TAYLOR ENGINEERING, INC.

Long-Range Dredged Material Management Plan Update

Intracoastal Waterway
St. Lucie County, Florida

July 2024

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Long-Range Dredged Material Management Plan Update
Intracoastal Waterway
St. Lucie County, Florida

Final Report

Prepared for

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by

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EXECUTIVE SUMMARY

The Florida Inland Navigation District (FIND) completed the *Long-Range Dredged Material Management Plan for the Intracoastal Waterway in St. Lucie County, Florida*, in November 1997. As a result of this initial effort, FIND delineated reach limits, established 50-year material storage requirements, identified and acquired upland Dredged Material Management Areas (DMMAs), and developed preliminary designs of dredged material management facilities to meet the long-term maintenance needs of the Intracoastal Waterway (IWW). This report — making no attempt to recount all the information previously developed in the St. Lucie County plan — summarizes the key elements and establishes the foundation of the Dredged Material Management Plan (DMMP), updates the 50-year maintenance dredging and storage requirements, and provides the current status of FIND-owned and designated DMMAs.

The St. Lucie County project area — comprises of two reaches (Reaches I – II) and six cuts (1 – 6) — extends 21.72 miles south of the Indian River-St. Lucie County line to the St. Lucie-Martin County line. The selected dredged material placement sites for St. Lucie County comprise two upland DMMAs (SL-2 and M-8) and one beach placement area [Fort Pierce Shore Protection Project (FP-SPP)]. Together, the two DMMAs and beach placement area provide sufficient storage capacity to manage the expected quantity of material dredged from Reaches I – II over a 50-year period.

A review of the historical maintenance dredging record and recent shoaling data provided the updated 50-year dredging and material storage requirements. The resulting dredging and storage volumes equate to 125,072 cy and 268,904 cy, respectively. The 50-year storage requirement is larger than the estimated 155,240 cy estimated in FIND's 1997 St. Lucie County DMMP based on the requirements of recent dredging events.

The distribution of sediments within St. Lucie County is consistent with the sediment transport mechanisms implied by the estuary's geometry and tidal communication with the open ocean. Areas in the vicinity of inlets are dominated by tidal currents, while areas of the waterway lacking significant tidal currents are dominated by wind-driven currents and upland runoff. Sediment samples collected for this project suggest that sediment in the St. Lucie County part of the IWW does not contain substantial quantities of contaminants. Metals were within natural ranges; pesticides and PCBs were below detectable limits. These samples were taken in areas considered most likely to be contaminated due to the presence of fine sediments and proximity to urban areas. However, the number of samples was limited, and additional chemical testing of IWW channel sediment will likely be required prior to dredging. Regardless of the Reach and regulatory standards, Taylor Engineering recommends sampling and testing of specific sediments proposed for dredging when permitting the dredging projects. The results of reconnaissance-level sediment investigation provide useful input for the development of sampling and testing protocols for those sediments that are potentially present within the County.

While Taylor Engineering has addressed the St. Lucie County DMMP's immediate dredged material storage needs, several outstanding requirements remain to meet the full potential of the outlined plan. Recommendations, in order of priority, are outlined as follows.

1. Conduct a geotechnical investigation of shoals identified by the 2021 survey to determine volume of beach-compatible material.
2. Update 50-year storage requirement based on the volume of beach-compatible material identified by geotechnical investigation.
3. Maintain permits for beach placement site, particularly to support placement of appropriate Reach I material.

Table of Contents

List of Figures

List of Tables

1.0 INTRODUCTION

Since its formation in 1927, the Florida Inland Navigation District (FIND) has served as the local sponsor for the federal Atlantic Intracoastal Waterway (AIWW) (26.08 miles), Intracoastal Waterway (IWW) (381.12 miles), and a portion of the Okeechobee Waterway (OWW) (97.46 miles) channels. FIND includes Florida's 12 east coast counties. As the federal projects' local sponsor, FIND provides the U.S. Army Corps of Engineers (USACE) with sites suitable for placing material dredged from the federally authorized navigation channels.

Collectively known as the "Waterway," the federal channels along Florida's east coast extend from the Florida-Georgia state line south to Biscayne Bay in Miami-Dade County. The ±26-mile Florida section of the AIWW comprises that portion of the federal navigation project that extends northward from the Jacksonville Harbor Project (JHP) at the St. Johns River to the state line, while the ±351-mile IWW extends southward from the JHP to the Miami Harbor Project. An additional ±31 miles — for a combined total of 408 miles — extends to the southerly Miami-Dade County line.

The Waterway supports three authorized project depths: (1) 12 ft below Mean Lower Low Water (MLLW) from the state line south to the Ft. Pierce Harbor Project (FPHP), (2) 10 ft below MLLW from the FPHP south to the Miami Harbor Project (MHP) in Biscayne Bay, and (3) 7 ft below MLLW from MHP south through Florida Bay to Cross Bank (with a 75-ft channel width).

Since the initial dredging of the IWW, two sections have undergone deepening projects to facilitate access for deeper draft vessels. The first project, completed in 2016, deepened a 3,500-ft-long section of the IWW located immediately west of Peanut Island in Palm Beach County to -17 feet Mean Low Water (MLW), with a project depth of -15 feet and 2-foot allowable overdedge. The second, completed in 2017, deepened a 14,400 ft section of the IWW to -17 feet MLW (project depth of -15 feet and 2-foot allowable overdredge) in Ft. Lauderdale, Broward County from just south of the 17th Bridge to just north of Las Olas Blvd.

The OWW channels follow four routes or segments. Working from west to east, the first segment (Route 1) comprises the eastern 23.13 miles of the 25.82-mile Cross-Lake Channel that extends through the lake's south-central portion from Port Mayaca southwestward to Clewiston in Hendry County. Consistent with its legislatively-established geographic limits, FIND's interest includes only the 23.13 miles of Route 1 from the Port Mayaca Lock to the Palm Beach/Hendry County line. The second segment (Route 2) comprises the eastern 35.20 miles of the 37.39-mile Rim Canal. The Rim Canal splits from Route 1 ±1,074 ft southwest of the Port Mayaca Lock. Route 2 then extends southeasterly to the lakeshore, then southerly and westerly 37.39 miles as it follows the lake's southeastern, southern, and southwestern shorelines to intersect again with Route 1 at the entrance to the Industrial Canal at Clewiston. Similar to the situation described for Route 1, FIND's jurisdiction includes only the 35.20 miles of Route 2 from its intersection with Route 1 near Port Mayaca to the Palm Beach/Hendry County line. The third segment comprises the 24.02 miles of the St. Lucie Canal which extends from the St. Lucie Lock southwest to the Port Mayaca Lock on Lake Okeechobee's eastern shoreline. The fourth segment comprises the OWW's eastern 15.11 miles within the St. Lucie River between the St. Lucie Lock and the OWW's eastern terminus at the IWW – an area known as the Crossroads (Taylor et al., 2007).

1.1 Background

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

guided the management of dredged material. Engineering/operational and cost 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 — typically named and identified by a maintenance spoil area and number designation — for significant acreage along the Waterway. Most of these easements, located almost entirely within the sovereign waters of the state, included open water areas as well as expanses of pristine salt marsh in the more northern counties and mangrove wetlands in the more southern counties. 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 dredging contractors to maximize operational efficiency, resulted in open-water and wetland placement of channel construction and maintenance material. These activities resulted in a loss of wetlands and the proliferation of numerous small spoil mounds and islands lining the Waterway. Today, many of these islands are considered important recreational areas and/or wildlife habitat.

To secure its ability to maintain the Waterway within the existing framework of engineering/operational and added environmental and socioeconomic/cultural considerations, FIND initiated preparation of a long-range Dredged Material Management Plan (DMMP). Beginning in 1986, the two-phased plan implemented planning and site acquisition activities on a county-by-county basis to accommodate all maintenance material dredged from the Waterway for the next 50 years. Phase I focused on developing basic plan concepts, the definition of long-term dredging requirements, and the identification of suitable management alternatives that satisfy the identified considerations to the extent practicable. Phase I resulted in the identification of a bank of primary and secondary sites potentially suitable for long-term dredged material management. Phase II focused on obtaining and documenting detailed site-specific information required for the preparation and submission of permit applications for the primary sites identified in Phase I. In addition, Phase II addressed site acquisition, design of site facilities, and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities.

Recently, national recognition of the value of dredged sediment has lead to a renewed focus on beneficial use options for individual dredging project. The USACE has set a goal to beneficially reuse 70% of all sediments dredged nationally by 2030. FIND's recognition of the value of dredged sediments decades ago lead to design choices for the numerous dredged material management areas (DMMAs) included in these DMMPs that allow recycling and perpetual operations of the sites. These sites provide an important baseline for the program that allows FIND and the USACE to maintain the waterway far into the future.

Additionally, FIND recognizes and supports the idea of individual dredging projects providing sediment directly for beneficial uses such as marsh restoration and island creation to help address climate change impacts across Florida's estuaries. Sediment incorporated in such projects provide direct environmental benefits, help meet the USACE reuse goals, and preserve valuable capacity in FIND's DMMAs. Such projects will most likely be one time efforts and should be considered during the planning stages of future dredging projects. Challenges to regulatory approval remain a concern given the environmental agencies reluctance to allow any impacts within estuarine waters.

1.2 Project Overview

In general accordance with the USACE Engineer Regulation 1105-2-100 guidance document, FIND completed the *Long-Range Dredged Material Management Plan for the Intracoastal Waterway in St. Lucie County, Florida*, in November 1997. The development of the original St. Lucie County Phase I report consisted of five primary components:

1. Establishment of the 50-year material storage requirement based on historic maintenance dredging volumes and subsequent examination surveys
2. Evaluation of existing easements and/or disposal areas within the project area to determine the remaining or potential storage capacity
3. Development of a management concept or strategy appropriate to specific engineering/operational, environmental, and socioeconomic/cultural considerations
4. Identification of additional candidate sites consistent with the management concept
5. Evaluation of all candidate sites based on a standard set of criteria that reflects specific engineering/operational, environmental, and socioeconomic/cultural considerations

With the completion of the Phase I report(s), FIND moved into Phase II of the DMMP, which included three primary components:

1. Collection of public record information (e.g., land use, zoning restrictions, taxes and assessed values, easements, and property ownership) to assist in the further development (and final site selection and acquisition) of the primary and secondary sites

2. Collection of site-specific information for primary sites (and secondary sites if the primary sites were deemed unfit)

    a. Boundary survey
    b. Topographic survey
    c. Subsurface and soils survey
    d. Environmental resource survey

3. Preliminary design and analysis of dredged material management facilities

Because of the preceding efforts, FIND developed four site-specific reports (i.e., Environmental Site Documentation, Management Plan, Engineering Narrative, and Cost Report) for each primary site. Combined, these collective Phase I and II documents, authored between 1997 and 2000 compose the original DMMP for St. Lucie County. This document updates the DMMP, succinctly incorporating recently collected data with previously published information to guide immediate and future dredged material planning efforts in St. Lucie County. Executed in close cooperation with FIND and the USACE Jacksonville District, this document:

1. Summarizes the key elements and establish the foundation of the DMMP
2. Establishes, defines, and updates the 50-year maintenance dredging and storage requirement
3. Provides the current status and evaluates the remaining or potential storage capacities of the FIND-owned and designated dredged material management areas (DMMAs)

This report makes no attempt to recount all the information previously developed for St. Lucie County during the original DMMP's two-phased implementation. Rather, the report summarizes relevant portions of this information and presents additional information developed to support the update of the long-range DMMP for St. Lucie County.

1.3 Established DMMP Features

As summarized above and detailed in the previously developed Phase I and II reports, the St. Lucie County DMMP recommended the establishment of multiple permanent dredged material management areas to receive, dewater, and temporarily store materials dredged from an adjacent segment (i.e., reach) of the Waterway. Previously defined reach delineation reflected the detailed review and consideration of

historical shoaling patterns, sediment quality, projected material transfer and storage requirements, area demographics, and site availability. Each reach comprises several straight-line segments (i.e., cuts). A change in orientation (i.e., direction) of the Waterway provides the end of one cut and the beginning of the next.

Thus, the St. Lucie County project area—comprised of two reaches (Reaches I – II) and six cuts (1 – 6)—extends 21.72 miles south of the Indian River-St. Lucie County line to the St. Lucie-Martin County line. The selected dredged material placement sites for St. Lucie County comprise two upland DMMAs (SL-2 and M-8) and one beach placement area [Fort Pierce Shore Protection Project (FP-SPP)].

Together, the two DMMAs and beach placement area provide sufficient storage capacity to manage the expected amount of material dredged from Reaches I – II over a 50-year period.

Table 1.1 and **Figures 1.1 – 1.3** present the reach delineation and accompanying dredged material management sites. Description of the channel geometry, specifically the detailed longitudinal stationing information included with the more recent dredging plans, establishes a system for cross-referencing a particular location along the Waterway to cut, end station, and channel mileage. As revised in Brownell et al. (2016) and a channel stationing adjustment in 2017, the Florida segment of the AIWW begins about 2,000 ft south of the Florida/Georgia state line (at Cut 2, Station 0+00 of the federal Fernandina Harbor Project (FHP)). The AIWW segment ends at the centerline of the JHP in the St. Johns River. After a 0.11-mile gap within the JHP, the IWW segment begins at the south side of the JHP. Due to the resolution of inconsistencies between the older plan documents (stemming from modifications in the channel geometry over the project lifetime) and the 2016-17 revisions, the channel mileages applied in this updated report vary from those in the original DMMP.

Table 1.1 Reach Limits and Designated Dredged Material Management Sites

Reach		Cut	End Station (ft)	Length (mi)	IWW Mileage	Dredged Material Management Site
I	Indian River/St. Lucie County line to Bear Point	CUT SL-1	278+20.71	5.27	224.19	SL-2
		CUT SL-2	55+77.32	1.06	225.25	
		CUT SL-3N	14+11.82	0.27	225.52	
		CUT SL-3S	10+60.87	0.20	225.72	
		CUT SL-4	4+53.88	0.09	225.80	
		CUT SL-5	77+60.00	1.47	227.27	
II	Bear Point to St. Lucie/Martin County line	CUT SL-5	308+39.49	5.84	233.12	M-8
		CUT SL-6	373+50.00	7.07	240.19	

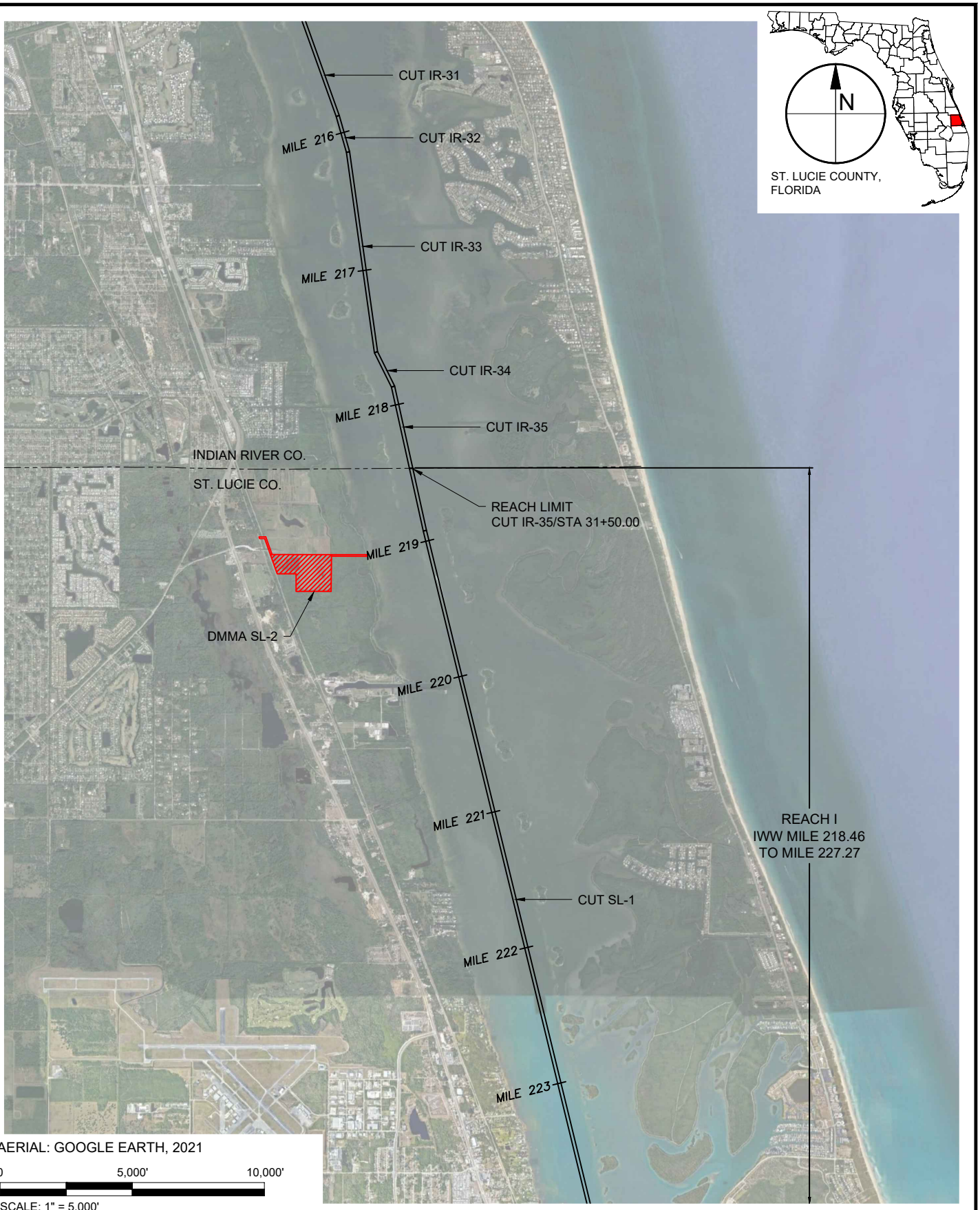

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FIGURE 1.1
REACH LIMITS AND DESIGNATED DREDGED MATERIAL MANAGEMENT SITES
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	1 of 14
DATE	NOV 2022

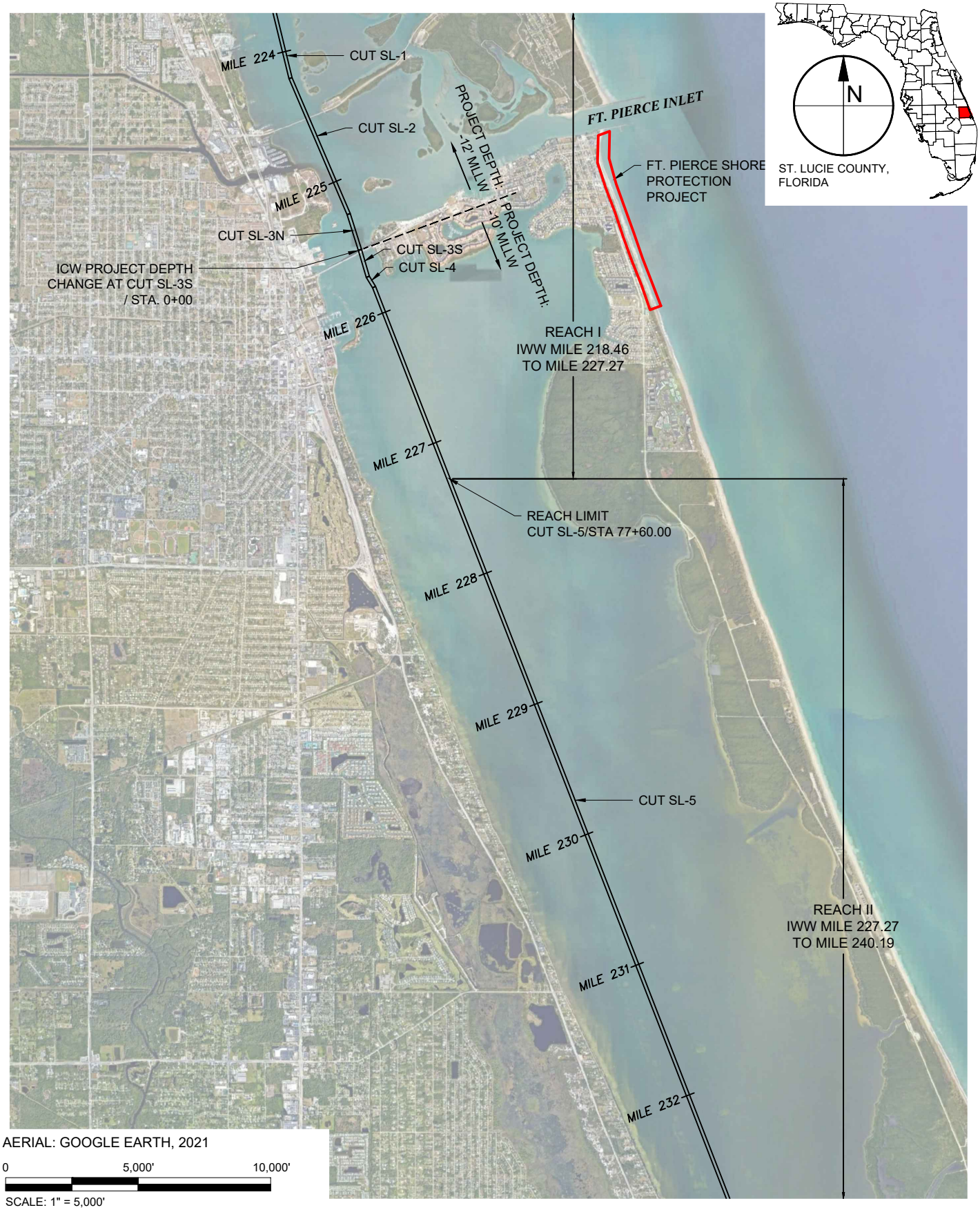

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FIGURE 1.2
REACH LIMITS AND DESIGNATED DREDGED MATERIAL MANAGEMENT SITES
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	2 of 14
DATE	NOV 2022

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FIGURE 1.3
REACH LIMITS AND DESIGNATED DREDGED MATERIAL MANAGEMENT SITES
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	3 of 14
DATE	NOV 2022

1.4 Report Organization

The methods reported herein closely follow the original Phase I and subsequent Phase II DMMP reports. The organization of this report generally reflects those methods. **Chapter 2.0**, *DMMP Development*, summarizes the primary components of the original DMMP development, including the selected dredged material management concept(s), and the evaluation criteria for the upland DMMA site selection. **Chapter 3.0**, *50-Year Material Storage Requirement*, provides a revised projection of the 50-year material management requirements based on an update of the historic channel maintenance records and evaluation of the most recent bathymetric surveys and channel sediment data; this chapter also discusses the implications of the revised projections. **Chapter 4.0**, *DMMA Design and Construction*, addresses the overall dredged material management strategy for St. Lucie County along with the current status, design, operation, management, and prior and future environmental mitigation for any actual and expected environmental impacts of the selected dredged material placement areas. **Chapter 5.0**, *DMMA Operational Considerations,* provides a summary of the three phases (pre-, during-, and post-dredging) of DMMA operations. **Chapter 6.0**, Beach Placement Site, provides a succinct summary of the St. Lucie County beach placement site, FP-SPP. **Chapter 7.0**, *Conclusions and Recommendations*, summarizes the updated findings.

