Coasting into Resilience

A Green New Infrastructure for Hampton's Buckroe Beach

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FIU | Landscape Architecture + Environmental and Urban Design
College of Communication, Architecture + The Arts

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Abstract

Title: Coasting Into Resilience: A green new infrastructure for Hampton's Buckroe Beach

Authors: Ebru Ozer, John Stuart, Simone Bailey, Sarah Belfer, Lorenzo Bellon, Emilie Catala, Christina Currais, Jhoanna Farray, Rose Gilson, Jose Gonzalez Del Pinal, Riley Jimenez, Estefania Ramos, Derrek Roncek, Sharon Ventura

The City of Hampton, Virginia, in Chesapeake Bay, faces significant threats from sea level rise. At Sewells Point, across the bay, sea level has risen 14 inches since 1950, and it continues to rise an inch every four years. Nearly 1.5 feet of increase is projected by year 2050. Projection maps show a large portion of the city will be underwater or experiencing severe flooding before then. Although the city's primary land use is low density residential, significant parts of the population reside in high and medium-density residential areas within flood zones. City's existing water infrastructure already struggles to address current needs. The issue is exacerbated by sea level rise. This research focuses on 1) Evaluating the city's stormwater and wastewater infrastructure as they relate to its social, economic, and environmental issues, 2) Exploring opportunities and obstacles presented by existing natural and engineered water management systems, and 3) Developing green infrastructure design scenarios to develop adaptation scenarios. Due to its historic, social, and ecological significance, the study team selected the Buckroe Beach neighborhood as the focus area. The goal was to attract residents and tourists back to the historically significant parts of the city through reimagining streets' role in connecting people to natural ecologies and educating the public about flooding and climate change.

Project Team

CERF 2021 Competition - OFFICIAL TEAM ROSTER for TEAM FIU

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Faculty:
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John Stuart

Expert Collaborators (not part of the design team, but have been guests in our class for the purpose of giving lectures and providing critiques for students' work):
Malone Matson, Phyla Studio
Valeria Quintanilla, City of Coral Gables
Katie Poppel, EDSA
Alex Fenech, EDSA
Kerby Kersaint, Dixie Landscape
Samira Damiscar, Strang Design
Alexandra Viala, Witkin Hults + Partners
Mairin Subervi, AECOM
Jennifer Daoulas, Kimley-Horn

Project Team

The Team


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Mairin Subervi, AECOM · Jennifer Daoulas, Kimley-Horn

CERF 2021 Design Competition: Coastal Virginia
Participating student team members, faculty and collaborators representing Florida International University

Summary of Team Effort

12 graduate students with backgrounds and education in marketing, sociology, psychology, agroecology, biology, and chemistry, engaged in a design process through a landscape architecture graduate design studio course. During the 17-week academic semester, the students listened to the expert lectures, received feedback from local community members, and worked closely with experts and real-life design professionals from South Florida. This presentation reports on the team's design approach, and discusses new perspectives explored, challenges experienced, and insights gained.

Project Description

Design Problem:
Buckroe Beach and Buckroe Beach Park border the magnificent Chesapeake Bay with three-quarters of a mile of clean beach. In the 1900s, this area was teeming with life and attracted numerous tourists thanks to its beachfront hotel and amusement park. Due to declining revenue caused by the competition of Busch Gardens, the amusement park closed in 1985 and was torn down in 1991. The “Old Lighthouse,” part of the amusement park’s mini-golf, remains the last relic of Buckroe Beach’s lively past. The park has been left with an abundant open space leaving an opportunity for additional programming to attract life, residents, and tourism.

A *seafood boil* is a unique tradition dating back to the early 1700s. The tradition spread throughout the Southern United States and New England, picking up influences from English, Irish, Spanish, Native American, and African cultures that were present at the time. Today it is a traditional feast to celebrate Memorial Day and Independence Day with friends and family. In New England, common shellfish ingredients are Chincoteague oysters, clams, and the iconic Chesapeake blue crab. This proposal includes opportunities to grow the ingredients for the *seafood boil* tradition and restore habitats of important local shellfish, with community celebrations of harvests and holidays.

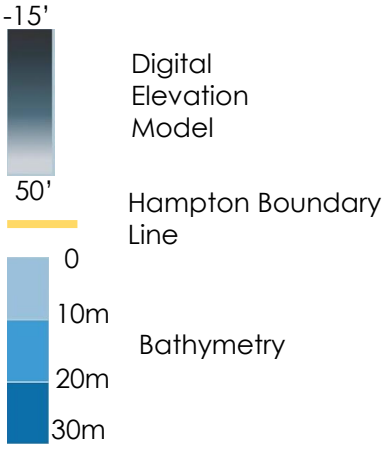
The intervention strategies within this proposal include community building programming, local economic initiatives, accessible habitat sites and educational opportunities.

