Barrier(s)

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Super Storm Sandy brutally exposed the vulnerabilities of the Atlantic coast leading to extensive damage and loss. It left 650,000 homes damaged or destroyed and caused $65.7 billion in damages in the tri-state area, making it the 2nd costliest storm in U.S. history. In the area of NJ alone, damages cost about $36 billion. In what way can architecture influence not only the how to rebuild but the way in which we think of recovery.
Due to its location, New Jersey’s coast was physically the largest impacted region after Sandy. (Although New York overall saw more damage due to its infrastructure and real estate costs) The state’s Barrier Islands, received the brunt of the storm. The low lying geography of the region coupled with the extreme density of development resulted in a large swath of physical damage which in turn, had a significant economic cost.
For example, Ocean County was a particularly vulnerable area. Just within the county’s barrier island communities alone, the damages due to Sandy were estimated to be between $750 million to $1 billion. Among those affected is the community of Seaside Heights, which is where I have focused. It is understood to be culturally and physically a quintessential “Shore Town” and was an area which 90% of the community’s structures were damaged or destroyed.
This is not the first threat this area has seen. Although not as costly, prior storms such as Gloria, Floyd, and Irene have struck this area before. However, due to an extreme increase in value of real estate in this area in recent years, these previous storm damages are not comparable.
Due to this value increase and each time a house is destroyed, the cost to rebuild inflates. For example, a house that originally cost $80,000 to rebuild after Gloria cost $200,000 to rebuild after Sandy. The cost would escalate from there each additional time it is rebuilt.
Between 2011-2012, federal spending for disaster relief was allocated $136 billion. That’s nearly $1.3 billion a week. Of this, $60.2 billion was appropriated to the Sandy recovery cost. With a steady increase in the scale and frequency of storms, future storms, much larger than Sandy are projected to reach this area. Estimates indicate that if a storm of Sandy’s scale were to hit this area in 2018 for example, the damages would reach $68.2 billion and rise to around $77 billion in 2024.

Disastrous Spending
review of disaster relief spending 2011-2012

$136 billion
total federal spending on
disaster recovery + relief

$60.2 billion
superstorm sandy disaster
supplemental appropriations 2013

$396
total cost per household per year
due to relief spending

Sandy Associated Costs:
2012 Damages: $60.2 billion
2018 Damages: $68.2 billion
2024 Damages: $77.3 billion
*based on 2% average annual inflation : Sandy scale storm
“It’s a hundred year storm? I’ll take my chances”

During any single year:
- House A: 0.2%
- House B: 1%
- House C: 10%

During any 30yr mortgage:
- House A: 6%
- House B: 26%
- House C: 95%

It should also be noted, that by the time Sandy actually hit the New Jersey Coast; it was only a 100-year storm. This means that there is a 1% chance that a storm of this scale will happen again in 100 years. However, with most mortgages lasting for about 30 years this means that a home has more than a 25% chance of damage. In addition, with sea levels rising along the East Coast, scientists project that in our lifetimes what was once considered a 100-year flood will happen every 3 to 20 years, therefore significantly multiplying the money spent to rebuild the coast. On the barrier island itself, homes sit within the 100 year to 10 year flood plain, which increases damages to 26%-96%.
### Flood Zone Redefinition Ocean County

**Coastal High Hazard Area | Zone VE**

<table>
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<th>Foundation Cost</th>
<th>Annual Flood Insurance Premium</th>
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<tbody>
<tr>
<td>$18,000</td>
<td>$31,500</td>
</tr>
<tr>
<td>$29,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>$30,000</td>
<td>$3,500</td>
</tr>
</tbody>
</table>

