

FINAL REPORT

Living Shoreline at Trinity Bay Discovery Center

TCEQ Contract # 582-18-80340

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Prepared for:



A PROGRAM OF THE TCEQ

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I. EXECUTIVE SUMMARY

The Trinity Bay Discovery Center (TBDC) Living Shoreline project aimed to protect the shoreline of the TBDC property from erosion and restore fringing estuarine marsh habitat. Owned by the Galveston Bay Foundation (GBF), TBDC is a 17-acre conservation and education property located on the northwest shoreline of Trinity Bay in Chambers County, Texas. Trinity Bay is a high wave energy environment, particularly in the immediate area of the project. The project is located along approximately 880 feet of eroding shoreline. Wind-driven waves have impaired the twenty-year-old bulkhead, installed by previous landowners, resulting in severe shoreline erosion as well as vegetation and soil losses.

GBF and project partners developed the TBDC Living Shoreline project to reduce wave energy impacting the shoreline, halt erosion of the shoreline, and promote deposition of suspended sediments landward of the structure. After acquiring the necessary permits and competitively bidding the project, GBF oversaw the construction of the 780-foot rip-rap breakwater which protects 540 feet of shoreline. In addition, GBF worked with volunteer groups to construct 400 linear feet of oyster shell breakwater along the northeastern shoreline which receives the lowest amount of wave action. The breakwater structures created approximately two-acres of calm water habitat that will allow for the re-establishment of intertidal marsh. As of August 2019, over half an acre of this area has been planted with smooth cordgrass by GBF volunteers.

II. PROJECT DESCRIPTION

The TBDC Living Shoreline project aimed to restore estuarine marsh habitat and protect the property's shoreline from continued erosion. The TBDC property was acquired by GBF in 2014, with the goal of developing it into a publicly accessible nature/education center with a variety of habitat restoration demonstration projects, ongoing environmental education, and volunteer opportunities. The 17-acre property sits on a point with resplendent views of Trinity Bay and is bisected by Cedar Gully, a freshwater gully which flows directly into the bay.

Like many shorelines along this part of the bay system, the TBDC shoreline has experienced historical erosion and loss of valuable fringing marsh. To abate this erosion and continued loss of property, the previous landowners of the (now-named) TBDC installed a bulkhead along the entire length of the property's shoreline over 20 years ago. Now the bulkhead is failing and the predominate wind and wave action has exacerbated the shoreline erosion. Approximately 240 feet of bulkhead failed entirely along the southeastern corner of the property. This location receives the greatest wave action and without protection lost nearly 60 feet of land.

In order to reduce wave energy and restore fringing marsh habitat along the TBDC shoreline, GBF and partners installed rip-rap and oyster shell breakwaters and are now in the process of transplanting smooth cordgrass behind the structures. It is anticipated that these breakwaters will not only reduce wave action and halt erosion, but will also result in sediment accretion behind the structures, building up intertidal elevations for the expansion of fringing marsh habitat. In addition, the hard structures, particularly the oyster shell, will provide substrate on which oyster larvae can attach and grow into matured oysters, increasing oyster reef habitat and reinforcing shoreline protection features. As demonstrated at numerous other high wave energy project sites around Galveston Bay, rip-rap breakwaters have been successful in reducing erosion, accreting sediments, reestablishing fringing marsh, and providing hard substrate suitable for oyster development.

The goals of the project included:

- Construct up to 1,200 feet of breakwater along the eroding shoreline and failing bulkhead,
- Restore up to 2.0 acres of intertidal marsh between breakwater and shoreline, and
- Protect the valuable coastal habitat of a GBF education and conservation property.

III. PROJECT METHODOLOGY

Project activities began in 2015 with GBF securing a survey contract with Cobb Fendley. In June 2016, a LSLS survey of the shoreline was completed. Based on the survey findings and multiple site visits by GBF Conservation Team staff, the size and location of the rip-rap and oyster shell breakwater structures was determined. This information was used to submit a lease application to the TX General Land Office (GLO) in July 2016 as well as a permit application to the US Army Corps of Engineers (USACE) in August 2017. The GLO lease was executed on July 26, 2017 (SL20170014) and the USACE permit was approved on September 25, 2017 (SWG-2017-00589).

In early 2018 GBF secured an additional survey contract with Ducks Unlimited who completed a bathymetric survey of the project site in February 2018. GBF staff performed additional site visits to confirm the required size of the rip-rap breakwater based on these findings.

