



# collective RESILIENCY

Understanding and designing for resiliency by Madison Schimpf

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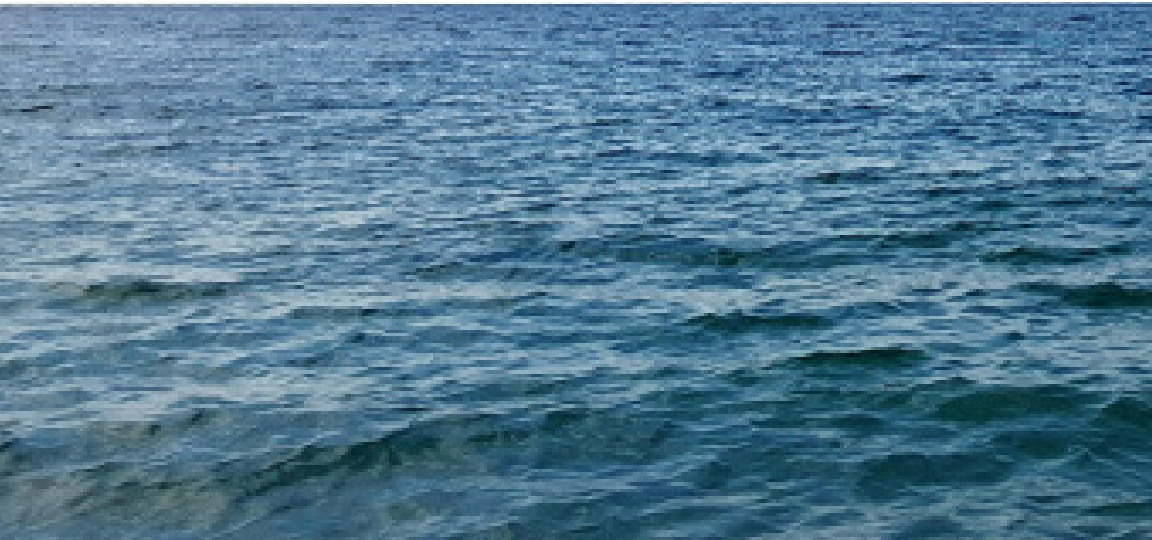
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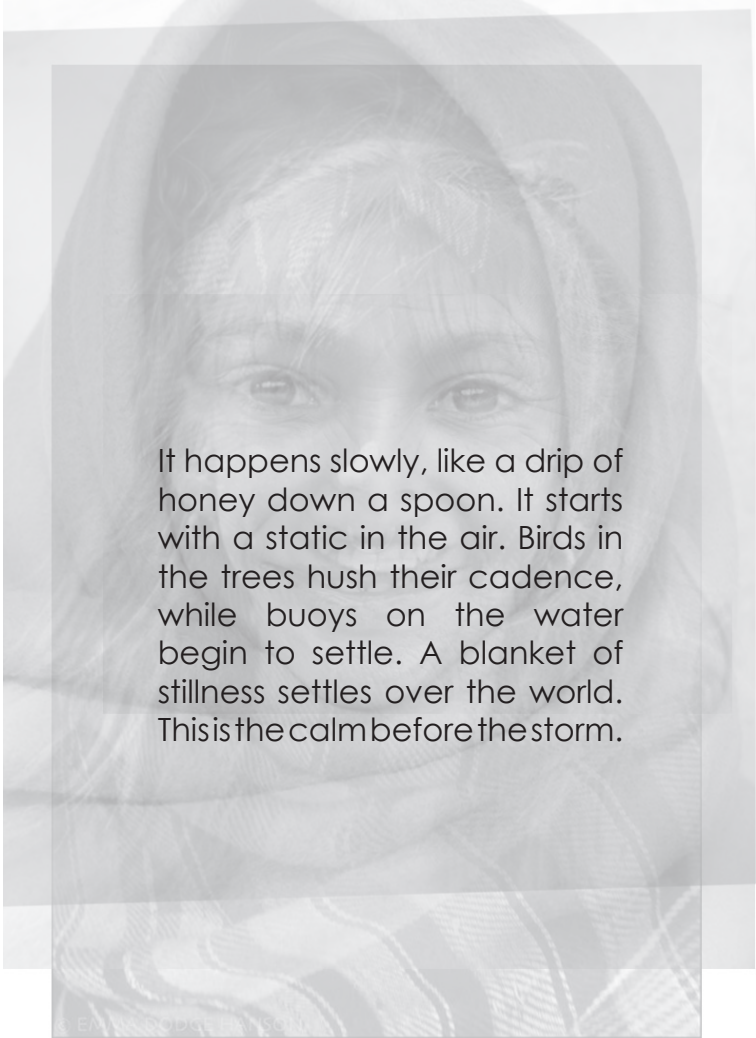
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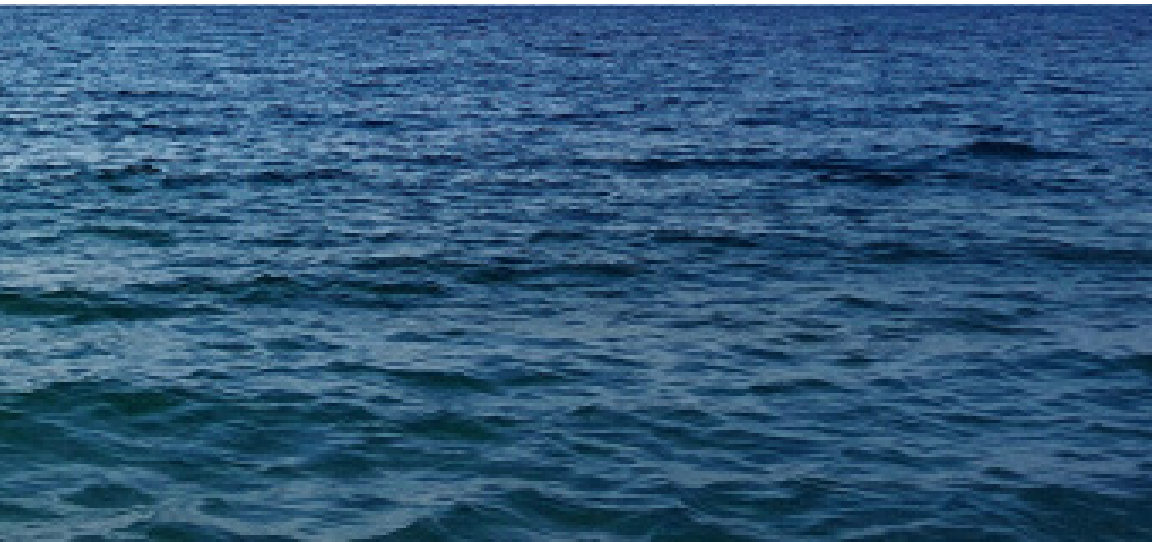
# PART 1

*The calm before the storm...*





It happens slowly, like a drip of honey down a spoon. It starts with a static in the air. Birds in the trees hush their cadence, while buoys on the water begin to settle. A blanket of stillness settles over the world. This is the calm before the storm.



# The Coast is a Magical Place

The sun shines brighter the air feels fresh and the beat of the waves on the shore is a calm repetition. This can all change in the matter of hours, as natural disasters are as much a part of the coast as sunshine and fresh air. Every year natural disasters are the cause of millions of dollars in damage and the loss of many lives. In most cases natural disasters like hurricanes bring more rain than the infrastructure of a city can handle. Global warming is a large factor in the ever increasing

severity of current storm trends and because of this flooding has grown into a big problem after a storm. The coast is more susceptible than most cities because of the amount of infrastructure directly in the path of a hurricane with ultimately no geographical protection geographically. It is because of this trend in storm weather and the vulnerability of today's cities that resilient strategies are necessary in the future of our cities.



Building resiliency through a need based architecture design strategy is important in society today based on current weather trends and flood levels and the ability for the community to rebuild and grow from flood waters and the damage that comes with it. Need based architecture is a form of design or strategy that primarily focuses on a functional basis. Whatever is designed or created is useful because of its necessity. Resiliency refers to the capacity to recover quickly from difficulties; toughness. Building resiliency has as much to do with the landscape and the built environment as it has to do with the complexity of human emotion and community.

A 'need' based strategy was important for the growth of resiliency. After a natural disaster three basic human needs are met within days, even hours. The three basic human needs are: water, food and shelter and are often considered first for their necessity to maintain human life. Temporary housing after a natural disaster is important and often considered first for design implications because of its endless capabilities regarding environment, material, and multi-use functionality. Designers are always looking

to reinvent temporary housing. However, re-designing public space for the future of flooding is a modern endeavor with the gradual change in severity of natural disasters.



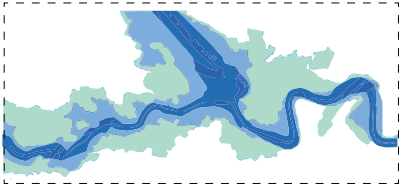
The focus of this thesis is building resiliency in the community, in the landscape and in the modified built environment. With an emphasis in maintaining public space during and after a natural disaster and concurrent flooding.

Collective resilience refers to the coping processes that occur in reference to and depend on a given social construct. Collectively the community must face the natural disaster and grow from its destruction and in doing so they will be stronger as a community and while using strategic design measures they will make their cities stronger as well. The collective was important because the community as a whole is affected during a natural disaster rather than a singular being.

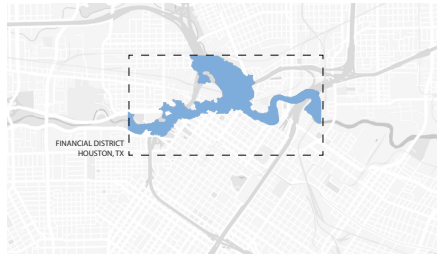
In the past 10 years the severity of hurricanes has come into question, whether they're getting stronger and why and how often we should expect them in the future. Hurricanes can be categorized into three types of flood levels. The first, a 10 year flood, is within a year span the percentage possibility of a flood happening in a single year. A 100 year flood is whether a flood has a 1 percent possibility of

happening in a single year. Each flood zone spreads wider and wider, from 10 year to the 500 year which is the most severe. The intervention highlights sites within the 500 year flood zone. Flood zones are important, especially in the insurance world. 10 years ago living on the coast would be simple, purchasing a home and then purchasing flood insurance. However, in the last several years a dramatic shift has happened when insurance companies stopped supplying flood insurance to those living within a flood zone and refusing to insure any citizen living on the coast in a flood zone. This has led to many complications such as wealthier citizens moving away from the coast and lower income citizens moving toward a finally affordable luxury home. But because of the insurance loss many low income members of the community are taking the change to live in an uninsured home due to the fact that they can now afford it.

