Dredged Material Management Planning
For Florida's Intracoastal and Okeechobee Waterways

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ABSTRACT

Increased environmental awareness and accompanying regulation during the 1970s made securing dredged material placement areas increasingly difficult and expensive, especially in Florida's high growth and increasingly urbanized coastal corridor. To address this situation, in 1986 the Florida Inland Navigation District (FIND) — local sponsor for Florida's Intracoastal Waterway (ICWW) and Okeechobee Waterway (OWW) — embarked on a long-range planning program to ensure the Waterway's continued viability over its 502 channel mile length. The basic program objective is to locate, obtain, design, permit, and construct dredged material management sites capable of handling projected 50-year maintenance dredging requirements. This work has required close coordination with the Jacksonville District Corps of Engineers (USACE), federal and state permitting agencies, local governments and, through numerous public workshops, local citizens' groups. Site acquisitions and construction projects are developed in conjunction with FIND's funding and grant cycles, to establish project priorities. When complete, the program will comprise a permanent infrastructure of approximately 52 containment facilities and 8 beach placement sites designed to manage over 41.5 million cubic yards of material over the next 50 years and beyond.

INTRODUCTION

Background. The U.S. Congress authorized the ICWW, from Fernandina Harbor to Miami, through various laws passed in the early to mid-1900's. Since its formation in 1927, the FIND has served as the local sponsor for the ICWW channel along Florida's east coast between Fernandina Harbor and Miami. As such, the FIND must provide the USACE with sites suitable for placing material dredged from the authorized federal navigation channel.

Prior to the increased environmental awareness and the reorganization of various federal and state regulatory agencies of the estuarine wetlands, a short-term economic approach guided management of dredged material. Engineering, cost, and operational considerations determined the design and execution of channel maintenance project. To this end, the State of Florida granted to the FIND perpetual

easement along the Waterway. A majority of these easements were located entirely within the sovereign waters of the state and included both open water areas and expanses of pristine salt marsh and mangrove wetlands. Additionally, many landowners with holdings adjoining the ICWW sought to improve the development potential of wetlands by granting disposal easements and allowing the unconfined placement of maintenance material. This approach, combined with the desire of the dredging contractor to maximize operational efficiency, resulted in the proliferation of numerous small spoil mounds and islands lining the ICWW.

As a result of increased environmental awareness, unconfined placement of dredged material within wetland areas is no longer a responsible approach to the maintenance of the ICWW. Thus, in order to secure its ability to maintain the ICWW and OWW within the existing framework of engineering, operations, and environmental constraints, in 1986, the FIND initiated an overall, strategic and consistent long-range dredged material management plan (DMMP). When fully implemented, this DMMP will provide at least a 50-year disposal capacity for all maintenance material dredged for the entire portion of the 404-mile ICWW and the 98-mile OWW.

Overview. Development of the long-range DMMP consisted of four primary components:

(1) Determination of the projected 50-year channel maintenance and dredged material storage requirements;
(2) Formation of an appropriate strategy or concept for satisfying these requirements;
(3) Identification of candidate sites designed to meet the projected storage requirements within the framework of the management concept; and
(4) Evaluation of each site based on a set of criteria consistent with the management concept.

Given the 15-year length of the DMMP development process (i.e., 1986 through 2001), the following sections provide an overview of the general process for each ICWW county-specific plan and for the OWW in its entirety.

DREDGED MATERIAL STORAGE REQUIREMENTS

Projection of Future Dredging Quantities. The 50-year dredging and material storage requirements for the entire project area were projected based on documented historical dredging records and hydrographic survey volume calculations. Derivation of baseline shoal volumes included two quantities: the estimated volume of material removed from the ICWW and OWW channels in maintenance dredging operations and the estimated shoal volume contained within the authorized channel.

