CWPPRA PPL 35 RPT

Demonstration Projects

PPL35 PROJECT FACT SHEET
February 4, 5, & 6, 2025

Project Name
Demonstration Project North Vermilion Bay Shoreline Protection Phase II

Project Location
Region __3__, __North Vermilion Bay___Basin, __Vermilion__ Parish

Master Plan Strategy
Consistent with the 2023 State Master Plan of land loss reduction and sediment restoration.

Problem
Protect coastline from the persistent wearing away of land or the removal of coastal wetland, beach or dune sediments by wave action, tidal currents, or wave currents.

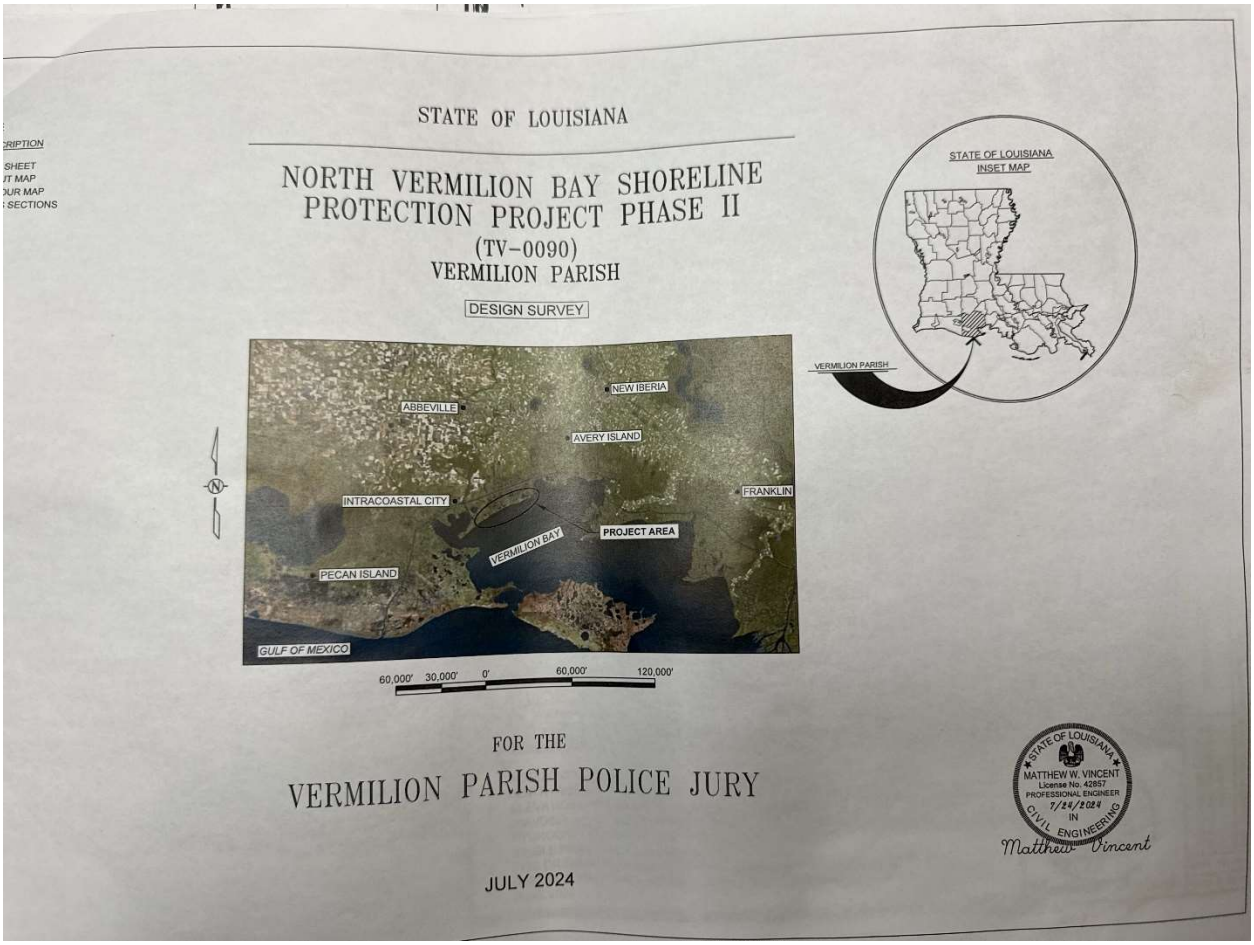
Proposed Solution
Utilizing dome structures in erosion control stemming from their inherent geometric advantages, namely the "quarter sphere". The geodesic dome is widely recognized for its strength, lightness, and efficiency in enclosing spaces. Leveraging these properties and adapting the dome into a seashell shape provides a structure capable of withstanding the dynamic forces of coastal waves. Another critical feature is the addition of a vent hole that allows water and sediment to enter the structure to enhance the dome stability with accumulation of sediment.

