Walkable Hydrology

Creating a New Public Realm Ground-scape for New Orleans

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Abstract

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The City of New Orleans and its response to water has been characterized by exclusion and separation. Currently climate change has made the exclusion of water from the city streetscape impossible, large rain events resulting in localized flooding have become a frequent occurrence. These events cause the public to be separated from the public right of way. The thesis focuses on developing a public ground-scape that reintroduces the public right of way to its geologic character below. The design explores developing a system of hydraulic tile modules that function to detain excess water from large storm events, allowing it to be absorbed by the surrounding soil, reimagining a public right of way that provides space for water and people to occupy.

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Acknowledgments:

Thanks To H.J. Bosworth, Jr. P.E.

My Civil Engineer, Historian and Hydraulic Specialist, and Dad,

who assisted, encouraged, and has always inspired me.

Thanks to all of my friends and family,

For the encouragement, love, and laughter.

Thanks to:

Janice Barnes, Charles Sterkx, and David Waggonner,

For the insight and encouragement.

Image of parade goers on Mardi Gras day.[i]

"Sponge City"

Sponge City,
Created by Author

(Figure 1.) Aerial collage of New Orleans 1965 & 2005

Chapter 1: Introduction

New Orleans has always been a city rich with water ever present in its air, soil, and natural features. The water's presence and the city's coastal location means that flooding has been a constant recurrence within the city's timeline. (see Figure 1.)[2] The city has always experienced degrees of flooding, however recently the flooding is happening more frequently and without the accompaniment of a natural disaster. The current systems of flood control in the city are only designed to be effective against flooding as an occasional disastrous occurrence. The city has always been defined by its cohabitation with water, however that unification is compromised when climate change is causing flooding to become a constant feature within the urban landscape, rather than an occasional inevitability.

Issue

With each passing year the effects of climate change are becoming more apparent and their consequences more severe. In 2018, the Louisiana region has acutely felt an increase in rainfall compounded with the rising sea levels.[3] As a result many costal cities have experienced regular and devastating flooding in the past 20 years, affecting millions of homes and causing billions of dollars in damages to city infrastructure and local ecology. New Orleans is one of these cities, and the continuation of these heavy precipitation events means that large area of the city are occasionally brought to a complete stop. While improvements have been made, the current urban infrastructure of the city does not have the architectural nor the ecological resilience to keep up with the current flooding.

In the past, the relationship of architecture and water in New Orleans has been one of barriers, diversion, and elevation. (see Figure 2.)[4] Architects and engineers have built walls, drainage systems, and modified structures in efforts to maintain the city's capacity for survival. However, circumstances have changed and the city floods regularly. The city's water management method of preparation for an inevitable event is no longer effective against water as a regular occurrence. Past methods cannot be effective for a new environment.

Argument

Water will occupy the city, but architecture can negotiate the methodology of occupation.

Since its founding New Orleans has been shaped by water[5] creating a unique and complex urban fabric. However, many of the alterations done in the name of water management have failed to acknowledge the role of organic elements within the city's fabric, and as such have not fully engaged the potential of the urban streetscape to respond to the current climatic needs.

Contextually water has been dealt with at the city's edges, however the majority of current flooding is caused by intense precipitation events that affect all areas of the city. Thus, a system of response can be most effective if implemented within the city's urban fabric, especially in areas that, due to their geographic location, are more prone to flooding.

At present, New Orleans is left with a natural character and constructed character that work independently of one another within its urban fabric. The future development of the city is now a conversation about cohabitation, between water and people.[6] Water will occupy the city and architecture is in a position to negotiate the methods of that occupation using the city's unique natural and built characteristics. This thesis proposes the design of grounds-scape that integrates the natural and constructed character of the city.

(Figure 2.)

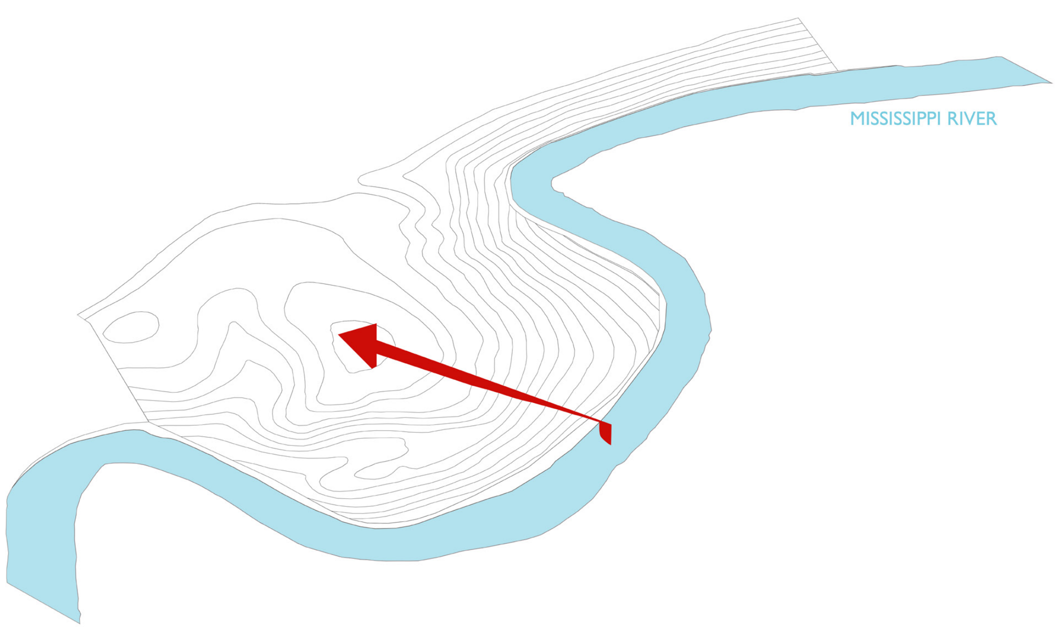
Chapter 2: Literature Review

Water and The City

The role of water in creating and developing the City.

New Orleans owes its existence to its relationship with water. The city is a product of the river, the land forming processes of sedimentation, that deposited sand and silt onto the landscape, was caused by the flooding and meandering of the river over time. These processes formed the ground, vegetation, and ecosystems of the city.[7] The city's natural systems and human modifications have evolved together to grow the city and both have inevitably been shaped by their response to water in the city.[8] Currently New Orleans is in a tenuous environmental situation that requires better communication between its ground and built systems.

Andrew Colopy argues that there is a causal relationship between the city's development and its environment.[9] Starting with the first European settlements in 1708 to the thriving cosmopolitan city that arose in the early 1900s, the urban fabric of the city followed the banks of the Mississippi River and the natural levee. Sedimentation along the river banks created natural levees that were higher than surrounding lands and rich in nutrients.



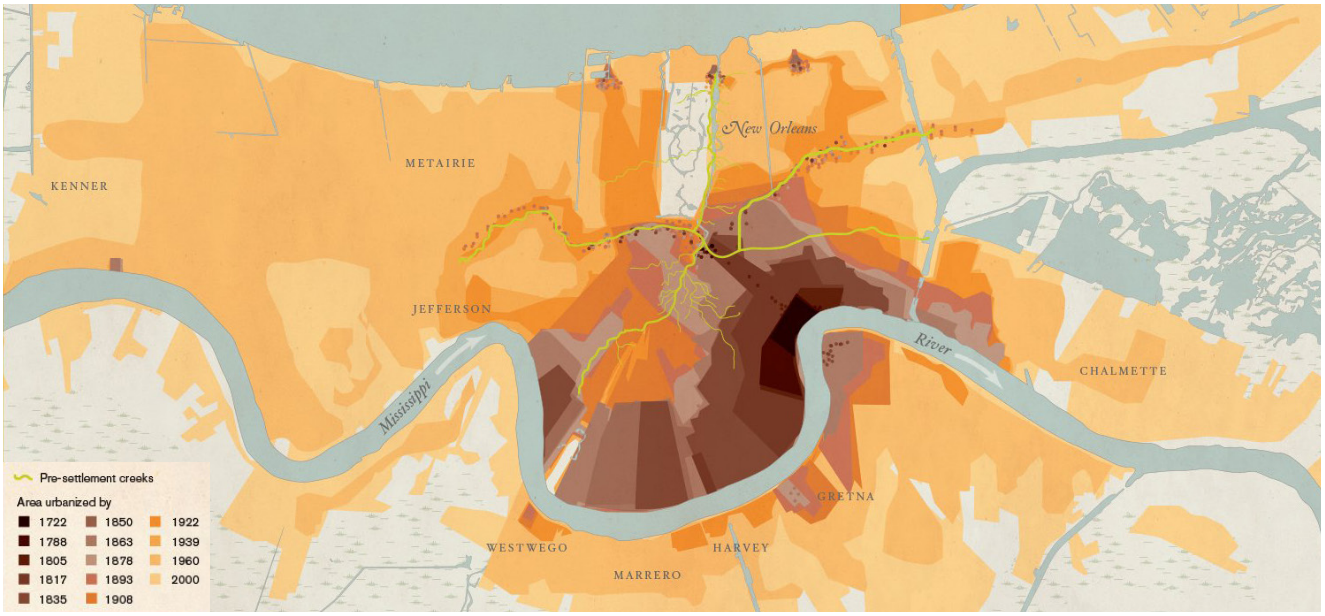
(Figure 3.)

The topography of the city is such that the highest land can be found along the banks that form the crescent shaped river bend where it was founded, with lower lands sloping away from the curve to a center point and then back up again to meet an old ridge opposite of the river. Thus, the city's overall shape is that of a bowl with the river on one side and Lake Pontchartrain beyond the ancient ridge. (see Figures 3. & 4.) [10]

These natural levees and topography drove property delineation and development in a pattern that followed the river's curvature, developing on top of the only dry land existing at that time.[11] This natural constriction of development persisted for the city's first two hundred years of urban growth.[12] (see Figure 5.)[13]

Living with Water, relationship and methodology

(Figure 4.)



(Figure 5.)

New Orleans was originally formed around processes of water yet developing the means to control water is fundamental to the city's prosperity and survival,[14] The desire to control water entering the city has meant the creation different methodologies for living with water, beyond responding to the city's topography. Water's power has been a major site constraint guiding strategies of urban development, with the urban fabric created being a mixture of hydraulic necessity and urbanistic desires.

Originally, these strategies acted as small-scale additions to the natural environment that were integrated at multiple levels of the urban fabric. The streets had a much more narrow footprint that left room for water, canals were created to carry water, parks located on low land to act as sponges for inevitable water build up, and houses used strategies of mezzanines or raised piers to make room for water within the footprint of the home.[15] These strategies can be traced along the river's edge in the older architecture and urban layout. This original plan that hugs the river's crescent shape, has been left largely untouched with new development following the old patterns. Its acknowledgement, or rather constrictions, of the geographic reality has given it architectural resilience, allowing the area to grow old and beloved.

Inevitably, technological advancements of the 1900's would allow urbanistic desires to surpass geographic limitations. The city would grow independent of its geography, ignorant of its unique ground condition and ignorant of traditional urban strategies, with the expansion of the city beyond the river's banks becoming increasingly generalized.[16]

Environmental conditions and the city's image

New Orleans's unique geological condition has also played a large part in defining the cultural character and image of the city. The geology has meant that many architectural features of the urban fabric are climatically responsive. A pattern of architectural responsiveness has left many areas of the city with a visual uniformity. Even areas developed in the twentieth century retained building types of the nineteenth, with held on to building types of the after the advancements of the twentieth century nineteenth, technological advancements easing their cost and expanding the possibilities of cosmetic

However, this commitment to traditions can often unnecessarily be mixed in with ideas about idealizing and adhering to past typologies. The fault in this is that past typologies respond to past geologic realities.[22] Now we are faced with new geologic challenges; past methods of responsiveness are made insufficient.

Future with Water: evolved methods and ideas

Since the late end of the 20th century new ecology research, climate change, and risk assessment have influenced the methods and perceptions regarding water management.[23] Traditionally water management strategies have centered around constructed methods that prioritize providing safety of home and property to survive an eventual catastrophic event. This notion of relying solely on artificially constructed systems to survive, has begun to shift recently.[24] The twenty first century has broadened the scope of what water management can be, by proposing the integration of urban planning and ecology into the methods of water control and retention. An integrated approach and methodology

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Opinions and strategies of water management, focused on retention and utilizing ecology do not currently have a place in the city of New Orleans.[26] The city has not conformed with contemporary water management ideas, and as such continues to mostly use constructed systems independent of the processes and conditions of the surrounding ecology and geology.[27] The result has been a struggle between constructed systems of water management and the ever increasing power of water, ultimately these systems are proving to be insufficient, as evident in the increased flooding of the city from heavy rains, due in part to their lack of integration and responsiveness. Integration as the component missing from New Orleans's current approach to water, can potentially be used to create a new system that can provide a more sustainable environment and enhanced the quality of life for the city's future.

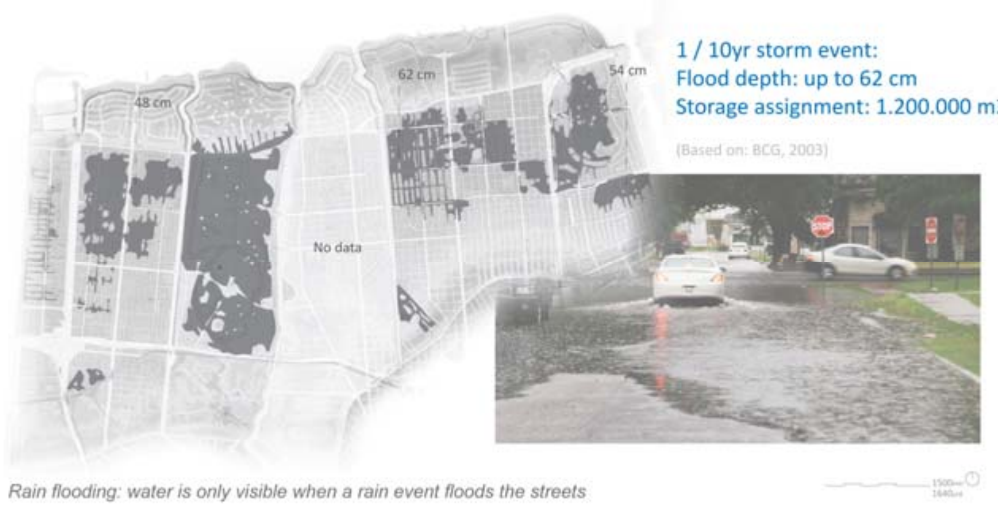
In order to achieve this desired integration the following will be an examination of the elements that make up the natural and built character of New Orleans.

Environmental Character

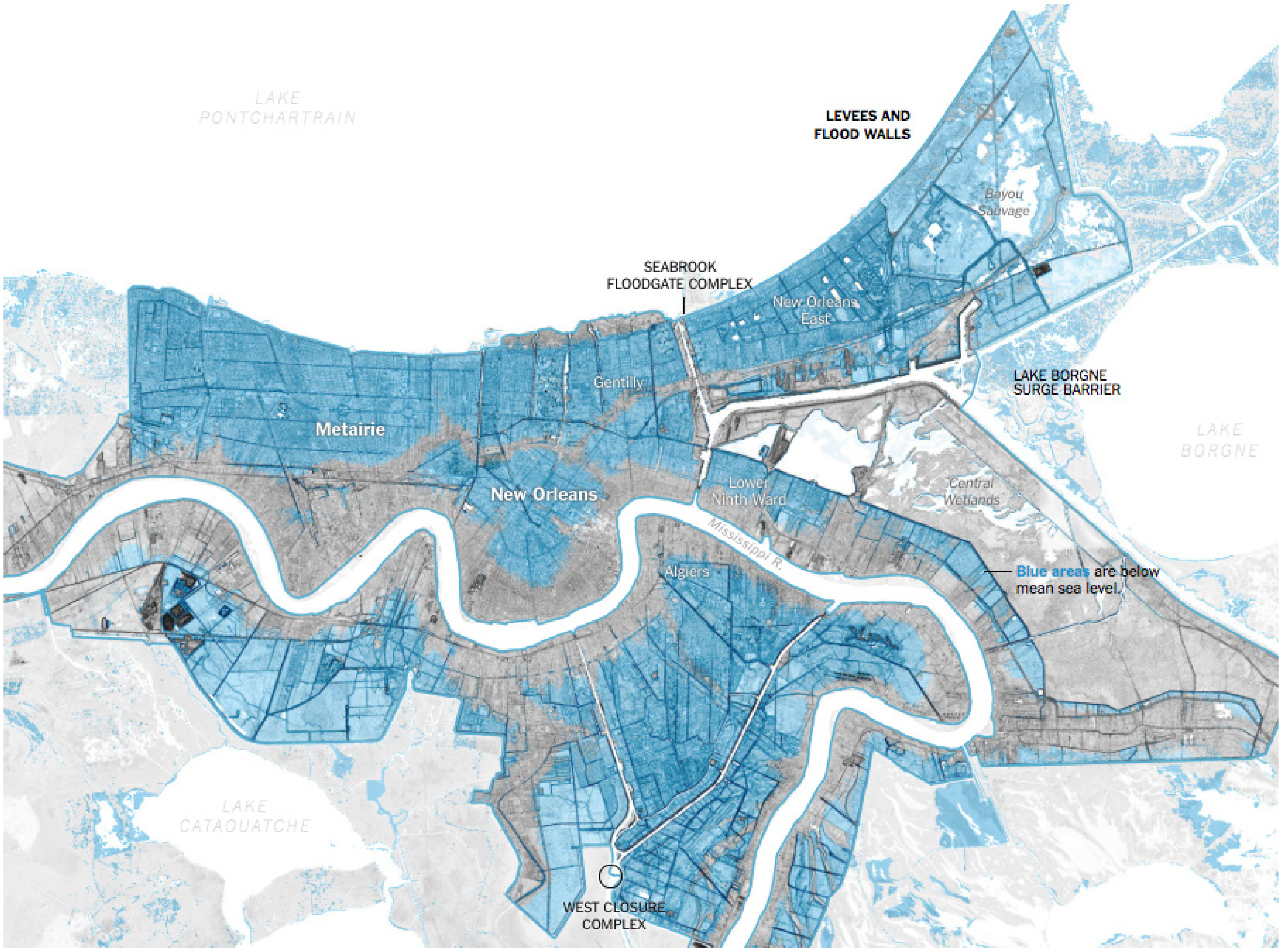
Climate

New Orleans's unique environmental character begins with its semi-tropical climate where the average temperature ranges from 12 to 28 degrees Celsius(50 to 82 degrees Fahrenheit).[28] The city experiences long hot and humid summers with brief mild winters. The effect on the geology is an acceleration of soil transformation by speeding up decomposition rates of surrounding vegetation while also keeping soils saturated throughout the majority of the year.[29] The city's climate facilitates the retention of moisture in the soil and populates the air with water. The annual precipitation amounts average around 1572 mm (62 inches) ,[30] and the rainfall events are characterized by annual intensive rainfalls that can reach up to 75 mm(3 inches) in 24 hours and 100mm(4 inches) in 48 hours.[31] (see Figure 6.)[32]

Climate change means that these large rain events are growing even more intense, "based on observations, 2004 observed a linear trend of an increase of 26% during heavy precipitation events-separated by longer periods of drought (Boesch, 2002)"[33] Over the past decade, events of extreme participation have occurred more frequently, (Faiers et al 1997; NASA Earth Observatory, 2007).[34] In 2010 these large volumes of water accumulated during short-term intense weather events, often exceeded the capacity of the current water management system's capacity, causing flooding and property damage.[35]



(Figure 6.) (Hermens 2010 38)



(Figure 7.)