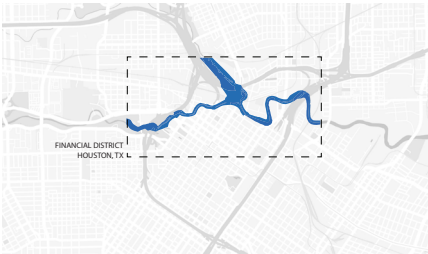




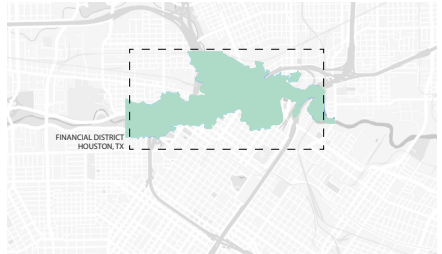
FLOOD ZONES IN HOUSTON



100-YEAR FLOOD PLANE



FLOODWAY



500-YEAR FLOOD PLANE

# Public Space Realm

The public space realm is where everything happens in a person's life outside of the home. Public space is the element in which necessary interactions take place and when those are fulfilled resultant activities like socializing or leisurely walks take place. Public space is also last on the list of elements repaired after big storms. When public space is inaccessible due to flooding then the activities taking place within this environment will be circumnavigated and may not occur at all or be severely limited. Between work and school and shopping and sending a letter there are many uses of public space, all of which fall within three main categories. The three main categories of public space include necessary, optimal and resultant.

One article by [\[author\]](#) goes into depth in an explanation of the public space realm and how planned public space could be categorized in an urban strategic environment. An Interim Public Plaza, dressing up a paved area inexpensively "Interim public plazas seek to transform under-utilized roadways or peculiar swathes of concrete/asphalt into usable public spaces. However, instead of waiting for capital funding and enduring a long construction process, inexpensive but reliable temporary materials are used." (Projexity 1) This is a smaller public space however, it utilizes the underutilized. Another type of public space, is the open streets, blocking off traffic and using the lanes for public space and public interest. Remember watching those apocalypse movies and people just wander wherever they want? What if you can do it without the end-of-the-world scenario? Open Streets festivals are temporary street closures that transform a roadway into a pedestrian and cycling only space. It originated in Bogotá, Colombia, where Ciclovías ("cycleway") has taken place since 1976. The photos below show various Ciclovías from this 2015. (Projexity 2)

Necessary public space activities fulfill the necessary role of public space in a citizens life including going to school, going to work, grocery shopping, taking the bus etc.



Optimal public space activities fulfill a secondary role of public space where all of the necessary activities have been taken care of and now there is room for taking a leisurely walk, sitting and talking with a friend, day dreaming and sitting around.



Resultant public space activities fulfill the remaining activities which occur within public space including children playing, stopping for a conversation with a stranger, eating a meal out being able to converse outside of a friend or family level.

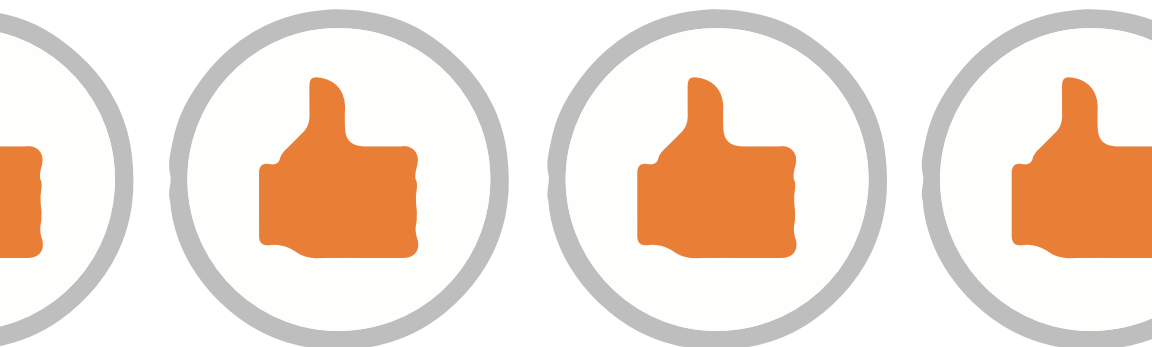


Throughout each level of public space commonalities tie each together. Communication via telephone poles and radio is important for people to link together especially during a natural disaster. Another key factor is transportation, both private and public, meaning free motorways and accessible escape routes for citizens in an emergency.

Within public space in an event of a natural disaster there are time based strategies utilized for design of the environment. Primarily there are two types of time-based design strategies used for flood design, short term and long term. Both strategies are used to mitigate the damage of flood waters however, a short-term design strategy implies bolstering a landscape or built environment for the future of flooding using techniques that produce quick results and are quickly efficient but not long lasting. A short-term design strategy has a limit, whether that be time, or severity of flood/ storm. A long-term strategy has much more to do with policy change and less to do with building or altering landscapes. Long term strategies aim to improve

the foundation of thought that the future of the built environment as well as the landscape are designed in a way that no longer needs any short-term strategy.

Taxation is a form of long term strategy as it can provide grants and funding to a community providing protection and the ability to re-build. Some major types of long term strategy is found in several cities across the United States, in particular Napa Valley, CA the city of Napa purchased the land of 80 homes located in a specific 'U' bend in the Napa river. Every year this particular location flood due to spring thaw. Once the homes were bought they were demolished and now insurance companies no longer annually pay to repair the damage to the 80 homes. Instead, every year this location fills with water, drains through the landscape and back into the natural flow of the river. This strategy is a form of property acquisition and relocation stabilizing both the economy and materials. Both long term strategies and short-term strategies are used to complement the existing landscape, bolster the built environment and provide a strategy for the future of an existing neighborhood and its residents.



In recent years global warming has contributed to not only the increasing severity of natural disasters but also their occurrence within a single hurricane season. As infrastructure along the coast has increased because of priority living conditions damage costs from hurricanes has increased exponentially. This increased density has contributed to rising damage costs along the coast. After hurricane Sandy, New York suffered millions of dollars in damages because of flooding. Hurricanes Florence and Michael ripped through the southern islands of the Caribbean and the southern border of the United States. Hurricane Florence ripped up the coast of the United States through the Carolinas before petering out. This caused massive damage at a massive cost in which the U.S is still recovering. A similar hurricane, Michael ripped through the island of Puerto Rico and prompted more damage, most of which the country will barely recover. It was along these lines the thesis structure began to take form.

The implication that public space, community, and social environments are just as important as housing relocation and dietary needs. While fo

ocusing on public space preventative design can change the outcome of a natural disaster zone, utilizing public space, civic need and the emotional community response. Through the study of previous natural disasters and the response of the community and the complexity of human resiliency. The problem this thesis engages is complex and multi-faceted and will be explored using several types of strategies simultaneously. A proactive approach is designing for the next storm in the wake of those already existing, a study of cities, income levels and consistency determine the site

There are currently 13 cities in the United States, all border states, which are considered the most dangerous to live in because of their hurricane susceptibility percentage. Many of these cities have experienced severe flood damage, even loss of life. Through a careful examination of income level and sites of consistency it has become clear that wealthier cities, like Myrtle Beach, FL are more likely to build a healthy resilience to hurricanes. to explore including case studies BIG U, Lower Manhattan, the flood of 1953 in Amsterdam or and New Orleans and Hurricane San

dy. Focusing on the landscape of Natural Disasters, what does this look like in terms of Public space, and civic space. Why are these important? Who is spending the money to rebuild these things? Taking a deeper look into these case studies was important because it starts to define already active strategies, as well as failed ones.



The first study, the great flood of 1953 in Amsterdam. Late in the night, a tropical storm quickly formed and surged toward the island country of Amsterdam. The technology of the time didn't allow for constant communication between islands nor did it allow for those islands to be prepared for this once in a lifetime flood. Unfortunately the flood hit the islands and consequently many people of Amsterdam were killed. Businesses were wrecked, people were displaced and public space was now under four feet of water and rising. Eventually the water stops rising and begins to drain, this leaves most towns in desolation and in dire need of help.

Amsterdam implemented many tactics after this disaster, in the form of flood and water control. However, the issue is that these technologies were designed for the prevention of water flow and almost exclusively that, they were not failures in any measure but rather than focusing on the interaction of people they focused on the allowance of water in a controlled manner through the inland waterways. It was because of these technologies that public spaces in Amsterdam today were largely

created and allowed to remain as they would no longer have the chance to be desolated and washed away. Public space had an opportunity to flourish, possibly for the first time .







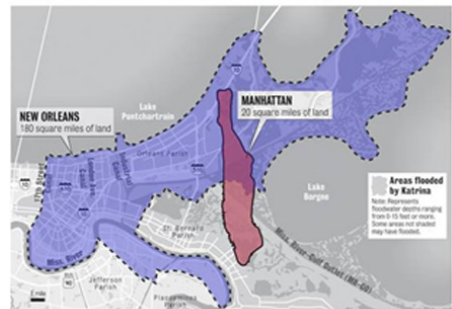
The next case study was Hurricane Katrina and New Orleans, in terms of Public space this was a failure not only because it led to the detriment of the city but it was also a testament of how unprepared we are as a general nation against these super storms, and because of global warming it was inevitable that these things will happen again and in that we are unprepared, or at least we were. Hurricane Katrina ripped through the city of New Orleans, in some places flood waters reached well over fifteen feet or higher. Eighty three people died because of superstorm sandy, in this day and age it was shocking to hear this because we should have been able to prevent this, we as a nation should have been able to help those of New Orleans more quickly.

New Orleans did not recover from this disaster as Amsterdam did, neither did they recover like New York, of course there are many differences and to why, economically speaking there is a large difference financially. There are things to learn from New Orleans, like maintaining current technology and adapting this to meet current requirements rather than letting a problem age. The levee system in New Orleans was not

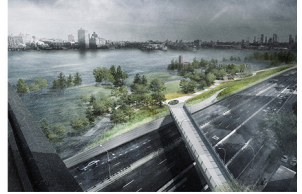
held to the standard in which it should have been and because of this there was more damage than there should have been. The super dome was used for public space during the preceding rush to fix and establish order, the original intent of the stadium was never meant to hold the entire city, however, it was one of the only buildings large enough and high enough it was possible to hold so many people.

## SEVEN MANHATTANS

About 80 percent of New Orleans was flooded by Hurricane Katrina's storm surge, a devastation zone covering about 144 square miles. To understand the scope of the damage, the area is more than seven times larger than Manhattan.



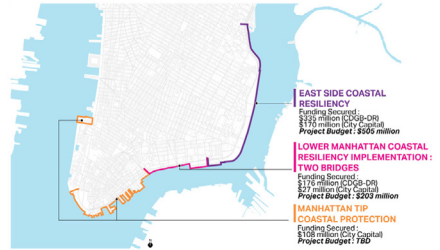




The last case study conducted was the BIG U in Manhattan, New York. After Hurricane Sandy flooded subway stations and roadways Manhattan fought back the rising tide with a new strategy, a landscape designed for future superstorms and consequent flooding. The BIG U is a landscape that wraps almost entirely around the main bur-row of Manhattan and Brooklyn.

