

5 MINUTE READ

# Fort Pierce Island



from **Engineering With Nature: An Atlas, Volume 3.**

by US Army Engineer Research and Development Center



## Fort Pierce, Florida, United States

**Creating a large living breakwater system to reduce future coastal storm risk.** Most of the City of Fort Pierce's waterfront is public access space that includes a marina and adjacent park. In 2004, Hurricanes Frances and Jeanne destroyed the marina, a vital component of the city's waterfront redevelopment efforts. To provide wave and current protection for the marina, Tetra Tech Inc. worked with the city to develop a six-hectare island breakwater system designed to perform under existing conditions and adapt to projected sea-level rise conditions. The system includes a first-line, nature-based island complex that incorporated beneficial reuse of approximately 114,683 cubic meters of dredged sand and provides structural stability and functional performance enhancement through mangrove plantings, tidal lagoon features, and oyster reefs. The final design consisted of T-head rock groins fronting the largest breakwater island and sand-filled geotextile tubes with circumferences of up to 14 meters creating a perimeter dike that protects the sand fill from the erosive effects of high tidal currents. This design received the Industrial Fabrics Association International's Award of Excellence in the Geosynthetic Projects

category in 2014 and two Project Excellence awards from the American Society of Civil Engineers and National Association of Environmental Professionals in 2016 and 2017, respectively. Five years postconstruction, the project has created roughly eight hectares of habitat features that dramatically increased the structural complexity of the benthic communities and the biodiversity within the project area.

Article Cover: Placing sand within the perimeter dike of Tern Island. (Photo by Tetra Tech Inc.)