2.0 DMMP DEVELOPMENT

The underlying foundation for the reach delineation and ultimate dredged material placement site selection — summarized herein and extensively detailed in the original DMMP reports — included selection of a dredged material management concept(s) and identification, evaluation, and eventual selection of two upland (SL-2 and M-8) for the management of dredged material from the Waterway. This report includes the addition of one beach placement area (FP-SPP) for the management of dredged material from the waterway. The following paragraphs summarize the development of the St. Lucie County DMMP.

2.1 Dredged Material Management Concept

The central issue guiding the development of a management concept — i.e., a guiding set of principles that reflects the attitudes and considerations of the project's local sponsor — for the Waterway in St. Lucie County was the selection of the most appropriate material management strategy. Based on previous experience and DMMP reports, four basic alternatives are available for consideration: (1) ocean disposal, (2) open water placement, (3) beach placement, and (4) centralized upland storage. The following paragraphs discuss each of these alternatives with respect to its applicability to St. Lucie County management requirements.

1. **Ocean Disposal –** While considered a favorable management strategy typically reserved for large volume dredging projects (e.g., entrance channels, inlets, deepening projects), ocean disposal requires the transport of dredged material from the dredging site to an authorized offshore disposal area. For the St. Lucie County project area, this condition would result in a very inefficient and costly operation for the following reasons. The dredge (hydraulic or mechanical) must first load the material into a hopper barge capable of transiting the relatively shallow depths of the Waterway. Within St. Lucie County, the channel's -12 ft and -10 ft MLLW controlling depths would place severe limits on the barge's draft and, therefore on its capacity. Regulatory restriction on overflowing the barge during filling would likely limit its effective capacity even further. After a barge meets (draft-limited) capacity, it must then transit to an appropriate point at which to transfer the material to a deep-draft seagoing barge for transport to an authorized offshore placement site. A review of offshore disposal areas currently authorized by the U.S. Environmental Protection Agency (EPA) to receive dredged material indicates the EPA-approved Fort Pierce Ocean Dredged Material Disposal Site (ODMDS) is 4.5 nautical miles offshore of Fort Pierce Inlet. However, given the depth-limited restrictions on barges in the waterway and distance offshore, the ocean disposal management strategy was not considered a viable option.

2. **Open Water Placement –** This particular method, as noted in Chapter 1.0, was perhaps the most widely used approach before the growth of today's environmental regulatory programs that address wetland and benthic habitat protection. Today, under the rubric of beneficial reuse of wetland or habitat creation, open water placement has found favor in areas (coastal Louisiana, Chesapeake Bay, etc.) that have experienced severe losses of similar wetland habitats. A renewed focus on beneficial reuse of dredged material supports consideration of similar projects in Florida. Challenges to regulatory approval remain a concern given the environmental agencies reluctance to allow any impacts within estuarine waters. However, FIND considers that such projects provide significant environmental value and can/should be pursued on a case-by-case basis. There has been some recent and limited success with the use of dredged material for environmentally beneficial island creations (i.e., use of Palm

Beach County maintenance dredged material for Snook Islands Natural Area and the Tarpon Cove Restoration Project). Palm Beach County designed the 46-acre Tarpon Cove project to fill in a deep dredge hole to restore and enhance critical shallow estuarine subtidal vegetation (seagrass) habitat through the covering of muck. The overall project required approximately 418,600 cy of sand; FIND's IWW Palm Beach Maintenance Dredging project provided 20% of that amount. While such projects do not provide for long-term dredged material management, they can play a key role in benefitting the overall environment by addressing climate change impacts.

3. **Beach Placement** – The State of Florida and the USACE (via its Regional Sediment Management Program) encourage the placement of beach-quality dredged material on the beach as a beneficial use of dredged material. FIND also includes this approach as an essential part of the dredged material management for channel reaches, which are likely to contain beach-quality sediments based on the historic data. 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. Material quality (Section 3.4), regulatory requirements, cooperation of beachfront property owners, the need for additional material on the beach, and seasonal operational restrictions due to sea turtles nesting, affect the feasibility of beach disposal, among other considerations.

4. **Centralized Upland Storage** – Centralized upland storage relies on the use of diked containment areas with appropriate outlet flow control structures. The dredging contractor pumps the dredged material in a sediment-slurry into one end of the containment basin opposite the outlet structure. Sediment settles in the basin while the clean residual water returns to the Waterway via the basin outlet structure and return pipeline. Upland storage sites offer a number of significant advantages over other available methods: (1) they provide 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) given the identification of suitable sites, they avoid most wetland impact issues inherent in the use of open *water* disposal; (3) they are conducive to reconfiguration and reconditioning for subsequent disposal events; and (4) unlike beach disposal, they do not demand particular physical characteristics of dredged material.

The use of a limited number of centralized upland storage sites has additional economical, 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 small sites; (3) the use of centralized sites allows for improved site security and requires the allocation of fewer operating personnel; (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 more efficient and comprehensive monitoring procedures; and (5) in the long-run, once contractors construct these sites, they reduce the total dredging costs. Thus, the selected dredged material concept for the St. Lucie DMMP is centralized upland storage with the option for beach placement of compatible material dredged from cuts near the Fort Pierce Inlet. Importantly, this does not preclude FIND's support of individual beneficial use dredging projects when appropriate and supported by local, state, and federal partners. Given that such beneficial use projects may arise opportunistically, the remainer of this DMMP focuses on the primary long-term management concept as identified in the original plan document. The centralized site approach provides and important backstop to ensure FIND and USACE can maintain the waterway in perpetuity.

2.2 Evaluation Criteria

With the management concepts in-hand, the final site evaluation and selection process for the overall site bank employed a standard set of criteria. Developed as part of the original 1997 Phase I report, these criteria remain consistent with the dredged material management strategy designated most appropriate for future St. Lucie County requirements. Taylor Engineering evaluated each centralized upland storage candidate site based on its ability to satisfy criteria in three broad areas:

1. **Engineering/Operational –** Engineering/operational considerations account for the mechanics behind the construction of an upland DMMA and maintenance dredging of the Waterway. Selection of the optimal site will have a long-term and compounding economic impact on the construction, operation, and maintenance of a particular site. Specific considerations within this broad-based criterion include ability of the site to meet the required storage capacity, provide adequate and appropriate dike material for site construction, minimize pumping distances during dredging, and offer available pipeline and upland access.

2. **Environmental –** By minimizing adverse impacts to sensitive habitats, the environmental site evaluation criteria guided the selection of sites that carried minimal environmental permitting constraints. Reflecting FIND's established principle of restricting the placement and storage of dredged material to upland areas, the resulting criteria fell under two categories: (1) criteria for the avoidance of wetland areas to the greatest extent possible, and (2) criteria for minimizing unavoidable impacts to sensitive upland habitats. Other environmental considerations included maximization of buffer area (to limit viewscape impacts and lessen sound intrusion for adjacent properties), identification/protection of potential archeological sites, and protection of groundwater.

3. **Socioeconomic/Cultural –** 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. Typically, the initial site selection process seeks areas of suitable existing on-site land use, with areas of minimal development receiving preference. Given their reduced environmental value, areas previously disturbed by clearing, excavation, timber harvesting, or drainage also received preference. To the maximum extent possible, the engineer considers a buffer to reduce potential conflicts by separating the site's active storage from adjacent residential or commercial development.

2.3 Site Identification

Given the established dredged material management strategy of centralized upland storage for each of St. Lucie County's two reaches, FIND evaluated sites throughout the county to identify those potentially useful as permanent dredged material management and storage facilities for the Waterway.

For the 1997 Phase I report, the site identification process began with a review of LABINS (Land Boundary Information System, FDEP Bureau of Survey and Mapping) visible/infrared aerial photography supplemented with aerial photography and other information from the St. Lucie County Property Appraiser's office. Other resource materials included U.S. Geological Survey 7.5-minute topographic

quadrangle maps, St. Lucie County Comprehensive Plan future land use and zoning maps, U.S. Fish and Wildlife Service (USFWS) wetland inventory maps, and U.S. Soil Conservation Service (USCS) maps.

Through the general process outlined above, the 1997 Phase I report originally identified the primary and secondary sites to serve the projected future Waterway dredged material management requirements in St. Lucie County. Moving forward, the remainder of this report discusses only those sites selected for ultimate centralized upland storage.

2.4 Public Involvement

Lastly, the implementation of the DMMP 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 Protection, and the Florida Department of Community Affairs; (2) a Citizens' Advisory Committee comprising community representatives appointed by the St. Lucie County Commission; (3) the Board of Commissioners for FIND; and (4) the general public. Through this review, Taylor Engineering identified potentially suitable sites for development as DMMAs. Consistent with FIND's established program standards, the selection of the identified sites reflects each site's potential to satisfy a range of engineering/operational, environmental, and socioeconomic/cultural criteria.

FIND conducted a series of presentations and workshops to inform both the citizens of St. Lucie County and their elected officials of FIND's intended action. To begin, the staff of FIND and Taylor Engineering made a presentation to the St. Lucie County Commission on September 13, 1995, to introduce the FIND program of long-range dredged material management for the Intracoastal Waterway, to inform the Commission that they had initiated a planning effort for the Waterway in St. Lucie County, and to request the appointment of a Citizens' Advisory Committee. To inform the citizens of St. Lucie County and to receive additional input, Taylor Engineering held four Public Information Workshops. Each of these workshops were advertised in the display and legal notice sections of the *Ft. Pierce Tribune* newspaper. Additionally, government representatives in St. Lucie County and other interested parties received meeting notices and status reports via a FIND-initiated mailing list. The Public Information Workshops occurred at the St. Lucie County Administration Building in Ft. Pierce October 19, 1995, and at the chambers of the St. Lucie County Board of Commissioners on March 4, 1996, March 13, 1997, and July 23, 1997.

3.0 50-YEAR MATERIAL STORAGE REQUIREMENT

The first step in re-establishing, defining and updating the 50-year maintenance dredging and material storage requirement required updating and reassessing the projected future dredging and material storage requirements of the project area. These projected requirements determine the volume of dredged material that each established placement area must accommodate. The projected dredging and dredged material storage requirements, in turn, reflect two quantities:

1. The estimated volume of material removed from the Waterway channel in all maintenance dredging operations since construction of the channel to its present project depth.
2. The estimated volume of shoaling presently within the authorized channel based on recent surveys of the project area.

The latter quantity represents the volume of shoaling since the last maintenance operation or, in non-maintained areas, the volume of shoaling since the channel's original construction to its present dimensions. By accounting for channel maintenance operations performed within the project area since the original 1997 study as well as more recent and comprehensive survey data unavailable at the time of the original study, this reassessment provides a more accurate, updated projection for the volume of dredged material that each DMMA must accommodate. The following sections provide a breakdown of both the historical maintenance and recent shoaling volumes, a summary of the resulting projection of the 50-year dredging and material storage requirements, and a review of the material quality (physical and sediment chemistry characteristics) of previously collected geotechnical borings.

3.1 Historic Channel Maintenance

Taylor Engineering extracted the volume of historic maintenance dredging from an analysis of the USACE Jacksonville District archival records — specifically, analysis of all engineering plans and supporting documents for channel maintenance performed in the St. Lucie County segment of the Waterway since the USACE deepened the channel to its authorized project depths. Within St. Lucie County, two segments corresponding to two authorized project depths comprise the Waterway. From the Ft. Pierce Harbor Project northward to Fernandina Beach, the authorized depth of the Intracoastal Waterway is 12 ft below Mean Low Water (-12 ft MLW)[1]. From the Ft. Pierce Harbor Project southward to Biscayne Bay in Miami, the authorized channel depth is -10 ft MLLW. Accordingly, the deepening of the channel within St. Lucie County was performed in two phases – from Wabasso in Indian River County southward to Ft. Pierce (Cut SL-3S, Sta 0+00; IWW mile 225.52) between early 1959 and late 1960, and from Ft. Pierce southward to St. Lucie Inlet in Martin County between early 1961 and early 1962. To achieve accuracy, consistency, and completeness, the original 1997 report review included all available sources of dredging information held by USACE Jacksonville District. Relevant sources included the annual Office of the Chief of Engineers (OCE) reports, previous USACE summaries of maintenance dredging within the project area, and interviews with USACE personnel. For this update, Taylor Engineering obtained and reviewed USACE documents generated since completion of the 1997 report. The primary sources of information, however, remained USACE archival maintenance plan documents and examination surveys.

The archival records express the estimated volume of material dredged in previous channel maintenance operations in two forms. The first estimate — the pre-dredging estimate, or the design volume of required dredging — reflects the comparison of the results of a detailed pre-dredging examination survey of the authorized channel to the project design depth. The plan for the dredging and

[1] The current design depth is defined as 12 ft below MLLW. Prior to 2008, the USACE referenced the design depth to MLW.

the bids of the dredging contractors reflects this estimate. The second estimate represents the pay volume (i.e., the volume of material removed and for which the contractor receives payment). This second estimate derives from comparison of detailed pre- and post-dredging examination surveys. Therefore, the pay volume closely corresponds to the actual volume of material removed from the channel and accounts for allowable overdepth dredging. 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 was unavailable, multiplying the design volume by a correction factor provides an estimate of the pay volume. Derived from all dredging records evaluated thus far in FIND's long-range program (and consistent with all other Waterway DMMP efforts), the correction factor of 1.19 represents the ratio of pay volume to design volume in those channel maintenance operations for which both quantities are known.

The updated analysis of historic dredging records (**Table 3.1**) established that FIND and the USACE performed two channel maintenance dredging operations in the period between 1959 and 2021. One in 1972 with a total pay volume of 2,381 cy for IWW Reach I and one in 2017 with a total pay volume of 74,709 cy for IWW Reach I. Survey data was not available for the 1972 event, so the reported pay volumes used the correction factor of 1.19; however, survey data was available for the 2017 event, so the reported volumes are based on the surveys and do not include a correction factor of 1.19. The lack of maintenance dredging recently or during the gaps in historical record does not necessarily indicate the absence of shoaling; various factors, including environmental regulation, contracting procedures, lack of funding and equipment, and lack of useable material management sites may have curtailed dredging in those reaches.

Table 3.1 Historic Maintenance Dredging, 1959-2021

Reach	IWW Mileage		Cut/Station		Length (ft)	Year	Design Volume (cy)	Pay Volume (cy)
	From	To	From	To				
I	225.43	225.47	SL-3N/9+50	SL-3N/11+50	200	1972	2,000	2,381
	225.42	225.45	SL-3N/9+00	SL-3N/10+50	150	2017	443	932
	225.99	226.45	SL-5/10+00	SL-5/34+00	2,400		46,994	41,307
	226.45	226.83	SL-5/34+00	SL- 5/54+00	2,000		26,043	16,029
	226.83	227.17	SL-5/54+00	SL-5/72+00	1,800		28,539	16,441
	Reach I Total						**104,019**	**77,090**
II	No Historical Maintenance Dredging							
	Reach II Total						**-**	**-**
Reach I - II Total							**104,019**	**77,090**

3.2 Recent Shoaling

As discussed in the introductory paragraph of **Section 3.0**, the volume of recent shoaling represents the second component that determines the projected future dredging and dredged material storage requirements for the St. Lucie County segment of the IWW. USACE completed the most recent comprehensive hydrographic survey of the Waterway in 2021. From the 2021 surveys, Taylor Engineering identified shoal locations and calculated the shoal volumes listed in **Table 3.2.** Shoal volumes calculated from the surveys correspond to the design volume (i.e., the amount of material requiring removal to re-achieve project design depth). The application of the correction factor (i.e., 1.19), as described in the previous section, then derived the corresponding pay volume to account for typical allowable overdepth dredging.

Table 3.2 Summary of Recent Shoals[1]

Reach	IWW Mileage		Cut/Station		Length (ft)	Year	Design Volume (cy)	Pay Volume[2] (cy)
	From	To	From	To				
I	218.46	223.52	CUT IR-35/31+51	CUT SL-1/242+37	26,670	2021	15,545	18,498
	223.61	224.10	CUT SL-1/247+27	CUT SL-1/273+48	2,620	2021	495	589
	224.40	225.19	CUT SL-2/11+06	CUT SL-2/52+64	4,158	2021	15,347	18,263
	225.42	225.59	CUT SL-3N/8+76	CUT SL-3S/3+96	932	2021	1,992	2,371
	225.71	227.27	CUT SL-3S/10+34	CUT SL-5/77+60	8,241	2021	30,026	35,731
	Reach I Total						**63,404**	**75,451**
II	227.27	229.48	CUT SL-5/77+60	CUT SL-5/194+26	11,666	2021	1,069	1,273
	230.47	232.77	CUT SL-5/246+12	CUT SL-5/367+99	12,187	2021	961	1,144
	232.98	234.20	CUT SL-5/378+90	CUT SL-6/57+33	6,443	2021	536	637
	234.80	240.19	CUT SL-6/88+77	CUT SL-6/373+50	28,473	2021	12,029	14,314
	Reach II Total						**14,595**	**17,368**
Reach I — II Total							**77,999**	**92,819**

[1]Tabulated volumes are rounded to the nearest yard, and tabulated totals may vary slightly due to rounding errors
[2]Pay Volume = 1.19 x Design Volume

As summarized, based on the 2021 survey, the estimated design and pay volumes of shoals within the St. Lucie County project area total 77,999 cy and 92,819 cy, respectively. The shoaling volume is predominantly in Reach I, which accounts for 81% of the total design volume. **Figures 3.1-3.3** depict the shoal locations listed in **Table 3.2.**

Recent surveys indicate the concentration of shoaling in Reach I is adjacent to the Fort Pierce City Marina's recently constructed breakwater structures. Survey data shows significant shoaling in Cut SL-5 between Stations 10+00 and 25+00, being most concentrated between Stations 16+00 and 20+00.

During the April 2019 FIND Board Meeting, FIND requested Taylor Engineering to review available data to provide an estimate of the current shoaling rate within ICWW Cut SL-5. The dredging records from 1961 through November 2018 provide the shoaling rates in Cut SL-5 before and after the construction of the breakwaters. Prior to the breakwater construction in early 2014, there are no records of dredging of Cut SL-5, which suggest a minimal historic shoaling rate. Following the breakwater construction in 2014, the shoaling rate from 2014 – 2017 was approximately 11,000 cy/year, as calculated by comparing the 2014 FIND Survey data to the 2017 pre-dredge survey data. FIND then dredged SL-5 to its authorized depth in 2017. A comparison of the June 2017 post-dredge survey to a November 2018 condition survey indicated a shoaling rate of 17,000 cy/year. An analysis of the most recent 2021 survey data indicates a significant amount of the shoaling in Reach I remains in SL-5 near the Fort Pierce City Marina. Given the increase in shoaling rates since the construction of the breakwaters, the portion of the waterway adjacent to the Fort Pierce City Marina is likely to remain a hot spot for shoaling.