The first quantity, the volume of historical maintenance dredging, was derived

from a detailed analysis of the USACE archival records — specifically, analysis of all engineering plans and supporting documents for channel maintenance performed for the ICWW and OWW since the channels were deepened to its presently authorized depth. All available sources of dredging information within the USACE were consulted to ensure accuracy, consistencies, and completeness. Preliminary sources included the annual Office of the Chief of Engineer Reports, previous USACE summaries of maintenance dredging within the project area, and interviews with District personnel. The primary sources of information were USACE archival maintenance plan documents and examination surveys.

In addition to historic maintenance dredging volumes, baseline shoal volumes were calculated by estimating the volume of shoaling contained within the authorized channel via the collection and analysis of recently collected bathymetric surveys. For each county-specific DMMP, the FIND undertook a comprehensive survey in 1996 (updated in 2000 and 2004) of the entire ICWW study area and in 2006 for the OWW. Taylor Engineering then developed mathematical routines — within the ESRI ArcGIS and ArcMAP interface — to integrate the survey data and calculate shoal volumes, in approximately 25-ft square grids, for the entire channel. Shoal locations were identified as those areas where the surveyed depths were less than the established project depth for that segment of the channel. Shoal volumes were then calculated based on an additional one foot of overdepth dredging in accordance with standard USACE practice. Analysis of these surveys, yielded location-specific shoal volumes that enabled comparison and, in some cases addition, to the historical dredging records.

Characterization of Sediment Profiles. Techniques employed to maintain water quality during dredging and dewatering are highly dependent on sediment chemistry and the physical characteristics of the dredged material. Therefore, in addition to projected material quantities, the DMMP also considered the chemical and physical properties of sediment to be dredged. In a procedure similar to that used to establish historic dredging volumes, all available sediment chemistry and physical data were collected and reviewed from USACE archival records.

To supplement the USACE data, a program of sediment sampling and analysis was performed, on a county-by-county basis, specifically for the DMMP. The objective of this sampling program was to screen sediments for potential contaminants and to verify the presence of muck sediment (i.e., fine black sediment containing more than 60% silts and clays, more than 50% water, and more than 10% organic matter) in areas previously determined to have accumulated fine sediment. Dredging and disposing of these sediments — given their known effects on water quality and benthic communities, and their tendency to accumulate pollutants — have resulted in permitting challenges. These challenges aside, fine sediments also impose physical constraints on dredged material handling and containment basin design.

For the DMMP sample collection effort, staff collected and analyzed a limited number of sediment samples, typically one per each reach, in both the ICWW and

OWW channels. Where possible, in order to assess the potential worst case scenarios for sediment contamination, sediments for chemical analysis were collected from areas previously identified as having accumulations of fine-grained sediments near potential sources of contaminations. Sediment analysis included 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.

DREDGED MATERIAL MANAGEMENT ALTERNATIVES

Selection of the most appropriate material management strategy included four basic alternatives: (1) ocean disposal; (2) unconfined disposal, (3) confined disposal, and (4) beneficial use. Given the environmental regulatory restrictions and infeasibility of long-term maintenance of ocean and unconfined (open water) disposal for the Waterway over a 50-year timeframe, only the third and fourth alternatives were carried forward in the ICWW DMMP. A detailed description of each of these management strategies follows.

Confined Disposal. Confined disposal refers to the use of a diked containment area (overlying open water, marsh, or an upland area) with appropriate outflow control structures. Under this approach, a hydraulic dredge pumps the dredged material as sediment-water slurry to one end of the containment area. The containment area serves as a settling basin within which the dredged sediment settles out of the transporting water. The basin or disposal area outlet structure and pipeline then return the residual, clarified water to the Waterway. The dewatered sediment remains in the diked containment area until, after multiple maintenance operations, the disposal area nears its design capacity. Ideally, given enough available acreage, each DA's design will provide sufficient capacity for the entire 50-year projected storage requirement for the reach each disposal area serves.

