

## ABSTRACT

Title of Thesis: THE NEW JERSEY MEADOWLANDS:  
INHABITING AN URBAN WILDERNESS

Karen Sendner, Master of Architecture, 2016

Thesis Directed By: Lecturer, James W. Tilghman, School of  
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The New Jersey Meadowlands is a thirty square mile industrial wetland between New York City and the commercial district of East Rutherford, NJ. The place is both strange and fascinating; many mysteries are hidden between the reed grasses and scattered garbage. Often exposed to subjectivity, the Meadowlands is commonly perceived as a weird, polluted, industrial, and even an other-worldly space; few know its beauty. These differing perceptions create a challenge when thinking of a cohesive identity and sense of place in the marsh. Over time, the once pure landscape has suffered from infrastructural slices, illegal dumping, and environmental abuse, resulting in fragmented land areas along the Hackensack River's edge. This thesis explores how to inhabit an ecologically devalued and residual landscape through ideas of place-making and re-connecting communities. Investigating the paradox of this massive urban landscape and capitalizing on the ecological and educational potential of the site, lends also to a challenge of

converging modern and forgotten life. Designing a place-based ecological research community within this currently placeless environment, will engage the public, reconnect lost communities, and bring a sense of renewal to the marsh.

THE NEW JERSEY MEADOWLANDS:  
INHABITING AN URBAN WILDERNESS

by

Karen Sendner

Thesis submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Master of Architecture  
2016

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## Dedication

I would like to dedicate this thesis to my dad, Ronald Sendner, for taking me to my first Jets game in the Meadowlands; for advising me to put 'architecture' in the last open spot on my high school elective sheet; for kayaking with me on the Hackensack River (right up next to the sunken ship); for investigating the derelict house on the outskirts of the site; for climbing the unstable double deck driving range in order to get the perfect panorama; for all of your help, guidance, and support every step of the way along this thesis adventure.

Also, to my mom Jane Sendner, for all of your encouragement and support throughout this year long thesis process and my entire school career.

# Acknowledgements

## **Engagement:**

Dr. Francisco Artigas  
Hooman Koliji  
Powell Draper  
Dom Elefante  
Michael Stepowyj  
Ronald Sendner  
Linda Fisher  
Rich Wallner  
Carl Bovill

## **Mentorship:**

James Tilghman  
Brian Kelly

## **Support:**

My parents: Ronald Sendner and Jane Sendner  
My sisters: Julie Sendner and Nikki Sendner  
Brent Rebele  
Jeannine Muller  
Rachel Flinn  
Spring 2016 Thesis Class

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## Disclaimer

For all figures in this thesis document that source NJMC/MERI GIS, the following disclaimer applies:

*“This (map/report/publication) was created using the New Jersey Sports and Exposition Authority/Meadowlands Environmental Research Institute Geographical Information System digital data, but this is a secondary product and has not been verified and is not authorized by the NJSEA/MERI GIS.”*

## List of Abbreviations

BF E: Base Flood Elevation

DEEC: DuPont Environmental Education Center

HMDC: Hackensack Meadowlands Development Commission

MERI: Meadowlands Environmental Research Institute

NJMC: New Jersey Meadowlands Commission

NJSEA: New Jersey Sports and Exposition Authority

PCBs: Polychlorinated biphenyls

PSEG: Public Service Enterprise Group

## Chapter 1: Background

*Your ordinary commuter,  
He crosses the meadows twice a day,  
Five days a week  
And he says  
"What a hole!  
Nothing but reeds and burning garbage."*

*All right  
To them it's a hole*

*But I can see the birds' nests  
In those reeds,  
And I know where to find  
Turtle eggs and muskrat runs  
In the creeks.*

*I watch the cars and buses and trains  
Going by-  
Heading east in the morning, west at night -  
And I look at the people in them and think,  
I've got an edge on you.  
I can see things here  
That you can't.*

*Well, goodbye.*

-Jake Kraft, one of the meadow rats from Carlstadt, NJ as told to John Brooks 1950's<sup>1</sup>

### Introduction:

The strange emptiness of the Meadowlands still intrigues me. As a child, driving on the NJ Turnpike and catching a glimpse of this massive void in the landscape before heading onwards toward New York City left me filled with curiosity. What kind of space is this? What happens within the wetlands? Why is it empty?

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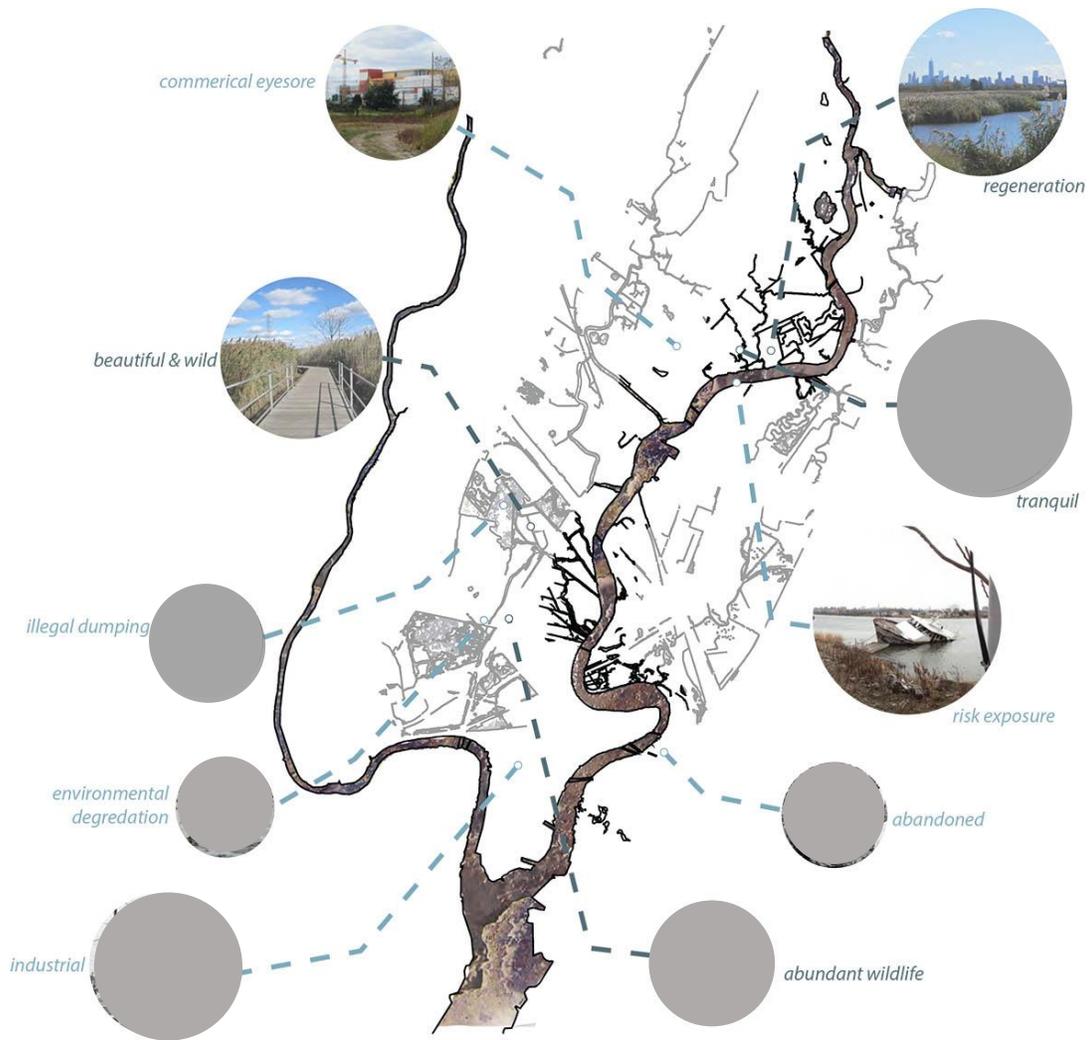
<sup>1</sup> Jonathan Williams, afterword to *Meadowland* by Ray Mortenson (New York City: Lustrum Press Inc., 1983)

From the NJ Turnpike, people pass by and forget about the Meadowlands. Even so, it is hard to ignore as the sheer size and momentous void of landscape clearly stands out from the dense urban surroundings. It is a unique piece of beauty, a patchwork of infrastructure, industrial, commercial, and residential buildings along the Hackensack River's edge.

Although the Meadowlands District is comprised of fourteen municipalities, it is a forgotten backyard to all of these local communities. The surrounding communities' connection to the marsh was severed when the Paterson Plank drawbridge was removed, and there now lacks a pedestrian sequence into the marsh. However, there is an opportunity to revive the spirit and sense of place in the marsh, and reconnect the idea of community within this district.

The Meadowlands is a mysterious place. Some are intrigued; others actively try to ignore. Most perceive the Meadowlands as a place to avoid, a place of pollution, industry, abandonment, smells, dead bodies, and strangeness. However, the only way to have a holistic understanding of the scale and hidden beauty of the Meadowlands is to explore.

There are many stories, opinions, and photographs that continue to fuel my personal curiosity of the Meadowlands. In order to understand the many perceptions, this thesis considers the weird, the serious, the adventurous, and the hopeful stories and opinions of the NJ Meadowlands as written by others.



**Figure 1: Site Perceptions**  
**Source: Image by Author, Underlay NJMC/MERI GIS**

Perceptions:

**Bryan Zanisnik | Author/Adventurer:**

“Beyond Passaic: A Meadowlands Photo Essay”

*“The Meadowlands cannot be comprehended from a bird’s-eye view, nor can it be experienced in a hazmat suit—or even by driving above the wetlands on the Turnpike. One must stay close to the ground and risk exposure to the environment. And so I did, armed with nothing more than a map and a camera.”<sup>2</sup>*

<sup>2</sup> Bryan Zanisnik “Beyond Passaic: A Meadowlands Photo Essay,” *Triple Canopy* (December 2011) accessed October 23 2015, [https://canopycanopycanopy.com/issues/15/contents/beyond\\_passaic](https://canopycanopycanopy.com/issues/15/contents/beyond_passaic)

Even though only one active landfill remains in the Meadowlands District, garbage still is scattered throughout its entirety. Bryan Zanisnik over a decade of time recorded a list of the garbage that he encountered on his adventures through the swamp. These items begin to depict the strangeness, and the forgotten remnants left in the marsh. A few of the items:

**Table 1: Bryan Zanisnik Record of Garbage**

• U.S. Army helmet	• Drafting desk	• Tackle box and fishing pole
• Baby carriage	• Electric guitar	• Car in a river
• Couch with a floral pattern	• Tanker truck	• Garage door

**Joshua Lutz | Photographer:**

Lutz’s photographs of the Meadowlands are provocative and convey a duality of strangeness and beauty. The images capture the people who inhabit the space, which is something that is often overlooked.

*The Meadowlands is a place to pass through and forget on the way to someplace else. Not unlike a neglected child, the Meadowlands has grown up without guidance, constantly unsure of what the future holds. It is this loneliness and solitude that continues to bring me back year after year. These disparate images tell different stories; like songs on an album that build upon each other. Each one may be about something specific. More often than not, the specifics are less important than the feelings conveyed.<sup>3</sup>*

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<sup>3</sup> “Meadowlands,” JoshuaLutz.com. Accessed November 12, 2015. <http://www.joshualutz.com/books/meadowlands/>

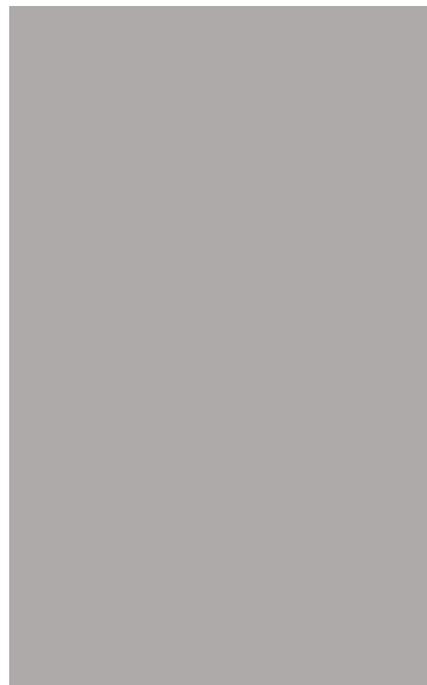


**Figure 2: Joshua Lutz Photographs from series Meadowlands**  
Source: JoshuaLutz.com

**Robert Sullivan | Author/Adventurer:**

“I Sing the Meadowlands!” | The Meadowlands, Wilderness Adventures at the Edge of a City  
1998

Known author and adventurer, Robert Sullivan has traversed the Meadowlands and canoed down the Hackensack River. His article “I Sing the Meadowlands” explicitly references perceptions of others, including authors of a federal report, American diplomats, and local residents of the Meadowlands. Un-phased by the negative perceptions of others, Sullivan proclaims his own views from the top of Snake Hill.



**Figure 3: Robert Sullivan's Map**  
Source: *The Meadowlands*, book by Robert Sullivan

*“I marvel that I am in the middle of a 32-square-mile wilderness, part natural, part industrial, that is five miles from the Empire State Building and a bit bigger than Manhattan.”<sup>4</sup>*

*“I marvel that the land before me was called "a swampy, mosquito-infested jungle, where rusting auto bodies, demolition rubble, industrial oil and cattails merge in unholy union" by the authors of a 1978 Federal report...<sup>5</sup>*

*“I marvel that American diplomats supposedly once tried to find a way to avoid driving Leonid Brezhnev, then the leader of the Soviet Union, through the Meadowlands on his way*

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<sup>4</sup> “I Sing the Meadowlands,” New York Times Magazine. Last Modified February 15 1998. Date Accessed December 13, 2015, <https://www.nytimes.com/books/98/04/19/reviews/sullivan-mag-article.html>

<sup>5</sup> New York Times Magazine, “I Sing the Meadowlands.”

*from New York to Washington because they were embarrassed, but they couldn't and it ended up being O.K. because he thought it was terrific.*"<sup>6</sup>

*"I marvel that when Orson Welles broadcast "The War of the Worlds," in 1938, many of the people who lived near the Meadowlands and had tuned in to the program late just assumed that the Martians had landed in the Meadowlands: it was the obvious place."*<sup>7</sup>

*"I marvel that in 1956 a man set out in the fall to walk across the meadows, which are now paved concrete from Newark to Elizabeth, and that he didn't show up until next spring, when his body was found in a creek."*<sup>8</sup>

*"But when I am on Snake Hill I feel as if I am listening to a beat-up old rock tell the very best stories about the world's most forgotten ground. There, with the sun burning through smog and lighting up the reeds, with eight lanes of turnpike traffic providing backup, I sing the Meadowlands. I am the dot on the Meadowlands' exclamation point."*<sup>9</sup>

### **Ray Mortenson | Photographer:**

Mortenson captures the industrial landscapes of the Meadowlands from 1978-80. The beauty in the juxtaposition of the infrastructure and power plants with the reed grasses and tranquility emphasizes the paradox of the site.

As recorded in an afterword by Jonathan Williams in Mortenson's book Meadowland:

*"This particular landscape is open, horizontal and deserted, yet it is only two miles from one of the most closed, vertical and densely populated cities in the world. It functions as a major transportation center and power supply for the city [...] a huge machine with no one there to run it"*<sup>10</sup>

*"When I am out there photographing, I am at ease. There is tranquility...space, peace and quiet. The place has a dream-like, almost other-worldly quality for me"*<sup>11</sup>

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<sup>6</sup> New York Times Magazine, "I Sing Meadowlands."

<sup>7</sup> New York Times Magazine, "I Sing Meadowlands."

<sup>8</sup> New York Times Magazine, "I Sing Meadowlands."

<sup>9</sup> New York Times Magazine, "I Sing Meadowlands."

<sup>10</sup> Williams, afterword

<sup>11</sup> Williams, afterword



**Figure 4: Ray Mortenson Photographs from series Meadowland**  
Source: raymortenson.com

**Kevin Manahan | Reporter:**

An article published on NJ.com in July 2012 titled “A haunting mystery: Man says he dumped his dead cousin in Meadowlands, but where is the body?”

Reporting the search for a body of a young man from Belleville, NJ Manahan writes:

*Just off Belleville Turnpike, in a marshy industrial area of graffiti-covered loading docks and abandoned radio-station antennas, a religious candle burns at the base of a scruffy tree. It's there, near the gravel path that leads to a power substation. Past the empty beer cans and crushed bait containers, you'll find the makeshift memorial of teddy bears and seashells, where gnats and mosquitoes pay their respects around the clock. Google Earth says this is Kearny. One look around says it's the middle of nowhere.<sup>12</sup>*

**Susan Bass Levin | NJ Dept. of Community Affairs Commissioner, NJ Meadowlands Commission Chair:**

As seen in the “New Jersey Meadowlands and More Birding & Wildlife Trails” Guide Book, 2006

The commissioner chair is featured on the back cover of the free guide book, produced by the NJ Audubon Society. The booklet markets the bird watching and wildlife trails in the Meadowlands, and is aimed at tourists, adventurers, and local community members.

Back Cover of Trail Guide, entitled “Dear Nature Enthusiasts”:

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<sup>12</sup> “A Haunting Mystery: Man says he dumped his dead cousin in Meadowlands, but where is the body?”Nj.com, Last Modified July 29, 2012. Accessed December 13 2015.  
[http://www.nj.com/news/index.ssf/2012/07/a\\_haunting\\_mystery\\_man\\_says\\_he.html](http://www.nj.com/news/index.ssf/2012/07/a_haunting_mystery_man_says_he.html)

*There are so many beautiful and wild places tucked away in and around the Meadowlands...when you look out at the wonder of it all, keep in mind that there was a time when all of this was destined to be filled in and erased. But thanks to people like you and the residents of this region - who care about natural jewels like the Meadowlands - we have saved this special place. We are planning a better, smarter future, and we hope you'll keep coming back to celebrate the regeneration of our Meadowlands.<sup>13</sup>*

So What?