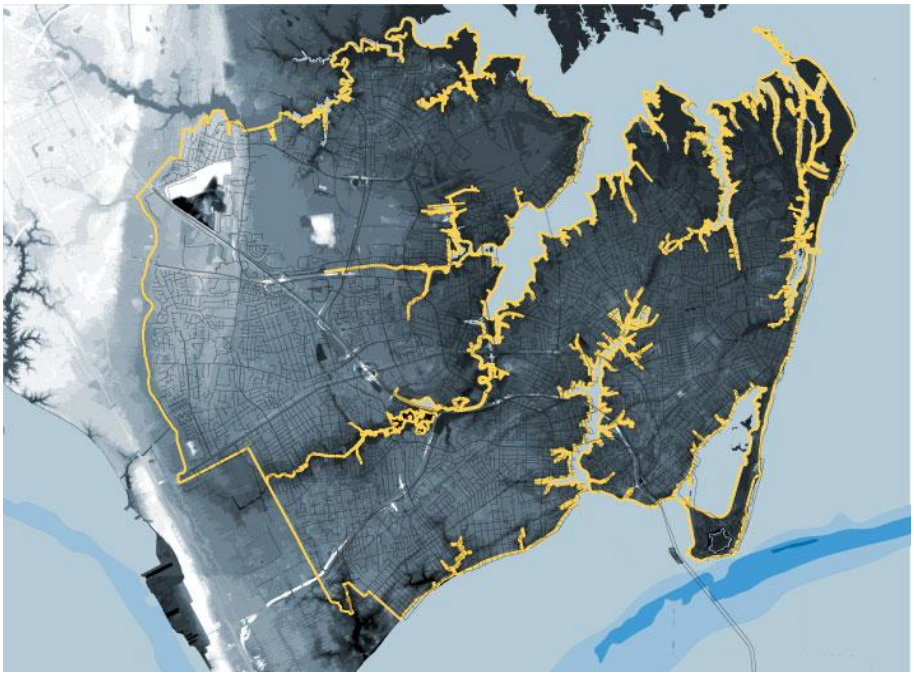
Project Description

The city of Hampton, VA, and specifically Buckroe Beach is under a serious threat due to the impacts of climate change. Like other low-lying coastal communities, this threat impacts the everyday lives of the residents including their livelihoods, homes, schools, and social spaces. The city of Hampton has been dealing with constant and consistent flooding due to a naturally high water table that has now become higher with sea level rise. The current infrastructure of the city cannot handle the additional inundation and is leaving residents with no choice but to wade through feet of water to access their homes and community features. Due to rising sea levels, the saltwater intrusion is threatening local ecosystems and has already impacted the coastal pine forest, reducing it to a ghost forest. The retreat of coastal pine habitats only increases the coastal exposure and reduces the natural barriers that the population relies upon for protection from storms and water uptake. Hampton's low canopy coverage and high percentage of impervious space lead to significant stormwater runoff and flooding. With few absorption options, the flooding in Hampton, and more specifically in Buckroe Beach, has become chronic and crippling.

FOCUS AREA

Virginia Hampton Buckroe



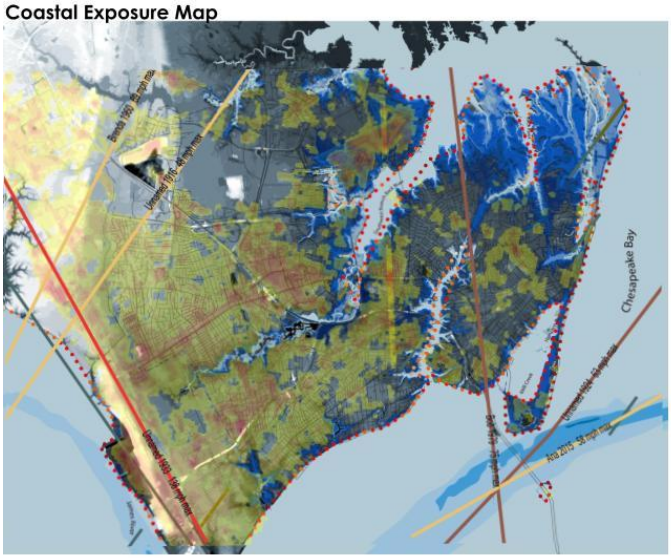


Project Description

The Coastal Exposure Map (below left) documents and layers the urban heat index due to large impervious areas, coastal exposure index, and sea level rise expectations. It highlights the areas along the coast with the most exposure to rising seas and the effects of climate change. The Urban Heat Island Effect is shown with the yellow-red gradient. The high volume of impervious surfaces in the Hampton area increases the temperature of the local context. In the blue gradient we can witness the encroaching sea level rise. The Northern area of Grandview is expected to be completely submerged by rising seas with Buckroe Beach also expected to be inundated, especially if no mitigation efforts are made to increase water uptake and to increase pervious areas around the city.

The Flood Duration Map (below right) highlights the number of hours Hampton residents can expect to invest annually to combat the flooded neighborhoods around the city. The standing water affects accessibility to properties, emergency services, and recreational activities. The light pink areas shown on the Flood Duration Map are areas that experience flooding from 5-100 hours per year. Shown in dark red are low-lying coastal areas experiencing more than 200 hours of flooding per year. These constantly flooded areas will only increase as sea level continues to rise.