The confined upland disposal management strategy option, given an appropriate location and site design, may provide an infrastructure of disposal area sites that (1) provide relatively close (preferably less than one mile) proximity to the Waterway; (2) provide a capacity necessary to meet the 50-year storage requirement; and (3) offer a one-time avoidance, minimization and mitigation, if required, for any natural resources during site permitting and construction.

Beneficial Use. The beneficial use of the material dredged from the Waterway channel will complement, but not replace, the need to secure and develop dedicated, permanent upland sites. Typically beneficial use, consisting mainly of beach placement and potential construction purposes, provides for only a single deposition of the material and typically requires dewatering and drying of the material before use. Beach placement — that is, placing material compatible with the native beach sands within a designated placement site — constitutes an approach that benefits both the ICWW and receiving beaches. In most cases, beach quality sediments accumulate

as shoals form, primarily when waves and tides drive sand through inlets to adjacent areas. Potential construction purposes of the dredged material include fill to build or expand land for airports, ports, residential, or commercial development. Other examples of one-time beneficial use options include shoreline stabilization and environmental enhancement by the creation or restoration of wetland, marsh, or upland habitat (earlier identified as unconfined open water disposal).

ESTABLISHMENT OF THE SITE BANK

Definition of Channel Reaches. The results of the future dredging projections, quantities, sediment characteristics, and dredged material management concept suggested logical divisions of pre-defined management reaches or *operational reaches.* Applying identified patterns of historical and current shoaling, considerations of material quality and quantity, and operations and regulatory constraints allowed sub-division of previously District defined reaches. After determination of each operational channel reach, calculations provided the 50-year maintenance and average dredging frequencies specific to the defined reach. The extent of each operational reach reflects several considerations: (1) each reach begins and ends with the District's predefined cut of that reach; (2) to the extent practicable, the reaches are approximately 10 miles long so as not to exceed the preferred 6-mile pumping distance tolerance to a disposal area; and, (3) the historical maintenance and shoaling volumes, disposal area location and capacity, and available physical and sediment chemistry characteristics of the material. For each defined operational reach, addition of the shoaling volume for the above-noted survey calculations to the historical maintenance dredging volumes produced a total dredging volume for each reach.

Site Bank. Creation of the site bank involved two primary steps: (1) identification and review of existing disposal areas under perpetual easement and (2) the identification and selection of sites that are compliant with the selected alternative management strategy. Given this, primary considerations for site selection included that, to the greatest extent possible, the placement of dredged material must be confined to upland areas and that a site must contain sufficient upland area to allow the construction of earthen dikes to dewater and stored the dredged material

Existing Sites. Review of the Jacksonville District USACE Real Estate maps provided an immediate snapshot of currently available perpetual easements and/or disposal areas. Staff took care to itemize each site (i.e., location, area, acreage, land use) to determine if any existing site could be used to meet the selected alternative management strategy for each defined reach. Unfortunately, most of the perpetual easements comprise of either open water or remnant spoil islands – neither of which provides adequate long-term dredged material management strategies, as compared to the primary considerations listed in the preceding paragraph, for the FIND. Therefore, in most cases, to meet the established program criteria and provide for the long-term maintenance of the Waterway, identification and evaluation of additional alternative sites was necessary.

New Candidate Sites. Definition of the management strategy and delineating logical channel reaches provided the means to evaluate existing easements with respect to the long-term, 50-year storage capacity, needs of the Waterway. In general, the process began with the identification of all areas within reasonable distance of the channel with the potential to satisfy the requirement of confined upland disposal with existing or potential upland road access to meet the demands of ongoing site management. Also considered was the degree to which the area had been previously disturbed by land clearing, logging, agriculture, or mining. Additional environmental considerations, such as the quality of existing habitat or the diversity of vegetation were not included in the initial site identification; however, these factors were considered in the final site evaluation. In some instances adjacent land-use conflicts (e.g., adjoining high-density residential development) or operational limitations (e.g., excessive overland pipeline access requirements).