For decades the Meadowlands has been, and always will be, judged, inspected, and examined from all angles. As there are many differing perceptions of the Meadowlands, this poses a challenge in creating a cohesive identity and sense of place in the marsh. The dictionary definition of the word ‘perception’ is “awareness of the elements of environment through physical sensation; quick, acute, and intuitive cognition.”<sup>14</sup> Even though there are many differing perceptions of the Meadowlands, very few have actually experienced the wilderness and physical elements of the environment. The passerby is quick to judge based on an intuition from a few moments of driving by on the Turnpike. If the sense of place within the Meadowlands is strengthened, new perceptions, ones from actually inhabiting the urban wilderness will strengthen the regeneration and renewal process of the marsh.

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<sup>13</sup> Susan Bass Levin, “Dear Nature Enthusiasts,” in *New Jersey Meadowlands and More Birding and Wildlife Trails Guide* (NJ Audubon Society, 2006)

<sup>14</sup> “Perception.” Merriam-Webster.com, accessed May 16, 2016 <http://www.merriam-webster.com/dictionary/perception>

## Chapter 2: Lenses of Inquiry

### Framework for Investigation:

This thesis investigates the meaning of place in the NJ Meadowlands. Currently the Meadowlands exists in a state of a heterotopia, a space somewhere between a “good place” and “no place,” and as Louis Marin, a critic of Foucault, refers to it, “the neutral.”<sup>15</sup> It is the leftover landscape in-between the NYC Metropolitan area and the East Rutherford, NJ Meadowlands sports complex. The Meadowlands District, juxtaposed between these two urban nodes and sliced by highway and rail infrastructure, lacks an identity of place. The paradoxical space is made up of many overlapping threads of industry, wetlands, education, hospitality, residential development, retail etc. that all stitch together along the Hackensack River to create this thirty square mile unique district.

This thesis proposes an ecological research community located within the marsh, with a place-based education focus. Implementing an educational approach to the site will allow students to relate back to the ecology and culture of the site. Through this symbiotic relationship of the student and the land, the Meadowlands’ identity as a place will strengthen. Students will learn about the marsh as it once was historically and study what it has become through years of industrialization and human intervention. By introducing an educational environment as an approach to

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<sup>15</sup> Kevin Hetherington, *The Badlands of Modernity* (New York, Routledge, 1997), vii-x

understand the Meadowlands as a place, the identity of the marsh could change to a space that is no longer seen as only in-between. Through creative place-making and the lens of place-based education, the surrounding communities can reconnect culturally and ecologically to the Meadowlands for what they once were, a beautiful unique landscape.

### Heterotopia

*“Heterotopia, literally meaning ‘other places’, is a rich concept in urban design that describes a world off-center with respect to normal or everyday spaces, one that possesses multiple, fragmented, or even incompatible meanings”<sup>16</sup>*

A topic first coined by Michel Foucault in the 1960’s, his article “Of Other Spaces: Utopias and Heterotopias” addresses six principles of this idea of heterotopia. Foucault refers to heterotopia as the mirror of a utopia, ‘outside of all places [...] a mixed, joint experience [...] a sort of simultaneously mythic and real contestation of the space.’<sup>17</sup> The Meadowlands can be described as a heterotopia, as it is a landscape that exists within its own time, forgotten as the modern world develops along the outskirts. The Meadowlands is seen as an ‘other’ space, where there is wilderness and strangeness and the modern world of New York City, only five miles away remains disassociated with this void in the landscape.

Foucault discusses the first principle as a ‘heterotopia of deviation: those in which individuals whose behavior is deviant in relation to the required mean or norm

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<sup>16</sup> Michiel Dehaene and Lieven De Cauter, *Heterotopia and the City: Public space in a postcivil society* (New York, NY: Routledge, 2008)

<sup>17</sup> Michel Foucault, “Of Other Spaces: Utopias and Heterotopias” *Architecture/Mouvement/Continuite* (October 1984): 4.

are placed.”<sup>18</sup> Situated on the immediate site of this thesis, there is an abandoned restaurant/double deck driving range, a large boat crashed along the river’s edge, and the original landowner’s house crumbling into the landscape. The site is, stuck in time, forgotten, and with an “idleness, [which] is a sort of deviation.”<sup>19</sup> There are marks of graffiti and profanity which plaster the sides of the buildings as well as broken windows with glass littering the ground. This site is currently a place of deviation, where teenagers congregate outside of the city.

In the third principle, Foucault discusses “heterotopia is capable of juxtaposing in a single real place several spaces, several sites that are in themselves incompatible [...] a whole series of places that are foreign to one another.”<sup>20</sup> The Meadowlands District itself is a combination of fourteen municipalities and two counties. The district reads as a patchworks of spaces and places all of very different identities. Within the district there is industry, three power plants still located along the river, juxtaposed with natural sites, wildlife reserves and the environmental center. There are landfill hills which sit overlooking the nature trails and bike paths. There is the new American Dream Meadowlands Mall (formerly Xanadu) which sits massive and looming over the landscape, adjacent to abandoned relics of a past marine life. At the immediate site this thesis investigates, there is a vacated restaurant/driving range which sits adjacent to brand new River Barge Park and Marina, this juxtaposition between a past forgotten marine life and a current modern life. These contrasting sites which sit adjacent to each other reinforce the notion of heterotopia, and the disconnected ‘series of places’ within the district.

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<sup>18</sup> Foucault “Of Other Spaces: Utopias and Heterotopias” 5.

<sup>19</sup> Foucault “Of Other Spaces: Utopias and Heterotopias” 5.

<sup>20</sup> Foucault “Of Other Spaces: Utopias and Heterotopias” 6.

The Meadowlands has been characterized as a void in the landscape, and as Foucault would identify, one of ‘those marvelous empty sites on the outskirts of cities.’<sup>21</sup> Dehaene and De Cauter argue that these spaces “have never been empty [...] these places also present history (rather than represent it), foster creativity and nourish the aesthetics of ruins; they are a habitat for wildlife and plants, places where the body has to adapt to its environment.”<sup>22</sup> The Meadowlands is a place that is flourishing with wildlife and plants, but has also been neglected, polluted, and abandoned due to past decades of human ignorance and abuse. It beckons for a new positive human intervention which will reinforce the idea of environment and ecology on the site and bring a sense of renewal to the marsh. A place where students and researchers will ‘adapt’ to the physical surroundings and inhabit the urban wilderness in order to truly experience the environment.

### Place-based Education

Place-based education is a symbiotic relationship between learning and site. The past neglect of the Meadowlands as a site allows for a unique opportunity in which education could have both a positive cultural and ecological impact. By implementing environmental research as a catalyst in the Meadowlands, students would not only understand the natural systems of the marsh, but also “strengthen the connections between education and where we, and other’s live.”<sup>23</sup> The complexity of

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<sup>21</sup> Foucault “Of Other Spaces: Utopias and Heterotopias” 7.

<sup>22</sup> Dehaene and De Cauter, *Heterotopia and the City*, 204.

<sup>23</sup> David Gruenewald, “Foundations of Place: Multidisciplinary Framework for Place-Conscious Education” *American Education Research Journal* 40, no.3 (Fall, 2003), 619-654.

the Meadowlands site begs for a unique approach to the cultural reconnection and ecological restoration of the marsh.

Through the design of an ecological research community, both the public and nearby university research students can reconnect with the Meadowlands through education and “cross-fertilize perspectives on place” creating a new identity for the site.<sup>24</sup> Traditional schooling techniques stress the importance of quantitative results through standardized testing, whereas a place-based approach allows students to understand more about the environment and how “places teach us about how the world works and how our lives fit into the spaces we occupy.”<sup>25</sup> Historically, humans have neglected the marsh and treated it as a dumping ground because of the lack of knowledge about environmental responsibility. Therefore, creating an educational campus will help to teach both the student and local communities to understand and “address the problems that the educational neglect of places help to create.”<sup>26</sup> The importance of strengthening the sense of place within the currently placeless Meadowlands, is to reconnect and re-engage the community with the landscape and the ecosystems that thrive within it.

### Site Archeology

There are many different layers and fragmented pieces that make up the composite NJ Meadowlands District. The paradox of the space is that industrial sites, infrastructure, and landfills are juxtaposed with lush reed grasses, wildlife reserve habitats, and new recreational facilities. Layered on top of these two landscapes are

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<sup>24</sup> Gruenewald, “Foundations of Place,” 619-654.

<sup>25</sup> Gruenewald, “Foundations of Place,” 619-654.

<sup>26</sup> Gruenewald, “Foundations of Place,” 619-654.

threads of urbanization and commerce, including the New American Dream Meadowlands, Metlife Stadium, the Horse Racing Track and the Izod Center. Placing these urban nodes on the outskirts of the Meadowlands District is a pre-meditated decision, one which was made knowing the stigma of the Meadowlands as a dumping ground. Therefore, the divide between the modern world and the forgotten world is heightened when viewing the juxtaposition of the derelict site with the New York City Skyline and the American Dream Meadowlands Mall.

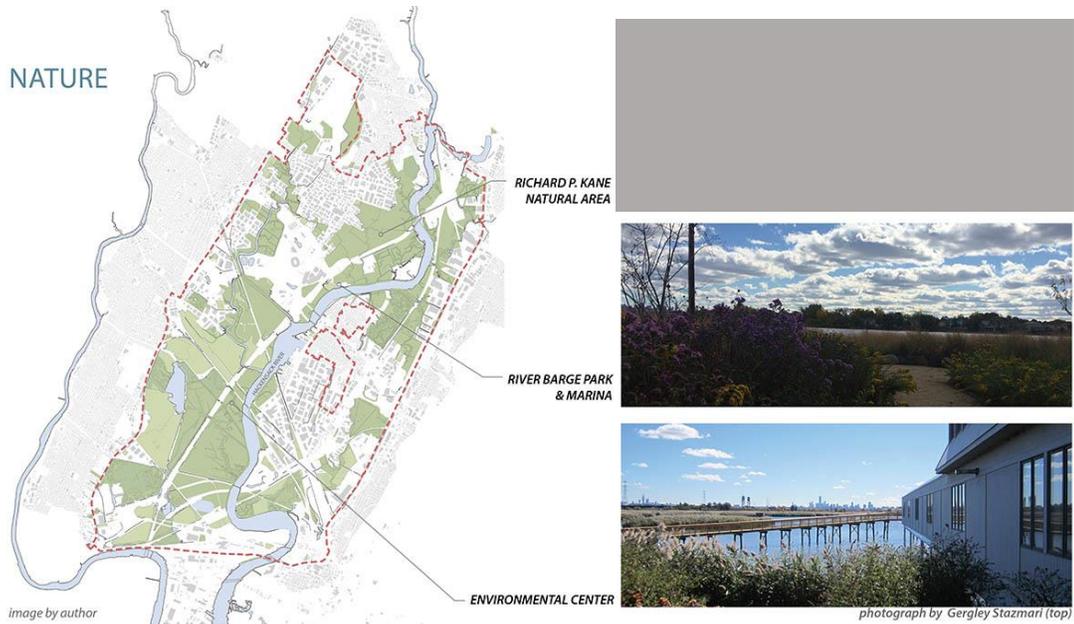
Juxtaposing Secaucus High School on the edge of the Hackensack River creates a unique dynamic between the usual “safe” schooling environment and the very “unsafe” history of the Meadowlands District. Historically, the Meadowlands District was industrial ground, where chemical waste spilled into the river and garbage littered the landscape, and appropriately so, it was referred to as NYC’s dumping grounds. Layers of infrastructure, industry, and urbanization have tarnished the Meadowlands as a site that is nothing more than a pass through and a space to which local communities turn their backs. The very condition of the site as a patchwork of unlikely pieces along the Hackensack River confuses the identity of the place. By strengthening the threads of education in the Meadowlands through the design of an ecological research community, this will create a connection back to the local communities as well as restore an appreciation for the pure landscape of the marsh. Figure 5 through Figure 9 are an analysis of the different overlapping threads and perceptions of the Meadowlands District which informed this investigation of the archeology of the site.



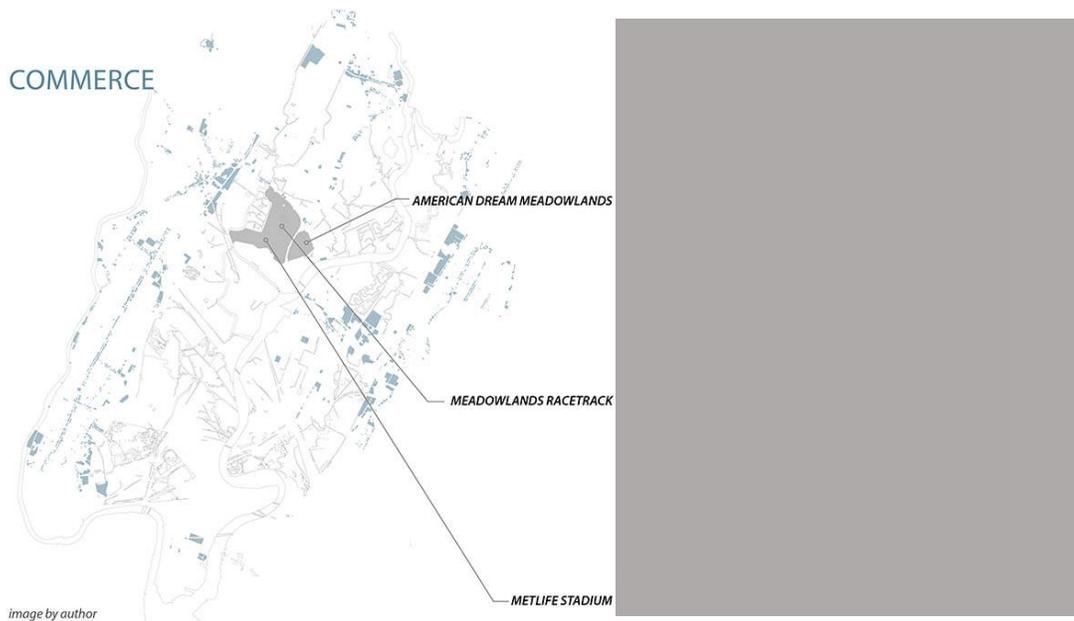
**Figure 5: Industry**  
**Source: Image By Author, Underlay NJMC/MERI GIS, NJ State GIS**  
**Photographs by Ray Mortenson**



**Figure 6: Pollution**  
**Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS**  
**Bottom Photograph Ray Mortenson, NJSEA.com, northjersey.com**

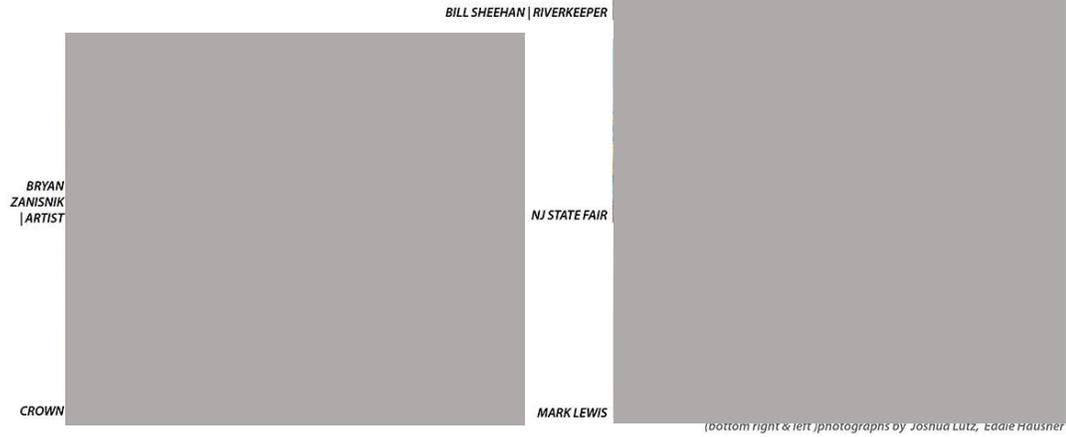


**Figure 7: Nature**  
 Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS  
 Top Photograph, Gergley Stazmani



**Figure 8: Commerce**  
 Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS  
 Photographs: Brad Miller, harnessracingupdate.com, examiner.com

## PEOPLE



**Figure 9: People**

Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS

Photographs (L to R) northjersey.com, blog.art21.org, njfair.com, Joshua Lutz

## FORGOTTEN ASPECTS



**Figure 10: Forgotten Aspects**

Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS

Photographs: (top and bottom) Joshua Lutz, Eddie Hausner

## Chapter 3: New Jersey Meadowlands District History



**Figure 11: NJ Meadowlands District Location & Participating Municipalities**  
(left) Author: NJMC | Source: Urbanhabitats.org  
(right) Source: Image by Author

### Background

Located five miles west of Manhattan, amidst industrial warehouses, the NJ Turnpike, bridges, pipelines, and railroad tracks, lies thirty square miles of what is known as the New Jersey Hackensack Meadowlands. The district, which consists of fourteen municipalities, is a large estuary and ecosystem of wetlands intertwined with the Hackensack River. The river, only fifty miles long, is one of the most urban,

located within a short travel distance for nearly 20 million people.<sup>27</sup> An examination of the district historically will address issues of human intervention and the ever-changing identity of the Meadowlands.

### *Pre-Historic*

Approximately 20,000 years ago the melting and recession of the Wisconsin Glacier created Glacial Lake Hackensack, ultimately forming the New Jersey Meadowlands. The glacial lake was 30,000 acres and had a bed of clay which reached 300 feet deep. About 10,000 years ago, the Hackensack River formed back when the sea level was 80 feet deeper than present day conditions.<sup>28</sup> About 8,000-3,000 years ago the NJ Meadowlands was a forested environment, with tree species including the Black Ash, Eastern Larch, and Black Spruce. Eventually the Atlantic White Cedar tree, an invasive species, took over approximately one third of the marsh.<sup>29</sup> The pre-historic time period consisted of an entirely different ecosystem, one which was populated with mastodons and caribou and Native Americans hunters who cared for and lived off of the land. Back before human intervention, the marsh was an unharmed and safe environment for wildlife and humans alike to thrive. The freshwater streams and the forested land reflect a pure identity before the heavy hand of the human industry took over.