Project Benefits
Dome shape effectively dissipates wave energy, reducing its impact on the shoreline without unduly eroding the structure itself, thereby providing protection from erosion which fosters the regeneration of marshland and other coastal habitats.
Design strategy balances the need for material efficiency with the requirement for structural stability making them ideal for deployment in unstable soil environments (Overall Distributed Weight is ~50 PSF once in place and filled with sediment).
Designed for deployment in shallow water environments to remain visible at high tide.
Multiple domes may be placed in a variety of patterns to accommodate landscape.
Currently manufactured on the intracoastal waterway for ease of deployment.

Project Costs
The estimated construction cost including 25% contingency, in $5 million increments, from $0 million to $5 million.

Preparer(s) of Fact Sheet:
Allen Lemaire 337-517-5369 - isprdomes@outlook.com

Project Maps:



SURVEY CONTROL POINT

POINT NAME	NORTHING	EASTING	ELEVATION (NAVD 88)	DESCRIPTION
TV13-SM-01	485,238.05	3,073,763.73	2.1	Monument
CP #700	467,001.05	3,058,322.88	2.3	SS Rod W/Aluminum Cap

NOTES:
1. HORIZONTAL COORDINATES ARE BASED ON LOUISIANA STATE PLANE SOUTH ZONE - NORTH AMERICAN DATUM OF 1983 (NAD 83) DATUM, US SURVEY FOOT.
2. ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), GEOID12B, US SURVEY FEET.
3. HYDROGRAPHIC SURVEY DATA ACQUISITION PERFORMED WITH AN HYDROLITE-TM SINGLE FREQUENCY ECHOSOUNDER.
4. THIS DRAWING INDICATES GENERAL CONDITIONS AT THE TIME OF SURVEY.
5. DESIGN SURVEY DATA ACUISITION WAS PERFORMED BY SELLERS & ASSOCIATES JUNE 2024

STATE OF LOUISIANA
MATTHEW W. VINCENT
License No. 42857
PROFESSIONAL ENGINEER
7/24/2024
IN
CIVIL ENGINEERING
Matthew Vincent