The landscape takes into account the people aspect neither of the other case studies have touched. It involves a public space that adapts and changes based on user need. It can also be shut off to the city to prevent flooding via large doors that roll out from underneath underutilized highways. It combines the use of people as well as the use of public space, education and the space for markets and businesses. This of course, does not solve the issue of flooding, however, it allows the possibility of help in the future. Holding back the ocean or raising the city can be an endless, and eventually losing argument. Although this design is considered successful the idea of resiliency asks for more, yes this solves the current issue as well as the future issues but more, how can

it adapt to new building structure, how does it facilitate business, how is this strategy designed for the long term when it seems a permanent solvent.



A wise masters student once told me to delve into purposeful meandering in order to more understand the topic. One of the next steps was developing a set of Collages, of diagrams, in order to deviate from traditional graphing using images of single things, built space, green space, elements (rain, wind, cold, warm etc...) this is to facilitate the understanding of public space, which aspect of this I am trying to understand and adapt or design for. And combining them into an interpretable diagram of how a disaster looks.

The idea of collective resilience first came up in conversation about public space. What does a collective human emotional scale look like. Especially considering emotional intelligence, public space, collective emotion? How do you accurately represent anger within an image, that means something to everyone? What do each of these emotions look like? To understand the collective, first you must understand the single person, each emotion on a scale of collective is easy to understand, however when you start looking at the collective this picture becomes murky, everyone reacts differently to each emotion.

differently to each emotion.

Taking a step back, looking into collective emotion in regard to Natural Disasters we can divide a natural disaster into six separate stages. Specifically, during a natural disaster, what are the most common emotions, researched and through interview accounts? What I have begun to do with the collages is to start this process of rebuilding emotions into easily understandable infographics. These ideas of emotion can start shaping how public space is supposed to look.

The six stages of the Natural disaster are as listed: Pre-impact, Impact, Damage assessment, Heroic intervention, Honey-moon and Disillusionment. Utilizing a set of interviews as a measurement tool picking each stage a part and defining them became the first experiment.

The first phase of a natural disaster is the Pre- impact, this is described as the initial panic. Knowing the storm is coming and taking immediate proactive measures to protect your loved ones and house are major keys to this phase. The emotions a person may feel are panic, loss of control etc.



This phase is dependent on the time line of the time it takes the storm to reach the particular area.

The next phase of the collective is the impact, this is usually the shortest timespan of the natural disaster. This stage is mainly described as a fearful time, in which you do not know the outcome of your own self nor do you know that of those around you, your loved ones or your possessions. It becomes clear in this stage where your priorities lie.

The third phase is the damage assessment, this phase usually comes with shock and sadness, an overwhelming feeling of either sadness or happiness depending on the weight placed on survival, of yourself, loved ones, and possessions. This phase is quickly followed by the next phase. The third phase is the fastest as the damage assessment can be conducted quickly and efficiently.

The next phase is the heroic intervention. Imagine superman coming to lift a tree off your home. This phase is primarily marked with hope, encouragement, excitement. Physically watching progress made is an effective does of

hope in the eyes of a Natural Disaster victim. The heroic phase lasts as long as progress is able to be witnessed, this may be a few days or a few weeks, eventually, it ends and with it comes the lowest emotional stage.

The fifth phase of the emotional scale of Natural Disasters is the Disillusionment phase. This phase is the reaction to slow progress, or even no progress. Sadness, disappointment, disparity are all common emotions during this phase. Realizing progress and change are not happening in the capacity in which you would like it to move is a disheartening realization and consequently leads to many feelings of unhappiness.

The next phase is the honeymoon phase. This is the phase of relief goods, hope and contentment in a situation. This phase typically occurs because good things are happening, basic needs are being met, and with a knowledge of where your next meal is coming comes a need to seek higher improvement in your surroundings. This can accompany the next phase the last and the most hope-filled.

The last phase may last the



longest, because although you may not see direct change you can see it happening and you have acknowledge that it is happening.



Low EMOTION

High EMOTION



fear/VULNERABILITY

shock/PANIC

courage/BRAVERY



OPTIMISM

DISCOURAGEMENT

recovery/HOPE

What does public space look like in a Natural Disaster? It has Green space, it has markets, it has entertainment, it has walkability, as well as vehicular ability, it looks like an open road, a pine forest, a dense city with a trailing of open paths, it looks like a market and it looks like the space of a bus stop.

Natural disasters are used to begin to understand the emotions through specific word choice, but it has proven only that you can describe an event, not truly explore it through emotion. The trend is important, but we already have a map of this data, but the data is not what I am looking for. Not numbers and easily definable patterns of quantifiable data. But rather the pictures that can explain them.

Diagraming emotion, through faces of humans combined is an experiment of human emotion. Evoking an **EVOCATIVE** diagram of emotional states during the full array of human emotion during a tumultuous event. Forming Collages, through color and collective theory, the collective theory of interviews, descriptor words, after, before is one way of understanding collective emotion.

“...**WE NEED HELP...**”

“...we **WEEP AGAIN...**”

“**We SURVIVED.**”

“This is the **START.**”

“...**GRATITUDE...**”

“**Who SURVIVED...**”

“...we received **NOTHING IN RETURN...**”

“...**TOOK US INTO THEIR HOME...**”

“...**RELIEF GOODS...**”



Santiago and Princess salvage usable items from the debris of their family home in the Philippines after it was destroyed by Typhoon Haiyan. (©2016 World Vision, photo by Joy Malujo)

To rethink the urban landscape we must be more deliberate, more direct in our action of replication, because the very essence of replication means to convey the same type of emotion that a real event would cause and in itself, would that not be creating disaster, rather than trying to learn from it.

Utilizing public space, civic need and the emotions of the community this thesis engages societal issues surrounding Natural Disaster relief. The implication that public space, community and social environments are just as important as temporary housing is a key concept in understanding resilient design. With a focus of need based architecture this thesis explores collective human emotion through group interview and expressive diagramming.

Each individual element broken down and dissected disassembles the basic understanding of the whole, in the end these individual elements can be rebuilt into a concept of need based design. The launching point begins with the type of specific Natural Disaster that becomes apparent in its destructive behavior, flooding. This type of

natural disaster leaves devastation, in landscapes and in human behavior. The combination of understanding and a design background will begin to dissect this relationship in hope to understand and build for the future in direct



Just days after Typhoon Haima struck their community in the Philippines, cousins Elaine and Faye play near where the grownups are salvaging items from their damaged houses. (©2016 World Vision, Joy Malujo)



Jonas and Gian, his 7-year-old son, pick through the debris of their belongings after Typhoon Haima destroyed their home in the Philippines in October 2016. (©2016 World Vision, photo by Dexter Gamboa)



Elena stands amid the debris of her home in Cagayan province, in the Philippines. The house and many of the family's possessions were destroyed by Typhoon Haima in October 2016. (©2016 World Vision, Joy Malujo)

Bruised clouds, rolling  
thunder, thrashing shutters  
and the scream of wind. It  
comes quickly but not quietly.  
In the distance, trees are  
swaying. The storm is vicious,  
ruthless, there is no mercy.



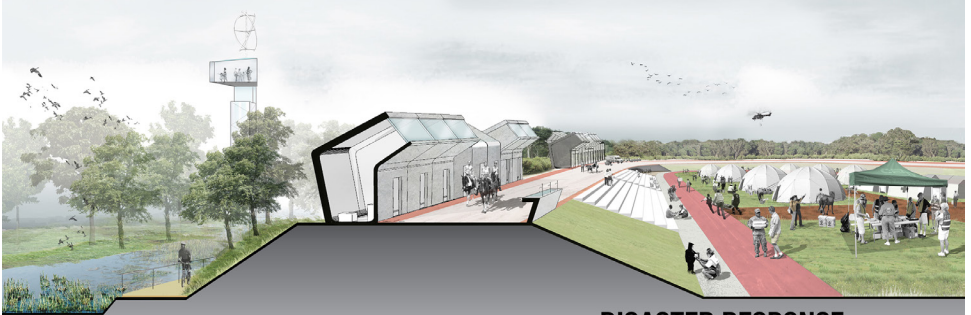
# PART 2

*The Storm...*





**EVERYDAY USE**



**DISASTER RESPONSE**



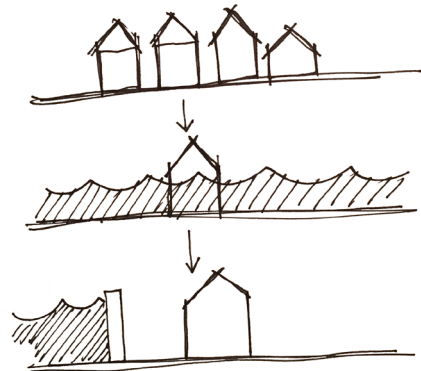
Studying natural disasters through flooding and hurricane damage narrows a type of need based architecture. Resilient design is a type of need based design which has a focus around human nature, public space and the collective health of society. Resiliency is the capacity to recover quickly from difficulties; toughness, which surrounds most natural disasters. Specifically, New Orleans where one of the most deadly and costly hurricanes led way to flooding, looting, the collective emotion of an entire city. The 1953 flood of the Netherlands which paved the way for new technology continually changing and adapting to the times. Lastly looking toward the future, the Big U, which has developed a landscape in direct answer to the warming water, destructive nature of hurricanes in an effort to protect a billion dollar city.