Coastal Exposure Map

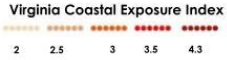


Urban Heat Island

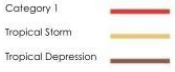
Sea Level Rise

Windstorms

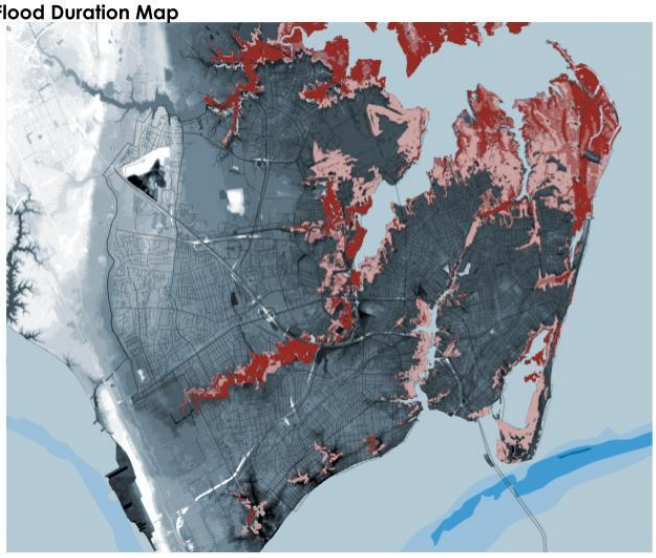
Virginia Coastal Exposure Index



Hurricane Paths



Flood Duration Map

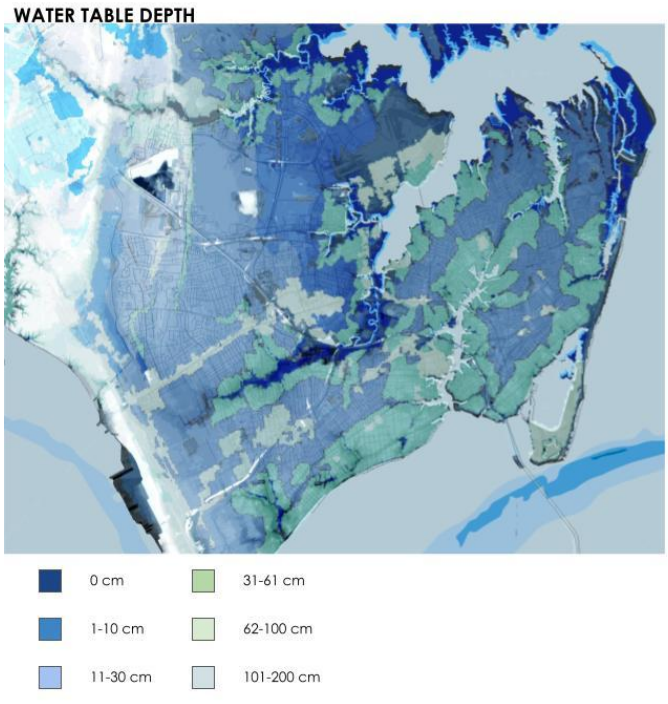


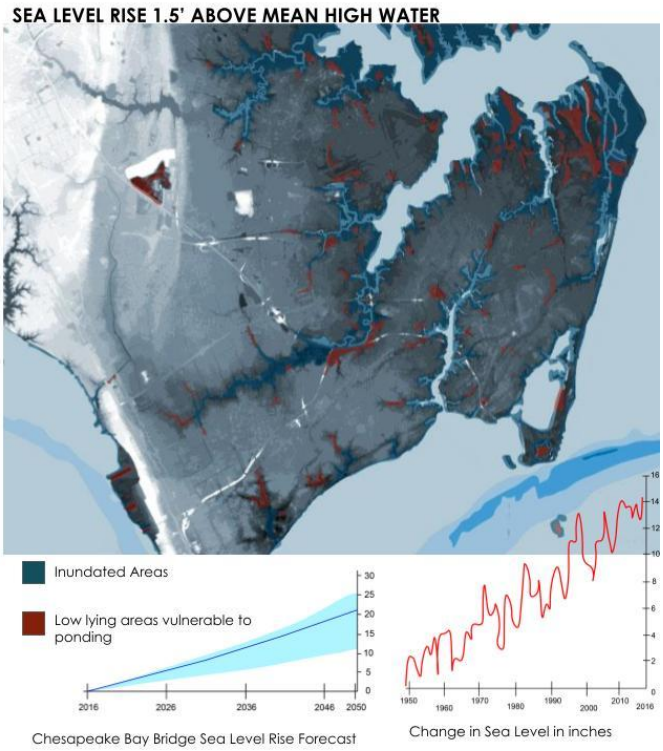
Current Flooding Durations (2020):

Project Description

Poorly draining soils cover most of the city. This increases the city's run-off potential. Significant impervious pavement coupled with very little canopy coverage further limit water absorption needed to offset current flooding trends and future sea level rise impacts. Buckroe Beach is comprised of mostly low-density residential properties with little commercial. It is dotted with underutilized lots and blocks with little to no vegetation. It is imperative for at-risk communities like Buckroe Beach, and Hampton more generally, to utilize available parcels as an opportunity to increase water-absorbing surface areas with canopy trees and dense vegetation.

The city of Hampton has gone through some of the most dramatic increases in sea level rise in the entire US. Around Sewells Point Virginia it has risen 14 inches since 1950, and has gained 1 inch every 4 years. (Atkinson, Ezer and Smith, 2021)At that rate we can see sea level rising 1.5 feet by 2050.
The maps below highlight the local water table and projected sea level rise for Hampton. The trends for sea level rise only move upward, making this challenge even more pressing. The water table depth in Buckroe Beach is measured at 0-24". Hampton will continue to see flooding and interruptions to daily life and must engage in mitigation efforts. Residents are currently dealing with high rates of repetitive loss to property due to constant flooding. With larger and more frequent storms predicted for the coastal United States in the immediate future, the time to mitigate is now.

