

# HOG ISLAND SHORELINE RESTORATION

*Implementation of a nature-based flood mitigation solution  
for Hog Island to attenuate wave energy and storm surge  
and ultimately improving community resiliency*



*This project Task 9 was funded by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant #NA20NOS4190207 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.*

*The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.*

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## Executive Summary

Hog Island is an emergent estuarine marsh complex that is part of the Guinea marshes in Gloucester County, Virginia. These marshes are located at the confluence of Mobjack Bay and the York River. In 2019, the Virginia Institute of Marine Science (VIMS) Shoreline Studies Program designed a Virginia Coastal Zone Management (Virginia CZM)-funded nature-based flood mitigation solution for Hog Island (FY18, Task 89.01). The plan included the construction of sills using various concrete and product design to protect the marsh that faces the York River. On the flanks of the island, smaller oyster structures were planned to be installed to enhance habitat and to provide shore protection along the limited fetch shorelines. These techniques are proven approaches to address coastal hazards and enhance coastal habitats. The project was designed to a 15 to 25-year Federal Emergency Management Agency (FEMA) design storm standard to help attenuate wave energy and storm surge. Finally, as the island is surrounded by shallow water, access would require specialized shallow water equipment.

With a mitigation plan and design, Middle Peninsula Planning District Commission (MPPDC) staff sought additional funding for the construction of the mitigation solution. Successful in applying and receiving grant funds, MPPDC staff procured a contractor to restore the shoreline of Hog Island based on approved permit designs and requirements. This NOAA 306A restoration project for \$427,200 (\$415,195 for construction related activity) was matched with \$20,000 from MPPDC general funds and leveraged the National Fish and Wildlife Foundation (NFWF) Project #76171 titled Phase I: Hog Island Restoration project funded at \$499,999.15 (\$394,782 for construction related activity). Although the combined construction funds are slightly less than the approximate \$900,000 in project restoration need, the combined funding provided enough funding to complete the majority of the proposed restoration project. MPPDC continues to seek additional funding to complete the entirety of the island. In addition, the two projects are completely separable as each project restored a particular linear footage. Two rows of NATRX units were deployed in parallel with a third unit centered and stacked on top. Generally speaking, a single Natrx unit is 3 feet wide by 3 feet deep. Using parallel and stacked deployment, overall, 711 linear feet (LF) of shoreline was protected, including 521 LF of shoreline using NOAA funds and 190 LF of using NFWF funds.

## Introduction

Hog Island is located within the new NOAA Middle Peninsula Habitat Focus Area, a targeted area for habitat restoration. The project site experiences high wave energy which has eroded the shoreline along its south face on the York River, and lower wave energy along its west and east flanks that occur on Monday Creek. Based on tidal gauge data from VIMS, relative sea-level rise rates ranging from 0.11-0.23 in/yr (2.9-5.8 mm/yr; period: 1976- 2007; 10 stations) within the Chesapeake Bay region, which are the highest rates reported along the U.S. Atlantic coast (Boon et. al. 2010). In addition to sea-level rise, the project location has a history of impacts from hurricanes and tropical storms. As storms pass over or near the coast, the atmospheric pressure drops, causing a large volume of seawater to build up, eventually being pushed ashore by the storm's winds

causing a storm surge. In Gloucester County, strong East and Northeast winds can push water from the Chesapeake Bay into the mouth of the York River and Mobjack Bay, flooding much of the county's low-lying areas (MPPDC, 2005).