**Total Damage Loss Due to Flooding**

- 6” $39,150
- 1’ $52,220
- 4’ $74,580

Post sandy Seaside was rezoned from an AE to a VE Flood Zone, the number above reflect the change in insurance for an average home of about 2,000sf. This area was originally zoned as AE, prior to seeing or predicting a storm of sandy’s size would hit this area. Therefore due to the increasing occurrence of storms and water level rise that is now projected, the area was rezoned to accommodate this “new” threat. Now homeowners are being told that they must either raise their homes or pay more than 15 times the previous insurance premium. Therefore causing a reevaluation on not only how to rebuild but the cost to do so.
My background research of Sandy impact and recovery, motivated me to further investigate both the economic and spatial implications of how to rebuild, if at all. I turned to the questions of what the response to this kind of damage should be, who is ultimately being asked to pay for the response, and what they are being asked to pay for.
When looking to recover from the damage of a storm, there is a default response to rebuild back what was there rather than to look for more effective solutions. This approach to damage mediation is highly influenced by contemporary political reality, which prioritizes immediate parochial and populist priorities. The community leaders and federal leaders often create solutions to garner favor with the areas affected, but do not necessarily look at the long-term implications. Current political and economic reality stymies any new possible alternatives for what recovery might look like.
Although often compared to in relevancy, Sandy’s impact is conversely different than that of Katrina. Aside from a difference in rebuilding costs, Katrina’s effected population was that of mostly government funded permanent residents, with about 30% living below the poverty line. Areas such as the lower 9th ward still struggle with recovery and a majority of the prior population has permanently relocated from the area. Some have done so by choice, but a majority has due to a negation of government spending to rebuild in a highly vulnerable area. How does this really compare to Sandy?
Like the other barrier island communities, Seaside Heights, although claiming a substantial portion of federal recovery funds, was primarily seasonal rentals, with only a small percent of permanent homes. On the coast of NJ 66% of all homes are seasonal, with the number rising to 77% within Seaside Heights. Therefore, in this area of repetitive damage, money is constantly being spent to rebuild seasonal secondary homes, which are used for a third of the year.
So who's paying for this rebuilding? A substantial portion of the rebuilding costs for Seaside, and many other shore towns like it, have been federally financed. A mixture of funds from FEMA, Federal Grants, and The National Flood Insurance Program make up the majority of the cost to rebuild. Therefore, the federal government is investing in maintaining obviously vulnerable development.
Although the Jersey shore markets itself as a workingman’s vacation spot and its accessibility to all, the reality is that it costs a lot to enjoy a shore vacation. Currently there is a large discrepancy between the average income of shore resident (about $30,000) and shore tourist ($60,000 +) showing that it is the seasonal residents who are claiming ownership of the island because of economic leverage. Those who enjoy the shore as seasonal residents make about double that of permanent residents and spend about 10% of a permanent resident’s annual salary in just one week. Therefore by funding rebuilding seasonal housing, the federal government using its resources to provide a luxury good for already privileged individuals. This appropriation of funds highlights the advantage being given to the Sandy damaged areas due to the high economic stature, and therefore power of the effected population.
As it now stands the jersey shore cannot continue to be inhabited using the current rebuilding policies. The projected increasing cost as well as, storm strength and frequency calls for a solution that challenges these policies by proposing a new, radical solution that is a response to the current rebuilding and spending fallacies. It would drastically change the physical and cultural identity of the shore.

But maybe that’s not such a bad thing.
To begin to formulate a way to respond to rebuilding, I began by looking at the existing site and identify opportunities for intervention. I categorized my findings into four categories.

- Boundary in flux: focusing on the instability, and constantly changing edge
- Character revival and manifestation: how identifiable aspects of the shore can be appropriated to support and protect the area
- Spread and density: problems cause by heavy residential gridding ad sprawl
- Repurposing areas of vulnerability: places to be transformed into ecology
Boundary in Flux

The edge condition of the water and the community is an unstable one. The grey zone of the beach territory is constantly affected and changed by the water. This line is blurred. Can there be a level of flexibility of programming or interaction within this space?

Can there be planning for the area to constantly adapt architecturally/programmatically to the changing context of this zone?

