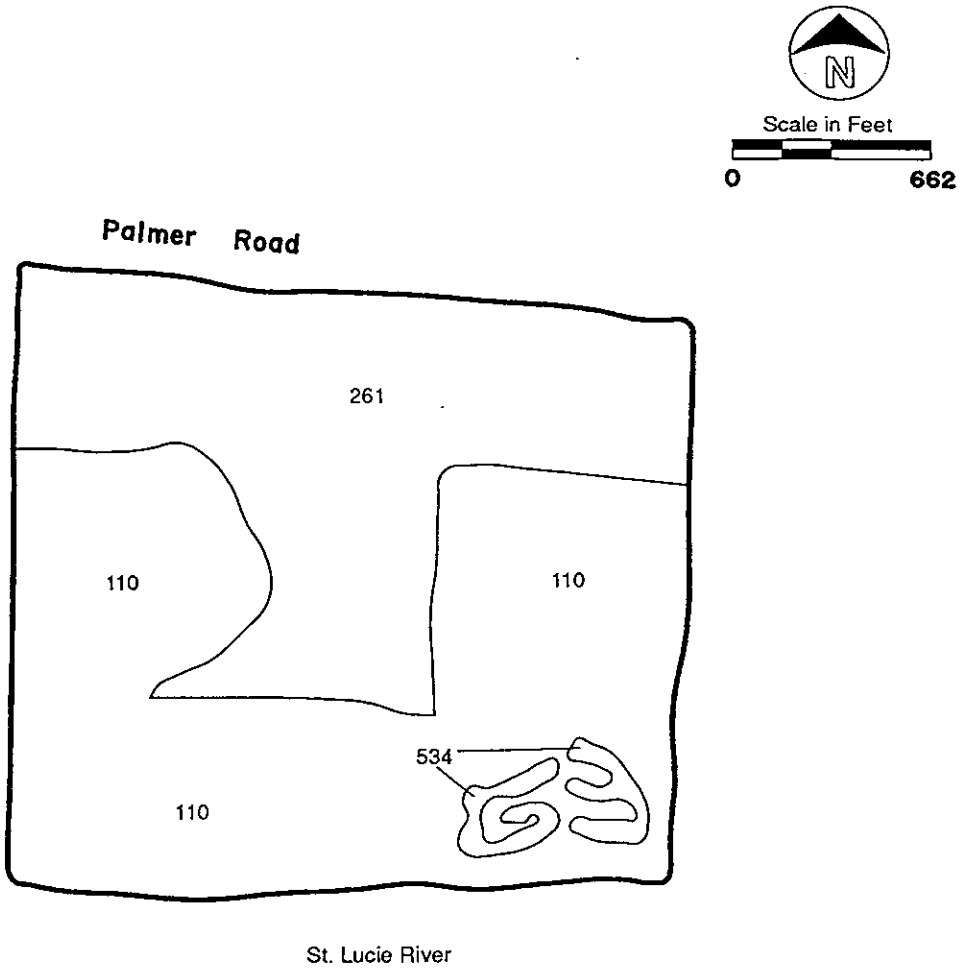
Site M-9 is located approximately one mile west of the ICWW, immediately south of Palmer Road. The southern portion of the site consists mostly of low density residential development (110). Construction on portions of the land was evident at the time of the field visit, although only privacy walls existed in some of the developed area. A system of reservoirs (534) is located near the southeastern site corner.

Fallow crop land (261) in the northern portion of the site consists primarily of old citrus groves that have not been maintained. Citrus trees (*Citrus* sp.) are scattered sparsely throughout this area. Ground cover species include natal grass (*Rhynchelytrum* sp.), Bermuda grass (*Cynodon* sp.), camphorweed (*Hetertheca subaxillaris*) with a few trees including Brazilian pepper (*Schinus terebinthifolius*) and sand live oak (*Quercus geminata*).

Table B-4 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-9, Martin County, Florida

Map ID No.	Name	Approximate Acreage
110	Residential Low Density	61.4
261	Fallow Crop Land	43.9
534	Reservoir	2.5
	Total	**107.8**

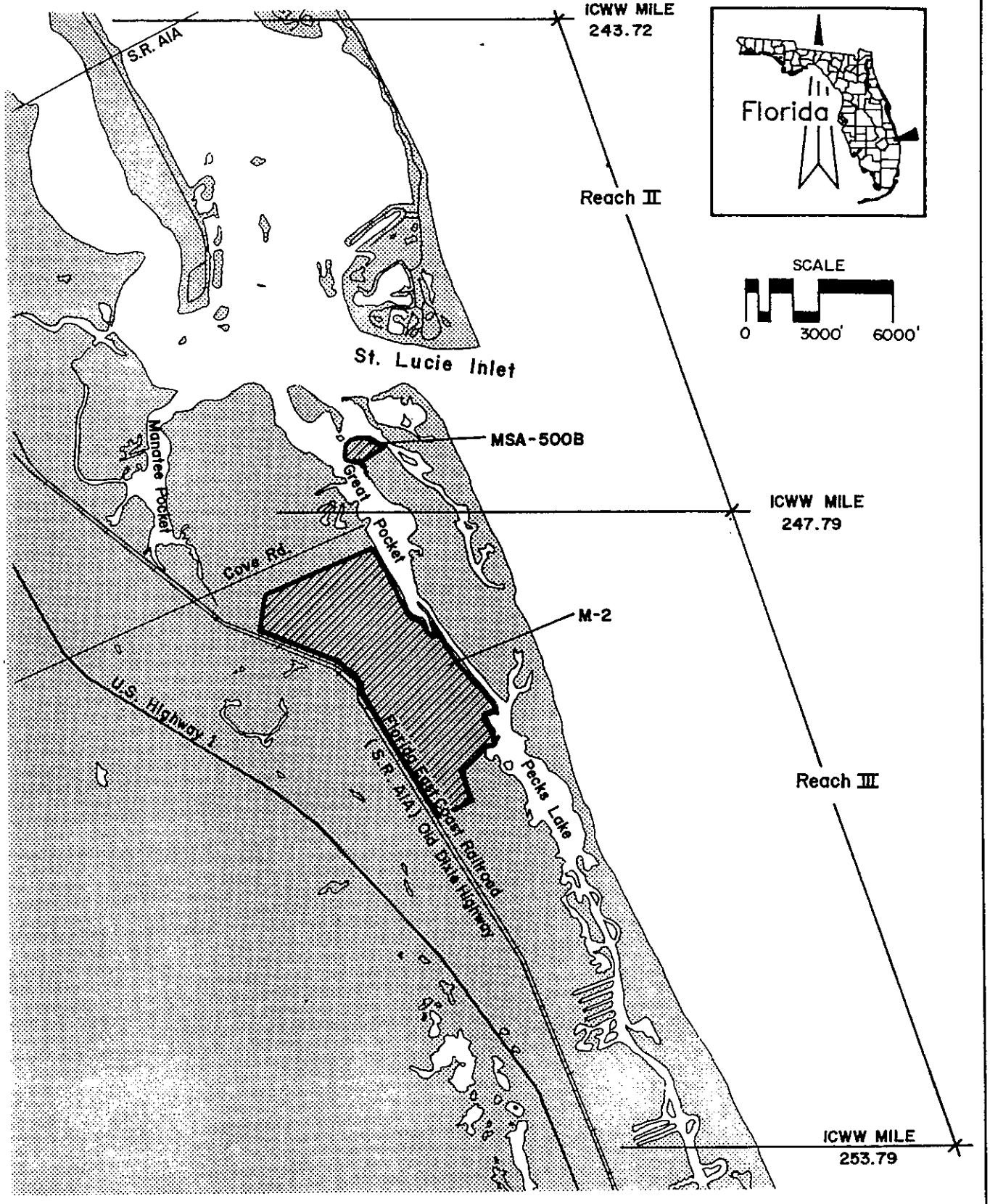
Source: WAR, 1993



LEGEND

110	Residential, Low Density
261	Fallow Crop Land
534	Reservoir

Figure B–5
Vegetation and Land Use of Candidate Site M–9
Martin County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure B–6 Location Map Candidate Sites, Reaches II and III Martin County, Florida	PROJECT REVISION SHEET DATE

