Absorbency in Tidal Resiliency

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Absorbency in Tidal Resiliency
Rethinking the Thick 2D

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“...they work with appreciation of the fact that design in an estuary, particularly an estuary in the problem of flood not by flood-control measures but by making a place that is absorbent and resilient.”

“...in an estuary where the sea and monsoon are insiders rather than outsiders, making a place where ambiguity and possibilities, rather than clarity and certainty, are the norm.”

“...these [adaptive design] and their forms must be adaptive and resilient to sudden, discontinuous environmental change - change that is normal, but cannot be predicted with certainty or controlled completely”
- Insurgent Ecologies (2010).

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"More than a formal configuration, the field condition implies an architecture that admits change, accident, and improvisation. It is an architecture not invested in durability, stability, and certainty, but an architecture that leaves space for the uncertainty of the real.”
- Stan Allen from “Field Conditions” in Points + Lines (1999)

Response: This statement supports the thesis critique that architecture can no longer be static but needs “ambiguity” aka absorbency.

Adaptive = ABSORBENT = Ambiguity

The inevitable truth of climate change has put coastal cities at great risk. Contemporary infrastructure and architecture are struggling to respond to the evolving, inevitable changes to the natural world such as tidal surge, flooding, and severe storms. Past natural disasters in the United States, such as Hurricane Sandy and Katrina, displaced many people, because the communities’ only protection was the failed infrastructure. Although hard and soft infrastructure strategies have addressed rising sea level, architecture at the building scale creates static surfaces and divisions that are slow to adapt to flooding and leave little to no room for the ambiguity of tidal and storm surge. This thesis responds to the current threat of the impact of sea level rise on coastal population cities and proposes to create a blurred, absorbent condition, similar to the relationship between water and land.

According to architect and theorist Stan Allen, field conditions, specifically “mats”, allow for ambiguity and uncertainty of a space. This thesis contends to re-evaluate Allen’s Thick 2D as a resilient, absorbent architecture. This thesis speculates the mat building not only as a landscape condition at the infrastructural scale, but to examine the thickened surface at the edge between land and water at the architectural scale.

Though numerous areas are at risk of sea level rise across the globe, the Chesapeake Bay area is one of the areas to face the highest risk in the Americas. It is a diverse area filled with several growing urban metropolis and an expansive estuarine environment. The ecology of the Chesapeake estuary will influence the small scaled “cell” to produce a large “mat” urban condition along the Chesapeake and Potomac estuary. By expanding the small scale to a larger scale, the cell will change and adapt to those conditions. This thesis proposes a new public interface and network of the fisheries and fish market that responds to the fluctuations of sea level rise and storm surge and social dynamics of the local and tourist people.

Global warming is causing depletion of the ozone layer, the temperature of the Earth to rise, and the ice glaciers to melt and the sea level and tides to rise. Because of the amount of greenhouse gases in the atmosphere already, we are and are going to be faced with major, long term consequences that won’t be as easily resolved. One of those consequences is most coastal or major waterway areas will be at risk of severe flooding. Areas that are beginning to show these changes are around the Chesapeake Bay area, Louisiana, and the western Gulf of Mexico. Hurricane Sandy and Katrina are significant examples of how damaging tidal flooding with storm can impact a coastal city. Both hurricanes caused major damage and displaced many people, because the communities only protection was the infrastructure, and it failed them. Buildings were exposed to rushing water and swept away.1

Estuaries and their surrounding wetlands are bodies of water usually found where rivers meet the sea. The Chesapeake Bay is the largest estuary in the United States. Estuaries are home to unique plant and animal communities that have adapted to brackish water, a mixture of fresh water from the land and salt water from the sea. The Chesapeake Bay provides important habitats for spawning and nursery grounds, for fish and shellfish species. Not only does this benefit the natural ecosystem, it also plays a significant role in the commercial and fishing industry. Though numerous areas are at risk of sea level rise across the globe, the Chesapeake Bay area is one of the areas to face the highest risk in the Americas.\(^1\)

By 2045, projected nearly 400 tidal floods annually in Washington D.C.
1. Jefferson Memorial
2. Lincoln Memorial
3. Naval Yard

Sea Level Rise
Strom
Surge

Category 2
Category 3
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State of the Bay

Pollution
The Nation's River is the Endangered River

“2012 - Potomac river was the nation's most endangered river”¹

Sedimentation is a major issue in the urban area of the Potomac river. The river is so polluted that it is considered unfit for swimming. Most of the pollution comes from industrial waste and storm water runoff. During storms, the river becomes a major problem because the sewer systems lead to the river. As a result of the rise in water, the systems become blocked, overflow, and flood the area.²

Loss of SAV Habitat
Submerged Aquatic Vegetation (SAV) are a vital part of the Chesapeake ecosystem and quality of water. However, there are not that many SAV beds in the local estuary because of water pollution and invasive species. As a result, many species, specifically blue crabs, are declining because of the loss of habitat, source of food, and shelter during their development.³ There are program and management plans to restore the SAV habitat in the bay.