Water, soil, and vegetation

These precipitation patterns influence[36] the soils ability to absorb water and foster vegetation. The soils relationship to water influences the growth of native vegetation, and in turn vegetation affects how the soil evolves over time. Richard Campanella explains that soil and water co-evolve in an effort to achieve a sustainable water balance.[37] Soil composition dictates how it will receive water, typically the coarser the soil (sand dominant) the more air gaps can be found between the particles, creating more space in the soils composition for water to filter through.[38] Allowing organic materials to decompose more rapidly.[39] In contrast, finer grained soil with more clay will have fewer air gaps, meaning that the majority of water coming to the area will accumulate and occupy on top of the ground.[40] This lack of water filtration causes the surrounding plant residue to experience any oxidation or decomposition, causing the soil to be rich in both water and organic material.[41]

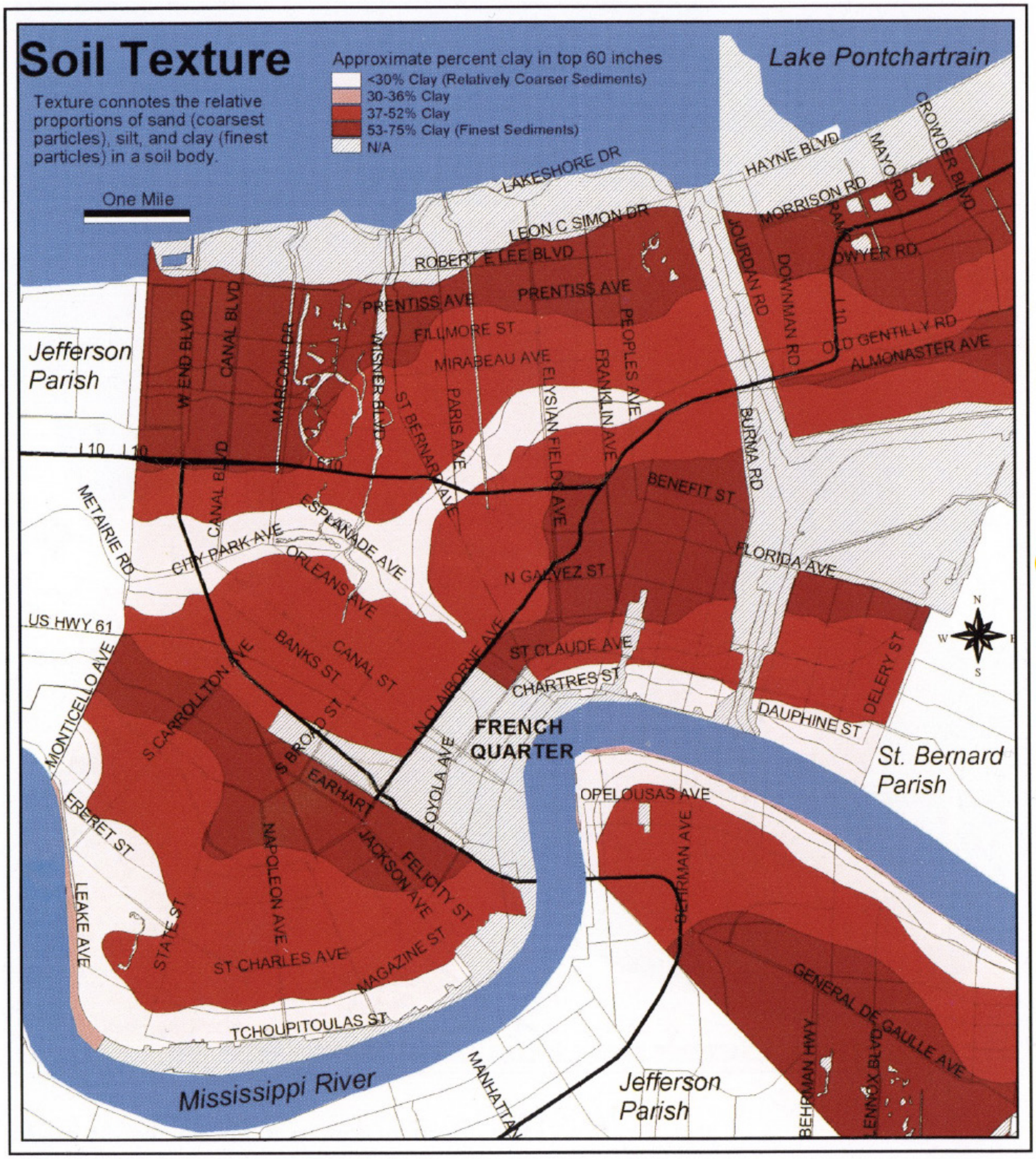
In New Orleans the coarser soils are found in the high ground of the natural levee along the river bank, and the finer soils are located in the lower areas, typically below sea level, of former back swamp land.[42] (see Figures 7.[43] & 8.[44]) Campanella observes that areas of low elevation are not only at an elevational disadvantage but also a ground resiliency disadvantage. However finer soils are more typical in most areas of New Orleans.[45] The composition of finer soil being rich in organic materials means that the city's ground condition is not simply a surface but what Companell calls "a natural body composed of minerals, organic compounds, living organisms, air and water in interactive combinations produced by physical, chemical and biographical processes."[46] New Orleans's soil is a rich fabric containing processes and combinations of the city's natural condition.

Vegetation in New Orleans creates its own ground layer that captures large amounts of water. This helps to reduce the stress and effects that rainfall has on soil. By acting as a porous feature in the ground condition, vegetation is able to move water into denser soils, making them more capable of water absorption.[47] In regard to water management, vegetation can be a tool in developing new ways of ground treatment that protects existing soils and assists water retention.[48]

Human Influence

Human modification of the natural character has impacted the ability of the ground condition to enact its natural processes of stabilization through systems of elimination. Donald Watson and Michele Adams described how the drainage and deforestation of the original back swamp has depleted the area of a large portion of its organic material, altering the way that water interacts with the ground.[49] Without its organic material the soil is left to compact and subside.[50] This result is responded to by adding no native soils and materials back to the ground-scape, excavation some areas and building up others.[51] Foreign additions to the ground have regularly brought with them non-native organic life that have ultimately affected the soil, from termites to banana trees.[52]

At the time of its creation, the drainage system was a world class technological marvel and the areas being drained were at the fringes of the city's footprint.[53] Drained around the beginning of the



(Figure 8.) (Campanella 2006 42)

twentieth century, the former back swamp is now a completely urbanized area completely altered from its original natural character.[54]

Constructed Character

Foundation of the City

The foundations of the built fabric of new Orleans rests on its soil, constructed through a process of addition. The natural organic ground was stabilized to create a modified ground that is a hybrid of organic processes and human modification.[55] This combination is exemplified best by digging up the ground. The city is not yet old enough to have many distinct soil stratification levels, with the exception of the levee. Distinct layers of soil stratification can be found are located around the historic districts as remnants of the last 300 years of human occupation. Digging into the historic French quarter area of the city, the layers Richard Campanella identifies in order from top down as two layers of concrete, old paving stones, and brick fragments from the nineteenth and eighteenth century.[56] Modification to the surface condition of the city must acknowledge the complex character of the ground beneath.

Prior the 1950's, the city was built on top of the natural levee deposits found along the river's edge.[57] The 50's brought about the opportunity arose to build on recently drained former back swamps and as such new strategies were tested in creating stable foundations. Originally concrete slabs were tested resulting in sinking, tilting, and breaking.[58] After that the strategy, that is still used today, was developed of driving wooden piles into the ground up 40 feet deep through the unstable soil of the former swamp land to reach stiffer soil condition farther down allowing the piles to provide stability for slab foundations.[59] The practice of using pilings to stabilize slab foundation eventually became a law for all of the city's built works, however, there still was the need to fill up to three feet of land in order to elevate and level the site before construction.[60]

Alteration of the ground condition through methods of layering and excavating has hidden its organic condition from the urban streetscape. Paving over the natural soils severs them from the atmosphere while also directing all water to constructed drainage systems.[61] Drainage, deforestation, paving, and flood control have created a new environment in New Orleans with the built and natural elements inseparable.[62]

The levees

The more extreme example of human modification to the soil is the augmentation of the natural levees, severing the Mississippi river from its natural distributaries and causing the soil to be deprived of the rivers replenishing sedimentation process for well over a century.[63] Levees and other constructed water management systems in New Orleans perpetuate a destructive geologic cycle.[64] The ways in which the systems are enacted and built regularly cause damage to the city's natural character, which then makes the city more vulnerable to climatic events, due to the damage done to its natural resiliency. The cycle then ends with the city needing more protection than before. The built water management system attempts to protect the city from an environmental catastrophe while simultaneously damaging the city's natural character.[65]

Strategies and effectiveness

Never was this cycle more apparent than in the wake of hurricane Katrina. The catastrophic flooding that happened as a result of the storm and the failure, through design errors, of the built water management systems, brought attention back to the city's bowl like topological condition.[66] Built systems of water management systems have used an approach of making "bigger and Better" protections at the rim of the city's bowl.[67] Post Katrina popular opinion has supported enacting bigger and more elaborate levees assisted by a new delta for the Mississippi river and artificial wetlands with the attached price tag of fourteen billion dollars.[68]

The approach of building protections at the cost of natural systems has left the city with a dependence on relatively unseen rigid fortifications of bulwarks, levees, and other rigid defenses built by the government.[69] The city has lost its ability be responsive to changes in the environment, while the city's geologic and ecological character have reverted to their original dynamic state.[70]

Strategies from abroad

Conversations for engaging more responsive water management strategies that engage the natural environment, have started by reaching out to other areas of the world that also have a close relationship with water. Projects such as Dutch Dialogues brings in some of those twenty first century ideas about water management into the city of New Orleans by looking at strategies found in The Netherlands.[71] While this and other knowledge sharing programs help broaden the conversation, they should not be seen as justification for repeating foreign strategies into the urban fabric of New Orleans. The Netherlands and Louisiana are both water rich areas, but they do not share similar geologic or climatic conditions. They also do not share the political limitations that come with facing issues that are not shared by the rest of the nation, thus limiting the support and funding applied to such issues.[72] These conversations have brought to light the importance and need for New Orleans to develop solutions that respond to the unique conditions found within the city.

(Figure 9.) (Zalige Bridge, 2016)

Chapter 3: Methods

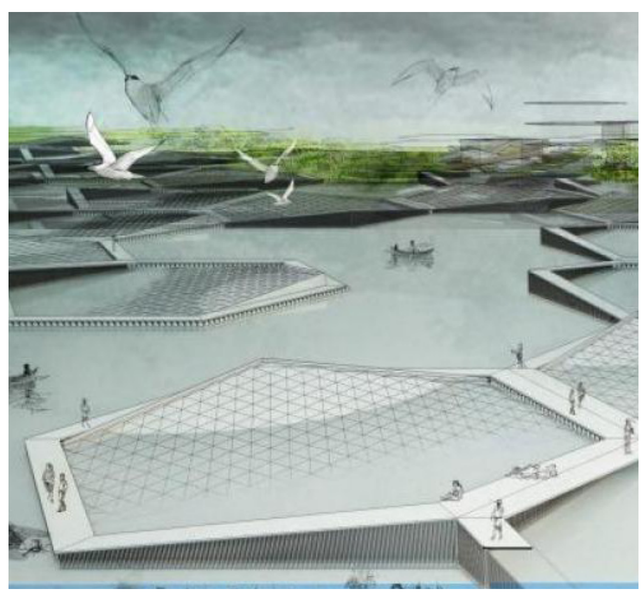
Precedents

Numerous projects have been proposed that begin to integrate constructed forms with fostering the creation, revitalization, and retention of environmental elements. While few projects attempt to engage an existing urban fabric, they still reveal methods of intervention that can be successful for integrating systems. These resulting methods involve elevation, layering, and retention of both constructed and environmental components. (see Figure 16.)[73]

The Zalige Bridge in The Netherlands, involves varied elevated platforms along the bridge's path such that seasonal rise of water levels means that certain areas of the bridge are periodically underwater. The bridge uses water levels to change the users experience.[74] (see Figure 9.)[75]

The CALTROPe project is an experimental design project seeking to invoke positive and productive change to the landscape in critical areas.[76] The project is constructed geometric units that serve to foster the development of mangroves while slowly disintegrating over time with a complete return to nature after forty years. Ultimately the system uses a simple built form to foster their own cohabitation with natural elements in order to repair and replenish the landscape.[77] (see Figure 10.)[78]

(Figure 10.) (CALTROPe, 2015)



(Figure 11.) (The Jacques Rougerie International Database, 2015 RHIZOPOROUS)

(Figure 13.) Typical conditions within the public right of way.

The Rhizoporous project[79] is a project proposal dealing with the issues of sea level rise and extreme weather conditions by creating a complex building that acts like its own self-sufficient island system along coastlines. Producing its own goods and service for both humans and the environment, also inspired by the Mangrove, the project seeks to develop its self-sufficiency by hybridizing human and natural services to serve both humans and the environment.[80] (see Figure 11.)[81]

Goals

The goal of this thesis is to design an architectural strategy that creates areas for both human and water occupation, through a methodology of hybridizing the city's existing layers of character. The hybridization would result in a type of urban occupation that engages the ground-scape by acting as a layer in the urban fabric of the city that acknowledges new environmental challenges. A layer that combines the city's dynamic natural character with the potential of new and existing constructed systems.

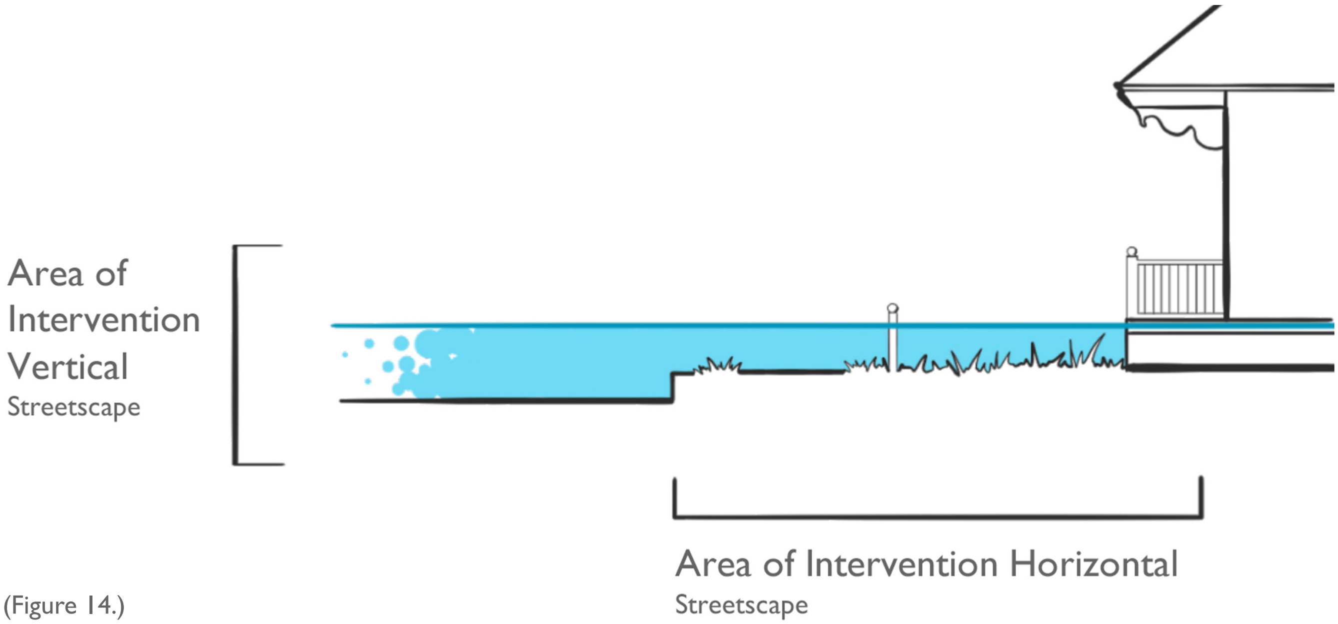
Site: Analysis

Currently the city's approach to water management mostly happens at the outskirts or hidden below the surface. However, a hybridized architectural strategy that focuses on integration of the existing natural and built forms has to happen where those forms are most often seen together, the urban streetscape. Thus the site selection are the areas within the urban realm that have unfulfilled potential for utilizing natural and built forms as a new method of water management. (Figure 13[82]. is a diagram of potential implementation areas within the streetscape) The urban streetscape is also the most recent receptacle for water accumulation during intense precipitation events, making it an ideal location for implementation of a system for both public and water occupation.

The streetscape has always been a beloved part of the public realm with traditions born of both environmental conditions and the built vernacular, shaping the way that the sidewalk, porch, and yard can be used.

Site analysis, Ground scape

The site is analyzed in two parts, the first being its potential for new water management methodologies and the second being its existing role as an area of water and public accumulation. The larger issue faced by the city should be explored in the diversity of site conditions, while the site's specific areas of influence within the streetscape respond to the two user groups of the system and the city, water and people.



(Figure 14.)

Currently water and people are occupying the same area. (Figures 14[83]. & 15.[84]) Conflict arises because there is no delineation between the area belonging to each group. Elevating buildings eliminates the need to share occupation, but this separation also separates people from the ground. A connection to the ground plane is an important to both the ecological and social life of the streetscape.

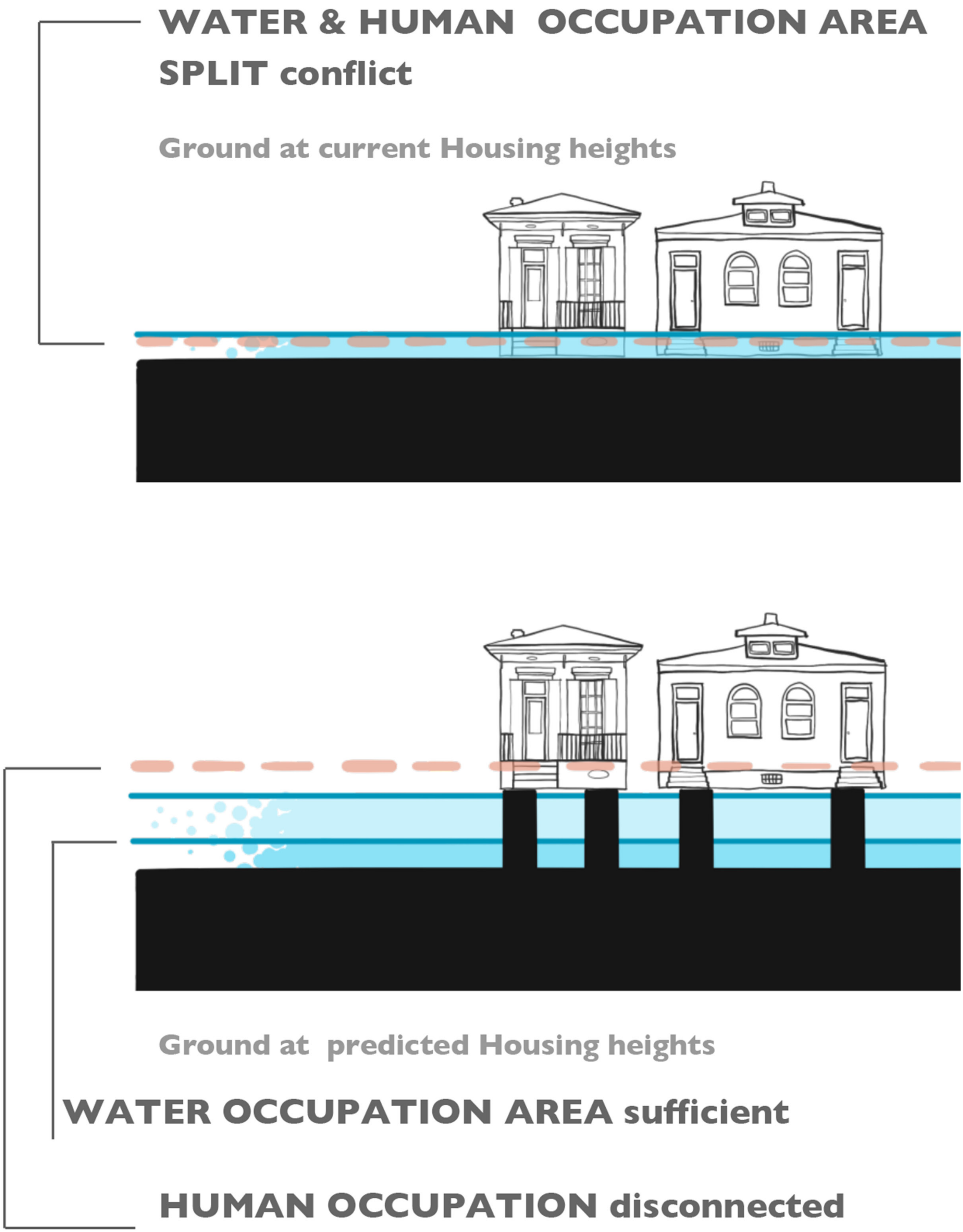
Site Analysis, Built-scape

The site analysis means that the system developed should respect existing methodologies as culturally significant to the image and traditions of the city. However, the water management goals of the design must acknowledge that the vernacular methods are effective for a past climatic condition, and as such cannot be seen as effective for current climate conditions. Water is part of the city's past, present and will have an even larger role in the city's future.

Many of the city's older climatic responsive design elements have retained their usefulness in the programmatic traditions they foster. Climatic systems should be prepared to be dynamic as a reflection of the climate itself and be built to serve function for its primary users throughout its evolution.

Program

This functionality for its primary users, that is not dependent upon its interactions and potential evolution with natural systems, can be designated as its programmatic identity as it pertains to becoming part of the city's streetscape. The program can correlate to its methodology and vary with different degrees of porosity, porosity in the way of varying the amount of public to private spaces as a


WATER & HUMAN OCCUPATION AREA SPLIT conflict
Ground at current Housing heights
Ground at predicted Housing heights
WATER OCCUPATION AREA sufficient
HUMAN OCCUPATION disconnected

(Figure 15.)

means of diversifying the program. At the moment many of the soft systems engage spaces that are typically programmed for housing or large scale public interactions, such as parks. But the programmatically ambiguous spaces of the yard, sidewalk, and public right of way offer the development of systems that create new delineations and spaces that are programed for occupation with different intentions of use. Ultimately the program is focused on making the public realm accessible, however the intent is also to create sub-programs within the designed system that respond to the question of: What can a water management system look like as an active ground-scape?