SITE MSA 500B DATA SUMMARY SHEET

I General Location

Martin	II	St. Lucie Inlet/Great Pocket (ICWW)
County	**Reach #**	**Waterbody Name**
20/38S/42E	2,423,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	3.50 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. A1A Bridge (mi 244.29) to Great Pocket (mi 247.79)		247.20
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

96.0 ac	7.45 ac	10.40 ac	Minimal Upland Buffer
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
< +5.0 ft NGVD	73,894 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.00 mi	10 ft	No Upland Access	Open Water/Public Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
No Upland Access	3.32 ft	Mangrove Swamp	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 500B, an existing FIND easement, is located on the eastern shore of Great Pocket. The upland portions of the site were created by the deposition of material dredged from the ICWW channel. A pure stand of Australian pine (437) is present in the western part of the site. A mixture of Brazilian pepper (*Schinus terebinthifolius*) and Australian pine (*Casuarina equisetifolia*) (422/437) occupy a recently disturbed area on the northwest side of the site. Other species in this community include cabbage palm (*Sabal palmetto*) and herbaceous ground cover. A small upland hardwood forest is located in the southwestern portion of the site. Red bay (*Persea borbonia*), cabbage palm (*Sabal palmetto*), and strangler fig (*Ficus aurea*) are the predominant species in this area.

The wetland communities on site consist of pure or mixed mangrove swamps (612). The mangrove areas on the south and east sides of the site contain red and black mangrove (*Rhizophora mangle* and *Avicennia germinans*), sea grape (*Coccoloba uvifera*), Australian pine, and a few Brazilian pepper. The swamps on the west and north sides consist primarily of red mangrove. Brazilian pepper fringe the upland edge of these swamps.

Table B-5 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 500B, Martin County, Florida

Map ID No.	Name	Approximate Acreage
422/437	Brazilian Pepper/Australian Pine	3.6
437	Australian Pine	6.8
612	Mangrove Swamps	19.1
652	Shorelines	0.6
Total		**30.1**

Source: WAR, 1993

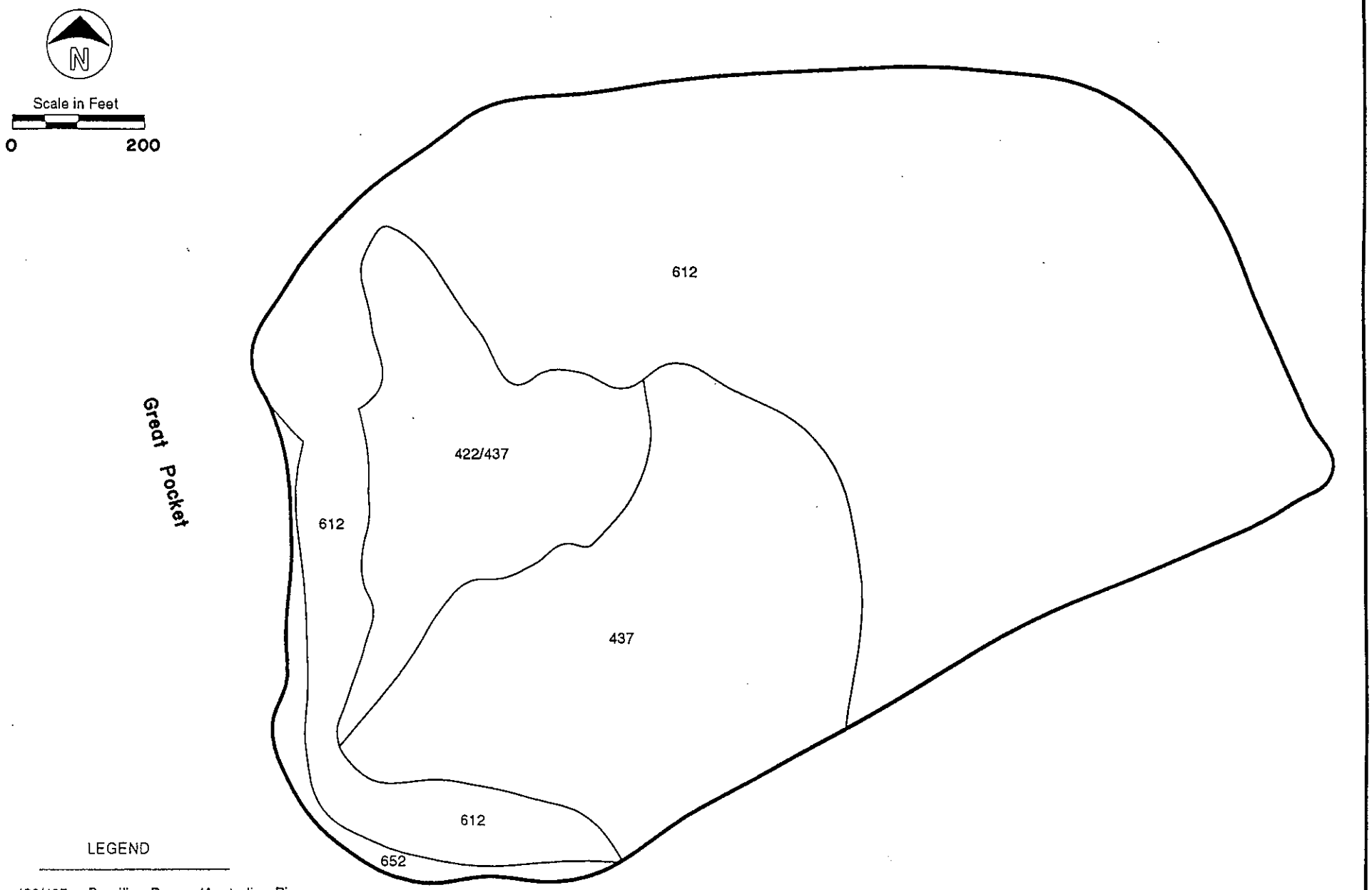


Figure B–7
Vegetation and Land Use of MSA 500B
Martin County, Florida

SITE M-2 DATA SUMMARY SHEET

I General Location

Martin	III	Great Pocket/Peck Lake
County	**Reach #**	**Waterbody Name**
29,32,33/38S/42E	90,000 cy	0.14 mi to 0.41 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	6.0 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Vic. of Great Pocket (mi 247.79) to Vic. of Hobe Sound (mi 253.79)		248.37
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

