BENEFICIAL USE: ESTUARINE ISLAND CREATION WITH INTRACOASTAL WATERWAY MAINTENANCE DREDGED MATERIAL IN LAKE WORTH LAGOON; PALM BEACH COUNTY, FLORIDA

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INTRODUCTION

Background

The Florida Inland Navigation District (FIND) — local sponsor for the 407 mile federally authorized Florida Atlantic Intracoastal Waterway (AIWW), Intracoastal Waterway (IWW) and the eastern 98 miles of the Okeechobee Waterway (OWW) — sponsored a project to maintenance dredge the IWW channel to -10 feet (ft) Mean Lower Low Water (MLLW), its federally authorized depth, in a 4.5-mile section from the Port of Palm Beach to the Town of Palm Beach docks in Palm Beach County, Florida (**Figure 1**). This portion of the IWW channel had not received maintenance dredging since its construction in the 1960s. The project removed shoals impeding navigation and restored the channel to its federally authorized dimensions.

FIND formulated the project to provide recreational boaters and commercial vessels safer access to the area's marinas, boatyards and shipping facilities. Partnerships between project stakeholders and environmental regulatory agencies — including the FIND, the Port of Palm Beach, Palm Beach County (County), state and federal permitting agencies, local boating and commercial industry groups, as well as the FIND Engineer (Taylor Engineering, Inc.) and the dredging contractor (Orion Marine Construction, Inc. [Orion]) — ultimately led to a successful project outcome.

FIND's IWW channel dredging permits authorized upland containment of dredged material in FIND's Peanut Island Dredged Material Management Area (DMMA). However, to support an overall cost-effective strategy to leverage beneficial sand sources for Palm Beach County's Tarpon Cove restoration project, Taylor Engineering facilitated coordination between the County and FIND to modify FIND's permits to allow placement of the IWW material in the county's restoration site. Palm Beach County had previously acquired Florida Department of Environmental Protection (FDEP) and Department of the Army (from the U.S. Army Corps of Engineers [USACE]) permits authorizing restoration and enhancement of Tarpon Cove — a 46 acre site located approximately 1.2 miles south of the Town of Palm Beach docks — by capping of muck sediments and creating seagrass, mangrove, and oyster reef habitat where poor sediment quality and dredged holes prevented development of high-quality habitats. Orion commenced dredging on a 24-hour, 7-days per week schedule in March 2019 and ended in May 2019. Orion mechanically dredged and transferred 84,650 cubic yards (cy) of material from the IWW channel to the Tarpon Cove restoration project.

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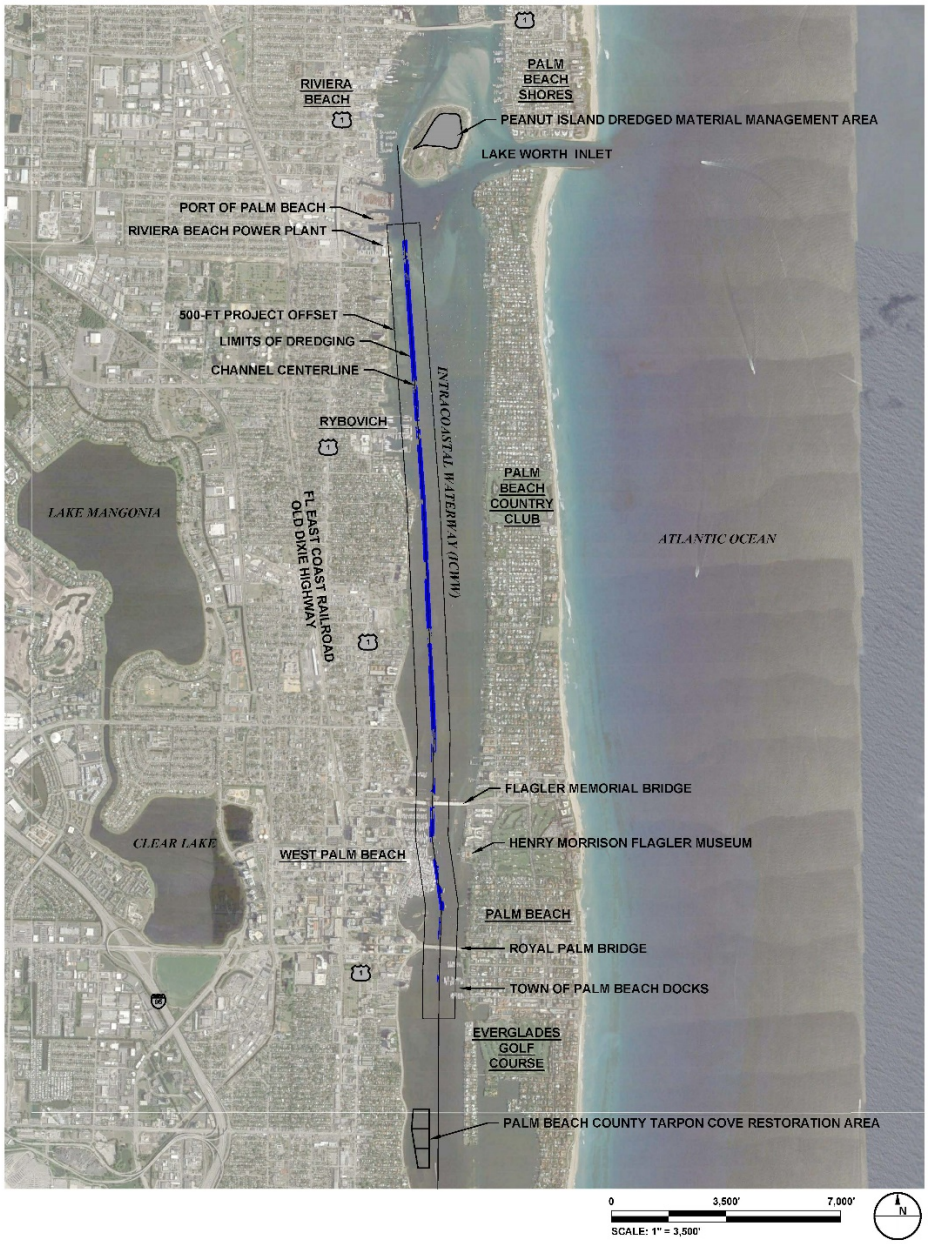