Spread and Density

Organization of the coastal communities is not conducive to allow for storm/seawater run off. There are no cuts/routes to allow water to drain or navigate the tight grids of housing. Reclaiming areas as open space to reduce bottleneck of water as well as potential emergency routes. Possibility of a reorganization of housing zones.

Character Revival and Manifestation

Due to destruction most of the identifiable character of the shore is devastated. Will it return? If so how will it manifest? Recreation or infrastructure, or both?

Opportunity for the structures that define the essence of the area to be adapted for future preparedness.

Repurposing Areas of Vulnerability

Projections of sea level rise as well as threats of storm surge dictate that large areas will be highly susceptible to flooding. Possible area of reintroduction of ecosystems as a means of soft infrastructure. Identifying areas of the highest potential risk and creating alternative use of them rather than building.

Will the architecture actively respond and react to the water? Will it work against it? Will it protect or allow infiltration?
inlet communities | constructed waterfront | private

gridded housing blocks | close proximity | public

island foundation | wetland protection | new areas
I then researched precedents and coastal recovery strategies, and from this I complied a set of strategies for not only addressing the architecture but also the site as well. I began to focus on how these interventions could be used to mediate the existing spatial implications of density and softening the existing edge.
**building strategies**

**Within the Water**

Building with the water, buoyancy + floating dialogue between water + architecture

**Transformable Spaces**

Depending on water level, the public interface + engagement changes, water level awareness

**coastal strategies**

**Diffusion Spaces**

Takes water influx and absorbs it, utilizing soft and hard infrastructure and ecologies.

**Repurposing Infrastructure**

Utilizing water management systems to be activated with new programmatic functions.
From this research I compiled my findings into four architecturally driven responses:

- Island City: creating an archipelago to protect the barrier island
- Recreation and Resilience: infrastructure that can be used recreationally
- Temporary Housing for Seasonal Living: addressing the seasonal swell
- Banding Together: urban organization techniques to reduce density
To determine how/where an intervention within the Seaside Heights community, I looked at three possible responses.

**Rebuild**
- raise foundations. preconcieved reconstruction

**Retreat**
- soft edge. eco-system. remove all development

**Reclaim**
- move out to water. new barrier. relocate

You can resist. (Rebuild)
- Keep housing on island and lift all 10ft+  
- Have to continuously rebuild with next storm happen

You can give in. (Retreat)
- Remove all density from the barrier islands  
- Redevelop the ecology of the island, creating a flood plain

You can try something new. (Reclaim)
- Move it out to sea further, where wave impact can be better planned for and raise it above water  
- Repurpose the island for recreation and flood absorbance
Through a review of multiple combinations of strategies and architectural responses, paired with the background information on recovery and spending, the final design an architecture that responds to the spatial, political, and economic implications of disaster recovery through the creation of the Barrier Towers and Barrier Island Park.
The proposal of the Barrier Towers, which sit off the shore of the Island, blends the need for relocating seasonal housing with protective infrastructure to create a long-term solution to reducing storm surge and rebuilding costs. The towers themselves provide space for housing relocation to reduce the barrier’s building density, while the base creates an artificial reef structure to aid in wave dampening.
To balance this new tower barrier, the existing barrier island edge is reorganized as well. The boardwalk and its existing commercial edge are reorganized into piers that act as groins, protecting the beach and allowing for people’s engagement of the ocean. From these piers, is a marina and ferry port, which enable access to the towers. Behind these piers, new dunes and green space create Barrier Island Park, which allows for a further absorption of storm surge. The reclamation of the ecological state of the island aids in resiliency of the edge as well as maintaining beach access.
Therefore, through my design, I looked to re-establish the shore in a way that does not just replaces what was lost, but responds in a way that addresses the architectural and economic fallacies of rebuilding on the Barrier Island. By designing in this way the architecture facilitates solutions such as relocating owners away from of high-risk properties, renewal of ecological systems and addressing building density, in order to reclaim a renewed inhabitation of the coast. It explores what thinking differently can do to change the existing rebuilding mentality, while showing an exaggeration of what could be built with the existing funds.
The creation of breakwater based towers creates a new barrier layer for the area that provides residential space for these seasonal homes as well as creating an artificial reef that will help to dampen storm surge.