### *Colonial (1600's-1700's)*

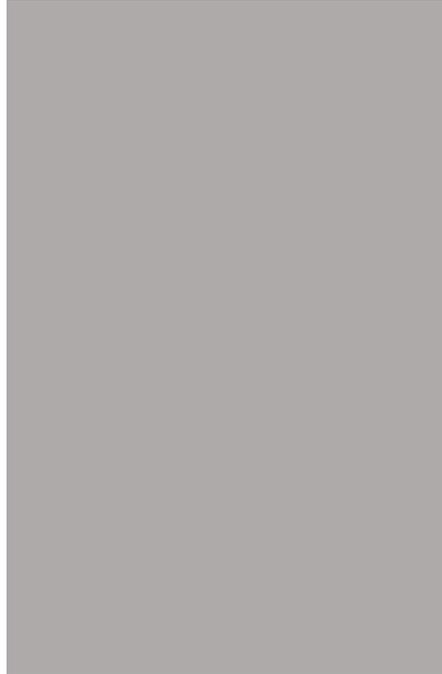
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<sup>27</sup> “The Hackensack River: A True Come-back Story” Hackensack Riverkeeper Inc., accessed October 24, 2015, <http://www.hackensackriverkeeper.org/history.html>

<sup>28</sup> “History of the District” New Jersey and Sports Exposition Authority, accessed October 15, 2015, <http://www.njsea.com/njmc/about/district/history.html>

<sup>29</sup> New Jersey and Sports Exposition Authority, “History of the District”

During the early 1600's European settlers traveled across the Hudson and began building permanent settlements on the high ground in the marsh. The settlers began the first exploitation of the land through agriculture by building large plantations which extended into the meadows. In addition, the Dutch deforested the Atlantic White Cedar trees and planted salt hay. Today, all that remains of the once heavily forested land are the tree stumps, which can be seen when the tide recedes. As these settlements became incorporated and further expanded, economic activity followed. Thus began the development of the first roads, which were already crossing the meadows in order to connect adjacent settlements. This allowed for the transportation of goods, such as salt hay and produce, to New York City. Further industrialization followed including activities such as milling and clay brick making, both of which exploited the natural resources of the Meadowlands. The identity of the marsh changed to one of environmental abuse and exploitation of the land.



**Figure 12: Atlantic White Cedar Trees**  
**Source: [www.fws.gov](http://www.fws.gov)**

*Nineteenth Century*



**Figure 13: ‘View from New Jersey Looking towards Downtown New York City’**  
**Author: Andrew W. Melrose**  
**Source: [cityinenvironment.blogspot.com](http://cityinenvironment.blogspot.com)**

**Figure 14: ‘Hackensack Meadows’**  
**Author: Herman Hartwich**  
**Source: [cityinenvironment.blogspot.com](http://cityinenvironment.blogspot.com)**

Early paintings from the 1800’s depict the Meadowlands as still a picturesque, calm, and beautiful environment, however the Industrial Revolution began a destructive pattern of human intervention and altering of the marsh. First, in 1816 three brothers “began diking and ditching marshes, eventually ‘reclaiming’ 1,300 acres for growing grains, vegetables,” and other produce.<sup>30</sup> However this effort failed due to a large storm which flooded the land only four years later. In the 1830’s Samuel Pike and Spencer Driggs continued to dam, ditch, and dike the marsh in order to install a canal and levee system for growing crops, this however was also unsuccessful since they were unable to harvest any crops. In order to sustain the transportation needs of the surrounding communities, rail lines were built across the Meadowlands. This required further ditching and diking as well as filling of the wetlands in certain areas. By 1896, twelve major railroads crossed the meadows. Modifications made to the marshes through human intervention resulted in a very fragmented ecology and hydrological system. Since the citizens did not consider the

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<sup>30</sup> “The Hackensack Meadowlands in the Imagery: History of a Deep Social and Environmental Transformation” modified March 17 2013, accessed October 23 2015

ecological value of these systems when constructing the dams, ditches, and dikes, not only did they harm the land, but also the wildlife species and their habitats.

### Twentieth Century

In 1922 the construction of the Oradell Dam changed the freshwater flows to the Meadowlands, causing it to shift from a palustrine ecosystem, non-tidal and vegetated, to an estuarine ecosystem, with daily tides. At this time, an abundance of mosquitoes in the marshes were found to be carriers of malaria. In 1950 the Bergen

County Mosquito

Commission constructed

ditches and “drained 17,000

acres of the marsh for ‘land

reclamation” and in attempt

to eradicate the

mosquitoes.<sup>31</sup> Also, about

30,000 gallons of home

heating oil per year were sprayed on the Meadowlands to control mosquito

breeding<sup>32</sup>. In 1952 the New Jersey Turnpike was opened, which became a corridor to

pass through the Meadowlands in route to New York City.

The 1940’s began a pattern of environmental abuse which would brand the Meadowlands as a wasteland, a place of dumping, foul stench, and pollution. There weren’t any regulations in place so “dumping in the Meadowlands became an



**Figure 15: Reclamation of Lower Hackensack Meadows (1867) Source: urbanhabitats.org**

<sup>31</sup> New Jersey and Spots Exposition Authority, “History of the District.”

<sup>32</sup> Matthew Potteiger and Jamie Purinton, “The Wasteland & Restorative Narrative” in *Landscape Narratives* (New York: J. Wiley, 1998) 217-36.

enterprise... continuing into the 1960's turning it into the largest landfill at the time."<sup>33</sup> In 1969 the State Department of Health conducted a survey which showed that "more than 5,000 tons were brought into the Meadowlands every day, six days a week, 300 days a year, from 118 municipalities."<sup>34</sup> Another source showed that at the height of the dumping era, the Meadowlands received "40% of the state's solid waste plus 10,000 tons from New York City."<sup>35</sup> The dumping destroyed the landscape, resulting in 2,500 acres of more than 200 isolated dumps spread throughout the marsh. The surrounding views of once beautiful forest and marsh now consisted of "landfill hills," the epitome of the unregulated and illegal dumping.<sup>36</sup> The environmental degradation has scarred the Meadowlands landscape and ecosystems forever.

(1969) Hackensack Meadowlands Development Commission

In efforts to change the identity of the Meadowlands and restore the marsh to its original state, the Hackensack Meadowlands Development Commission (HMDC) was founded in 1969 in order to create regulations. Tasked with managing the solid waste, providing for economic development, and protecting the environment, the commission had a complex list of issues to balance. By the mid 1970's the commission was able to close down approximately fifty landfills. Addressing the issue of economic development, the HMDC viewed the area as a "real-estate hotspot"

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<sup>33</sup> "The Hackensack Meadowlands in the Imagery: History of a Deep Social and Environmental Transformation"

<sup>34</sup> New Jersey and Spots Exposition Authority, "History of the District."

<sup>35</sup> "The Hackensack Meadowlands in the Imagery: History of a Deep Social and Environmental Transformation"

<sup>36</sup> "The Hackensack Meadowlands in the Imagery: History of a Deep Social and Environmental Transformation"

and saw this as an essential way to receive funding for restoring the wetlands.<sup>37</sup> In addition, in 1976 the sports complex in East Rutherford opened, which was built upon one of the largest landfills in the Meadowlands. In the early 1980's the development and construction of the Meadowlands Environmental Center was underway, as well as the restoration of the wetlands and the extraction of methane from the surrounding landfills. In the 1990's a proposal for a national wildlife refuge was in order, and efforts to create a safe environment and restore the wetlands remained a top priority.

### Today

Presently, the environmental restoration of the Meadowlands is starting to change the face of how this marshland is perceived. Currently the New Jersey Meadowlands Commissions (NJMC) (formerly the HMDC) has implemented projects that have helped to bring the environmental habitat back to a healthy state. The Meadowlands now has twenty parks, waterfront recreation, an observatory, as well as trails which weave throughout the marsh. All dumping is now regulated, and currently there is only one active landfill located in a section near Kearny, NJ. The Meadowlands Environmental Center sits in front of one of the largest landfills, in efforts to remember the past in order to plan for a better future. Additionally, another landfill referred to as 'Sky Mound' is now a thirty-five acre solar park. Recently, there have been strong efforts to re-brand the marsh as the 'New Meadowlands' a design which incorporates a regional park, new bus line, urban densification and has an initial award of \$150 million.<sup>38</sup> Additionally, the 'American Dream

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<sup>37</sup> Potteiger, "The Wasteland & Restorative Narrative" 217-36.

<sup>38</sup> Audrey Wachs "Rebuild Reset" The Architect's Newspaper, last modified October 14, 2015 accessed October 20, 2014, <http://archpaper.com/news/articles.asp?id=8279#.Vi6ouPmrSM9>

Meadowlands,' (formerly the commercial eyesore, Xanadu) a mall that is five floors and 4.8 million square feet, is set to open in the Spring of 2017 in East Rutherford.<sup>39</sup> The juxtaposition of the mall and the ecological reserve will create a unique dynamic looking toward the future of the Meadowlands.

### Looking Forward

Looking forward, the Meadowlands is gaining traction as a place for research design, and regeneration. After Hurricane Sandy completely inundated the area in 2012, there has been a developed awareness among the designers and community members for a stronger focus on the Meadowlands District as a place in need of resilient design. In following the 'New Meadowlands' masterplan proposal, the district seeks to overcome both environmental and cultural factors which have strongly influenced decades of negative perceptions. The time is now to address these issues of environmental degradation, pollution, hydrology, and lost communities along the river. The NJ Meadowlands is in a state of transformation, with endless potential to inhabit this urban wilderness through ideas of re-connecting and place-making. The hidden beauty that lies within the tranquility of the lush wildlife and reed grasses is one that is known to few, and the opportunity for restoration and renewal of this ecosystem is essential to re-establishing the identity of the marsh.

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<sup>39</sup> Charles V. Bagli, "Huge Mall Rising at Troubled Site in North Jersey," *New York Times*, October 2, 2015 accessed October 26 2015, <http://www.nytimes.com/2015/10/03/nyregion/dream-of-a-mall-starts-to-rise-out-of-a-meadowlands-nightmare.html>

## Chapter 4: Meadowlands District Site Analysis

### Site Planning

Comprehensive plans of the Meadowlands District:

Over the past decades there have been multiple land use and master plans for the NJ Meadowlands District. Common threads among all of them include focusing on the restoration of the wetlands as well as increasing development. Over the years the masterplans have been redefined and refined, and begin to focus more on the ecological systems of the marsh. However, commercial and residential development in this area also remains important for economic reasons.



**Figure 16: Comparison of Meadowlands Master Plans**  
Source: [www.newmeadowlands.org](http://www.newmeadowlands.org)

**1970: Hackensack Meadowlands Comprehensive Land Use Plan**<sup>40</sup>

- 1,500 acres of marshland conservation
  - Proposes flood control mechanisms including levees and tidal gates
- 4300 acres of commercial development
- 70,000 units of residential development
  - Build new residential islands in wetlands area
- 23 million ft<sup>2</sup> of commercial/office space
- 90 million ft<sup>2</sup> of industrial/warehouse space

**1995: Special Area Management Plan (SAMP)**<sup>41</sup>

- Core goal to preserve, restore and enhance natural resources
  - 749.8 acres of wetland fill
- 17.75 million ft<sup>2</sup> of offices
- 13.9 million ft<sup>2</sup> of residential
  - 40 dwelling units per acre proposed in Carlstadt
- 14,000 housing units of residential development
- Primary office: 18.0 million ft<sup>2</sup>
- Secondary office: 6.3 million ft<sup>2</sup>
- Warehouse/distribution: 9.0 million ft<sup>2</sup>
- Commercial 2.5 million ft<sup>2</sup>

**2004: New Jersey Meadowlands Commission Master Plan**<sup>42</sup>

- Protection, enhancement and preservation of 8,400 acres of wetlands
- Removal of 3.5 million ft<sup>2</sup> of existing structures for redevelopment
- 3741 new units of residential development
- 14.5 million ft<sup>2</sup> of new commercial/office development
- 12.1 ft<sup>2</sup> of new industrial development

**2014: New Meadowlands**<sup>43</sup>

- Meadowband – A 63 mile berm (primary berm: 47 miles; secondary berm 16 miles)
- Recreational area proposed: 400 acres
- Wetland restoration area proposed: 3895 acres
- Residential units proposed: 96,700
- Office area proposed: 0
- Industrial/Commercial proposed: 43,141,060 ft<sup>2</sup>
- New Jobs: 10,784

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<sup>40</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands* (2014) accessed October 28, 2015, <http://newmeadowlands.org/book/>

<sup>41</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*

<sup>42</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*

<sup>43</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*



**Figure 17: Rendering, New Meadowlands Proposal**

**Source: [www.newmeadowlands.org](http://www.newmeadowlands.org)**

The recent design proposal, New Meadowlands (2014), was submitted by a team from the MIT Center of Advanced Urbanism, as well as two Netherlands architecture firms, ZUS and URBANSTEN. The proposal was submitted to the Rebuild by Design Competition, an initiative of the President’s Hurricane Sandy Rebuilding Taskforce. The proposal is evocative and “articulates an integrated vision for protecting, connecting, and growing this critical asset to both New Jersey and the metropolitan area of New York.”<sup>44</sup>

The proposal addresses the Meadowlands District as a whole, with an integrative and connective approach through the use of the *Meadowpark*. The goal of the Meadowpark is that it “will allow for the various past and ongoing marshland restoration efforts by the Meadowlands Commission to become connected and legible as one large, regional wildlife refuge, to be made accessible at appropriate places for

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<sup>44</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*

visitors.”<sup>45</sup> Creating a connective park network which weaves throughout the Meadowlands District is essential to mending the ecological fragmentation. Restoring the connective tissue of the wetland landscape will allow the wildlife species within the marsh to thrive. The site this thesis addresses is located next to a conservation and wildlife reserve area, which will connect into the Meadowpark network.

Another unique characteristic of the New Meadowlands plan is the *Meadowband*. The Meadowband is “a civic amenity consisting of a local street, a Bus Rapid Transit-line, and a strong of public spaces, recreation zones and wildlife reserve access points on top of the outer berm and its slopes.”<sup>46</sup> Although the Meadowband does propose major mixed-use development and new transportation lines, the most important feature is a large berm which encompasses the entire district. In the future, connecting this thesis’ site into the berm network will help to mitigate the inundation from storm surge and sea level rise.



**Figure 18: Meadowband Berm**  
Source: [www.newmeadowlands.org](http://www.newmeadowlands.org)

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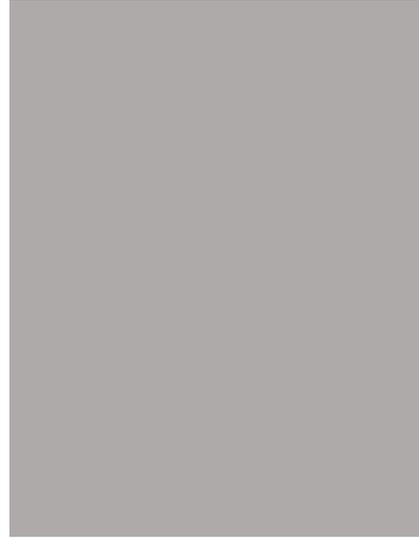
<sup>45</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*

<sup>46</sup> MIT CAU + ZUS + URBANSTEN, *The New Meadowlands*

This thesis can also plug into the New Meadowlands proposed bike path network.

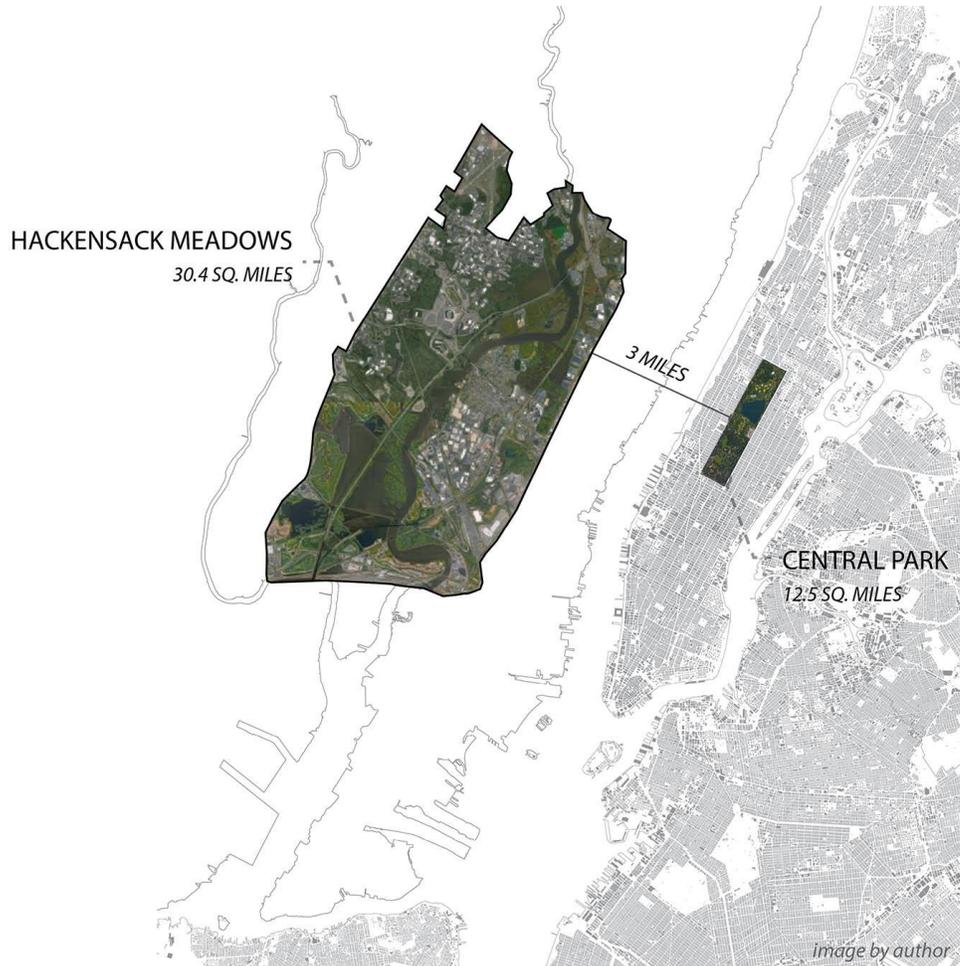
The paths connect throughout the Meadowlands District as well as across to New York City. Existing wildlife and bike trails in the Meadowlands are used often, and local community members as well as students could utilize these new proposed paths. The New Meadowlands proposal introduces canoe and

kayak launch points. This site this thesis addresses is located next to an existing park and marina, a spot that is frequented by local nature enthusiasts. The proposed ecological research community will plug into this network of bike paths and kayak launch points through the design of a boat dock and pedestrian bridge. Connecting the immediate site into the larger Meadowlands District network of paths will create a new community connection and a sense of place.