3.3 Projected 50-Year Dredging and Material Storage Requirements

Sections 3.1 and 3.2 provide information to develop the projected 50-year dredging and material storage requirements for the St. Lucie County reaches (**Table 3.3**). These projections were derived as follows. To calculate the corresponding 50-year maintenance requirement for the St. Lucie County project area, the volumes of shoaling (that is, the pay volume of historic maintenance dredging and recently

documented shoaling) over the 62-year period of record (1959 – 2021) were summed, converted to an annual shoaling rate, and then interpolated to 50-year volumes. The resulting dredging volumes of 125,072 cy for IWW Reaches I – II correspond to the in situ or unbulked volume of dredging anticipated over the next 50 years. Translating the projected 50-year in situ dredging volume into the storage volume required to handle the dredged material requires the application of a bulking factor.

Table 3.3 Projected 50-Year Dredging and Material Storage Requirements

Reach	Length (mi)	Historical Maintenance Pay Volume (cy)	2021 Shoal Volume (cy)	Total Volume (cy)	Volume (cy/ year)[1]	Volume (cy)/ year/ mile	50-Year Dredging Req. (cy)	50-Year Storage Req. (cy)
I	8.81	77,090	63,404	140,494	2,266	257	113,302	243,598
II	12.91	0	14,595	14,595	235	18	11,770	25,306
I - II	**21.72**	**77,090**	**77,999**	**155,089**	**2,501**	**115**	**125,072**	**268,904**

[1] Based on data from 1959 – 2021

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 for long-term storage, the dredged material will begin to consolidate under its own weight. Given the 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 before dredging. The present study (as well as the original 1997 report) applies a conservative factor of 2.0 to account for the increase in volume of the dredged material compared to its in-situ volume. Consistent with USACE Jacksonville District experience and recommendations, an additional allowance of 15% of the original in situ volume accounts for overdepth dredging. Thus, multiplying the projected 50-year volume of required dredging by the effective bulking plus overdepth dredging factor of 2.15 yields a projected 50-year material storage requirement of 268,904 cy for the St. Lucie County IWW project area.

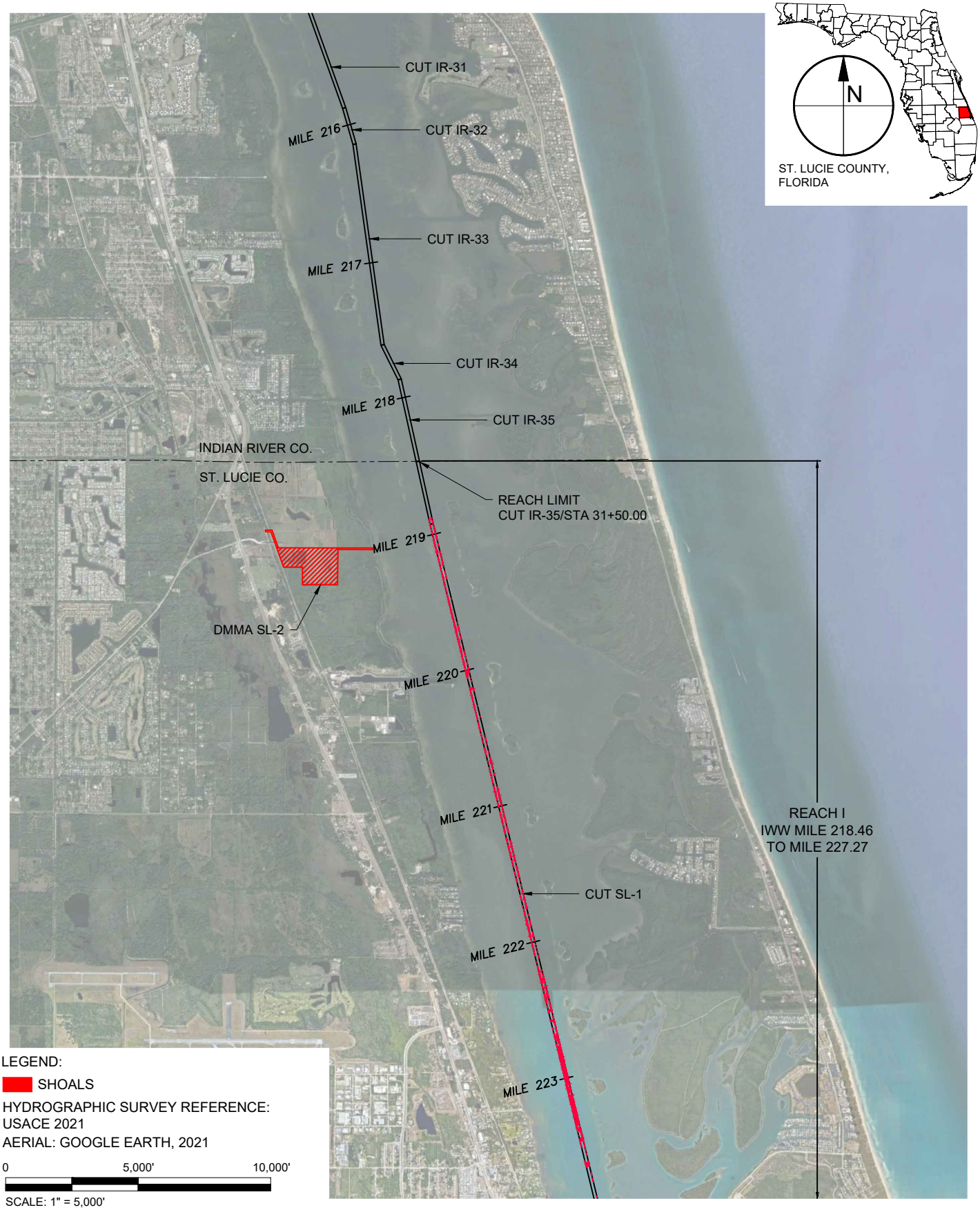
As summarized in **Section 3.2**, 2021 survey data forms the basis of this most recent projected 50-year material storage requirements for Reaches I – II. In 1996, 2000, 2005, and 2014 — to provide improved data on recent shoaling within the Waterway under its sponsorship — FIND completed comprehensive bathymetric surveys of the IWW. The USACE completed the most recent comprehensive bathymetric survey in 2021. **Table 3.4** provides a comparison of the material storage requirements between those survey years and the original 1997 report. Given that the Waterway channel geometry (e.g., centerline location, longitudinal stationing, and reach definition) has adjusted over the previous 25 years, the updated material storage requirements for each individual reach (**Table 3.3**) are not directly comparable on a reach-by-reach basis. As summarized, the total for the IWW indicates an approximate 73% increase (from 155,240 cy to 268,904 cy) in material storage requirements for the St. Lucie County project area between 1996 and the 2021 survey.

Table 3.4 Updated and Previously Reported 50-Year Material Storage Requirements

Reach	Length (mi)	50-Year Storage Requirement (cy)				
		2021	2014	2005	2000	1996
I	8.81	243,598	144,516	75,560	80,327	99,516
II	12.91	25,306	15,393	122,299	75,997	55,724
I - II	**21.72**	**268,904**	**159,910**	**197,859**	**156,324**	**155,240**

Reach I has two records of historic maintenance dredging within the St. Lucie County project area. This reach experienced a 145% (144,082 cy) increase in dredged material storage requirements between 1996 and 2021. One of the reasons for the increase in Reach I is the 2017 dredging event in this reach which removed 74,709 cy of material from the channel and recent shoaling adjacent to the Fort Pierce City Marina. Historical dredging volumes and the recent increase in shoaling rates strongly influence calculations of the 50-year dredging requirement. The increase in volume is also due to the extension of Reach I since the 1996 survey. The 2021 Reach I volume now includes portions of the waterway previously reported as Reach II in 1996. This extension of the reach not only expanded its footprint further south but also added portions of the waterway with more shoaling, including areas adjacent to the Fort Pierce City Marina.

Meanwhile, there has been a 55% (30,418 cy) decrease in the predicted 50-year storage requirements for Reach II. The reasons for the decline in Reach II are the absence of historic dredging in this reach and the lack of shoaling indicated by the most recent 2021 survey. The reduction in storage requirements is also due to the change in reach locations between the 2021 and 1996 surveys. In 1996 Reach II included segments of the waterway now located in Reach I which contained more shoaling. This shift in the location of Reach II to portions of the waterway with less shoaling drove down the storage requirements for the reach.



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REGISTRY # 4815

FIGURE 3.1
RECENT SHOALS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	4 of 14
DATE	NOV 2022

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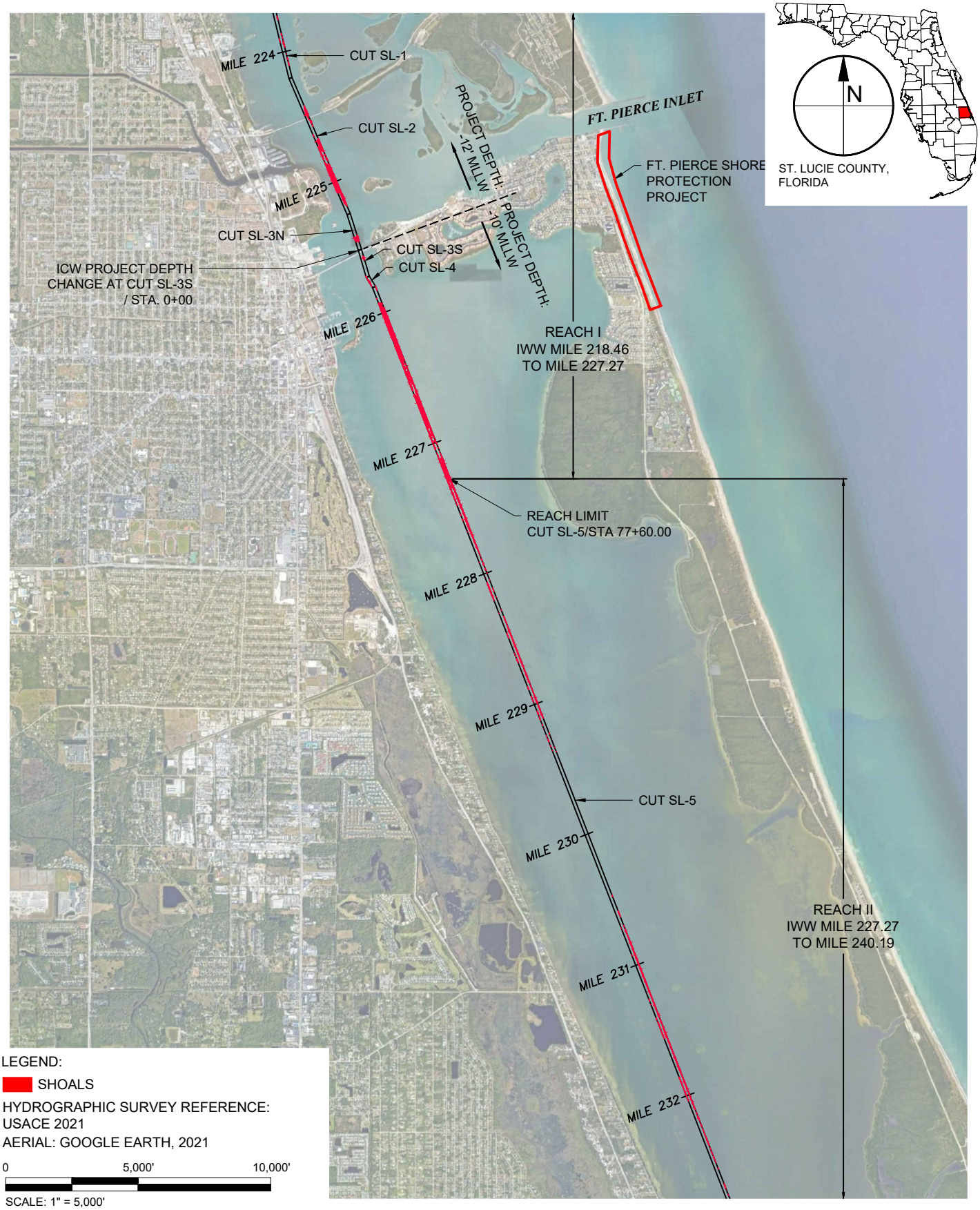

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FIGURE 3.2
RECENT SHOALS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	5 of 14
DATE	NOV 2022

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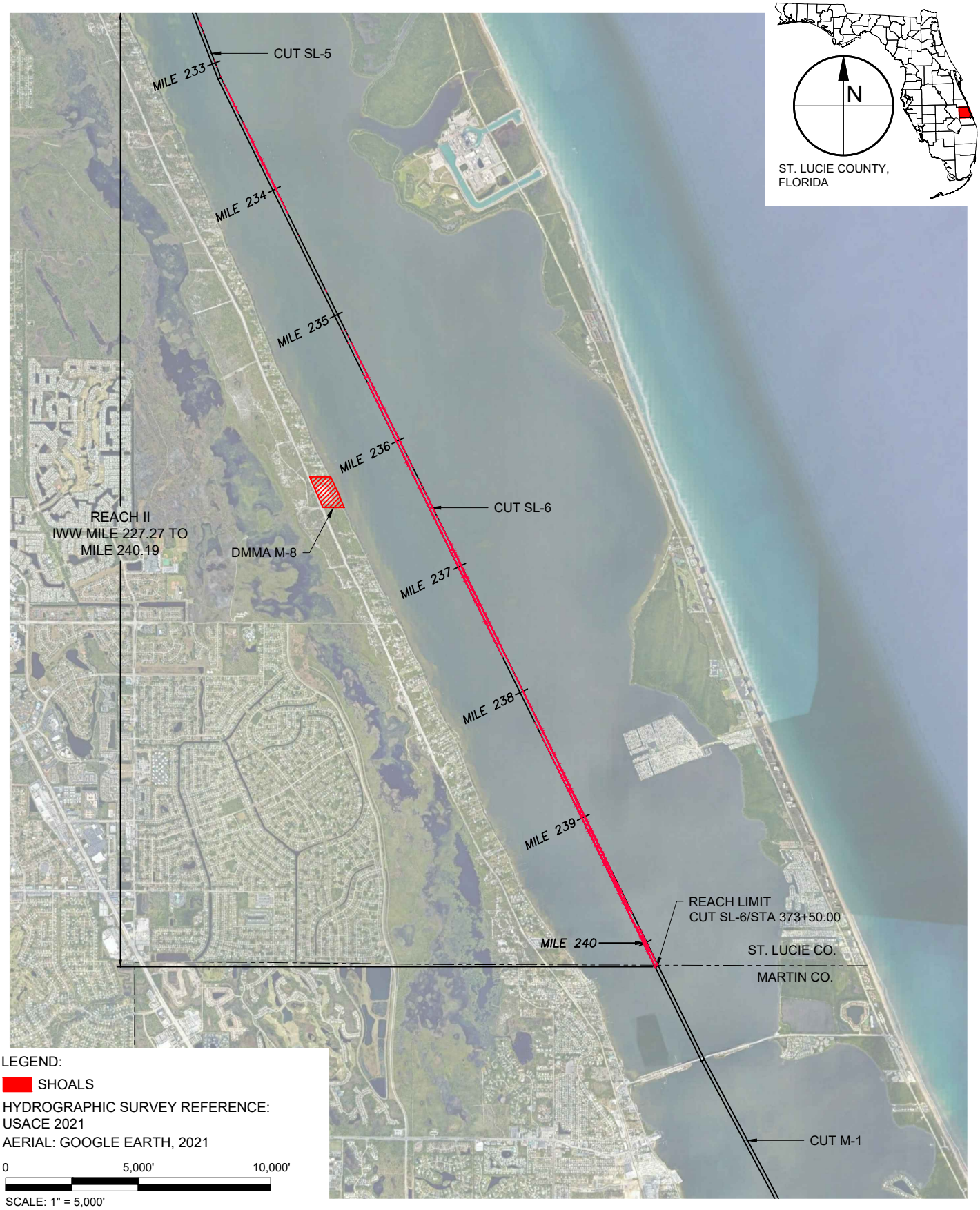

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FIGURE 3.3
RECENT SHOALS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
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SHEET	6 of 14
DATE	NOV 2022

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3.4 Material Quality

In addition to projected material quantities, the long-range DMMP must also consider the physical and chemical properties of channel sediments. Techniques employed to maintain water quality during dredging and dewatering operations depend on the material's physical (i.e., particle size, specific gravity, etc.) and chemical characteristics. In addition, physical and chemical properties determine the dredged material's potential for reuse (e.g., construction fill, landfill cover, etc.) and, therefore, influence a dredged material management site's effective service life.

St. Lucie County lies physiographically within the Coastal Lowlands characterized by terraced level plains. Pleistocene marine deposits of the Anastasia Formation overlain by a thin layer of recent coastal sediments characterize the regional geology of the project area. The Anastasia Formation extends from the land surface to a depth of 100 to 150 feet and comprises interbedded sands and coquina-type limestones. The most recognized facies of the Anastasia sediments are an orangish brown, unindurated to moderately indurated, coquina of whole and fragmented mollusk shells in a matrix of sand often cemented by sparry calcite. Sands occur as light gray to tan and orangish brown, unconsolidated to moderately indurated, unfossiliferous to very fossiliferous beds.

3.4.1 *Sediment Physical Characteristics*

Historically, USACE Jacksonville District only obtained channel sediment data as part of the planning process for scheduled channel maintenance operations and then only within the proposed dredging template as required to obtain the state water quality certification (WQC). The following paragraphs detail four known sets of geotechnical sampling data — collected in Reaches I and II — obtained in 1995/1997, 2001/2006, 2010, and 2017 within the St. Lucie County Waterway.

In October 1995, Taylor Engineering collected nine sediment samples from the designated IWW channel throughout St. Lucie County. Three (one each from the northern, central, and southern portions of the county) were analyzed for metals, organochlorine pesticides and polychlorinated biphenyls (PCB), polynuclear aromatic hydrocarbons (PAH), total organic carbon, total Kjeldahl nitrogen, carbonate, and grain size. Taylor Engineering analyzed the six remaining samples for grain size only. Two additional samples were collected on October 10, 1997, from shoals in the IWW a short distance north and south of Taylor Creek. These samples were analyzed for the same chemical constituents noted above and additionally organophosphorus pesticides. Where available, **Table 3.5** lists mean grain size and silt and clay content of the St. Lucie County sediments. Taylor Engineering classified two of the samples as silts, eight as fine sand, and one as medium sand. Sediment in the southern part of Reach II generally contained the greatest proportion of fine-grained material.

The USACE collected and analyzed two core borings – between Cuts SL-2 and SL-3N – in 2001 in the vicinity of Ft. Pierce Inlet. USACE collected one additional boring in 2006 within Cut SL-5. The total depth of each boring extended between -14.3 to -19.5 ft MLLW. Borings CB-IWW01-SL2-1 and CB-IWW01-SL3N-1 fell within the -12 ft MLLW project area, while boring VB-IWW06M-SL5-1 fell within the -10 ft MLLW project area. According to the logs, sediments within the project depth consisted of silt, fine sand, and little shell, and ranged from greenish gray to dark gray in color. Limestone was present in boring VB-IWW06M-SL5-1 at 0.2 ft below the project depth.

USACE collected a third set of geotechnical sampling data in 2010, which consisted of 22 surface grab sediment samples taken from Cuts SL-1, SL-2, SL-3N, and SL-5. Grab samples consisted primarily of fine to medium-grained sand with varying amounts of silt and sand to gravel-sized whole and broken shell.

In February 2017, Taylor Engineering collected 19 vibracore borings from within the IWW Reach I as part of the FIND's maintenance dredging of the IWW. Taylor Engineering analyzed the cores to determine if the maintenance dredged material would be suitable for beach disposal. The total depth of each boring extended between -10.8 and -22.4 ft MLLW. Borings SL-17-V-01 to SL-17-V-06 fell within the -12 ft MLLW project area, while borings SL-17-V-07 to SL-17-V-19 fell within the -10 ft MLLW project area. The core boring logs generally characterized the sediments within the project depth as sand to silty sand, grey to brown in color, with trace amounts of shell and rock. **Figures 3.4 – 3.6** provide general descriptions and locations of the historical sediment samples.

IWW sediments in St. Lucie County have variable physical textures. Recent samples and previous work indicate some areas of fine-grained or muck sediment in the northern part of Reach I and southern part of Reach II.

Due to a lack of borings and geotechnical data, Taylor Engineering also reviewed information about muck sediment distribution as documented by Trefry et al. (1990) and Trefry et al. (1987). These works define muck sediment as fine, black sediment containing more than 60 percent silts and clays, more than 50 percent water, and more than 10 percent organic matter. In their initial work, Trefry et al. (1987) took samples in the IWW and adjacent areas near Ft. Pierce. Muck sediment was not present in any of the samples. In subsequent sampling, spanning the entire length of the IWW in St. Lucie County, Trefry, et al. (1990) did not find any muck deposits north of Herman Bay Point. A one-half-mile-long deposit of thin (0.1-2 in.) muck was present at Herman Bay Point. A thick (>12 in.), six-tenths-mile-long muck deposit was present midway between Herman Bay Pt. and Nettles Island. Two thick muck deposits, each about one-half-mile-long, were present near Nettles Island.

