

BREAKWATERS AT CITY OF FT. PIERCE MARINA
FORT PIERCE, FL, USA

COASTAL PROTECTION

Product: MacTube® , MacBag® , Maccaferri Polymeric Marine Mattress (MPMM)

Problem

The Ft. Pierce City Marina is located on the Indian River Lagoon, a long and wide estuarine water body separated from the Atlantic Ocean by barrier islands on Florida’s southeast coast. In 2004, Hurricane Frances made a slow 34 hour approach toward the marina as a Category 2 hurricane. Out of 269 slips, the hurricane totally destroyed the 138 slip floating dock portion of the outer marina and incurred additional damage to the inner marina basin slips. The hurricane caused approximately \$14.9 million in damages to the boats and \$13 million in damages to the marina facilities.



Damage caused by Hurricane Frances

Solution

The City of Ft. Pierce recognized that simply replacing the marina facility ‘in-kind’ was not the solution for long term protection from potential future storms. The proposed solution was to create a permanent wave barrier configured as a carefully sculpted, but naturally appearing, artificial island breakwater to protect the marina from a 100-year storm event, as mandated by FEMA regulations. The project consisted of constructing a 12 island breakwater and one peninsular structure storm protection system to harbor the marina and adjacent public waterfront areas, while providing storm protection, habitat creation, and water quality enhancement (grand total of 14.66 acres). Along with providing storm damage protection of the marina, upland infrastructure, and surrounding downtown waterfront area, the islands also provide significant environmental enhancements that include mangrove planting (1.54 acres), oyster recruitment (1.28 acres), shorebird habitat and natural limestone artificial reef areas. The State of Florida has recognized this project as a pilot study for its environmentally friendly and sustainable elements, potentially setting the bar for future storm damage protection projects as an alternative to typical shoreline hardening solutions.



Islands under construction

Together with the City of Ft. Pierce and the coastal consulting firm, Tetra Tech, Inc., Maccaferri assisted in developing the MacTube® dimensional tube geometry, and fabric type. The MacTube® OS500 material was selected based on its strength properties. MacTube® OS500 is composed of high-tenacity polypropylene yarns, which are woven into a network in such a manner that the yarns retain their relative position to each other. The MacTube® OS500 material is inert to biological degradation and resistant to the most naturally encountered chemicals, alkalis, and acids.



Maccaferri Polymeric Marine Mattress installation

Client:

CITY OF FT. PIERCE, FL

Main contractor:

CASHMAN/LUCAS MARINE

Designer:

TETRA TECH

Products used:

MACTUBE®, MACBAG®, MPMMI*

Date of construction

FEB 2012 - MAY 2013

Technical Characteristics

The storm protection breakwater system is anchored by a 10.5 acre peninsular island, known as Tern Island, which shelters the marina from large open water fetch and harsh wave climates to the south and southeast. This island is comprised of;

- T-groin stabilized, crenulated beaches on the windward side of the island
- A coastal sand dune in the island center, and
- A bench for oyster recruitment and mangrove planting along the leeward side.

The project foundation consists of nearly 10,700 Lft (3,300m) of geotextile containment structures, including MacTubes[®] and small MacBags[®]. These structures were used in conjunction with 250,000 SF (23,000m²) of Maccaferri Polymeric Marine Mattresses to establish the perimeter of Tern Island and provide a foundation and structural core for the groins.

Approximately 35,000 tons of limestone armoring units were used to provide structural integrity to the breakwater system while providing ecological enhancements.

In order to achieve the specified island design elevations, four tube configurations were used. Single tubes were used in shallow water locations in the central portion of the island while two tier configurations were utilized in the deeper portions of the island. One configuration consists of a single 45' (13.7m) circumference bottom tube and a top layer of sand bags which was utilized along portions of the perimeter for oyster bench/dike creation. Another two tier configuration was utilized in deeper water consisting of two base tubes and a single top tier tube. A pyramidal stack of 30' (9.1m) circumference tubes was utilized for the structural core of groin #1, while a pyramid stack of 45' (13.7m) circumference base tubes was utilized along the leeward side of the island in order to maximize the oyster bench area.

Maccaferri Polymeric Marine Mattresses were installed in conjunction with the geotextile tubes and served as a critical component to their successful installation and structural protection of the island.



Aerial view



Maccaferri Polymeric Marine Mattress installation



MacTube[®] installation

* = Not all products are available in all Maccaferri subsidiaries around the world. Please contact your local Maccaferri technical office for support to identify the optimum solution on your project.

Officine Maccaferri S.p.A. Global Headquarters

Via JF Kennedy 10, 40069 Zola Predosa (BO) - Italy

T: (+39) 051 6436000 F: (+39) 051 643 6201

E: info@hq.maccaferri.com

www.maccaferri.com

Maccaferri operates under strict quality assurance and management procedures. Please visit the website of your local subsidiary for details of their Certifications.