- **reef:** damping of storm surge and ecological regeneration for defense
- **tower:** urban organization, reducing the density and sprawl, beach reclaiming
- **park:** removing residences from flooding, space to diffuse through flood plains
With the seasonal housing consolidated into the new barrier towers, there is also now a smaller building footprint of housing on the island. This allows for ecological reclamation on the barrier island and creates flood plains to help decrease damage due to existing issues of density. The softening of this area helps to further protect the flooding threats towards the permanent housing on the mainland. It builds upon the existing ecological gradient from grassy inlands, to bay marshlands, to the beach. By reclaiming the island to an ecological state and expanding the beach, there is an emphasis on the interaction of the community, rather than an extremely privatized area.
Although the design follows the same principle of raising the individual houses on stilts, this way lifting the residence from the water level, serves a purpose of not only protection to the immediate structure, but to the overall area as well. Designing a base, which not only elevates the tower above the water, but also creates an artificial reef, which can aid in drastically diffusing the effect of large tidal waves and storm surge. In addition, consolidating multiple units into a single structure helps to reduce the development density within the area, which was a major factor of the scale of damage done due to flooding.

The design responds to the current constraints of rebuilding in terms of insurance and guidelines (10+ feet lifted), but creates an intervention, which proactively helps to protect the barrier while addressing the inhabitance for a seasonal population.
The creation of the barrier towers and reclamation of the barrier island forms a gradient of layered infrastructural and ecological coastal protections to increase the number of diffusion barriers, reducing the effect of storm surge while providing viable living space within this coastal region.

The occupation of the new towers by these seasonal residents also creates a physical manifestation of the current economic barrier existing within many of these shore towns due to a strong tourism based economy. It is this split of permanent and a temporary resident that relates to the extreme shifts of seasonal population swell and contributes to vulnerability of the barrier island communities.

The tower development would be accessed by private boat or ferry, similarly to shore community islands like Nantucket or Martha’s Vineyard. This further asserts the economic entitlement of secondary home ownership in this area. To accommodate this transportation, the existing casino pier would be extended to host a marina and small ferry port at the end.
Since the occupancy is seasonal, there will not be residents in the towers when the storm actually happens. Currently during the storm season, the proliferation of suburban sprawl homes adds to the flooding and damage problems in the area. However, with this new development, even when not in use creates an auxiliary function that is beneficial to the area, and maximizes the use of these residences even when unoccupied. So the development’s function changes seasonally between residential and defensive.

### Seaside Heights Census Data

<table>
<thead>
<tr>
<th>Housing Type</th>
<th>Total Units</th>
<th>Family Unit Size</th>
<th>Max Occupancy</th>
</tr>
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<tbody>
<tr>
<td>L</td>
<td>72</td>
<td>1403 sq ft</td>
<td>6 adults</td>
</tr>
<tr>
<td>M</td>
<td>48</td>
<td>963 sq ft</td>
<td>4 adults</td>
</tr>
<tr>
<td>S</td>
<td>68</td>
<td>878 sq ft</td>
<td>4 adults</td>
</tr>
<tr>
<td>XS</td>
<td>96</td>
<td>430 sq ft</td>
<td>2 adults</td>
</tr>
</tbody>
</table>

**Rental** | Seasonal (+/-3 months)  
**Permanent** | Year Round  
**Rental** | Weekly  
**Rental** | Weekend/ Overnight  

- Single Detached  
- Single Attached  
- Dual Family  
- Condo  
- Apartment

**Seasonal Rental Property**