Hog island provides critical storm protection to an existing, well established Big Island Aquaculture company which relies on calm water for oyster growth. The fetch originates as a direct easterly line from Western Sahara, Africa. Its south-facing shoreline is exposed to large waves coming from the Atlantic Ocean through the mouth of Chesapeake Bay as well as Bay-generated waves coming from the east and east-southeast. It is eroding at a high rate of -4 to -5 ft per year. The east and west-facing Hog Island shorelines along Monday Creek have lower fetch exposures (0.2 to 0.5 miles) and erosion rates of about - 1 ft/yr. The proposed living shoreline project protects a total of about 3,200 ft of low marsh shoreline and consists of 15 stacked concrete oyster structures and 12 concrete oyster structures. Proposed structures will be cast by NATRX ([NatrX Nature-Based Coastal Resilience Solutions](#)) using a patented Dry Forming™ technology which provides the ability to move from digital design to physical ExoForm™ structure within 1 day. Dry Forming enables the unprecedented ability to optimize and deliver ExoForms™ at scale.

- Efficiently mass manufactured with patented digital manufacturing platform
- 7x faster production than additive printing techniques and lower cost than traditional product (e.g. rock, riprap, concrete) implementations
- Void design tailored to ensure local habitat thrives
- Up to 80% reduction in carbon footprint vs. traditional products
- Using data gathered from our SatTech analysis and other location-specific research, solution design for ExoForm is custom to the project's habitat, climate, and project goals.

With funding through the Virginia CZM 306A restoration project and National Fish and Wildlife Foundation (NFWF), MPPDC staff procured a contractor to restore the shoreline of Hog Island based on approved permit designs and requirement.

## Product #1: Finalized JPA and Permits

MPPDC staff submitted a [joint permit application \(JPA\)](#) to the Virginia Marine Resource Commission (VMRC) on June 28, 2022. On September 27, 2022, at the request of VMRC/VIMS, MPPDC staff resubmitted the JPA to ensure Submerged Aquatic Vegetation avoidance. VIMS Shoreline Studies Program provided permitting agencies with additional information and technical guidance throughout the permitting process. MPPDC staff received [final permits](#) in November 2022.

## Product #2: Final Report on Procurement of Construction Firm and Construction of Habitat

MPPDC staff followed Virginia Procurement laws. Procurement items were posted on the MPPDC website [Bids/RFPs/RFQs \(mppdc.com\)](https://mppdc.com) and in the local Gloucester Gazette Journal. Here is the request of proposal: [MPPDC Hog Island Living Shoreline Solicitation RFP - Repost](#). Two companies responded to the RFP. One was deemed ineligible based on the response and the other, Biogenics, submitted a [winning bid packet](#). MPPDC staff and Biogenics [signed a contract](#) to commence the restoration work on Hog Island. Please note that there were two award dates - first on March 31, 2023 and then the amendment on August 8, 2023.

Biogenics provided a summary and photos of the work, including a CZM/NOAA acknowledgement sign completed on Hog Island in Attachment A. Overall they deployed 711 linear feet (LF) of reef, including 521 LF of reef using NOAA funds and 190 LF of reef using NFWF funds.