**Figure 19: Regional Bicycle Network**  
Source: [www.newmeadowlands.org](http://www.newmeadowlands.org)

Meadowlands District Scale



**Figure 20: Scale Comparison**

**Source: Image by Author**

**Underlay: NJMC/MERI GIS, NJ State GIS, NY State GIS, Google Maps**

The New Jersey Meadowlands District is quite larger than its urban neighbor, New York City. The district is roughly thirty square miles in size. As seen in Figure 20, the size of Central Park (12.5sq. miles) is dwarfed by the size of the Meadowlands (30.4sq. miles). When put in comparison to a seemingly massive Central Park, one can begin to recognize the massive size of this urban wetland.

*Aerial Photographs:*

The following set of photographs reinforce the juxtaposition of the urban environment and the wetland landscape. The paradox of an urban wildness can be seen through the dense New York City skyline contrasted with the massive open meadows, an expansive natural void in the surrounding urban fabric.



**Figure 21: Aerial View – Hackensack Meadowlands**  
Source: Urbanhabitats.org



**Figure 22: Birds Eye - Hackensack Meadows**  
Source: [www.njsea.com](http://www.njsea.com)



**Figure 23: Aerial View over Kearny NJ**  
**Author: Doc Searls Source: Flickr Creative Commons**



**Figure 24: Aerial, Meadowlands Solar Landfill**  
**Source: [www.gettyimages.com](http://www.gettyimages.com)**

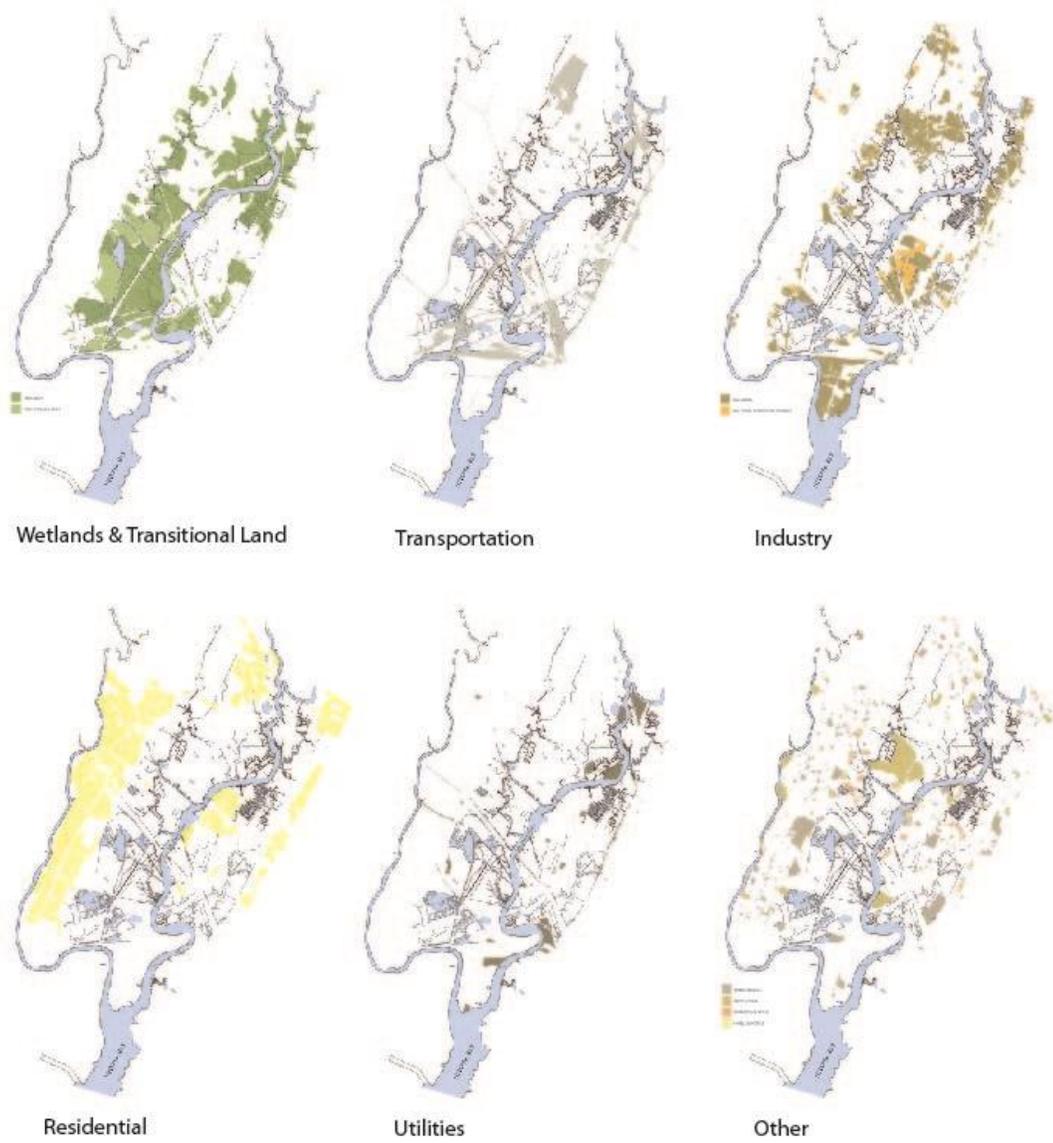
Site Analysis

Figure-Ground:



**Figure 25: Figure Ground**  
**Source: Image by Author**  
**Underlay: NJMC/MERI GIS, NJ State GIS, NY State GIS**

Land Use:



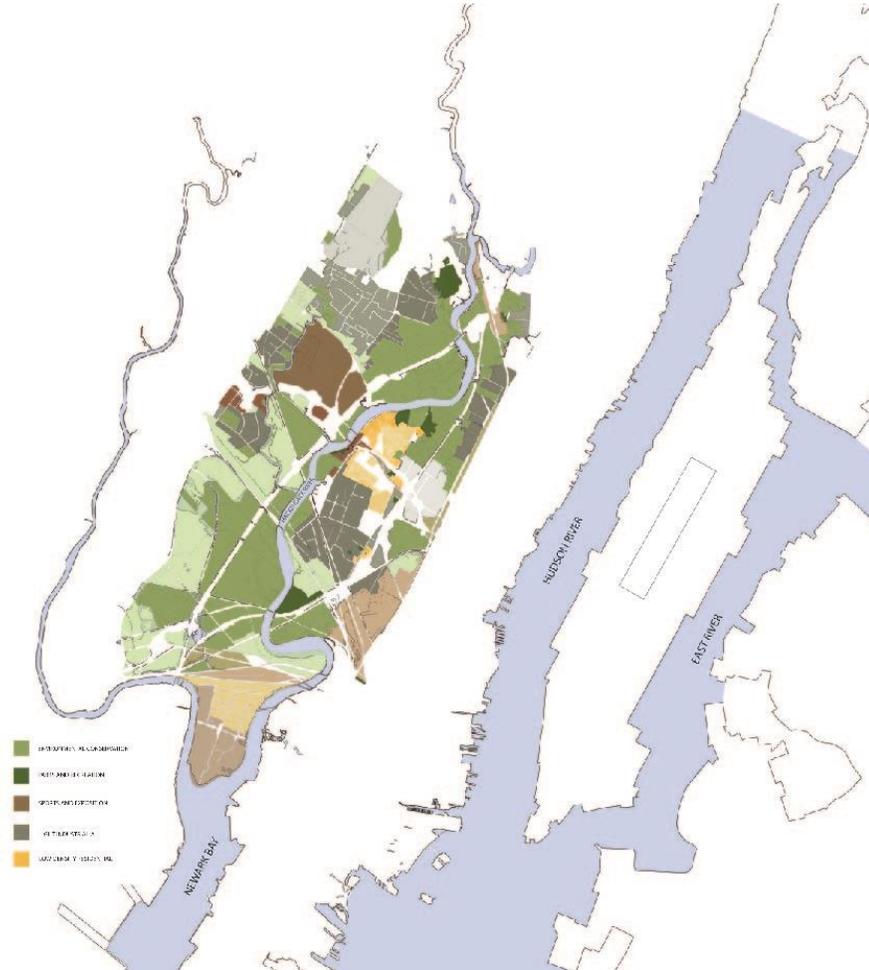
**Figure 26: Land Use Layers**  
Source: Image by Author  
Underlay NJMC/MERI GIS, NJ State GIS



**Figure 27: Composite – Land Use**  
**Source: Image by Author**  
**Underlay NJMC/MERI GIS, NJ State GIS, NY State GIS**

As a whole, the Meadowlands District is a compound of many different land uses. When pulling apart each layer, it is prevalent that there fragments clustered around the Hackensack River's edge. Separating the wetland layer begins to show that there is hope for the restoration of the natural landscape. When transportation, industry, utilities, and the residential layers are then overlaid on to the wetlands, the natural landscape becomes sliced into fragments.

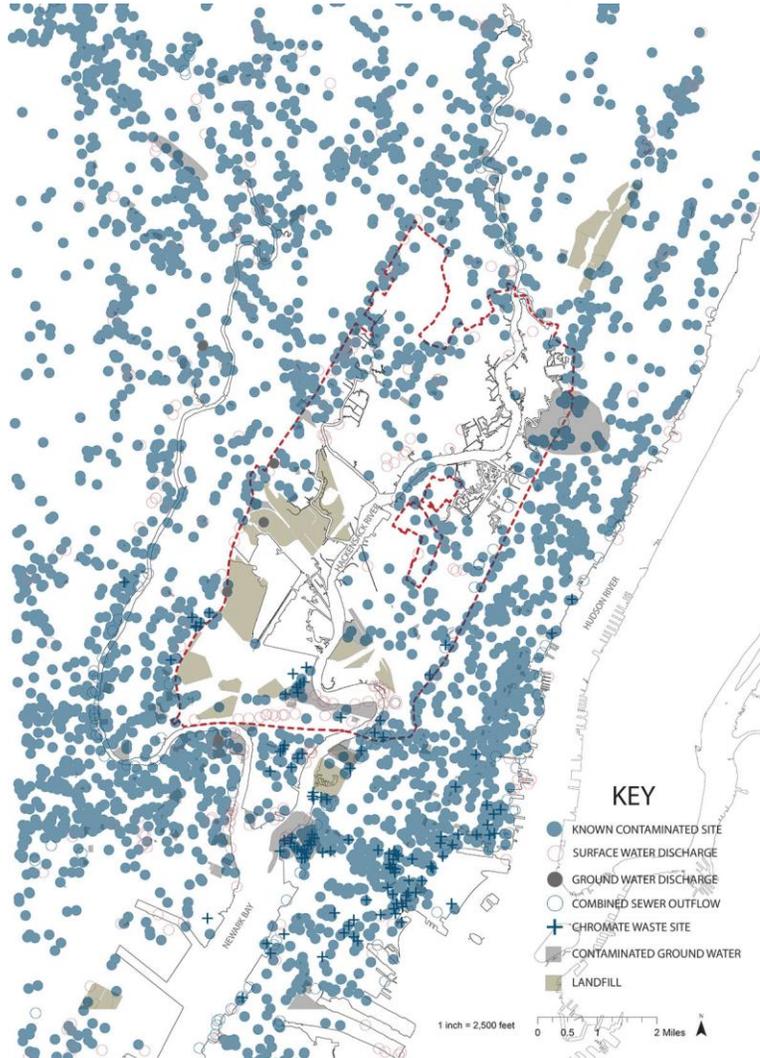
Zoning:



**Figure 28: Zoning Meadowlands District**  
**Source: Image by Author,**  
**Underlay NJMC/MERI GIS, NJ State GIS, NY State GIS**

The zoning of the Meadowlands District consists of many sub-categories. The five largest categories are: 1. Environmental Conservation 2. Parks and Recreation 3. Sports and Exposition 4. Light Industrial A 5. Low Density Residential. Looking at the zoning map, the light and dark greens (environmental conservation and parks and recreation) are a large portion of the Meadowlands District. However, they are juxtaposed with industrial and sports and exposition zones.

Contamination:



**Figure 29: Composite - Contamination in NJ Meadowlands District**

**Source: Image by Author**

**Underlay NJMC/MERI GIS, NJ State GIS, NY State GIS**

Figure 29, is very alarming and quite overwhelming when seeing all the blue dots, the known contaminated sites, located in and around the district. Decades of illegal dumping and chemical waste spills from the nearby industrial factories have created a much polluted environment. The Hackensack River itself is currently being evaluated

as a Superfund site by the Environmental Protection Agency.<sup>47</sup> According to a 1970's report by Zurn Environmental Engineering, there were eleven active landfills at the time, which received approximately 30,000 tons of waste a week from 118 municipalities including New York City.<sup>48</sup> The waste included household, industrial and demolition by-products. Decades of environmental abuse and neglect has left a scar on the Meadowlands that will take time and advanced efforts in remediation tactics in order to restore the ecological wellness of the marsh. However, since the formation of the Hackensack Meadowlands Department Commission, there have been strong efforts to bring a sense of renewal to the marsh. This thesis addresses the themes of environmental degradation and pollution by investigating water remediation on site. The proposed ecological research community will also provide an outlet for further study of the contamination within the marsh and have a unique opportunity to live within the environment that they are studying.

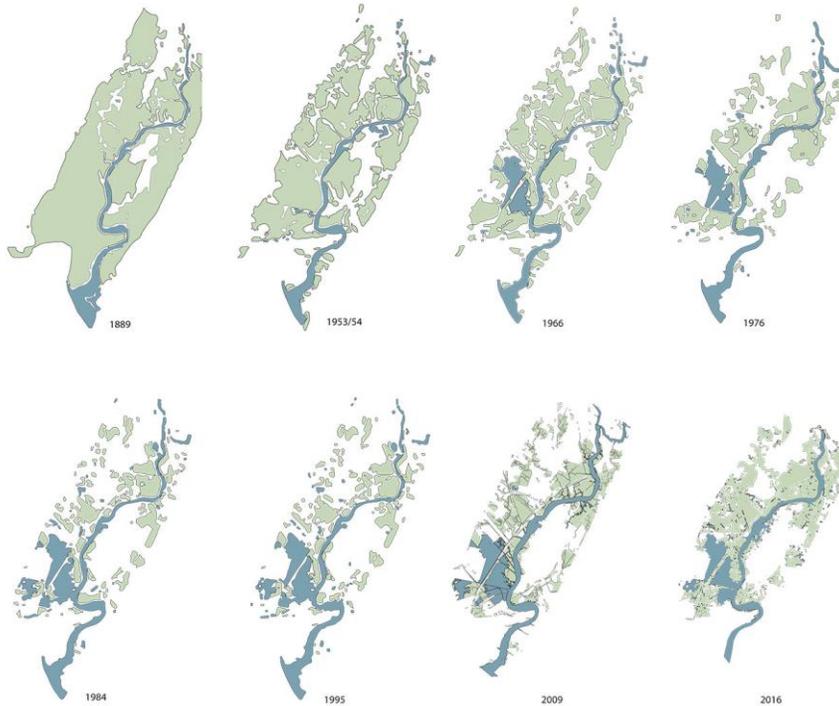
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<sup>47</sup> Meghan Grant "Hackensack River a step closer to Superfund Designation" NorthJersey.com, last modified November 12, 2015, accessed April 12, 2016

<http://www.northjersey.com/news/environment/hack-closer-to-becoming-a-superfund-1.1454033>

<sup>48</sup> Robert Ceberio and Ron Kase. *New Jersey Meadowlands: A History* (Charleston: The History Press, 2015) 57.