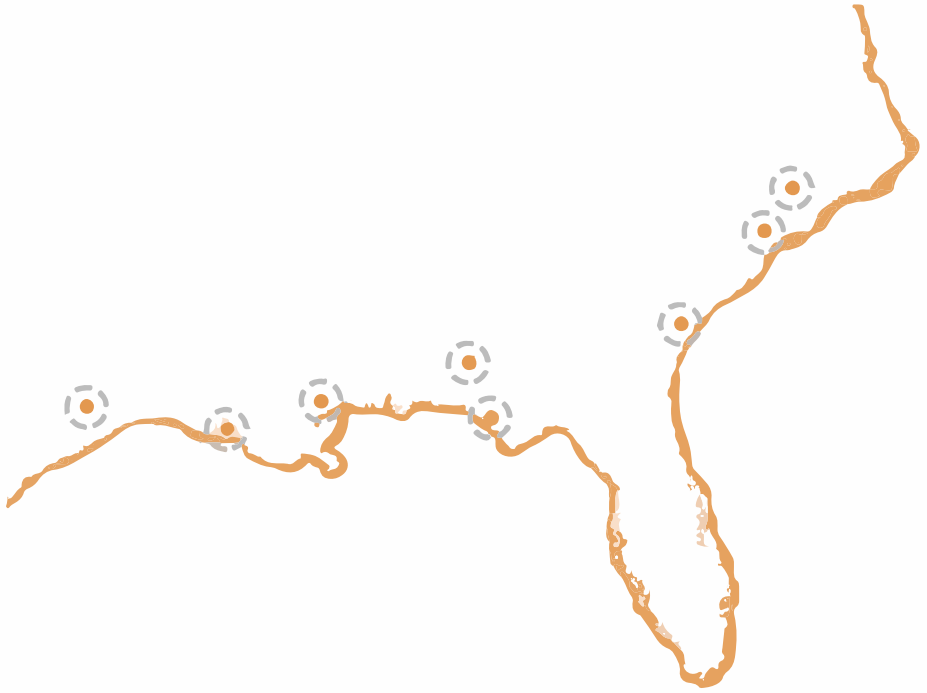
Delving further this thesis takes the human condition into account when designing for natural disaster. Humans above all, are the lifeline that directly has affect and is directly affected by the displacement, discouragement and eventually the rebuilding of their surroundings. Studying the collective, how people move through a

human condition to make sense. Collective emotions can be studied through individual need but also through group emotion, through family generations and through the leadership follower construct.

Through this analysis of study several questions regarding timelines need to be considered, the short term where a strategy is implemented right away. This type of strategy is not meant to last long, it is valuable for the change to change of set of circumstances and not necessarily meant to grow or be permanent.

These selected spaces based on their identity on the South eastern border of the United state which is the most susceptible to Hurricanes, are potential future sites where intervention may take place. These are also the towns in which lead a continuation of disaster





1. Geneva County, Alabama – The most inland of all the cities, this would be an exploration in wind damage more than water as it is so far inland.
2. Panama City, Florida -Similar to Myrtle Beach this area specifically is an edge condition.
3. Savannah, Georgia – The entire county of this area was affected by flooding damage.
4. Cameron, Louisiana – Another area, closer to New Orleans however, it was not as badly damaged and therefore not as a greater hazard as New ORLEANS was.
5. Biloxi, Mississippi – A larger city on the coast. This has potential to be similar to New Orleans.
6. Lumberton, North Carolina – One of the poorest towns on this list. Due to flooding and little economical help this poor town could utilize a new sort of technology in its reliance bouncing back from the surge.
7. Myrtle Beach, South Carolina – The water edge condition may be interesting to explore due to the large multistory condos along the vulnerable edge of the ocean. This area is specifically vulnerable to Hurricane force winds.
8. Houston, Texas – Massive amount of the city were destroyed due to floods, government funding is strong in this area, as well as displaced people.

These places of coastal disaster lead to varying levels of intervention and for the continual study of natural disaster resiliency.



















# PART 3

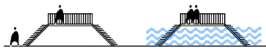
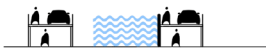
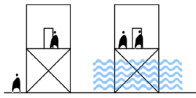
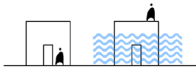
*The Aftermath ...*

Scattered through the streets,  
clinging to the trees, punctured  
fully through, the aftermath is  
messy, devastating, careless.

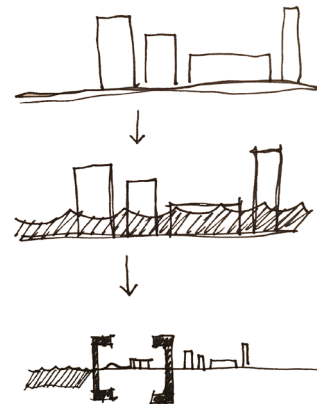
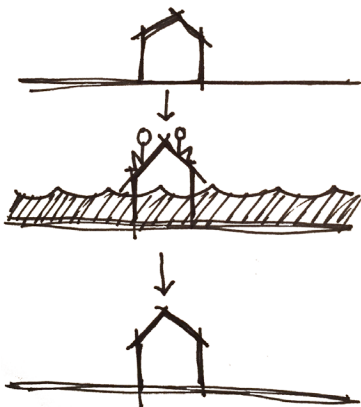
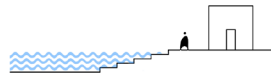
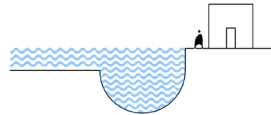
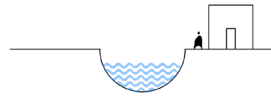
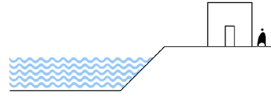




Modified Built Typologies



Modified Landscape Typologies

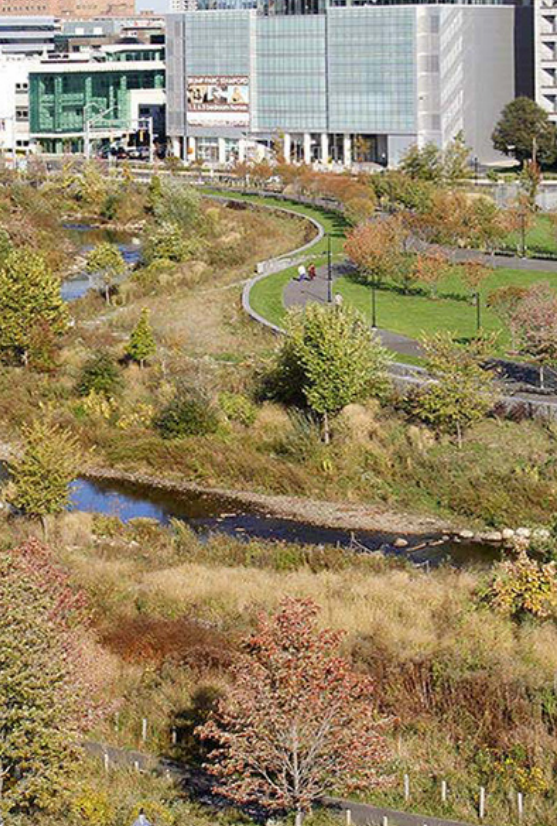


One of the directions was to move forward with a temporary recovery strategy. This type of strategy involves a short-term initiative that would involve a short-term time line. In terms of resiliency this means that devising a plan for temporary solutions like where people go and how public space is involved in this temporary relocation process. On the other hand the strategy can also be a long term strategy. This is to say that the plan for resiliency is strategically in place to be utilized for the next 5-10 years. Thinking of the intervention in this way means a permanent solution, a built space or landscape or strategy and because this topic is constantly changing then the solution must also be constantly changing which defeats the purpose of a permanent building or strategy.

The problem with designing for resiliency is that a permanent resolution to the problem must involve some type of ever-changing strategy or design. This is because Natural Disasters change the environment in which we are used to. The comfort we feel in the familiar is ripped away and in its place destruction, a clean slate for something new. They change the environment

and because of this designing a solution that is permanent defeats the purpose of an ever changing problem, the strategy must also change to keep up with the growing demands.

Each site has the opportunity to host multiple types of intervention typologies Policy, landscape and modified built. Each strategy has the potential to mitigate the damages done by flooding and the immediate necessary results to utilize public space during a natural disaster and directly after. Natural disasters affect everyone equally, they do not pick and choose who they affect. What is not equal is each communities ability to respond to natural disasters and flooding and damages. Lower income communities do not have the same advantage as higher earning income communities. The three intervention sites explore the dynamic of both higher income and lower income communities and how different strategies can positively affect the lasting resiliency of each community.





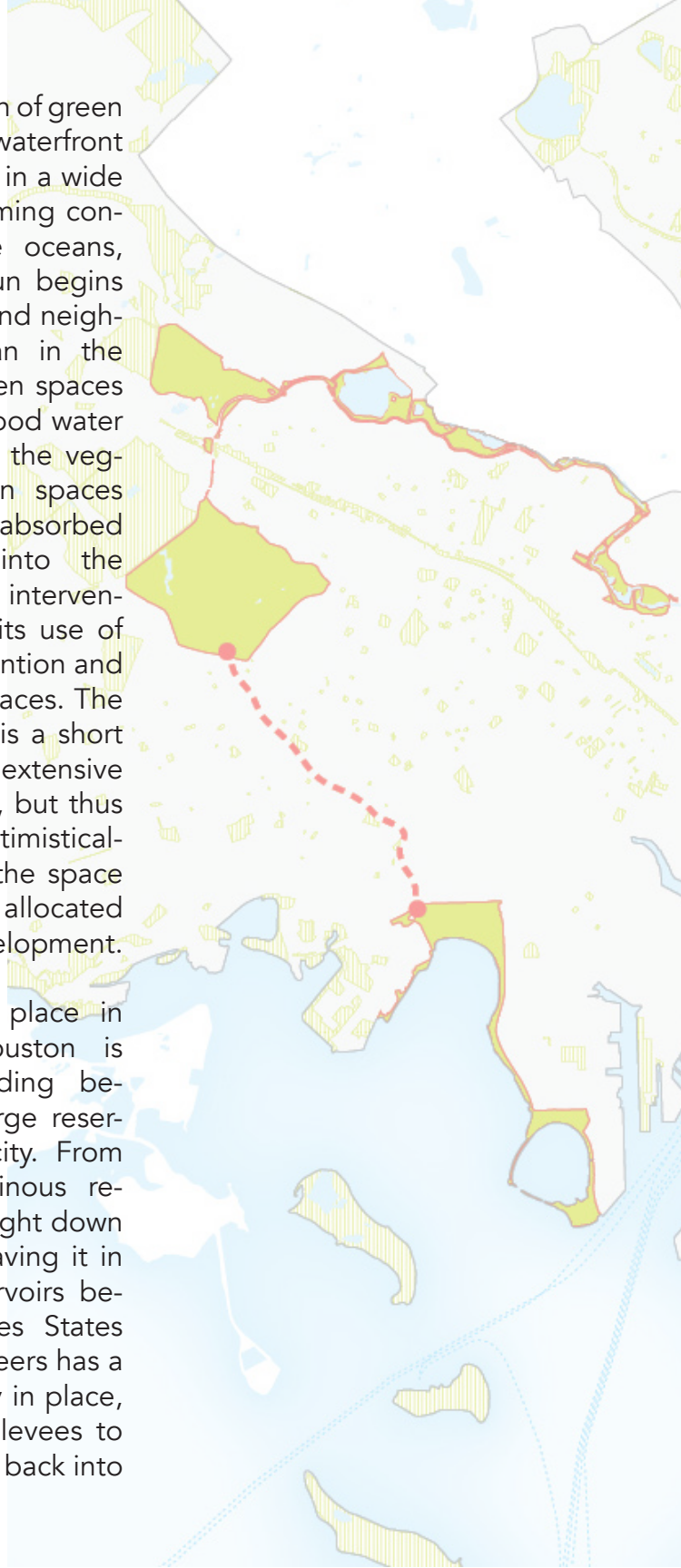
After the initial research into strategic resilience there are many examples already implemented with results. In Napa Valley California a river winds its way through the valley, through communities, around homes and fully immersed in the valley. One particular twist in the river is shaped like a horse shoe, and inside the width of the horseshoe were 80 homes of members of the community.