Table 3.5 Sediment Sampling Locations and Physical Characteristics

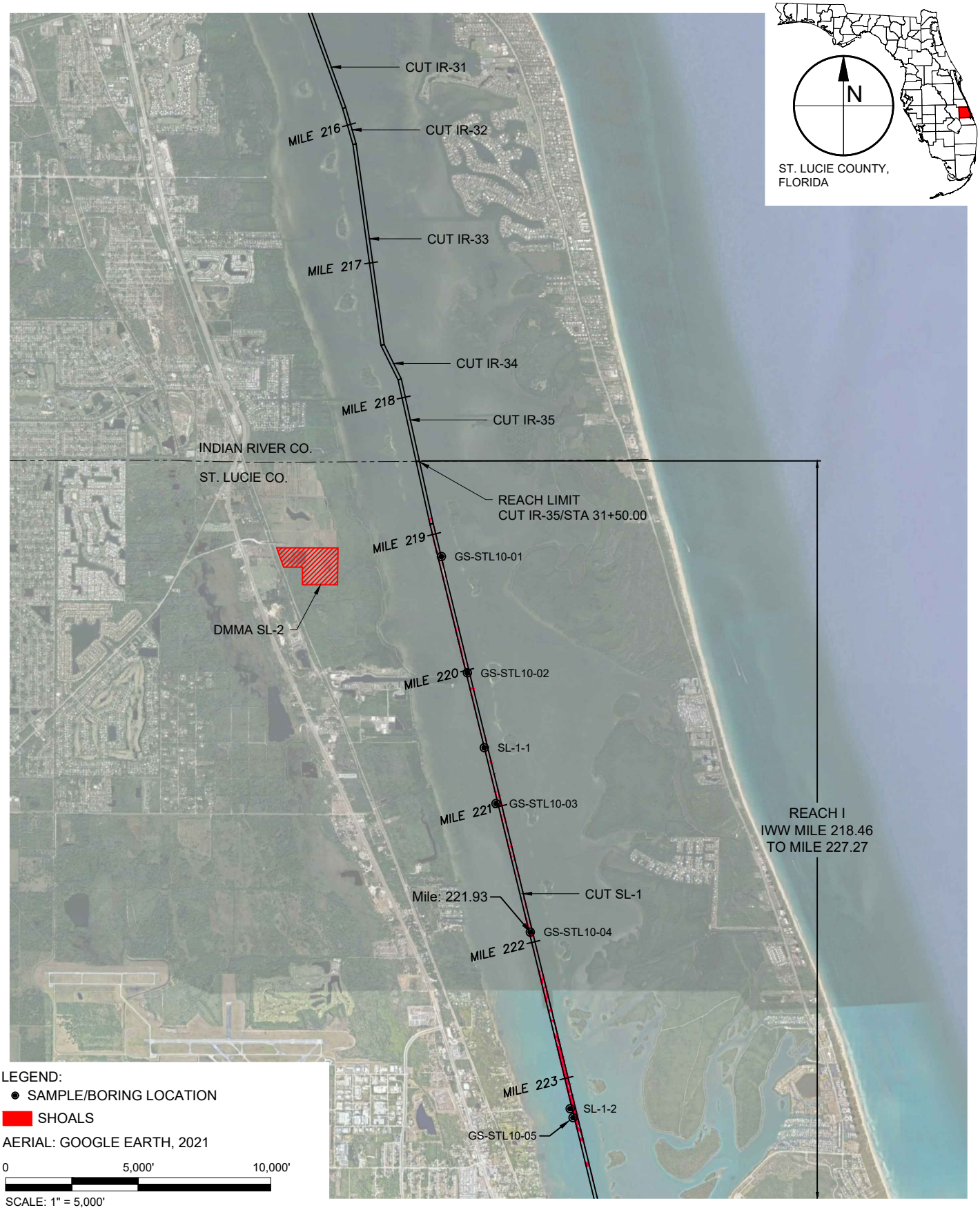
Reach	IWW Mileage	Year	Boring ID	Northing	Easting	Datum	Top of Boring Elevation (FT)	Bottom of Boring Elevation (FT)	Soil Description (Depth, FT: Description)
				NAD83 FL State Plane, East Zone, FT					
SL-I	219.17	2010	GS-STL10-01	1,168,709.30	868,353.80	N/A	N/A	N/A	SP-SM: Sand with silt, some shell fragments, very dark greenish gray
SL-I	220.02	2010	GS-STL10-02	1,164,321.50	869,331.20	N/A	N/A	N/A	SP: Sand, little shell fragments, trace silt, very dark greenish gray
SL-I	220.57	1995	SL-1-1	1,161,497.24	869,969.24	N/A	N/A	N/A	Mean Grain Size: 0.361 mm Fine Sand, 1.5% Silt + Clay
SL-I	220.97	2010	GS-STL10-03	1,159,388.90	870,410.80	N/A	N/A	N/A	SP: Sand, little shell fragments, trace silt, very dark greenish gray
SL-I	221.93	2010	GS-STL10-04	1,154,538.30	871,706.30	N/A	N/A	N/A	SP: Sand, little shell fragments, trace silt, very dark greenish gray
SL-I	223.22	1995	SL-1-2	1,147,873.92	873,209.31	N/A	N/A	N/A	Mean Grain Size: 0.397 mm Fine Sand, 1.3% Silt + Clay
SL-I	223.29	2010	GS-STL10-05	1,147,538.40	873,319.90	N/A	N/A	N/A	SP-SM: Sand with silt, little shell fragments, brown
SL-I	224.24	1995	SL-1-3	1,142,627.83	874,560.58	N/A	N/A	N/A	Mean Grain Size: 0.819 mm Medium Sand, 3.6% Silt + Clay, 0.95% Organic Matter
SL-I	224.46	2010	GS-STL10-06	1,141,671.20	875,216.10	N/A	N/A	N/A	SP: Sand, some shell fragments, brown
SL-I	224.62	2017	SL-17-V-01	1,140,827.60	875,392.30	MLLW	-13.9	-20.8	13.9 - 14.6 - SW: Sand, trace shell, very dark gray 14.6 - 15.9 - SW: Sand, trace shell, gray 15.9 - 17.0 - SW-SM: Sand with rock, trace shell, gray 17.0 - 19.0 - SW: Sand, trace shell, gray 19.0 - 20.8 - SW: Sand with shell, gray
SL-I	224.73	2017	SL-17-V-02	1,140,328.50	875,704.50	MLLW	-12.5	-17.8	12.5 - 16.6 - SW: Sand, trace shell, gray 16.6 - 17.8 - SW: Sand with rock, trace shell, gray
SL-I	224.76	1997	ICWW-TC-1	1,140,132.46	875,644.25	N/A	N/A	N/A	Fine Sand, 0.4% Organic Matter
SL-I	224.81	2017	SL-17-V-03	1,139,933.00	875,816.00	MLLW	-13.8	-17.8	13.8 - 16.7 - SW: Sand, trace shell, gray 16.7 - 17.8 - SW: Sand with rock, trace shell, gray
SL-I	224.91	2017	SL-17-V-04	1,139,436.80	876,103.50	MLLW	-13.6	-16.6	13.6 - 16.3 - SW: Sand, trace shell, gray 16.3 - 16.6 - SW-SM: Sand with rock, trace shell, gray
SL-I	224.99	2010	GS-STL10-07	1,139,061.10	876,221.20	N/A	N/A	N/A	SM: Silty sand, trace shell fragments, very dark greenish gray

Reach	IWW Mileage	Year	Boring ID	Northing	Easting	Datum	Top of Boring Elevation (FT)	Bottom of Boring Elevation (FT)	Soil Description (Depth, FT: Description)
				NAD83 FL State Plane, East Zone, FT					
SL-I	225.03	2001	CB-IWW01-SL2-1	1,138,853.19	876,265.10	MLLW	-11.1	-19.5	11.1 - 12.7 - MH: Silt, little fine sand, dark gray 12.7 - 14.5 - SM: Silty sand, fine, dark gray 14.5 - 19.5 - SP: Sand, fine, some shell, dark gray
SL-I	225.09	1997	ICWW-TC-2	1,138,510.74	876,262.76	N/A	N/A	N/A	Fine Sand, 1.45% Organic Matter
SL-I	225.11	2017	SL-17-V-05	1,138,521.50	876,674.60	MLLW	-11.6	-17.3	11.6 - 15.8 - SM: Silty sand, trace shell, dary gray 15.8 - 16.3 - SW-SM: Sand, trace shell, light brownish gray 16.3 - 16.7 - SW-SM: Silty sand, trace shell, dark qrey 16.7 - 17.3 - SW: Sand, trace shell, grayish brown to gray with mottling
SL-I	225.17	2017	SL-17-V-06	1,138,163.10	876,589.00	MLLW	-16	-22.4	16.0 - 22.4 - SW-SM: Sand with silt, trace shell, gray
SL-I	225.25	2010	GS-STL10-08	1,137,791.70	876,786.60	N/A	N/A	N/A	SM: Silty sand, trace shell fragments, very dark greenish gray
SL-I	225.42	2001	CB-IWW01-SL3N-1	1,136,919.19	877,062.10	MLLW	-9.9	-17.2	9.9 - 17.2 - SP: Sand, fine, little shell, gray
SL-I	225.85	2017	SL-17-V-07	1,134,786.30	877,776.30	MLLW	-12.1	-17.6	12.1 - 13.6 - SW-SM: Silty sand with rock, trace shell, pale brown 13.6 - 14.6 - SW-SM: Silty sand, trace shell, light gray 14.6 - 15.1 - SW-SM: Silty sand, trace shell, grayish brown 15.1 - 16.5 - SW-SM: Silty sand, trace shell, dark brown 16.5 - 17.6 - SW: Sand with shell, gray
SL-I	225.87	1995	SL-2-1	1,134,716.77	877,872.68	N/A	N/A	N/A	Mean Grain Size: 0.242 mm Fine Sand, 5.7% Silt + Clay, 0.98% Organic Matter
SL-I	225.96	2010	GS-STL10-09	1,134,028.40	877,428.90	N/A	N/A	N/A	SP: Sand, trace silt, very dark greenish gray
SL-I	226.00	2017	SL-17-V-08	1,134,075.00	878,126.40	MLLW	-11.4	-16.4	11.4 - 12.5 - SW-SM: Silty sand with rock, trace shell, light gray 12.5 - 12.9 - SW-SM: Silty sand with rock, trace shell, pale brown 12.9 - 15.5 - SW-SM: Silty sand with rock, trace shell, gray 15.5 - 15.6 - SP: Sand, trace shell, dark brown 15.6 - 16.4 - SP: Sand, trace shell, brown

Reach	IWW Mileage	Year	Boring ID	Northing	Easting	Datum	Top of Boring Elevation (FT)	Bottom of Boring Elevation (FT)	Soil Description (Depth, FT: Description)
				NAD83 FL State Plane, East Zone, FT					
SL-I	226.21	2017	SL-17-V-09	1,133,054.30	878,519.50	MLLW	-7.8	-13.6	7.8 - 11.1 - SP: Sand, trace shell, gray 11.1 - 13.8 - SW-SM: Silty sand with rock, trace shell, pale brown
SL-I	226.30	2017	SL-17-V-10	1,132,579.10	878,603.80	MLLW	-8.8	-15.7	8.8 - 10.6 - SW-SM: Silty sand, trace shell, gray 10.6 - 11.9 - SW-SM: Silty sand, trace shell, light gray 11.9 - 12.9 - SW-SM: Silty sand with rock, trace shell, gray 12.9 - 15.7 - SW-SM: Silty sand, trace rock, trace shell, pale brown
SL-I	226.40	2017	SL-17-V-11	1,132,126.30	878,873.30	MLLW	-8.1	-13.5	8.1 - 10.1 - SW: Sand, trace shell, gray 10.1 - 11.6 - SW: Sand, trace shell, light gray 11.6 - 13.5 - SW: Sand, trace rock, trace shell, light gray
SL-I	226.49	2017	SL-17-V-12	1,131,640.10	879,012.30	MLLW	-9.8	-12.8	9.8 - 11.6 - SW: Sand, trace shell, gray 11.6 - 12.5 - SW: Sand, trace rock, trace shell, gray 12.5 - 12.8 - GP: Rock fragments with sand, light gray
SL-I	226.51	2010	GS-STL10-10	1,131,409.60	878,677.60	N/A	N/A	N/A	SP-SM: Sand with silt, trace shell fragments, very dark greenish gray
SL-I	226.60	2017	SL-17-V-13	1,131,107.10	879,275.70	MLLW	-9.1	-15.4	9.1 - 11.4 - SW-SM: Silty sand, trace shell, grayish brown 11.4 - 13.7 - SW-SM: Silty sand, trace rock, trace shell, pale brown 13.7 - 14.9 - SW-SM: Silty sand, trace shell, gray 14.9 - 15.4 - SW-SM: Silty sand, trace shell, gray
SL-I	226.69	2017	SL-17-V-14	1,130,656.50	879,359.20	MLLW	-8.8	-16.7	8.8 - 10.8 - SW: Sand, trace shell, gray 10.8 - 12.1 - SW-SM: Silty sand with rock, trace shell, light brownish gray 12.1 - 12.2 - SW-SM: Silty sand, trace shell, dark gray 12.2 - 14.8 - SW-SM: Silty sand, trace shell, light gray 14.8 - 16.7 - SW-SM: Silty sand, trace shell, very dark gray
SL-I	226.70	2006	VB-IWW06M-SL5-1	1,130,614.15	879,424.10	MLW	-7.1	-14.3	7.1 - 8.8 - SP-SM: Sand with silt, some shell, pale olive 8.8 - 10.2 - SM: Silty sand, little shell, greenish gray 10.2 - 11.7 - LIMESTONE: light greenish gray 11.7 - 13.4 - SHELL: sand to gravel sized, few silt, light greenish gray

Reach	IWW Mileage	Year	Boring ID	Northing	Easting	Datum	Top of Boring Elevation (FT)	Bottom of Boring Elevation (FT)	Soil Description (Depth, FT: Description)
				NAD83 FL State Plane, East Zone, FT					
									13.4 - 14.3 - SP: Sand, little shell, trace silt, greenish gray
SL-I	226.79	2017	SL-17-V-15	1,130,184.10	879,639.20	MLLW	-9.7	-10.8	9.7 - 10.8 - SW: Sand with rock, trace shell, gray
SL-I	226.87	2017	SL-17-V-16	1,129,758.40	879,688.40	MLLW	-9.7	-16.7	9.7 - 12.0 - SP: Sand, trace shell, gray 12.0 - 12.5 - SW-SM: Silty sand with rock, trace shell, gray 12.5 - 13.0 - SW-SM: Silty sand with rock, trace shell, gray 13.0 - 14.5 - CH: Sandy clay, trace shell, pale brown 14.5 - 16.3 - PT: Peat and silty sand, trace shell, dark brown 16.3 - 16.7 - GM: Rock with sand, trace shell, dark gray
SL-I	226.99	2017	SL-17-V-17	1,129,231.60	880,021.60	MLLW	-9.8	-16.8	9.8 - 11.8 - SW: Sand, trace shell, gray 11.8 - 12.5 - SW: Sand with rock, trace shell, gray 12.5 - 13.3 - SW: Sand, trace shell, gray 13.3 - 15.1 - SW: Sand with rock, trace shell, gray to light gray 15.1 - 16.8 - SW: Sand, trace shell, pale brown
SL-I	227.07	2017	SL-17-V-18	1,128,787.20	880,094.40	MLLW	-10	-15.9	10.0 - 13.2 - SW: Sand, trace shell, gray 13.2 - 13.5 SW-SM: Silty sand with rock, trace shell, pale brown 13.5 - 15.9 - SW-SM: Silty sand with rock, trace shell, gray
SL-I	227.17	2017	SL-17-V-19	1,128,322.10	880,358.80	MLLW	-10.1	-16.1	10.1 - 12.2 - SW: Sand, trace shell, gray 12.2 - 13.0 - SW-SM: Sand, trace rock, trace shell, gray 13.0 - 16.1 - SW-SM: Sand, trace shell, pale brown
SL-II	227.31	2010	GS-STL10-11	1,127,510.70	880,366.10	N/A	N/A	N/A	SP-SM: Sand with silt, trace shell fragments, very dark greenish gray
SL-II	228.07	2010	GS-STL10-12	1,123,813.20	881,927.60	N/A	N/A	N/A	SP-SM: Sand with silt, little shell fragments, greenish gray
SL-II	228.45	2010	GS-STL10-13	1,121,979.80	882,739.90	N/A	N/A	N/A	SM: Silty sand, few shell fragments, very dark greenish gray
SL-II	228.55	1995	SL-2-2	1,121,503.98	882,892.92	N/A	N/A	N/A	Mean Grain Size: 0.131 mm Fine Sand, 18.9% Silt + Clay

Reach	IWW Mileage	Year	Boring ID	Northing	Easting	Datum	Top of Boring Elevation (FT)	Bottom of Boring Elevation (FT)	Soil Description (Depth, FT: Description)
				NAD83 FL State Plane, East Zone, FT					
SL-II	228.90	2010	GS-STL10-14	1,119,803.40	883,617.30	N/A	N/A	N/A	SM: Silty sand, few shell fragments, very dark greenish gray
SL-II	229.52	2010	GS-STL10-15	1,116,688.70	884,644.30	N/A	N/A	N/A	SM: Silty sand, trace shell fragments, very dark greenish gray
SL-II	229.97	2010	GS-STL10-16	1,114,482.50	885,603.30	N/A	N/A	N/A	SM: Silty sand, few shell fragments, greenish gray
SL-II	230.46	2010	GS-STL10-17	1,112,124.90	886,581.20	N/A	N/A	N/A	SM: Silty sand, few shell fragments, very dark greenish gray
SL-II	230.86	2010	GS-STL10-18	1,110,119.30	887,277.70	N/A	N/A	N/A	SM: Silty sand, few shell fragments, very dark greenish gray
SL-II	231.25	2010	GS-STL10-19	1,108,266.20	888,171.80	N/A	N/A	N/A	SM: Silty sand, trace shell fragments, very dark greenish gray
SL-II	231.79	2010	GS-STL10-20	1,105,493.80	888,990.10	N/A	N/A	N/A	SP-SM: Sand with silt, little shell fragments, very dark greenish gray
SL-II	232.10	1995	SL-2-3	1,104,037.67	889,716.13	N/A	N/A	N/A	Mean Grain Size: 0.163 mm Fine Sand, 17.2% Silt + Clay
SL-II	232.30	2010	GS-STL10-21	1,103,036.30	890,131.20	N/A	N/A	N/A	SM: Silty sand, few shell fragments, greenish black
SL-II	232.76	2010	GS-STL10-22	1,100,789.30	891,000.80	N/A	N/A	N/A	SM: Silty sand, little shell fragments, very dark greenish gray
SL-II	234.14	1995	SL-3-1	1,094,181.31	894,016.25	N/A	N/A	N/A	Mean Grain Size: 0.350 mm Fine Sand, 8.3% Silt + Clay
SL-II	236.23	1995	SL-3-2	1,084,285.52	898,945.38	N/A	N/A	N/A	Mean Grain Size: 0.058 mm Silt, 50.5% Silt + Clay
SL-II	238.33	1995	SL-3-3	1,074,401.54	903,928.75	N/A	N/A	N/A	Mean Grain Size: 0.041 mm Silt, 44.3% Silt + Clay, 7% Organic Matter



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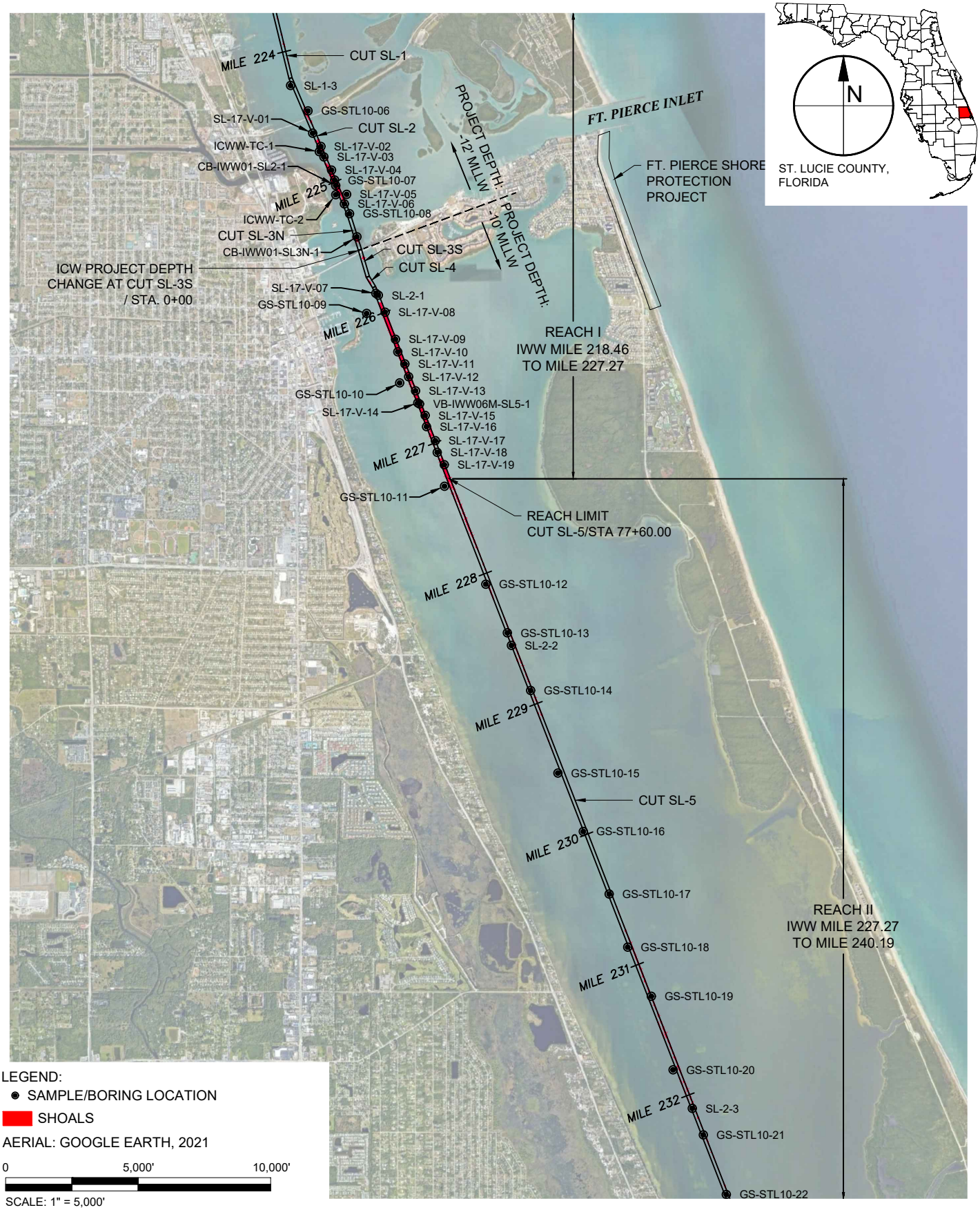
REGISTRY # 4815

FIGURE 3.4
SAMPLE AND BORING LOCATIONS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	7 of 14
DATE	NOV 2022

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.