### Wetland Loss Over Time:



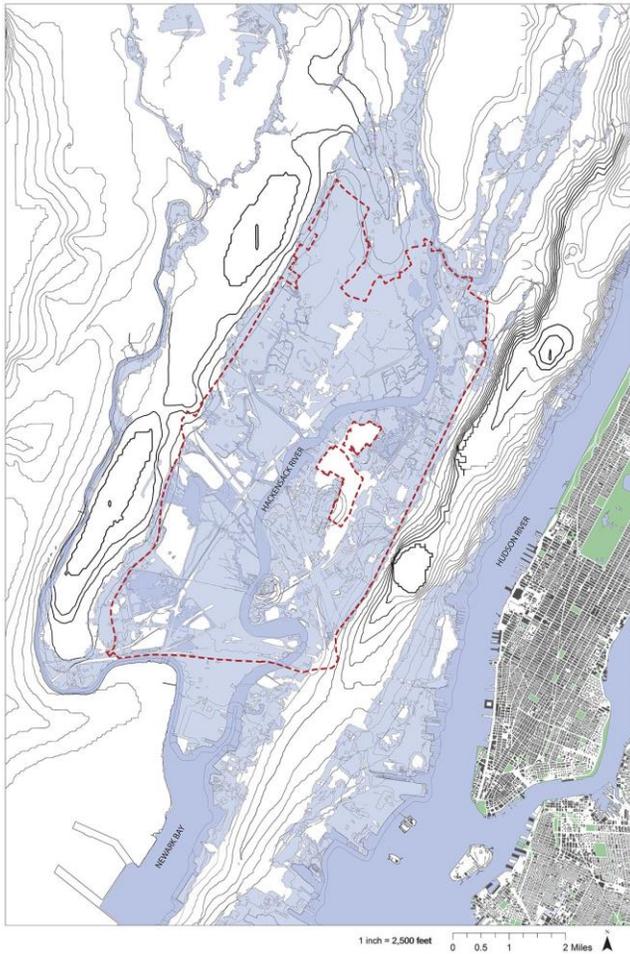
**Figure 30: Wetland Loss over Time**  
Source: Image by Author, Underlay NJMC/MERI GIS, NJ State GIS

Human environmental degradation has greatly altered the natural wetland landscape of the district. Originally in the 19<sup>th</sup> century the Meadowlands were forested with Atlantic White Cedar trees and lush with vegetated wetland. However, due to human activity of damming, diking, and ditching the meadows in order to reclaim them for agricultural purposes, the amount of wetland has steadily decreased. In addition, since there was a lack of environmental education, wetland landscapes were not viewed as ecologically valuable. This resulted in human ignorance and decades of environmental neglect and abuse through industrial waste spills and illegal dumping. Prior to settlers, there was 21,000 acres of undeveloped wetlands, now only 8,400 acres of wetland remain.<sup>49</sup>

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<sup>49</sup> “Natural Resources” New Jersey Sports and Exposition Authority, accessed April 2016, <http://www.njsea.com/njmc/about/natural-resources.html>

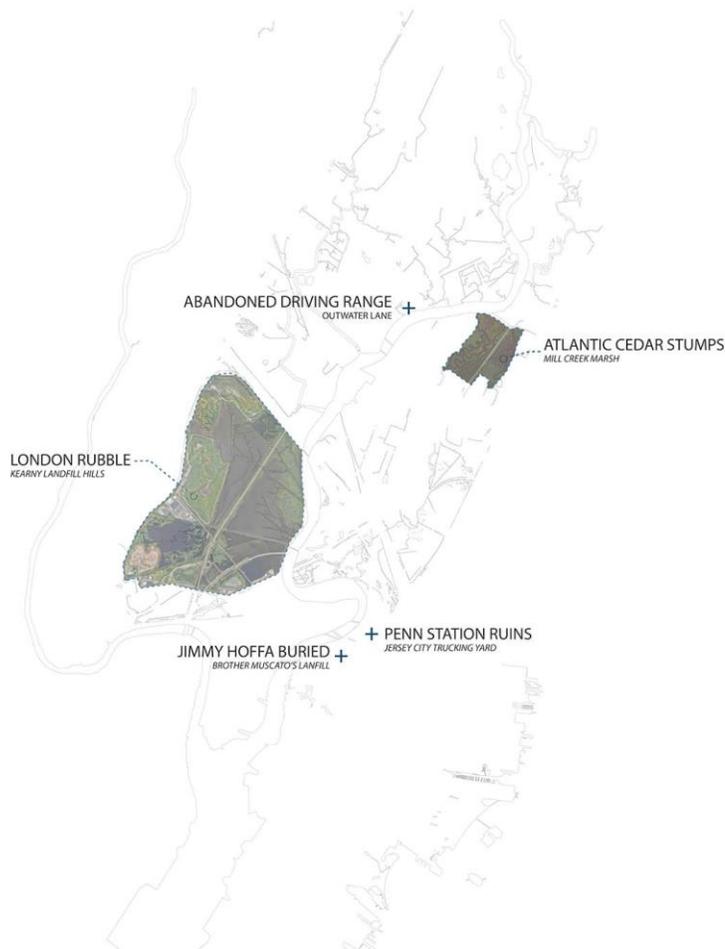
## 100 Year Flood Plain



**Figure 31: 100 Year Flood Plain (right) Hurricane Sandy Impact (left)**  
Source (right): Image by Author Underlay, NJMC/MERI GIS, NJ State GIS, NY State GIS  
Source (left): newmeadowlands.org

In the event of a 100 year flood, the New Jersey Meadowlands District will be completely inundated with water. In 2012 when Hurricane Sandy hit New Jersey, the impact was devastating. As seen in Figure 31, Hurricane Sandy severely impacted almost the entire district. Future flood prevention on the site is essential to preserving the local communities as well as existing and proposed infrastructure/landscape design.

## Forgotten Aspects:



**Figure 32: Forgotten Aspects**  
**Source: Image by Author**  
**Underlay NJMC/MERI GIS, Google Maps**

Looking at the forgotten aspects of the marsh, it is evident that there has been a history of human environmental neglect. The once forested area was cut down and now all that remain are the stumps of the Atlantic White Cedar trees which can be seen at low tide in the Mill Creek Marsh. The ruins of the original Penn Station were dumped in a landfill in Jersey City. Rubble from the London bombings was exported to the United States and dumped in another landfill in the Meadowlands. Of course some will say the most famous thing dumped in the Meadowlands is Jimmy Hoffa.

## Chapter 5: Precedents

### DuPont Environmental Education Center

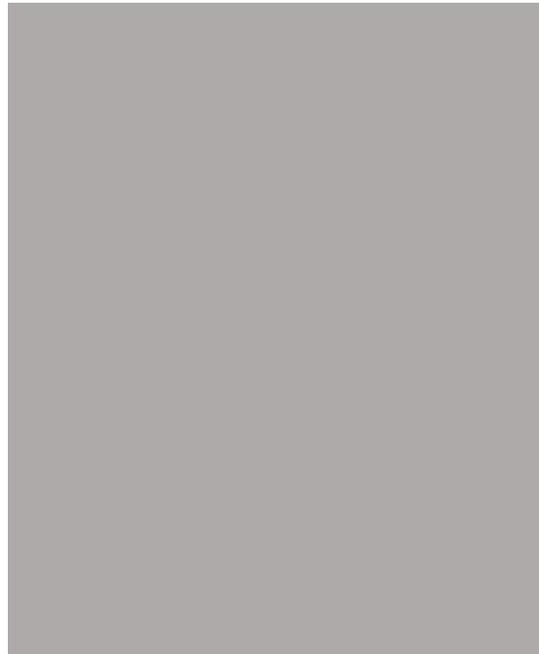
Overview:

Location: Wilmington, DE  
Architect: GWWO Architects, 2009  
Building Size: 13,500 SF

Site Situation:

Pinched between Interstate 95 and 495 in Wilmington Delaware, the DuPont Environmental Education Center (DEEC) is juxtaposed with infrastructure, industrial sites, and the natural landscape.

Situated along the Christina River, neighboring sites to the east consist of open lots and industrial plants. To the north of the DEEC is the 1.3 mile Christina Riverwalk at the water's edge which creates a pedestrian connection from the building into downtown Wilmington. The riverwalk from downtown bridges over active train infrastructure and becomes a means of pedestrian access to the site. The goal of the riverwalk and pedestrian bridge was "to create a symbiotic relationship between urban development along the waterfront and the natural environment."<sup>50</sup> The DEEC engages the site through pedestrian walkways which weave throughout the marsh,



**Figure 33: Site Context**  
Source: Image by Author, underlay from ArchDaily.com

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<sup>50</sup> "DuPont Environmental Education Center / GWWO Architects," ArchDaily, last modified Aug 29, 2011. Accessed November 27, 2015, <<http://www.archdaily.com/164484/dupont-environmental-education-center-gwwo-architects/>>

bringing people close, yet also protecting the ecosystem from damage. Also, the DEEC responds to the tidal wetlands condition of the marsh and was structurally built on piloti to acknowledge the change in water level.



**Figure 34: Site Section – East Elevation**  
**Source: Image by Author, underlay from Archdaily.com**

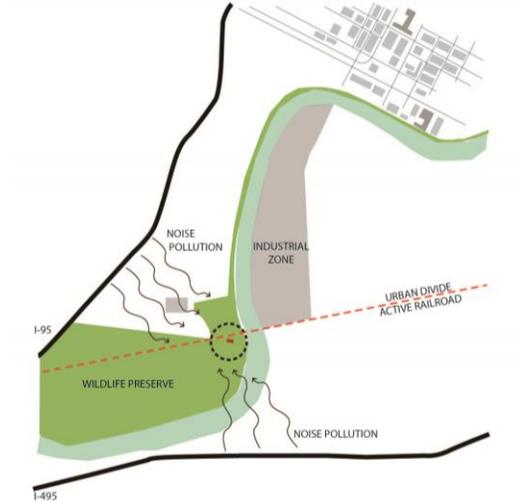
Program:

The building is designed for both educational and environmental purposes. Rooms are available for classroom activities, including a specialty spaces for ecological learning and workshops. The program was designed to foster a connection between man and nature. Designing around this ideology, GWWO Architects created pedestrian walkways, viewing decks, and gathering spaces all located within the marsh. Other unique features of the program include a botanical garden and marsh laboratory, which reinforce the connection between humans and nature. Including spaces for learning and recreation is important in order to promote public access and engage students in understanding nature and the biological processes of the marsh.

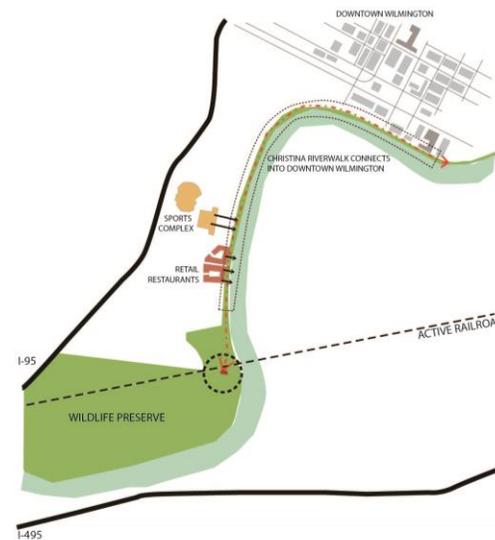
Precedent Critique:

The site is situated between two major interstate highways, which produce a steady influx of noise pollution. Since the DEEC intends to foster a learning environment, excessive noise is a significant design obstacle. The center does not seem to address the noise pollution architecturally at all which could significantly affect the ability to learn. A potential solution remediate the noise would be to build a sustainable or even parametric screen which would deflect sound waves and still fit within the context of the marsh. So What?

The study of the DuPont Environmental Education Center is vital in order to understand the complexities of site, and how to connect urban and natural moments through the design. Through the Christina Riverwalk the DEEC is able to “enhance and encourage the relationship



**Figure 35: Noise Pollution**  
Source: Image by Author



**Figure 36: Christina River Waterfront**  
Source: Image by Author

between urban development along the water front and the natural environment.”<sup>51</sup>

The riverwalk activates the water’s edge by filtering people from downtown into the natural landscape and ultimately straight into the building. The Christina Riverwalk, is successfully populated with a mixed use of amenities, including retail, restaurants, baseball stadiums and the ecological center.

At the NJ Meadowlands site, the Hackensack River is fragmented, without a true identity or use. Potentially designing a Hackensack Riverwalk to weave along the edge of the river, as well as bridge over existing infrastructure to connect to surrounding urban nodes, could be a strategy to re-activate the waterfront. Existing urban cores of the MetLife Stadium and the new American Dream Meadowlands are located approximately half a mile from the site, which could create a steady influx of pedestrian activity for a new and natural public amenity.

The DEEC addresses the obstacle of train infrastructure through use of a pedestrian bridge. In the Meadowlands, a bridge could be a strong asset to re-connecting educational and residential community nodes. The 1850’s bridge across the Hackensack River connecting to Secaucus could potentially be re-instated in order to bridge the gap between human interaction and nature. In the Meadowlands site, the NJ Turnpike is located approximately 700 feet from the site, which creates the concern for noise pollution whereas the DEEC is located half a mile from both I-95 and I-495. Although there were not any direct attempts to mitigate noise pollution in the DEEC, this precedent shows that building an ecological and educational building adjacent to massive infrastructure is not impossible.

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<sup>51</sup> ArchDaily. "DuPont Environmental Education Center / GWWO Architects"

North Cascades Environmental Learning Center

Overview:

Location: Diablo Lake, North Cascades National Park, WA

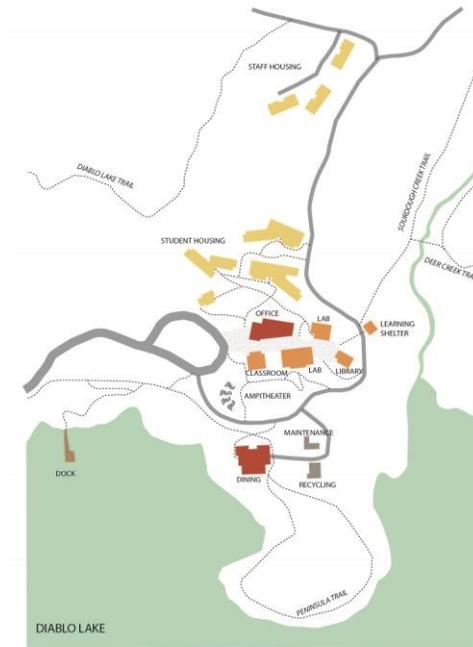
Architects: HKP Architects, 2005

Campus Size: 38,582 SF

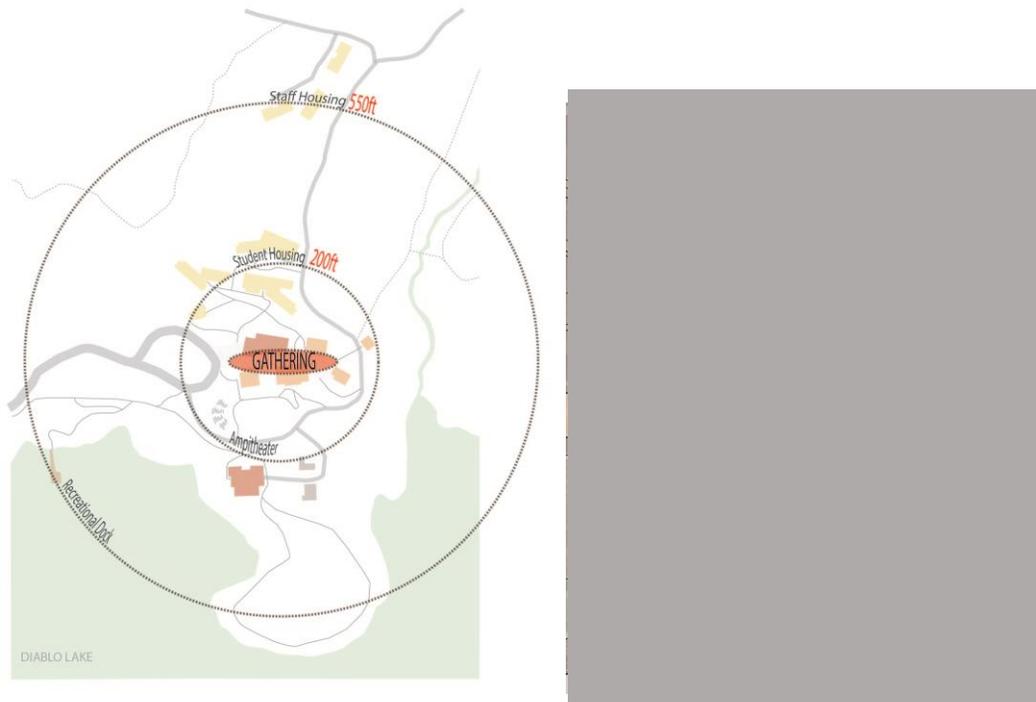
Site Situation:

Situated within North Cascades National Park, the environmental learning campus is secluded and quiet, hidden under the canopy of forest trees. The forested site opens out on to Diablo Lake, which is fed by the Skagit River. The site situation allows for a retreat-like space, in which people can truly experience nature. The proximity to the lake allows for recreational activities for the students and public to

experience. There is also a ferry terminal nearby which connects into a lakeside resort. Within the campus, there is a network of trails that connect the different areas of campus and also expand out into the surrounding wilderness.



**Figure 37: Site Plan**  
**Source: Image by Author**



**Figure 38: Radiating Design (left) Collaborative Space (right)**

**Source: Image by Author**

**Underlay: Photo by David Hill (right)**

Program:

The environmental learning center is associated with North Cascades Institute, and is a residential campus for graduate students, adult classes, and everyday visitors. Students interested in attaining a Masters of Education in Environmental Education have the opportunity to study and engage with their major first-hand at this campus. Equipped with facilities for both learning and living, the campus is designed around a center communal space, which is connected by large overhangs. Learning buildings which face out on to this space include specialty laboratories, a library, and classrooms. A large office building also faces out on to the space, which shows the physical connection and importance of administration and learning. The communal space shared by all the building blends between an outdoor and indoor space.

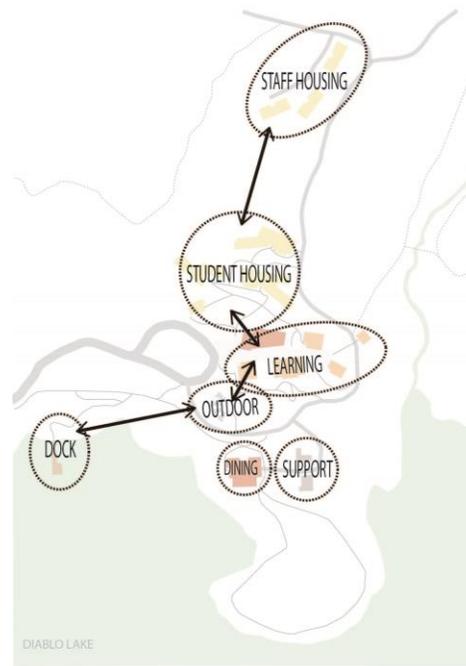
Students, when walking between buildings could feel like they are indoors,

since they are sheltered from rain even though not enclosed by walls on four sides. The communal space also bleeds out to an amphitheater in the landscape which can also act as a space for learning, as well as outdoor performances. The cluster of student lodging is located 50 feet north of the learning buildings, which allows for easy access for students at all times of the day. Staff housing is located approximately 250 feet north of the student lodging, to allow for some separation.