SELLERS & ASSOCIATES, INC.
(4x8 EAST STREET
LAFAYETTE, LA 70506

VERMILION PARISH POLICE JURY
100 NORTH STATE STREET
ABBEVILLE, LOUISIANA 70510

DESIGN SURVEY

NORTH VERMILION BAY SHORELINE PROTECTION PHASE II

DESIGNED BY: MWV

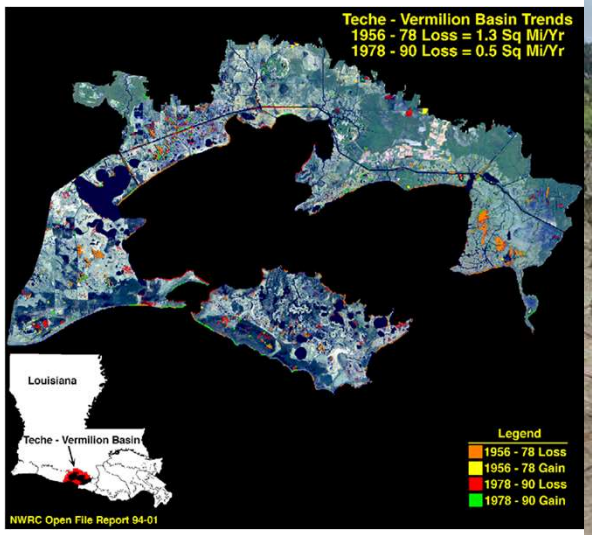
TV-0006

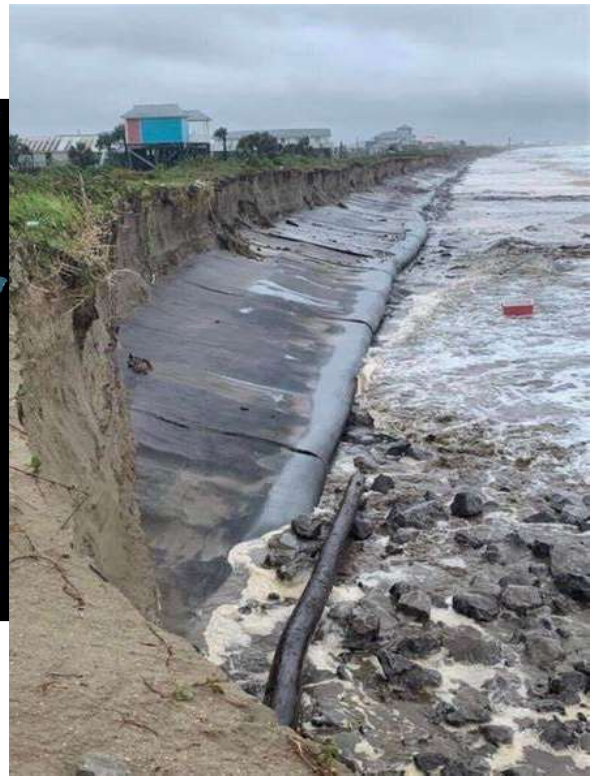
DATE: 7/24/2024

SHEET 2 OF 16

Project: Concrete Dome Structures - Shore Shells™
International Shoreline Protection & Restoration

Allen Lemaire
isprdomes@outlook.com

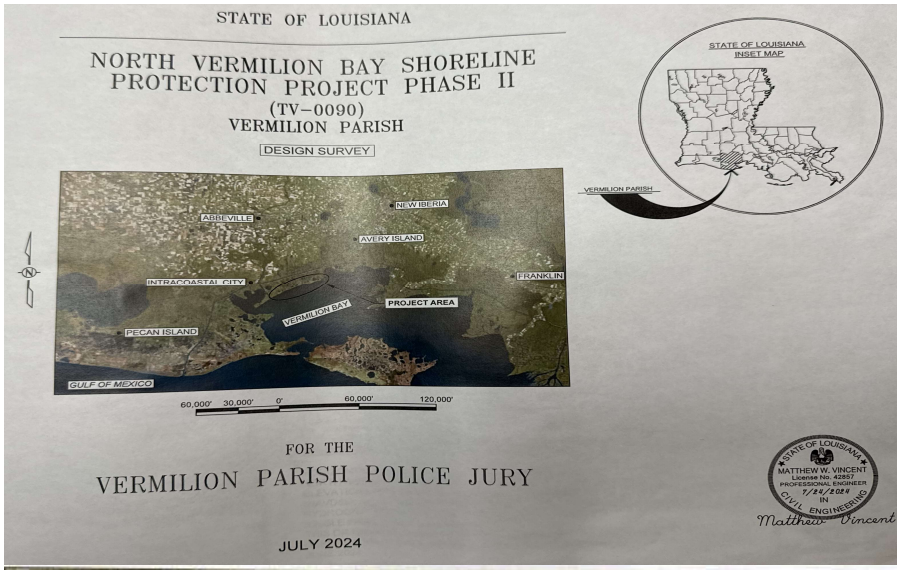




Problem

Coastal Erosion

- Wearing away of land or the removal of coastal wetland, beach or dune sediments by wave action, tidal currents, wave currents, or drainage.



Our Solution:

- Utilizing dome structures in erosion control stemming from their inherent geometric advantages, namely the “quarter sphere”. The geodesic dome is widely recognized for its strength, lightness, and efficiency in enclosing spaces.
- Leveraging these properties and adapting the dome into a seashell shape provides a structure capable of withstanding the dynamic forces of coastal waves.
- Another critical feature is the addition of a vent hole that allows water and sediment to enter the structure to enhance the dome stability with accumulation of sediment.

Project Location:

- Demonstration project approved by Vermilion Parish Police Jury at North Vermilion Bay Shoreline Protection Project Phase 2.
- Project addition to existing permit is expected within 30 days.