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SUITE 310
JACKSONVILLE, FLORIDA 32256
REGISTRY # 4815

FIGURE 3.5
SAMPLE AND BORING LOCATIONS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	8 of 14
DATE	NOV 2022

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FIGURE 3.6
SAMPLE AND BORING LOCATIONS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	9 of 14
DATE	NOV 2022

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

3.4.2 *Sediment Chemistry*

Chemical contaminants enter St. Lucie County coastal waters from non-point (e.g., agricultural, urban stormwater runoff, atmospheric pollutant deposition, and marine craft operations) and point (e.g., industrial and municipal wastewater effluent) sources. These compounds may accumulate in the surficial sediments. Urbanized areas may contribute metals (e.g., arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury), pesticides, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Several of the metals and PAH compounds may have a natural origin, and some others do not occur naturally. Others, such as pesticides, do not occur naturally and can be considered contaminants if present at any concentration. The burdens of these chemicals in the sediment need to be understood to make appropriate sediment management decisions to decide whether the sediments will require special handling before being pumped into or within a DMMA. The presence of a chemical does not necessarily indicate that it will cause adverse environmental effects during dredging or dredged material placement. Expression of contaminant effects depends on a variety of factors, including the contaminant concentration and chemical properties and other sediments characteristics.

The 1997 St. Lucie County DMMP summarized sediment chemistry analysis evaluations for sediment samples collected by Taylor Engineering in 1995 and 1997. The objective of this sediment sampling program was to screen sediments for potential contaminants and to verify the presence of muck sediments in areas previously determined to have accumulated fine sediments. As noted above, Taylor Engineering collected nine (9) sediment samples in October 1995 from the designated IWW channel throughout St. Lucie County, of which they analyzed three (3) samples for sediment chemistry. In response to public concern about potential contaminants being carried into the IWW from Taylor Creek, in 1997, Taylor Engineering collected two (2) additional sediment samples for analysis from shoals located in the IWW a short distance north and south of Taylor Creek.

Of particular interest in the Indian River is the distribution and composition of fine-grained, organic carbon-rich sediments. These surficial sediments, commonly called muck, are of concern because of their potential effects on water quality and benthic communities and for their tendency to accumulate pollutants. As noted earlier, in St. Lucie County, these surficial sediments accumulate in deeper portions of the Indian River Lagoon, such as the IWW channel (Trefry et al., 1987 & 1990). Where possible, sediment sampling for chemical analyses occurred from areas of previously described accumulations of fine-grained sediments near potential sources of contamination (e.g., urban areas). The three (3) locations selected for sediment chemistry analysis in 1995 represent potential worst-case scenarios for sediment contamination in the county's north, central, and southern. The sediment chemistry analyses for the three (3) 1995 samples include testing for metals (aluminum, arsenic, cadmium, chromium, copper, iron, lead, nickel, zinc, and mercury), organochlorine pesticides, and polychlorinated biphenyls (PCB), polynuclear aromatic hydrocarbons (PAH), total organic carbon, total Kjeldahl nitrogen, carbonate, and grain size. The two (2) samples collected in 1997 were analyzed for the same chemical constituents as the previous 1995 samples with additional testing for organophosphorus pesticides.

Metals are natural components of sediments, but man's activities may enrich the concentration in the sediments. Only when metal concentrations exceed natural levels should they be considered pollutants. The natural occurrence of metals at variable concentrations complicates the evaluation of metal values. One approach to interpreting metal concentrations is based on the likelihood of metal causing adverse effects on aquatic organisms. MacDonald (1995) has calculated Threshold Effects Levels (TEL) and Probable Effects Levels (PEL) for several metals and other compounds. For the 1995 and 1997 studies, all metal concentrations were below the TEL, indicating that they are unlikely to cause adverse biological effects. Another method involves looking at a metal enrichment ratio (i.e., the ratio of measured

metal concentration to maximum predicted natural concentration), where enrichment ratios greater than one indicate metal contamination. For the 1995 and 1997 Studies, metal enrichment ratios in most of the tested samples were less than one, indicating that metals in these sediments are within natural ranges. Copper, lead, and zinc were somewhat enriched in one of the 1995 samples (SL-1-3), and Cadmium was slightly enriched in both of the 1997 samples (IWW-TC-1 and IWW-TC-2).

The State of Florida uses the soil cleanup target levels (SCTL) (Chapter 62-777, Florida Administrative Code) to define the risk thresholds for many contaminants. The Direct Exposure Residential SCTL and groundwater leachability thresholds define acceptability for the general upland disposal of sediments. Organochlorine pesticides, PAH, and PCB concentrations were below reporting limits in all samples.

In addition to the chemicals discussed above, Taylor Engineering examined several other components of the sediment as part of the 1995 and 1997 studies to ascertain whether the IWW contains atypical concentrations of chemicals. This study compared total organic carbon and total Kjeldahl nitrogen to the results of statewide sediment data collected by the FDEP from natural coastal sediment from 1984 through 1990. The sediment samples contained organic carbon and nitrogen typical of those in natural Florida sediments, though concentrations were at the higher range for the southernmost sample. Oil and grease values in the St. Lucie County IWW sediments ranged from 18 to 23 mg/kg^{-1}. By comparison, Lyman et al. (1987) reported oil and grease concentrations ranging from 200 to 170,000mg/kg^{-1} in a number of coastal sediments known to be polluted. The St. Lucie County IWW sediments, with oil and grease values well below those reported by Lyman et al. (1987), do not appear to be contaminated with oil and grease.

Based on historical samples, sediment test results suggest that sediment in the St. Lucie County part of the IWW does not contain substantial quantities of contaminants. Metals were within natural ranges; pesticides and PCBs were below reporting limits. These samples originated in areas considered most likely to be contaminated due to the presence of fine sediments and proximity to urban areas. The number of samples was limited; however, additional chemical testing of IWW channel sediment will likely be required prior to dredging. Regardless of the Reach, current regulatory standards and Taylor Engineering recommend sampling and testing of specific sediments proposed for dredging when permitting the dredging projects. The results of reconnaissance-level sediment investigation provide useful input for the development of sampling and testing protocol for those fine-grained sediments prevalent within the County.

4.0 DMMA DESIGN AND CONSTRUCTION

With the foundation of the DMMP established (Chapter 2.0) and the update of the 50-year maintenance dredging and storage requirements complete (Chapter 3.0), this section of the report focuses on a design and operational overview of the two — SL-2 and M-8 – St. Lucie County dredged material management sites.

Taylor Engineering selected the two sites based on the sites' ability to best satisfy three primary categories of consideration — engineering/operational, environmental, and socioeconomic/cultural. The following section, presenting the DMMAs in order from north to south, details these considerations and how they factored into the design life cycle of the DMMA (i.e., preliminary design, permitting, and final design and construction). This section also includes a location map, plan view, and representative cross-sectional drawings depicting the as-built site condition for each site and a tabular summary of site characteristics (i.e., location, reach, DMMA design, and access) for both DMMA as constructed by FIND.

4.1 DMMA SL-2

The SL-2 DMMA is located approximately 3,300 feet south of the Indian River/St. Lucie County line and about seven miles north of Ft. Pierce. The site comprises the southern 56.63 acres of a larger (150+ acre) actively managed citrus grove that lies between U.S. Highway 1 and the Indian River's western shore. FIND purchased the site in 1998 from Kennedy Groves Inc. The Florida East Coast Railway lies west of the site, with Old Dixie Highway immediately west of the railway. Between the site and the Indian River shoreline lies a large disturbed Brazilian pepper and mangrove wetland/mosquito impoundment. Undeveloped land lies south of the site, with additional citrus groves to the north.

4.1.1 *Preliminary Design*

Engineering/Operational - FIND constructed the DMMA SL-2 containment basin in 2009 on the 56.63-acre property. SL-2 serves Reach I of the IWW in St. Lucie County. The basin design capacity is 94,488 cy which in combination with beach placement of the material, will provide sufficient capacity to meet the Reach's updated 50-year storage requirement of 243,598 cy. No dredging operations have used the site since its construction in 2009. Therefore, the site's original capacity remains available. Should the containment basin reach capacity, offloading of the site to restore capacity may be required.

Much of the maintenance dredging material from Reach I will likely be compatible with the native sands of local beaches, especially material from Cuts near the Fort Pierce Inlet. For this reason, the primary means of disposal of maintenance material from Reach I will be beach placement at the FP-SPP (**Chapter 6.0**). However, timing maintenance dredging to coincide with optimum conditions for beach placement may prove difficult or impossible. Should the beach placement area be unavailable, SL-2 and M-8 will provide temporary storage of dredged material until beach nourishment operations are implemented.

Environmental - Prior to construction of DMMA SL-2, site inspections performed in May 2006 indicated that an active citrus grove covered 85% of the property, with shallow ditches throughout. A drainage ditch separated this area from off property mangrove swamp to the east. Other less significant land cover types included drainage ditches (6% coverage) and wet prairie/swale (4% coverage).

The site is bounded to the north by abandoned citrus groves and undeveloped lands, on the south by undeveloped lands, on the east by undeveloped lands and the Indian River Lagoon, and on the west by The Florida East Coast Railroad and North Old Dixie Highway, providing easy access to the site via truck. The predominant soil types on the property are poorly drained soils. A submerged resources survey

conducted within the Indian River Lagoon—between the mangrove shoreline and the channel—identified a shallow, gently sloping sand shelf with 5% to 100% seagrass cover.

While meeting the minimum engineering/operational requirements, the basin's design configuration also minimized environmental impacts. Following the construction of the DMMA, much of the adjacent mangrove wetlands remain undisturbed and continue to function as mosquito impoundments, and much of the uplands are occupied by the DMMA basin. Conditions of the permit to construct the DMMA offset unavoidable wetland impacts through: (1) the removal of all exotic and nuisance plant species listed on the "Florida Exotic Pest Plant Council's 2007 List of Invasive Plant Species" from a 1.8-acre onsite drainage ditch wetland area and (2) the creation and preservation of mangrove wetlands within the SL-2 Mangrove Restoration Site located in Indian River County. Monitoring reports submitted annually to FDEP indicate successful wetland creation for this site.

Socioeconomic/Cultural - The design minimizes site development impacts on adjacent properties and environmentally sensitive on-site habitats by incorporating appropriate buffer (varying between 150 ft and 1,130 ft) areas surrounding the containment basin. A review of the Florida Master Site File revealed no historical or archeological activities of record within the site boundaries.

4.1.2 *Easements and Permits*

On March 13, 2008, FDEP issued ERP No. 56-0255662-001 for the construction of Dredged Material Management Area SL-2. On February 10, 2009, USACE issued permit No. SAJ-2005-9292 (NW-GGL) authorizing construction of the DMMA. FIND obtained perpetual access easement Book 1174-Page 2783 on September 15, 1998, and perpetual access easement Book 1173-Page 1614 on September 18, 1998. FIND also obtained the pipeline easement Book 1174-Page 2787 on September 15, 1998. The easements allow for ingress and egress and pipeline transmission.

4.1.3 *Final Design and Construction*

Carrying forward the preliminary design and permitting features that inherently included the original engineering/operational, environmental, and socioeconomic/cultural criteria, FIND constructed the site in 2009.

The site's as-built capacity based on drawings provided by Taylor Engineering is 94,488 cy. The dike has a crest elevation of 14.94 ft NGVD, a dike crest width of 12 ft, 3H:1V interior and exterior side slopes, and a varying bottom basin toe elevation – that ranges from 2.0 ft to 5.0 feet NGVD from east to west. Excavating the basin interior to this depth plus the use of an adjacent borrow area provided the material necessary for site construction. The containment dike also includes a ramp to provide ingress and egress to and from the interior of the containment area. The outside slope of the ramp and the slope of the supporting toe maintain the same 3H:1V slope as the main dike. The ascending/descending grade is 20H:1V. These ramps allow the removal of the dewatered dredged material from the DMMA without disturbing the overall structural integrity of the dike. With the containment basin filled, the surface of the deposition layer will lie an average of 4 ft below the dike crest, allowing a minimum of 2 ft of freeboard and 2 ft average ponding depth.

4.1.4 *Summary*

The primary goal of the upland DMMA is to provide sufficient capacity to receive, dewater, and temporarily store sediments dredged from the adjacent reach. **Table 4.1** provides a summary of the

location, reach, and DMMA features. **Figure 4.1** and **Figure 4.2** provide a plan and section view of the DMMA.

Table 4.1 DMMA SL-2 Site Data Summary Sheet

Location			
Section/Township/Range	**5/34S/40E**	East/West of Waterway	**West**
County	**St. Lucie**	Municipality	**St. Lucie County**
Reach			
Designation	**SL-1**	Projected Dredging Frequency	**10 – 20 years**
Length (mi)	**8.81**	50-Year Dredging Requirement (cy)	**113,302**
Mileage	**218.46 – 227.27**	50-Year Storage Requirement (cy)	**243,598**
Cut/Station	**IR-35/31+50.00 - SL-5/77+60.00**		
Geographic	**Indian River/St. Lucie County line to Bear Point**		
Dredged Material Management Area			
Property Area (ac)	**56.63**	Design Basin Capacity (cy)	**94,488 cy**
Basin Area (ac)	**13.08**	Available Basin Capacity (cy)	**94,488 cy**
Buffer Width (ft)	**N = 350**	Dike Slope	**3H:1V**
	S = 350	Crest Width (ft)	**12**
	E = 150	Natural Grade Elevation (ft NGVD)	**3.3**
	W = 350 – 1,130	Depth of Excavation (ft)	**1.3**
IWW Mileage	**219**	Dike Height Above Natural Grade (ft)	**11.64**
Max. Pumping Distance (mi)	**±8.91**	Required Ponding & Freeboard (ft)	**4**
Distance from Waterway (ft)	**1,330**	Type of Weir System	**Three half-pipe weirs**
Impacted Wetlands (ac)	**0.89**	Weir Crest Length (ft)	**24**
Mitigation	**Yes**	Entity and Year Constructed	**FIND, 2009**
Regulatory Permits	**FDEP ERP56-0255662-001-EI, 003-EM, 004-EM USACE SAJ-2005-9292 (NW-GGL)**		
Access			
Public Access	**Old Dixie HWY**	Pipeline Easement	**Yes**
Road Easement	**Yes**	Deep Draft Access	**No**
Narrative			
The 56.63-acre SL-2 DMMA is located about 3,300 ft south of the Indian River/St. Lucie County line (about seven miles north of Ft. Pierce. The site lies on the western shore of the Indian River. The parcel is east of U.S. Route 1 and offers relatively direct pipeline access, crossing a disturbed mangrove/mosquito impoundment via an easement. Conditions of the permit to construct the DMMA offset unavoidable wetland impacts by: (1) the removal all exotic and nuisance plant species listed on the "Florida Exotic Pest Plant Council's 2007 List of Invasive Plant Species" from a 1.8-acre onsite drainage ditch wetland area and (2) the creation and preservation of mangrove wetlands within the SL-2 Mangrove Restoration Site located in Indian River County. Monitoring reports submitted annually to FDEP indicate successful wetland creation for this site.			

SITE FEATURES	
DIKE SLOPE	3H/1V
CREST WIDTH	12 FT
REQUIRED FREEBOARD AND PONDING DEPTH	4 FT
DIKE HEIGHT ABOVE NATURAL GRADE	11.64 FT
DEPTH OF EXCAVATION	0 FT
PROPERTY AREA	56.63 AC
BASIN AREA	13.08 AC
BASIN DESIGN CAPACITY	94,488 CY

SOURCE: TAYLOR ENGINEERING, 2008

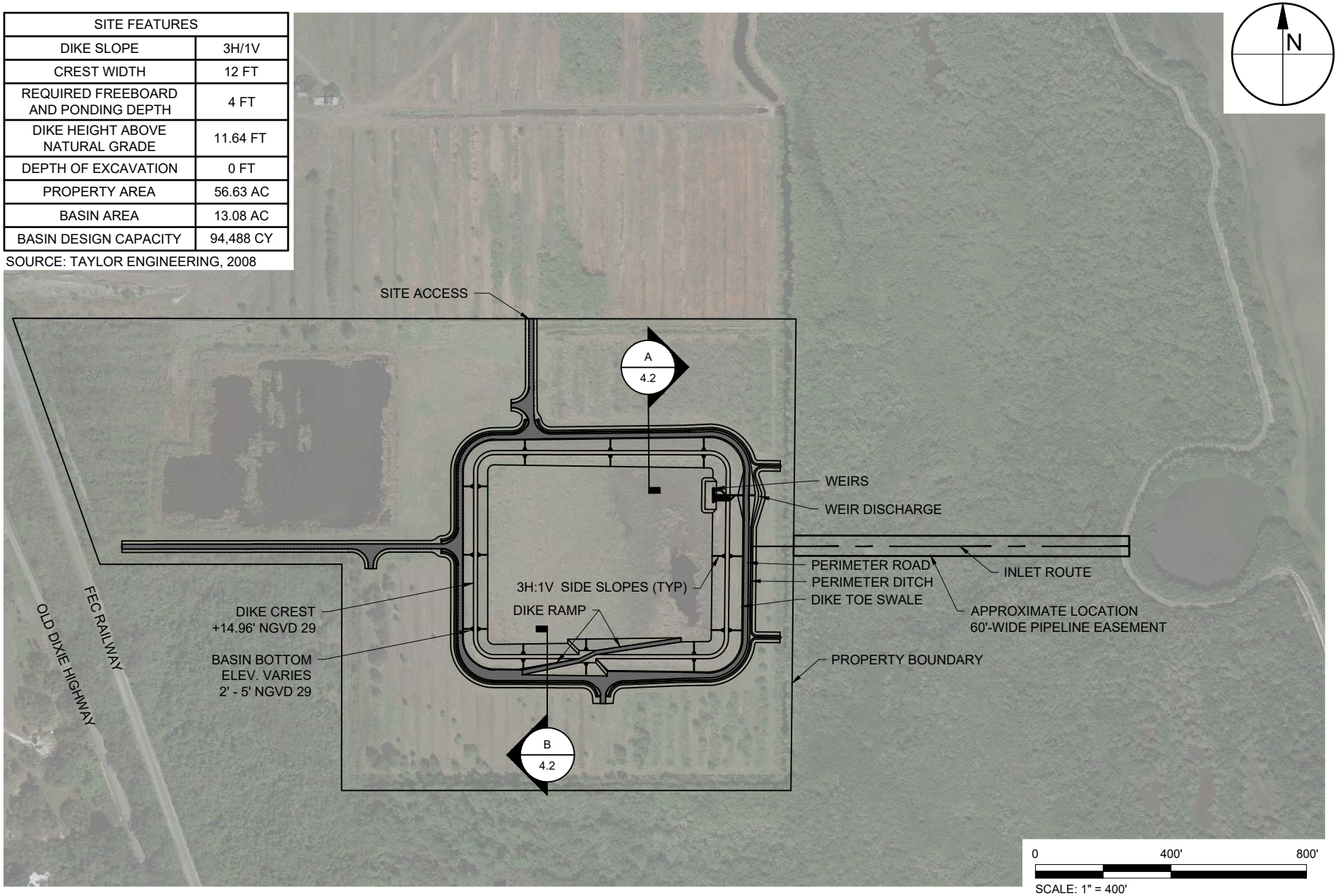

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FIGURE 4.1
DMMA SL-2 PLAN VIEW
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	10 of 14
DATE	NOV 2022

