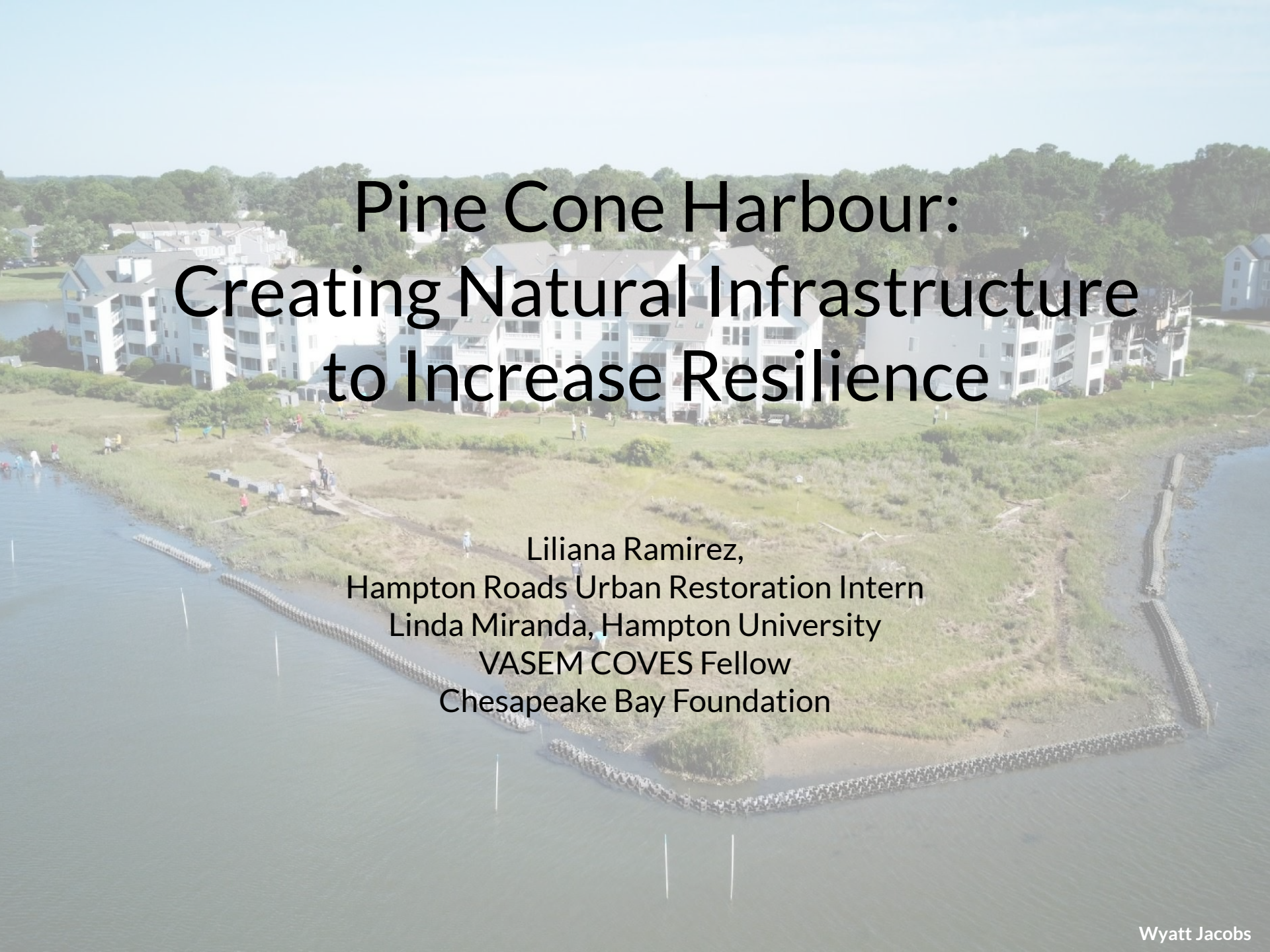


An aerial photograph showing a coastal restoration project. In the background, there are several multi-story white apartment buildings with grey roofs. In the foreground, a large area of marshland is being restored, with a long, narrow strip of land extending into the water. The strip is bordered by a line of stone or concrete structures, possibly a breakwater or a barrier. People are visible walking along a path in the marshland. The water is calm, and the sky is clear.