Project construction and deployment cost including contingency: $0-$5M

Demonstration requirements:

- ✓ Directly provides wetland benefits
- ✓ Technology not fully developed for routine applications
- ✓ Transferability including coastwide applications
- ✓ Unique and non-duplicative – Provisional patent filed & accepted

The Benefits

Dome shape effectively dissipates wave energy, reducing its impact of the shoreline without unduly eroding the structure itself, thereby providing protection from erosion which fosters the regeneration of marshland and other coastal habitats.

Multiple domes may be placed in a variety of patterns to accommodate landscape.

Design strategy balances the need for material efficiency with the requirements for structural stability making them ideal for deployment in unstable soil environments (~50 lbs. per SF)

Currently manufactured on the intracoastal waterway for ease of deployment.

Designed for deployment in shallow water environments to remain visible at high tide.

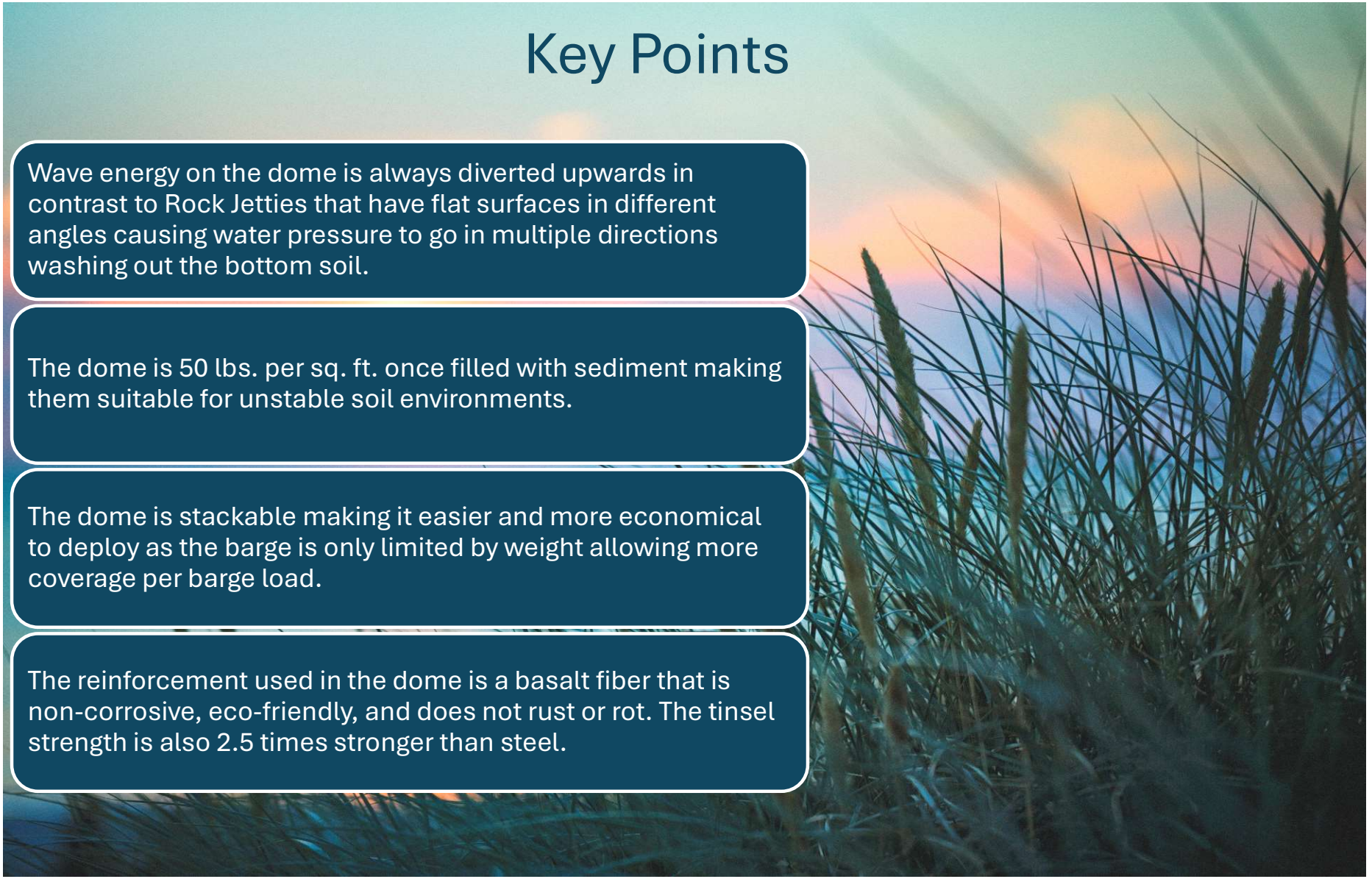
Key Points

Wave energy on the dome is always diverted upwards in contrast to Rock Jetties that have flat surfaces in different angles causing water pressure to go in multiple directions washing out the bottom soil.