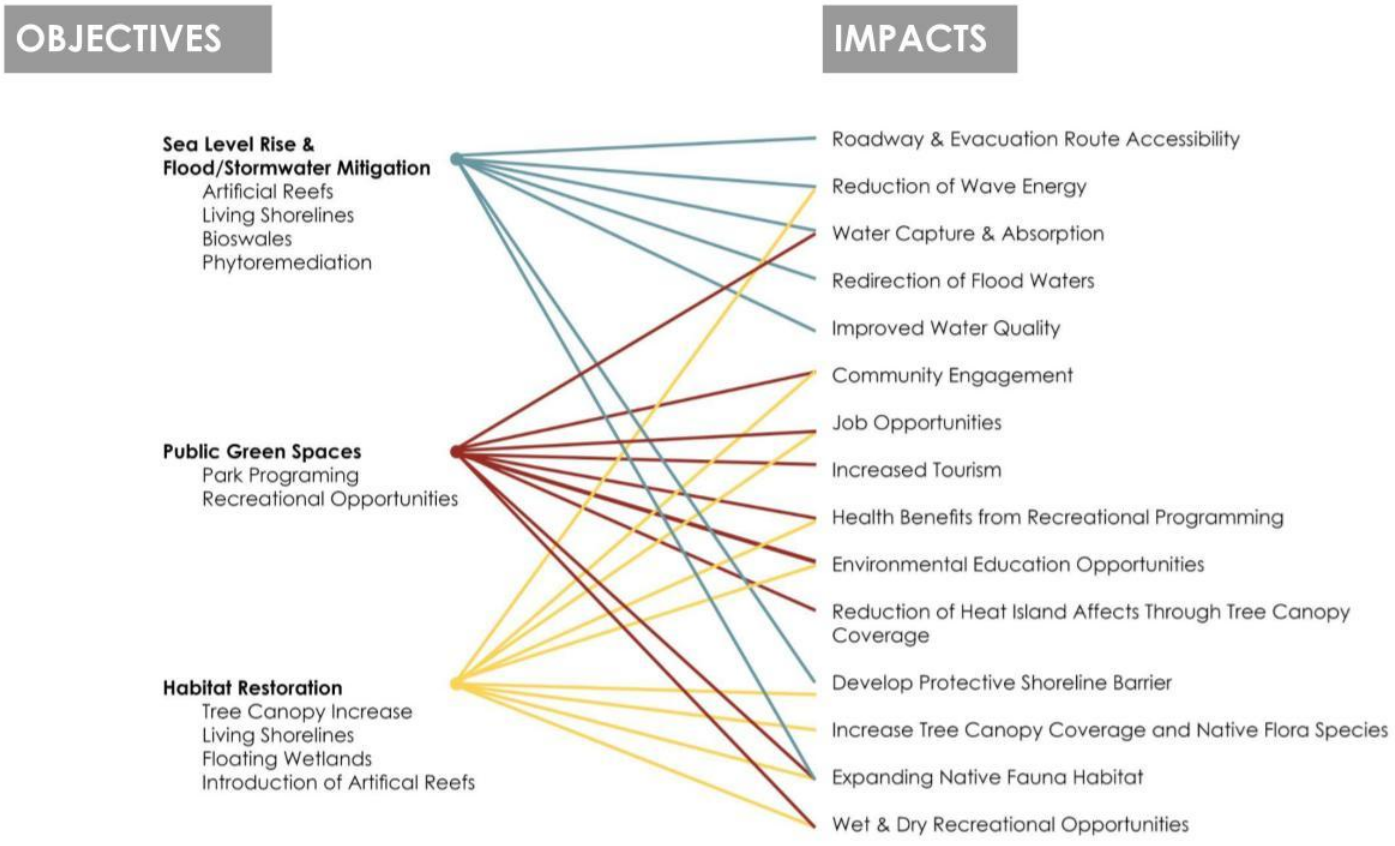




Project Description

In considering the existing conditions of Buckroe Beach, we wanted to devise a design solution that would allow maximum community involvement with additional opportunities to be created to spur the local economy. How can we design solutions that will enhance the local lifestyle while adapting for future climate change?

This project focuses on 1) Evaluating the city's stormwater and wastewater infrastructure as they relate to its social, economic, and environmental issues, 2) Exploring opportunities and obstacles presented by existing natural and engineered water management systems, and 3) Developing green infrastructure design scenarios to develop adaptation scenarios.



Project Description

Site Evaluation: Buckroe Beach

Buckroe Beach is a severely threatened community within greater Hampton, VA. with the following features:

-Impacted by sea level rise (SLR), tidal flooding, storm surge from Nor'easters.
-High water table, 0-24".
-Primarily medium-low density residential usage.
-Sits almost at sea level, similar to Miami.
-Already experiencing severe flooding on a chronic basis.
-Multiple zones of little vegetation compared to other communities.
-Currently has little relationship with nearby educational institutions and the larger Hampton community.
-Will become unlivable with the effects of sea level rise if no mitigation strategies are implemented.

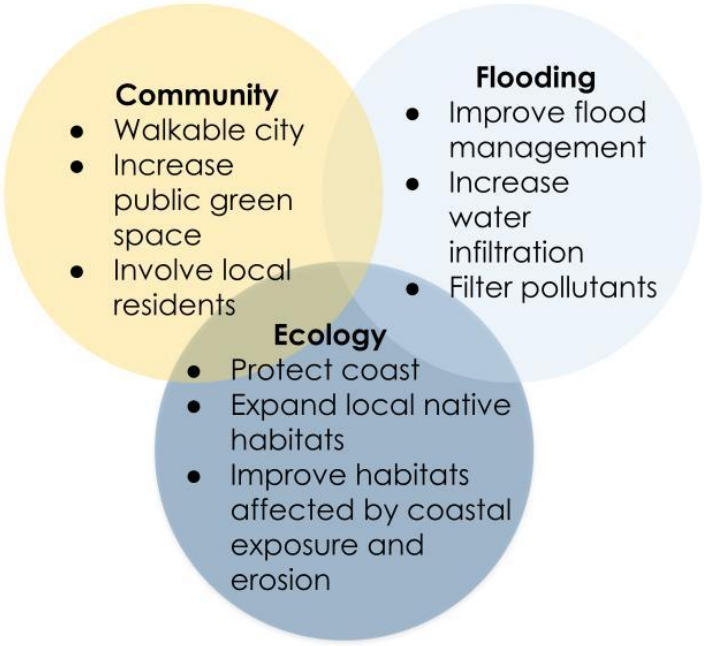
SITE OPPORTUNITIES

- Public recreation areas
- Improvement of water ecology
- Community engagement

SITE CONSTRAINTS

- Water salinity levels
- Public beach access
- Little space to work with (right-of-way & front yard)

CRITICAL TASKS



Project Description

Design Solution:
Our design solution is centered around the development of underutilized spaces within Buckroe Beach to create programming for residents and tourist, while promoting environmental mitigation strategies to reduce and adapt to the effects of climate change. The design strategy for this project includes revisions to existing infrastructure, including public streets, the revitalization of vacant lots and the beachfront, the investment in habitat creation and preservation, as well as community involvement strategies and project branding and educational materials.