Decline of Female Blue Crab Population
In 2013 and 2014, the population of adult female dropped considerably. Therefore, the reproduction percentage has dropped significantly as well.⁴

². Ibid.
⁴. Ibid.
Salinity Levels (ppt)

0-2.4
2.5-7.5
7.5-12.5
12.5-15.0
15.0-21.0
21.0-27.0

Dissolved Oxygen Levels (%)

0-<20 (Very Poor)
20-<40
40-<60
60-<80
80-<100
100 (Excellent)

Lippson and Lippson (1984)

“Dissolved Oxygen Threshold” (2014)
Bay's Health Index

Chemical Contaminants

- 75.4% PCBs
- 12.3% PCBs + Metals
- 1.5% PCBs + Unknown Toxics
- 7.7% PCBs + Priority Organics
- 3.1% PCBs, Priority Organics, + Metals
- None Listed

“Health Index Threshold” (2014) Chesapeake Bay Program (2010)
The monuments of the past, including the skyscraper, a modernist monument to efficient production, stood out from the fabric of the city as privileged vertical moments. The new institutions of the city will perhaps occur at moments of intensity, linked to the wider network of the urban field, and marked by not by demarcating lines but by thickened surfaces.

- Stan Allen from “Field Conditions” in Points + Lines

“...section is not the product of stacking (discrete layers as in a conventional building section) but of weary, warping, folding, oozing, interlacing, or knotting together”.

- Stan Allen in “Mat Urbanism: The Thick 2-D”

Rethinking the Thick 2D

Thick 2D: Moires, Mats

‘Mat-building’ has the potential to be speculated as a form of absorbent and resilient architecture and how it can engage the edge between land and water.

Question: How can the sectional relationship between the land and water affect the Thick 2D?

In “Mat Urbanism: The Thick 2-D”, architect and theorist, Stan Allen theorizes ambiguous borders of architecture and its context. Allen stated “...section is not the product of stacking (discrete layers as in a conventional building section) but of weary, warping, folding, oozing, interlacing, or knotting together”.

(def) Field Condition

“A built environment conceived as a series of parts and begins with a single element/s that cluster or aggregate to become many”

From MoMA’s Rising Currents workshop and exhibition, a biodiversity armature to nurture and develop an oyster bed to help improve the water quality and to provide the community with an engaging public space. The web of rope helps with wave attenuation. Eventually, the armature will become a part of an interactive harbor.1

Response: Oyster-tecture involves the community and the ecology of the local area, while designing a resilient strategy against flooding and hurricane surge. However, the armature can only really operate as a landscape oriented framework.

**Water Proving Ground | LTL Architect**

From MoMA's Rising Currents workshop and exhibition, it is comprised of artificial landforms and piers that redefine the edge and create a large tidal zone. These landforms are created by redistributing the historic landfill.1

**Response:** This project carefully considered the temporality and the degree of severity of tidal flooding. Its creates a variety of landforms connected through a processional boardwalk.

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**New Aqueous City | nArchitects**

From MoMA's Rising Currents workshop and exhibition, the project creates a new type of house that flips it upside down to reduce the total floor area vulnerable on the sea level floor. The housing is connected to a larger system of islands and storm barriers.1

**Response:** It is an innovative method of the housing project. The larger system of storm barrier islands seems disconnected with the housing. How does the vertical wall surface handle the rising tides?

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A construction system that is “organized, distributed and expands as cells” elevated above the ground, to make way for the recovery of the wetlands. As a translucent and permeable structure, it allows for the natural regeneration of the ecosystem. With different “inputs”, the habitats and wetlands are encouraged to have self-sufficiency.

**Response**: It creates a large scaled infrastructure system. The permeability of the framework allows for the growth and restoration of the wetlands. It is a good example of expanding a small scaled element, like a cell, to work at a large urban scale.

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A network that rethinks the sea wall edge to create a “soft” infrastructure to mitigate the impact of sea level rise while re-mediating the local ecology. The structure consists of low-impact access catwalks and seed distribution networks.