The dome is 50 lbs. per sq. ft. once filled with sediment making them suitable for unstable soil environments.

The dome is stackable making it easier and more economical to deploy as the barge is only limited by weight allowing more coverage per barge load.

The reinforcement used in the dome is a basalt fiber that is non-corrosive, eco-friendly, and does not rust or rot. The tinsel strength is also 2.5 times stronger than steel.



PPL35 DEMONSTRATION PROJECT NOMINEE FACT SHEET
31 JANUARY 2025

Demonstration Project Name:
QuickReef® Living Shoreline

Potential Demonstration Project Location(s):
Coast-wide application
Well-Suited to:

- Region 1, Pontchartrain Basin
- Region 2, Barataria and Breton Sound Basins
- Region 3, Terrebonne Basin

Problem:
Shoreline retreat is occurring at alarming rates across the coast of Louisiana. Living shorelines have become a popular stabilization method in recent years as these create valuable ecological benefits in addition to slowing shoreline erosion. However, most of these measures are targeted to low wave energy environments and cannot provide shoreline protection to the extent at which a traditional rock structure can. In addition, engineering and ecological benefits have rarely been quantified, providing difficulty in design and in fully calculating project benefits. Further, the price of rock shoreline protection has recently become almost cost prohibitive.

Goals:
To provide a sustainable form of living shoreline that performs as well as traditional rock structures from an engineering perspective but exceeds rock structures' ability to provide motile and sessile fauna habitat, all at a potentially a lower cost than rock. With installation in the presence of oyster spat, oyster growth on intertidal structures over time has been shown to keep up with sea level rise (Rodriguez et al., 2014), potentially extending the project design life. Structures would target intermediate and/or saline, interior, high-wave energy environments.

Proposed Solution:
The QuickReef® Defender™ has been designed to reduce shoreline retreat rates, facilitate sediment accretion, and provide unmatched habitat development. A physical and numerical modeling study has quantified wave attenuation and structural stability capabilities and has shown that QuickReef® can directly replace rock dikes. In addition, numerous studies are in progress to quantify ecological benefits, including motile and sessile fauna habitat, marsh accretion, shorebird use, seagrass, and more (e.g. North Carolina SeaGrant studies, Tso et al., 2024, University of North Carolina at Chapel Hill, North Carolina State University, East Carolina University, and University of Maryland). Dunn et al. (2014) found that concrete, shell, and marl (the components of QuickReef® units) recruit oysters at densities significantly higher than granite, and preliminary findings suggest that QuickReef® living shorelines grow oysters at twice the rate of oyster shell bag living shorelines (Tso et al., 2014). However, this technology has not been tested in Louisiana. In addition, the price of rock shoreline protection has become

significantly more expensive as of late. QuickReef® has been installed for a lower cost than traditional rubble-mound structures and can be installed at much faster rates.

The QuickReef® Defender™ is a shoreline protection measure made of native coastal materials that rapidly recruits oysters and other sessile fauna to build a reef quickly, while also providing habitat for motile fauna and attenuating wave energy. Its high surface roughness yields exceptional sessile fauna growth, and its abundant interstitial space provides for significant motile species habitat. In physical and numerical modeling studies, QuickReef® has demonstrated the ability to attenuate wave energy comparable to a traditional rubble-mound structure. In addition, QuickReef® has been installed for a lower price than rock structures. This technology has been used in soft soils on the Atlantic coast and should be practical for coastal Louisiana applications. The material is less dense than rock and is designed to distribute loads over large areas. Baffled gaps would be installed to provide for fish passage and hydrologic connectivity while still protecting the marsh.

Preliminary Project Benefits:
Significant oyster spat recruitment has been observed at deployment sites around the U.S., typically within 1-year post-deployment. A reduction of coastal erosion has been observed at backing marshes, and marsh recovery has been observed at some locations. Oyster recruitment appears to result in increased wave attenuation and structure strength.