# Pine Cone Harbour: Creating Natural Infrastructure to Increase Resilience

Liliana Ramirez,  
Hampton Roads Urban Restoration Intern  
Linda Miranda, Hampton University  
VASEM COVES Fellow  
Chesapeake Bay Foundation



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## About Me: Linda Miranda

- Title: VASEM COVES Fellow for the Chesapeake Bay Foundation's Urban Restoration Team
- Hampton University Master's Candidate in Biological Sciences
  - Expected graduation date: December 2025
- Post-graduation goals: Apply to PhD programs this fall, particularly ODU and VIMS
  - I chose to do this internship in collaboration with my science policy fellowship because it focused on using natural infrastructure to adapt to climate change.
  - It also gave me the opportunity to venture into field work, something I had not done before.



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## About Me: Liliana Ramirez

- Title: Hampton Roads Urban Restoration Intern for the Chesapeake Bay Foundation
- University of Mary Washington BS in Conservation Biology
  - Graduated Spring 2023
- Post-graduation goals: plan to attend graduate school for wildlife conservation, parasitology, or infectious diseases.
  - Having lived on the James River for much of my life, I am fascinated by the variables that impact the health of the bay and have, through my internship, fostered a specific fascination with oyster parasites and diseases.
  - I hope to continue working towards a healthy ecosystem and make strides in oyster pathology.



## Primary Responsibilities:

- Supported the Urban Restoration Team with a living shoreline and buffer installation at Pine Cone Harbour (Hampton River).
- Split time between field work in Hampton, VA and the Brock Center in Virginia Beach.
- Contributed to natural erosion control efforts by installing a sill to reduce wave energy, and planting native grasses, shrubs, and flowers to help restore and stabilize the shoreline ecosystem.



## Summer 2025 | May 8th – July 10<sup>th</sup>

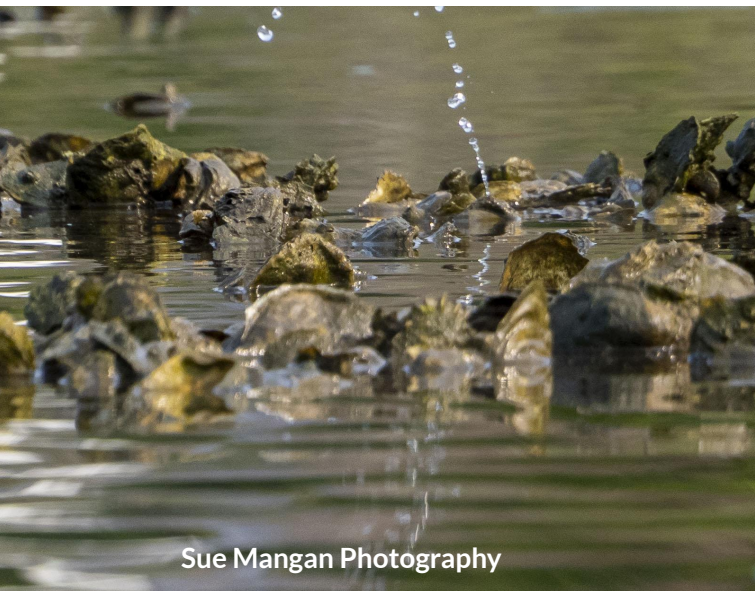
Over **33 workdays** and **3 months**, more than **200 volunteers** helped transform the shoreline—one piece at a time.