Concept

In the past, human modifications have been done to allow the expansion of human occupation at the expense of organic occupation. While the environmental state has been altered, human built landscape modifications contain the ability of providing assurance and stability for the city. In regard to the built systems, the new strategy should begin by asking, what elements of the city's built character are important to preserve, revive, and used as design constraints?

In New Orleans the ground condition's natural composition is characterized as a complex body of many different organic compounds and processes. Reimagining the city's current ground condition can mimic its original condition as a complex layer rather than simply a surface to occupy. In regard to utilizing elements of the natural character of the city, the new strategy should ask, what elements of the city's natural character are important to preserve, restore, and use as design constraints?

The concept behind the design is integration as resiliency, integration of the natural and constructed states into a system that not only acknowledges the built and environmental system but is able to integrate them to work together at establishing more effective systems of resiliency in New Orleans. The city will flood and water will occupy the city, however the architecture of resiliency has the ability to negotiate the terms and conditions of that occupation.

The infrastructure of the city was designed to survive large or catastrophic events, but did not address everyday resilience.

Chapter 4: Execution

Conditions

The image in Figure 16[85] was taken after a heavy rain event on August 5th, 2017 and shows what areas of New Orleans, my hometown, looked like after getting 10.5" of water over the course of a few days.

(Figure 16.) New Orleans, August 5th 2017

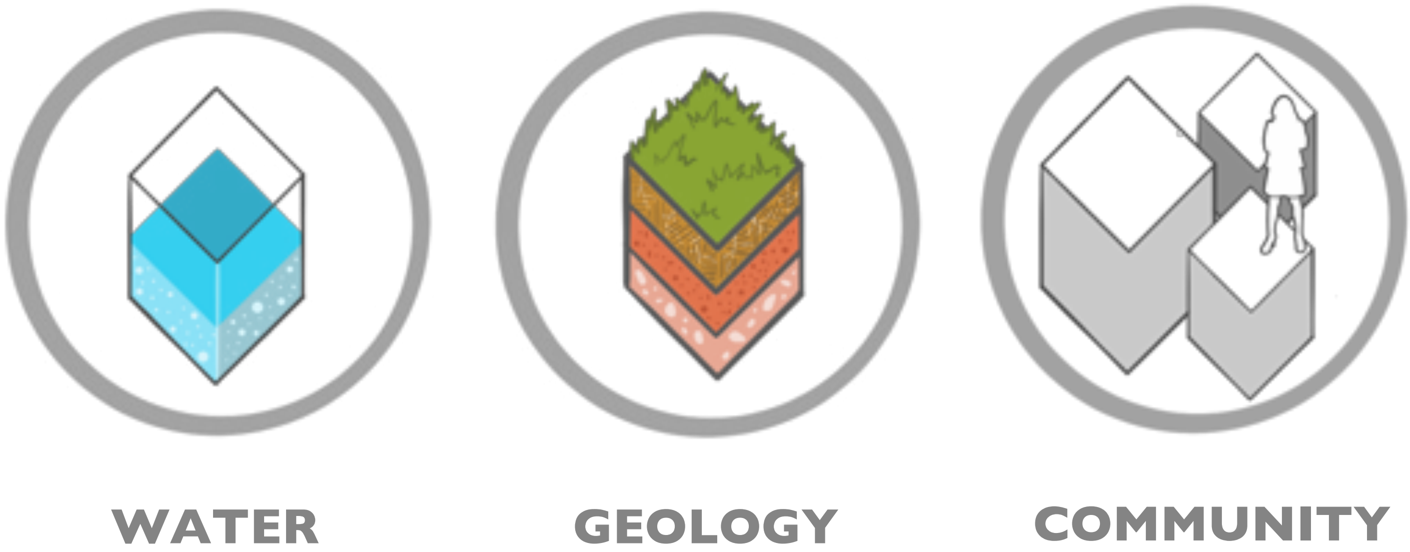
(Figure 17. Top) (Figure 18. Bottom)

(Figure 19. Top) (Figure 20. Bottom)

(Figure 21.)

(Figure 22.)

The infrastructure of the city was designed to survive large or catastrophic events, but not everyday resilience. Climate change has meant that flooding and living with open water has become a frequent occurrence. The images in (Figures 17-21) are all from the 2017 flooding and in sequence show how the flooding at the higher parts of the city becomes an inconvenience at a few inches (Figures 17[86]&18).[87] Figure 18 is taken from the French quarter, one of the highest points in the city. The flooding levels farther inland from the river can become high enough to change the ways that people can move around the city (Figures 19[88]& 20)[89]. Figure 19 shows how canoes and kayaks have become more functional than recreational in the public realm. At the lowest parts of the city the flooding confines people to their homes, excluding them from the public right of way entirely (Figure 21).[90] The next pair of images in Figure 22[91] are from August 2018 and taken outside my childhood home after only 3 hours of rain. The images show the flooding as well as the state of the ground conditions in the public realm being uplifted, cracked, and submerged.

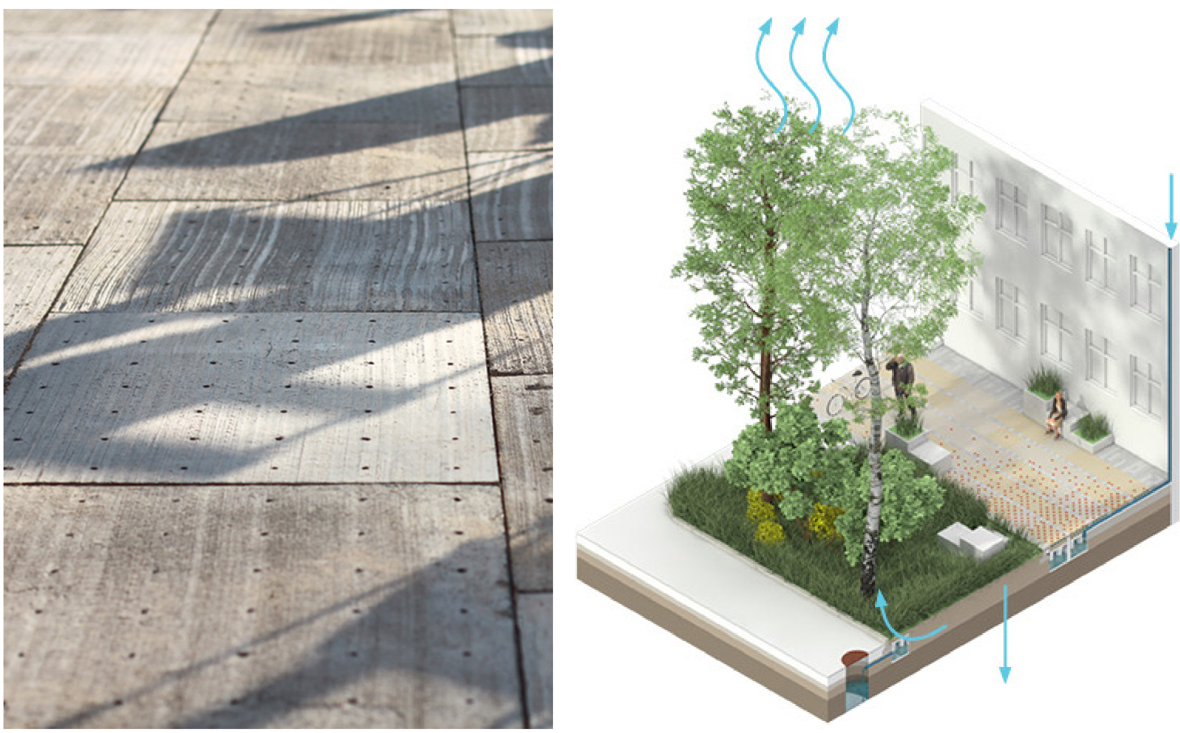


(Figure 23.)

However, recently the City of New Orleans has begun to buy into the idea of resiliency by talking with local architects and discussing larger urban design gestures that focus on resiliency. One of these Local architecture firms is Waggonner & Ball who has been working with the city on projects such as the "Greater New Orleans Urban Water Plan" and the "Mirabeau Water Garden".[92] Waggonner & Ball has also participated in a collaboration called Dutch Dialogues, which seeks to create a dialogue with other water enriched cities, such as those in The Netherlands, in an effort to learn from one another and acknowledge the differences and strengths in each other's geologic and climatic concerns. All of these plans seeks to insert resiliency into the City, but the design and specifications of all of those resiliency components and what they could be has yet to be fully developed.

The design response of the thesis focuses on taking an accepted resiliency idea of permeable pavement and rethinking its design and integration within the city in order to expand its effectiveness to become an architectural element that integrates water, geology and the community within the city of New Orleans.

An existing precedent that seeks to think of a permeable pavement as being becoming something more effective is the "Climate Tile". The Climate Tile are perforated rigid pavers that collect rain water and reintroduce it into the natural water circuit. They function as a kind of topper for larger detention tanks focused on getting the water from the sidewalks and adjacent rooftops and inserting them into adjacent planting beds and existing storm water systems. The surface of the tiles and the diagram of where they are collected and then diverted can be seen in Figure 24[93].



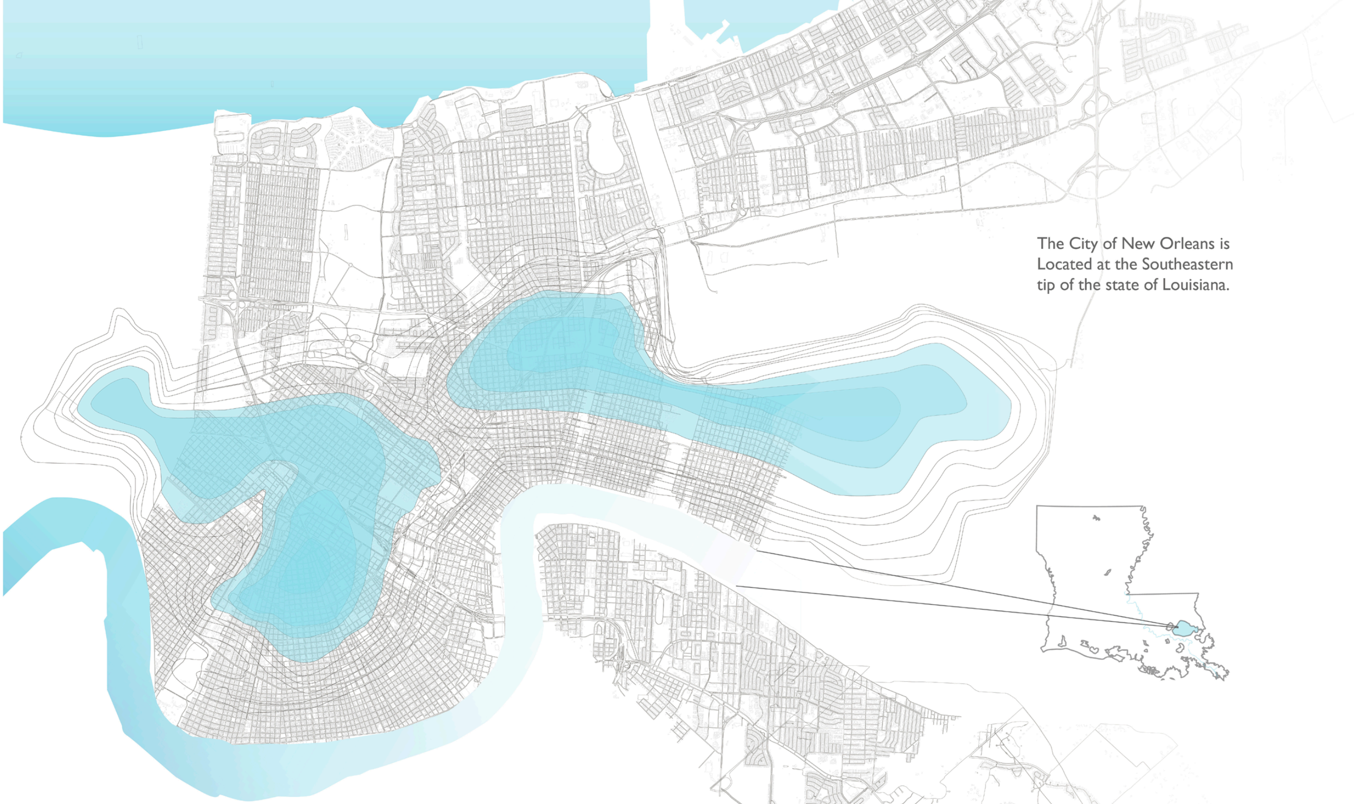
(Figure 24.)

CONTEXT

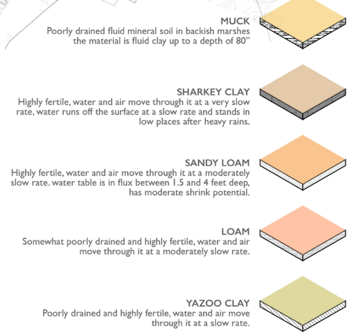
The contextual response for the City of New Orleans focuses on the cities topography and geology in order to influence the design approach.

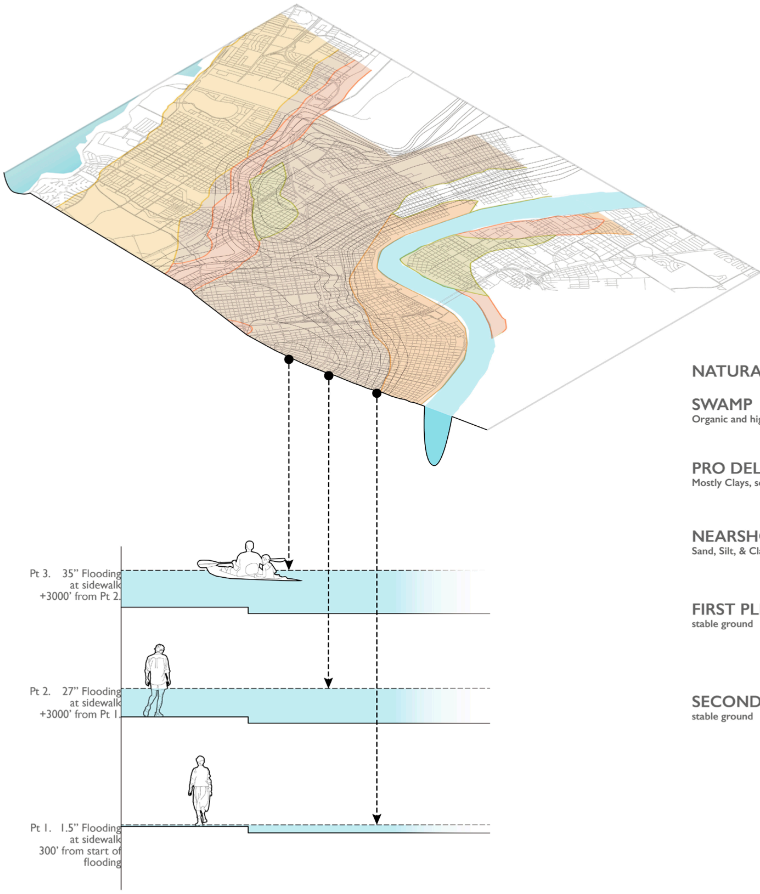
CONTEXT

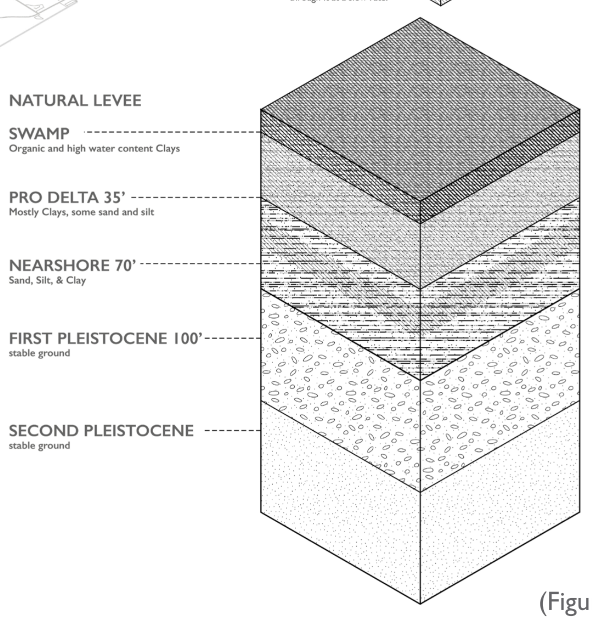
New Orleans, Louisiana
The city of New Orleans is surrounded by water, Lake Pontchartrain to the north, the Mississippi River defining the city's edge, and the Gulf of Mexico miles away to the south. These waters define the cities ecological and geologic conditions.



Map of New Orleans with topography lines at every 1'



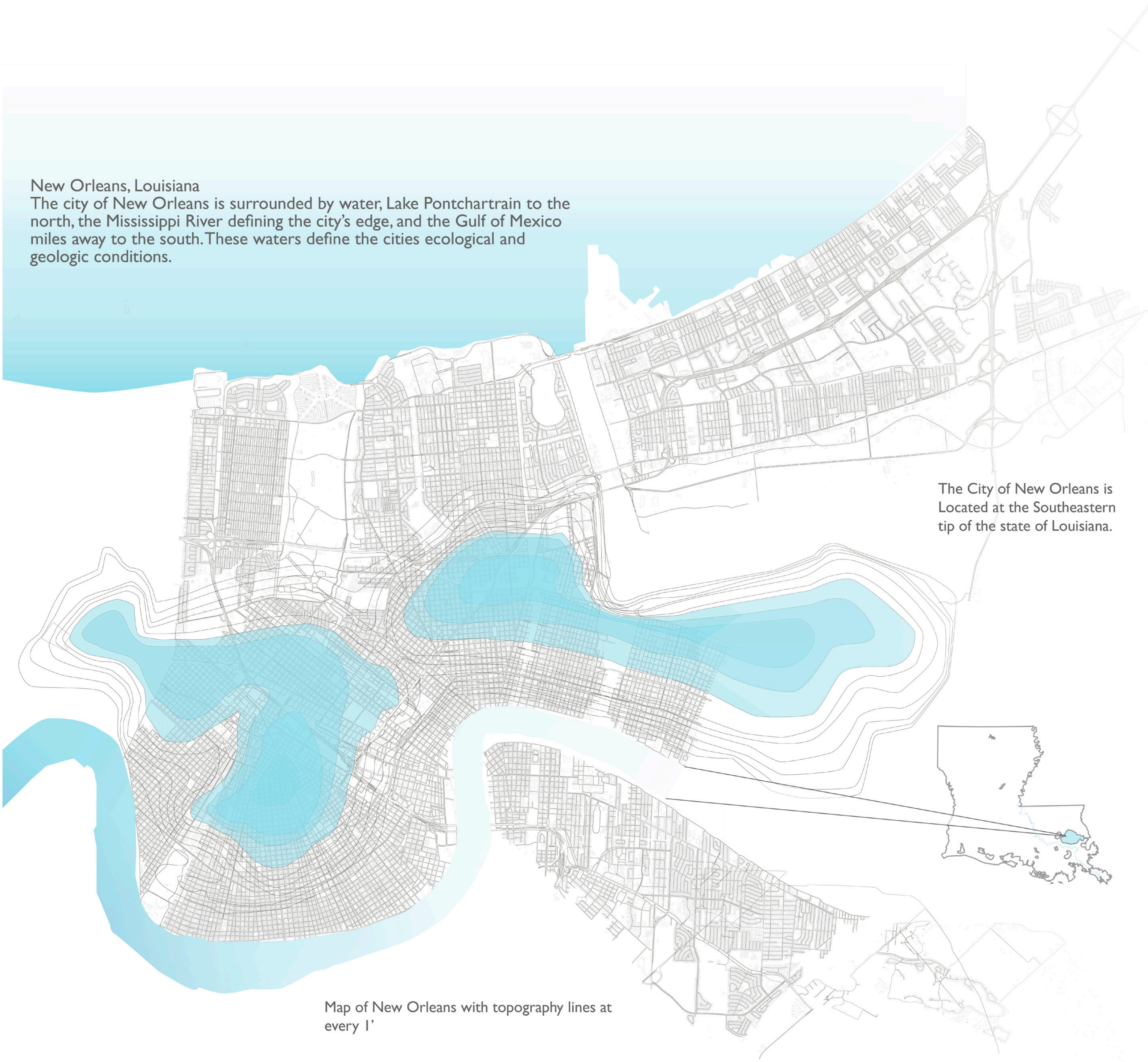




(Figure 25.)