Other facilities on campus include a large dining hall as well as smaller buildings for maintenance and recycling. Since the campus is a LEED Silver, it was meant to “serve as a model of conservation to teach people about earth-friendly building practices.”<sup>52</sup> Recreation is encouraged for students, as there is a dock as well as numerous trails through the woods. As part of the learning experience, there are numerous learning shelters which are adjacent to the trails, to act as places to stop and learn about the environment.

So What?

The design of the North Cascades campus is conducive to living and learning within the environment. A strong sense of place is identified by grouping the learning



**Figure 39: Program Adjacencies on Site**  
Source: Image by Author

<sup>52</sup> “North Cascades Environmental Learning Center” HKPA.com. Accessed November 27, 2015, <<http://www.hkpa.com/project-details/north-cascades-environmental-learning-center/>>

buildings and creating a central gathering space for the campus. The gathering space allows for interaction among the different types of learning (library research, aquatic/terrestrial labs, and multimedia classrooms) as well as with office administration and lodging.

The proximity of the “living” cluster to the “learning” cluster creates a dynamic interaction between spaces. Students can have the unique learning experience which allows them to live in the environment that they are studying. Supporting facilities, such as the amphitheater, trail network, learning shelters and lakeside dock create a recreational component to balance the living and learning components. Outdoor spaces encourage students to study in the landscape, not just in buildings. The interplay between building and landscape is important to understand how these two elements work together to foster both living and learning spaces for students.

## Chapter 6: Immediate Site Analysis

### Site Selection:

<p><b>PATERSON PLANK ROAD</b></p> 	<p><b>MEADOWLANDS ENVIRONMENTAL CENTER</b></p> 	<p><b>SNAKE HILL</b></p> 
<p><b>CARLSTADT, NJ</b> 16 ACRES - EXPANDED SITE 151 ACRES</p>	<p><b>LYNDHURST, NJ</b> 68 ACRES</p>	<p><b>SECAUCUS, NJ</b> 4 ACRES</p>
<p><b>PROS</b> WATERFRONT ACCESS LOCATED NEAR RECREATIONAL FACILITY ACROSS FROM SECAUCUS HIGH SCHOOL ABANDONED BUILDING, AMPLE OPEN SPACE ON SITE ADJACENT TO MARSH</p>	<p><b>PROS</b> OPEN SPACE NEAR EXISTING ENVIRONMENTAL CENTER NEAR NETWORK OF TRAILS/BIKE PATHS AMPLE OPEN SPACE</p>	<p><b>PROS</b> ADJACENT TO PARK HISTORICALLY SIGNIFICANT SITE WATERFRONT ACCESS</p>
<p><b>CONS</b> 770' FROM NJ TURNPIKE INUNDATED WITH WATER UPON STORM SURGE</p>	<p><b>CONS</b> SUPERFUND SITE RAILROAD BLOCKS ACCESS TO MARSH 100 YEAR FLOOD INUNDATES SITE 230' FROM NJ TURNPIKE</p>	<p><b>CONS</b> SMALL AMOUNT OF ACREAGE 130' FROM TURNPIKE PREVIOUS POTTER'S FIELD INOT LOCATED NEAR A COMMUNITY</p>

**Figure 40: Site Selection Matrix**  
Source: Image by Author, Underlay: Google Maps

Three sites within the Meadowlands District were examined for this thesis. The first site is located at the end of Paterson Plank Road, in Carlstadt, NJ. The second site, located adjacent to the current environmental center is in Lyndhurst, NJ. The third site, Snake Hill, is located in Secaucus, NJ. The site near the environmental center was not chosen due to the fact that it is a Superfund site and an active railroad line traverses the site. These two obstacles could potentially pose a major issue to site safety for an educational community. The Snake Hill site was not chosen due to the

small acreage as well as the extreme topography and historical context. Snake Hill is also not located near an existing community and was historically a potter's field. Ultimately, the site located at the end of Paterson Plank Road was chosen for this thesis since it its prime location point and allows for strong connections to urban, natural and educational nodes. It also has unobstructed access to the waterfront, an amenity that is essential to the identity and renewal of the marsh.

### Site Background



**Figure 41: Immediate Site Context**  
**Source: NJGIN Warehouse**

The site is located off of the NJ Turnpike near the American Dream Meadowlands (formerly Xanadu) and MetLife Stadium complex. Paterson Plank Road connects to Outwater Lane, a short dead end road leading to newly renovated River Barge Park & Marina. In the 19<sup>th</sup> century, Paterson Plank Road was constructed of wide board cedar planks and spanned across the meadows connecting to Secaucus.

The bridge landing is still located on the site, and across the river is Trolley Park, where Secaucus end of the bridge connected. In the 1970's the Steiner Family owned the site at Outwater Lane, and at the edge of the wetland is Old Homestead, their abandoned and dilapidated house.

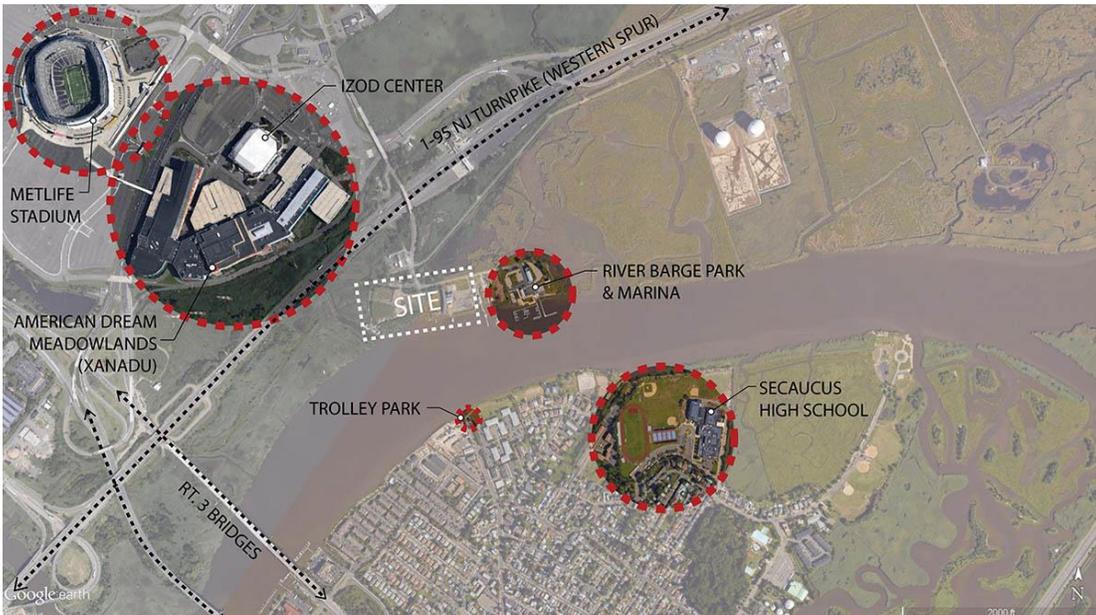
Currently located on the site is an abandoned restaurant and double-deck driving range. The building is overgrown and littered with golf balls, a washed-up boat, and even a humpty dumpty statue. With sight lines to the Empire State building and Freedom tower, waterfront access, and proximity to River Barge Park & Marina, and the American Dream Meadowlands, the site is in prime location point, as seen in Figure 43. Bordering the site is also the Hackensack Conservation and Wildlife Reserve. The site also looks out on Moonachie Creek to the Northeast and Cedar Creek to the Southwest, as seen in Figure 44. The site borders a PSEG metering and pressure reduction station to the North and two small private boat clubs to the East.

The location of the site allows for a design intervention which can connect all of these surrounding nodes. Re-connecting the two ends of Paterson Plank Road with a new pedestrian bridge will invite students, community members, and visitors into the site. Connecting to the American Dream Meadowlands will blend the modern life with the forgotten natural landscape. Designing an ecological community will respect the existing marsh and wildlife reserves adjacent to the site.

Site Survey



**Figure 42: Extended Site Context**  
Source: Image by Author  
Underlay Google Maps



**Figure 43: Surrounding Nodes**  
Source: Image by Author  
Underlay Google Maps



**Figure 44: Natural Nodes**  
**Source: Image by Author**  
**Underlay: Google Maps**



**Figure 45: Figure Ground**  
**Source: Image by Author**  
**Underlay: NJMC/MERI GIS**

Site Context:

How do we inhabit this urban wilderness? These series of photographs, Figure 46 through Figure 52, display a cultural phenomenon, a museum of dereliction within the Meadowlands. Relics of a past marine life washed up along the shoreline, deteriorating with the passing of time; Figure 46. Looking to the north down Cedar Creek, the original landowners' house is falling derelict into the landscape, overgrown with Phragmites reeds. Yet there is Xanadu looming over the meadows in the background, swallowing its surroundings; Figure 48. Turning South down Cedar creek the beautiful New York City Skyline is seen in the distance, and in the foreground is the same house, abandoned, broken and derelict; Figure 49. The edge of the site is littered with garbage and temporary structures. The netting of the driving range ripped to pieces, blowing in the wind. Yet there is Xanadu again in the background surrounded by seven cranes booming with construction; Figure 50.

The site is fascinating, filled with other-worldly sensations. The divide between the urban life and the natural landscape is heightened through these photographs which capture the juxtaposition of the modern and the forgotten. The site is the crux of this thesis, fueling the necessity to develop a sense of place and identity in the marsh. It is necessary to re-connect the lost communities which lie on either end of Paterson Plank Road and design an intervention which will bring a renewal to the marsh. How do we inhabit this urban wilderness?



**Figure 46: Site, looking south toward Secaucus**  
**Source: Image by Author**



**Figure 47: Site from Hackensack River, looking north**  
**Source: Image by Author**



**Figure 48: West edge of site, Cedar Creek, Looking north**  
Source: Image by Author



**Figure 49: West edge of site, Cedar Creek, looking south**  
Source: Image by Author



**Figure 50: Site looking west**  
**Source: Image by Author**



**Figure 51: Site, looking east, existing driving range**  
**Source: Image by Author**



**Figure 52: River's edge, looking east**  
Source: Image by Author



**Figure 53: Site shoreline, as seen from Trolley Park**  
Source: Image by Author



**Figure 54: Secaucus High School Marsh**  
Source: Image by Author

As seen from across the river at Trolley Park in Figure 53, the site shoreline is fragmented, with American Dream Meadowlands (Xanadu) looming to the left and the new River Barge Park and Marina to the right. As seen in Figure 54, the site's neighbor, Secaucus High School, uses boardwalk pathways to engage the students and public with the natural wetland. Creating interventions like these on the site will allow for a re-connection with the landscape.

Landmark Views:



432 Park Ave



Empire State Building



Freedom Tower



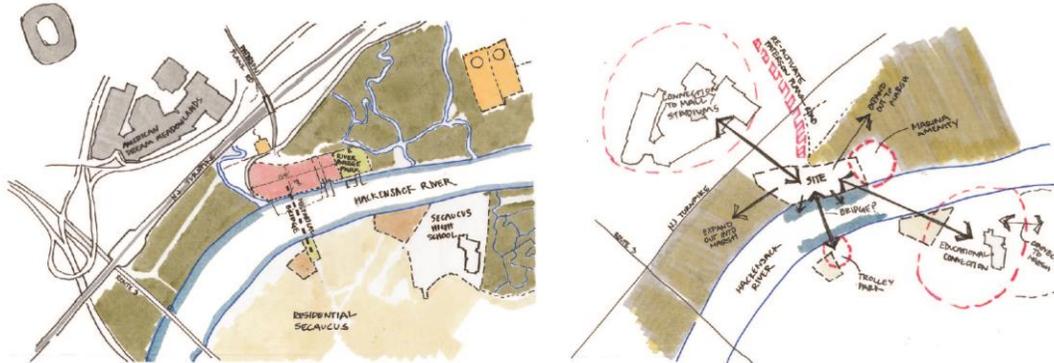
New York City Skyline - As seen from River Barge Park

**Figure 55: Views from River Barge Park to New York City**  
**Source: Images by Author**

As seen in Figure 55, River Barge Park and Marina offers fantastic views to the New York City Skyline. As seen in the circular callouts above the panorama, there are landmark views from the site at the abandoned driving range. By raising the building up ten feet to accommodate base flood elevation, this will also offer expansive views across the river and to the NYC skyline, in addition to the pedestrian bridge which will offer views from fifty-two feet above the river.

## Site Analysis

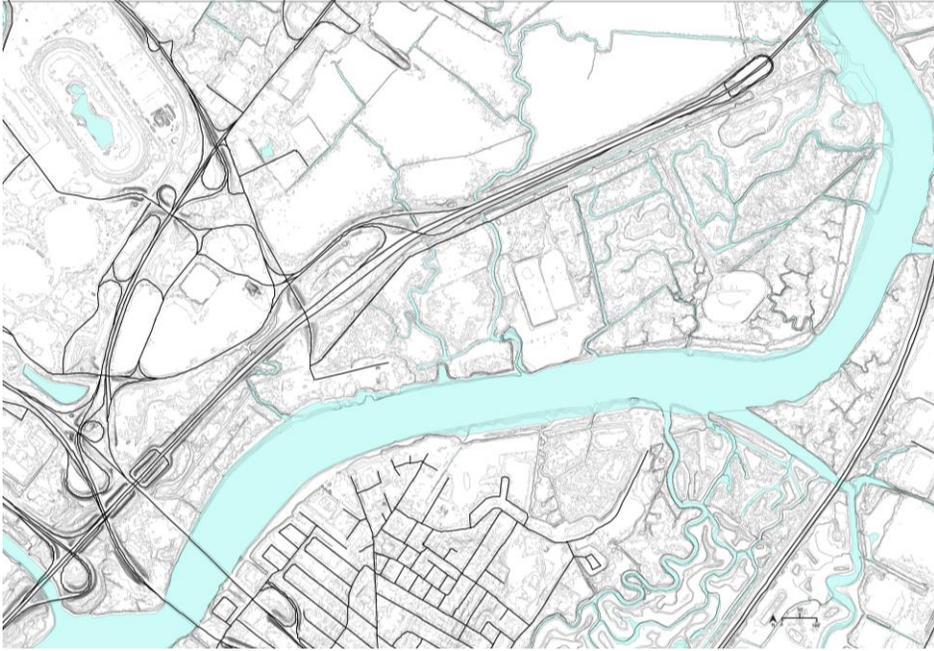
Site Adjacencies/Connections:



**Figure 56: Site Sketches; Adjacencies (Left) Connections (Right)**  
Source: Image by Author

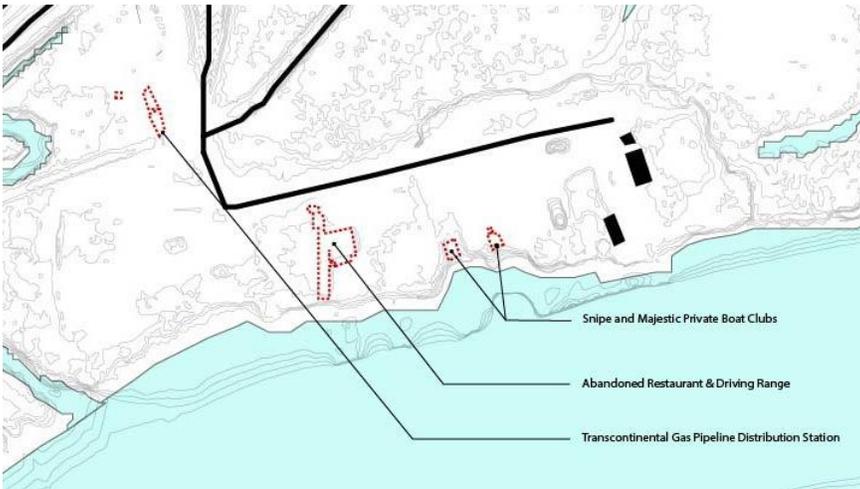
Initial sketches begin to show the complexity and dynamic surroundings of the site. Mapping the adjacent parcels and identifying urban and recreational nodes will allow for connections to these sites. Connection to existing nodes as well as looking for new connections, such as to the American Dream Meadowlands or across the Hackensack River will strengthen the community within the site. Connecting to the natural habitats which juxtapose the site, is important in the design of an ecological research community.

Contour/Slope:



**Figure 57: Contour**  
Source: NJMC/MERI GIS

Demolition plan:



**Figure 58: Demolition Diagram**  
Source: Image by Author, Underlay NJMC/MERI GIS

Existing buildings on the site include an abandoned restaurant and driving range, as well as two private boat clubs. Currently the boat clubs are closed due to an environmental investigation on the site. The restaurant and driving range's, 20 acres

is currently being advertised for sale. To the north currently exists a PSEG metering and pressure reduction station. River Barge Park & Marina will remain to the east of the site, and will be a great public amenity to connect into.

Wetlands:



**Figure 59: Wetlands**  
Source: Image by Author, Underlay NJMC/MERI GIS

Although most perceive the Meadowlands as one large wetland system, there are multiple different types which create the collective whole. Surrounding the site to both the east and west is the Phragmites dominant coastal wetlands. These are the reed grasses that are most abundant in the site, and are actually considered an invasive species. Nearby are a significant area of disturbed (modified) wetlands, including the Secaucus High School marsh across the river. There is also a considerable amount of saline low marsh with patches of high marsh to east of the immediate site.