1095.3 ac	10.0 ac	36.45 ac	300 ft minimum all sides
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+15 ft NGVD	99,909 cy	0.14 mi to 0.41 mi	Residential Estate, Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.56	10 ft	None Required	Undeveloped/Residential
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
S.R. A1A (Old Dixie Highway)	4.63 ft	Wetland Forested Mixed, Mangrove Swamp	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-2 is located on the western shore of the ICWW at the southern end of Great Pocket. Cove Road lies along the northern site boundary and S.R. A1A lies along the western boundary. Much of the western half of the site contains coastal scrub vegetation (322). This site is being considered for purchase under the State of Florida's CARL program because of the presence of this large, relatively undisturbed, coastal scrub community. The scrub area contains a dense cover of sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia*), and saw palmetto (*Serenoa repens*). Scattered sand (*Pinus clausa*) and slash pine (*Pinus elliottii*) are also present in the northern portion of the community. The south and central areas of the community are more open and contain bare sand patches and rosemary (*Ceratiola ericoides*). The western half of the site also contains a sand pine (413) community and is separated from the eastern half of the site by a band of pine flatwoods (411).

The eastern half of the site consists mainly of two bands of wetlands oriented along north-south axes. The western band is wetland forest mixed (630) and the band adjacent to the ICWW consists of mangrove swamp (612) and pockets of shoreline/Australian pine (652/437).

The southern end of the site is being developed as a residential community called Loblolly Pines Golf Club.

Table B-6 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-2, Martin County, Florida

Map ID No.	Name	Approximate Acreage
100	Urban and Built-Up	159.4
322	Coastal Scrub	403.5
411	Pine Flatwoods	92.6
413	San Pine	90.0
612	Mangrove Swamp	125.0
630	Wetland Forested Mixed	204.6
652/437	Shoreline Australian Pine	14.8
740	Disturbed Land	5.4
	Total	**1095.3**

Source: WAR, 1993

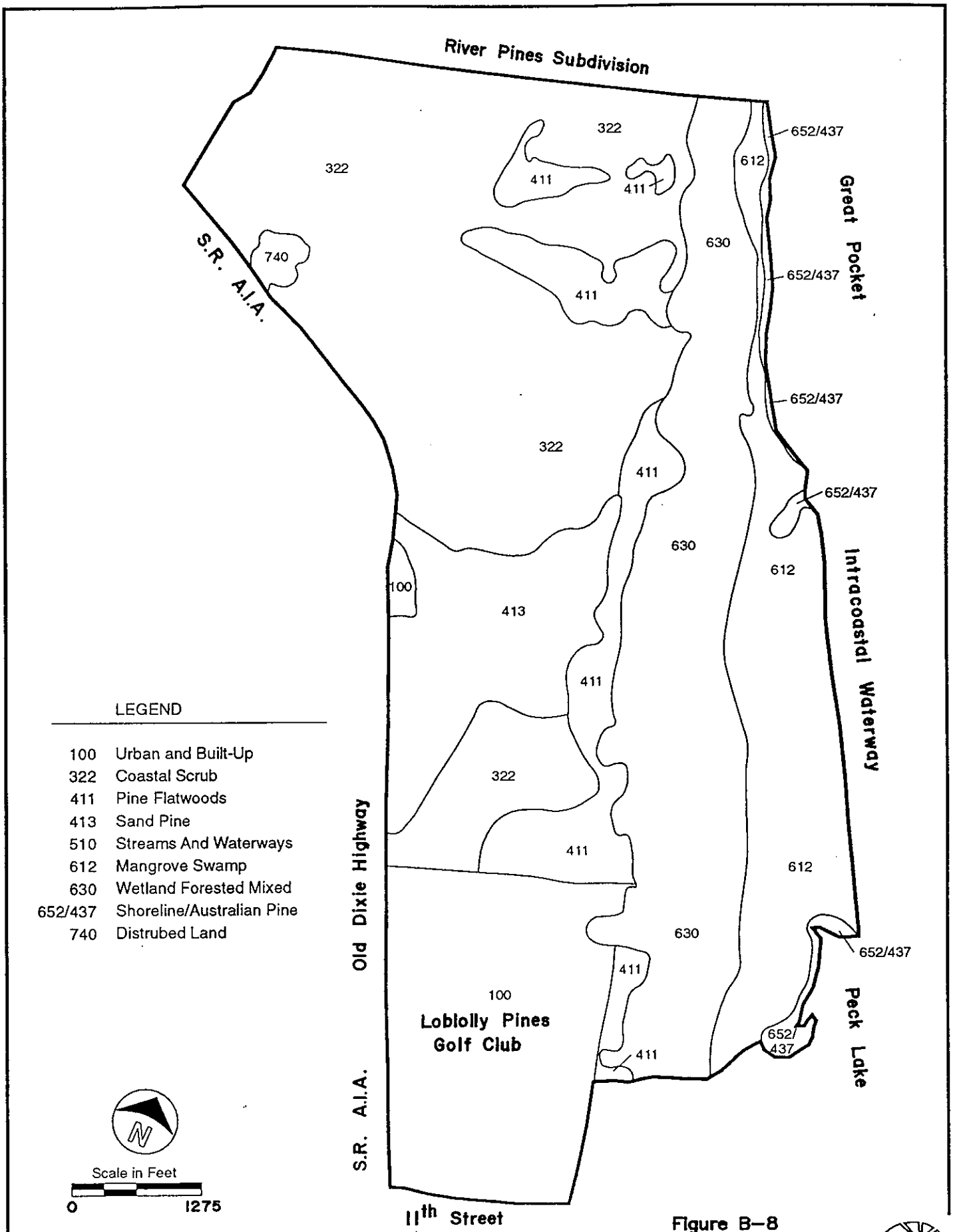
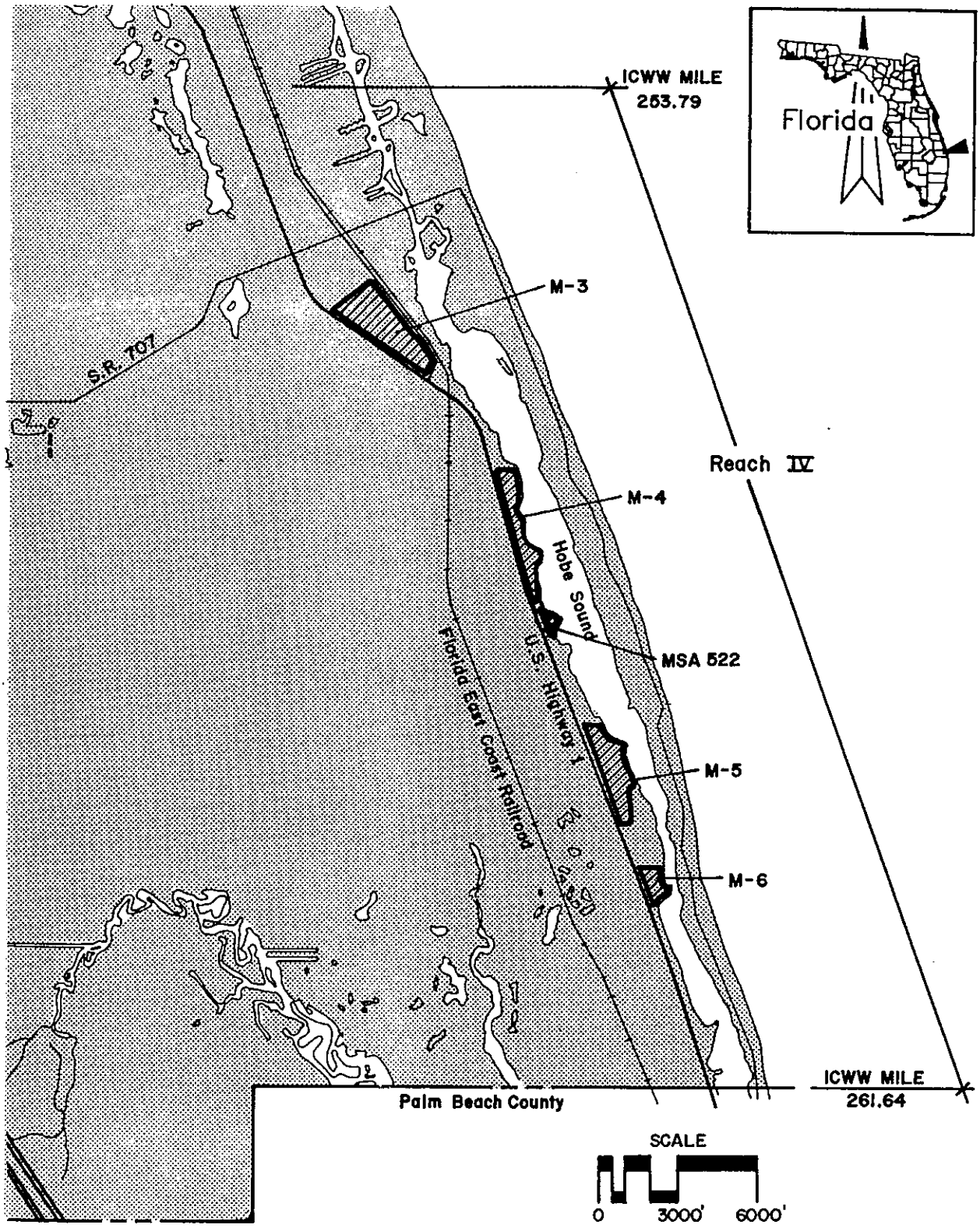