From April to July of 2018, student volunteers from GBF's "Hip to Habitat" Program constructed 300 feet of the oyster shell breakwater along the northeastern shoreline of the property. The shells were obtained from GBF's Oyster Shell Recycling Program and the volunteer construction was supported by TX Parks and Wildlife Department (TPWD) as well as Houston Wilderness funding. During this same time, GBF developed bidding and contract documents for the rip-rap breakwater portion of the project.

A notice to Bidders was advertised in the Baytown Sun newspaper on June 5 and June 12, 2018. GBF also distributed the documents directly to project partners and contractors that expressed an interest in these type of projects in the past. A pre-bid meeting was held at the TBDC property on June 14, 2018.

Two bids were received on June 28, 2018. GBF determined that the low bidder was well qualified to complete the project and a Notice of Award was issued to Crawley's Shoreline Construction, Inc. on July 3, 2018. A construction contract was executed between GBF and Crawley's on August 20, 2018. A notice to proceed was also issued to Crawley's on August 20, 2018 after execution of the contract.

During the last week of August, Crawley's received the initial delivery of project materials and mobilized construction equipment. Crawley's completed the debris removal activities on August 27, 2018 and began construction of the rip-rap breakwater on August 28, 2018. Construction was completed on October 1, 2018 and GBF, along with US Fish and Wildlife Service (USFWS), visited the site to perform a final walkthrough. Work was approved pending survey results. In early November 2018, as built surveys were conducted by Wells Land Survey (WLS). Additional cross-section drawings were provided by WLS on December 13, 2018.

As of August 2019, the 400-foot oyster shell breakwater is complete and over 13,800 stems of smooth cordgrass have been planted by community and student volunteers. The planting effort will be completed with the help of additional student groups and community volunteers, starting next Spring.

IV. PROJECT RESULTS

At this time, the construction efforts, both contracted and volunteer based, have resulted in 780 feet of rip-rap breakwater and 400 feet of oyster shell breakwater, protecting a total of 880 feet of shoreline. Reflective warning signs were placed bayward of the rip-rap breakwater to warn and inform boaters of the presence of the structure. The rip-rap breakwater was left open on the southernmost and northernmost ends and gaps were integrated into the oyster shell breakwater structure to enable ingress/egress of water and wildlife. The breakwater structures protect the 17-acre TBDC property and have established a two-acre calm water habitat area between the structures and the shoreline. This two-acre area has the potential to restore intertidal marsh as elevations allow. As of August 2019, over 0.50 acres of this area has been planted with smooth cordgrass by community volunteers and students.

V. MOVING FORWARD

Upon completion of this grant agreement, GBF will continue to pursue volunteer, student, and/or contractual opportunities to plant the area behind the breakwaters with smooth cordgrass.

If funding allows, GBF will monitor the project site for up to five years. Monitoring will include vegetation data and oyster community data collection with assistance from partners at TX A&M University Galveston and/or University of Houston.

VI. PROJECT FUNDING

Partner	Contribution	Contribution Type
GBEP (TCEQ)	\$85,000.00	State
USFWS Coastal Program	\$45,471.69	Federal
CCA Texas	\$40,000.00	Private
NFWF Conoco Philips via Houston Wilderness	\$25,000.00	Private

TOTAL: \$195,471.69

VII. CONCLUSION & LESSONS LEARNED

The shoreline dynamics at the TBDC property are similar to another GBF property, Shipe Woods, located on the eastern side of Trinity Bay. The rip-rap breakwater constructed along the Shipe Woods shoreline has been successful, showing significant sediment accumulation and marsh growth post transplanting efforts. Thus, the TBDC rip-rap breakwater was modeled after this design.

Based on the elevation data provided by Ducks Unlimited and an assessment of the mean high tide level, GBF decided on a preferred elevation of +2.5' NAVD for the rip-rap breakwater. While this height has proven effective at reducing wave action and depositing sediment shoreward, GBF staff have observed water overtopping the breakwater on at least three occasions in early 2019. If extreme high tide conditions persist, it may be prudent to construct a larger structure, perhaps to an elevation of +3.0' NAVD, on future shoreline protection efforts.

The bidding structure for this project was based on linear feet rather than tonnage or cubic yards in an effort to avoid material shortage. Based on past shoreline protection projects, GBF found this to be the most effective method to bid linear projects and reduce risk. This approach proved vital for the TBDC Living Shoreline project as there was temporary shortage of the specific rock grade required for the project due to high demand in the Houston area. Based on discussions with the contractor it appears this shortage was due to post Hurricane Harvey flood mitigation projects.