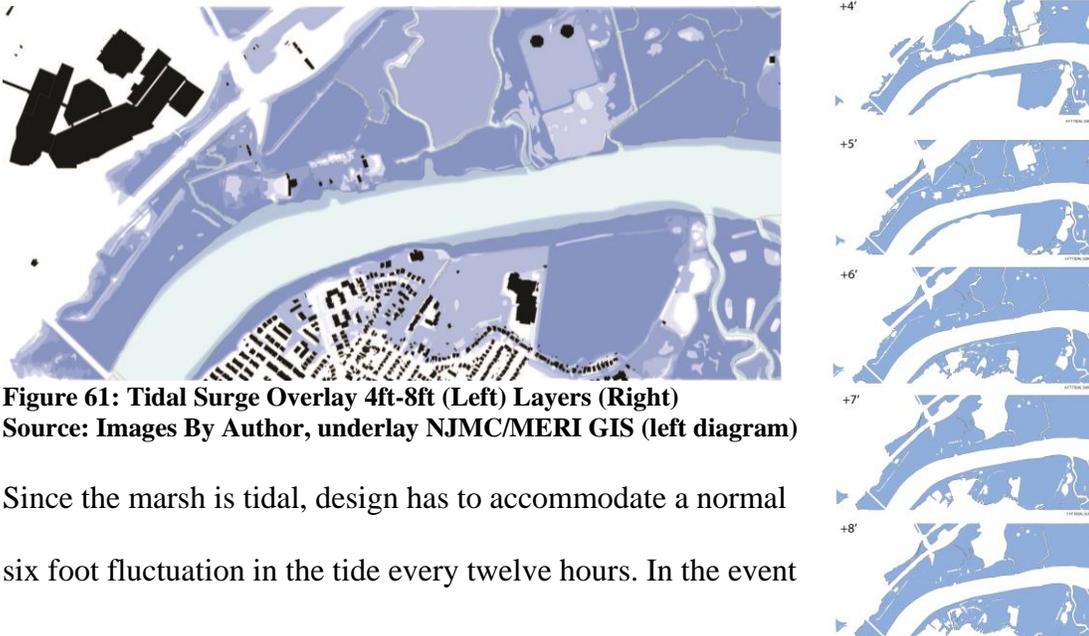
100 Year Flood Plain:



**Figure 60: 100 Year Flood Plain**  
Source: Image by Author, Underlay NJMC/MERI GIS

The overlay of the 100 year flood plain shows the site, and most of its surroundings, completely underwater. Designing resiliently is essential for this site.

Storm Surge:



**Figure 61: Tidal Surge Overlay 4ft-8ft (Left) Layers (Right)**  
Source: Images By Author, underlay NJMC/MERI GIS (left diagram)

Since the marsh is tidal, design has to accommodate a normal six foot fluctuation in the tide every twelve hours. In the event

of a storm surge, eight feet of water almost completely inundates the site.

#### Sea Level Rise:

As seen in the following series of diagrams, sea level rise will greatly affect the site over the next 100 years. The site is located in flood zone AE with base flood elevation (BFE) at 8 ft.<sup>53</sup> In order to prepare for rising waters, storm surge, and BFE, the building is elevated 10 feet off the ground plane. This also allows for an opportunity to place parking and storage below the building since these are areas that can be easily flooded. There are also opportunities for soft infrastructure such as riprap edges, which will help protect against sea level rise and storm surge.

+1 FOOT SEA LEVEL RISE | predicted +1.3 ft rise by 2050



**Figure 62: 1 Foot Sea Level Rise**  
Source: Image by Author, Underlay NJMC/MERI GIS

<sup>53</sup> “What is my base flood elevation (BFE)? Address Lookup Tool” FEMA Region II Coastal Analysis and Mapping, last updated March 24, 2015, accessed January 2016, <http://www.region2coastal.com/resources/glossary/#Zone>

+2 FEET SEA LEVEL RISE

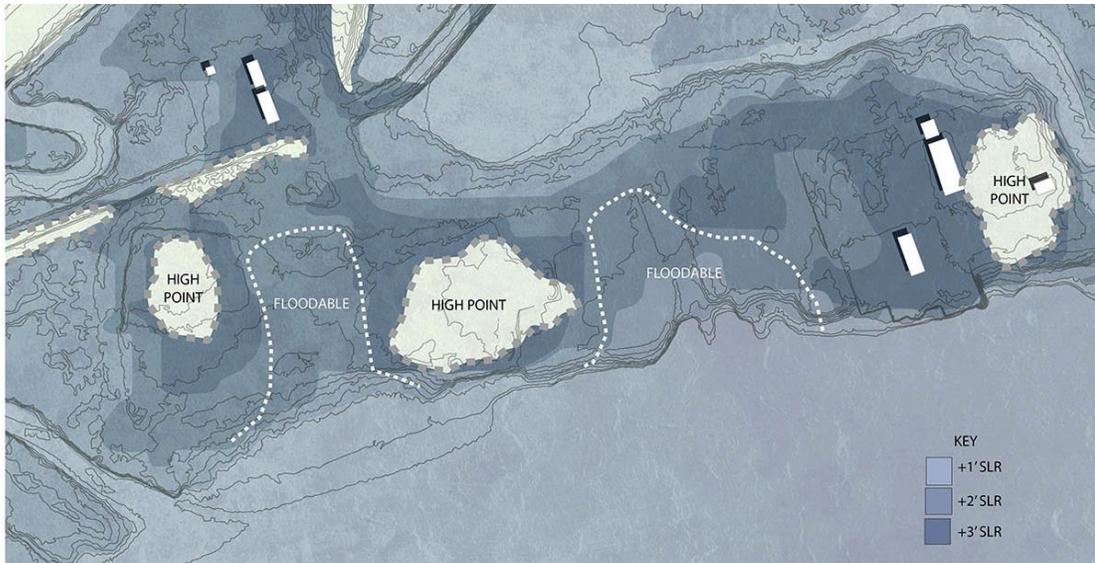


**Figure 63: 2 Feet Sea Level Rise**  
Source: Image by Author, Underlay NJMC/MERI GIS

+3 FEET SEA LEVEL RISE | predicted +3.1ft by 2100



**Figure 64: 3 Feet Sea Level Rise**  
Source: Image by Author, Underlay NJMC/MERI GIS



**Figure 65: Sea Level Rise Design Implications**  
 Source: Image by Author, Underlay NJMC/MERI GIS

In mapping the sea level rise, as seen in Figure 65, the diagram begins to denote two high points on the site, as well as the easily floodable landscape. This significantly informed the overall site strategy and parti design.

Site Access:



**Figure 66: Site Access**  
 Source: Image by Author, Underlay Google Maps

As seen in Figure 66, there lacks an access into the current site since the historic drawbridge connecting the two ends of Paterson Plank road was removed. There is no pedestrian access to the site since the Route 3 bridges are lacking sidewalks or bike lanes. Designing a bridge would allow for a 3.5 minute walk across the river and into the site. The site is also currently in easily accessible to the American Dream Meadowlands mall, only a 14 minute walk and 3 minute drive, a great access point for the public to engage with the site. An educational connection will also be created since Secaucus High School is in walking distance of Trolley Park, the pedestrian bridge connection point. For students to connect with the ecological research community for school events or further learning opportunities it would be less than a 10 minute walk. Re-instating the connection across the river is essential for pedestrian access into the site. Since the area is currently lacking this pedestrian connection, according to Google Maps, it would be a 4 hour and 10 minute walk from the site to Trolley Park via pedestrian friendly routes.

Biodiversity:



**Figure 67: Biodiversity in the Meadowlands**  
Source: [newmeadowlands.org](http://newmeadowlands.org)

The NJ Meadowlands is full of biodiversity, with multiple types of fauna, as well as fish and bird species. Historically, the Meadowlands has always been a habitat for unique creatures, including mastodons in the pre-historic age. However as time progressed and humans began to abuse the meadows, illegally dumping in them, many of the natural habitats were destroyed. In recent years there has been an effort to restore the habitats where these species thrive. Many of the bird and fish species have returned,



**Figure 68: Declining, Endangered, and Threatened Wildlife** Source: NJMC Masterplan

but are now considered endangered species. Also, due to high levels of mercury and PCBs in the water, people are advised to not eat the crabs and bluefish.

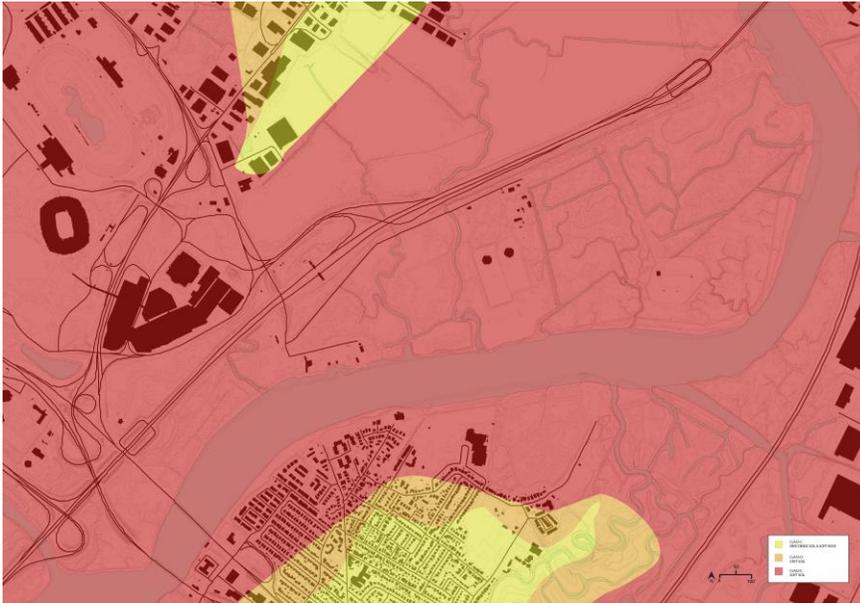
#### Hazardous Conditions/Materials/Wastes:



**Figure 69: Contamination**  
Source: Image by Author, Underlay NJMC/MERI GIS

After decades of environmental abuse, the Meadowlands has layers of contamination that need to be addressed. Currently the site at 254 Outwater lane is on the known active contaminated site list and has been undergoing environmental investigation/clean up since March 14, 2012. In addition, the Trolley Park site, which is where a potential pedestrian bridge could connect to Secaucus, is also on the known contaminated site list. In close proximity to the site there is surface water discharge in Moonachie Creek, adjacent to the site, as well as on the northern side of the NJ Turnpike. Further from the immediate site there are areas with contaminated groundwater.

Soil Conditions:



**Figure 70: Soil Conditions**  
Source: Image by Author, Underlay NJMC/MERI GIS

The soil conditions of the site are Class E – Soft Soil. This could lead to structural concerns, including excessive settlement. Boring depths were taken near the PSEG metering center, which will allow for a greater understanding of the necessary structural implications. These readings show approximately thirteen to fourteen feet of river mud and peat, which is not very conducive to structural support.



**Figure 71: Boring Depths Source:**  
Master Plan Series, Report 1

## Existing Land Use:



**Figure 72: Existing Land Use**

**Source: Image by Author, Underlay NJMC/MERI GIS**

The existing land use of the site is divided into multiple categories. The immediate site, is comprised of commercial retail, recreational, transitional lands, communication/utility, and wetlands. The fragmented edge of the water is seen clearly in the land use diagram. Across the Hackensack River the edge consists of mainly residential, but also pieces of industrial, open lands, and public services. The design potential of connecting Secaucus High School to the site through a pedestrian bridge will also allow residential Secaucus to access the wetlands and recreational activities.

Zoning/FAR:



**Figure 73: Zoning**  
**Source: Image by Author, Underlay NJMC/MERI GIS**

The zoning of the immediate site is Waterfront Recreation. The surrounding zones include environmental conservation, sports and exposition, and across the Hackensack River, low density residential.

## Chapter 7: Building Program

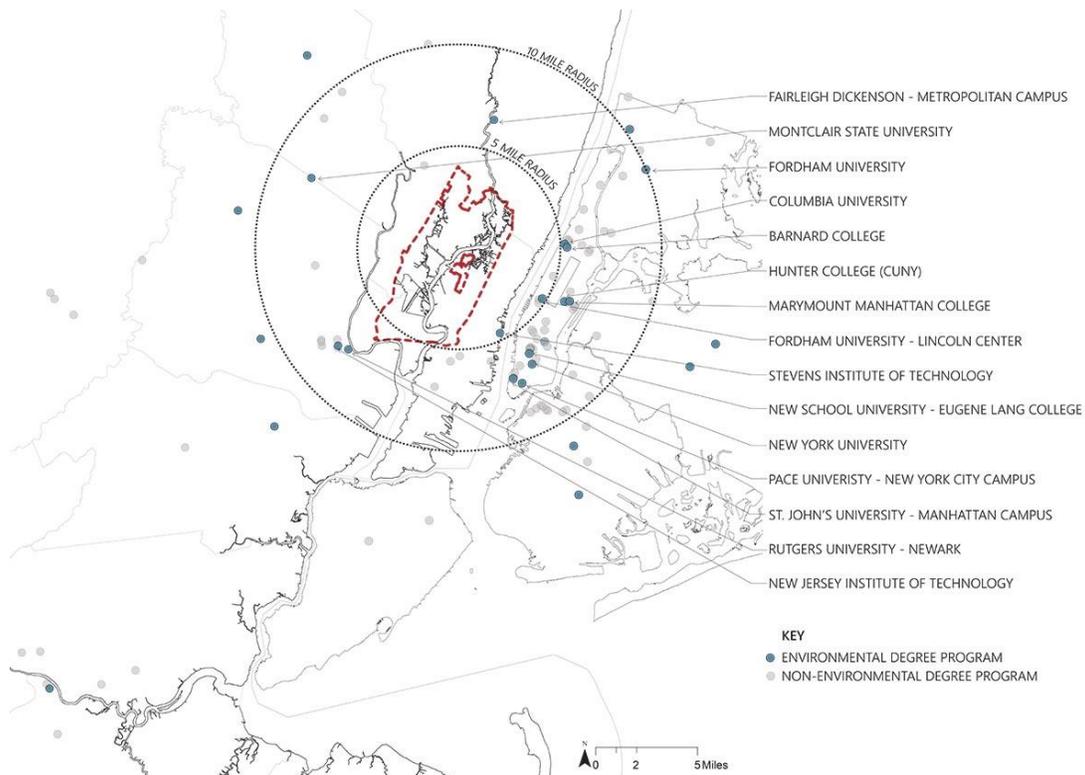
### Introduction:

This thesis proposes an ecological research community which focuses on elements of living, learning, and recreation within the Meadowlands. Identifying the proper programmatic intervention in the district was a challenge since the current conditions include such a patchwork of different land-uses. Identifying which programmatic elements would survive was essential since many buildings along the river and within the district are derelict and abandoned. Creating a place within the marsh which will re-connect the public with the site is also a challenge since many buildings are located off of the main roads, and are considered on the outskirts, with no incentive to entice the passerby off of the Turnpike.

### Program Objectives:

- Cluster living spaces with learning spaces to create unique student research experiences
- Blend built form and landscape to create collaborative spaces for learning within the environment
- Re-connect Paterson Plank road through a pedestrian bridge, establishing a relationship between Secaucus High School and the new ecological campus
- Frame views of landmarks around the site, developing connections to New York City
- Integrate sustainable techniques which focus on water collection at multiple scales

Program Mapping:



**Figure 74: Environmental Science University Mapping**  
Source: Image by Author, Underlay, NJMC/MERI GIS, NJ State GIS, NY State GIS

As seen in Figure 74, when mapping the existing higher education universities in the metropolitan area which have a focus on environmental science, there is a number of schools within a 5-10 mile radius of the Meadowlands District. The district is the uniting factor between all of the universities in the area. A new ecological community within the heart of the Meadowlands would give students a new opportunity to live and inhabit the environment in which they are studying. In communicating with Dr. Francisco Artigas, the current director of the Meadowlands Environmental Research Institute, he advised that “we are so close to NYC where the limiting factor is space and lodging. Lots of people want to come here to do research

but it is too expensive to live/stay in this area.”<sup>54</sup> Creating a new community for research students to stay for a semester and cross-fertilize ideas, collaborate, and inhabit the environment in which they are researching would create new place in the marsh and bring a sense of renewal to the environment. Students would be able to analyze environmental issues on the site such as pollution and wetland remediation, while also interacting with the surrounding public communities. By proposing a place-based educational approach to the site the students will be able to re-connect with the land and new educational identity will thrive in the marsh.

The programmatic design objective of this thesis is to create a narrative of spaces which reinforce the notion of living and learning within the wetland environment. Through the design of an ecological research community, landscape and built form blend in order to allow students to have a heightened experience of the environment that they are researching. The programmatic design of the building results in three main zones, the living community, the academic buildings and the public buildings.

Designing the living community adjacent to Cedar Creek natural wetland on the site will allow for students to have a stronger experience of inhabiting the wetland after class hours.

Designing the academic buildings with a more rigid and industrial approach will reflect the atmosphere of the surrounding area. Standard laboratories are designed on a thirteen foot module. Designing this building to be a collaborative working environment for the student is very important, so the flexibility of laboratory spaces to be combined into larger work areas is essential.

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<sup>54</sup> Francisco Artigas, email message to author, February 2, 2016.

Designing two public buildings on the site, a café and a great hall space, will bring together the local community on the site and allow for an interaction between the public and research students. The design of a cable-stayed pedestrian bridge across the Hackensack River will re-connect the communities with the wetland.

Designing sustainably and resiliently is necessary in order to prepare for future natural disasters. The river is tidal and fluctuates six feet every twelve hours, and is a major design consideration. Integrating water collection techniques for re-use on site is important for educational and environmental purposes.

*Program Summary:*

The following table is break down of the programmatic elements of the ecological research community. The Meadows Community is the living community, comprised of six units. The Great Hall is the main flexible space for both public and private events. It is used for a variety of different activities including lectures, student exhibitions, and special events. The study is a private building located on the main community plaza space and is a space for the students to use for studying as well as research. The café is a public building which is open for the community as well as tourists and locals. The academic building is private and for the office employees, faculty members, and students. A main portion of the program is landscape components, which are for both the public and researchers to engage and have a new experience with the wetland environment.