Specific Benefits: Shoreline retreat can be significantly slowed through the use of QuickReef®, and shoreline accretion may result in some locations. Based on engineering studies, shoreline response is expected to be similar to that of traditional rock structures.

QuickReef® components are prefabricated, facilitating installation at a much faster rate than traditional rock structures (resulting in cost-savings).

CWPPRA Demo Requirements:

A. **Directly provides wetland benefits**: Shoreline retreat rates would be reduced, shoreline accretion is possible in some areas, and habitat for motile and sessile fauna would be enhanced.
B. **Technology not fully developed for routine application**: Technology has not been fully developed in the Gulf coastal zone.
C. **Transferability**: As this technology replaces traditional rubble-mound structures, this may be applied coastwide.
D. **Unique and not duplicative**: Few living shoreline designs have been shown to deliver wave attenuation capabilities comparable to traditional rock.

This project will develop a living shoreline technology in Louisiana that performs as well as traditional rock shoreline protection but provides significantly greater ecological benefits that may enable it to increase in elevation and keep pace with sea level rise. As QuickReef® can be installed at a much faster rate than rock, QuickReef® has previously implemented projects at lower costs than rock.

Preliminary Construction Costs:
$2 million

References:

Dunn, R. P., Eggleston, D. B., & Lindquist, N. (2014). Effects of Substrate Type on Demographic Rates of Eastern Oyster (Crassostrea virginica). *Journal of Shellfish Research*, *33*(1), 177–185. https://doi.org/10.2983/035.033.0117

Rodriguez, A. B., Fodrie, F. J., Ridge, J. T., Lindquist, N. L., Theuerkauf, E. J., Coleman, S. E., Grabowski, J. H., Brodeur, M. C., Gittman, R. K., Keller, D. A., & Kenworthy, M. D. (2014). Oyster reefs can outpace sea-level rise. *Nature Climate Change*, *4*(6), Article 6. https://doi.org/10.1038/nclimate2216

Tso et al. (2024, August 28). Wave attenuation performance of constructed oyster breakwaters across varying levels of oyster colonization. ASPBA Coastal Conference, Galveston, TX, USA. https://asbpa.org/wp-content/uploads/2024/08/2024-National-Coastal-Conference-Program-Matrix-Current.pdf

Preparer(s) of Fact Sheet:

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QuickReef® Living Shorelines