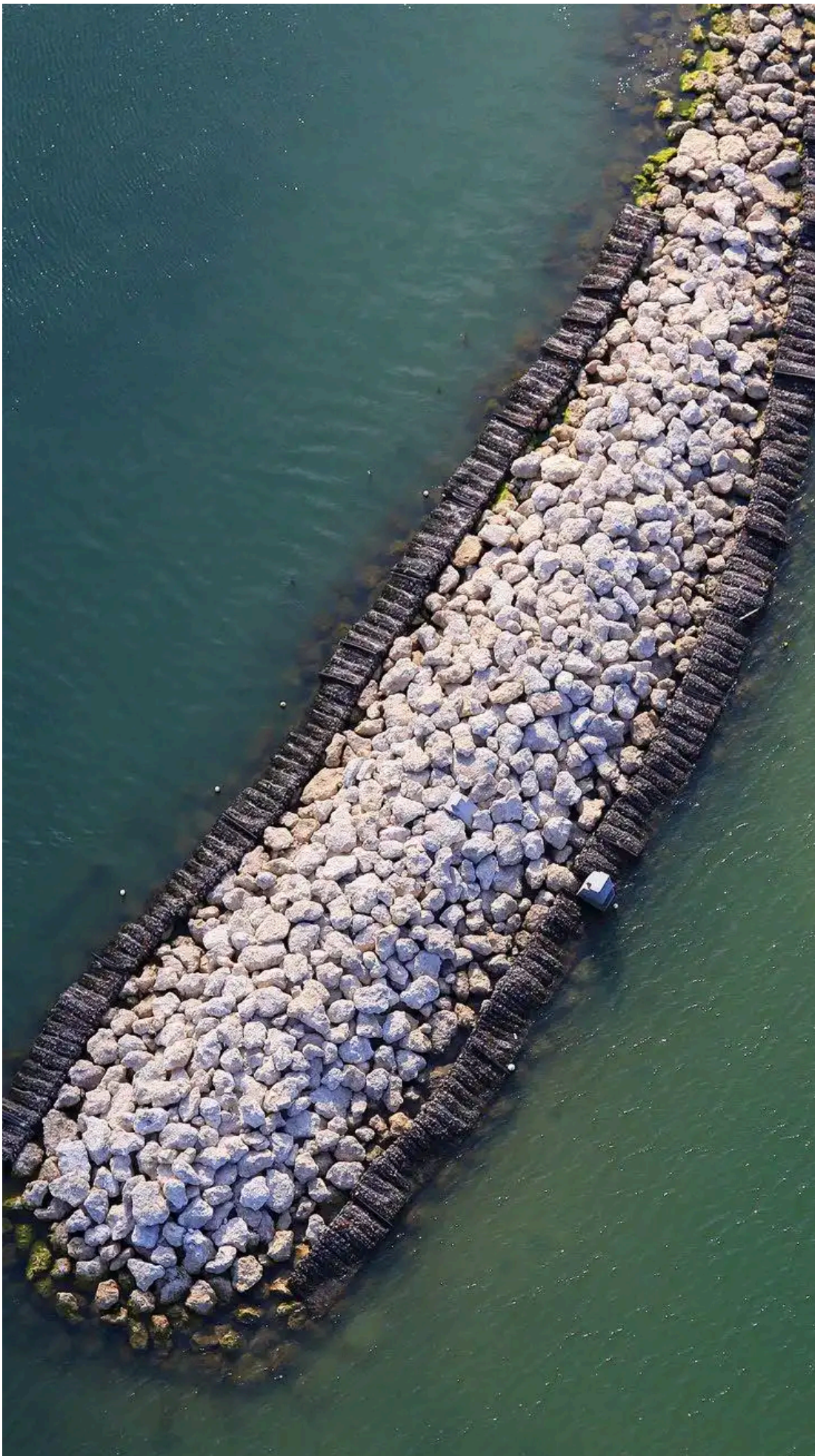
## **Producing Efficiencies**

Six hectares of breakwater islands are located in the dynamic flood tidal delta of the Fort Pierce Inlet (where tidal currents of up to four knots occur) and proximate to the Atlantic Intracoastal Waterway. These islands had to be positioned and configured to avoid any disturbance to the area's current and sediment transport patterns. Tetra Tech Inc. performed extensive numerical modeling of currents, sediment transport, and turbidity for the full project configuration and for construction of each island in the complex, including flume testing of critical sections, 3D movable bed physical modeling, CGWAVE (wave prediction) modeling, and multiple marine resource surveys.

## **Using Natural Processes**

The project design included approximately six hectares of habitat components, such as seagrass, mangroves, oysters, dune vegetation, and shorebird nesting, that contributed to the overall environmental enhancement, structural stability, and functional performance, as was demonstrated by mangrove plantings. The project was funded under the Federal Emergency Management Agency's (FEMA's) hazard damage mitigation program, where the operable design criterion is the 100-year storm. FEMA would not fund designs that met more severe conditions than the 100-year flood. To accommodate, the design included mangrove plantings that would over time result in an effective wave attenuating component to protect the islands and prevent overtopping.









Breakwater Island with intertidal marine mattress as a substrate for oysters. Additionally, nearly 200 macroalgae, sessile invertebrate, and fish species have been documented.

(Photo by Tetra Tech Inc.)

## Broadening Benefits

Consisting of open, fast-moving water with less than 0.4 hectare of submerged hard substrate and 0.016 hectare of seagrass, the former project area provided no refuge or foraging habitat for marine species. The islands now support a vibrant marine and vegetation ecosystem. The large breakwater island crest hosts habitat for shorebirds and attracts protected species for nesting. Fishing and birdwatching are popular activities in the species-rich area. The breakwater islands provided protection against 100-year storms, allowing rebuilding with reduced concerns over future storm damage and impacts to lost revenue each year the outer marina was out of service.



Aerial view of the completed project in 2015. The marina and breakwater island complex has endured Hurricanes Matthew (2016), Harvey (2017), and Ian and Nicole (2022) without any significant damage to the marina docks and breakwater islands.

(Photo by Bellingham Marine)

## Promoting Collaboration

The project included an active public participation process with a high-rise residential condominium association in view of the project area, the Marine Industries Association, and the Port of Fort Pierce Advisory Committee to advise on proposed plans and solicit feedback. Collaboration with the Advisory Committee was critical to permitting and a prerequisite to the state approval of the project due to its location within the Port of Fort Pierce Master Plan area. Extensive negotiations with the Florida Department of Environmental Protection were required before the project was finally approved by the Florida governor and cabinet as a pilot project.



Oysters and mangrove seedlings in the marine mattress. The project created 0.6 hectare of oyster beds, 0.6 hectare of mangrove fringe along the islands' shores, and 12 hectares of seagrass beds.

(Photo by Tracy Lybolt, Tetra Tech Inc.)

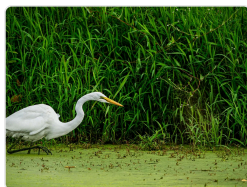


Mangroves growing in the marine mattress layer where none were present before.

(Photo by Tracy Lybolt, Tetra Tech Inc.)



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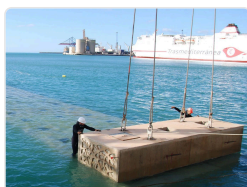
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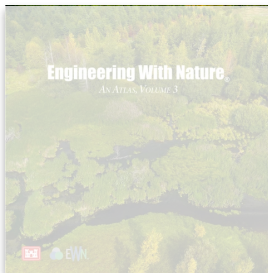


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