### Materials Installed:

- 5,584 Oyster Castles
- 650 Bushels of Loose Oyster Shell
- 660 Natrx Basalt Shell Bags
- 21 Coir Logs
- 9,000 Low-Marsh Wetland Plugs
- 3,500 High-Marsh Wetland Plugs

### Impact:

- **1,078 ft** Living Shoreline
- **3,232 sq ft** Intertidal Oyster-Reef Habitat
- **9,514 sq ft** Marsh Wetland Habitat



# Step 1: Clearing the Project Footprint

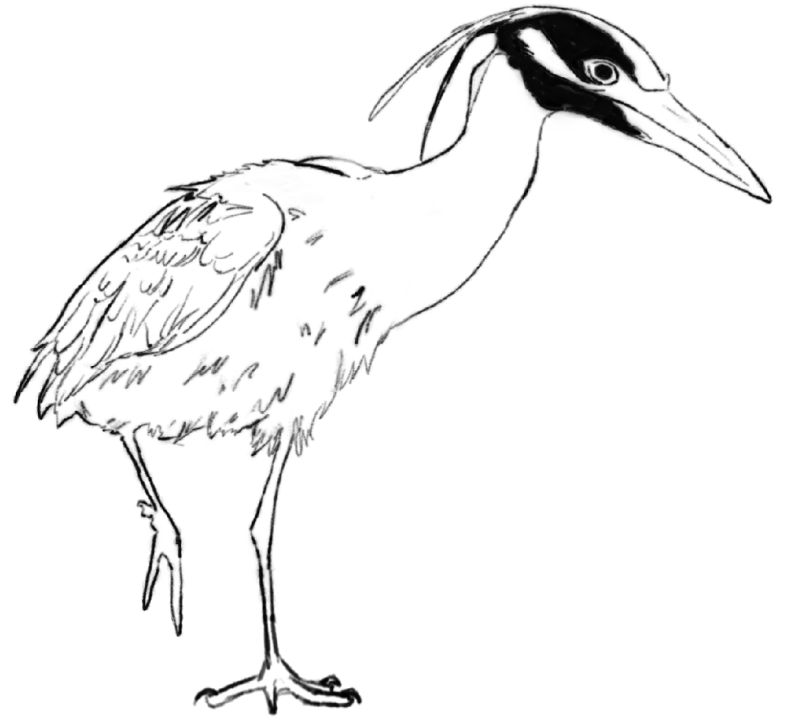




- 2 days were spent removing wild, live oysters from the project footprint
- This ensured a smooth surface for construction and minimized a negative ecological impact



## Step 2: Oyster Castle Installation





- 30-lb concrete blocks (1 ft wide, 6 in tall) that interlock like LEGO bricks.
- Modular design allows for flexibility—ideal for adapting to unique shoreline conditions.