Figure B–8
Vegetation and Land Use of
Candidate Site M–2
Martin County, Florida



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure B–9
Location Map
Candidate Sites,
Reach IV
Martin County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

SITE M-3 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound (ICWW)
County	**Reach #**	**Waterbody Name**
26/39S/42E	48,000 cy	700 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Hobe Sound	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Vic. Hobe Sound (mi 253.79) to S. County Line (mi 261.64)		255.60
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

137.8 ac	6.94 ac	20.72 mi	200 ft minimum all sides
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
> +25 ft NGVD	49,817 cy	0.13 mi	General
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.92 mi	8 ft	None Required	Muni. Well Field, Treatment Plant, Hobe Sound NWR, Residential
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. 1	3.96 ft	None	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-3 is located northwest of the intersection of U.S. Highway 1 and S.R. A1A. Highway lies along the site's southwestern boundary and A1A lies to the northeast. The northern portion of the site is mostly developed land (100/413) consisting of a water treatment facility and several residences. Undeveloped land within the area is vegetated with sand pine (*Pinus clausa*). The southern portion of the site contains a sand pine community (413). Vegetation cover in this community includes a canopy of large sand pine (10-12" dbh), saw palmetto (*Serenoa repens*), rosemary (*Ceratiola ericoides*), myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus geminata*), and deer moss (*Cladonia sp.*). Small quantities of sand spike moss (*Selaginella arenicola*), a species listed by the state as threatened, exists in this community. The scrub lizard (*Sceloporus woodi*), a candidate for federal listing, inhabits portions of the site.

There is a small disturbed area near S.R. A1A that may have served as a sand borrow site. The native sand pine community vegetation has been removed from the area. Brazilian pepper (*Schinus terbinthifolius*), muscadine (*Vitis rotundifolia*), and sneezeweed (*Heterotheca subaxillaris*) now grow there.

Table B-7 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-3, Martin County, Florida

Map ID No.	Name	Approximate Acreage
100/413	Urban and Built-Up/Sand Pine	65.9
413	Sand Pine	70.3
740	Disturbed Land	1.6
Total		**137.8**