Figure 1. Project Area Limits

Partnership History

The Lake Worth Lagoon (Lagoon) estuary in Palm Beach County runs approximately 20 miles along the southeast coastline of Florida. The Lagoon is an urban estuary that has suffered extensive loss of estuarine habitats and degraded water quality due to human development activities over the past century. Approximately 81% of the Lagoon's shoreline is developed with seawalls associated with private residences and businesses (PBC ERM, 2016). Sediments throughout the Lagoon were dredged, decades ago, to support local development. The dredging created large benthic 'holes' that now impair the Lagoon's ecosystem as they are well below adjacent grade, often anoxic, and generally do not support seagrass or other submerged resources. Additionally, canals that drain into the Lagoon have introduced

fine, silty sediments that settle in these holes, hindering recruitment of seagrasses and diminishing water quality.

FIND and Palm Beach County Department of Environmental Resources Management (PBC ERM) are two members of the Lake Worth Lagoon Initiative (Initiative), a multi-agency effort to increase awareness, support, and funding assistance for projects to improve and protect natural resources within the watershed of the Lagoon. The Initiative has successfully promoted interagency coordination and commitment to Lagoon restoration and protection. The Initiative was the genesis to the FIND and PBC ERM partnership that enabled IWW maintenance dredged material placement at the County's Tarpon Cove restoration project.

FIND has historically supported County restoration and public use projects by providing dredged material for beneficial reuse, or through project grant funding cost-share participation via FIND's Waterway Assistance Program. For example, 1.2 million cy of material from Peanut Island DMMA was transferred to the Snook Islands Natural Area in 2003-2005 to create a 100 acres of shallow water estuarine habitat of seagrass, mangroves, spartina, and oyster reefs. In 2009-2010, 47,000 cy of material from FIND's Juno Dunes DMMA area was used to create and enhance 14 acres of mangrove habitat and create 3.2 acres of shallow water seagrass area accompanying the construction of boardwalks, floating docks, an observation tower and picnic areas. The material excavated to create the wetlands was used to fill dredged holes to create intertidal mangrove islands at the County's South Cove Natural Area in West Palm Beach. Also, in 2010 FIND expedited and completed a small (16,250 cy) IWW maintenance dredging project in West Palm Beach to provide fill for the South Cove Natural Area project which had the capacity to beneficially reuse dredged material.

The successful completion of restoration of dredged holes at Snook Islands and South Cove Natural Areas did not rely solely on a partnership with FIND to provide material; the local marine community (i.e., Rybovich Marine Center, Palm Harbor Marina, and Lockheed Martin) also provided material for the projects as a cost-effective alternative for disposal of beneficial dredged materials. Seeing the positive results of these public-private partnerships, the County saw a need to have additional dredged holes, such as Tarpon Cove, permitted for future restoration and beneficial use of dredged materials.