New Orleans, Louisiana

The city of New Orleans is surrounded by water, Lake Pontchartrain to the north, the Mississippi River defining the city's edge, and the Gulf of Mexico miles away to the south. These waters define the cities ecological and geologic conditions.



The City of New Orleans is Located at the Southeastern tip of the state of Louisiana.

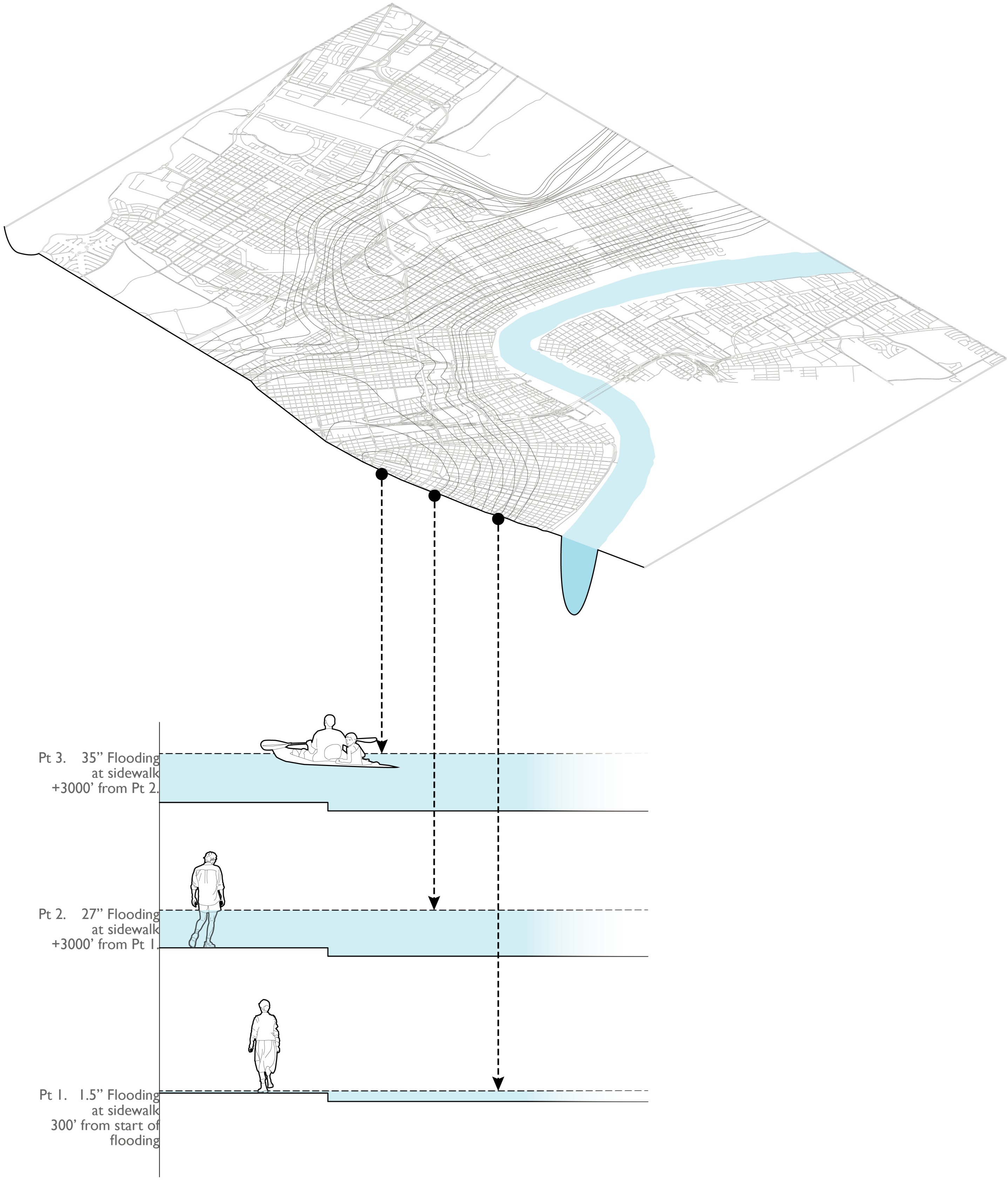
Map of New Orleans with topography lines at every 1'

(Figure 26.)

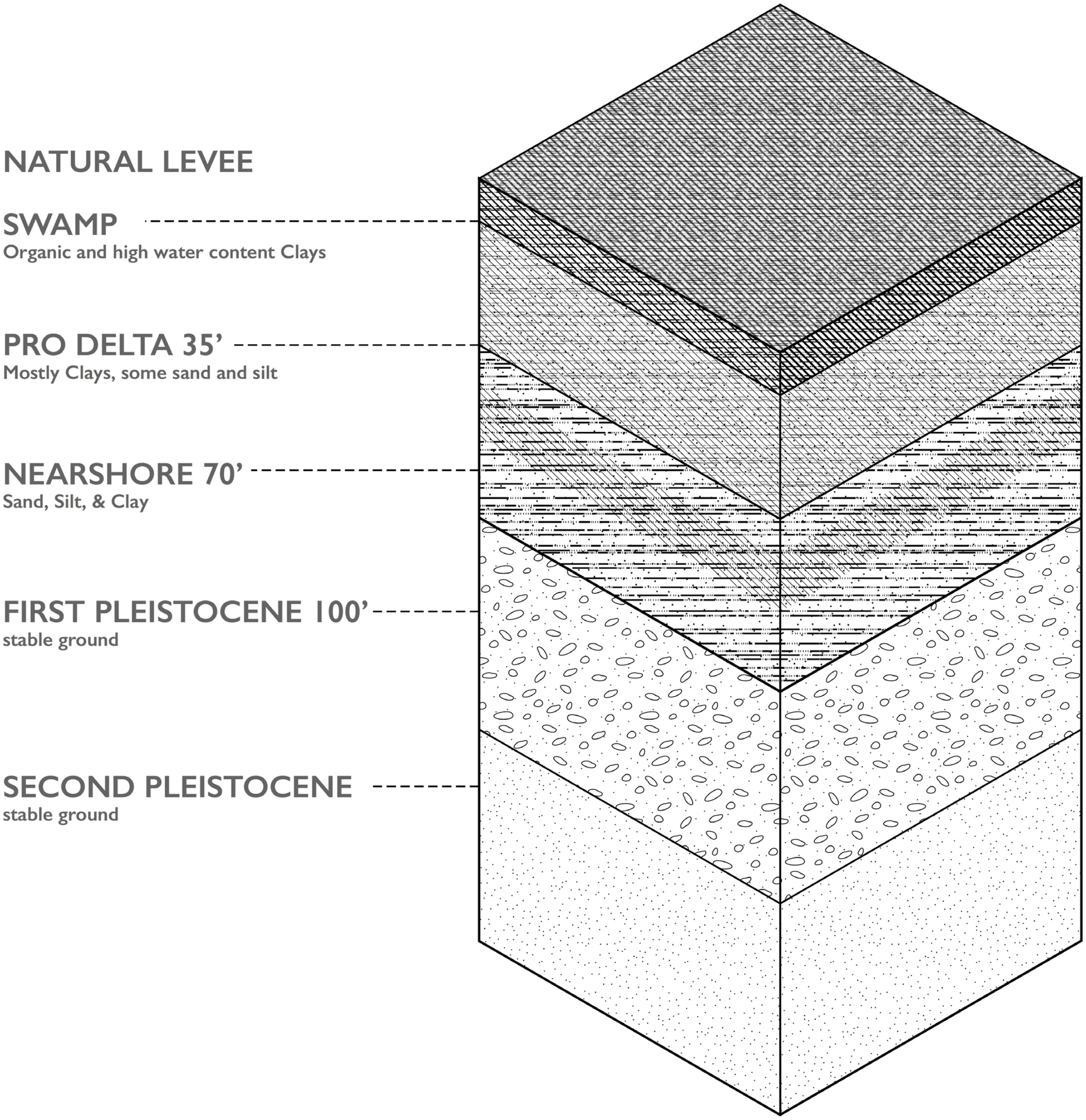
Context

New Orleans is located near the southeastern tip of Louisiana, roughly 50 miles from the Gulf of Mexico, and bordered by Lake Pontchartrain to the north and the Mississippi river to the south. Most of southeastern Louisiana is a deltaic formation, formed by Mississippi river alluvium over multiple centuries. The waters define the cities location and have helped form its topography. The city's topography is such that the city is shaped like a bowl with its highest natural areas located along the river's edge. The Map in Figure 26[94], depicts the city's relative location to the various bodies of water as well as the topographical lines at every one foot of height change. The 2 blue areas that are inland show the locations and amounts of water that pools and collects in the city's bowl shape. The forms follow the topo lines of the city and depict the amount of water that the city receives in a large rain event averaging 10.5" of rain. The calculations are based solely on the topography of the city and negate the amount of water that would be managed by the city's various flood mitigation services, due to the past unpredictability of various water management systems. The area of rainfall flooding starts around 1.25 miles inland from the river's edge and reaches 3' deep at the lowest areas of the city. The topography, while seemingly slight with only a 10' difference from the cities highest to lowest points, still has a profound effect on the amount and location of flooding in the city. The two blue flood areas also show the organic form of the city's topography, their shapes are molded by the surrounding bodies of water, especially the Mississippi River. The realities of what 10.5" of water really looks like depending on where you live in the city can be understood in the sections of Figure 27.[95] These sections also take into account the flooding difference between the sidewalk and street, at the highest point on the map, 300' from the start of the flooding, the sidewalk gets 1.5" of rain. At point 2, another 3000' inland from point 1, the flooding reaches 27", and at point 3, another 3000' inland, the flooding can get to 35" deep.

The Geologic composition of the city can be seen in figure 28.[96] The composition from the ground down is: The Natural Levee a surface soil, The Swamp (made of organic and high water content Clays) varies from a few feet deep to 10', The Pro-Delta (consisting of mostly clays, some sand, and silt)


Pt 3. 35" Flooding
at sidewalk
+3000' from Pt 2.
Pt 2. 27" Flooding
at sidewalk
+3000' from Pt 1.
Pt 1. 1.5" Flooding
at sidewalk
300' from start of
flooding

(Figure 27.)

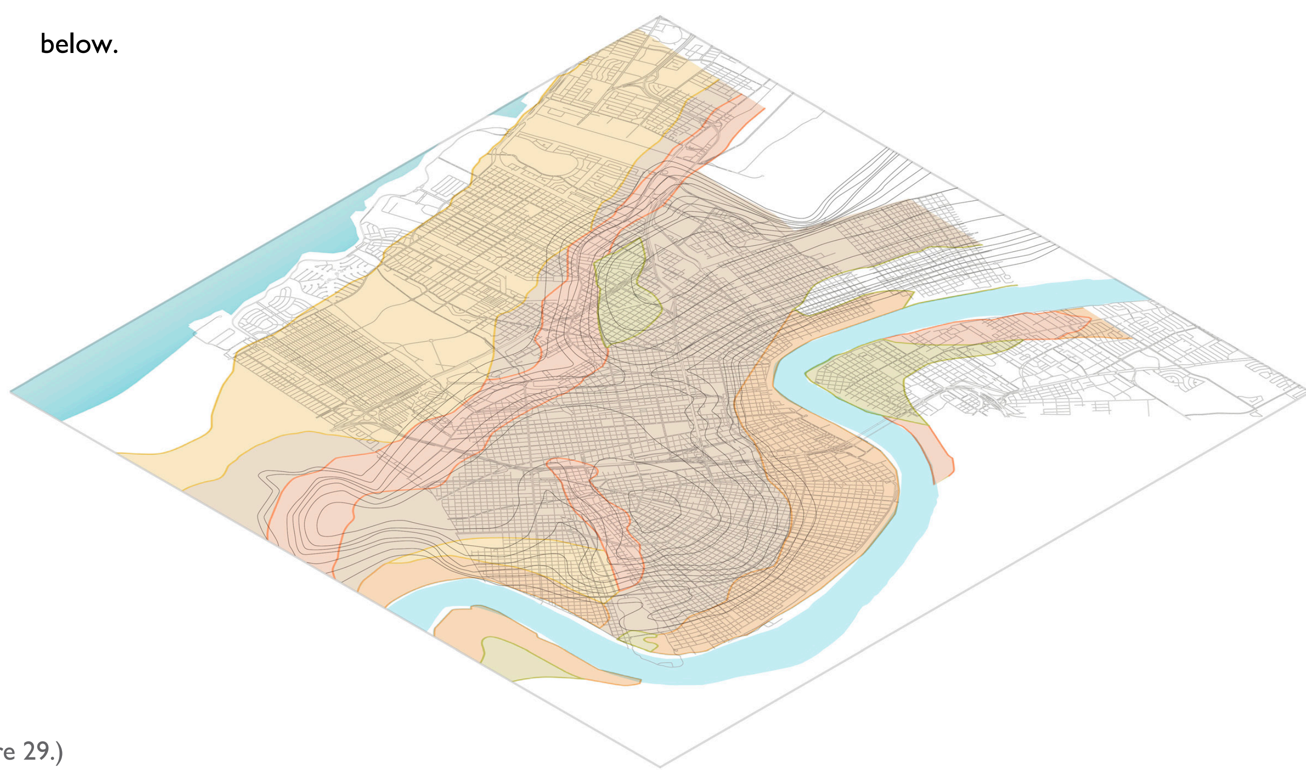

NATURAL LEVEE
SWAMP
Organic and high water content Clays
PRO DELTA 35’
Mostly Clays, some sand and silt
NEARSHORE 70’
Sand, Silt, & Clay
FIRST PLEISTOCENE 100’
stable ground
SECOND PLEISTOCENE
stable ground

(Figure 28.)

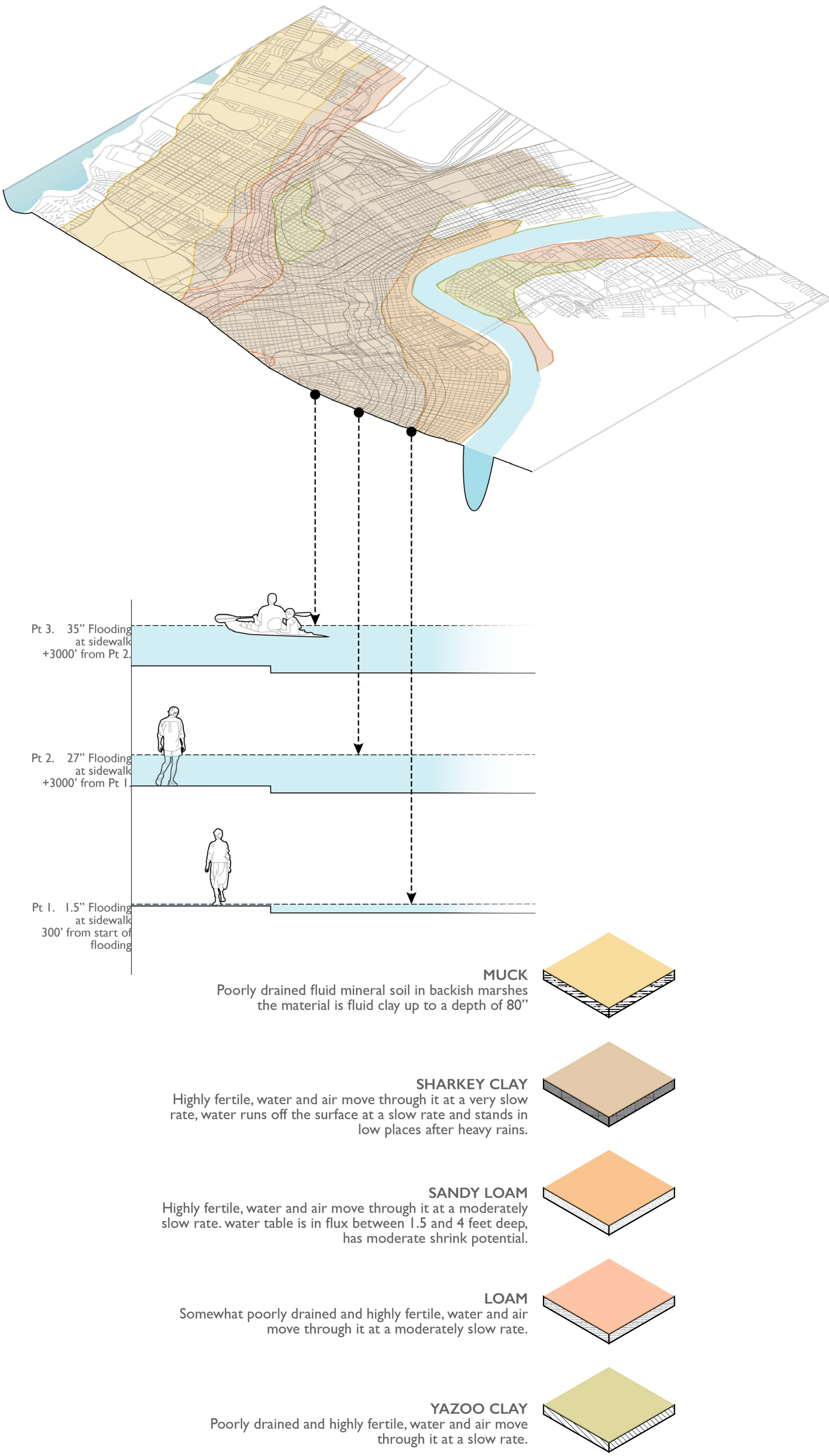
35’ deep, Nearshore (sand, silt, and clay) 45’ deep, First Pleistocene (stable hard ground) roughly 50’ deep and starts 80’ from the grounds surface, and Finally Second Pleistocene (stable hard ground) roughly 50’ deep and starting around 125’ deep. Overall the geologic strata means that much of the city sits atop a soft and organic composition for up to 80’ deep.

The city’s surface geology is made up of soil types that are often a mixture of highly organic materials that are distributed by the river over time, this map shows the locations of various surface soil types such as muck, Sharkey clay, sandy loam, loam, and Yazoo Clay. The most common soil type is Sharkey clay, as evident in Figure 29.[97] Sharkey clay is a soil that is very fertile but water and air move through it very slowly. More specifications about the various soil types can be read in Figure 29.[98] The various soil types vary in permeability but in general all of the city’s surface soil types are very to moderately slow to absorb water. Figure 30[99] shows the soil diagram as they relate to the sectional quality of the city. The lowest areas of the city are also the areas that contain Sharkey clay, the least permeable top soil.

These contextual studies reveal the importance of retaining water on all sites, especially in the higher areas of the city, in order to reduce run off and thus increased flooding in lower areas and how the effectiveness of permeable surfaces is dependent upon the receptiveness of the soil condition below.



(Figure 29.)



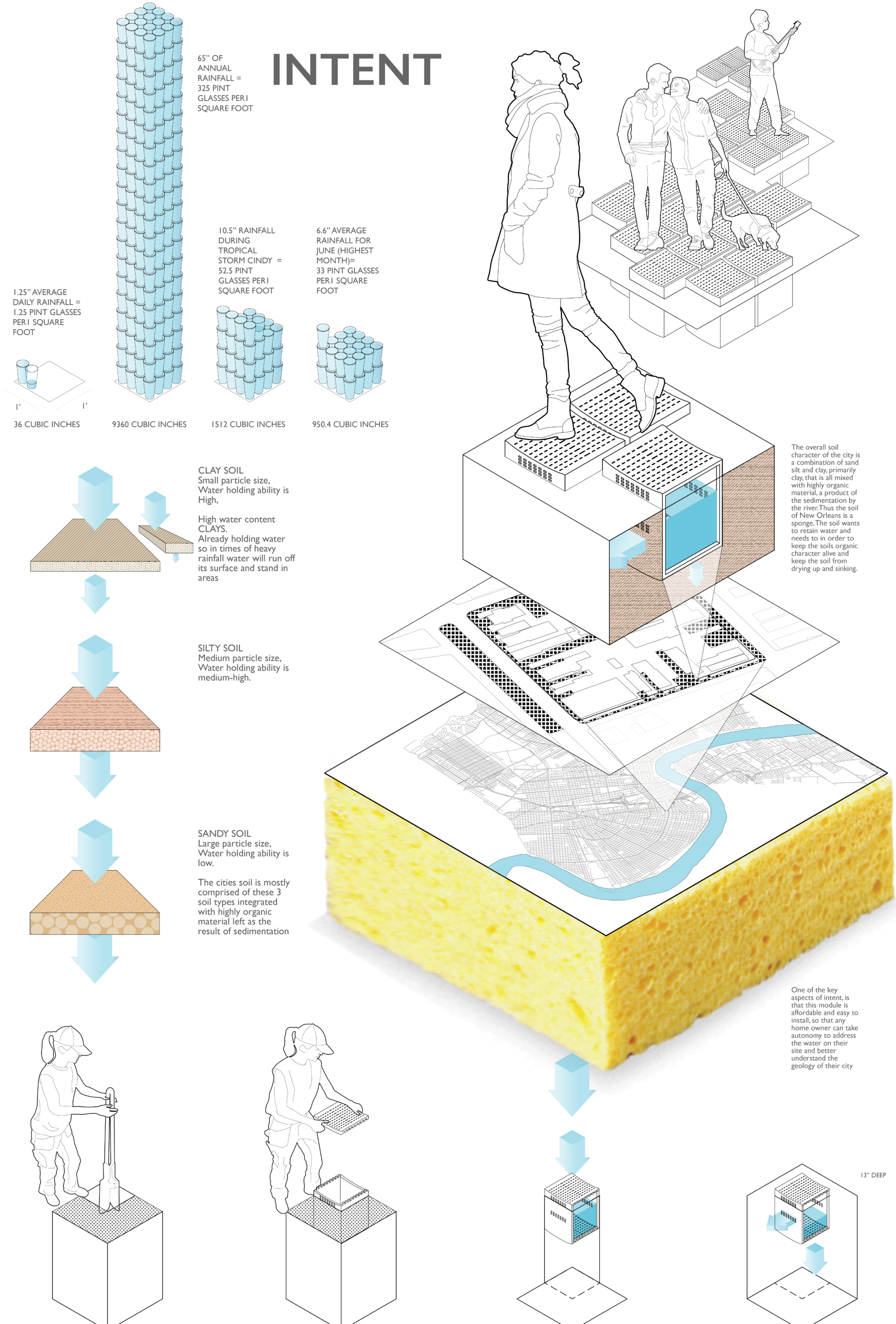
Pt 3. 35" Flooding at sidewalk +3000' from Pt 2.
Pt 2. 27" Flooding at sidewalk +3000' from Pt 1.
Pt 1. 1.5" Flooding at sidewalk 300' from start of flooding
MUCK
Poorly drained fluid mineral soil in backish marshes the material is fluid clay up to a depth of 80"
SHARKEY CLAY
Highly fertile, water and air move through it at a very slow rate, water runs off the surface at a slow rate and stands in low places after heavy rains.
SANDY LOAM
Highly fertile, water and air move through it at a moderately slow rate. water table is in flux between 1.5 and 4 feet deep, has moderate shrink potential.
LOAM
Somewhat poorly drained and highly fertile, water and air move through it at a moderately slow rate.
YAZOO CLAY
Poorly drained and highly fertile, water and air move through it at a slow rate.