Sue Mangan Photography

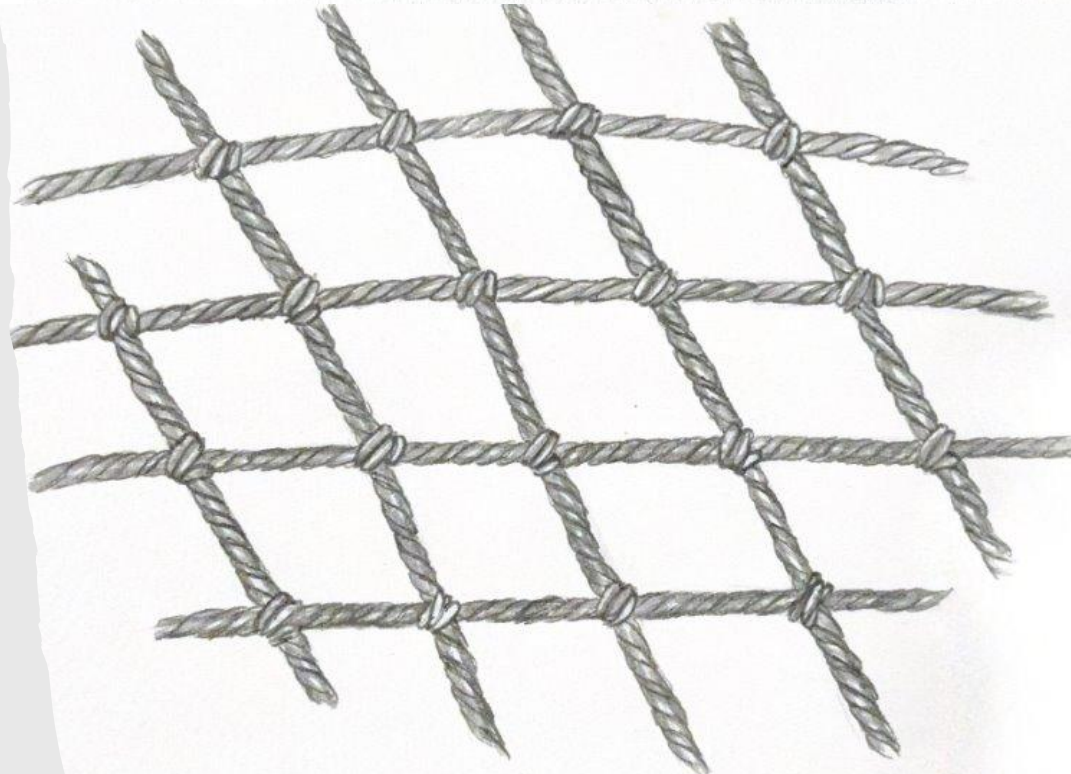
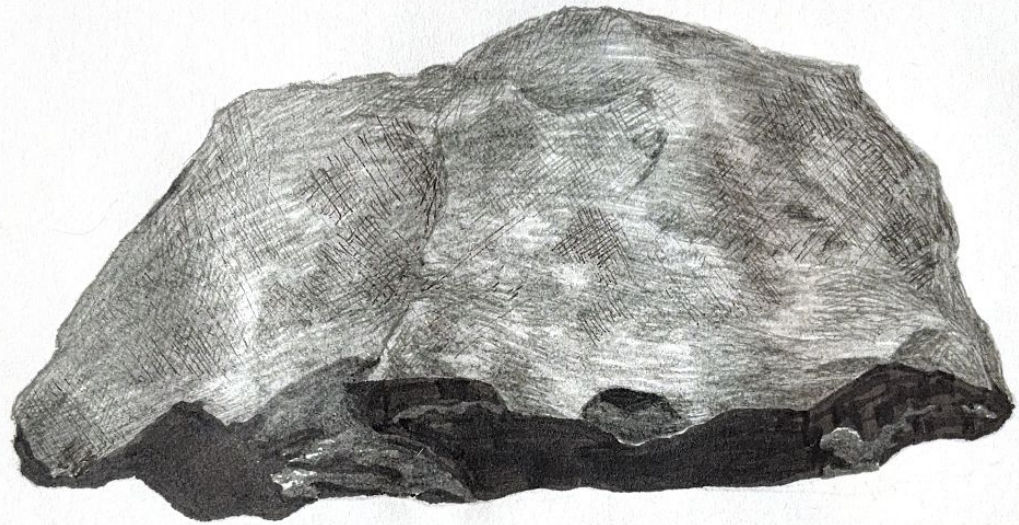
# Step 3: Coir Log Installation





- Biodegradable logs (16" x 12') made of coconut husk wrapped in jute netting.
- Used by CBF to support loose oyster shells or shell bags in low-energy environments.
- Last ~2 years, holding shape while oysters settle and grow, creating a stable structure.