Every year, around spring the river running through Napa Valley floods. Specifically it floods the area between the horseshoe bend of the river, flooding those 80 homes. Thousands of dollars in damages are repaired only for the same predicament to happen in the next season. In order to reduce the amount of money being spent each year on damage repair the city of Napa instead purchased the land between the bend in the river, they then relocated each of the homes into dryer, higher parts of the city and demolished the structures in the bend. Instead every year when the river floods acres of water resilient landscaping are flooded and drained back into the river, the space is now utilized for a park and open to the public use. This is one instance where relocation was

possible because money was available for the homes to be moved and spend to redesign this area. In many parts of the United States this sort of intervention is not possible, either for financial reasons or space issues.

In Boston a linked path of green space connects the waterfront to the rest of the city in a wide circle. As global warming continues to warm the oceans, water rises and in turn begins to flood city streets and neighborhoods easier than in the past. This link of green spaces is designed to pull flood water from the streets into the vegetation of the green spaces where the water is absorbed and drains back into the oceans. This type of intervention is successful in its use of topographical intervention and pre-existing green spaces. The intention is that this is a short term solution to an extensive long lasting problem, but thus far has proven optimistically successful in that the space and funding were allocated and available for development.

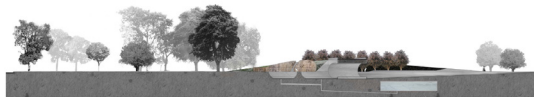
The last site takes place in Houston Texas. Houston is susceptible to flooding because of the four large reservoirs north of the city. From surrounding mountainous regions water runs straight down through the city, cleaving it in two. When the reservoirs become full, the United States Army Corps of Engineers has a system of technology in place, including dams and levees to slowly feed the water back into



the river, Buffalo Bayou, and to the ocean. The site itself is located north of the business district of Houston, in a park also called Buffalo Bayou. This park acts as another catch basin for flooding when the reservoirs get full or when a natural disaster like Hurricane Harvey dumps billions of gallons of water on the city in a matter of hours. Buffalo Bayou fills with water, and because highways run high over the park, driving is still possible and the business district of Houston is protected from flood damage. This is a successful intervention as two hurricanes have emptied into Houston and each time Buffalo Bayou has protected the city and kept large scale damage from happening.

Houston Texas is where each intervention takes place because not only does it allow for multi purpose intervention sites but it has many diverse communities with different needs that can be fulfilled with each type of intervention. Houston is not traditionally located on the coast but rather 45 miles inland, however, flood waters cause a large majority of infrastructural damage in the city annually, including when large storms pass through. Houston has a diverse range of com

munities with a diverse income level as well. Each site, Second Southwest and Canyon Gate have varying levels of income and thus varying levels of strategic allowable resilience, relocation may be available to a wealthier community where a lower income level community may have no choice in relocation and must use a more sustainable path for resiliency.



Above: Long section cut of Evans Way Park cut through the full pipe bridge, showing fast garden on left and slow garden on the right  
Anne Weber



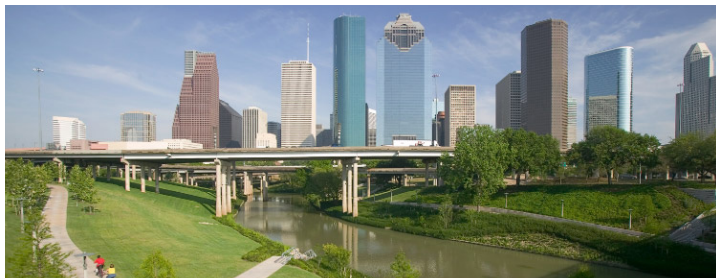
The Cultural Landscape Foundation

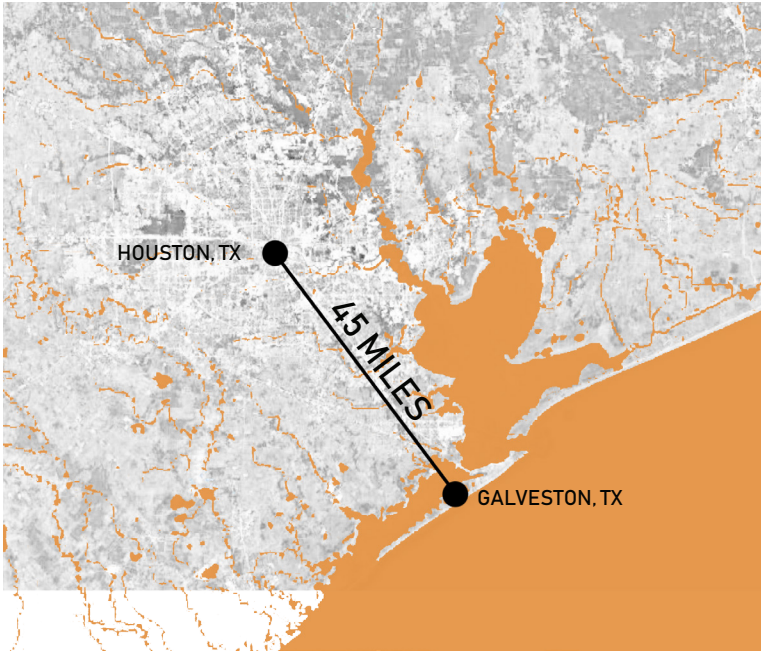
Each site has the opportunity to host multiple types of intervention typologies Policy, landscape and modified built. Each strategy has the potential to mitigate the damages done by flooding and the immediate necessary results to utilize public space during a natural disaster and directly after. Natural disasters affect everyone equally, they do not pick and choose who they affect. What is not equal is each communities ability to respond to natural disasters and flooding and damages. Lower income communities do not have the same advantage as higher earning income communities. The three intervention sites explore the dynamic of both higher income and lower income communities and how different strategies can positively affect the lasting resiliency of each community.

Each site location and amenities was analyzed and then categorized into most necessary typology needs. Either policy, landscape or modified built typology. Between modified built typologies and built landscape typologies a list of specific modifications was created to explore all aspects of both types of typology. A policy intervention was found most useful for the larg

est site, Canyon Gate as well as both landscape and modified built typology, however for the smaller sites although a policy change intervention could be useful, the smaller sites utilize more physical modification traits. For the built typology, floating buildings, resilient buildings, buildings built up on a hill and buildings reinforced with foundations and on the opposing sides the landscape typologies, building up a landscape or removing dirt for a natural decline. Identifying multiple strategies per site allows for the strategies to work simultaneously and because of this the best can be most identifiable. Short of removing and relocating, which is not possible for many citizens in lower income level communities, identifying several strategies that will eliminate the need to relocate is a far more optimistic endeavor and should be explored thoroughly.







**AFTER HURRICANE HARVEY  
WATER LEVELS**



**AUG. 25**

- 12.5' HIGHEST RECORDED WATER LEVEL
- AVG. 33.7" COVERING 1700 MILES OF HOUSTON

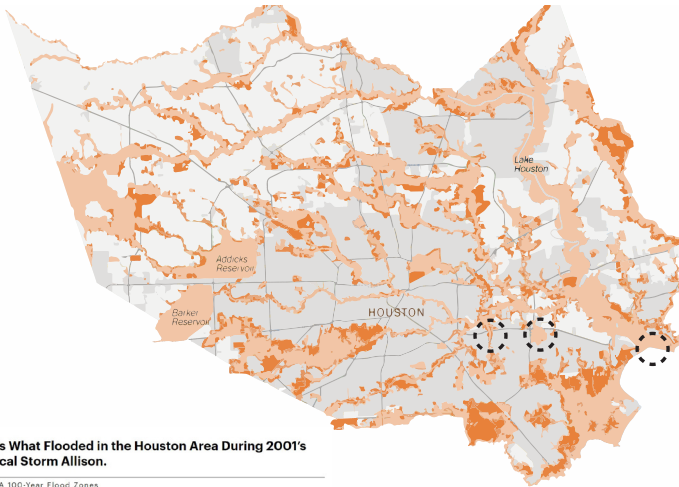
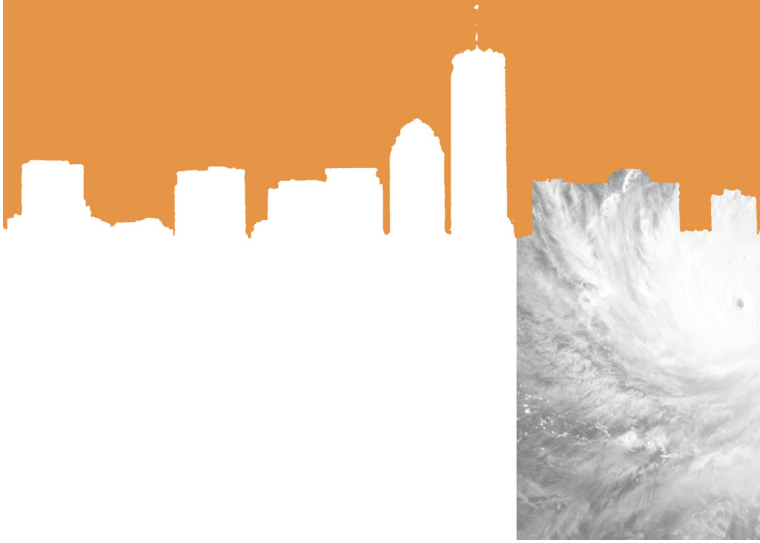
**AUG. 28**

- U.S. ARMY CORPS OF ENGINEERS BEGIN CONTROLLED WATER RELEASE FROM RESERVOIRS

**AUG. 29**

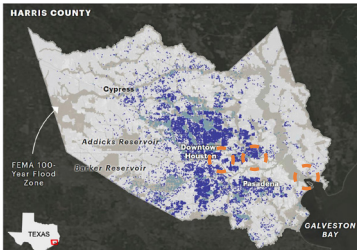
- WATER IN BUFFALO BAYOU AND RESERVOIRS RETURNS TO NORMAL LEVELS

# 1/3 of Houston Flooded during Hurricane Harvey



## Here's What Flooded in the Houston Area During 2001's Tropical Storm Allison.

- FEMA 100-Year Flood Zones
- Flooded Structure Within FEMA 100-Year Zone
- Flooded Structure Outside FEMA 100-Year Zone



Above: Houston Flood Zone Map. Three circled areas are potential sites of intervention  
Left: Houston flood zones during Hurricane Harvey, some three potential sites of intervention are highlighted.