The design we are proposing includes four main intervention sites:

- Long Creek Marsh
- Boulevards; including Tappan and Buckroe Ave
- Buckroe Beach Park
- Buckroe Beach shore and waters

INTERVENTION SITES

Project Description

Habitat Creation and Preservation:
The project sites of the marsh and the Buckroe Beach shoreline will be revitalized to include marsh habitat preservation and viewing, floating island habitats for preservation, recreation and educational programming.

This area is susceptible to flooding during high tides. We are proposing a raised road to allow access to these areas and create an accessible green space. Planting palette includes native grasses as well as salt and moisture tolerant species. The marshes help restore the habitats of native aquatic species important to keep the balance in the environment and important for the shellfish industry, such as the Chesapeake Bay crab and other shellfish species that will be used for the annual seafood boil.

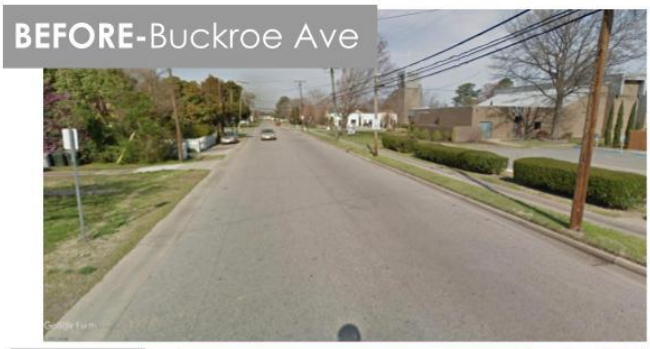
Long Creek Park Pier & Bikeway

Long Creek Park & Bridge

Project Description

Revisions to Existing Infrastructure:
The project proposes revisions to existing infrastructure, which includes the addition of bike lanes to local boulevards. These bike lanes will help to tie the multiple satellite sites together and will continue the Buckroe Beach master plan for community improvements. Bike and walking paths will follow branded signage to allow users to discover and engage the various satellite sites of the project.

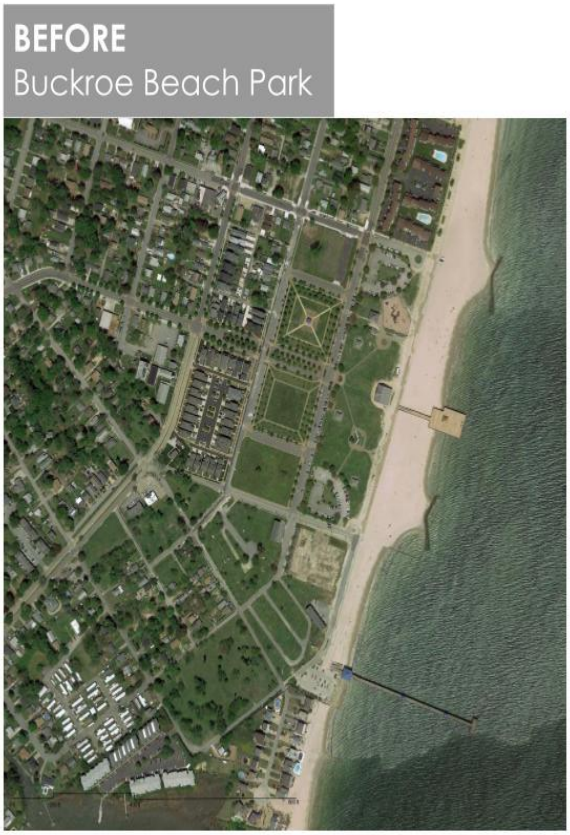
Bioswales are intended to be added to the main thoroughfares including Tappan and Buckroe Ave. The addition of heavily planted bioswales provides an aesthetic component to the existing water capture systems and has the ability to increase the capture volume through absorption. These bioswales are intended to be planted with native species with appropriate characteristics for current and anticipated salt tolerance requirements. The visible cue created by the planted bioswales can also serve as an additional guide between satellites sites and as a reminder of the project and its objective to impact the daily lives of residents.

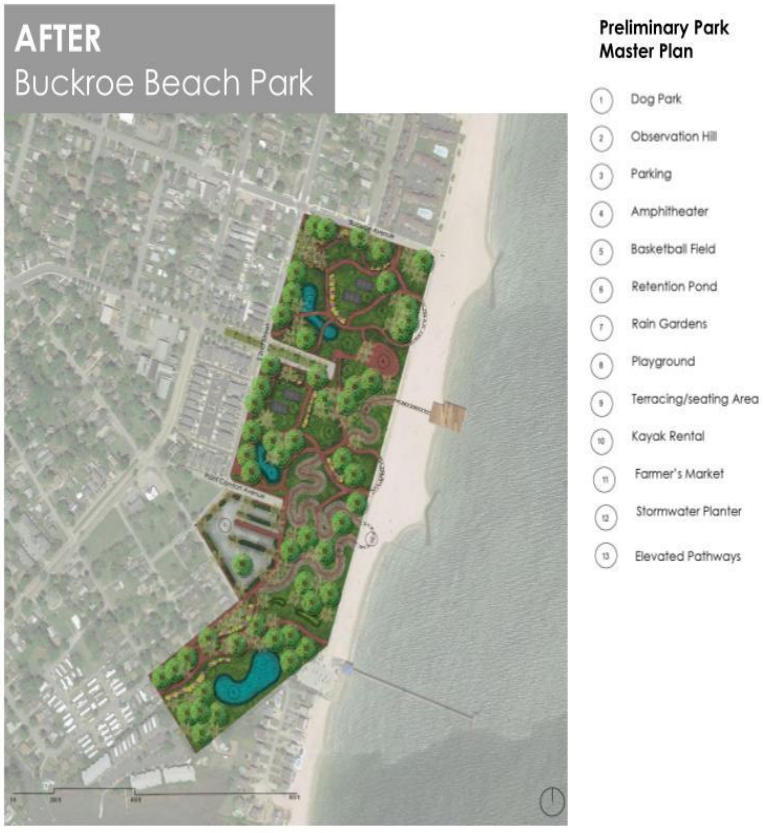


Project Description

Revitalization of Vacant Spaces:
The satellite site location of the existing Buckroe Beach Park will serve as a site for community park programming and environmental measures. The park is currently underutilized in programming and users. The park will be developed to include community recreational fields, natural trails, look-out opportunities, micro-ecosystems, public facilities, visual and sound experience programming, commercial opportunities, bike trails, educational opportunities and a link to the extended living shoreline activities and spaces.