Attachment A: Construction Summary

# **Hog Island Project Update for the Middle Peninsula Planning District Commission**

By Russell Burke

Biogenic Solutions Consulting, LLC

26 August 2023

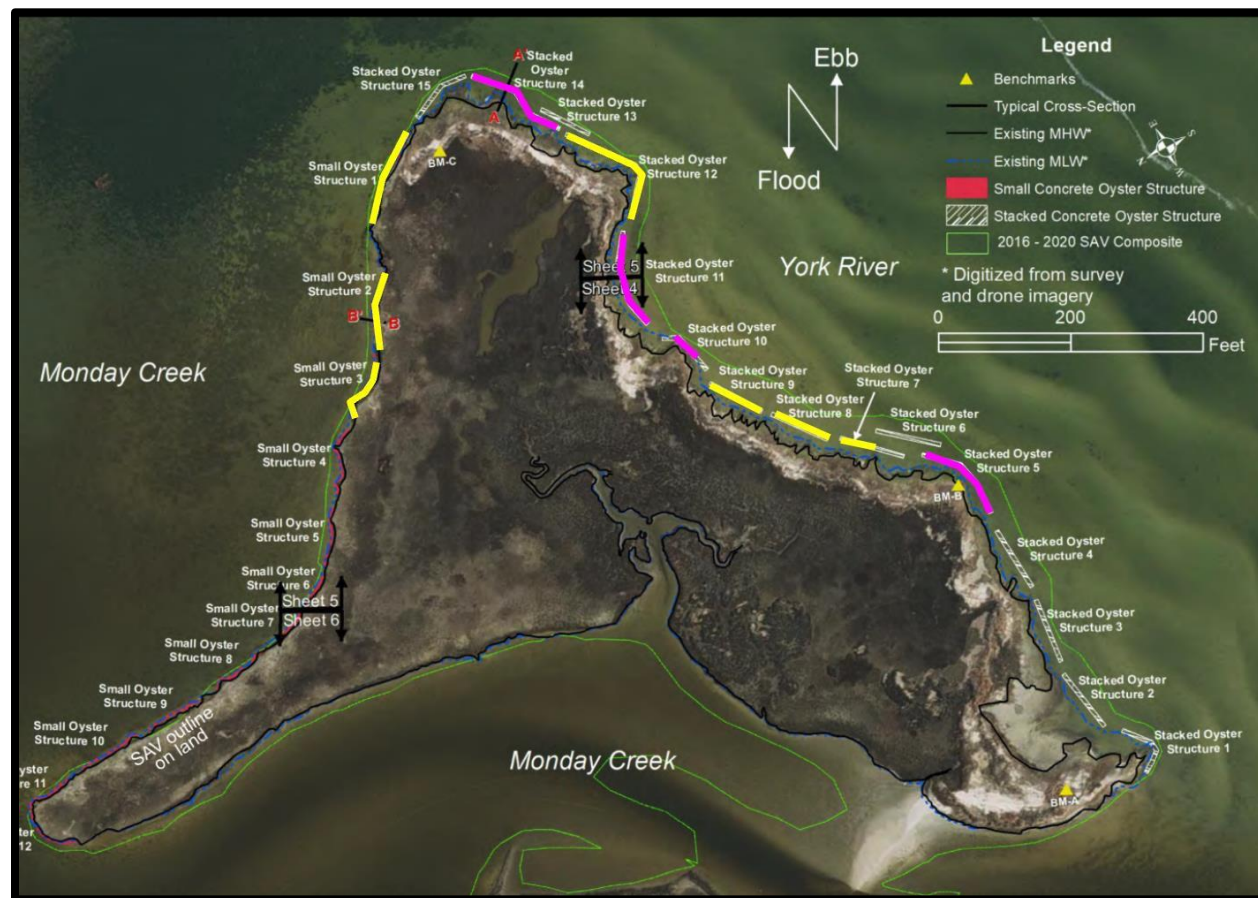
# Hog Island Project Summary (as of 8/26/2023)

NOAA Reefs Deployed (Stacked Oyster Structures in **Purple**):

- 521 (equates to 521 linear feet)
  - Structure 5: Complete
  - Structure 10: Complete (+7 LF NOAA budget amendment funds)
  - Structure 11: Complete
  - Structure 14: Complete

NFWF Reefs Deployed (**Yellow**):

- 190 (equates to 190 linear feet)
  - Structure 7: Complete
  - Structure 8: Started
  - Structure 9: Not Started
  - Structure 12: ~50% Complete
  - Small Oyster Structures (1, 2, and 3): Not Started
    - Not Started



# Methods Used and Lessons Learned

- Reefs were delivered by tractor trailer from the Natrx facility in Raleigh, NC to the Golden Oyster Marine Service (GOMS) property in Hayes, VA
- Reefs were individually unloaded using a tracked skidsteer with forks
  - The same skidsteer was used to move reefs to a designated area adjacent to the GOMS dock
- On deployment days, the GOMS crane truck was moved onto the dock with the GOMS (and/or Seaduce) barge tied up along the dock.
  - The crane operator raised each reef individually via a strap and lifting bar, and placed the reef on the barge deck.
- Aboard the barge, a specialty pallet jack was employed to arrange the reefs in a manner that stabilized the load.
- Once fully loaded, the barge captain and crew disembarked from the dock and navigated downriver (~2.0 miles) to Hog Island
  - An aluminum johnboat (24 ft long) traveled alongside the barge, serving as a safety vessel in case of emergency and carrying additional gear, including a backup pallet jack