Source: WAR, 1993

LEGEND

100/413	Urban and Built-Up/Sand Pine
413	Sand Pine
740	Disturbed Land

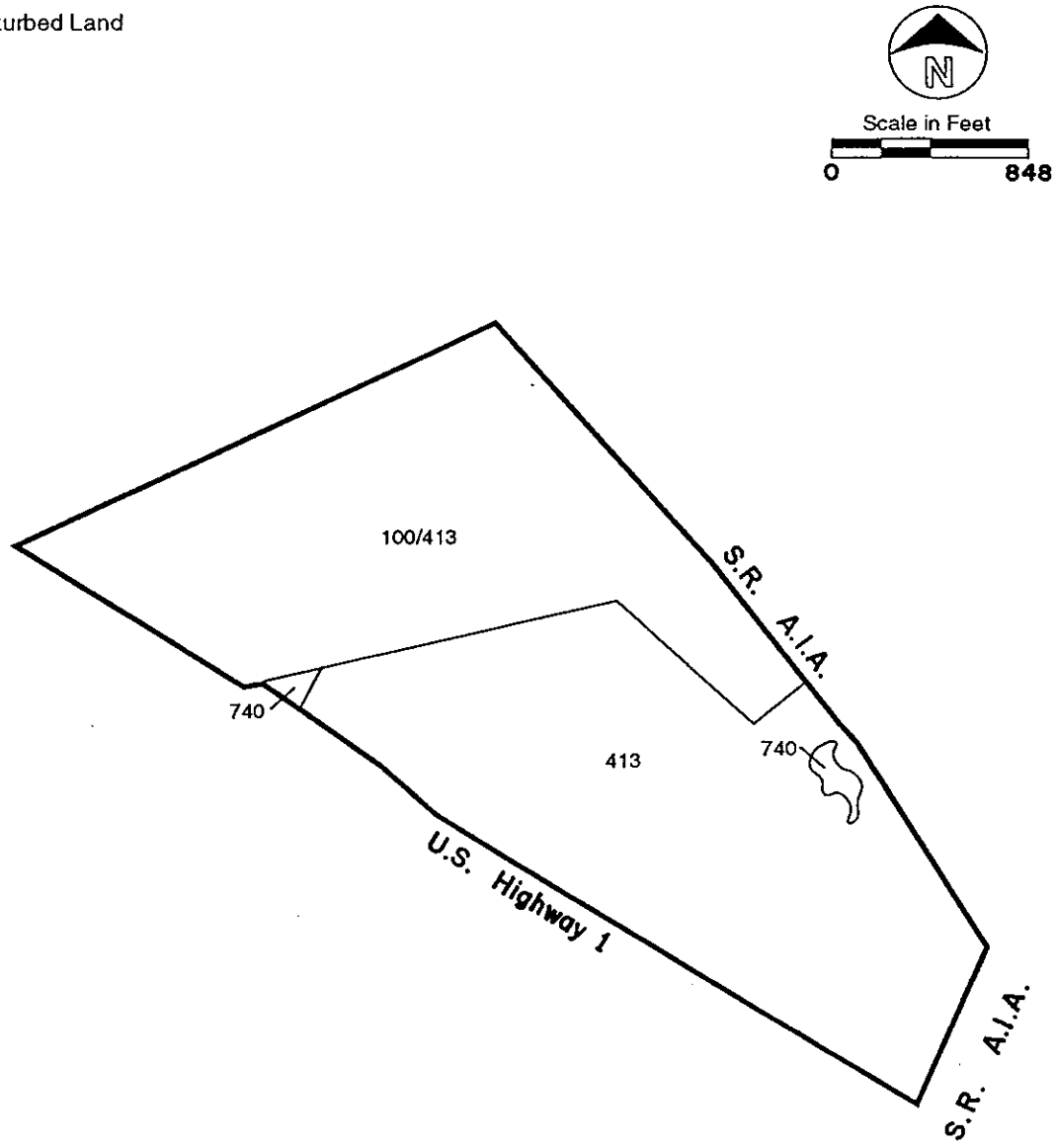


Figure B–10
Vegetation and Land Use of
Candidate Site M–3
Martin County, Florida

SITE M-4 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound (ICWW)
County	**Reach #**	**Waterbody Name**
35/39S/42E 1/40S/42E	48,000 cy	On western shore of Hobe Sound
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Vic. Hobe Sound (mi 253.79) to S. County Line (mi 261.64)		256.74
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

71.4 ac	8.63 ac	22.98 ac	100 ft W, 300 ft S,E,& W
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
+20 ft NGVD	49,265 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.12 mi	7 ft	None Required	Hobe Sound National W.R.
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. 1	3.05 ft	Mangrove Swamp	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-4 is located on the western shore of Hobe Sound within the Hobe Sound National Wildlife Refuge. It lies immediately south of the Refuge headquarters and includes a nature trail associated with the headquarters facility. Sand pine communities (413) are present in the northern and southern ends of the site. The central part of the site contains a coastal scrub community (322).

The sand pine communities are dominated by 8-10" dbh sand pine (*Pinus clausa*), rosemary (*Ceratiola ericoides*), myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus myrtifolia*), and saw palmetto (*Serenoa repens*). Deer moss (*Cladonia sp.*) covers the ground in some areas and prickly-pear cactus (*Opuntia sp.*, listed by the state as threatened) is also present there. Florida scrub lizards (federal candidate species) inhabit portions of these communities.

The cover in the coastal scrub community ranges from a thick oak scrub to bare sand patches with only scattered scrub. The scrub vegetation is similar to that of the sand pine communities on site but lacks sand pine trees. Suitable habitat exists on site for the state and federally threatened Florida scrub jay.

Mangrove wetlands containing Australian pine (612/437) fringe the eastern site shoreline. In addition to black mangrove (*Avicennia germinans*), red mangrove (*Rhizophora mangle*), and Australian pine (*Casuarina equisetifolia*), this area is vegetated with a diverse mixture of plants including leather fern (*Acrostichum sp.*), Brazilian pepper (*Schinus terebinthifolius*), and swamp fern (*Blechnum serrulatum*).

Table B-8 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-4, Martin County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	30.3
412	Sand Pine	31.0
612/437	Mangrove Swamp/Australian Pine	10.1
Total		**71.4**

Source: WAR, 1993

1/27/93
92-5149-3/Martin

LEGEND

322 Coastal Scrub
413 Sand Pine
612/437 Mangrove Swamp/Australian Pine

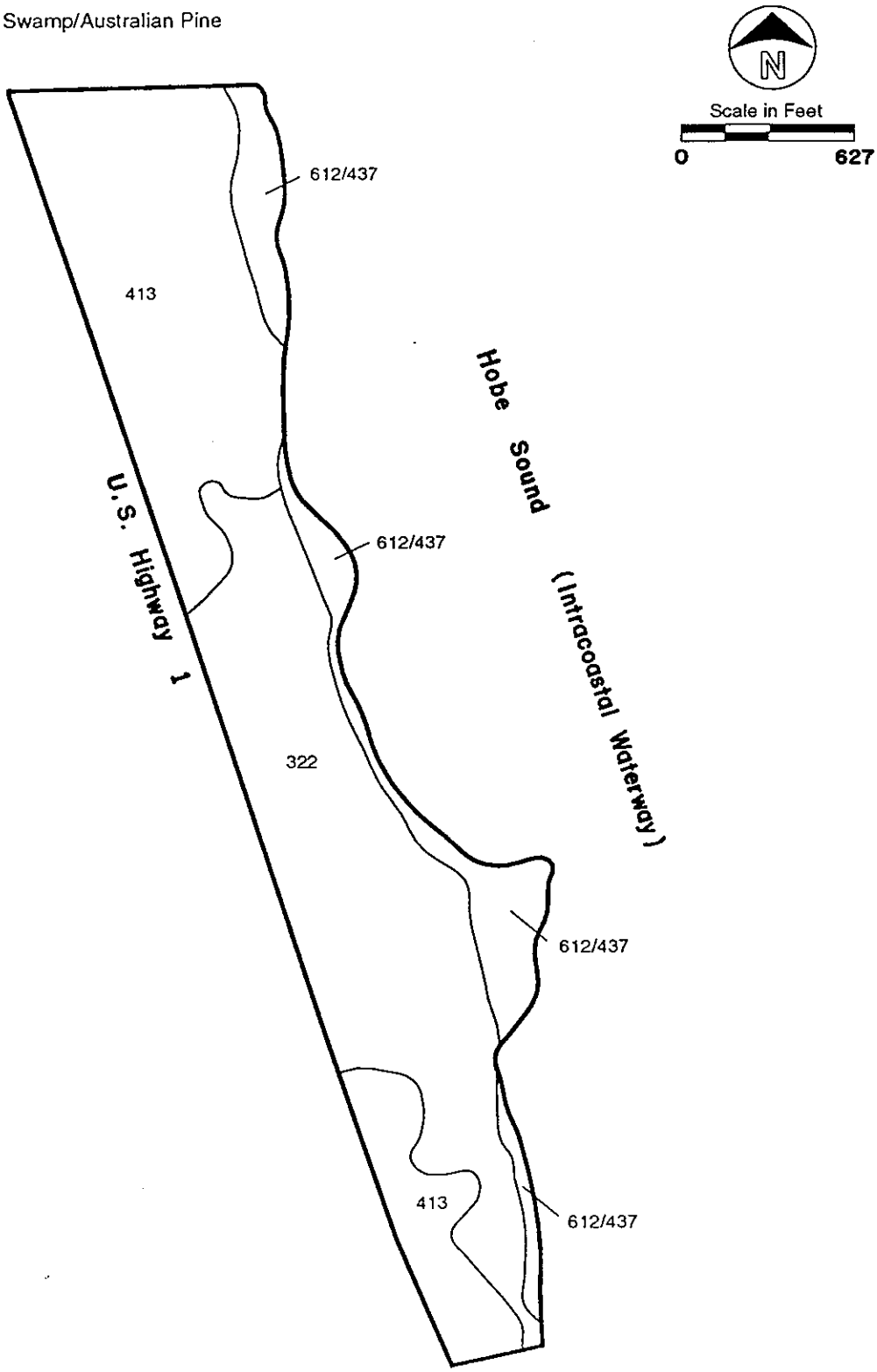


Figure B–11
Vegetation and Land Use of
Candidate Site M–4
Martin County, Florida

SITE MSA 522 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound (ICWW)
County	**Reach #**	**Waterbody Name**
1/40S/42E	48,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Hobe Sound (mi 253.79) to Mar/P.B. Co. Line (mi 261.64)		257.88
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