Increased tree canopy coverage and water absorption are vital aspects of the park's revisioning and climate change mitigation strategy for the community. Tree coverage will increase shaded opportunities for residents to utilize the space comfortably and more frequently. Buckroe Beach Park is an opportunity to serve as connection to existing public green spaces, a meeting space for regularly scheduled programming and is an important component of the reimagined living shoreline.





Project Description

The Living Shoreline:
The project will also include an ecosystem development on the shore of Buckroe Beach. Increasing the shore's vegetation can increase soil stabilization and flood water uptake. These planted shore spaces will be coordinated to create a fluid connection between park programming at the Buckroe Beach Park, and shoreline programming. Lookout points, nature trails and bike paths extending from the park will allow users to enjoy these vegetated areas to their maximum potential. An additional key feature for the shoreline project will include a constructed artificial reef made from local debris materials.

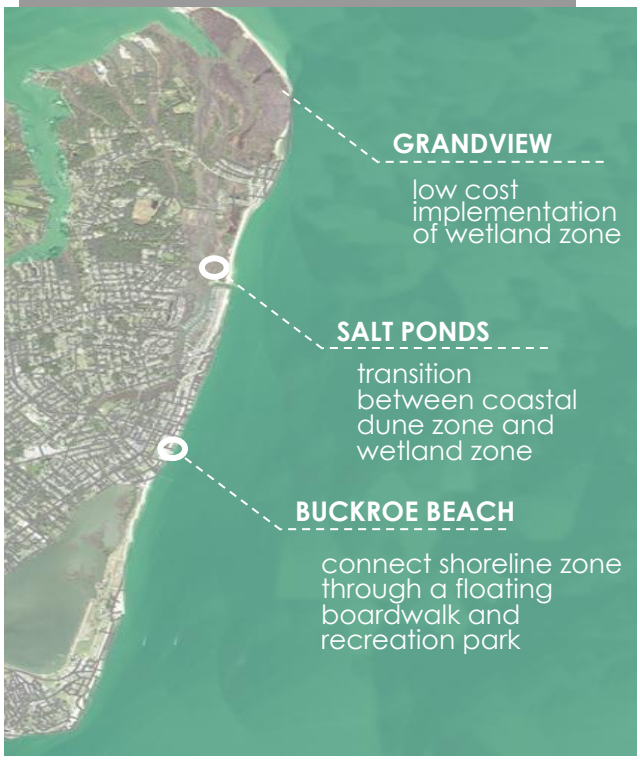
The reef is intended to help disrupt incoming wave action and to work in coordination with the project's floating island habitats. The construction material used for these reefs is intended to consist of debris materials identified as appropriate for reef construction. We intend for the materials to be collected from community members and local projects to enhance the community involvement and sense of ownership for the reef. Additionally, a reef art installation is planned for the beach to engage users in understanding the project elements that cannot be seen and to encourage educational opportunities about reef building and its benefits.

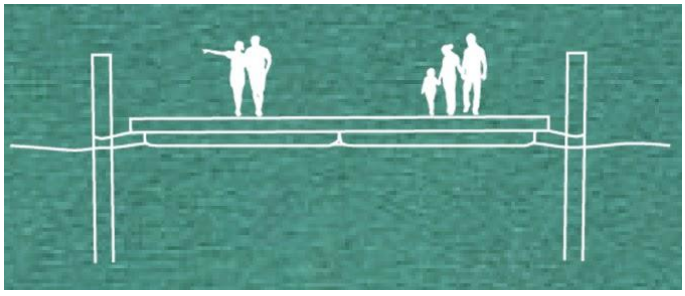
Project Description

As a continuation of the shoreline, we envision floating islands dotted along the extended waterfront of Buckroe Beach. These islands would create opportunities for water recreation and wildlife observation. The islands will serve as floating habitats for appropriately planted aquatic grasses, dune grasses, and salt-tolerant native species while also providing natural water filtration and habitats for native fauna. A few of the anchored islands are to connect through a series of floating boardwalk bridges for recreational and educational access. The floating islands are also an opportunity for local educational institutions to study the ecology of these floating habitats.

This floating island intervention is replicable and can be adapted to accommodate the various needs of the ecologies along Hampton's coastline. Within the Salt Ponds area, this intervention can be transitioned into vegetated dune islands, create habitat, attenuate wave action, and help prevent beach erosion and flooding. These vegetated dune islands also serve below surface communities through artificial reefs constructed of recycled shellfish. Continuing along the coastline,, this intervention can continue to transform from a vegetated dune island to a floating wetland to create a transition between the coastal dune and wetland habitats of Grandview, respectfully. This floating intervention system can be replicated in the wetland area of Grandview, creating habitat, filtering water, and adding protection to the coastline.