Step 4:  
Natrux Basalt  
Shell Bag  
Trailer  
Loading &  
Installation



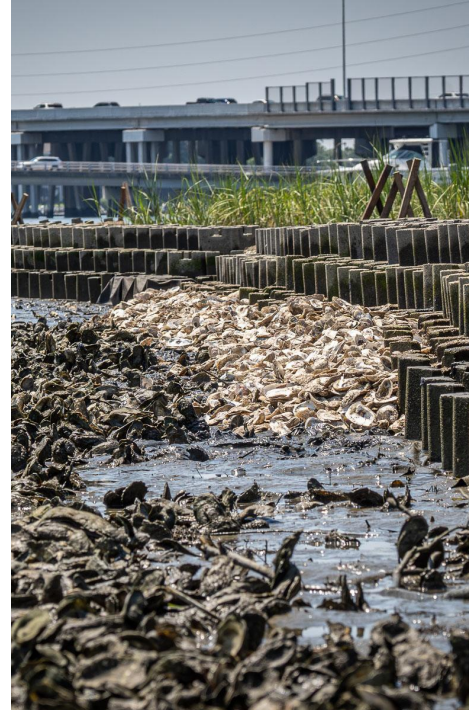
# Innovating Beyond Plastic: NatrX & CBF Collaboration

- Traditional shell bags use plastic mesh, which poses risks like chemical leaching, microplastics, and long-term pollution.
- Eco-alternatives like jute, coconut, and biodegradable plastics haven't proven durable.
- Basalt fiber, made from volcanic rock, shows strong potential for marine durability.
- A basalt-based prototype is now being tested at Pine Cone Harbour, with plans for future use along the Hampton River.



Step 5:  
Loose  
Oyster  
Shell  
Installation





- Just like a beach chair sinks as waves wash away sand, erosion can destabilize oyster castles.
- This effect, known as undercutting, causes structures to tilt toward the channel.
- To prevent this, CBF installs a wedge of loose oyster shells on the channel side.
- This stabilizes the base, reduces erosion, redirects wave energy, and adds habitat.



Step 6: Planting



- To enhance shoreline resilience, native grasses and shrubs were planted to reduce erosion, absorb wave energy, and provide habitat.
- We chose 4 species:
  - *Spartina alterniflora*
  - *Juncus roemerianus*
  - *Spartina patens*
  - *Borrchia frutescens*
- These species were chosen for their salt tolerance, soil stabilization, and ecological value.



Pine Cone Harbour | BEFORE

Sue Mangan Photography



Pine Cone Harbor | AFTER

Sue Mangan Photography

# What's Next: Linda Miranda

As I come to the end of my fellowship, I am finishing a practitioner guidebook on how to incorporate loose shell into living shorelines, working with state agencies on updating living shoreline permits and creating a one-pager on the Natrx basalt shell bags.

During the construction of the Pipe Cone Harbour living shoreline and through conversations with the  Urban Restoration and Oyster Teams, it became clear that there is increasing concern about how to effectively evaluate the long-term success of these projects.

My experience working with CBF has given me direction in what to pursue for my dissertation and a sense of fulfillment giving back to the community and the Chesapeake Bay that I have not experienced in my academic career. I am extremely grateful for the opportunity to work with Liliana, Kati, and the rest of the CBF team.

# What's Next: Liliana Ramirez

Working with CBF has provided me with the opportunity to better understand the Bay and the methods we use to preserve it, as well as the ability to network with the wide range of fascinating people who are currently making strides in that area.

I feel that I could continue to contribute to Chesapeake Bay conservation efforts by using what I have learned with CBF to guide my future educational endeavors and hopefully create a healthier ecosystem for the future.

I plan to pursue a Master's degree in Parasitology or Infectious Diseases and continue to study ways to improve the health of the bay and its inhabitants.



Sue Mangan Photography

# Thank you!

- Blocker Foundation
- Immaculate Conception Catholic Church
- All 200+ volunteers
- And especially our mentor Kati Grigsby, the Chesapeake Bay Foundation, and VASEM