(Figure 30.)

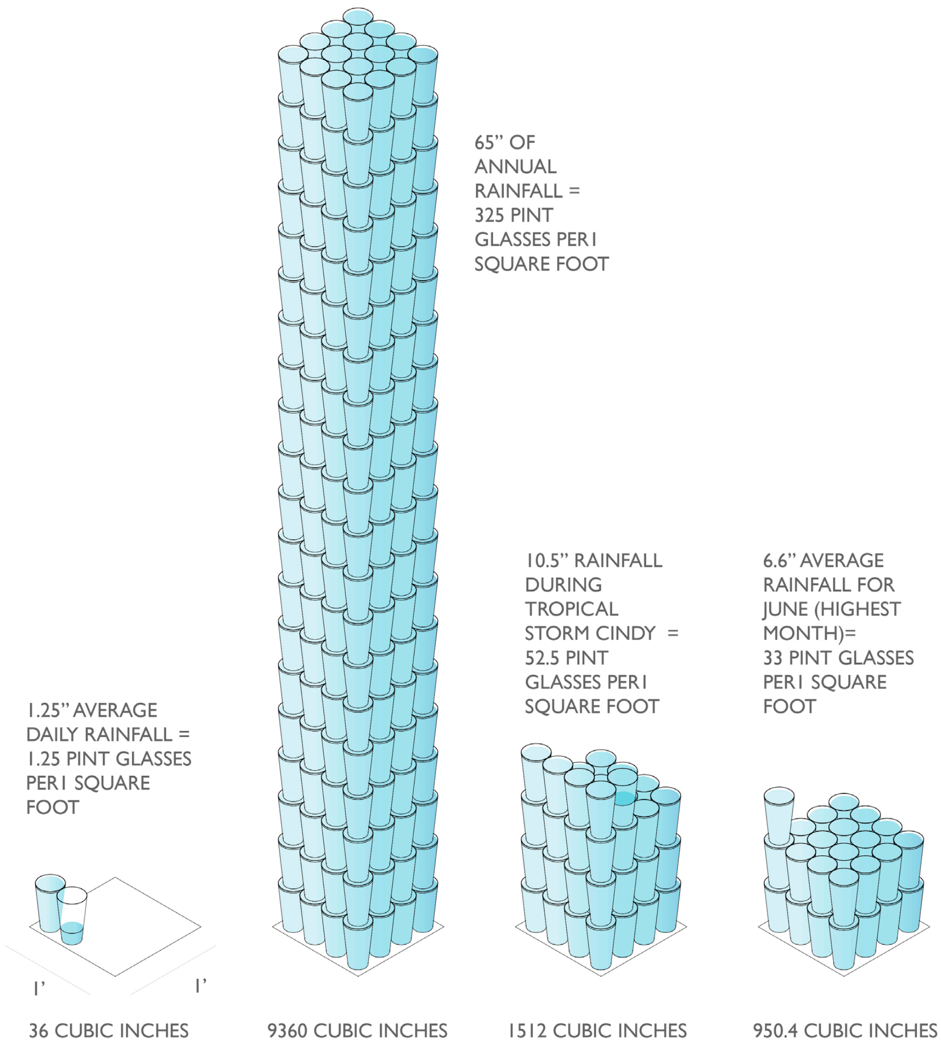
INTENT

The overall intent of the design's functional objectives is to connect the cities streetscape to its geologic character below in order to create space for both people and water in the public realm.

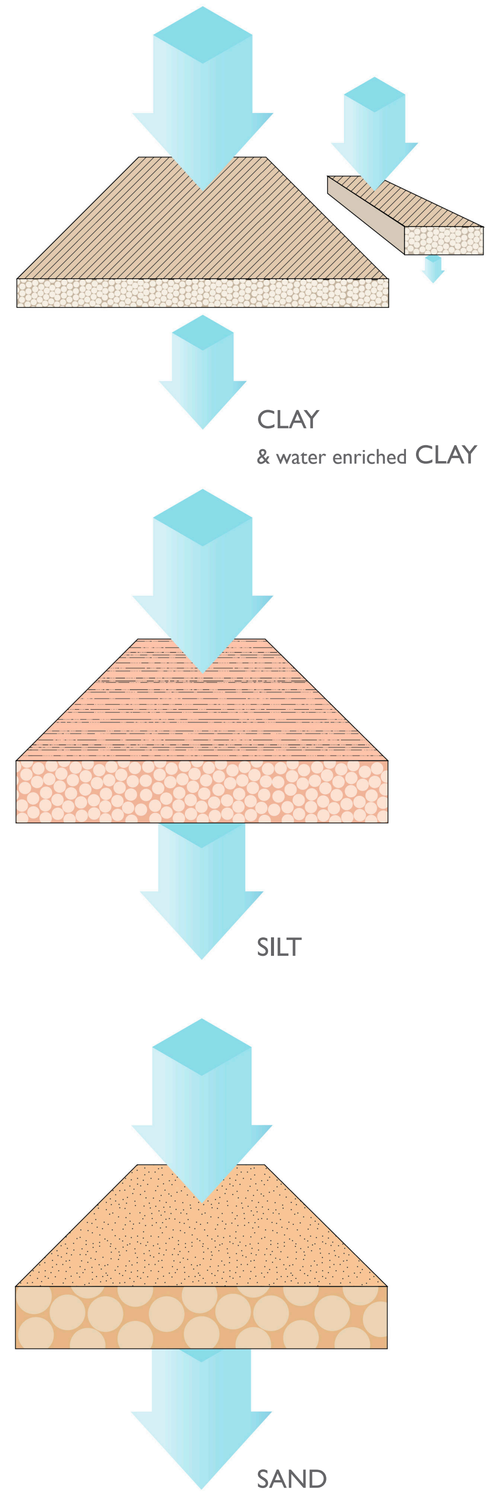
INTENT



(Figure 31.)



(Figure 32.)



(Figure 33.)

Intent

The first objective is an understanding of precipitation and time, how much rain does the city get on average over time versus the amount received in large and short rain events. Annually the city can receive 65" of rain which amounts to 325 pint glasses of water per every square foot of land. This equates to be 1.25" of rain per day ~ 1 and 1/4 pint glasses of water per every square foot of land. For the month of June, the city receives over 6.6" of rain ~ 33 pint glasses of water per every square foot of land. During the last large rain event on August 5th, 2017, the city received 10.5" of rain ~ 52 and a half pint glasses of water per every square foot of land, over the course of 2-3 days ~ about ¼" of rain every 2 hours. The graphic representation of these precipitation amounts in terms of pint glasses is shown in figure 32.[100]

All of the rainwater interacts with the varying soil types around the city differently, see figure 33.[101] Clay, Silt, and Sand are three main soil composites found in the geology of New Orleans. Clayey soil has the smallest particle size and thus its long term water holding ability is high, however if the soil is rich in high water content clays then any additional water will run off the soils surface and pool. Silty soil has medium particle size and thus its water holding ability is medium high, and water runs through it moderately quickly. Sandy soil has the largest particle size of the three and thus its long term water holding ability is low. In figure 33, the circle on the soil types elevations are scaled according to the relative particle sizes or each type. The larger the particle size means the lower the long term water holding ability, meaning clay has a high water holding ability, silty soil has a medium to high water holding ability, and sandy soil has a low water holding ability.

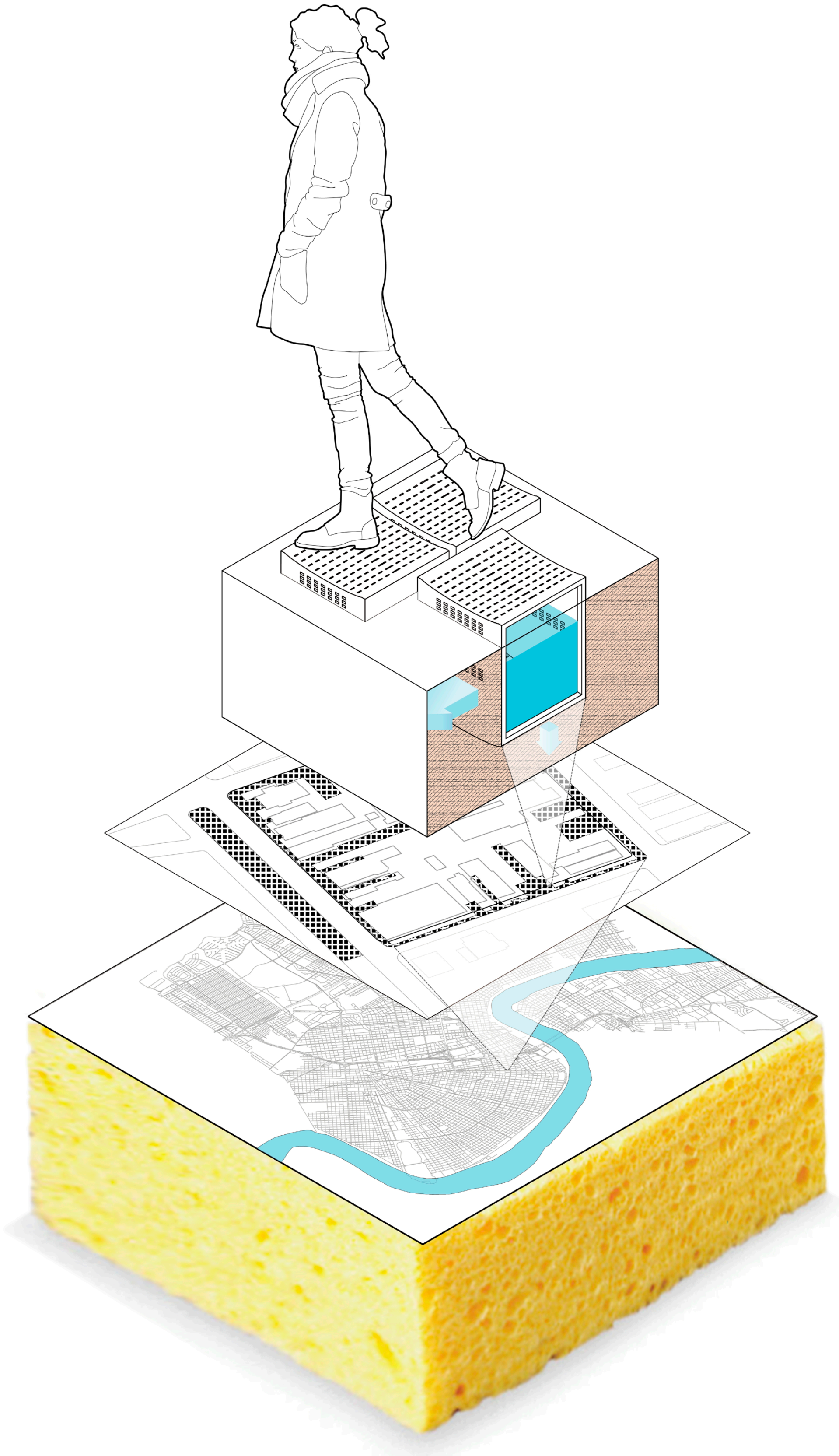
While clayey soil is the most common, all three types are integrated with highly organic material left as the result of sedimentation. As seen in figure 28, much of the city's top soil is made of high-water content clays, meaning that much of the city's top soil is slow to absorb any additional water and most if not all of the water from a large rain event will pool on the surface of the city. These soil types and their relative particle size and diagrammatic permeability can be seen in figure 33.

The overall soil character of the city is a combination of sand silt, organic matter, and clay, all mixed together varying in ration percentages based on their locations proximity to the river and topography, but at almost all locations mixed together with highly organic material. Thus, the soil of the city can be compared to that of a sponge (Figure 34).[102] The city has always had this sponge-like ground. When the city was originally founded the sponge was filled with water, but over time the soil has been separated from water and thus the sponge has dried out and shrunk. Instead of trying to work with the water below and above, the city has instead tried to keep water out of the city altogether.[103] This also means that the city has always had a fairly high-water table and need to maintain the height of its water table in order to keep the soil from shrinking.

While the city needs water in order to maintain its sponge, the current scale and speed of large rain events are a challenge for e areas of exposed soil to absorb. These large rain events, like the one on August 5th, 2017, are becoming more and more typical and the speed and amount of rain is more than the city's soil and water management system can handle. Thus, the design intention is to integrate the city's geology with its ground-scape in a method that can respond to these large rain events. Figure 35,[104] shows how a perforated detention paving module can connect the public right of way to the ground below, and then be implemented on a larger scale within city blocks, all culminating in creating a ground that essentially puts more air pockets into the sponge of the city allowing the soil to be hydrated and the ground-scape to stay above water. The system of creating a new type of ground-scape is

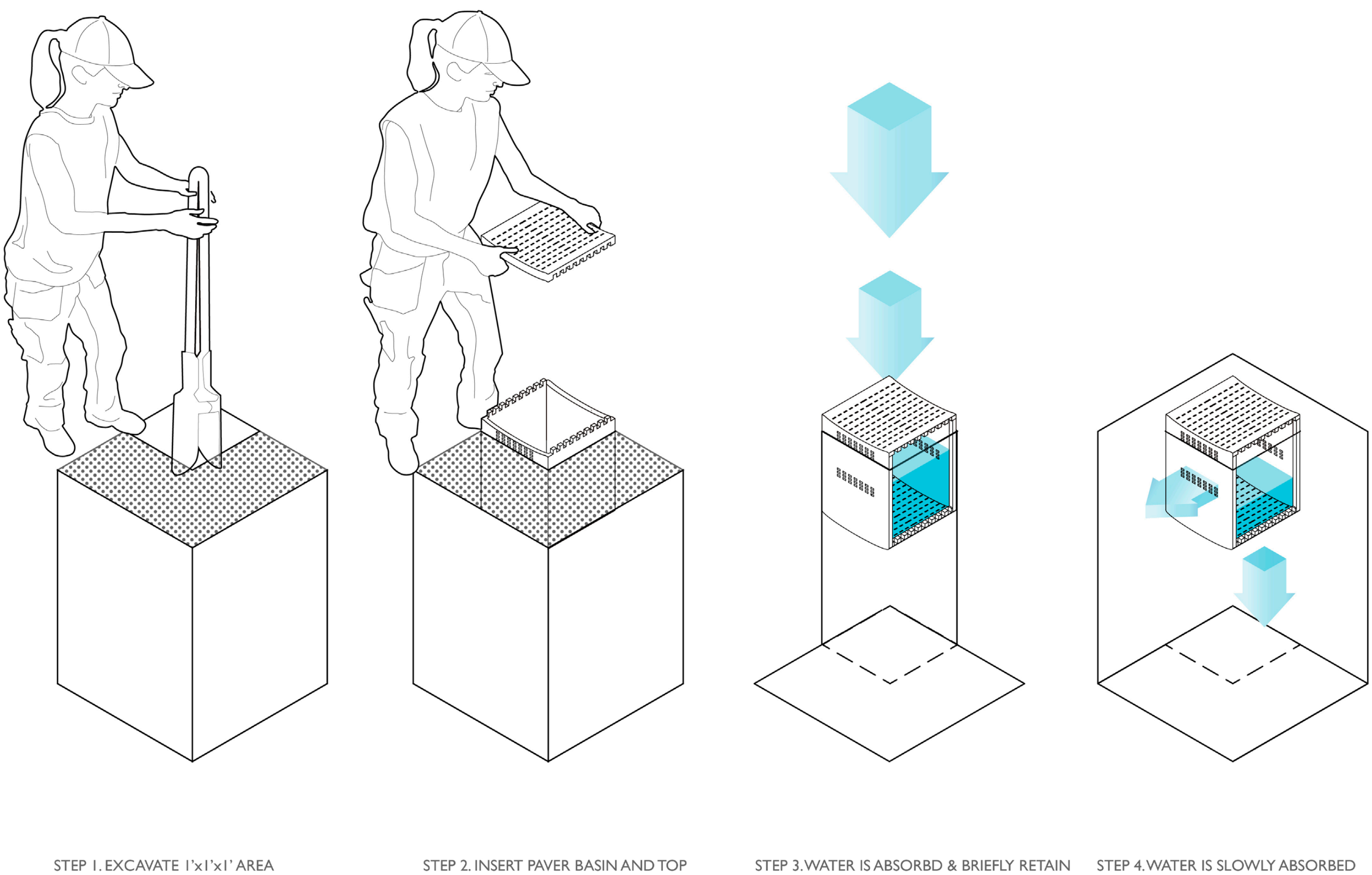
(Figure 34.)

intended to be a way of mimicking the city's already resilient soil and give it the capability to respond to new environmental challenges. It is meant to act as one component of a larger system of resiliency and not as one element that stands alone as a solution.



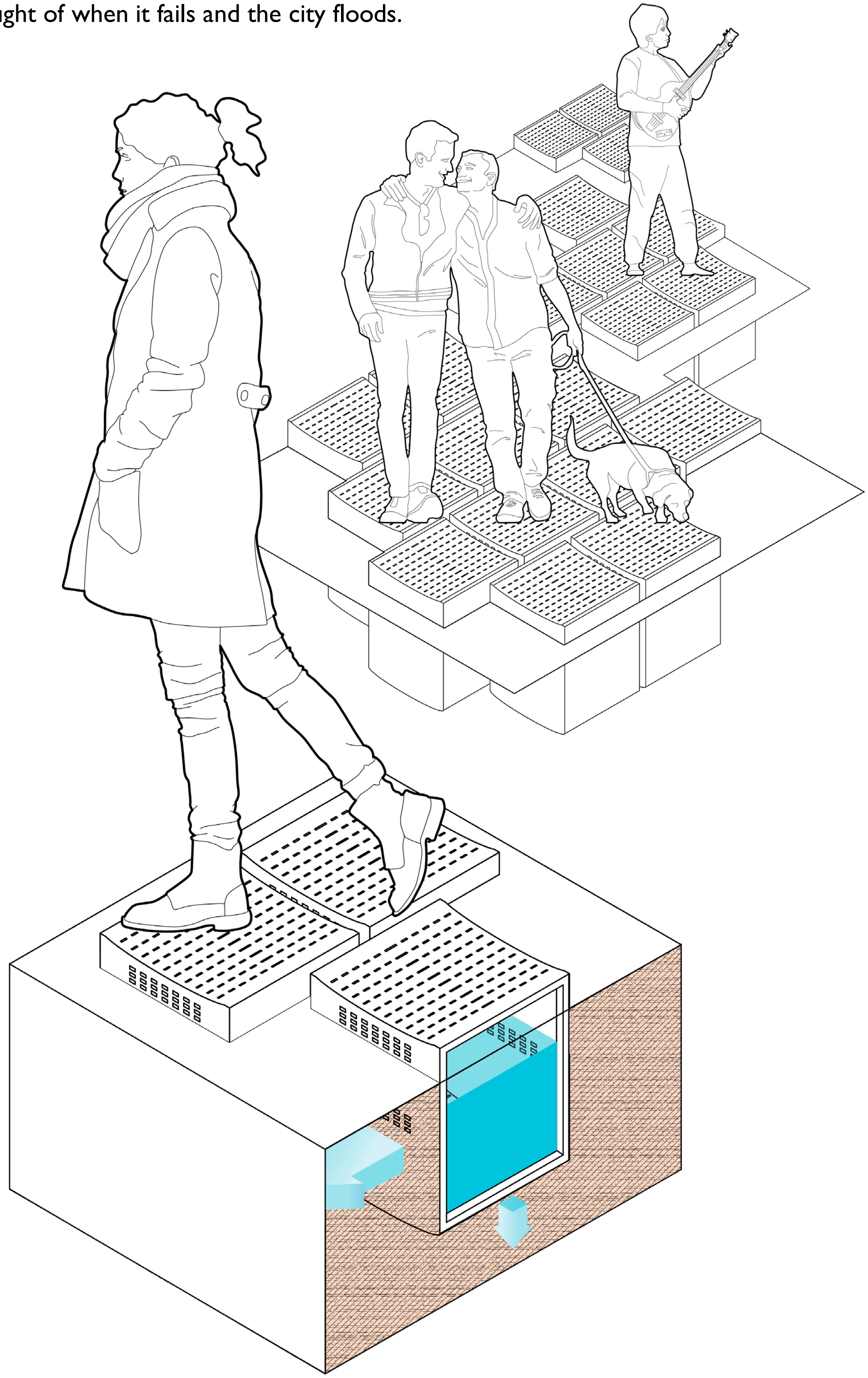
(Figure 35.)