FLOATING ISLANDS



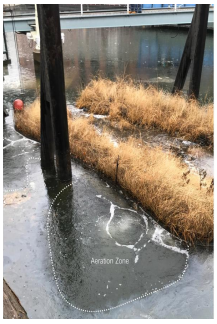


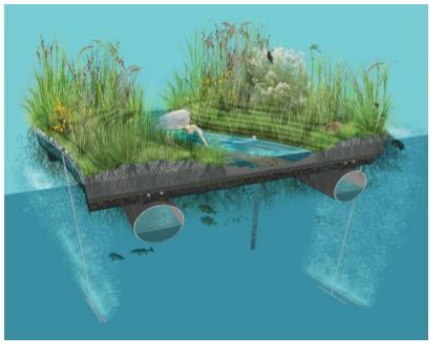
Project Description

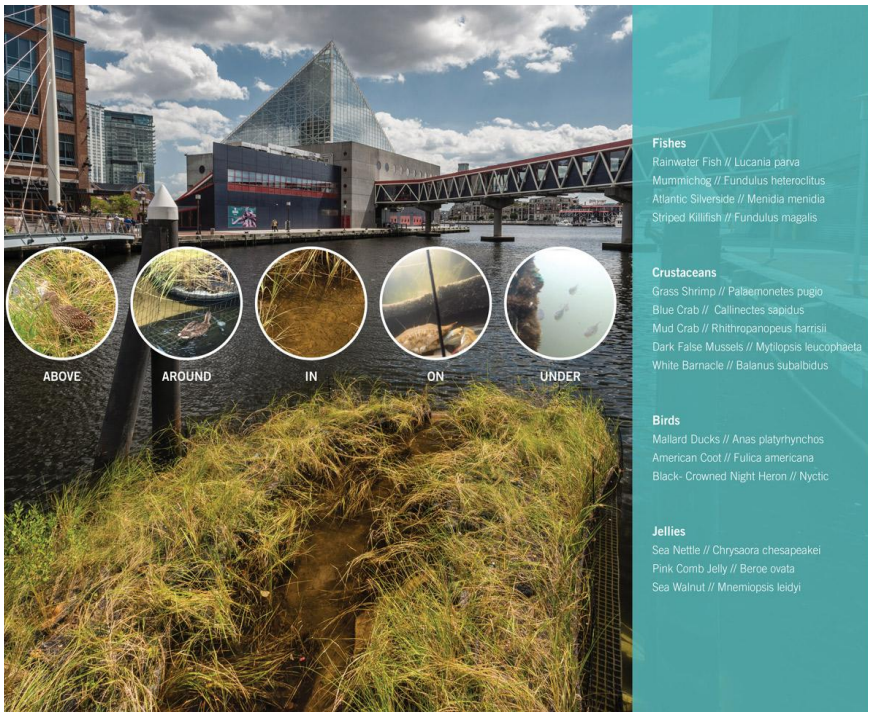
BUCKROE BEACH

Floating Island Precedent Study:

Urban Aquatic Health:
Integrating New Technologies and Resiliency into Floating Wetlands
Baltimore, MD







Fishes
Rainwater Fish // Lucania parva
Mummichog // Fundulus heteroclitus
Atlantic Silverside // Menidia menidia
Striped Killifish // Fundulus magalis

Crustaceans
Grass Shrimp // Palaemonetes pugio
Blue Crab // Callinectes sapidus
Mud Crab // Rhithropanopeus harrisii
Dark False Mussels // Mytilopsis leucophaeta
White Barnacle // Balanus subalbidus

Birds
Mallard Ducks // Anas platyrhynchos
American Coot // Fulica americana
Black- Crowned Night Heron // Nyctic

Jellies
Sea Nettle // Chrysaora chesapeakei
Pink Comb Jelly // Beroe ovata
Sea Walnut // Mnemiopsis leidyi


Limited Species Before Intervention


Increased Biodiversity After Intervention

Project Description

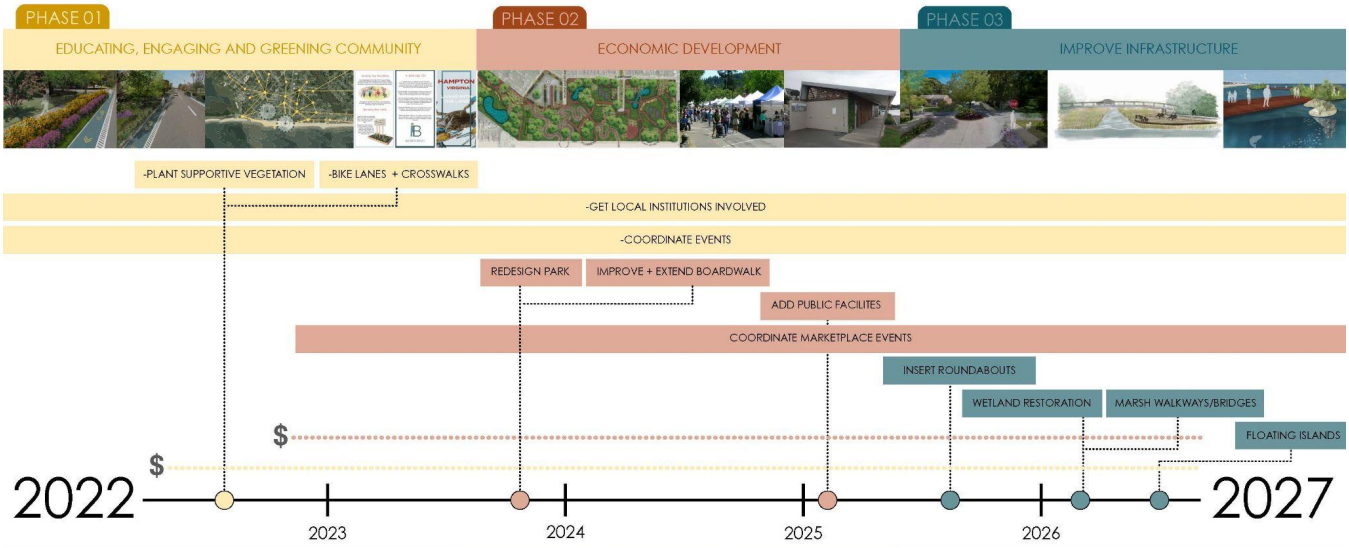
Community Involvement and Project Branding:
This project aims to involve both the local Buckroe Beach residents, as well as the larger Hampton community, including its educational institutions as well as attracting potential tourist to the area. Ongoing and annual community events with direct relationship to the design initiative of reef development, climate change mitigation strategies, and local economic stimulation are included in the project proposal. This project will be branded with signage opportunities to further the intent of the project and to garner more local and tourist utilization of the project sites and features.