PERMITTING AND DESIGN

IWW Maintenance Dredging

Taylor Engineering began permitting the project in 2015; state and federal agencies issued environmental permits in 2018, permit modifications for alteration of the final placement area was completed in 2019. Taylor Engineering faced significant permitting and design challenges, which resulted in a two-year permitting timeframe, stemming from (1) modification of the original project from a deepening to a maintenance dredging project, (2) identification of seagrass and hardbottom impact, (3) surveying and performing diving investigations for thirty-two utility crossings, and (4) modification of the final dredged material placement area. Technical resolution of these issues and ultimate permit acquisition focused on developing alternative strategies that optimized channel design while balancing the economic return to the local area community, minimizing environmental impacts, and providing environmental restoration benefits.

A March 2001 USACE Detailed Project Report (*Palm Beach Harbor Lake Work Access Channel Expansion Section 107 Small Navigation Project; Palm Beach County, Florida*) made a case for a 5.2 mile long — inclusive of the area between the Port of Palm Beach and Town of Palm Beach Docks — deepening project that would increase the channel depth from -10 ft MLLW to -18 ft MLLW. To reevaluate the project need, nearly two decades later, FIND and Taylor Engineering evaluated several channel design alternatives — including an existing adjacent federally-authorized 2.8 mile side channel and basin (USACE, 1971) east of

the IWW, extending south between Lake Worth Inlet and the shoreline of the Town of Palm Beach — for project depths ranging between -10 and -20 ft MLLW, with an assumed allowable 2-ft overdepth dredging. Evaluation criteria included variable project lengths, dredge quantities (as compared to the Peanut Island DMMA capacity of 366,000 cy), conflicting submerged utility crossings, and submerged natural resource impacts. The 2001 USACE Detailed Project Report recommendation entailed the greatest dredging volume (1.2 million cubic yards) at -18 ft MLLW, 32 possible utility crossings, and submerged natural resources impact. Based on a current lack of substantial marina and mega-yacht facilities south of the Port of Palm Beach, 16 of the 32 identified utilities requiring relocation, and impacts to submerged environmental resources, FIND elected to move forward with a project to maintenance dredge 4.5 miles of the existing IWW channel to a depth of -10 ft MLLW (with an additional 2-ft of allowable overdepth) to serve the immediate needs and use of the IWW.

Tarpon Cove Restoration Area

In 2014, the County implemented a scoping effort to identify the dredged holes in the Lagoon and determine potential environmental enhancement projects and options for possible future mitigation needs. The first component of that effort was to create a Sub-Committee from the County's Artificial Reef and Estuarine Enhancement Committee to get the groups' feedback on the potential restoration sites, eliminate from consideration some of the holes that have substantial recreational/fishing value, and get a consensus on which holes to study for potential restoration. The Sub-Committee identified the Tarpon Cove project area as a section with high wave energy associated with an unrestricted wake zone and good shoreline fishing. These conditions offered an ideal area for island creation to provide wetland habitat, protect the adjacent shoreline, and enhance fisheries utilization. The Committee recommended to keep all structures and enhancements 150 ft from the shoreline and stated that clean fill and restoration components would cap fine grain (muck) sediments within the dredged hole and provide for suitable estuarine habitats. Over the next three years, the County implemented benthic surveys, bathymetric surveys, and seagrass surveys to assess project feasibility. A conceptual design was created considering the view from the adjacent neighborhood, navigation, fishing from the seawall, costs, and the development of a large site for the marine community to use for the beneficial placement of dredged material. The project received positive feedback from all the stakeholders, and in May 2017 the County submitted a joint Environmental Resource Permit Application to the FDEP and USACE. The County received the FDEP permit on June 23, 2017, and the federal permit on February 15, 2018.

In general, the 46-acre Tarpon Cove project was designed to fill in a deep dredge hole to restore and enhance critical shallow estuarine subtidal vegetation (seagrass) habitat through the capping of muck. Capping the muck and filling the hole will allow for natural recruitment of seagrasses, including Johnson's seagrass (*Halophila johnsonii*), a federally threatened species, which occurs near the project area. Additionally, the project will result in five intertidal islands consisting of mangrove, emergent (tidal marsh), unconsolidated sand (tidal flat), reef (oyster), and coastal nesting bird island habitats. These islands should support a wide variety of fish, invertebrates and birds. Other benefits of the project include downstream water-quality improvements, improved wildlife-oriented recreational opportunities, increased protection of shorelines from sea level rise, and increased carbon sequestration capabilities. Methods chosen to achieve this project have been used by the County to successfully restore over 250 acres of high-quality habitat within Lake Worth Lagoon. The project will also serve as a natural buffer between the IWW and existing shoreline, providing for both refuge and safer passage by listed species, such as manatees and sea turtles, outside of the busy IWW channel. Project components include:

- Restore 39.9 acres of estuarine habitat
- Cap 15.9 acres of muck sediments while allowing for deep-water refuge landward of the project

- Create 34.8 acres of seagrass habitat
- Create 2.7 acres of emergent islands with intertidal mangrove and spartina habitat
- Create 0.3 acres habitat for coastal nesting birds
- Create 2.1 acres of oyster and artificial reef habitat

The overall project requires approximately 418,600 cy of sand; the FIND IWW Palm Beach Maintenance Dredging project provided 20% of that amount. Construction of the Tarpon Cove project began in February 2018 with the placement of beneficial material of opportunity generated from the Town of Palm Beach Channel Maintenance Dredging project and Rybovich Super Yacht Marina Center expansion in West Palm Beach. Construction continued with the placement of the FIND IWW maintenance dredging material in 2019. Future phases of the project will occur as funding and other beneficial use sources of fill material become available.

CONSTRUCTION

Orion completed the construction phase of the IWW Maintenance Dredging project between March 2019 and May 2019, approximately two months before the required completion date. Orion removed 86,450 cy of material over the project duration. The construction phase of the project went relatively smoothly largely due to Orion's attention to detail and support from the project stakeholders. A brief description of the equipment, procedures, and stakeholder coordination follow.

Equipment and Procedures

Orion used a mechanical dredge equipped with 14-cy environmental clamshell and 6-cy rock bucket to dredge the channel (**Figure 2**). A tender tug relocated the dredge during the dredging operation. The environmental bucket minimized sediment suspension, thereby reducing impacts to water quality.

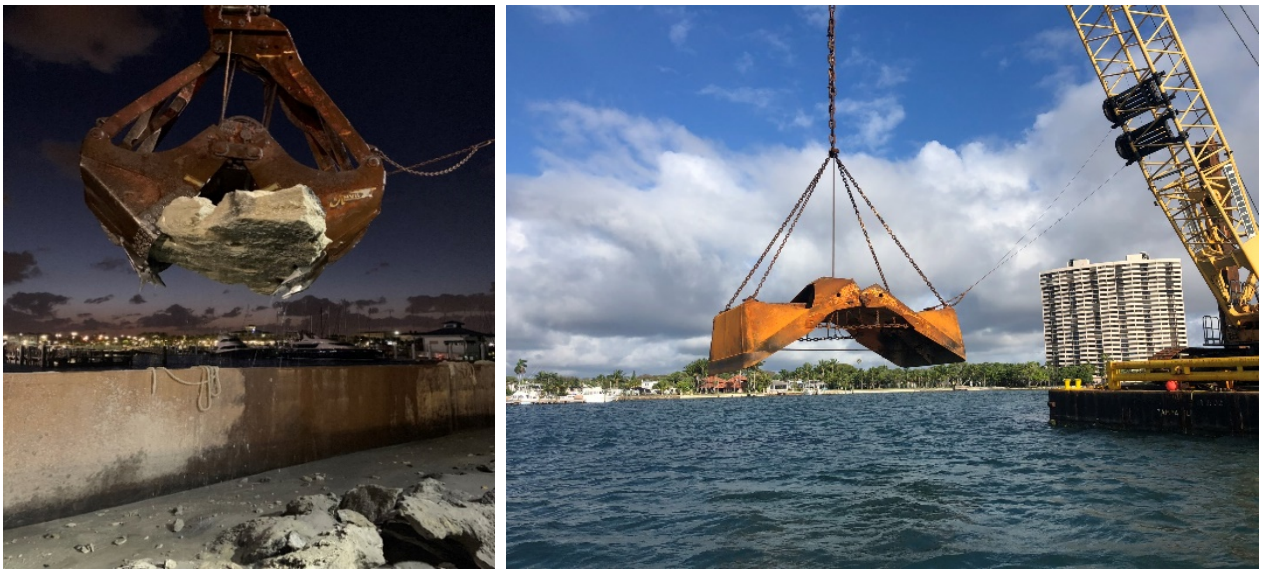

Figure 2. Orion Marine Construction 6 cy Rock Bucket and 14 cy Environmental Clamshell Bucket

The mechanical dredge — a Liebherr HS 895 HD excavator — was powerful enough to break through the weathered limestone (**Figure 3**) encountered along some sections of the channel. To facilitate movement of larger vessels during the March 2019 Palm Beach International Boat Show, Orion began dredging in shoal areas targeted by FIND and the marine industry at the south end of the project area. Orion then continued working northward towards Peanut Island.