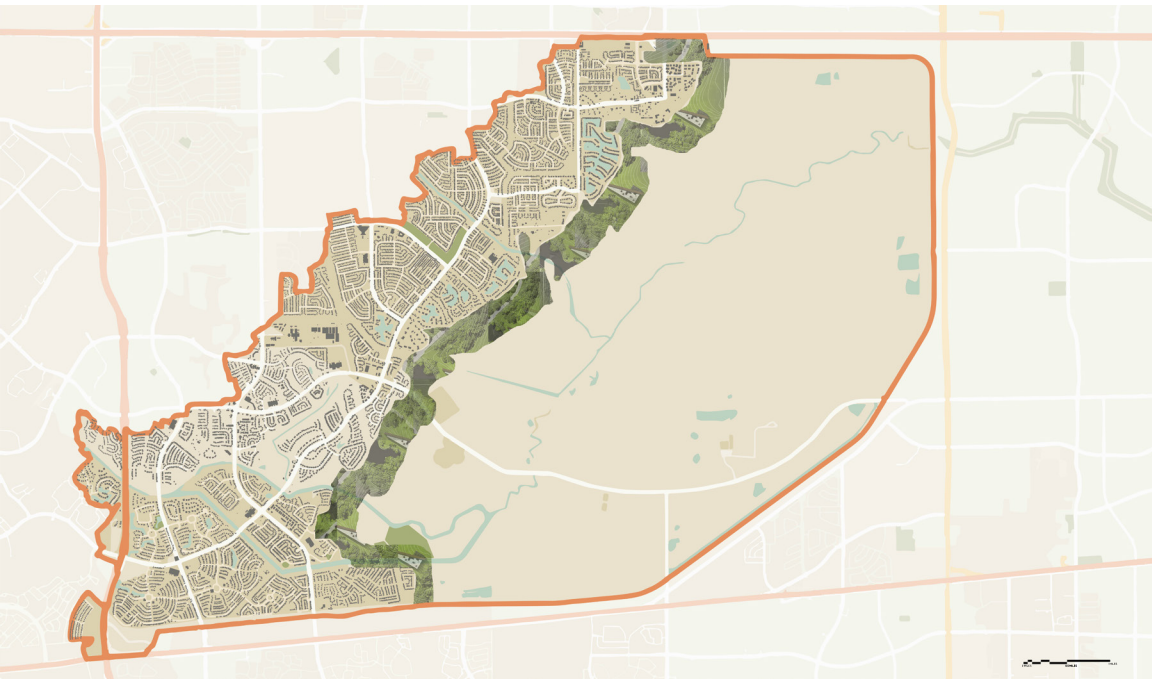
### SITE 3: CANYON GATE

Canyon gate is the largest site, and sits within the border of Barker Reservoir, 40 miles west of Houston. There are four reservoirs in the surrounding Houston area. All are used for overflow rain and flood waters essentially the reservoirs are used for back up catch flow and eventually drain into the Buffalo Bayou river which runs directly through the core of Houston. When these reservoirs overflow, dams and drainage control systems are in place to divert the water further, the idea was that the overflow water would cause less damage to the business commercial corridor of Houston and find its way filling unoccupied space instead. Of course, this strategy was most useful when infrastructure and residential development didn't reach quite as far nor was around at the time of the Reservoir construction. In the late 70s early 80s the border of Barker Reservoir was re-negotiated when the local Texas government decided to sell part of the land inside reservoir. This land was sold to private developers who used the land to develop a series of upper-class neighborhoods, one of which included Canyon Gate. This land was re-zoned to

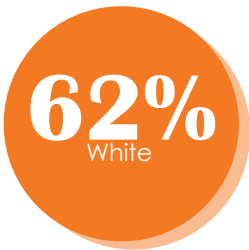
be residential however, this did not stop the reservoir from filling with water after Hurricane Harvey and causing millions of dollars of damage to the homes built inside its borders.

The citizens of this upper-class primarily white neighborhood were not aware their homes were in a flood zone and didn't find out from the developers but rather the gallons of water from a torrential down-pour and the resultant flood waters filling their basements. Inevitably, when their homes flooded the news came to the surface and these citizens became aware of where exactly they purchased their homes. There is an innocence in un-awareness and because of this innocence these citizens cannot be expected to pay for the damage to their homes themselves. They cannot be expected to properly prepare if they are unaware of the location. The argument changes when these citizens are made aware of the situation, the location of their homes, when they are warned of the dangers and now have options.

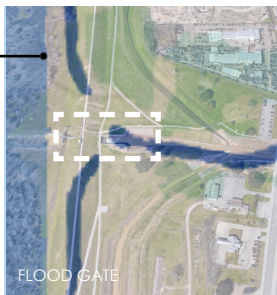
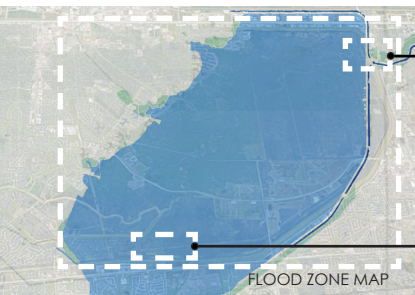




# CANYON GATE



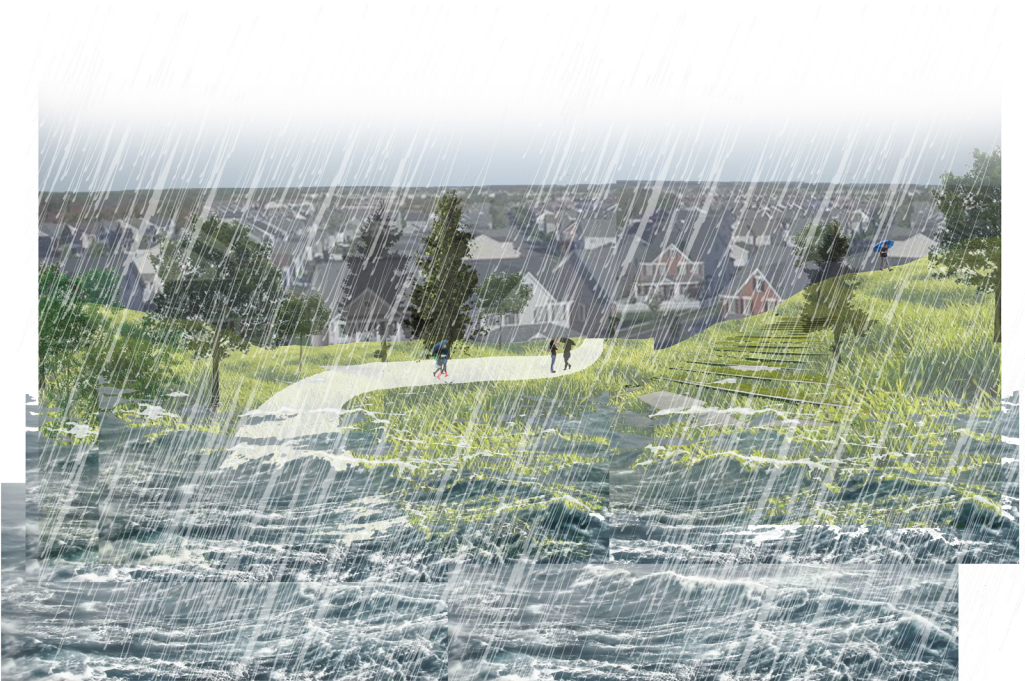
**\$135 k**  
Median Income

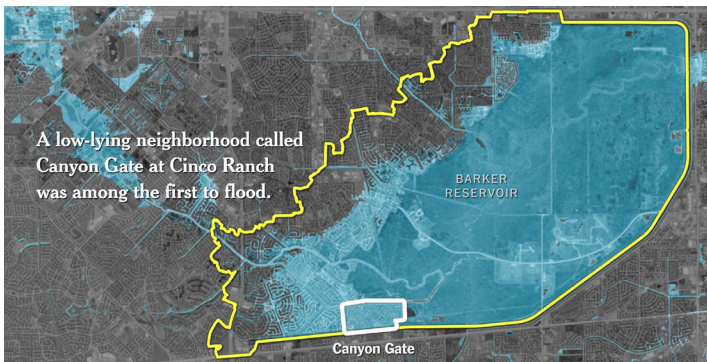


Modified landscape  
typology

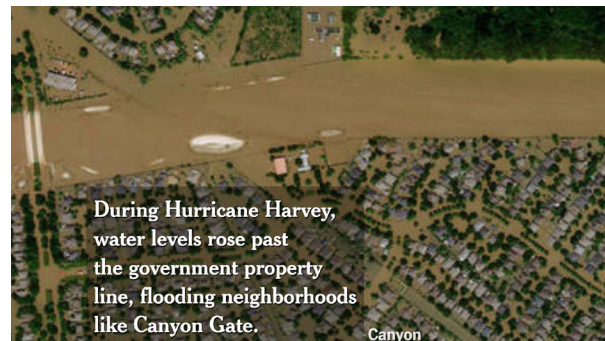
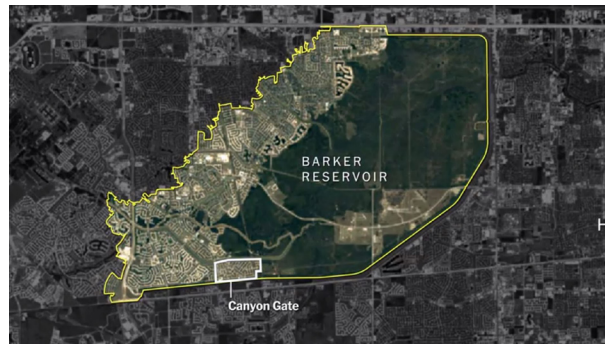
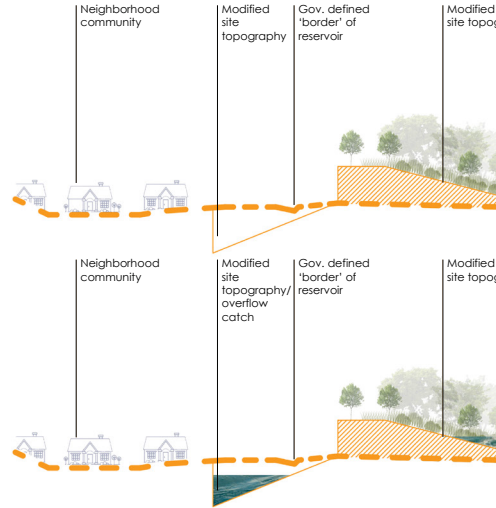
Existing neighborhood  
of Canyon Gate