Initiatives involving the community include:

- Plant, sustainable gardening and climate change mitigation educational series' for local residents.
- Annual Seafood Boil for local and extended Hampton residents to encourage community synergy and participation in reef building through collection of refuse shell materials.
- Seafood for Annual Boil to be locally sourced for economic boost and sustainable practice encouragement
- Art installations on the newly planted Buckroe Beach living shoreline to encourage residents to be active participants in their community's climate change mitigation strategies.
- Local colleges and universities are invited to participate in the management of the newly formed living shoreline including the floating habitats. These places can provide spaces of local scientific study for these students and programs.
- Regular marketplace events in Buckroe Beach Park.

Project Description

Phasing Strategy:
Phase 1 includes implementing soft infrastructure and green infrastructure. We have proposed minor and fairly inexpensive methods that would improve walkability, flood resistance, and community engagement. These improvements include demarcating bike lanes and crosswalks using our proposed neighborhood branding, developing planted boulevards on the existing main roads, and planting vegetation in the pre-existing culverts to improve flood conditions and overall aesthetic. During the first phase, our proposal encourages local institutions, including places of worship, and educational centers like Hampton University, to use the beach as a social hub for the purpose of community engagement. Our research, including speaking with local residents of Hampton, found that there is little to no engagement with the HBCU despite the fact that the campus is a ten minute drive and twenty six minute bus ride away. Local institutions would host educational events on the benefits of planting rain gardens for stormwater retention, filtration, and delayed infiltration. Our proposal capitalizes on this opportunity to host events to not only improve social cohesion but also to coordinate marketplace events that will collect revenue for the neighborhood to fund stage 2 and 3 of our phasing strategy.



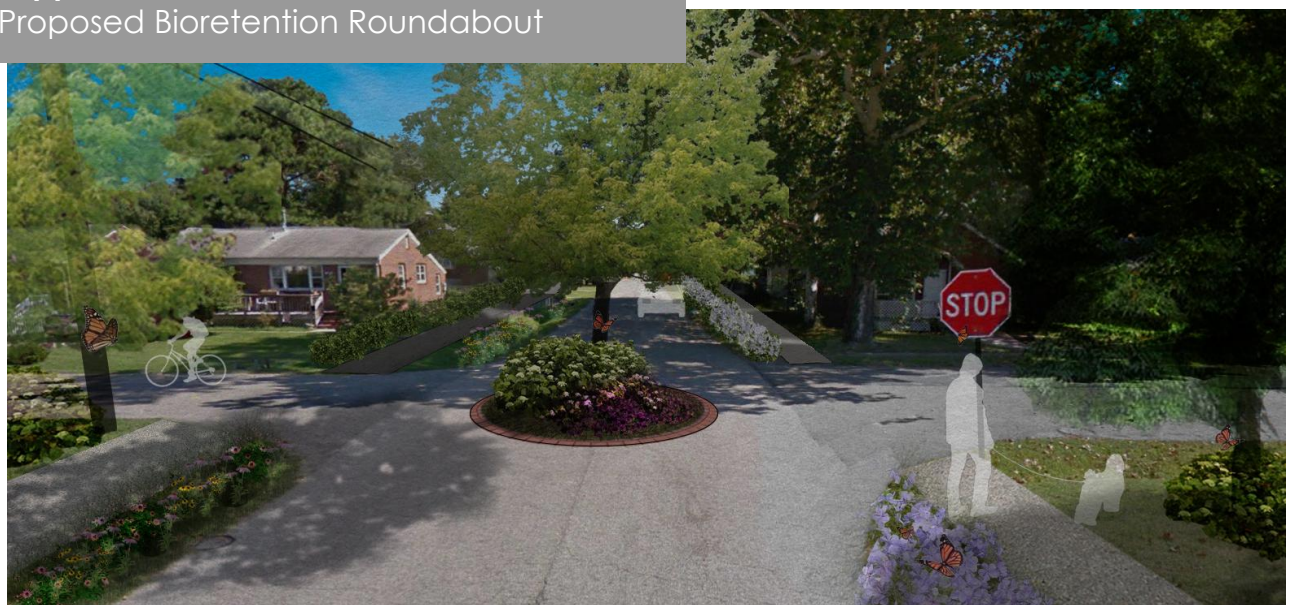
The chart above highlights our proposed phasing strategy for Buckroe Beach.

Project Description

Phase 2 of our strategy focuses on establishing a strong structure for hosting recurring marketplace events and improving beach conditions. The beach currently includes a narrow concrete boardwalk that offers no shade and insufficient outdoor facilities. The boardwalk divides the beach from Buckroe Beach Park. The park currently has few amenities and offers little shade. During this phase, we propose an entire redesign of the park, including planting of vegetation to create shade and to facilitate a visual and physical connection with the planted shoreline, outdoor facilities that include bathrooms, showers, foot wash/dog wash and changing rooms. To establish marketplace culture, local businesses, artists, and musicians will be encouraged to utilize the beach and park to set up temporary structures to sell products and services. Per the Buckroe Beach Master Plan, we are similarly proposing supporting facilities and pop-up restaurants to complement the existing pier infrastructure.

Phase 3 focuses on the implementation of the hard infrastructure required to fulfill our strategy for Buckroe Beach. We are proposing a bioretention system that acts as a roundabout in areas susceptible to flooding, including the west end of Tappan Ave. During this stage, we also propose to restore and extend the marsh to improve flood conditions including infrastructure for both pedestrian and vehicular access to and across the marsh. Accessibility to the marsh is designed to bring residents in closer contact with existing and important natural features of the area and to educate the community on the importance of the natural marshes and finger creeks.

Tappan Ave
Proposed Bioretention Roundabout



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