Figure 3. Coquina Encountered Within the Dredging Template Overdepth

Hopper barges (260 ft x 52 ft x 12 ft) transported the material from the dredging location to the Tarpon Cove restoration project located about one mile south of the southern project limit. When filled to capacity the hopper barges could hold 3,900 tons of material; however, shallow depths in the offloading area restricted barges to a maximum of 1,850 tons. At the Tarpon Cove restoration project, Orion moored the loaded barges to an offloader barge (**Figure 4**). The offloader barge — a large excavator equipped with a hydraulic environmental bucket — began placing material from the southern portion of the placement area moving north. A turbidity barrier enclosed the placement area to prevent water quality standards exceedances. The excavator released the material below the waterline to further minimize turbidity.

Figure 4. Offloading Operations at Tarpon Cove Restoration Area

The contractor experienced substantial variability in daily production rates due to (1) weather and mechanical delays, (2) difficulty in dredging coquina and hard packed sand; (3) attempting to mechanically dredge a relatively thin-layer of material spread out over several miles; and (4) increased vessel traffic associated with the Palm Beach International Boat Show.

Stakeholder Coordination

Partnerships between project stakeholders and environmental regulatory agencies — including FIND, Palm Beach County, Marine Industries Association of Palm Beach, Town of Palm Beach, state and federal permitting agencies, local boating and commercial industry groups, and the dredging contractor — had a tremendous, positive project impact. Because the IWW is a key access corridor for many commercial marinas, public outreach and coordination with the local boating and commercial groups was crucial. Providing a daily email update with the construction status, targeted mailings, outreach to the marine industries, public outreach meetings with the historic El Cid neighborhood (lying adjacent to the Tarpon Cove restoration project), and U.S. Coast Guard (USCG) coordination greatly aided in the overall project success.

Maintenance of Marine Traffic. Due to presence of the Port of Palm Beach, timing of the Palm Beach International Boat Show with project construction, several marinas, a mega-yacht service facility, and numerous private docks, this section of the IWW experiences high volumes of marine traffic. Combined, the dredge and the barge measured approximately 90 ft in width, which substantially reduced the navigable channel width for marine traffic. To buffer potential maintenance of marine traffic issues, Orion provided daily equipment position reports that helped to notify local mariners of the dredging and offloading locations (**Figure 5**). These reports were shared via email with the engineer, Port of Palm Beach Pilots, USCG, affected marinas along the IWW, and other stakeholders or individuals that requested this information.

Figure 5. Example of Contractor's Forecast Location Map

Noise and Light Mitigation. Due to the proximity of the El Cid neighborhood, lying approximately 500 feet west of the Tarpon Cove restoration project, Orion had to be cognizant of both noise and light disturbance. To reduce noise during the offloading operations, all equipment operating at Tarpon Cove restoration project had muffler systems in place and, as much as practical, Orion minimized noises associated with the mechanical aspects of the offloading procedures. Orion also conducted noise monitoring along the El Cid seawall to measure background and construction noise levels. Readings in the 60 decibels (dB) were recorded for passing cars and 80 dB for planes flying overhead. Construction noise levels were measured between 70-75 dB at the seawall, approximately 450 ft from the offloader.

With regard to light mitigation, Orion initially staged the barges in an east to west direction filling the placement area in rows, once a row reached capacity, the offloader barge was moved north to start another row. A few weeks into the dredging operation, the contractor reoriented the barges in a north-south direction (**Figure 6**). This change (1) reduced light impacts from the tugs on the historic El Cid neighborhood, located along the eastern edge of the IWW and (2) resulted in safer offloading as this orientation facilitated the arrival and departure of the tugs and scows with respect to currents and prevailing winds.

Figure 6. Tarpon Cove Restoration Area During Project Construction

SUMMARY

Through coordination between stakeholders — FIND, Palm Beach County, regulatory agencies, and the contractor — Taylor Engineering obtained permit modifications, revised the dredging contract specifications, and issued a change order to Orion to place the dredged material as fill at Palm Beach County's Tarpon Cove restoration area. Orion completed dredging and transport of 84,650 cy dredged material to Palm Beach County's restoration project within a consolidated timeframe.

Following the completion of the IWW maintenance project, Palm Beach County residents and the area's vital marine industry have benefited from easier and safer navigation. This project demonstrated that through proper planning, design, and co-ordination with the relevant stakeholders, maintenance dredging projects may provide sediment for environmental restoration with economic benefits to both the navigation authority and local government.

REFERENCES

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