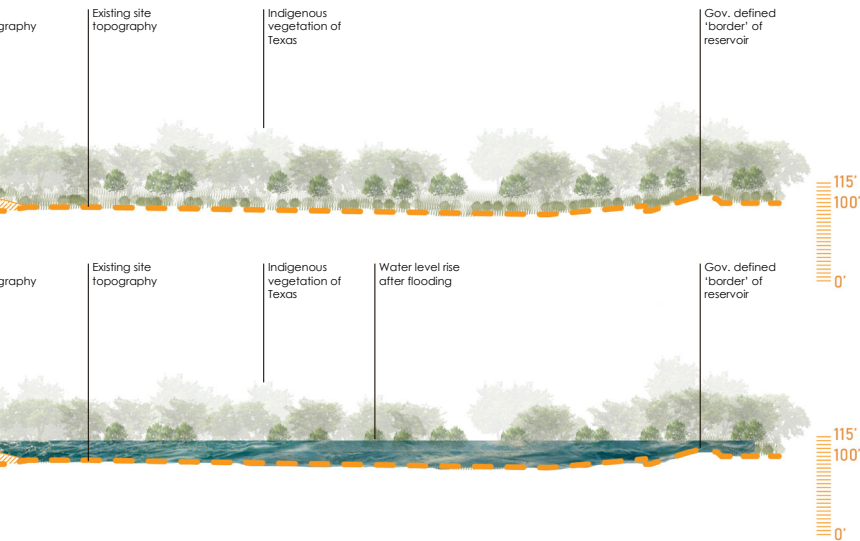
Indigenous  
vegetation of  
Texas





The members of the Canyon Gate community have options available to them that other citizens of Houston do not. Based on the knowledge of wealth and household income information the citizens of canyon gate can move out of canyon gate and find other accommodations if necessary. This is where the policy change intervention is important. In the policy change for Canyon Gate the members of the community are asked to pay for the protection of their houses. The payment is an annual fee that must be met in order to continue living within the community. This payment is used to build, develop, and maintain a protective landscape in the reservoir to potentially save the homes of Canyon Gate.





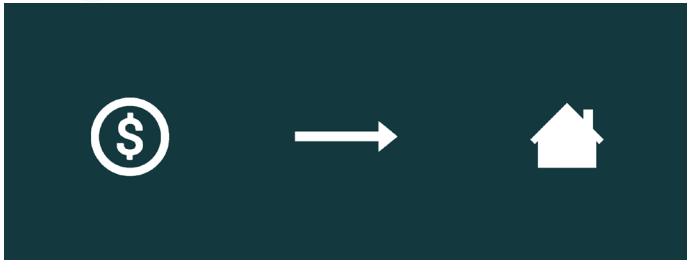
1/128" - 10"

# PAY AND STAY

AND

## A POLICY CHANGE INTERVENTION

- Homes located within the border of Barker Reservoir are not protected against future flooding. Protection both physically and politically will be established for citizens of Canyon Gate to remain in their homes and in the community.
- This policy intervention intends to collect revenue from the citizens living within the borders of the greater reservoir to fund the implementation and maintenance of a border to protect against flooding. Thus minimizing flood damage and its costs as well as decreasing a life threatening situation.
- Citizens who pay this annual cost will be protected by the landscape during flood weather, saving thousands of dollars.
- Citizens who choose to not pay this annual cost will be required to locate elsewhere outside of the border of the greater reservoir area.



## SITE TWO: SOUTHWEST

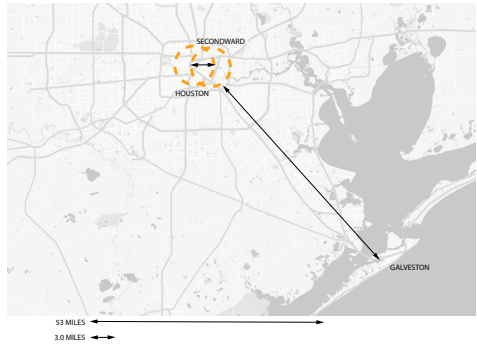
The second site is located 25 miles east of Houston, in Southwest. This site sits on the edge of Harrison County in the bay leading to the ocean. This particular site is surrounded by tall freeways and water on all sides. The landscape intervention is intended to build the landscape from the waters edge and up several feet at a gradual angle. The majority of this site sits flat which is ideal for modified built typologies to use the site before and after a natural disaster.

Before, it can be used to house a farmers market, host a school and garden area. However, after the rain and flooding the site can be used as a meeting spot for rescue or community reach. Southwest houses one of the lowest income levels in the Houston and because of this it makes for a perfect spot for both modified built typologies and landscape typologies. South west is surrounded by many community assets, grocery stores and libraries, however, non of these buildings cross into the site. Located several miles from the core of Houston this would not be an ideal spot for a commuter to use.

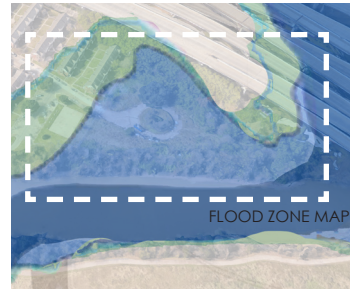
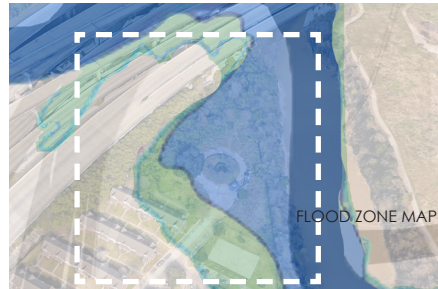
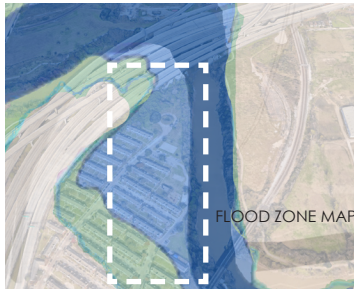
The intention for this site is to be used as a land bolster to defend the surrounding neighborhood against rising flood waters from the bay. Because this specific location of land is particularly susceptible to rising waters from the ocean the main protective tool will be a built modified landscape with a gradual uphill.



# SECONDDWARD



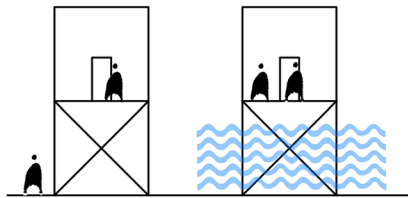
**\$25 k**  
Median Income



Community Garden/  
resultant  
public space  
activity

Modified  
built  
topography

Indigenous  
vegetation of  
Texas

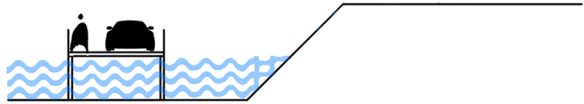
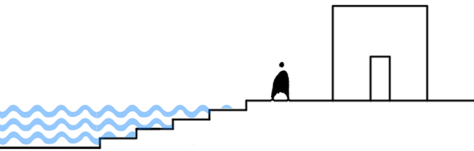
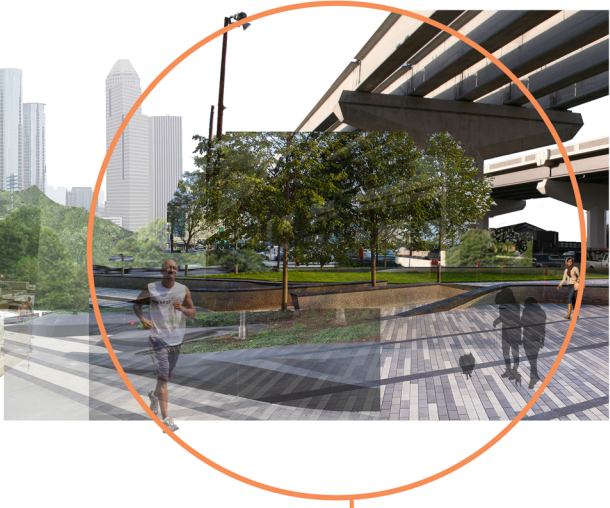


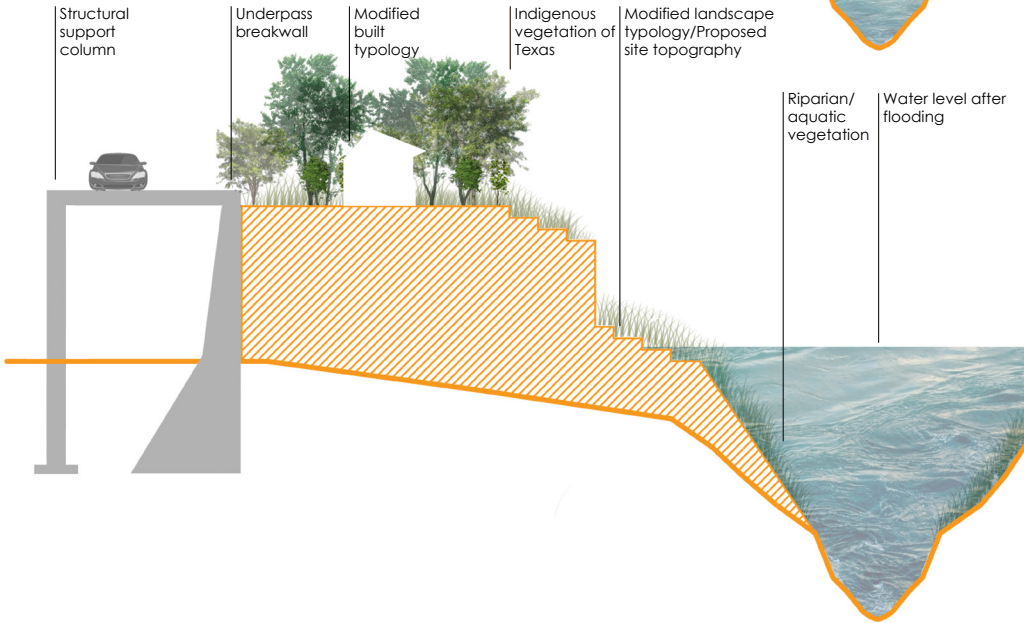
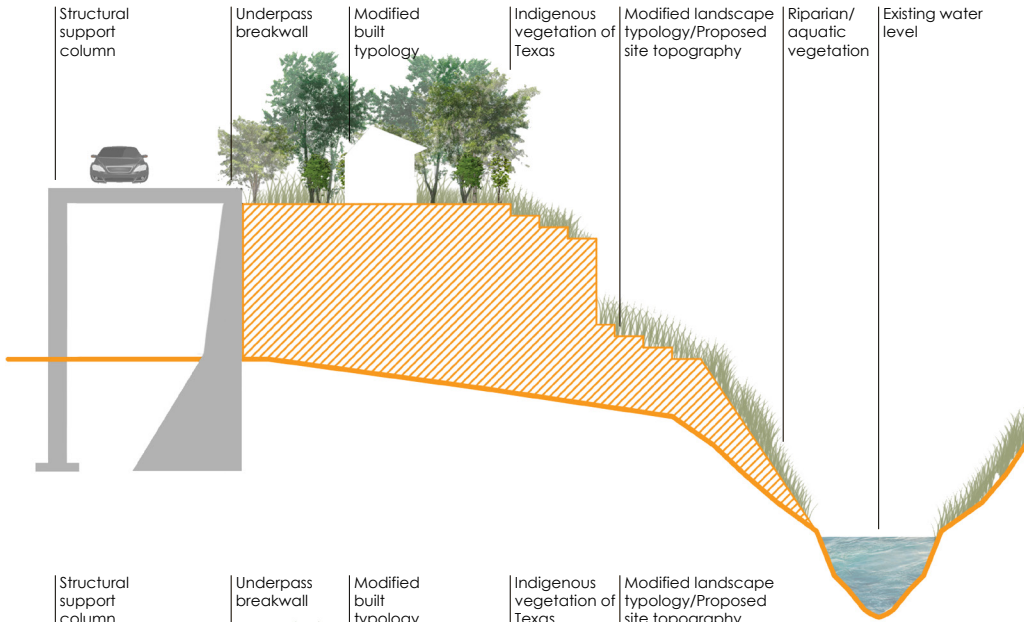