**Response**: This is a good precedent in how the local ecology impacts the design of the network while creating a public, recreational space. However, it is primarily a horizontal condition with distribution pods and elevated catwalks.
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Proposal
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Washington DC is the U.S. capital along the Potomac River of the Chesapeake. It’s defined by iconic monuments and historical buildings, such as the Jefferson Memorial, the Pentagon, and the White House. Currently, the estuary city faces approximately 43 floods annually. By 2030, a sea level rise of 5 inches would drastically increase the number of annual floods to 155 floods. By 2045, the amount would be 400 annual floods. Washington DC is dealing with the crisis of a growing population but low-topographic setting with the rising of sea level.

Maine Avenue Fish Market

Maine Avenue Fish Market “The Wharf” is the oldest, still operating fish market in the United States. In 1918, the Fish Market opened and was originally very successful. However, in 1960, the southwest quadrant of Washington DC declined and was planned for urban renewal. Because of the renewal plan, the fish market vendors were displaced to the Washington Channel on barges. Currently, it is pushed up against a highway along the river at the edge of the yacht basin. Near L’Enfant Plaza, it is not easily accessible from the rest of the city or visitors and mostly known by the locals. It is isolated from the National Mall of the city.

“The Wharf”

The Wharf is a development project for revitalizing the south west waterfront by the firm, Hoffman-Madison. The development plan includes 27 acres of land and 50 acres of water. The goal of this development project is to improve Washington’s southwest waterfront by designing a composition of mixed use buildings of commercial, residential, recreational, hotels, and restaurants.¹ This thesis critiques the “The Wharf” as a prime example of contemporary architecture’s lack of consideration of the surrounding context. It is unprepared for the sea level rise and tidal flooding.

Conflict

Because of the development plan, there is a tension between the Maine Avenue Fish Market and the “Wharf”. The Fish Market only occupies a small portion of the waterfront, underneath the highway. Some believe that the Fish Market is further being neglected and disregarded by the Wharf’s design. According to one source, “PN Hoffman is seeking to evict Salt Water Seafood and the Wharf, the market’s dominant tenant.”¹ People appreciate that the market is for locals only and that there aren’t that many tourists. However, some believe that the plan will revitalize the waterfront. The multi-use buildings will attract people and revenue for the city. The current situation of the fish market and the developing design are not adaptable to the changing site.

This thesis proposes to create a public interface between the ecology and architecture that will generate a new type of monumental architecture that is adaptable to the both the local and tourist needs of the site. Should there be a distinction between locals and tourist spaces of Washington DC?

One of the main problems of the Potomac River is the invasive species, Hydrilla verticillata, from southeast Asia (right). The introduction of this invasive species into the ecosystem of the Potomac river has disrupted and harmed the food web of the Chesapeake. Submersed aquatic vegetation (SAV) is affected the most by Hydrilla verticillata. It is important to the ecosystem of the Chesapeake because it provides shelter and food for fish and other aquatic animals. In 1930, there was no SAV (left) in the Potomac River deeply affecting the quality of water in Potomac River. Currently, there is a harvesting program ran by U.S. Army Corps of Engineers, to control the Hydrilla verticillata beds.

2. Ibid.
3. Ibid.
It is a summer vacation destination, previously for Washington D.C. notables, located at the mouth of the Potomac River. The lighthouse is at the southern point of the town and is currently used as a historical museum.¹

It was selected as one of the multiple sites for a program to restore the eelgrass, an important subaquatic vegetation to the estuary, to help improve the overall environmental health and water quality of the Chesapeake Bay.² Its low-lying topography means that it at a great risk of tidal flooding and hurricane surge from sea level rise.

Crisfield, located at the most southern tip of Maryland, is well known for its seafood and as a major distribution site in the Chesapeake Bay because of its proximity to both oyster and the crab habitats. However, the nutrient pollution and overharvest of shellfish in the estuary has negatively affected the population of the Maryland Blue Crab. Furthermore, the sea level rise is a major issue for the town. Smith Island, one of the major blue crab habitats, is predicted to disappear by 2025.

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The method is seed buoys filled with eelgrass reproductive shoots. The distribution of the eelgrass seed is performed seasonally during the Fall and Spring. The restoration of the eelgrass would help clean the water of the estuary by filtering pollution and runoff, act as fisheries, and provide food sources. Furthermore, it acts as a natural wave attenuator.1

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What is my Cell? Expanding the Small Scale

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