One of the other design intentions of creating a system of individual modules is to create a system that can be taken on by individuals. Figure 36[105] shows the general implementation strategy of the modules as a 1-2 person instillation task of excavation than insertion and then the natural process of capture, detention, then finally re-absorption by the soil. The size of the module is roughly a 12"x12"x12" cube, with the goal being that its size and simplistic form makes it cheaper to manufacture, easy to afford, easy to transport and easy to install by a team of 1-2 people. By making it easily attainable the city's inhabitants can take on the autonomy of implementing the modules and thus managing the onsite rainwater for their own properties and adjacent public right of way spaces. Figure 37[106] shows this idea of the module being something that multiplies and starts to replace features of the public realm, such as sidewalks, entirely.



(Figure 36.)

Most of the water management systems that exist in the city today are controlled by the city, however by giving the citizens a role in the water management within their city, the whole system can start to become more inter-active. Citizen understanding can increase and then water management can become a part of living in New Orleans, as opposed to the current situation, where water management is only thought of when it fails and the city floods.



(Figure 37.)

FUNCTION

The design of the module is meant to detain excess rain water and allow it to be absorbed by the surrounding ground at a pace dictated by the soil.

FUNCTION

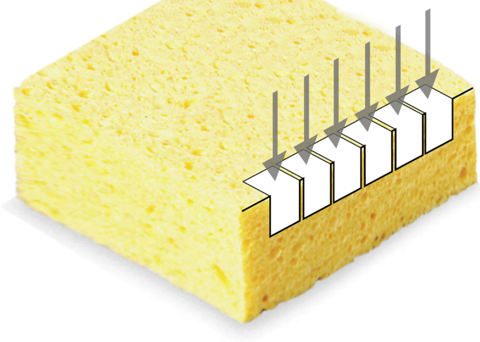
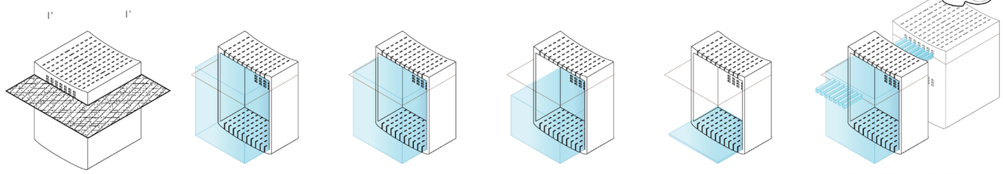
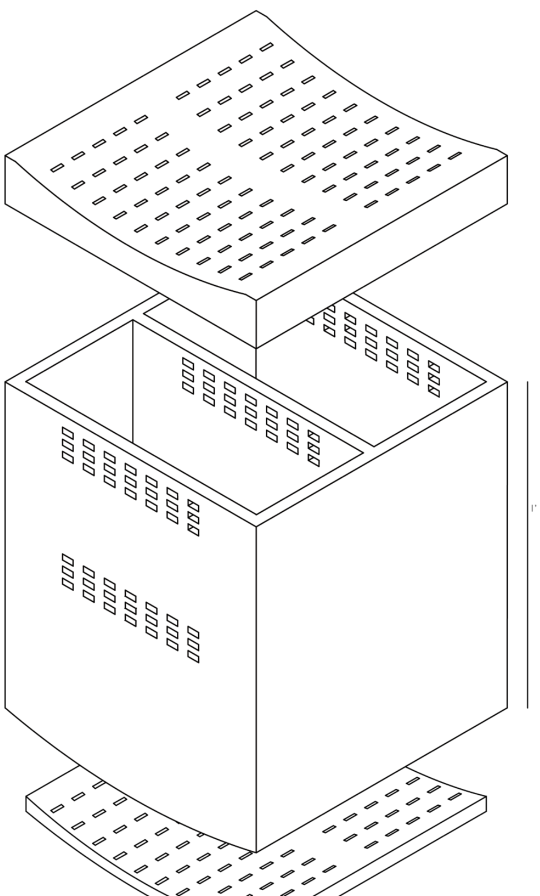


Diagram of the pavers punching new holes into the sponge of the city

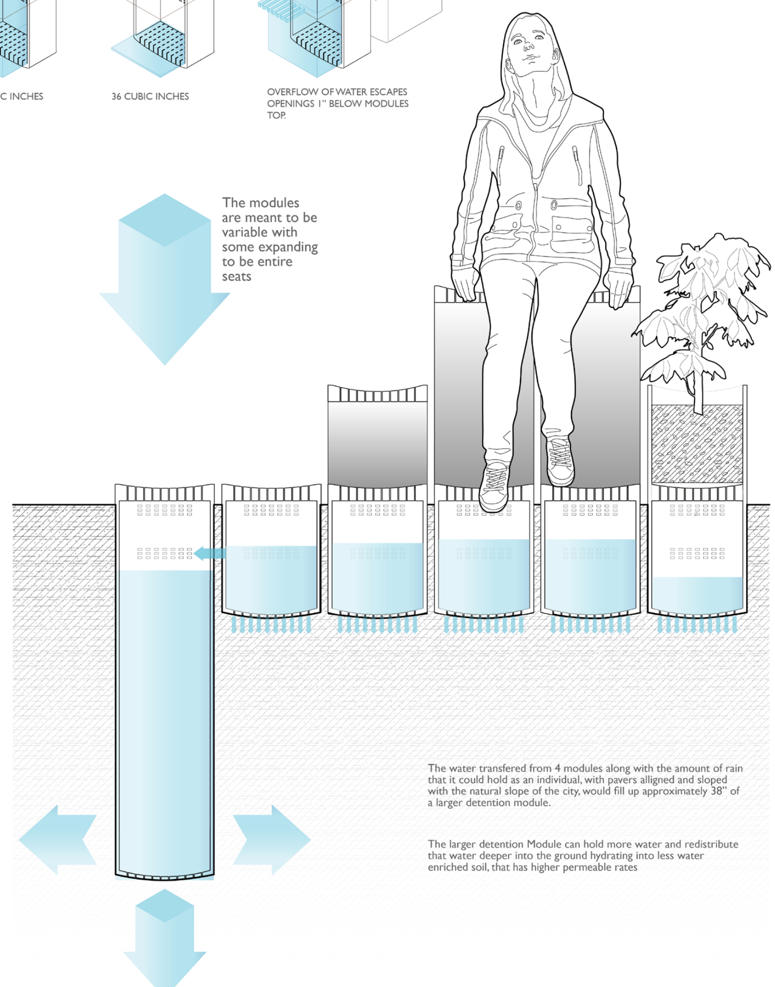
The city has always had a high water table, and it needs this to keep the city hydrated,
by punching more holes into the sponge these pavers can respond to the cities character as a sponge assisting the soils orginal absorbant nature, aknowleding that due to climate change and the degradation of the cities geology the soil now needs assistance.
to keep the water form rising and alow the soil more time to get the hydration that it needs.

Hydrolic pressure moves the surplus of water horizontally through openings on the sides of the moduals, and eventually in to a larger detention module.





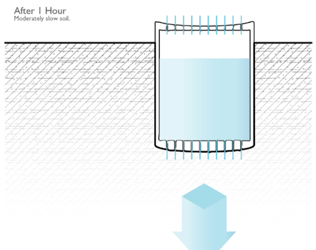
Exploded axon of one Module



The modules are meant to be variable with some expanding to be entire seats

The water transfered from 4 modules along with the amount of rain that it could hold as an individual, with pavers alligned and sloped with the natural slope of the city, would fill up approximately 38" of a larger detention module.

The larger detention Module can hold more water and redistribute that water deeper into the ground hydrating into less water enriched soil, that has higher permeable rates

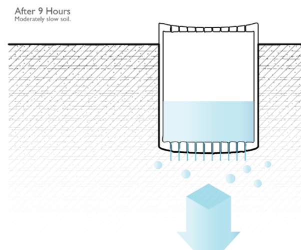


In each module the water that doesnt over flow from the sides will slowly start to be absorbed by the soil as the soils permeation rate alows

Permeation rate:

Very slow -.06" =1Hr
Slow - .2" =1Hr
Mod. slow -.6" =1Hr
Moderate -2." =1Hr

Most of the cities soil is either very slow, slow, moderately slow, or moderate.

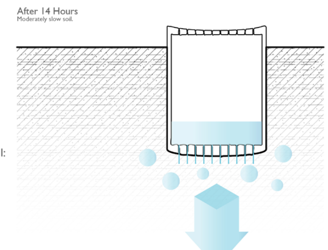


In areas that have very slow permeable soil, it would take 10.5" -175 Hrs and 1.25" -20 Hrs

Slow permeable soil:
10.5" -52.5 Hrs and
1.25" -6.25 Hrs

Moderately slow permeable soil:
10.5" -17.5 Hrs and
1.25" -2 .0 Hrs

Moderate permeable soil:
10.5" -5.25 Hrs and
1.25" -35 Mins

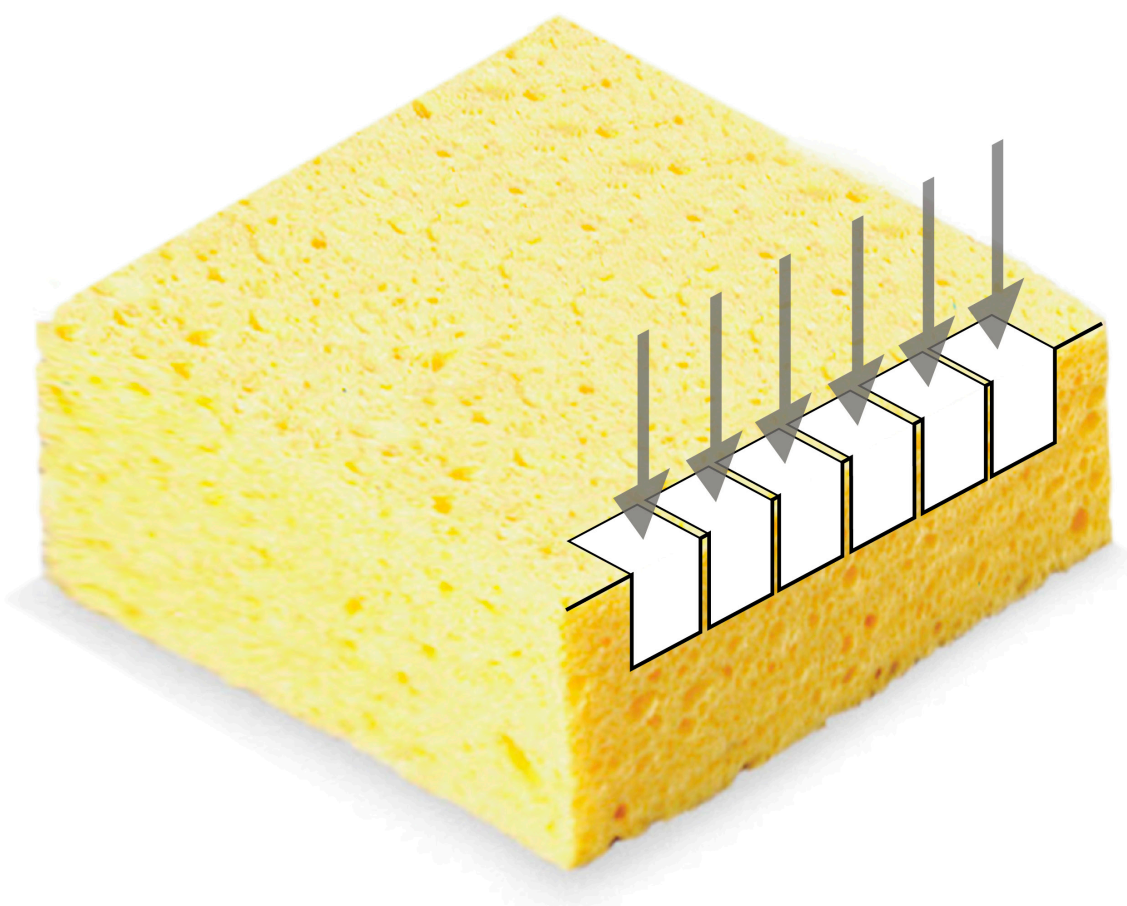


(Figure 38.)

Function

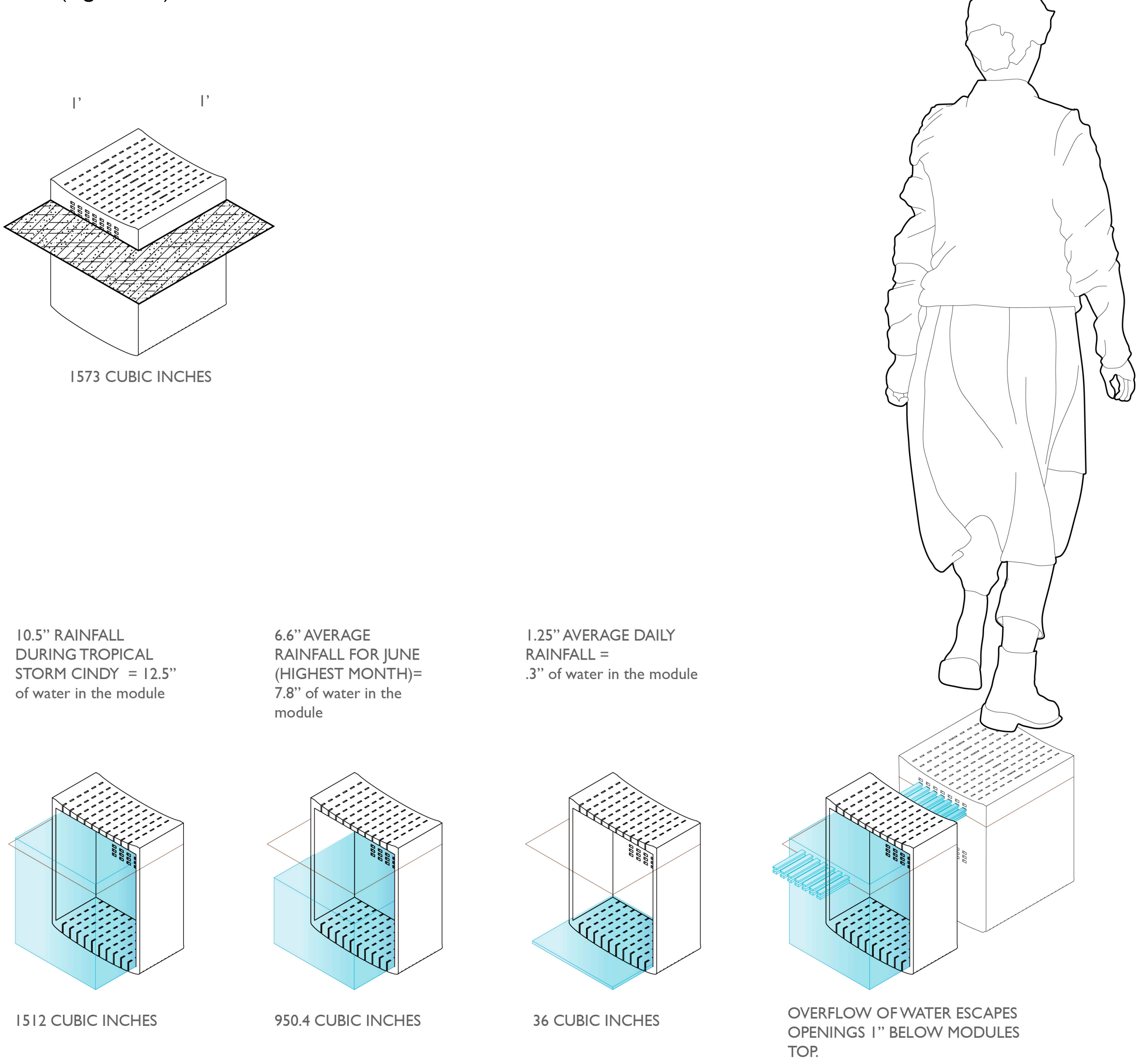
By punching holes into the sponge of the city, these modules can mimic and assist the soil's already absorbent nature and help to keep the city's water table high, thus reducing the rate of additional sinking. The sponge diagram in figure 39[107] shows how the modules implementation focuses on putting more air-gaps and spaces for water into the already sponge like and porous soil of the city.