Modified  
landscape topography

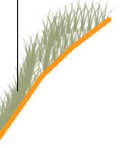


Modified  
built topography

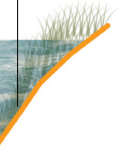




Existing site  
topography



Existing site  
topography



1/16" = 10'

## SITE ONE: SECONDDWARD

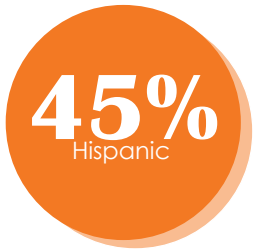
Secondward is the lowest income community, sitting the bend of a river, adjacent to a highway underpass and 2 miles from the city made of primarily government funded housing. This low income neighborhood sits within the 500 year flood zone, and in 2017 was demolished by hurricane Harvey when it ripped up the coast and through Houston. As it was rebuilt in the same area no other preventative measures have been taken.

ular hours it could primarily run on the first floor and during a flood the main activities can be moved to the second floor.

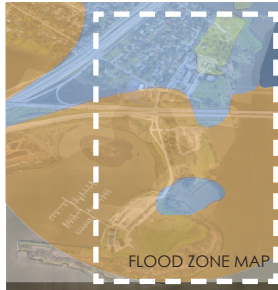
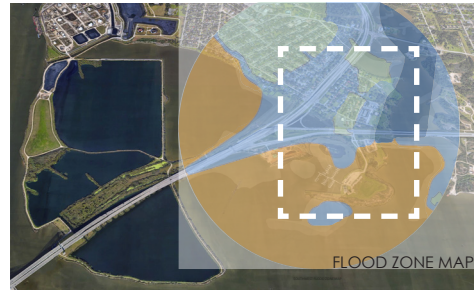
The intention for Secondward is to add landscaping between the river and the start of the housing buildings, this will create a band of resilient indigenous landscape to hold flood waters before it reaches the buildings. The landscape would be built up to run parallel to the highway to the east and would function as a barrier to the rising flood waters. An additional community building may be useful along the river to act both as a useful community building during regular times and a flood resilient building during a flood. If this building were to act as a farmers market then it could function on two floors, during reg



# SOUTHWEST

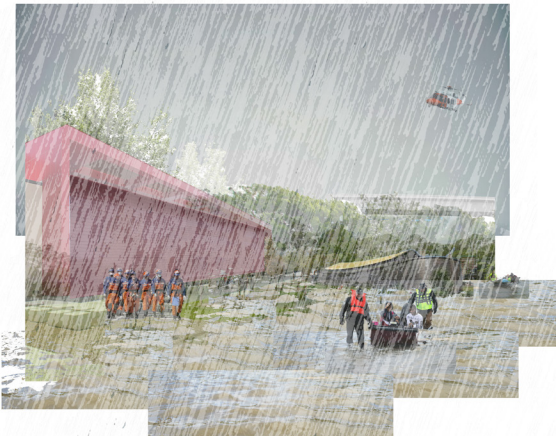
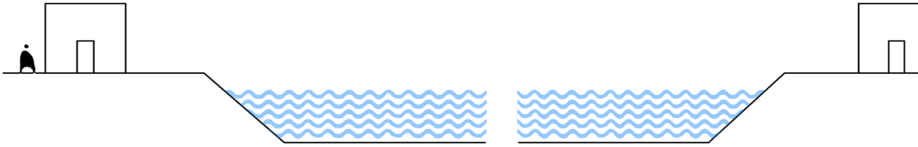
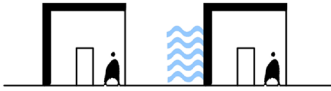


**\$46 k**  
Median Income



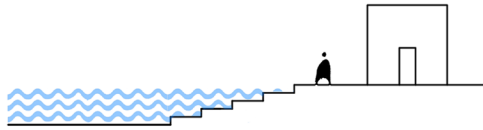
Modified  
built typology

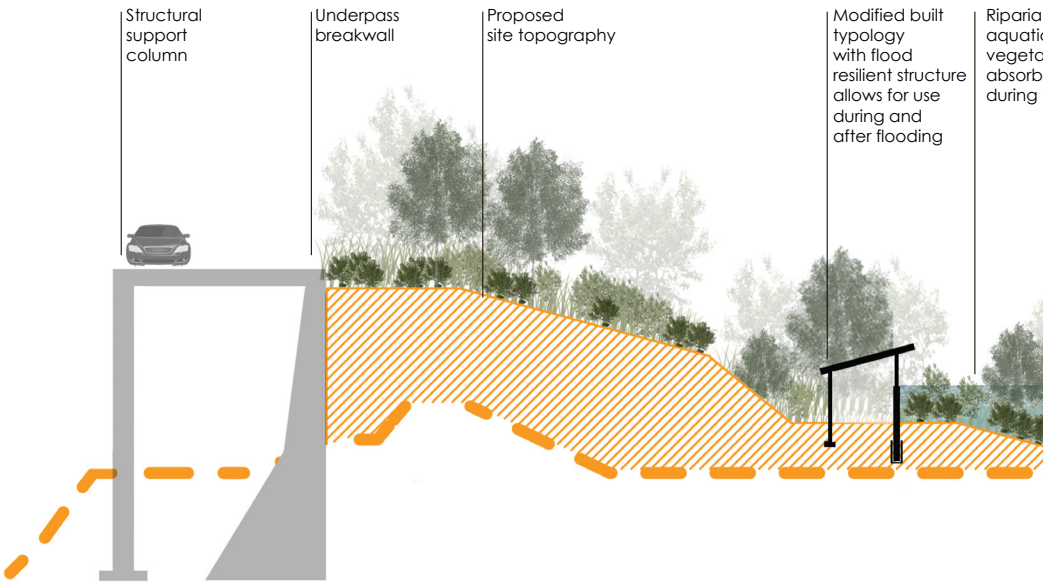
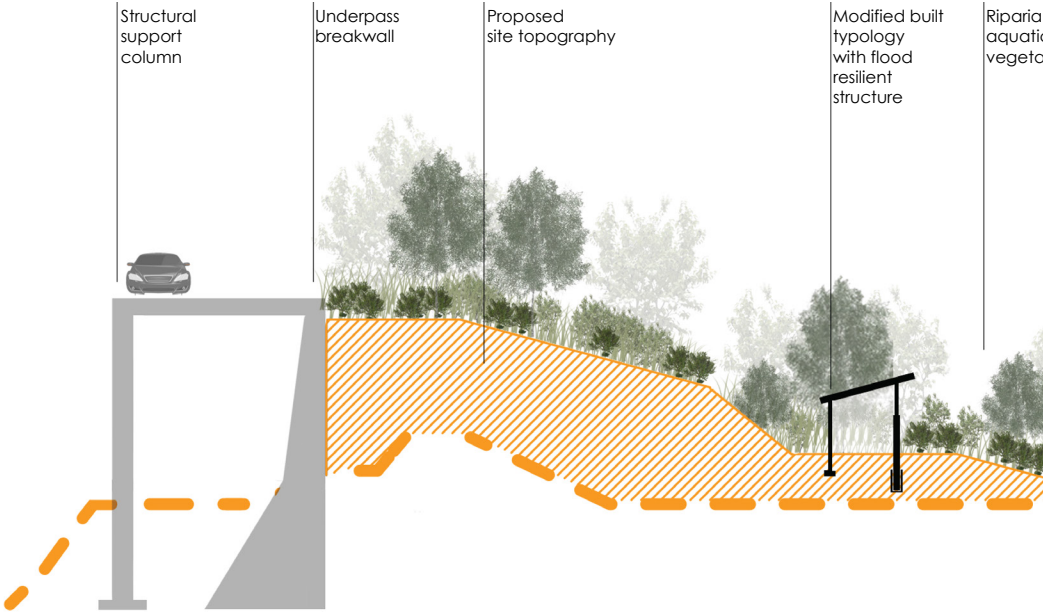
Fishing/  
optimal  
public space  
activity



Farmers market/  
optimal  
public space  
activity

Modified  
landscape typology

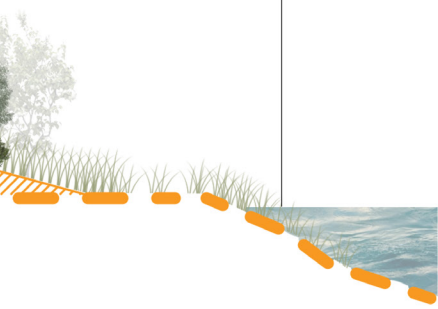






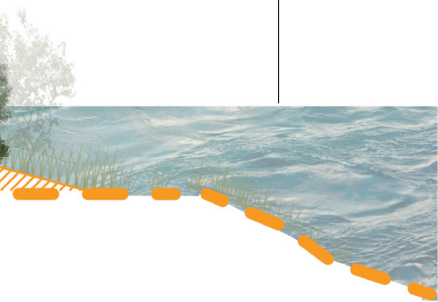
n/  
c  
ation

Existing  
water level



n/  
c  
ation  
s water  
flooding

Water level  
after flooding



1/32" - 1'0"

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- <http://blogs.worldbank.org/nasikiliza/creating-a-flood-resilient-city-moving-from-disaster-response-to-disaster-resilience-in-ibadan> - resilient projects overseas can offer more, especially when, economically speaking they are not as prosperous nor are they as populous