10.09 ac	Insufficient Upland	N/A	N/A
Area of Easement	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+0 to +25.0 ft NGVD	N/A	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.35 mi	N/A	250 ft from U.S. 1	Public Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. Highway 1	N/A	Wetland Forested Mixed, Veg. Non-Forested Wetland	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 522 is an existing FIND easement located on the western shore of Hobe Sound within the Hobe Sound National Wildlife Refuge. Vegetation in the upland portion of the property is dominated by a sand pine community (413). This area contains a sand pine (*Pinus clausa*) overstory and a ground cover of scrub live oak (*Quercus geminata*), saw palmetto (*Serenoa repens*), rosemary (*Ceratiola ericoides*), and deer moss (*Cladonia sp.*). Few pines grow on the bluff adjacent to the sound shoreline although shrubs typical of the sand pine community are abundant.

A mixed forested wetland (630) lines the shore of the site. It contains a mixture of freshwater and estuarine plant species. Australian pine (*Casuarina equisetifolia*), leather fern (*Acrostichum sp.),* and swamp fern *(Blechnum serrulatum*) are present in the freshwater portion of the wetland. Red mangrove (*Rhizophora mangle*) is present in the tidally influenced portion, with an almost pure stand at the water's edge. A vegetated, non-forested wetland (640), dominated by swamp fern (*Blechnum serrulatum*), lies near the center of the forested wetland.

Table B-9 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 522, Martin County, Florida

Map ID No.	Name	Approximate Acreage
413	Sand Pine	3.7
630	Wetland Forested Mixed	6.0
640	Vegetated Non-Forested Wetlands	0.4
	Total	**10.1**

Source: WAR, 1993

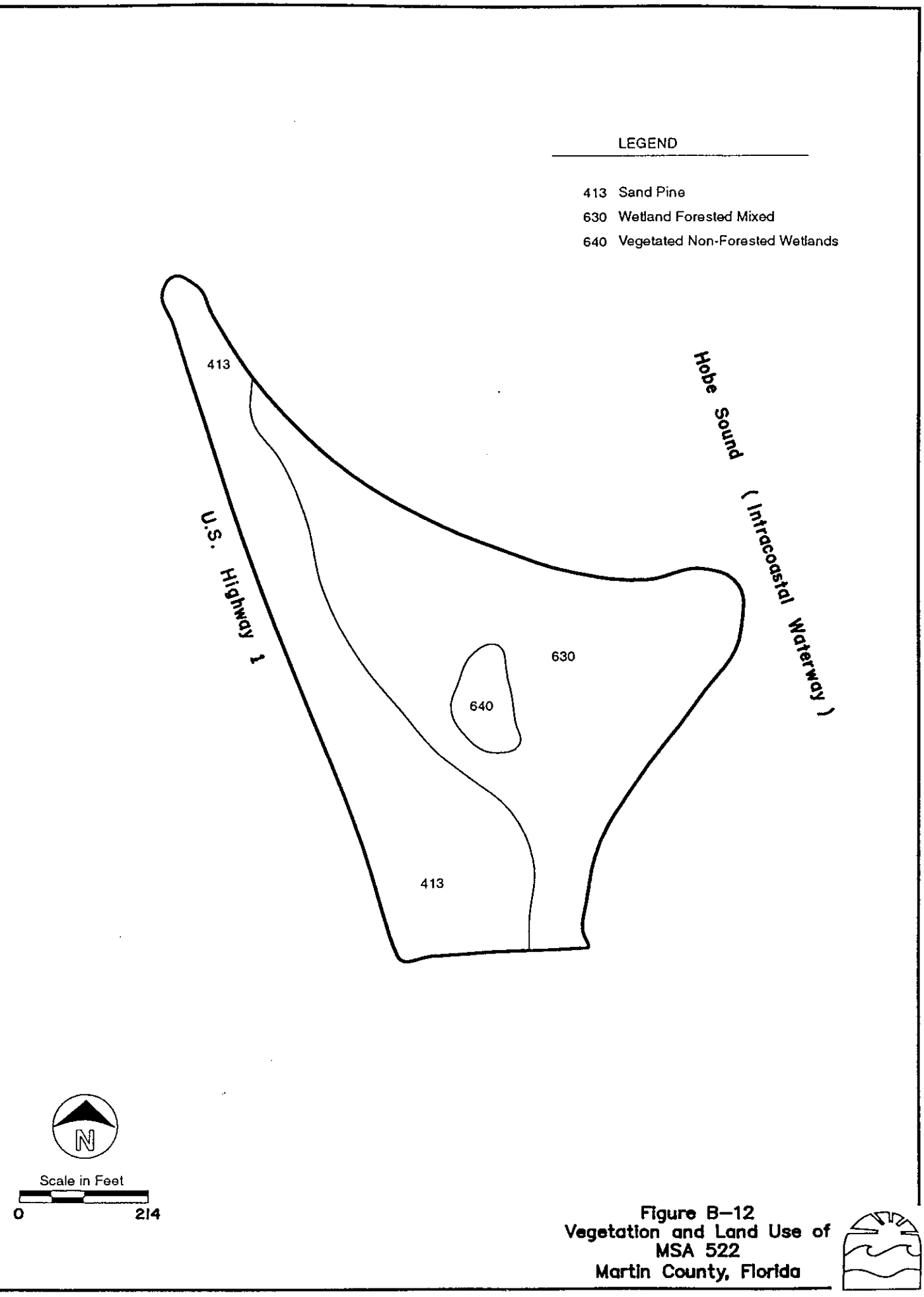


Figure B–12
Vegetation and Land Use of
MSA 522
Martin County, Florida

SITE M-5 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe Sound
County	**Reach #**	**Waterbody Name**
12/40S/42E	48,000 cy	On western shore of Hobe Sound
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
	7.85 mi	Class III
Municipality	**Reach Length**	**DER Receiving Water**
Vic. Hobe Sound (mi 253.79) to S. County Line (mi 261.64)		258.87
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

58.2 ac	6.94 ac	30.36 ac	300 ft minimum all sides
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
> +20 ft NGVD	49,817 cy	None Required	Public Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.34 mi	8 ft	None Required	Hobe Sound National W.P.
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. Highway 1	3.96 ft	Mangrove Swamp	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-5 is located on the western shore of Hobe Sound within the Hobe Sound National Wildlife Refuge. The western portion of the site contains a sand pine community (413), while the center of the site is dominated by a scrub community (322). A sharp change in elevation along the shoreline of the site marks the eastern edge of the scrub community. A narrow band of mangrove swamp with Australian pine (612/437) fringes the Hobe Sound shoreline bordering the ICWW.