Preliminary identification and evaluation of the sites was accomplished through the use of all available resources. In general, these resources included U.S. Geological Survey (USGS) color-infrared aerials (1:24,000), FIND blueline aerials (1:2,400); FIND black-and-white contact prints (1:24,000); based maps including USGS 7.5-minute topographic quadrangle maps (1:24,000), U.S. Fish and Wildlife Service Wetland Inventory maps (1:24,000), and U.S. Soil Conservation Service maps (various scales). The future land use maps that accompany the comprehensive plan documents for individual counties were also considered. By these resources, candidate sites were selected for preliminary field inspection.

The basic objective of the field inspections for the identified candidate sites, each conducted by a biologist and an engineer, were to document and evaluate the environmental characteristics and the existing and adjacent land-use of each site and to assess its general suitability for site development. Specific objectives included preliminary delineation of wetlands and the initial assessment of vegetation communities, habitat, and environmental constraints include the presence of protected wildlife. Also noted during the site inspections were site topography, general soil conditions, existing or potential road access, possible pipeline routes, and obvious archeological features, if present. Following each site inspection, candidate sites were either eliminated (due to an abundance of environmental impacts) or preliminary designed to calculate the site's capacity as compared to the required 50-year storage capacity. Sites were then ranked by location, mapped area, containment area, capacity, maximum pumping distance, comprehensive plan designation, predominant habitat, and, if necessary, limiting factors.

Final Site Selection. The following standard set of criteria was used to perform the final site selection:

- Engineering and Operational Considerations
    - Capacity
    - Adequate Dike Material
    - Pumping Distance

    - Pipeline Access
    - Upland Access
    - Soil Properties
- Environmental Considerations
    - Wetland Impacts
    - Upland Impacts
    - Buffer Area
    - Archeological Value
    - Groundwater Conditions
- Socioeconomic or Cultural Considerations
    - Land Use
    - Zoning and Comprehensive Plans
    - Property Ownership

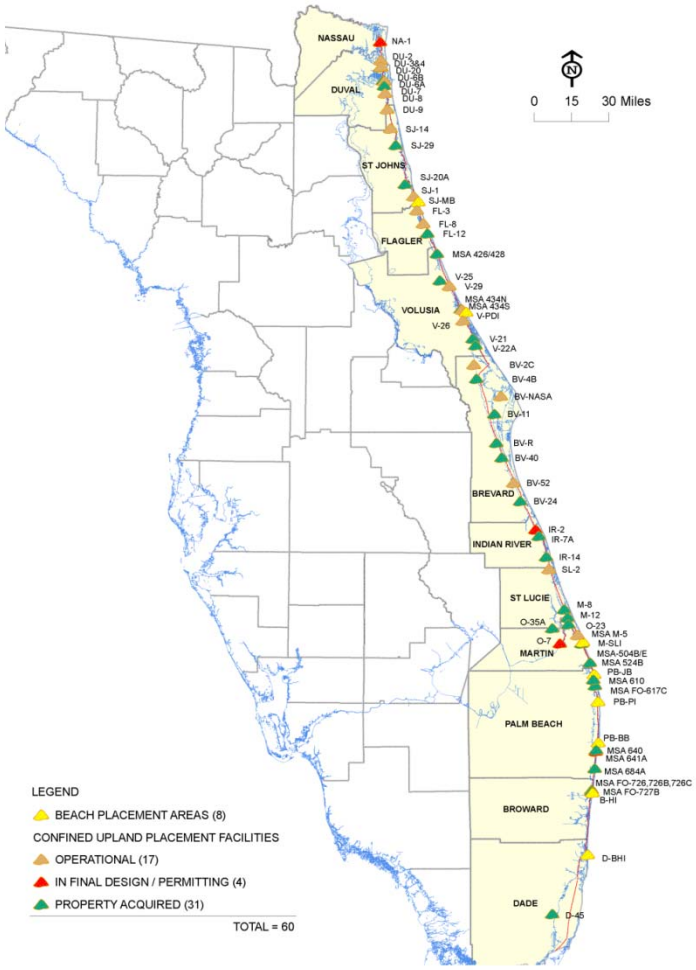

Figure 1. ICWW and OWW Site Bank

In evaluating a particular site, each criterion was then given more or less weight based on the effect of the overall site suitability. Recommendations were then made for a primary and a secondary site to serve the requirements of their designated channel reach. As their names imply, these sites represent the best and second-best alternatives after consideration of all engineering, operational, environmental, and socioeconomic/cultural factors influencing the final site location.