These modules acknowledge that due to climate change and the degradation of the city's geologic nature (due to water pumping and paving), the geology needs assistance to give the soil more time to absorb the rain water. One module, that occupies 1 square foot of area in plan, can hold 1573 cubic inches of water, 10.5" of rain is equal to 1512 cubic inches of water per every square foot of area. Which means that each module has enough volume for a rainfall that may exceed 10.5". The modules



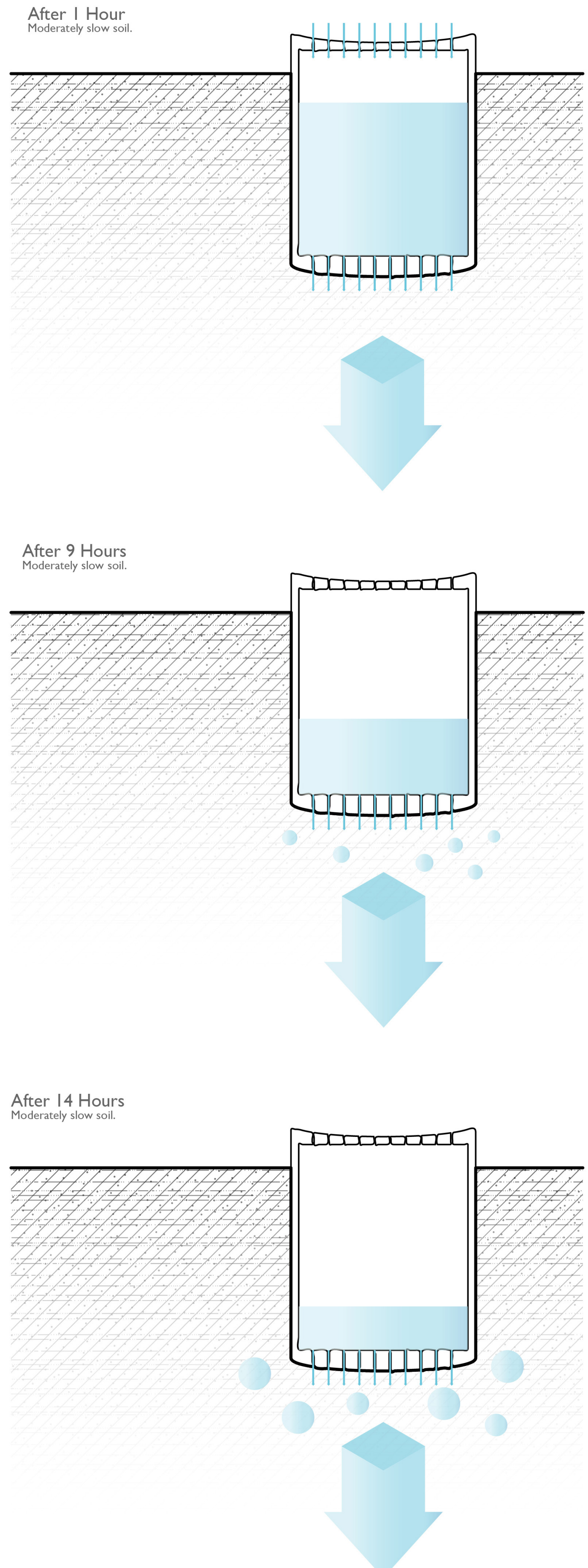
(Figure 39.)

are also designed so that in the event of an overflow, there are holes in the sides where the water flows either into an adjacent module using hydraulic pressure or simply spill out onto the surface. This design feature is primarily focused on keeping the water moving in the event that certain modules receive more water than others, and also to avoid the possibility of water uplifting the module and dislodging its position in the ground. The module's water holding calculations and related design features can be seen in (Figure 40.)[108]



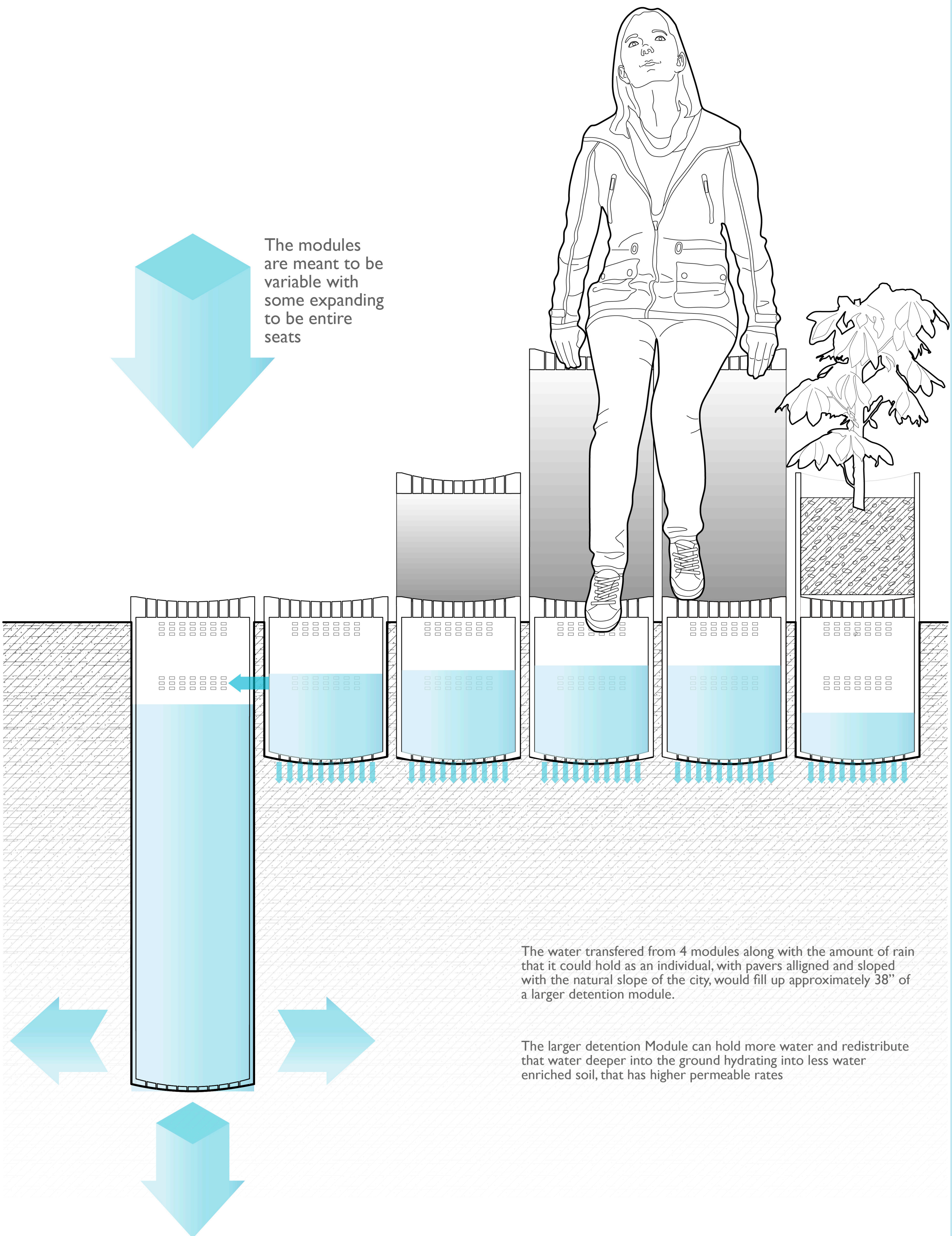
(Figure 40.)

The expansion of the modules, their depth and amount per area will vary depending upon the permeability of the soil at the area of instillation. The soil in New Orleans has typically very slow to moderately slow permeability.[109] In each module the water that doesn't overflow from the sides will slowly start to be absorbed by the soil at a pace that is dictated by the soil's permeability rate. The rates of the different permeabilities of soils are as follows; Very slow permeability have a rate of .06" per hour, slow permeability .2" per hour, moderately slow permeability .6" per hour, and moderate permeability 2" per hour. This means that it would take 10.5" 175 hours to fully be absorbed by soils with very slow permeability, and 17.5 hours to fully distribute in soils with moderately slow permeability. Thus, some modules would only have to store water for a day and others would have to store it for a week. Slow permeable soils would take 52.5 hours to fully distribute 10.5" and Moderate permeable soils 5.25 hours. The visual interpretation of these permeability facts can be seen in figure 41.[110]


After 1 Hour
Moderately slow soil.
After 9 Hours
Moderately slow soil.
After 14 Hours
Moderately slow soil.

(Figure 41.)

Due to the variation in water amounts and detention times of the water retained in a module, there is an obvious need for creating a larger detention module or assembly. The larger detention module assembly as seen in figure 42[111], can hold 3x the amount of water as one typical module. The larger detention module can hold a portion of the water collected from 4 adjacent modules along with the amount of rain that it would have to account for based on its square foot surface area and be up to 38" full and be roughly 4/5ths of the way full. These larger detention modules also have the advantage of being able to redistribute the detained water deeper into the ground into soil that may be slightly less water enriched and thus have higher permeability rates. the relative size of the detention modules versus the base modules can be seen in figure 42. The modules are also meant to expand above ground as well, in order to accommodate different activities within the public realm, with some modules becoming entire seats or benches.

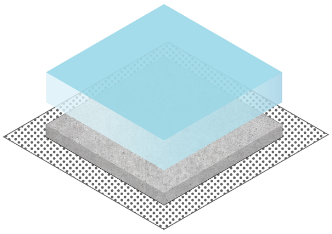

The modules are meant to be variable with some expanding to be entire seats
The water transfered from 4 modules along with the amount of rain that it could hold as an individual, with pavers alligned and sloped with the natural slope of the city, would fill up approximately 38" of a larger detention module.
The larger detention Module can hold more water and redistribute that water deeper into the ground hydrating into less water enriched soil, that has higher permeable rates

(Figure 42.)

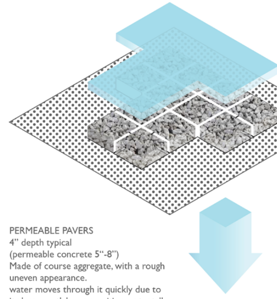
INTEGRATION

The design of the modules is meant to integrate ad maintain city's existing character and culture in a way that celebrates the concept of living on spongy ground.

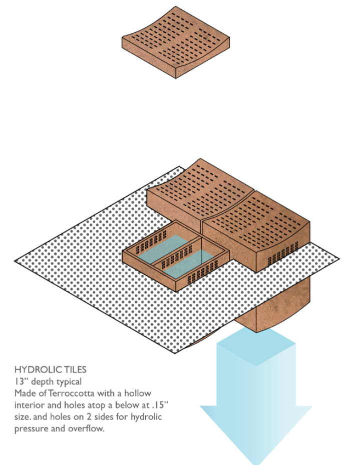
INTEGRATION



CONCRETE,
4" depth typical
completely non permeablewater pools on top and is not allowed to interact with the soil below.

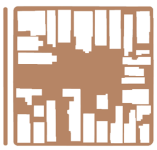


PERMEABLE PAVERS
4" depth typical
(permeable concrete 5"-8")
Made of course aggregate, with a rough uneven appearance.
water moves through it quickly due to its large partlcle composition, potentally too quickly for the soil below to absorb in large rain events.



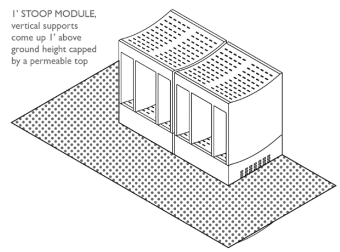
HYDROLIC TILES
13" depth typical
Made of Terroccotta with a hollow interior and holes atop a below at .15" size. and holes on 2 sides for hydrolic pressure and overflow.

The modules come as a kit of parts beyond the base module:



If the modules are used for the area of the whole block and median area, excluding the building footprints they can account for over 50% of the water to fall on site in a large rain event and 90% of the water amount average for the month of June.

If the modules are used for a partial area of the whole block at the perimeter and median, the modules can account for 24% of the water to fall on the block in a large rain event and 50% of the water amount average for the month of June.



1' STOOP MODULE,
vertical supports come up 1' above ground height capped by a permeable top

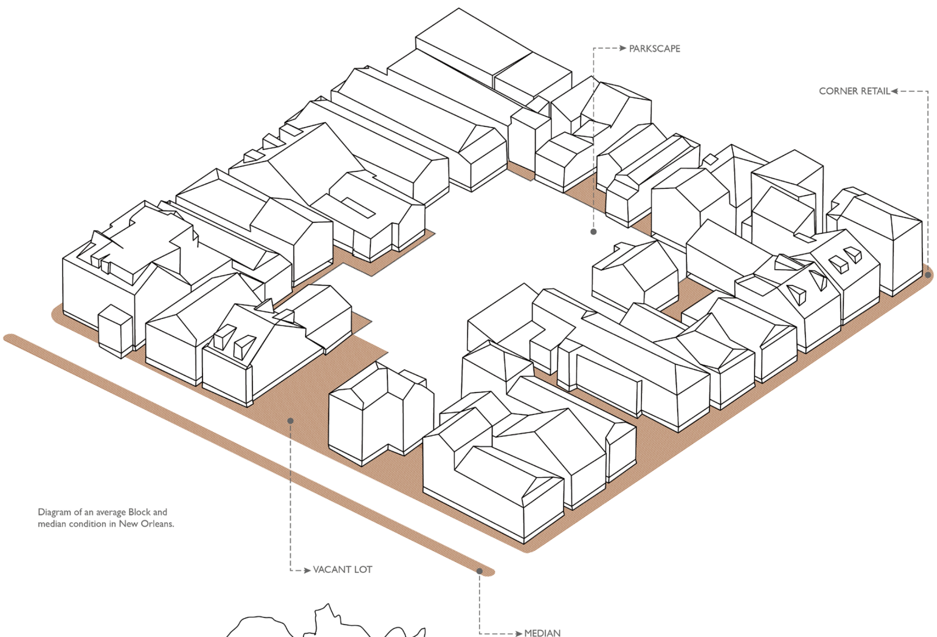
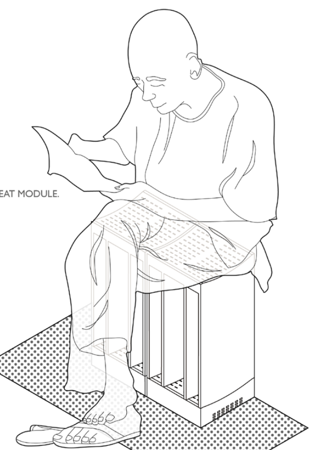
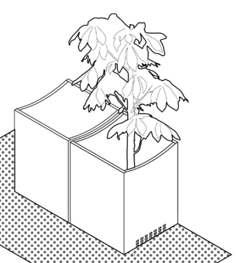


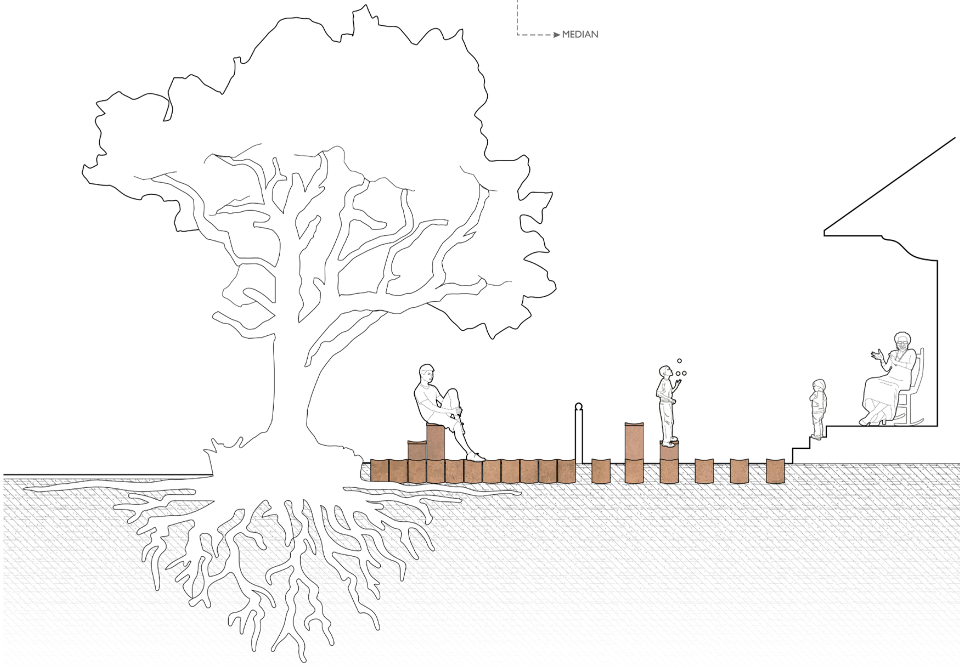
Diagram of an average Block and median condition in New Orleans.



2' SEAT MODULE.



1' PLANTER Module,
alows plants to inhabit atop a typical base module with the the excess water not needed by the plant to filter through to the ground soil

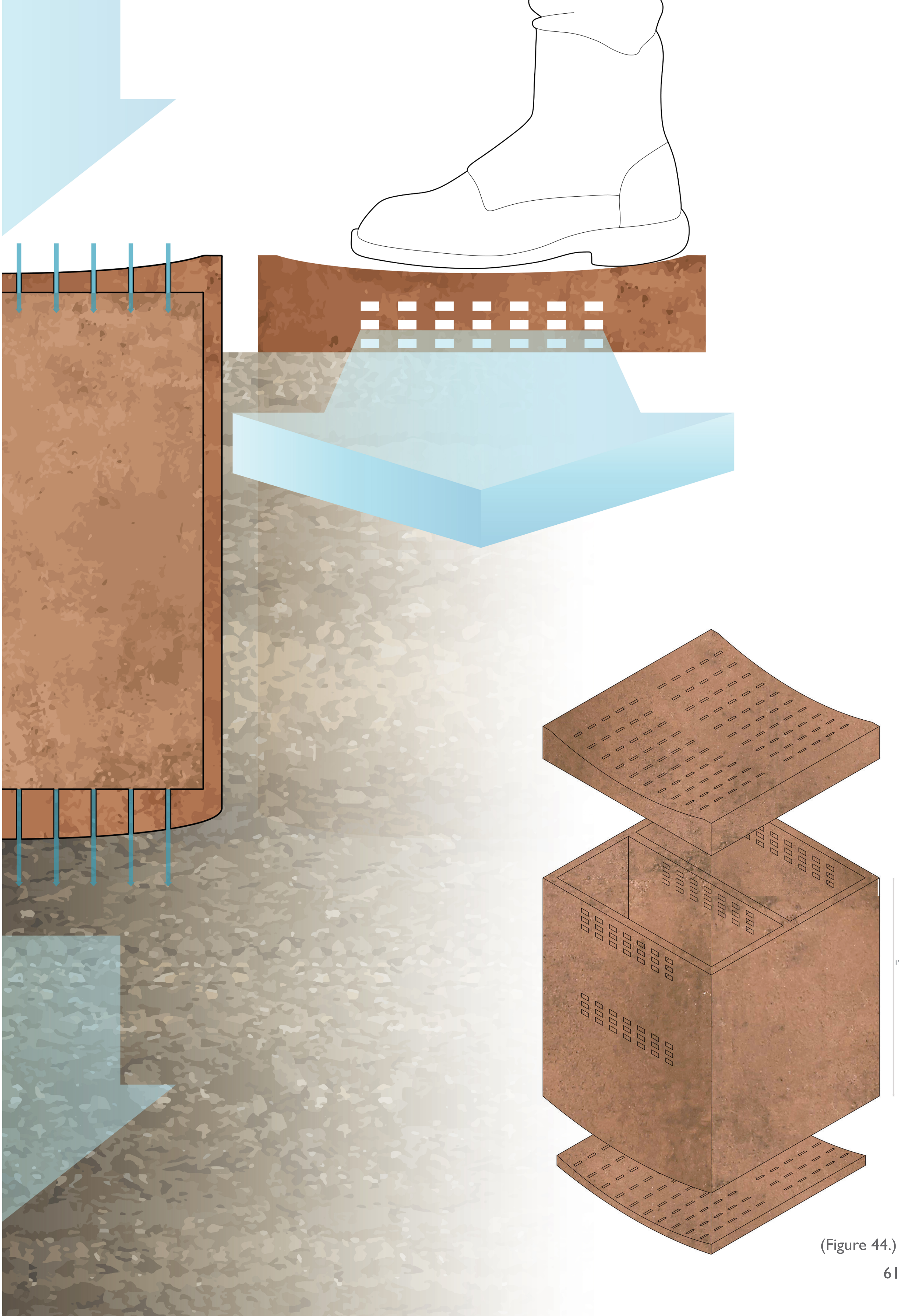


Section diagram showing how the modules will integrate with the sidewalk, yard, porch, and oak trees that characterize the public right of way

(Figure 43.)

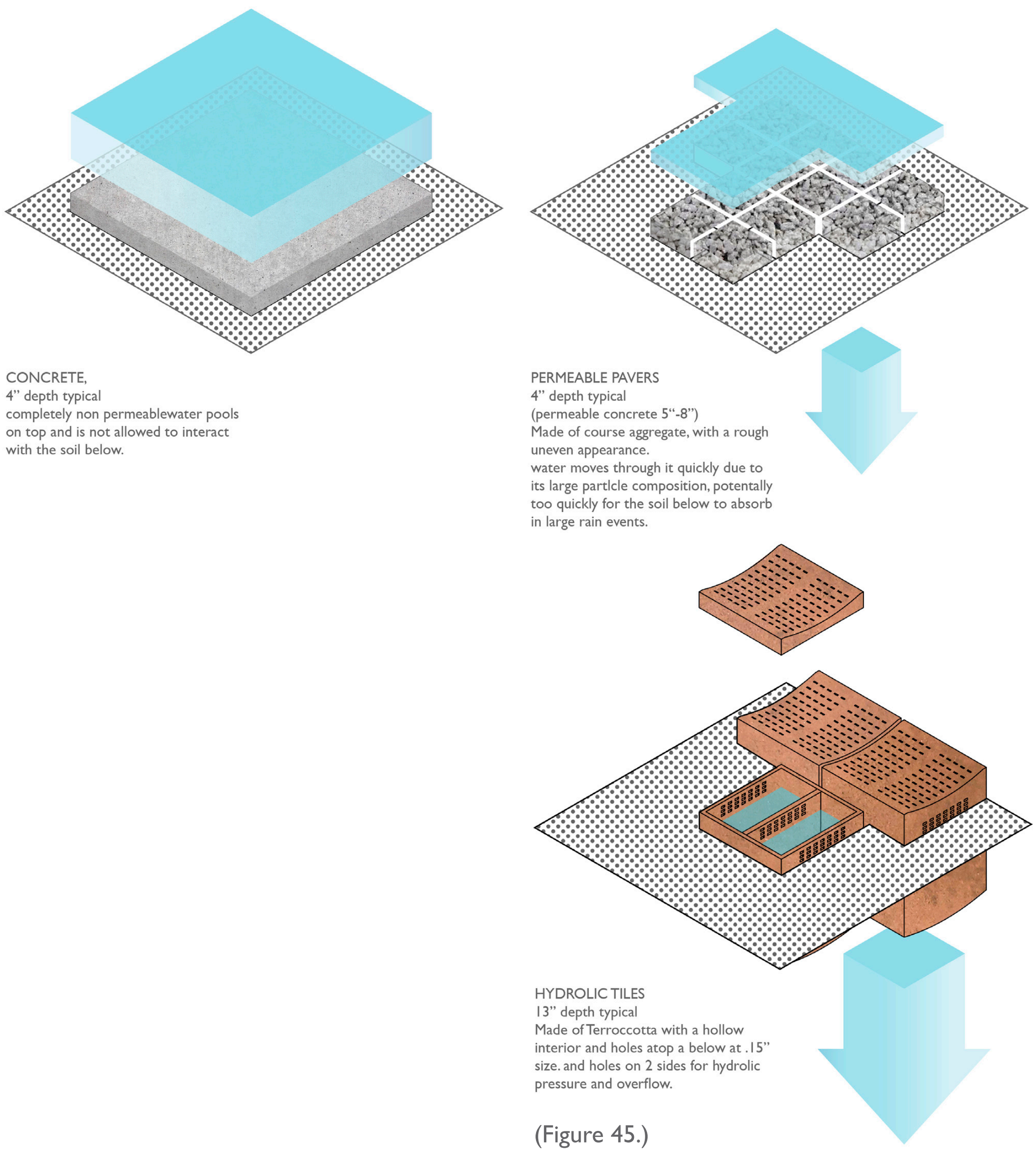
Integration

Currently the city's public right of way is almost completely covered in concrete, completely separating the surface water from the correlating soil below. A concrete sidewalk is typically 4" deep and completely non-permeable. The next best alternative to concrete that exists are permeable pavers and permeable pavement. It is made of coarse aggregate with a rough uneven appearance. Water moves through the pavers relatively quickly due to its large particle composition, potentially too quick for the corresponding soil below them to absorb water when there are large rain events. The "Hydraulic Tile" modules could be made of ½" thick terracotta hollow form with an interior vertical support and small .15" repeating holes punched into the top and bottom of the module, as well as larger weep holes on 2 of the module's sides and its interior vertical support. The visual example of the design can be seen in figure 44.[112] The entire module is 13" deep and is intended to be submerged 11" into the ground and then be surrounded by 2" deep infill of permeable joint material or drainage aggregate. The spacing between adjacent modules is meant to be about ¼" to 1/2".