# Methods Used and Lessons Learned

- When the barge and safety boat were within ~0.5 miles of Hog Island, the safety boat proceeded ahead of the barge to ensure that the depth was adequate for safe passage of the fully-loaded barge, as well as to minimize impacts to the seagrass beds located adjacent to the island.
- The safety boat then anchored a safe distance from the intended deployment area and the occupants entered the water to assist the barge with precise positioning on site. Other crew members aboard the barge prepared to anchor/spud and readied the davit and winch for reef deployment.
- Once the barge was in place, the reefs were offloaded one at a time using the pallet jack, davit, winch, strap and lifting bar.
- Depending upon wind strength, one or more crew members were in water assisting with angling the bow of the boat to ensure safe, precise reef placement.
  - To enable structures to curve, reefs were either intentionally ended and restarted at a different angle (such as NOAA Reef Structure 10) or slowly arched over the course of many reefs (such as NOAA Reef Structure 11) – the latter was more difficult but became more manageable as the crew's experience grew
- Once all reefs were cleared from the barge deck, the crew returned to their respective vessels and navigated back to the GOMS dock to reload, or tie up and/or retrieve vessels if the field day was set to conclude.

# The Golden Oyster Marine Services Barge

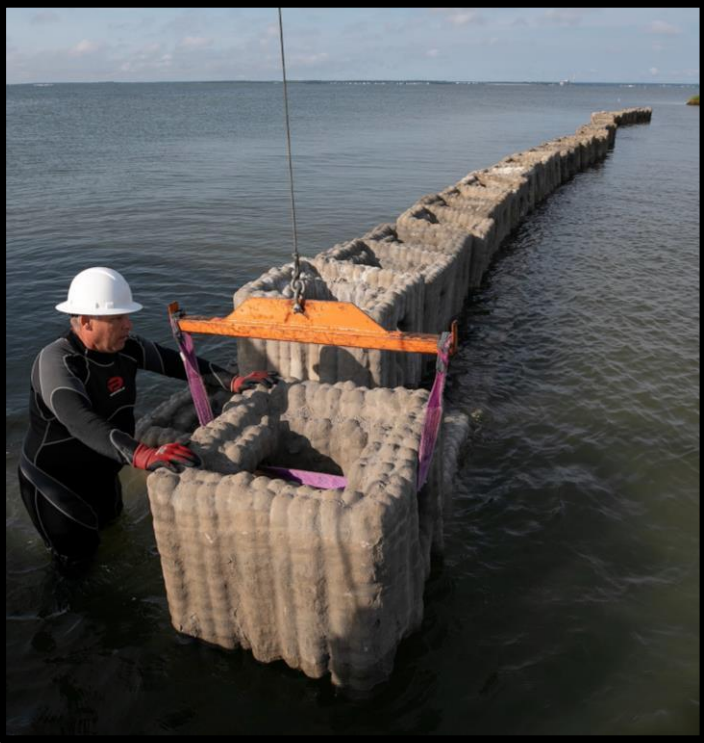


# The Seaduce Barge



# The Biogenic Solutions Consulting Safety Boat









# Structure 5 - NOAA





# Structure 7 - NFWF



# Structure 8 (Incomplete) - NFWF



# Structure 10 - NOAA



# Structure 11 - NOAA



# Structure 12 (Incomplete) - NFWF



# Structure 14 - NOAA











## Attachment B: Virginia CZM/NOAA Acknowledgement Sign