DEVELOPMENT OF THE DMMP

To complete the DMMP process, the following tasks were conducted for each primary and secondary upland confined and, if necessary, beneficial use selected site:

1. Document public record information concerning land use and zoning restrictions, taxes and assessed values, easements, property ownership, and other site encumbrances.
2. Obtain engineering and environmental site information required for preliminary engineering design and permitting of primary sites such as:
    a. Boundary Survey — Perform boundary survey of each primary site and the associated pipeline and road access easements. Survey should include sufficient detail to support legal and engineering actions required for acquisition of the site, as well as acquisition of

additional easements under consideration by the USACE and for site development for the purposes of dredged material management.

b. Topographic Survey — Perform topographic survey to obtain information for site planning, permitting, and design purposes.
c. Subsurface and Soils Survey — Perform core borings and analysis to document site soil characteristics. Analysis should include boring logs, grain size distributions, specific gravity, organic content, Atterberg limits (where appropriate), shear strength, compaction, and consolidation. Survey should also include groundwater table elevations at a sufficient number of locations to provide estimates of on-site water table potential surface elevations.
d. Cultural Resources Survey — Coordinate with the State Historic Preservation Office (SHPO) (appropriate to each USACE District) to obtain a preliminary review of identified cultural resources within the primary candidate site area.
e. Environmental Survey — Perform field survey and data collection efforts to provide:
    i. Detailed documentation of site vegetation communities, including species frequencies of occurrence, and the delineation of wetlands and transitional areas via state-approved methods.
    ii. Detailed documentation of on-site animal species, including endangered or threatened species, and pertinent habitat information.
    iii. Documentation of existing vegetation communities and species habitats along proposed pipeline access and return drainage routes.
    iv. Documentation for a Phase I Site Environmental Assessment for concerns related to hazardous waste.

3. Develop site documentation and a preliminary design and analysis for permitting. Information necessary for permitting may include Phase I Site Environmental Assessment Report, site capacity analysis, and preliminary design calculations and permit drawings.
4. Prepare a site management plan for each primary site. The plan should include brief descriptions of all site design features as they relate to the long-term operation of the site and the management of dredged material such as dredging procedures, ponding depth, monitoring, and post-dredging procedures.
5. Prepare an opinion of probable cost (inclusive of site improvement, operation, and maintenance) for all primary sites.

SUMMARY

Increased environmental awareness and accompanying regulation during the 1970s made securing dredged material placement areas increasingly difficult and expensive, especially in Florida's high growth and increasingly urbanized coastal corridor. To address this situation, in 1986 the Florida Inland Navigation District (FIND) — local sponsor for Florida's ICWW and OWW— embarked on a 15-year long-range planning program to ensure the Waterway's continued viability over its 502 channel mile length. The basic program objective is to locate, obtain, design, permit, and construct dredged material management sites capable of handling projected 50-year maintenance dredging requirements. This work has required close coordination with the Jacksonville District Corps of Engineers (USACE), federal and state permitting agencies, local governments and, through numerous public workshops, local citizens' groups. Site acquisitions and construction projects are developed in conjunction with FIND's funding and grant cycles, to establish project priorities. When complete, the program will comprise a permanent infrastructure of approximately 52 containment facilities and 8 beach placement sites designed to manage over 41.5 million cubic yards of material over the next 50 years and beyond (Figure 1).

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