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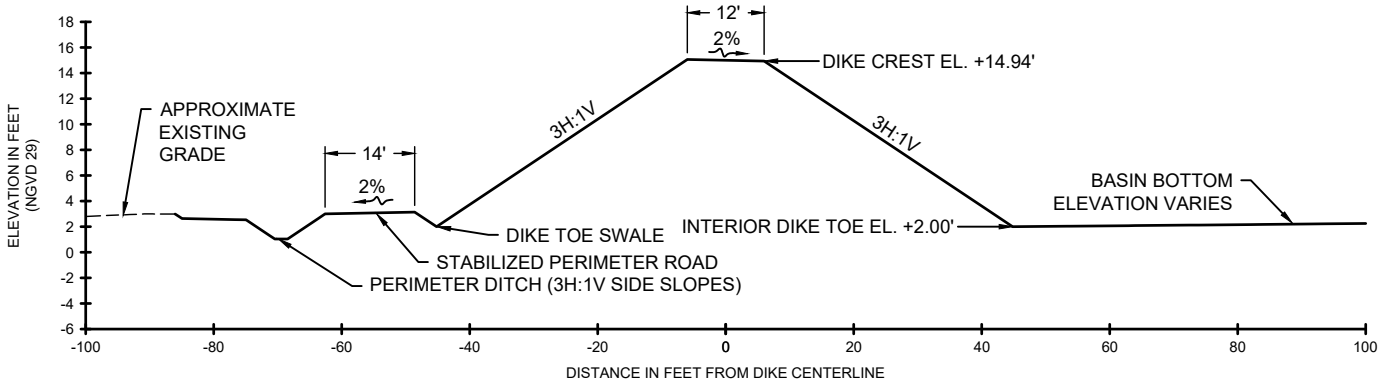
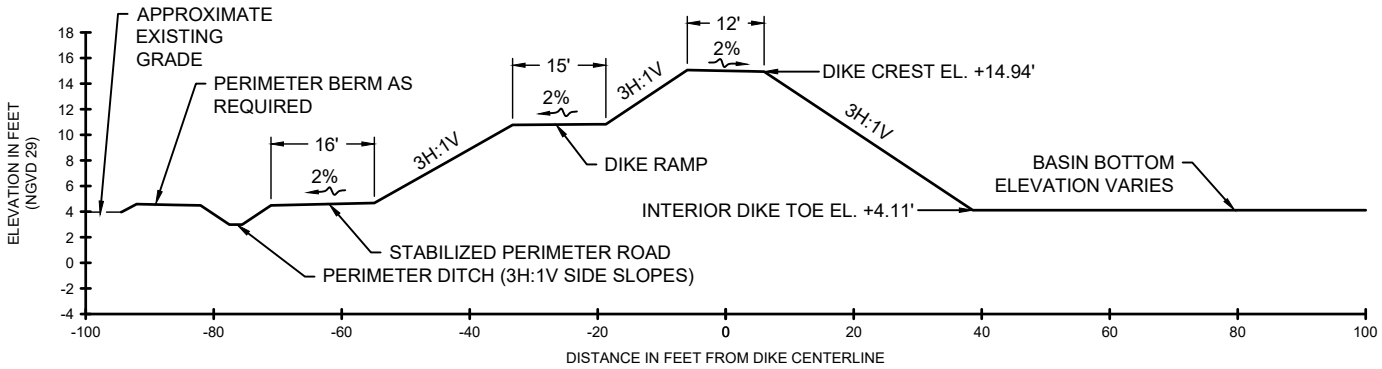
PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.



A SL-2 TYPICAL CROSS-SECTION

SCALE: 1" = 1'
V-SCALE: 1" = 1'



B SL-2 TYPICAL RAMP CROSS-SECTION

SCALE: 1" = 1'
V-SCALE: 1" = 1'

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FIGURE 4.2
DMMA SL-2 TYPICAL CROSS-SECTIONS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	11 of 14
DATE	NOV 2022

4.2 DMMA M-8

FIND constructed the M-8 DMMA in 2020 to serve Reach II's dredged material management needs. FIND purchased the site in 1995 from the John D and Catherine T MacArthur Foundation and sold a portion to St Lucie County in 1998. The 20.3-acre site lies about 3.3 miles north of the St. Lucie/Martin County line and 4,00 feet north of Walton Road. The Savannas State Preserve borders the site to the west, and the Indian River Lagoon borders it to the east. Originally identified as part of a larger 53.9-acre undeveloped parcel, FIND's acquisition and subsequent transfer of the original site's southern 33.6 acres (designated Parcel A) to St. Lucie County for park development reduced the site to its present size. Within the remaining site (Parcel B), elevations range from +42 feet NGVD in the southwest corner to about +21 feet NGVD along Indian River Drive (S.R. 707), a narrow secondary road that lies 60-70 feet west of and parallel to the Indian River shoreline. East of the roadway, a steep bluff descends to the water's edge. Low-density residential properties lie immediately to the north of the site, with the undeveloped park property immediately to the south. The Florida East Coast Railway right-of-way separates the site from the Savannas State Preserve farther to the west.

4.2.1 *Preliminary Design*

Engineering/Operational - FIND constructed the 13.68-acre DMMA M-8 containment basin in 2020 on the 20.30-acre property. M-8 serves Reach II of the IWW in St. Lucie County. The basin design capacity is 79,552 cy which will provide sufficient capacity to meet the Reach's updated 50-year storage requirement of 25,306 cy. No dredging operations have used the site since its construction in 2020. Therefore, the site's original capacity remains available. The excess capacity may be used to supplement the storage deficit for Reach I/DMMA SL-2 should beach placement not be an available option at the time of dredging.

Environmental - Prior to construction of DMMA M-8, site inspections performed in November 2016 identified six habitats within the property boundaries. The predominant community type, cabbage palm/sand live oak, covered 37% of the property and occurred on the eastern portion of the site up to the western edge of Indian River Drive. The coastal scrub community, located in the central portion of the site, was absent a canopy stratum and covered 21% of the property. A sand pine community occurred within the southwestern portion of the property and covered 18% of the property. Disturbed land comprised the far eastern edge of the property consisting of the Indian River Drive right-of-way and a steep bluff descending to the water's edge. The right of way is frequently mowed, and the bluff slope experienced significant disturbance during a previous shoreline stabilization project that included the installation of articulated concrete block along the toe and slope of the bluff.

The predominant soil types on the property are excessively drained soils. Paola Sand dominates the eastern portion of the property (6.9 acres), and the western portion is dominated by St. Lucie Sand (13.5 acres). The primary seagrass habitat identified during the survey of the adjacent Indian River consisted of low-density, monospecific beds of *H. wrightii*. *H. johnsonii*, a federally listed threatened species, that inhabited two small beds intermixed with *H. wrightii.*

Socioeconomic/Cultural - The placement of the containment basin within the site provides adequate separation from adjacent properties. As shown in **Figure 4.3**, the containment dike's outside toe lies about 250 ft inside the northern site boundary, 150 ft inside the southern boundary, 180 ft inside the eastern boundary, and 50 ft inside the western boundary. These setbacks allowed for the construction of a service road and perimeter ditch while maintaining reasonable buffers separating the construction

area with adjacent properties. A review of the Florida Master Site File revealed no historical or archeological activities of record within the site boundaries.

4.2.2 *Easements and Permits*

On August 31, 2017, FDEP issued ERP No. 56-0356316-001 for the construction of Dredged Material Management Area M-8. On May 21, 2018, USACE issued permit No. SAJ-2017-02292 (SP-LCK) authorizing construction of the DMMA.

4.2.3 *Final Design and Construction*

Carrying forward the preliminary design and permitting features that inherently included the original engineering/operational, environmental, and socioeconomic/cultural criteria, FIND constructed the site in 2020.

The site's as-built capacity, based on drawings provided by Taylor Engineering, is 79,552 cy. The dike has a crest elevation of 38.6 ft NAVD 88, a dike crest width of 12 ft, 3H:1V interior and exterior side slopes, and a bottom basin toe elevation of 25.8 ft NAVD 88 to meet the borrow area requirements for the DMMA construction. Excavating the basin interior to this depth provided the material necessary for site construction. The containment dike also includes a ramp to provide ingress and egress to and from the interior of the containment area. The outside slope of the ramp and the slope of the supporting toe maintain the same 3H:1V slope as the main dike. The ascending/descending grade is 20H:1V. These ramps allow the removal of the dewatered dredged material from the DMMA without disturbing the overall structural integrity of the dike. With the containment basin filled, the surface of the deposition layer will lie an average of 4 ft below the dike crest, allowing a minimum of 2 ft of freeboard and 2 ft average ponding depth.

4.2.4 *Summary*

The primary goal of the upland DMMA is to provide sufficient capacity to receive, dewater, and temporarily store sediments dredged from the adjacent reaches. **Table 4.2** provides a summary of the location, reach, and DMMA features. **Figure 4.3** and **Figure 4.4** provide a plan and section view of the DMMA.

Table 4.2 DMMA M-8 Site Data Summary Sheet

Location			
Section/Township/Range	**29/36S/41E**	East/West of Waterway	**West**
County	**St. Lucie**	Municipality	**Port St. Lucie**
Reach			
Designation	**SL-II**	Projected Dredging Frequency	**10 – 20 years**
Length (mi)	**12.91**	50-Year Dredging Requirement (cy)	**11,770**
Mileage	**227.27 – 240.19**	50-Year Storage Requirement (cy)	**25,306**
Cut/Station	**SL-5/77+60 - SL-6/373+50.00**		
Geographic	**Bear Point to St. Lucie/Martin County Line**		
Dredged Material Management Area			
Property Area (ac)	**20.30**	Design Basin Capacity (cy)	**79,552**
Basin Area (ac)	**13.68**	Available Basin Capacity (cy)	**79,552**
Buffer Width (ft)	**N = 250**	Dike Slope	**3H:1V**
	S = 150	Crest Width (ft)	**12**
	E = 180	Natural Grade Elevation (ft NAVD 88)	**29**
	W = 50	Depth of Excavation (ft)	**3.2**
IWW Mileage	**236**	Dike Height Above Natural Grade (ft)	**9.6**
Max. Pumping Distance (mi)	**±8.41**	Required Ponding & Freeboard (ft)	**4**
Distance from Waterway (ft)	**200**	Type of Weir System	**3 Steel Frame Box Weirs**
Impacted Wetlands (ac)	**0.002**	Weir Crest Length (ft)	**24**
Mitigation	**No**	Entity and Year Constructed	**FIND, 2020**
Regulatory Permits	**FDEP ERP56-0356316-001 USACE SAJ-2017-02922(SP-LCK)**		
Access			
Public Access	**Indian River Dr.**	Pipeline Easement	**No**
Road Easement	**No**	Deep Draft Access	**No**
Narrative			
The 20.30-acre M-8 DMMA lies about 3.3 miles north of the St. Lucie/Martin County line and 4,00 feet north of Walton Road. The site is bordered to the west by the Savannas State Preserve and to the east by the Indian River Lagoon. Within the site elevations range from +42 feet NGVD in the southwest corner to about +21 feet NGVD along Indian River Drive (S.R. 707), a narrow secondary road that lies 60-70 feet west of and parallel to the Indian River Shoreline. East of the Roadway, a steep bluff descends to the water's edge. Low-density residential properties lie immediately to the north of the site, with the undeveloped park property immediately to the south. The Florida East Coast Railway right-of-way separates the site from the Savannas State Preserve farther to the west.			

SITE FEATURES	
DIKE SLOPE	3H:1V
CREST WIDTH	12 FT
REQUIRED FREEBOARD AND PONDING DEPTH	4 FT
DIKE HEIGHT ABOVE NATURAL GRADE	9.6 FT
DEPTH OF EXCAVATION	3.2 FT
PROPERTY AREA	20.30 AC
BASIN AREA	13.68 AC
BASIN DESIGN CAPACITY	79,552 CY

SOURCE: TAYLOR ENGINEERING, 2018

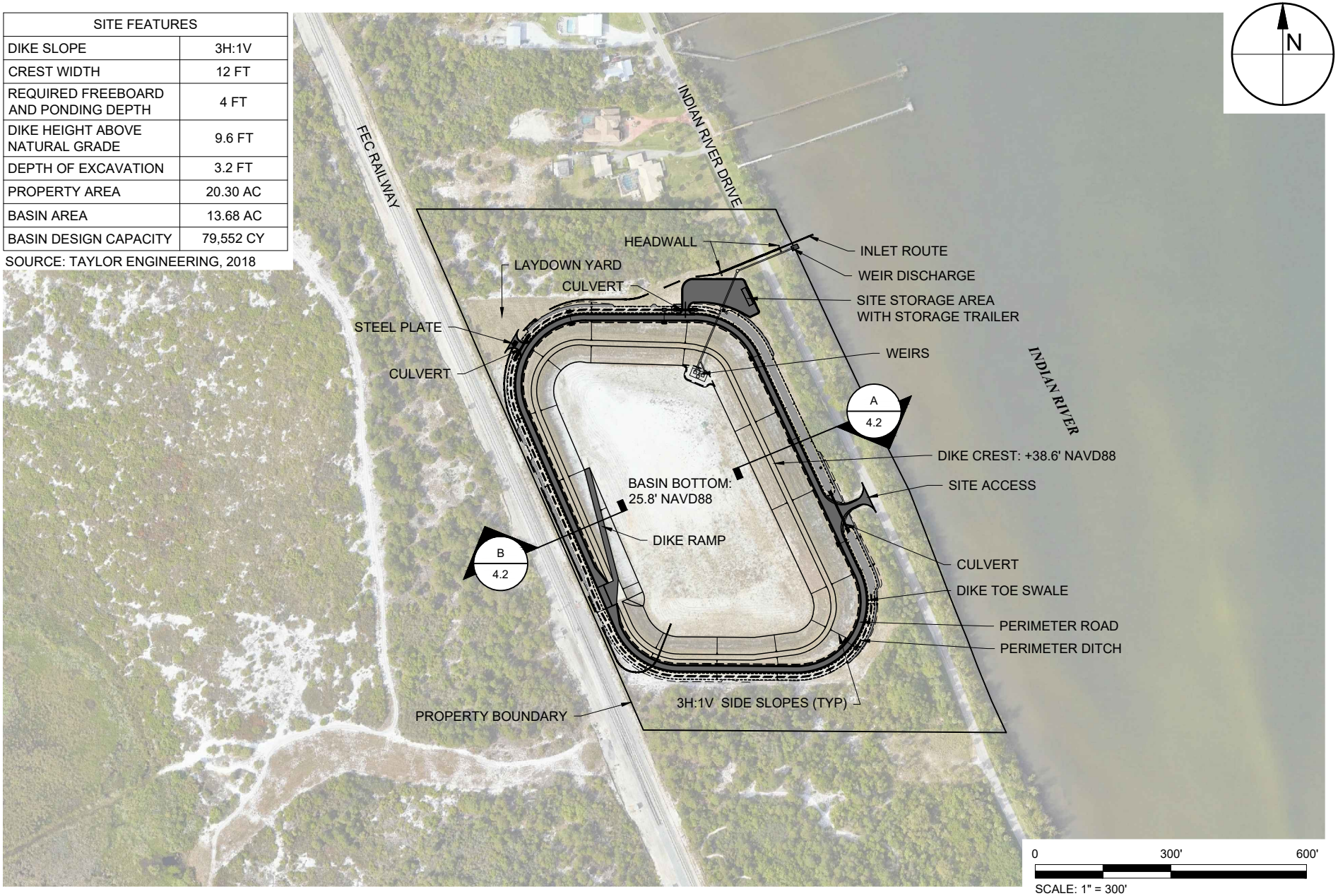

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FIGURE 4.3
DMMA M-8 PLAN VIEW
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
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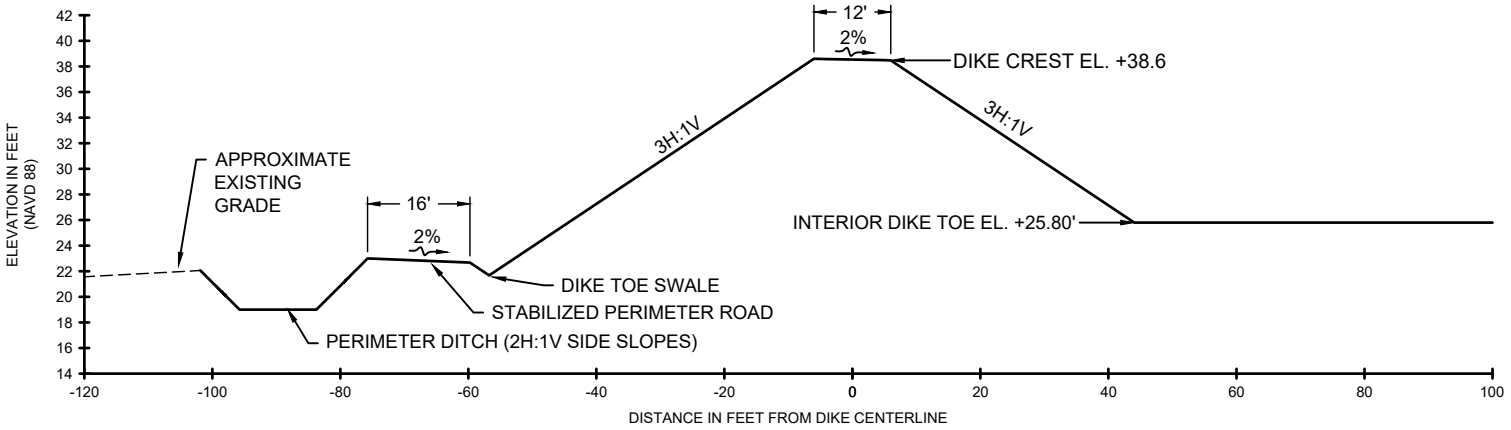
SHEET	12 of 14
DATE	NOV 2022

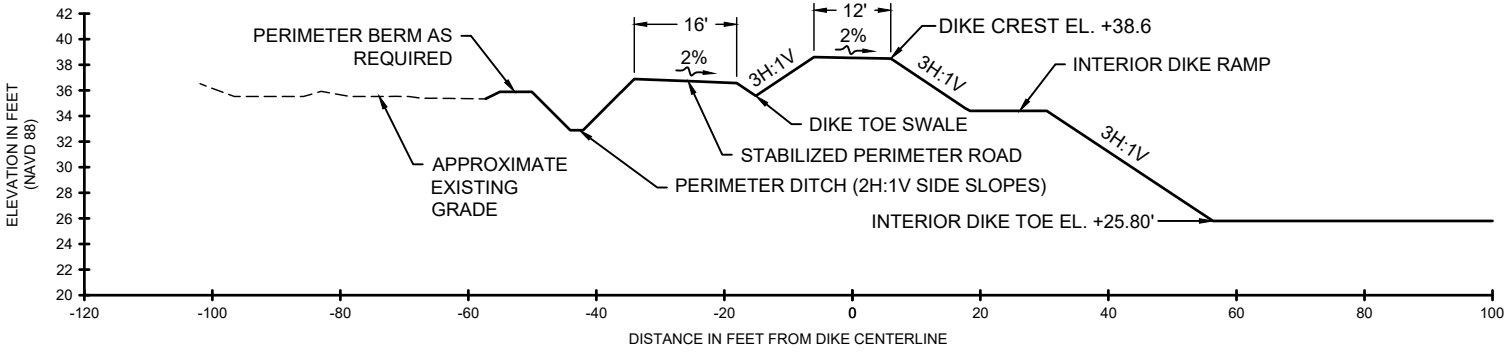
PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.



A M-8 TYPICAL CROSS-SECTION

SCALE: 1" = 1'
V-SCALE: 1" = 1'

0 1'



B M-8 TYPICAL RAMP CROSS-SECTION

SCALE: 1" = 1'
V-SCALE: 1" = 1'

0 1'

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FIGURE 4.4
DMMA M-8 TYPICAL CROSS-SECTIONS
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	13 of 14
DATE	NOV 2022

5.0 DMMA OPERATIONAL CONSIDERATIONS

This section provides guidance for the operation of DMMAs to achieve optimum efficiency in both effluent quality and management area service life. This section addresses site-specific design and operational elements, as well as those facets of design and operation that directly influence site efficiency or reduce off-site conflicts. The three phases of operational considerations include (1) elements of site preparation prior to the initial dredging and disposal of dredged material; (2) techniques of decanting and dewatering the dredged material during and immediately following a disposal event; and (3) criteria for post-dredging site operation and maintenance. Throughout the operations, implementation of each aspect of site management helps the site not only achieve its minimum design service life but serve as a permanent operating facility for the intermediate storage and re-handling of maintenance material dredged from the Waterway.

Both state and federal regulatory requirements are subject to change. Currently, maintenance dredging with upland disposal may qualify for a state permit exemption and federal authorization under a regional general permit. If FIND acts as the permittee for a dredging project, FIND may request that the FDEP approve a maintenance dredging exemption from state permitting and that USACE verify federal authorization under Department of the Army Regional General Permit SAJ-93 for Waterway maintenance dredging.