VIII. PROJECT MAP



IX. PROJECT PHOTOGRAPHS



Figure 1. Approximate locations of Trinity Bay Discovery Center shoreline over time, indicating erosion on southeastern point since the failure of the bulkhead in 2012.



Figure 2. View of northeast shoreline BEFORE debris removal facing east/southeast



Figure 3. View of northeast shoreline AFTER debris removal facing east/southeast



Figure 4. Removal of pier pilings/debris



Figure 5. Start of construction of the southernmost section of rip-rap breakwater



Figure 6. Construction Day 1



Figure 7. Construction Day 2



Figure 8. Ongoing construction of rip-rap breakwater



Figure 9. Ongoing construction of rip-rap breakwater



Figure 10. Last day of construction – October 1, 2018



Figure 11. View of rip-rap breakwater from offshore



Figure 12. View of rip-rap breakwater looking north



Figure 13. Aerial view of complete rip-rap breakwater and 300-foot oyster shell breakwater



Figure 14. Oyster shell breakwater at low tide (December 2018)



Figure 15. Oyster shell breakwater and rip-rap breakwater at low tide (December 2018)



Figure 16. Rip-rap breakwater at low tide in December 2018, showing sediment accumulation directly behind the rocks



Figure 17. Student workday, building the oyster shell breakwater



Figure 18. GBF interns/staff and Houston Wilderness building oyster shell breakwater (July 2018)



Figure 19. GBF interns/staff and Houston Wilderness building oyster shell breakwater (July 2018)

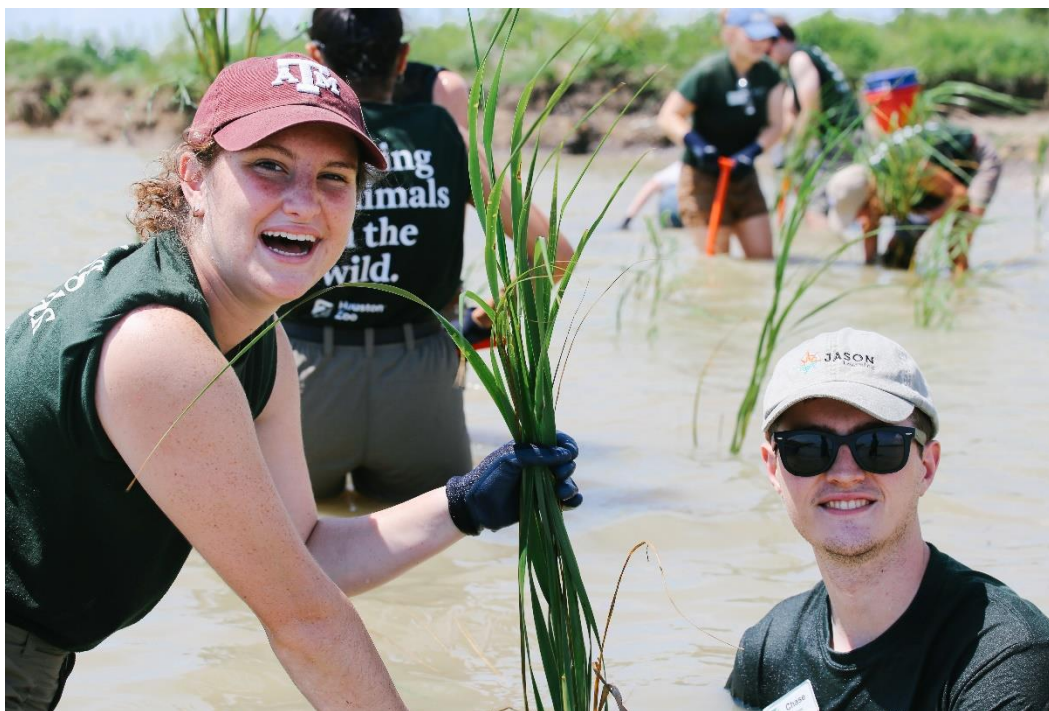


Figure 20. Houston Zoo interns planting smooth cordgrass (July 2019)



Figure 21. Houston Zoo interns building oyster shell breakwater (July 2019)



Figure 22. Accenture volunteers and TX Conservation Corps Crew planting smooth cordgrass (July 2019)



Figure 23. Area planted by Accenture volunteers and TX Conservation Corps Crew (July 2019)