The sand pine community contains sand pine (*Pinus clausa*), rosemary (*Ceratiola ericoides*), myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus myrtifolia*), and saw palmetto (*Serenoa repens*). Deer moss (*Cladonia sp.*), prickly-pear cactus (*Opuntia sp.*, listed by the state as threatened), and large-flowered rosemary (*Conradina grandiflora*, Florida endangered; federal candidate species) form the ground cover in this area.

Much of the scrub community contains thick oak scrub although some areas contain only scattered scrub. The scrub vegetation is similar to that of the sand pine communities on site but lacks sand pine trees. Suitable habitat exists on site for the state and federally threatened Florida scrub jay.

The mangrove wetlands vegetation is dominated by black mangrove (*Avicennia germinans*), red mangrove (*Rhizophora mangle*), Australian pine (*Casuarina equisetifolia*), and Brazilian pepper (*Schinus terebinthifolius*). Ground cover there includes leather fern (*Acrostichum sp.*) and swamp fern (*Blechnum serrulatum*).

Table B-10 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site M-5, Martin County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	8.9
413	San Pine	47.0
612/437	Mangrove Swamp/Australian Pine	2.3
Total		**58.2**

Source: WAR, 1993

LEGEND

322	Coastal Scrub
413	Sand Pine
510	Streams and Waterways
612/437	Mangrove Swamp/Australian Pine

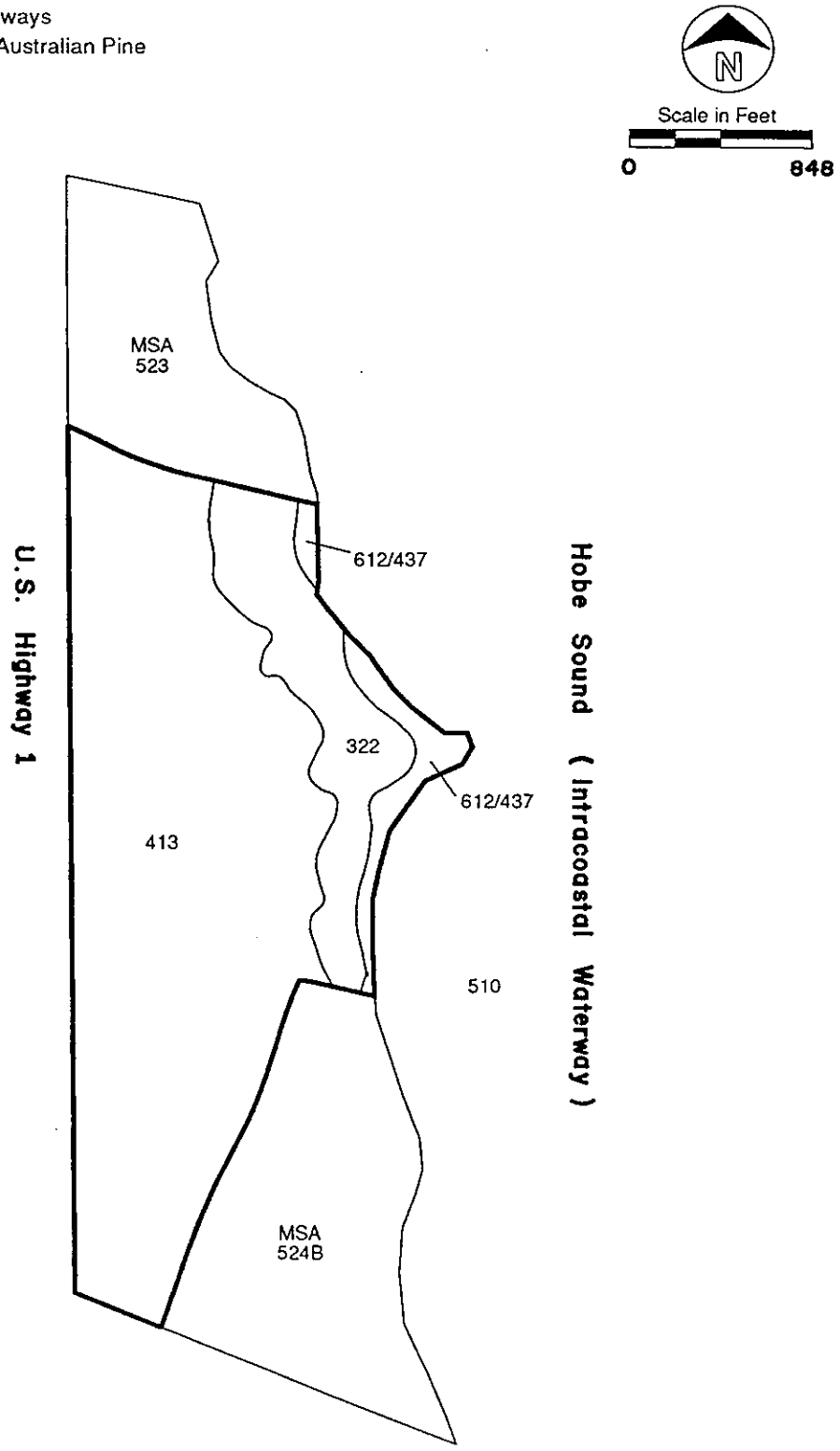


Figure B–13
Vegetation and Land Use of
Candidate Site M–5
Martin County, Florida

SITE M-6 DATA SUMMARY SHEET

I General Location

Martin	IV	Hobe & Jupiter Sound (ICWW)
County	**Reach #**	**Waterbody Name**
13/40S/42E, 18/40S/43E	48,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
N/A	7.85 mi	III
Municipality	**Reach Length**	**DER Receiving Water**
Vic. Hobe Sound (mi 253.79) to S. County Line (mi 261.64)		259.94
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

14.73 ac	5.75 ac	14.73 ac	100 ft All Sides
Initial Site Area	**Containment Area**	**Total Area Required**	**Buffer Width N,S,E,& W**
> +20 ft NGVD	41,808 cy	300 ft	Residential Estate
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
6.24 mi	8 ft	None Required	Residential Estate
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
U.S. Highway 1	5.41 ft	None	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site M-6 has recently been developed as "Indian Hills," a single-family residential community. Therefore, it was dropped from further consideration as a candidate site. This site was not mapped.