5.1 Pre-Dredging Site Preparation

5.1.1 *Earthwork*

Site preparation will include clearing and grubbing vegetation that has grown since site construction or last use of the facility and altering existing topography within the DMMA. Documentation (Haliburton, 1978; Gallagher, 1978) has established that a limited amount of herbaceous vegetation or native grasses in the basin can improve sedimentation by filtration. However, large woody vegetation (brush, trees) can constrict or channelize the flow through the containment area, resulting in short-circuiting of flow, reduced retention times, resuspension of sediment, and the deterioration of effluent quality. Additionally, failure to clear existing vegetation will increase the organic content of the fill, rendering it less suitable for removal and reuse as construction material.

Similarly, the existing topography (resulting from previous dredged material deposition) within the containment area, if allowed to remain undulating and non-uniform, may cause the flow from the inlet to the weir to channelize, thereby reducing the effective sedimentation area, increasing flow velocities, and decreasing the efficiency of solids removal. Moreover, irregular topography will produce irregular deposition, which, in turn, will result in the ponding of surface water, thereby inhibiting the drying of the deposition layer and making initial attempts at surface trenching more difficult. Therefore, providing a uniform grade with a slope on the order of 0.2% from the inlet to the weir becomes very important. In addition, given an initially level surface, differential settling of varying grain size fractions will quickly establish a deposition surface sloping downward from the inlet to the weir as coarse sediment deposits near the inflow and fine sediments deposit near the weirs.

5.1.2 *Migratory Bird Protection*

Should construction activities at any of the DMMAs take place during the migratory bird-nesting seasons, FIND or the USACE must coordinate with the USFWS to establish site-specific migratory bird protection activities.

5.1.3 *Gopher Tortoise Protection*

Where permits require ongoing tortoise management practices, FIND must comply with the permit requirements. Prior to each site use, FIND or the USACE should survey the containment basin, dikes, and any ground areas potentially impacted by the project for tortoises. If the surveys find tortoises or burrows potentially affected by site operation, consultation with FWC must occur.

5.1.4 *Groundwater Monitoring*

In general, material dredged from the Waterway and pumped into each DMMA will contain approximately 20% marine sediments and 80% saline water. This slurry will remain ponded within the containment basin only during dredging operations and for a short period immediately following dredging as the clarified effluent is released back to the Waterway. Such periods generally last approximately 6 – 8 weeks, once every 5 – 10 years (or less frequently). Despite the infrequency of operation, hydrostatic pressure could potentially force saline water from the basin into the local surficial aquifer. For all DMMA, guarding against groundwater impacts dictates an on-site groundwater monitoring program to detect any changes in local groundwater conditions due to site operations.

Implementation of a groundwater monitoring program requires installing and monitoring shallow test wells before site construction activities commence. Each site's geotechnical characteristics and site-specific concerns (e.g., vicinity of public wells for water supply, local area contamination) will dictate the placement and depth of the installed wells. Samples from the test wells will be analyzed to document pre-operational groundwater elevations and chloride concentrations. Analysis of the groundwater samples may also include additional chemical constituents if present in the dredged sediment. Monitoring well data will establish baseline groundwater conditions before site development and identify changes in groundwater elevation due to site development or changes in off-site groundwater demand. Though little change in groundwater conditions typically occurs before the first dredging operation, groundwater monitoring should continue on a regular schedule. Samples should be taken monthly for the first year after the wells are installed and quarterly after that until the containment facility's first use.

Each site's first use as a containment facility will likely prove the most crucial period for monitoring the potential seepage of saline water through the dike's foundation and side slopes. During this time, soils forming the dike will be most porous due to their disturbance during site construction. Thus, the initial period of each dredging operation requires frequent sampling and analysis of groundwater. The collection of groundwater samples should occur every 24 hours during the site's initial use. This sampling regimen should begin at the start of dredging and continue for a period equivalent to the theoretical transit time of saline water from the basin to the furthermost sampling well. Maximum transit time should be estimated during the final site design process, given adequate data to define soil permeability, stratification, and the governing groundwater flow gradient. Following the estimated maximum transit time through the remainder of the decanting process, sampling should occur at least every 24 hours. If at any time elevated chloride levels are detected in the monitoring wells, the contractor should stop dredging and reduce ponding depth until additional corrective measures are taken. These measures may include the installation of a system of well points around the dike to reverse groundwater flow. Operational experience has shown that dike permeability decreases as the dike material filters and traps the finer fraction of dredged sediments. Thus, saline seepage from the containment basin should become increasingly reduced with each successive dredging operation.

5.2 Operational Considerations During Dredging

The primary objectives of site management during dredging operations are to maintain acceptable effluent quality during the decanting process and maximize the potential for dewatering the deposited material by controlling the deposition pattern. To these ends, the following paragraphs discuss eight unique aspects of site management:

1. Placement and handling of the supply and return water pipelines
2. Operation and monitoring of the dredged slurry inlet
3. Operation and adjustment of the weirs
4. Monitoring of the released effluent
5. Inspection of the dike
6. Continued monitoring of local groundwater
7. Migratory bird protection
8. Gopher tortoise protection

5.2.1 *Pipeline Placement*

Each maintenance and disposal operation over the design life of each DMMA will require the temporary placement of supply and return pipelines (when permanent discharge pipelines are not part of the facility). Given the historical dredging frequency of each St. Lucie County reach, typically spanning between 10 and 20 years, allowing these pipelines to remain permanently in place is not necessary or economically feasible. In general, the supply pipeline will traverse the most direct and least environmentally impactful route between the Waterway and the containment basin property boundary. Once entering the site, the supply pipe will be routed along the outside toe of the dike, entering the basin from the opposite side of the weir and passing over the dike crest. Where necessary, the dredging contractor will install a single return pipeline via a water-tight connection to the weir discharge pipe such that the decanted water returns to the Waterway via the identical route, in most cases, as the supply line. Following the completion of dredging, the dredging contractor will remove the supply pipeline. In the absence of a permanent discharge line, the return pipeline must remain in place until all ponded water drain or infiltrates, and the decanting process is complete.

Stormwater runoff, expected to collect in the containment area, will be treated and decanted via the weir system. The basin will retain any suspended sediment from deposited material and minor dike erosion. The runoff will route, via the manifold system, to the exterior perimeter ditch and, when not conveyed through a permanent discharge system, will either evaporate or seep into the ground. Also, due to the relatively high-water table at most St. Lucie County DMMA sites, seepage during operation of the DMMA could result in the perimeter ditch overflowing during dredging operations. If necessary, the dredging contractor must pump water from the ditch back into the DMMA to provide adequate stormwater and seepage storage capacity and comply with water quality discharge criteria.

5.2.2 *Inlet Operation*

The quality of the dredged sediment, specifically the settling characteristics of the different grain-size fractions, governs the inlet's operation (i.e., the point at which the supply pipe discharges the dredged material slurry into the containment basin). The coarsest fraction of material will rapidly settle out of suspension and form a mound near the inlet. Successively finer fractions, characterized by lower settling velocities, will deposit closer to the outlet weir. Absent an inlet operation strategy, the dominant grain-size fraction will determine sediment distribution within the basin. For example, if fine-grained sediments dominate, a relatively large volume of material will concentrate near the weirs. As discussed below, an

extensive concentration of fine-grained sediment may require specialized dewatering procedures to speed drying.

Most of the St. Lucie DMMAs will likely receive sediments characterized primarily as fine sand with silt and clay components. For these DMMAs, the primary strategy makes no attempt to segregate material grain size fractions; however, the position of the inlet will move during disposal operations to minimize mounding of the coarser fraction of sediment and to achieve more uniform deposition. This operational strategy will generally entail a progressive extension of the supply pipe from the point where it enters the containment area, resting each extension on the sediment mound formed by deposition at previous inlet position. A minimum distance of 100 ft must be maintained between the inlet and the inside toe of the dike to prevent erosion or undercutting of the interior dike slope. The resulting deposition pattern should maintain a consistent slope from the inlet to the weir and should minimize dead zones and channelization.

An additional, although secondary, advantage gained through extending the inlet pipeline results from shutting down the dredge plant to allow the addition of each extension. These operational intermissions, together with temporary shutdowns to move the dredge, effectively increase the retention time of the containment area, thereby increasing the solids retention efficiency of the basin.

Within areas of discrete shoals or significant depositional strata characterized as predominantly fine-grained materials, such as organic silts or clays, the contractor may employ an alternate strategy of inlet operation to segregate fine sediments. Segregation of the fine-grained fraction to optimize the engineering properties of the remaining sediment can occur by moving the inlet pipe to deposit silts and clays nearer the weirs, thereby keeping the fine material spatially concentrated on one side of the basin. The contractor may then deposit the coarser fraction of material dredged during the same operation along the opposite side of the containment area. This alternate strategy would necessitate additional operating precautions. Given the reduced distance between the area of fine material deposition and the weirs, retention times adequate to allow precipitation of the fine sediment and maintain acceptable effluent quality must occur via additional ponding depth, intermittent dredge operation, or the use of turbidity control devices. Preliminary analysis of channel sediment core borings indicated that each St. Lucie County DMMA provides adequate solids retention. Combined with the expected shutdowns in pumping operations to relocate the dredge plant and inlet pipe, this strategy would maintain acceptable effluent quality. However, to achieve the desired segregation of fine-grained material, this strategy must also include the removal of a substantial portion, if not all, of the segregated material following dewatering and prior to succeeding placement operations. The design of each St. Lucie DMMA site specifically excludes interior dikes and compartmentalization for segregation of fine sediments. However, facilities include additional space to accommodate a range of management strategies for fine-grained, organic muck sediments that are known to occur in the area.

5.2.2.1 Monitoring Related to Inlet Operation

Dredging operations will require several monitoring procedures related to inlet operations. Ponding depth is a critical parameter for maintaining acceptable containment basin performance. Increased ponding depth improves solids retention performance of the basin by increasing retention time. However, under saturated foundation conditions, unbalanced hydrostatic forces resulting from too great a ponding depth could create the potential for dike failure. Indications of impending dike instability include foundation saturation at the outer dike toe and excessive seepage through the dike's outer slope, followed by piping and small-scale slumping. Obviously, such conditions must not occur. Therefore, the ponded water surface should be allowed to rise above the 2-ft minimum depth only under close

monitoring by visual inspection of dike integrity. Experience has shown that as the ponded water percolates into the interior dike slope, the coarser dike material filters the fine suspended sediment. This filtering reduces the dike permeability and thus decreases the dike's susceptibility to excessive saturation and seepage.

Optimal operating efficiency requires that flow through the containment basin approaches plug flow (i.e., flow without any mixing) to the greatest degree possible. Uneven flow distribution — evidenced by irregular sediment deposition, channelization, and short-circuiting — increases flow velocities, reduces retention time, and promotes sediment resuspension. If an inspection reveals an irregular deposition pattern, the contractor should reposition the inlet pipe to produce a more uniform depositional surface.

Lastly, the contractor and the engineer should monitor the incoming slurry periodically at the containment basin inlet to confirm or refine dredge output specifications, including volumetric output and slurry solids content. In combination with the actual duration of dredging, these parameters can serve as an independent measure of deposition volume to determine the remaining site capacity. The computed deposition volume can be used with pre- and post-dredging surveys of the channel along with topographic surveys of the containment basin obtained following placement and dewatering of the deposition layer, to refine the bulking factor employed to translate in situ dredging volumes to required storage volumes. Also, within the same monitoring program, the quality of dredged sediment should be established by laboratory analysis of grain size distributions, settling velocities, specific gravity, and Atterberg limits, if appropriate. The results of this monitoring and analysis will provide a basis for the operational management of containment area performance and efficiency.

5.2.3 *Weir Operation*

Weir operation —controlling the ponding depth and flow rate over the weirs by adjusting the weir crest elevation — is the procedure most critical to maintaining effluent quality during dredging and decanting operations. Operational requirements begin during containment basin construction and continue after that. The initial elevation above the mean interior site grade should allow for the required anticipated ponding depth (noted for each constructed DMMA in **Chapter 4.0**).

Once dredging begins, the weir crest elevation should be maintained at its initial elevation until the ponded water surface approaches the weir crest. As ponding depth increases above the 2-ft minimum design depth, the decision must be made to initiate the release of the supernatant. Notably, a flow control structure such as a weir cannot improve effluent quality beyond that of the surface water immediately interior to the weir crests. The decision to release effluent over the weirs should be based on the results of turbidity testing or suspended concentration analysis conducted on surface waters inside the weirs. These tests must reflect conditions at the maximum withdrawal depth. If adequate water quality is not achieved prior to the ponded water surface reaching the initial weir crest elevation, the dredge plant must shut down until the surface water turbidity reaches acceptable limits, or until alternative measures such as the installation of turbidity screens or floating baffles are implemented. If the desired water quality is achieved at a ponding depth less than the initial weir crest elevation, as long as the dike integrity is not threatened, the rising water surface should still be permitted to rise to the weir crest.

Once flow over the weirs has begun and effluent of acceptable quality discharges through the outflow, as indicated by the effluent sample analysis, the hydraulic head over the weir becomes the most readily used criterion for weir operation. The actual operating head over the weir can be measured on site by two methods. First, it can be determined using a stage gage, located in the basin where velocities caused by the weir are small (at least 10 – 20 ft from the weir), to read the water surface elevation subtracting from it the elevation of the weir crest. The static head can also be determined indirectly by

measuring the depth of flow over the weir. If the head over the weir, as measured by either method, falls below the site-specific weir design loading because of unsteady dredge output or intermittent operation, effluent quality should increase. However, if the head exceeds these values, the ponding depth should be increased by adding flashboards or temporarily halting dredging to prevent a decrease in effluent quality. At all times, the contractor must maintain each of the weirs at the same elevation to prevent flow concentration and a decrease in effluent quality related to an increase in weir loading. Preventing floating debris from collecting in front of the weir sections is also important. An accumulation of debris at the weirs will reduce the effective weir crest length and thereby increase the withdrawal depth. This may increase the effluent suspended solids concentration.

With dredging completed, decanting— the slow release of all remaining ponded water within the basin by gradually removing flashboards — begins. Flow over the weirs should drop essentially to zero before the contractor removes the next flashboard. Effluent monitoring must continue during the decanting process. If, at any time during this process, effluent turbidity violates water quality standards, the weir must retain the effluent until analysis of the interior surface waters shows the suspended solids concentration within acceptable limits. Decanting then continues in this manner until all ponded water flows through the weir.

5.2.4 *Effluent Monitoring*

As discussed in the preceding section, effluent monitoring is an integral part of facility operation. Calculations indicate that each designed and constructed St. Lucie DMMA produces effluent that should meet or exceeds water quality standards for Class III waters as set forth in Chapter 62-302, *Florida Administrative Code.* The monitoring program, generally dictated by permit conditions, must therefore continue throughout dredging and decanting operations. Effluent samples should be taken and analyzed as often as practical. The minimum recommended sampling frequency is twice per 8-hour daylight shift. Unless specifically required by permit conditions, no nighttime turbidity monitoring will occur at the weir discharge pipe due to safety issues.

5.2.5 *Dike Inspection Requirements*

Throughout all phases of dredging and dewatering, the contractor will be responsible for additional inspections of the containment facility to evaluate the integrity and stability of the containment dikes and related structures. The following paragraphs summarize the required critical and supplemental inspections to monitor dike conditions.

5.2.5.1 Critical Inspections

The contractor will perform periodic inspections of the containment dikes to check for certain critical conditions that may require the implementation of remedial measures. A qualified geotechnical engineer or engineering technician with specific training and experience in performing inspections of earthen dams, earthen reservoirs, or earthen dredged material containment facilities will conduct all inspections. As part of the required pre-construction submittals, the contractor must submit the qualifications of the designated inspector for review and approval of FIND or its authorized representative.

The contractor will conduct inspections for the items listed below during each day of operation. Any of these conditions could indicate a critical condition that requires immediate investigation and may require emergency remedial action. Immediately upon confirming the existence of a critical condition, the contractor must inform FIND and its authorized representative and increase the inspection frequency. FIND will then immediately notify the FDEP. Within 24 hours of confirming a critical condition, the

contractor must submit to FIND and its authorized representative documentation of the inspections and implemented remedial actions. FIND will then submit to the FDEP a written report detailing the condition and the implemented remedial actions within seven days of confirming the critical condition. The following items could indicate a critical condition:

1. Seepage with boils, sand cones, or deltas on the outer face of the dike or downstream from the dike's outer toe
2. Silt accumulations, boils, deltas, or cones in the drainage ditches at the dike's base
3. Cracking of soil surface on the dike's crest or on either face of the dike
4. Bulging of the downstream face of the dike
5. Seepage, damp area, or boils in the vicinity of or erosion around a conduit through the dike
6. Any subsidence of the crest or faces
7. Any failure of the weir structure or its operation
8. Any leaks or seepage of the supply or return pipelines

5.2.5.2 Supplemental Inspections

During the critical inspections described above, the items listed below could indicate potential areas of concern. The contractor must then continue to monitor closely during subsequent inspections and perform repairs as necessary. Within 24 hours of confirming the presence of an indicator of a potential area of concern, the contractor must also inform FIND and its authorized representative of the item and any required repairs undertaken. Indicators of potential areas of concern include the following:

1. Overgrown patches of vegetation on the inside and outside portions of the dike
2. Surface erosion, gullying, or wave erosion on the inside portion of the dike
3. Surface erosion, gullying, or damp areas on the outside face of the dike, including the berm and the area immediately adjacent to the outside toe
4. Erosion below any conduit exiting the dike
5. Wet areas or soggy soil on the outside face of the dike or in the natural soil below the dike
6. Failure of the weir boards, their containing structure, or any blockage or interference of weir operations

5.2.6 *Groundwater Monitoring*

Per the groundwater monitoring program (**Section 5.1.4**), groundwater monitoring shall continue throughout the duration of DMMA operation.

5.2.7 *Migratory Bird Protection*

Should dredging become necessary during the migratory bird-nesting season (March 15 – September 1), FIND or the USACE must coordinate with the USFWS to establish site-specific migratory bird protection activities. Expected activities include education of contractor personnel, daily monitoring for nesting activity, steps to deter nesting activity within the active construction area, avoidance of nests and, if necessary, to protect nesting birds, cessation of construction activities. Alternatives to prevent impacts to nesting birds include creating undesirable habitat (e.g., flagging construction area, placement of ground cover, seeding or sodding exposed areas), dissuasion through noise or activity, or creation of alternative nesting sites. A final, undesirable alternative — incidental take — should only be considered during a documented emergency.

5.2.8 *Gopher Tortoise Protection*

Prior to construction, gopher tortoises must be relocated from work areas in accordance with any FWC relocation permit. Relocation permits or the results of consultation with FWC could require protective measures such as marking buffers (generally 25-ft) around tortoise burrows remaining near the work area or erecting barriers (e.g., silt fence) to exclude tortoises from the work area. Observations of gopher tortoise in the work area during construction will trigger consultation with FWC to determine protective actions.

5.3 Post-Dredging Site Management

Following the completion of each dredging operation, the post-dredging phase of the disposal site operation occurs. This phase continues until the next maintenance dredging event begins. The contractor must manage the dredged material deposited within the containment area to maximize the rate of drying. In so doing, the material is made suitable for handling and removal from the site, which is the primary objective of the DMMA management plan. However, given the permanent nature of each DMMA, other management procedures between active dredging operations must occur. These include a comprehensive monitoring and data collection effort to guide the efficient use and environmental compliance of the disposal area, the handling of stormwater runoff, vegetation control and maintenance, the monitoring and maintenance of site habitat, mosquito control measures, and the provision for adequate ongoing site security. The document discusses these in the following sections.

5.3.1 *Dewatering Operations*

Following the completion of dredging operations, the contractor must continue to operate the weir system and slowly release the clarified surface water that remains ponded within the basin over the weir crest by incrementally removing weir boards. The process, known as decanting, continues until all residual ponded water within the basin at the completion of dredging is released over the weirs. To maintain effluent quality throughout the decanting process, the contractor should allow the flow over the weir to drop essentially to zero before removing weir boards. If at any time during the decanting process, monitoring shows effluent turbidity to exceed permitted standards, the contractor must again add weir boards until testing of the ponded water that remains within the basin confirms that turbidity has returned to acceptable limits.

Decanting all ponded surface water is necessary before significant evaporative drying of the deposited material can occur. Simply continuing to lower the weir crest will remove most of the ponded water following the completion of dredging operations. However, the anticipated topography of the deposition layer makes draining all ponded water in this manner unlikely. As discussed, differential settling of the various size fractions of the sediment results in partial segregation of the dredged material within the containment basin. Coarser sand- and gravel-sized particles settle nearer the inlet, while finer particles concentrate near the weir. The sand-sized fraction should experience relatively little consolidation because of its low initial water content. However, the fine material's greater consolidation will likely form one or more depressions near the weirs. To remove the ponded water that remains in these areas, the contractor may need a drainage trench to connect each depression to a sump excavated adjacent to one or more weirs. During this phase of operations, the contractor may raise the weir crests to prevent the premature release of the ponded water, which will likely contain a high concentration of suspended solids as a result of the excavation. As soon as the effluent turbidity standards are met by the contractor, the contractor may then release the clarified water over the weirs.