(Figure 44.)

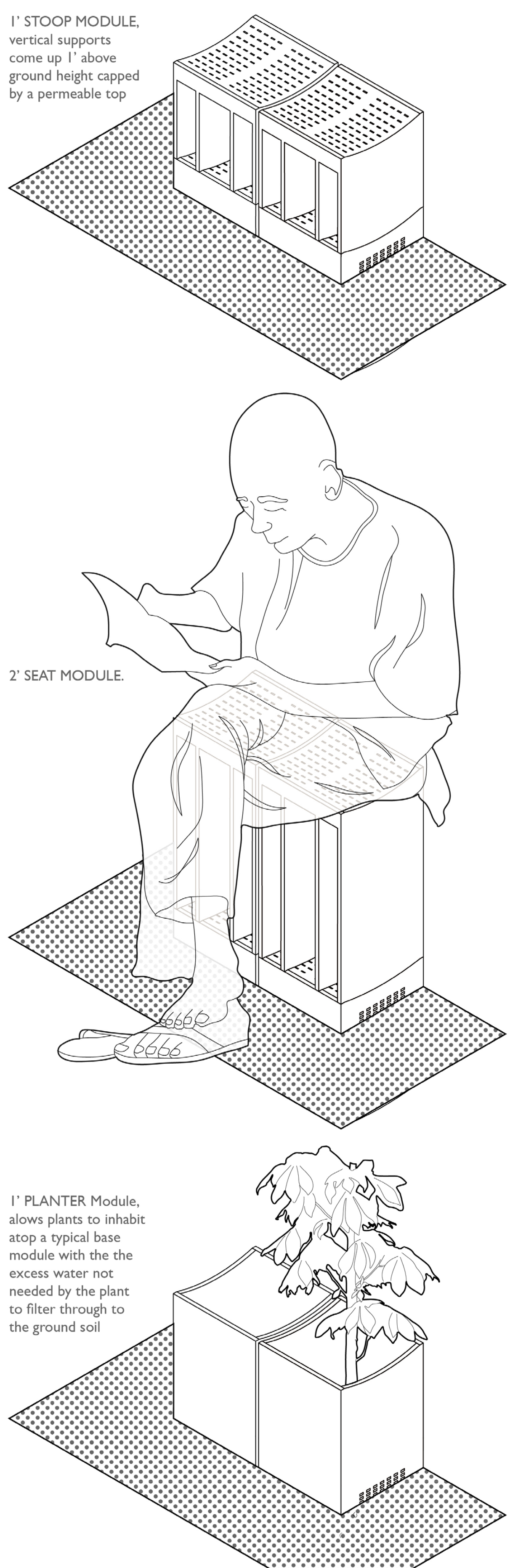
The overall design seeks to take the idea of permeable pavement and expand its effectiveness in order to better respond to the current state of the city's geology and the climatic conditions that it is now facing. Permeable pavers help to connect rainwater to the soil below, The Hydraulic Tile seeks to do the same but also acknowledge New Orleans's unique site condition above and below the ground surface. The city's amount of precipitation and geologic state mean that the soil can't take in the amount of rain water it receives at a rapid enough pace, thus by creating a ground surface that implants itself into the soil The Hydraulic Tiles are able to make an effective permeable ground that responds to the climate and geology of the city. The comparison of the 3 different ground surface treatments can be seen in (Figure 45)[113].



(Figure 45.)

The reality of the instillation is that 1584 cubic inches, or .9 cubic feet of soil would have to be relocated for each paver installed. The first inclination is to try and reuse the excavated soil, which is typically clay rich, to make other modules but unfortunately the cities clayey soil is not refined enough to be used for making a brick like component. The second inclination this thesis proposes is to relocate the soil excavated where the tiles are installed in higher elevation areas and use it as infill in installation sites located in the lower elevation areas. The intention being that in the lower areas there would be the need for less excavation and installation would just be about using the excavated soil from the higher sites to help raise up the lower parts of the city.

The Hydraulic Tile's function is also meant to expand programmatically into the public sphere, creating 4 different tile types. Each of the 4 different types can be seen in axonometric form in (Figure 46).[114] The 4 types are: The Base Tile, The Stoop Tile, The Seat Tile, and the Plant Tile. The Stoop module has the same base module's function and uses vertical supports coming off the Base tiles top, that rise 1' above the ground's surface and are capped by a perforated terracotta top similar to the base Tile's top. The Stoop Tile's height is such that it can be used for sitting like you would on the front steps of a home and mimics the milk crate and stoop sitting culture used by local street performers. The second type is the Seat Tile, its design is similar to the Stoop's except in that it rises 2' off the ground at a height that is more amenable to sitting. The idea of these Tiles that extend out of the ground surface is to retain the same idea that an object does not have to be solid in order to be occupied along the street scape. The last tile type is the Plant Tile, which is essentially a planter that sits atop the Base Tile and allows some water to be filtered and absorbed by the plant before trickling down to the detention basin and then soil below. A large amount of plant life is not suited to be submerged in water and thus most don't survive well in areas of flooding, the Plant Tile creates a chance for smaller more diverse plant life to flourish in the public right of way.


1' STOOP MODULE,
vertical supports
come up 1' above
ground height capped
by a permeable top
2' SEAT MODULE.
1' PLANTER Module,
alows plants to inhabit
atop a typical base
module with the the
excess water not
needed by the plant
to filter through to
the ground soil

(Figure 46.)

These tile types are not meant to recreate the way that the public right of way is used in the city. The public right of ways of New Orleans are spaces that tourists and locals alike take full ownership of; many are connected to the homes due to the city's porch culture that extends the living room out into the adjacent porch, stoop, yard and sidewalk. It may also be 130 festivals that take place in the streets, parks, and fairgrounds of the city, or the parade culture that promotes dancing in the streets for weddings, funerals, and Mardi Gras. The sidewalks and the public realm are extensions of the home and meant for watching and participating in the celebration of the spectacle. The tile's extend above the ground is simply to help make room for the activities and the spectacle that already exists in the public realm. Making areas for watching parades, for musicians to set up shop, and mainly to help in keeping less water in the public streets and making it more hospitable to all of the city's public life.

The effectiveness and thus the role that they can play in reducing the flooding in low lying areas of the city is based on the amount of water that they can detain per block, and thus reduce runoff in higher areas and pooling water in others. If just the Base Tiles are installed in all of the area of an average city block and adjacent median area, excluding the building footprints, As seen in figure 48.[115], they can account for 50% of all the water to fall on the whole block and median area in a large rain event and 90% of the precipitation average for the month of June. If the Base Tiles are installed in only a partial area of an average block, (Figure 49)[116] focused on the sidewalks, alleyways, vacant lots and adjacent median, they can account for 24% of all the water to fall on the whole block and median area in a large rain event, and 50% of the precipitation average for the month of June. These statistics reveal the how effective the tiles are in their ability to keep the soil hydrated with average amounts of precipitation, which is typically pumped out or diverted to drainage basins even in small quantities because the ground condition currently has no absorbent properties or top soil that is already too water enriched to be absorbent.

objective. The design began under the understanding that the city is integrating multiple resilient systems and a permeable ground surface is only one. The larger axonometric diagram in figure 47[117] depicts a typical New Orleans block with the terracotta toned area being if the pavers were partially installed. The Diagram also points out areas of the block that represent four typical conditions found in the public right of way that offer the best opportunities for expanding the areas of implementation of Hydraulic Tiles; the median, the hard park-scape, the vacant lot, and the corner retail. However the most typical integration will be in the sidewalks and yards of the streetscape, The diagrammatic section in figure 50,[118] is a visual representation of this typical implementation. The tiles are meant to be inserted into the ground and able to fluctuate with the organic nature of the soil and its adjacent plant root systems. The section also shows how the relative height of the tile types as they relate to the vernacular of the yard steps and porch of the streetscape vernacular and how the Stoop and Seat tiles create area for observers and areas to be observed.

The effects and experience of implementing the Tiles in the public right of way as a means to reduce flooding while also celebrating public space is explored through experiential renderings. Each one focuses on one of the four typical conditions of a corner retail, a park-scape, a median, and a vacant lot. All of the renderings seek to show how the tiles can help to reduce flooding and also celebrate the vibrant life in such a wet city.

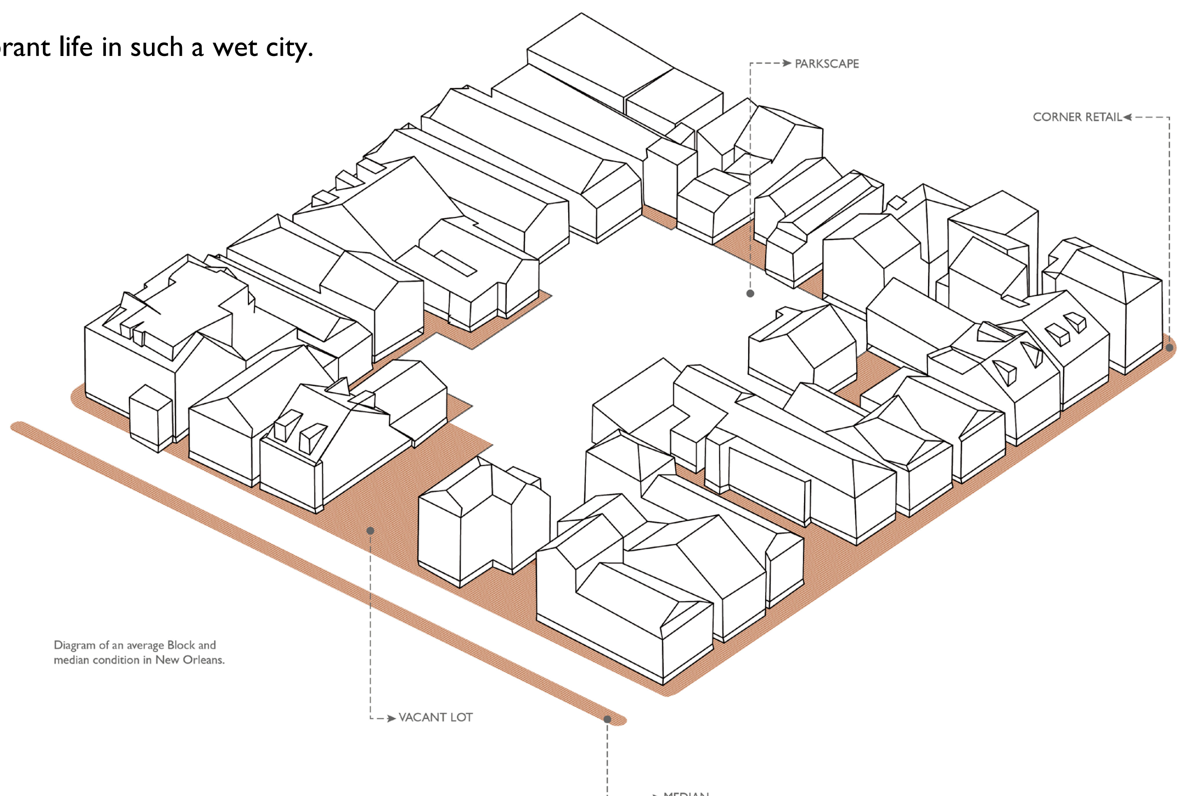
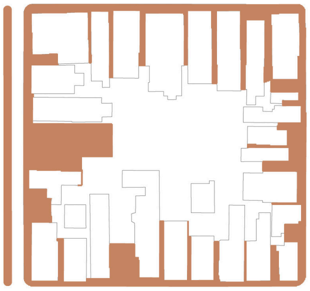


Diagram of an average Block and median condition in New Orleans.

(Figure 47.)

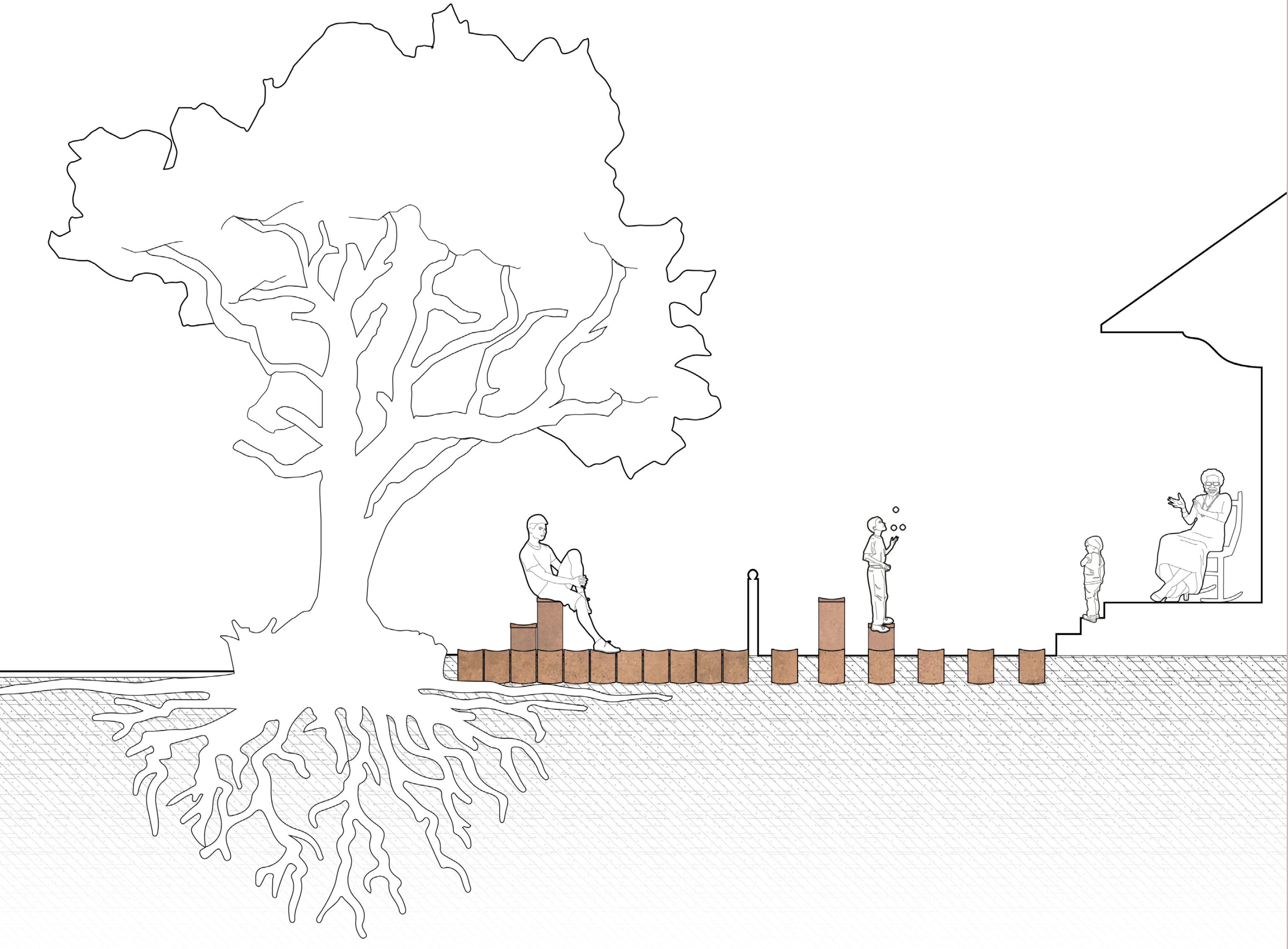
If the modules are used for the area of the whole block and median area, excluding the building footprints they can account for over 50% of the water to fall on site in a large rain event and 90% of the water amount average for the month of June.

(Figure 48.)



If the modules are used for a partial area of the whole block at the perimeter and median, the modules can account for 24% of the water to fall on the block in a large rain event and 50% of the water amount average for the month of June.

(Figure 49.)



(Figure 50.)

Culture

A Corner Retail: (Figure 51)[119] The establishment in the rendering is Pal's Lounge, a local bar in the Bayou St John Neighborhood, specifically located at the edge of where the flooding would start on Figure 26. Corner stores and corner bars are common and frequently occupied for gathering, expanding the bar's customer area as an outdoor space without the need for any formal delineation of space, due to the fact that drinking on the streets is legal in the city.

(Figure 51.)

A park-scape: (Figure 52)[120] This view is of the corner entrance to a hardscape playfield, also located in the Bayou St John neighborhood. This is a typical condition of how sidewalks along public parks and playfields are often used for drop-off and pick up spots along with viewing or waiting spots for parents. This rendering also indicates that the Tiles can become areas for street performers.

(Figure 52.)


ONE WAY

A Median: (Figure 53)[121] Median are a typical condition of many large to medium sized streets in the city, and range in size from 2' to 20' widths. These medians in particular are located in the Mid-City neighborhood. They are often under used as fields of grass or the occasional walking path, but during parades and other festivals the medians become viewing platforms essential to carnival amusement.

(Figure 53.)

A Vacant Lot; (Figure 54.)[122] Vacant lots are sparsely located around the city with more in some areas than others, this lot shown is located in the Bayou St John area. The rendering reimagines the lot as a place to potentially host an art market, with the tiles acting to help break down the space and suggest areas of gathering and travel.

(Figure 54.)


NIKE

The last two images in figures 55&56,[123] are a before and after section perspective view of Jazz Fest. Jazz Fest is an annual music festival that is located on the existing fairgrounds/ horse tracks in the fairground's neighborhood next to Bayou St. John. The Festival, typically held in the spring, is known to receive heavy rains every year, to the point that most veterans of the festival show up wearing rain boots. The final rendered section perspective seeks to reimagine how the muddy or flooded ground-scape can be reimagined with the Hydraulic Tiles to create an area that has space for both people and water to occupy.

(Figure 55.)

(Figure 56.)


FAIS DO DO
CONGO SQUARE
CONGO SQUARE
¡LATINFEST!

Lessons

Prototyping is the next step going forward with the technical design. Ideally creating 3 different full-scale modules. One of the aspects of alteration would be the location of the perforated holes and where on the module they would congeal the least amount of silt and best distribute into the soil. Also, the interior treatment of the modules would be tested to account for different durations of standing water. The Implementation of the design going forward would seek to locate specific areas that are ideal for different module sizes, how many would be needed and where in order to reach their full potential. The modules are idea for reducing runoff but would be far less effective in areas where the flooding reached above 1' of water. Part of the implementation plan would focus on time and how implementing the Hydraulic Tiles in higher areas would ideally make their effectiveness in adjacent lower areas more effective. The intent going forward is to build a prototype and create a manual of execution and installation location practices, setting up the Hydraulic tiles as a realistic implementation and moving the conversation of resiliency to being about implementing strategies that are environmentally specific and open for citizen participation.

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[20] (Kingsley 2007 719)

[21] (Kingsley 2007 720)

[22] (Kingsley 2007 725)

[23] (Hermens 2010 39)

[24] (Hermens 2010 40)

[25] (Hermens 2010 40)

[26] (Hermens 2010 42)

[27] (Hermens 2010 42)

[28] (Hermens 2010 37)

[29] (Campanella 2006 42)

[30] (Hermens 2010 37)

[31] (Hermens 2010 37)

[32] (Figure 6.) (Hermens 2010 38)

[33] (Hermens 2010 37)

[34] (Hermens 2010 37)

[35] (Hermens 2010 38)

[36] (Campanella 2006 43)

[37] (Campanella 2006 43)

[38] (Campanella 2006 43)

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