APPENDIX C

Width of Dike at Grade, B_G

$$B_G = 2HS + T \quad (1)$$

Width of Dike at Excavated Grade, B_g

$$B_g = 2HS + T + (G - g)\,S \quad (2)$$

Width of Dike at Depth of Freeboard and Ponding, B_F

$$B_F = 2FS + T \quad (3)$$

Volume of Dike Material Required, V_{MR}

$$V_{MR} = \tfrac{1}{2}H\,(T + B_G)\,P \quad (4)$$

Volume of Dike Material Available on Site, V_{MA}

$$V_{MA} = (G - g)[A - \tfrac{1}{2}P_I\,(B_g - B_G)] \quad (5)$$

Volume of Disposal Capacity, V_D

$$V_D = V_{MA} + (H - F)\left\{A + \tfrac{1}{2}P_I[B_G - (H - F)\,S - B_F]\right\} \quad (6)$$

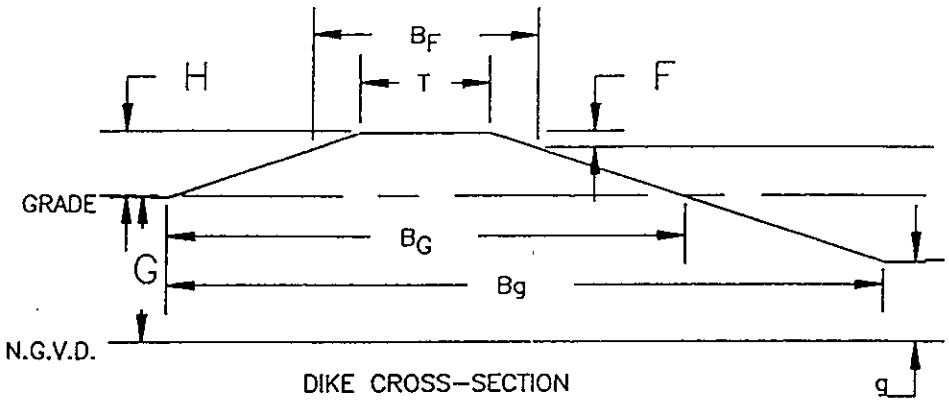
Depth of Excavation, $(G - g)$

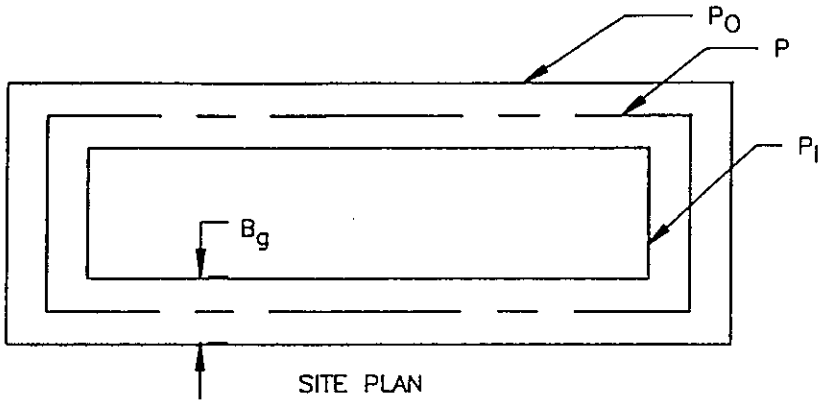
$$(G - g) = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (7)$$

where: $a = \tfrac{1}{2}P_I S$

$b = P_I HS + \tfrac{1}{2}P_I T - A - \tfrac{1}{2}P_I B_G$

$c = \tfrac{1}{2}H\,(T + B_G)\,P$





P_o	OUTER PERIMETER OF DIKE FOOTPRINT	SITE SPECIFIC
P	DIKE PERIMETER @ CENTERLINE OF DIKE CREST	SITE SPECIFIC
P_I	PERIMETER OF DIKE AT INTERIOR DIKE TOE	SITE SPECIFIC
A	REQUIRED DISPOSAL AREA, BOUNDED BY P_o	SITE SPECIFIC
A_I	AREA WITHIN P_I	SITE SPECIFIC
G	SITE GRADE (+ NGVD)	SITE SPECIFIC
g	EXCAVATED GRADE (+ NGVD)	SITE SPECIFIC
H	DIKE HEIGHT ABOVE GRADE	15 ft.
S	DIKE SIDE SLOPE	3 (1V:3H)
T	DIKE CREST WIDTH	12 ft.
F	FREEBOARD AND PONDING	4 ft.

TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure C-1
Dike Requirements and Site Capacity

PROJECT
REVISION
SHEET
DATE

APPENDIX D

Table D-1 Site Ownership[1], Primary and Secondary Sites, Martin County (page 1 of 3)

Site Name	Parcel Number	Owner	Parcel Acreage	Assessed Value
M-12	4509-801-0008-010/9	Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	N/A	$112,500
	4509-801-0012-000/0	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	N\A	13,200
	4509-801-0014-000/4	Creative Environment Enterprises P.O. Box 305 Port Salerno, FL 34992	N/A	45,130
	4509-801-0019-000/9	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	N/A	40,600
	4509-801-0020-000/9	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	11.65	186,100
	4509-801-0021-000/9	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	0.63	22,050
	4509-801-0022-000/3	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	0.84	29,400
	4509-801-0023-000/0	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	0.98	34,300

[1] Based on 1992 Tax Rolls, St. Lucie County/Martin County

Table D-1 Site Ownership[1], Primary and Secondary Sites, Martin County (page 2 of 3)

Site Name	Parcel Number	Owner	Parcel Acreage	Assessed Value
M-12 (cont.)	4509-801-0024-000/7	Savannah Dunes, Inc. 5901 N.E. 7th Avenue Boca Raton, FL 33487	0.64	$ 28,800
	4509-801-0025-000/4	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	0.68	30,600
	4509-801-0026-000/1	Same as Above	0.66	29,700
	4509-801-0027-000/8	Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	10.26	366,480
	4509-801-0028-000/5	Savannah Dunes, Inc. c/o Sun Bank/Treasure Coast N.A. P.O Box 8 Ft. Pierce, FL 34954	0.86	121,670
	4509-413-0001-000/9	Same as Above	0.42	1,260
M-8	3529-701-0006-000/7	Corbally, John E., J.M. Furman, D.M. Murdoch 4176 Burns Road Palm Beach Gardens, FL 33410	4.28	119,930
	3529-701-0008-000/1	Same as Above	10.53	327,490
	3529-701-0011-000/5	Same as Above	15.65	515,180
	3529-701-0014-000/6	Kwapinski, Elke H. 11 Ocean Drive Jupiter Inlet Colony, FL 33469	N/A	97,350
	3529-701-0016-000/0	Corbally, John E., J.M. Furman, D.M. Murdoch 4176 Burns Road Palm Beach Gardens, FL 33410	6.66	288,360
MSA M5	18-38-42-000-000-00010-20000	State of Florida/T.I.I.T.F. Former Murphy Land Act Dept. of Natural Resources Douglas Building 3900 Commonwealth Building Tallahassee, FL 32399	N/A	9,200

[1] Based on 1992 Tax Rolls, St. Lucie County, Martin County

Table D-1 Site Ownership[1], Primary and Secondary Sites, Martin County (page 3 of 3)

Site Name	Parcel Number	Owner	Parcel Acreage	Assessed Value
MSA 504B/C/E/F	34-38-42-000-030-00000-80000	Florida Inland Navigation District 1314 Marcinski Road Jupiter, FL 33477-9427	126.29	4,352,400
MSA 523	12-40-42-000-000-00040-50000	United States of America c/o Nature Conservancy Federal Building 75 Spring St. S.W. Atlanta, GA 30303	14.14	1,008,000
MSA 524B	12-40-42-000-000-00050-20000	South End Improvement Group P.O. Box 3628 Tequesta, Fl 33469-0628	15.49	345,600

[1] Based on 1992 Tax Rolls, St. Lucie County, Martin County