CWPPRA PPL35 RPT Meeting

Mary-Margaret McKinney, RF
Director of Coastal Restoration

Proud Partner in the

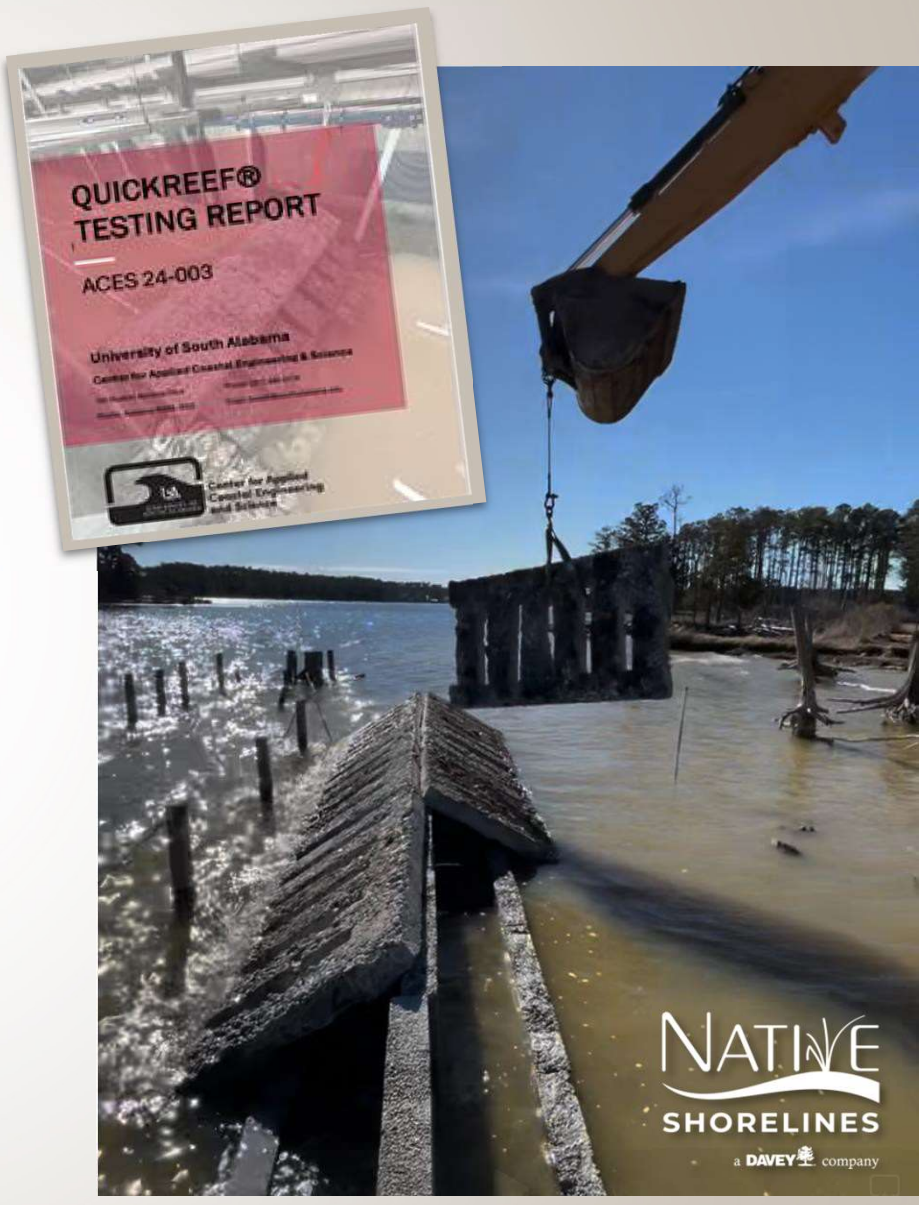
NATIVE SHORELINES
a DAVEY company

NETWORK FOR ENGINEERING WITH NATURE

Problem

- *Shoreline retreat is occurring at alarming rates in Louisiana*
- *Living shorelines, while effective at providing habitat, are typically designed for low-energy wave environments*
- *Engineering and ecological benefits have rarely been quantified for alternative living shoreline materials making design and benefit calculations problematic*
- *The price of rock shoreline protection has recently become almost cost prohibitive*

Proposed Solution
QuickReef® Defender™ Living Shoreline



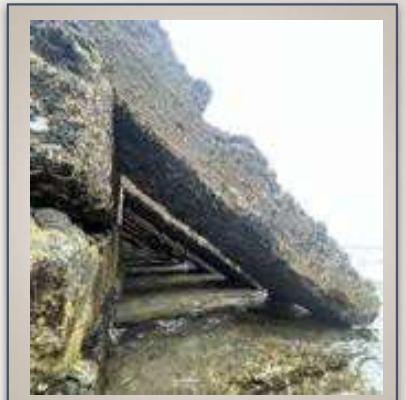
- *Proven through physical testing and modelling to attenuate waves at rates comparable to rock structures,*
- *Reduce shoreline retreat rates, often facilitating shoreline accretion,*
- *In recent studies, appear to recruit and grow sessile fauna at faster rates than oyster shell bags, and*
- *Have been installed for lower cost than traditional rubble mound structures, as it is installed at a much faster rate.*

QUICKREEF® BENEFITS?

NATIVE SHORELINES
a DAVEY company

QuickReef absorbs and gently disperses the energy of waves & boat wakes, allowing the structure to remain intact & effective over time

QuickReef has been shown to attract oysters at twice the rate of oyster shell bags



QuickReef's patented arrangement creates aquatic habitat within the living shoreline structure itself

As waves roll over QuickReef, they deposit carried sediment, allowing for the regrowth of marsh behind it and creating potential for shoreline accretion.

CWPPRA Demo Requirements

A. *<u>Directly provides wetland benefits</u>: Shoreline retreat rates would be reduced, and shoreline accretion is possible in some areas.*

B. *<u>Technology not fully developed for routine application</u>: Technology has not been fully developed in the Gulf coastal zone.*

C. *<u>Transferability</u>: As this technology replaces traditional rubble-mound structures, this may be applied coastwide.*

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