Following the removal of all remaining ponded water, evaporative drying will eventually form a crust over the deposition layer. This crust will trap water beneath its surface and retard continued evaporation. In addition, the desiccation cracks that quickly form in the crust will hold rainwater and limit further drying. Therefore, complete drying may require additional trenching. Initially, a dragline or clamshell operating from the crest of the containment dike can excavate a perimeter trench. More intensive trenching must wait until a crust of significant thickness (greater than 1 – 2 in.) has developed on the deposition surface. The crusted surface will eventually allow the use of conventional low-ground pressure equipment. The contractor may then construct a network of radial or parallel ditches throughout the area of fine sediment deposition. The slumping resistance of the semiliquid layer beneath the crust will determine the appropriate depth of each trenching operation. The thickness of the fine-grained deposition layer will dictate the number of trenching operations required. After constructing the trenches, the DMMA may require grading to provide sufficient drainage for the relatively thin fine sediment deposition layer. Given a sufficient volume of coarser sediments, the contractor could transfer the dried surface crust to a more well-drained area of sandier material nearer the inlet. This would expose the wetter under layers and restore a relatively high rate of evaporative drying.

The dewatering process will continue until the moisture content of the deposition layer has lowered to a level necessary for efficient handling and removal. The time required to complete this phase of site operation will depend on the physical characteristics of the sediment, as well as climatic conditions (e.g., rainfall, relative humidity, season, etc.). During the entire dewatering phase, the contractor must operate the weirs to control the release of residual water and impounded stormwater. The clarified effluent will be routed to the perimeter ditch or drained off site.

5.3.2 *Grading the Deposition Material*

To prepare for the next dredging operation, grading the dried sediment will follow dewatering. Grading will distribute the mounded sand, shell, and gravel over the remainder of the containment area and serve a number of necessary functions. These functions include reestablishing the initial uniform slope from the inlet down to the weirs, restoring the effective plan area of the containment basin, and improving subsequent dewatering of the fine-grained material by separating successive deposition layers with a free-draining substrate. As discussed in the next section, grading also provides for stormwater runoff control. Finally, a series of post-grading topographic surveys will assess material consolidation and refine estimates of remaining storage capacity.

5.3.2.1 Control of Stormwater Runoff

Grading the dewatered deposition layer provides the additional benefit of allowing the control and release of stormwater that drains from the interior slopes of the containment dike as well as the dewatered sediment. In compliance with regulatory policy, the contractor should construct a sump or retention area of adequate capacity adjacent to the weirs (with the weir flashboards in place) to retain rainfall runoff. A site operator would then gradually release the ponded runoff at intervals determined by local weather conditions. Before the dredging contractor demobilizes from the site, FIND, and its authorized representative will determine the weir crest height required to prevent uncontrolled release of stormwater following the project close-out. This determination will reflect information specific to each placement operation at a specific DMMA site, including the bulked volume of the dredged material, the geometry of the deposition, and the specific permit requirements imposed to govern the control and release of stormwater from the DMMA facility. The contractor must then reinstall the weir boards in all weirs at or above this elevation.

After the dredging contractor completes demobilization from the DMMA, responsibility for continued management of stormwater within the basin, as well as all other continuing site maintenance between successive dredging operations, resides with FIND. FIND's designated site operator will periodically return to the site to release stormwater as well as the accumulated drainage from the dredged material as it continues to consolidate under its own weight. To release this water, the site operator will remove one or more weir boards from a single stack as necessary to release the surface layer of the ponded water. To minimize the work required, the operator needs only open one side of a single weir stack and only to the level to start water flowing over the lowered weir crest. Only when the flow over the lowered weir crest approaches zero should the operator remove another board. This process should continue one board at a time until all ponded water drains from the site. The operator should then replace the weir boards to the required elevation to prevent uncontrolled stormwater releases.

5.3.3 *Material Rehandling/Reuse*

As discussed previously, St. Lucie County has two DMMAs to serve the long-term maintenance requirements of the Waterway. This report, as well as the 1997 DMMP report, have emphasized that although each site has been designed for a specific service life, they must also operate as permanent facilities for the intermediate storage and rehandling of dredged material. To fulfill this intended use, at some point the dewatered material will require removal. The following paragraphs discuss the ultimate use of this material.

Based on a comprehensive analysis of dredging records and recent survey data, the bulked material volume projected for placement and temporary storage over the 50-year design service life of the two facilities serving the St. Lucie County segment of the Waterway exceeds 125,072 cy (**Table 3.3**) dredging requirement, which by any standard, is a significant volume of potentially valuable material. Ignoring the return on the sale of the dredged material, the cost savings of permanent storage alone would justify an effort to determine, through formal market analysis, the potential demand for dewatered dredged material. If such a determination shows that material resale or reuse is practical, the properties of the dredged material must satisfy the requirements of commercial interests. The coarsest fraction of material (sand and gravel) can have further applications as fill or construction material. The predominantly fine-grained material, containing large percentages of organic silt or clay, may prove suitable for municipal composting or agricultural amendments once rainfall and percolation have reduced its chloride content. Elevated concentrations of contaminants that remain below the threshold for an environmental hazard could further limit the material to ornamental horticulture (e.g., sod farms) or landfill capping.

A determination by FIND that resale or reuse is unfeasible will dictate locating and developing one or more permanent storage site(s). The appropriate location for such sites would appear to be inland, where lower real estate values and development potential make permanent storage more economically feasible. The optimal distance from the initial containment area(s) to the permanent storage site would represent a compromise between lower land costs and higher transportation costs.

5.3.4 *Maintenance of Vegetative Cover*

Following the construction of the containment facility and again following each use of the facility to receive and dewater dredged material, FIND will remain responsible for establishing and maintaining a vegetative cover on all exposed surfaces of the dike. To prevent the establishment of shrubs, trees, or other woody vegetation, FIND will regularly mow the dike's slopes and crest. Mowing will maintain vegetation sufficiently short to allow visual inspections of the soil surface in critical areas such as

1. The condition of vegetation and soil surface on the dike and in areas up to 50 ft from the outside toe
2. The condition of drainage ditches around the base of the dike
3. The freeboard slope above the liquid surface elevation
4. The condition of weirs and water level control structures, including all conduits exiting the dikes

FIND should conduct periodic inspections of both the interior and exterior of the dike berm for herbaceous vegetation potentially damaging to the berm integrity. Removal of this vegetation, by hand or mechanically, should occur regularly and in a manner that maintains berm integrity. Regular spot treatment (with proper herbicides) for herbaceous vegetation should occur as needed.

5.3.5 *Additional Environmental Considerations*

5.3.5.1 Migratory Bird Protection

Available sediment data suggest that the deposition layer will likely present sandy substrate, thus proving suited for migratory birds nesting. Given sufficient sandy material, migratory birds may nest in portions of the containment basin following dewatering and grading as well as on the containment dikes. Should post-dredging site management activities be required during the March 15 – September 1 nesting season, the contractor must conduct them in accordance with site-specific migratory bird protection activities developed in consultation with USFWS.

5.3.5.2 Gopher Tortoise Protection

Gopher tortoise management will continue as a post-construction activity in accordance with any tortoise relocation permit conditions.

5.3.5.3 Groundwater Monitoring

After the release of all ponded water remaining from the previous dredging operation, post-dredging groundwater sample collection will begin. During this period, groundwater samples will be collected and analyzed monthly for the first year following the completion of decanting and quarterly after that unless otherwise needed. Conditions may warrant more frequent sampling intervals. Should elevated chloride levels be detected at any time, FIND will take corrective actions.

5.3.5.4 Mosquito Control

The basic approach of the mosquito control program for each DMMA in St. Lucie County will emphasize physical rather than chemical control. The contractor must ensure that the time during which standing water remains inside the containment area is kept to a minimum to reduce the potential for mosquito breeding. The operational phase most favorable for mosquito breeding follows decanting when desiccation cracks form in the crust. Trenching procedures will accelerate the dewatering process. However, given the anticipated thickness of the deposition layer and the nature of the dredged material, the dewatering phase could extend long enough to result in mosquito breeding within the desiccation cracks and residual ponds. This situation could require a short-term spray program coordinated through St. Lucie County's Mosquito Control.

5.3.5.5 Site Security

Providing adequate security will remain a key element in the proper management of each DMMA. Unsecured dredged material containment areas typically host a variety of unauthorized activities, including illegal dumping, vandalism, hunting, and dike destruction by off-road vehicles. Permanent security fencing erected around the site's perimeter and locked gates will control access at SL-2 and M-8.

FIND restricts DMMA access to its authorized agents and representatives, USACE Jacksonville District, and, when required, contractor personnel. Access gates will remain locked at all times except during dredging and maintenance operations. The presence of an on-site operator during such operations should further discourage unauthorized entry to the site and the occurrence of unsanctioned activities. Between dredging operations, the site operator will be responsible for carrying out regularly scheduled security inspections. These inspections, which may occur in conjunction with routine operational functions, intend to maintain facility security. Upon the identification of security breaches, FIND will take appropriate actions as quickly as possible to restore the security measures.

6.0 BEACH PLACEMENT SITE

One beach placement site — the Ft. Pierce Shore Protection Project (FP-SPP) (between FDEP Reference Monument (R-Monuments), R-34 and R-41 in Fort Pierce) — has received beach-quality material dredged from Reach I of the ICWW on at least one occasion. The use of the FP-SPP supplements the upland storage capacity and makes up for the upland DMMA storage deficit for Reach I. The effective management of the FP-SPP is guided by the physical characteristics of the channel sediments to be dredged and the need to mitigate inlet-related erosion and conserve existing supplies of littoral material (sand) through inlet management.

The 2017 Reach I Maintenance Dredging Project permitted the placement of ICWW material on the beach within the FP-SPP limits (**Figure 6.1**). This project placed 74,709 cy of beach compatible sand between R-34 and R-36. In preparation for the use of the beach placement site, St. Lucie County obtained modifications to the original shore protection project FDEP Permit No. 0327791-001-JC. Permit Mod 0327791-002-JN, granted in March 2017, authorizes the use of maintenance dredged material from the Atlantic Intercoastal Waterway in the vicinity of Ft. Pierce Harbor Cut SL-5 as a beach fill source on an as approved by the Department basis. Permit Mod 0327791-003-JN, granted May 2017, authorizes the use of maintenance dredged material from the Atlantic Intercoastal Waterway Cut SL-3N as a beach fill source.

Placement of ICWW sand on the beach shall occur in compliance with environmental permits authorizing each dredging operation. Regulatory permits for future beach placement of ICWW maintenance material will determine specific conditions for the use of FP-SPP. Permit conditions will include beach placement templates showing the placement area, berm width and slopes; seasonal and operational restrictions to avoid impacts to nesting sea turtles and shorebirds; turbidity monitoring during construction; post-construction physical and turtle monitoring; as well as others.

ANTON FLEWELLING X:\SYS\PROJECTS\P2021-131_STLUCIED\MMP\FIGURES\P2021-131-F-FT PIERCE SHORE PROTECTION PROJECT.DWG 11/3/2022 4:26:56 PM

TAYLOR ENGINEERING INC.
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JACKSONVILLE, FLORIDA 32256
REGISTRY # 4815

FIGURE 6.1
FT. PIERECE SHORE PROTECTION PROJECT OVERVIEW
INTRACOASTAL WATERWAY
ST LUCIE COUNTY, FLORIDA

PROJECT	C2021-083
DRAWN BY	AF
SHEET	14 of 14
DATE	NOV 2022

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The St. Lucie County project area — comprising two reaches (Reaches I – II) and six cuts (1 – 6) — extends 21.72 miles south of the Indian River-St. Lucie County line to the St. Lucie-Martin County line. The selected dredged material placement sites for St. Lucie County comprise two upland DMMAs (SL-2 and M-8) and one beach placement area (FP-SPP). Together, the two DMMAs and beach placement area provide sufficient storage capacity to manage the expected amount of material dredged from Reaches I – II over a 50-year period.

A review of the historical maintenance dredging record and recent shoaling data provided the updated 50-year dredging and material storage requirements. The resulting dredging and storage volumes equate to 125,072 cy and 268,904 cy, respectively. The 50-year storage requirement is 73% greater than the 155,240-cy estimate in FIND's 1997 St. Lucie County DMMP. This increase is primarily driven by the 2017 dredging event and recent shoaling in Reach I, which strongly influenced calculations of the 50-year dredging requirement.

Recent surveys indicate the shoaling in Reach I is primarily concentrated adjacent to the Fort Pierce City Marina's recently constructed breakwater structures. Prior to the breakwater construction in early 2014, there are no records of dredging of Cut SL-5, which suggests a minimal shoaling rate. Following the breakwater construction in 2014, the shoaling rate from 2014 – 2018 was approximately 11,000 cy/year. An analysis of the most recent 2021 survey data indicates a significant amount of the shoaling in Reach I is concentrated in SL-5. Given the increase in shoaling rates since the construction of the breakwaters, the portion of the waterway adjacent to the Fort Pierce City Marina is likely to remain a hot spot for shoaling and has contributed significantly to the increase in the storage requirement from the 1997 report.

The design and operation overview of the two upland DMMAs suggests a few considerations for the future use of each site. **Table 7.1** provides a tabular summary of the primary DMMA features.

Constructed site DMMA SL-2 has a design storage capacity of 94,488 cy, which, in combination with beach placement, should provide sufficient capacity to meet the Reach's updated 50-year storage requirement of 243,598 cy. One documented dredging operation has occurred since construction in 2009. However, this operation placed all material on the beach. Therefore, the site's original capacity remains available. Should the containment basin reach capacity, offloading of the site to restore capacity may be required.

Constructed site DMMA M-8 has a design storage capacity of 79,552 cy which will provide sufficient capacity to meet the Reach's updated 50-year storage requirement of 25,306 cy. No documented dredging operations have occurred since construction in 2020. Therefore, the site's original capacity remains available. The excess capacity may be used to supplement the storage deficit for Reach I/DMMA SL-2 should beach placement is not an available option at the time of dredging.

The FP-SPP provides an additional site for the placement of beach-compatible material from the waterway. Historically, the most recent and only significant dredging event in 2017 placed all 74,709 cy of material from Reach I on the beach. However, timing maintenance dredging to coincide with optimum conditions for beach placement may prove difficult or impossible. Should the beach placement area be

unavailable, SL-2 and M-8 will provide temporary storage of dredged material until beach nourishment operations are implemented.

While the plan results in a storage capacity deficit, conditions in the County dictate that the two constructed sites, in combination with the beach placement site, are likely sufficient to meet the storage needs of St. Lucie County. Based on the 2017 dredging event, Taylor Engineering anticipates that a significant portion of the material dredged within the St. Lucie County Reach I project area may include beach-compatible sediments. These sediments will require analysis for beach compatibility and permitting for beach placement to meet the 50-year material storage requirement. However, this beneficial use fits the best practice for regional sediment management and should be considered for future dredging operations.

Table 7.1 DMMA Summary

Reach	DMMA	Status		50-Year Material Storage Requirement (cy)	DMMA As-Built/Design Capacity (cy)	Engineering/ Operational Issues
		Constructed	Operation Permit			
SL-I	SL-2	Y	Y	243,598	94,488	• Storage requirement exceeds capacity • Only one record of significant dredge event placed all material on beach • Channel material beach compatibility is critical to meeting storage requirement • Offloading may be required if beach placement is not available
SL-II	M-8	Y	Y	25,306	79,552	• May be used to supplement storage requirement for Reach I

7.2 Recommendations

While Taylor Engineering has addressed the St. Lucie County DMMP's immediate dredged material storage needs, several outstanding requirements remain to meet the long-term requirements of the outlined plan. Recommendations, in order of priority, are outlined as follows.

1. Conduct a geotechnical investigation of shoals identified by the 2021 survey to determine volume of beach-compatible material.
2. Update 50-year storage requirement based on the volume of beach-compatible material identified by geotechnical investigation.
3. Maintain permits for beach placement site, particularly to support placement of appropriate Reach I material.

8.0 REFERENCES

Deeds / Easements

1995. Warranty Deed. OR-0981 Page 2881. M-8. St. Lucie County, Florida.

1998. Access Easement. Book 1174. Pages 2784 – 2786. SL-2. St. Lucie County, Florida.

1998. Access Easement. Book 1173. Pages 1614 – 1618. SL-2. St. Lucie County, Florida.

1998. Warranty Deed. OR-1174 Pages 2791 – 2792. SL-2. St. Lucie County, Florida.

1998. Warranty Deed. OR-1176 Page 2668. M-8. St. Lucie County, Florida.

1998. Warranty Deed. OR-1176 Page 2668. M-8. St. Lucie County, Florida.

1999. Warranty Deed. OR-1224 Page 1185. M-8. St. Lucie County, Florida.

2009. Warranty Deed. OR-3106 Page 179. SL-2. St. Lucie County, Florida.

Environmental Reports

Geotechnical Data / Reports

Corps of Engineers Jacksonville District. 2014. *Intracoastal Water Way Jacksonville to Miami Maintenance Dredging 12-foot project, Reach 1, FL Geotechnical Data Report*. St. Lucie County, Florida.

Regulatory

Florida Department of State. 2006. *Archeological Research Permit,* Permit No. 0607.01. St. Lucie County, Florida.

Florida Department of Environmental Protection. 2008. *Environmental Resource Permit and Sovereignty Submerged Lands Authorization, Construction of SL-2*. Permit No. 56-0255662-001. Issued 03/13/2008. St. Lucie County, Florida.

Florida Department of Environmental Protection. 2008. *Environmental Resource Permit and Sovereignty Submerged Lands Authorization, Construction of SL-2 Modification*. Permit Mod No. 56-0255662-002. Issued 02/06/2009. St. Lucie County, Florida.

Florida Department of Environmental Protection. 2015. *Environmental Resource Permit and Sovereignty Submerged Lands Authorization, Construction of SL-2 Modification*. Permit Mod No. 56-0255662-003. Issued 01/22/2015. St. Lucie County, Florida.

Florida Department of Environmental Protection. 2016. *Environmental Resource Permit and State-owned Submerged Lands Authorization, Construction of SL-2*. Permit Mod No. 56-0255662-004-EM. Issued 04/08/2016. St. Lucie County, Florida.

Florida Department of Environmental Protection. 2017. *Environmental Resource Permit and State-owned Submerged Lands Authorization, Construction of M-8*. Permit No. 56-0356316-001-EI. Issued 08/31/2017. St. Lucie County, Florida.

Florida Fish and Wildlife Conservation Commission. 2018. *Gopher Tortoise Conservation, M-8.* Permit No. GTC-18-00248. Issued 08/06/2018. St. Lucie County, Florida.

U.S. Army Engineer Jacksonville District. 2011. *Department of the Army Permit, DMMA SL-2*. Regional General Permit No. SAJ-93. Issued 02/16/2011. St. Lucie County, Florida.

U.S. Army Engineer Jacksonville District. 2018. *Department of the Army Permit, DMMA M-8*. Permit No. SAJ-2017-02922 (SP-LCK). Issued 05/21/2018. St. Lucie County, Florida.

Planning and Design Documents

Taylor Engineering, Inc. N.D. *Engineering Narrative SL-2 Disposal Area*. Jacksonville, Florida.

Taylor Engineering, Inc. N.D. *Engineering Narrative M-8 Disposal Area*. Jacksonville, Florida.

Taylor, B. R., McFetridge W. F. 1999. *Cost Report SL-2 DMMA*. Taylor Engineering, Inc. Jacksonville, Florida.

Taylor, B. R., McFetridge W. F., Wagner R. J. 2002. *Management Plan M-8 DMMA*. Taylor Engineering, Inc., Jacksonville, Florida

Taylor, B. R., McFetridge W. F. 2002. *Cost Report M-8 DMMA*. Taylor Engineering, Inc. Jacksonville, Florida.

Taylor, B. R., McFetridge W. F., Stites D. 2007. *Long-Range Dredged Material Management Plan for the Okeechobee Waterway.* Taylor Engineering, Inc., Jacksonville, Florida

Taylor, B. R., McFetridge W. F., 2008. *Management Plan SL-2 DMMA*. Taylor Engineering, Inc., Jacksonville, Florida

Taylor, B. R., McFetridge W. F. 2009. *Technical Addendum Weir Design Modifications and Operational Guidelines Site SL-2, St. Lucie County*. Taylor Engineering, Inc. Jacksonville, Florida.

Taylor, B. R., McFetridge W. F. 2009. *Technical Addendum Weir Design Modifications and Operational Guidelines Site IR-14, St. Lucie County*. Taylor Engineering, Inc. Jacksonville, Florida.

Surveys

Department of the Army Jacksonville District, Corps of Engineers. 2010. *Record Drawing As-Built Bcpeabody Construction Services, Inc, SL-2*. St. Lucie County, Florida.

Masteller, Moler & Reed Inc. 1997. *Boundary and Topographic Survey of Lands Location in Section 16,17,20 and 21 Township 31 South, Range 39 East* St. Lucie County, Florida Site SL-2

Masteller, Moler & Reed Inc. 2001. *Boundary and Topographic Survey of DMMA M-8*

Morgan & Eklund, Inc. 2014. *Hydrographic Survey IWW St. Lucie County, Florida*. Deerfield Beach, Florida.