**Table 2: Building Program Distribution**

<b>Meadows Community</b>	<b>6,600 SF</b>
Researcher Living Units (x6)	1120sf
Bedroom (x4)	118sf
Bathroom (x2)	60sf
Kitchen	170sf
Private Deck/Balcony (x2)	380sf
<b>Great Hall</b>	<b>9,200 SF</b>
Lobby	730sf
Flexible Space	3730sf
Balcony	1340sf
Outdoor Decks (x2)	1400sf
Storage	115sf
Bathrooms	500sf
<b>Study</b>	<b>3,015sf</b>
Library	1350sf
Lounge Area	1071sf
Bathroom	105sf
Balcony	360sf
Storage	130sf
<b>Café</b>	<b>2,000sf</b>
Dining Area	1555sf
Kitchen	350sf
<b>Academic Building</b>	<b>28,000 SF</b>
Lobby	890sf
GIS Office	2482sf
Faculty Offices (x16)	155sf
Dry Laboratory Space	3435sf
Flexible Wet Lab Space	3435sf

Cafeteria	1045sf
Greenhouse	1615sf
Archives	570sf
Mudroom	1615sf
Bathrooms	550sf
Mechanical	600sf

**Table 3: Landscape Program Components**

<b>Recreation</b>	<b>58,000 SF</b>
Tidal Cove	9,000sf
Living Laboratory	42,120sf
Learning Pavilion	980sf
Boat Dock	5600sf

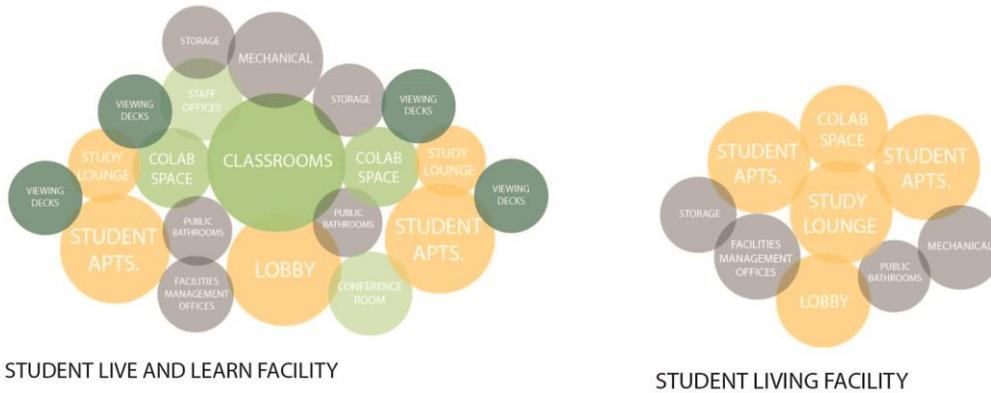
Program Graphic Depictions:



**Figure 75: Live, Learn, Play, Programmatic Elements**  
**Source: Image by Author**

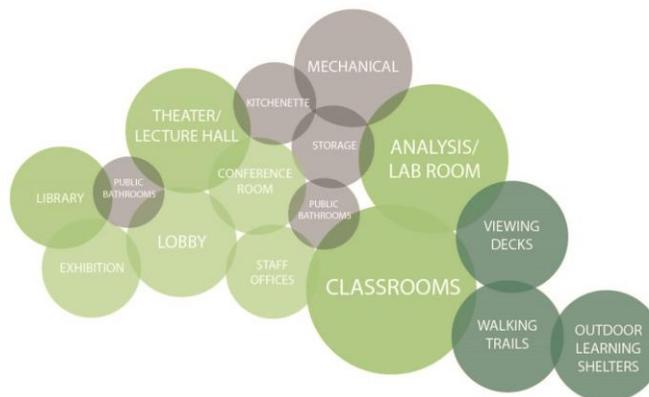
An initial study of the programmatic elements of live, learn, play spaces on the site allowed thought to be given about the arrangement of rooms within the buildings as well as on the landscape. Balancing aspects of living and learning with

recreational components will engage the public communities as well as student groups.



**Figure 76: Live and Learn Facility, Adjacencies (Left) Living Facility (Right)**  
**Source: Image by Author**

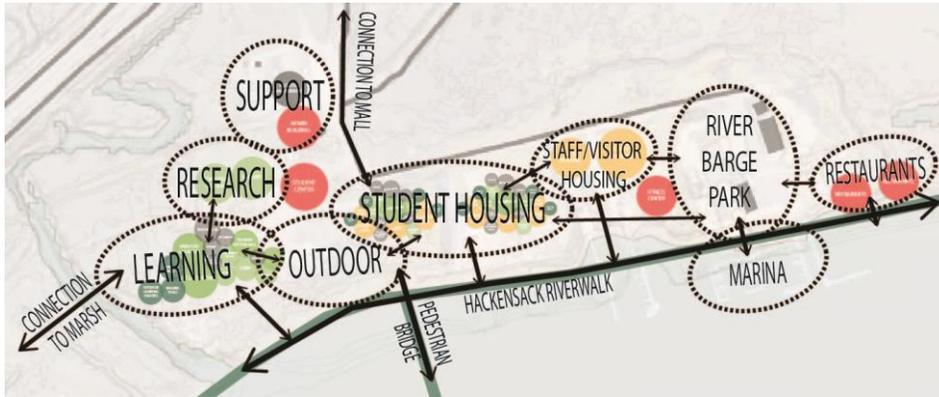
Figure 76 is an initial study of the programmatic arrangement of the living and learning spaces arranged within one building as well as an arrangement of spaces within a more typical living facility.



**Figure 77: Academic Building, Programmatic Adjacencies**  
**Source: Image by Author**

An initial study of the components of an academic building on the site. Programmatically it looked at integrating research laboratories as well as classrooms for students to learn. A main idea of the center was to extend interior rooms of the

environmental center such as the classroom space out and into the landscape through walking trails, viewing decks and outdoor learning shelters, in order to make an important connection back to the landscape.



**Figure 78: Program Adjacencies & Relationship to Site**  
Source: Image By Author: Underlay NJMC/MERI GIS, Google Maps

An initial mapping of the program adjacencies arranged on the site. This study informed how different arrangements of program on the site can reinforce an overall experience of the wetland. This layout evolved into a more refined arrangement of program by creating an axis, across the river as well as a cross-axis of research and public components. This study also began to inform the amount of program needed on the site, and evolving the design from and more typical campus design approach to a specialized ecological research facility.

## Chapter 8: Constructional Implications

### Structural Implications:

#### Challenges to Building in a Wetland Environment:

The site conditions in the Meadowlands require special structural consideration. The soil is soft, and the wetland environment requires in certain cases, structures to be built above the ground plane. Also, locating buildings close to the Hackensack River's edge requires extensive planning for resilient design and the 100 year flood plain. In addition, the Meadowlands marsh is tidal, so buildings need to be designed to accommodate a six foot change in water level, as well as prepare for flood surges of up to eight feet. The conditions of these sites also suffer from common problems including "excessive settlement, low bearing capacity, high water level, frost heave and corrosion potential."<sup>55</sup>

#### Excessive Settlement:

When building on soft soil, the structural approach needs to be tactful due to concerns with excessive and differential settlement, which occurs when the soil cannot bear the weight of the structure. A report on constructional considerations for marshlands, specifically studies the wetlands in the Meadowlands District existing structures and has found "for structures on foundations supported by marshy soils

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<sup>55</sup> A. Rhett Whitlock, Shahzad S. Moosa, "Foundation Design Considerations for Construction on Marshlands" *Journal of Performance of Constructed Facilities* 10, no.1 (February 1996) 15-22

total settlement on the order of two to 20 centimeters is not uncommon. Some studies have shown that marshy soils may compress from 25% to 50%.<sup>56</sup> This settlement can be mitigated using multiple control tactics, all of which need to be made with economic and sustainable considerations as well. The recommended tactics to control and prevent settlement are:

1. The removal of soft marsh soils and their replacement with suitable backfill
2. Constructing the building on deep foundations that bear on non-compressible materials
3. Modification of the in-situ conditions by pre-compression<sup>57</sup>

If choosing to build deep foundations, it is also important to consider materials and decide on timber, concrete or steel structure. There are limitations with each, as well as a varying expense range. A major drawback to the driving of deep piles is that they “create large vibrations and noise. These vibrations and noise can be forceful enough to cause settlement and/or damage to nearby structures.”<sup>58</sup> Not only could this harm the animal habitats and wildlife reserve sites that are nearby, but also other buildings and infrastructure, such as the NJ Turnpike or River Barge Park Marina.

The last example given to consider for controlling settlement is pre-compressing the soil so that it stabilizes. However, a drawback to this method is that it affects the time schedule, and “it is not uncommon for soils to take a year or even longer to become stabilized.”<sup>59</sup> The recommended use of a steel structure due to the lightweight material, should strongly be considered when building on the marsh. This would help with the issue of excessive settlement.

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<sup>56</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 16.

<sup>57</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 19.

<sup>58</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 19.

<sup>59</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 19.

#### Material Choice:

It is important to choose materials which have an economic, durable and cultural appeal. Since the site has many unique characteristics, including the marsh soil conditions and an extensive industrial history, structure can be a way to celebrate the importance of site. Considering the three main structural material options, timber, concrete and steel, each have limitations and concerns for durability in a wetland environment. The foundation material may deteriorate more due to the organic material usually found in peat soils in wetlands, and therefore certain precautions must be taken. The connection of culture to structural material choice is important for this unique site. Designing either a steel or timber frame could benefit the message and importance of the educational ecological campus on the site.

#### Steel:

The industrial history of the Meadowlands could be acknowledged through designing a steel framework for the buildings, in order to acknowledge the past but lead toward a better future. Steel connotes an industrial and infrastructural feel, especially if the structural components were to be exposed in the building for the public and students to see. The idea of using a steel frame could also relate to back to the modern life outside of the forgotten Meadowlands, and by using this material choice it is a small gesture to reconnect and blend the modern and forgotten.

The paradoxical approach to designing with a very industrial cold material is the juxtaposition to fragile ecosystems and wildlife habitats which encompass the site. Although the steel looks industrial, it is lightweight, which would express the concept

of intervening lightly in the marsh habitat, as to not disturb the ecosystems. A drawback to using steel in the wetland environment is that it is likely to suffer from corrosion especially marshy areas with brackish waters due to chloride levels. In order to mitigate this concern, it is recommended to either use an epoxy coating or choose to use thicker steel pilings in order to “increase the life expectancy” against deterioration.<sup>60</sup>

Timber:

Choosing a timber structure for the buildings could connect cultural to the idea of emphasizing the pure and original landscape of the Meadowlands. Using a warmer and natural material would connect to the idea of preserving the landscape and connecting back to the Atlantic Cedar Forest which once covered the site. However there are some limitations for timber piles, including available length and load capacity. Timber piles are usually around “40-60ft” and have a “maximum allowable load ...rarely over 30 tons.”<sup>61</sup> Therefore this structural system is usually only used for light commercial structures or residential, which could be applicable in the educational campus community design.

In the marsh environment, timber piles could be subjected to deterioration if they are “above the zone of saturation when subjected to microbial action combined with alternate drying and wetting,” however “by the impregnation of the wood with chemicals” the life expectancy of the piles will increase.<sup>62</sup> Although this could help a timber piling system, this could culturally deteriorate the idea of a pure and natural

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<sup>60</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 21.

<sup>61</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 19.

<sup>62</sup> Whitlock, “Foundation Design Considerations for Construction on Marshlands.” 19.

landscape. The site has suffered from chemical pollution over decades of environmental abuse, and chemically treating the wood, although logical, could morally dispute the pure and elemental relationship to the site. A design consideration could pair the two structural systems of steel and timber to increase the paradoxical compulsion of the site.

#### Pedestrian Bridge:

Designing a pedestrian bridge to span the Hackensack River and connect from the site across to Trolley Park in Secaucus, is a 1,120ft span from bank to bank and requires considerable structural planning. The pedestrian bridge should reflect a multi-modal use by having biking paths as well as walking lanes. Creating a connection with the bridge will strengthen the educational community and allow the ecological campus to be part of the Secaucus High School network. It will also connect into a large network of bike and walking trails which weave along the Hackensack River's edge. Developing the waterfront along the west side of the Hackensack River, could also exemplify the use and need for the bridge connection. Historically, as seen in Figure 79 there was a drawbridge which connected either end of Paterson Plank Road across the marsh. Reestablishing this historical connection could open up the opportunity to bring local communities together and into the Meadowlands landscape.



**Figure 79: 1930's Aerial, Bridge**  
**Source: Image by Author,**  
**Underlay NJMC Historical Imagery Viewer**

## Chapter 9: Design Approach

### Objectives:

- Blend architecture and landscape so that the ecological research community is responsive to site conditions
- Bridge across to Secaucus High School to create a stronger educational community connection
- Connect buildings to public amenity along Hackensack River's edge in order to bring people into the site
- Cluster campus buildings to blend living and learning space in order to create unique student research experiences

### Problems/Issues:

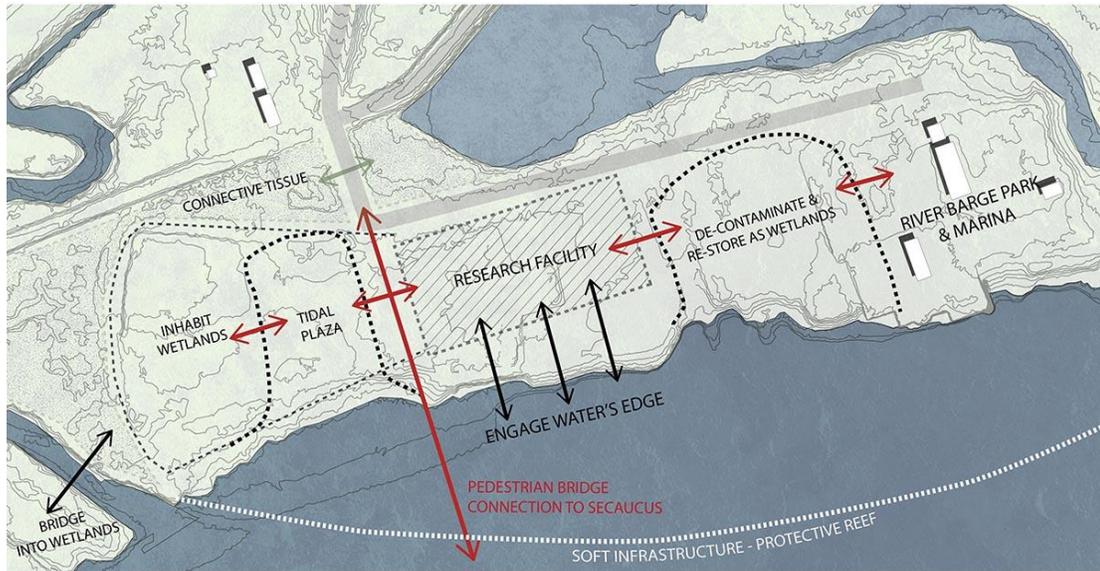
There are many important factors to consider when designing on this site, located at Outwater Lane in Carlstadt, NJ. The site is located in flood zone AE, which requires structures to be built above base flood elevation, which is 8 feet. Since sea level rise as well as storm surge will greatly affect the site, this has led to a series of hydrology studies in order to indicate the high and low points. The building will also be elevated on piles ten feet above the ground level.

### Conceptual Design Strategies:

### Site Opportunities:

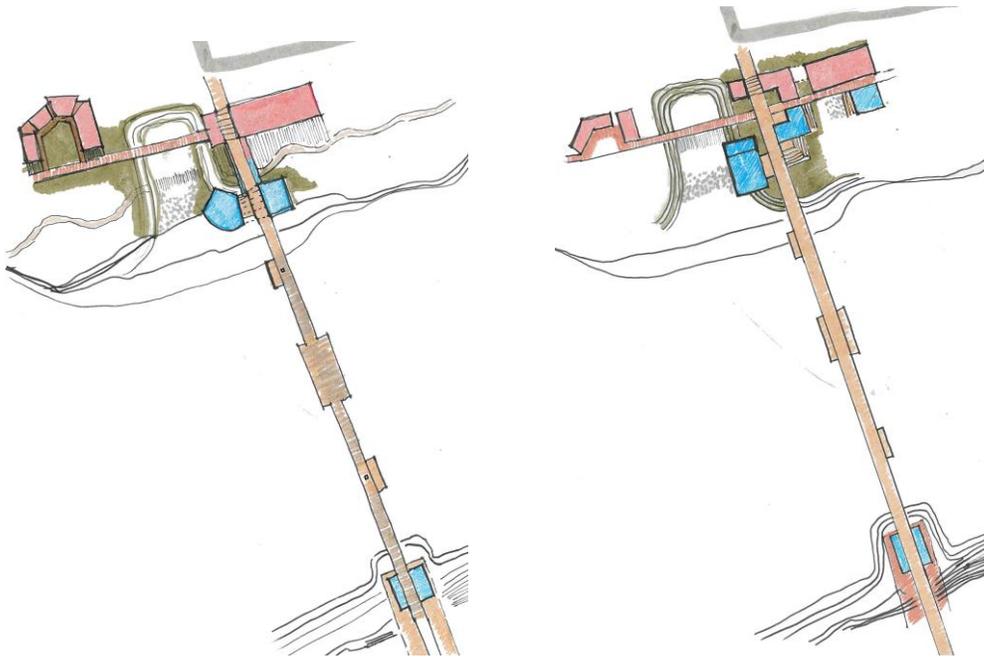
After a thorough analysis of the site conditions and the building program, Figure 80 is a composite diagram which depicts the design opportunities of the site.

Looking at the diagram, the axis across the river via, the new pedestrian bridge becomes a clear design driver. A cross-axis of building and landscape components re-orientates the user east-west out to the landscape. The strategy of placing the building components including the living units and research facility hark back to high/low point diagram, Figure 65.



**Figure 80: Site Opportunities**  
Source: Image by Author, Underlay NJMC/MERI GIS

### Initial Parti Sketches:



**Figure 81: Research Bar (left) Public Square (right), initial process sketches**  
Source: Images by Author

Initial conceptual sketches begin to address the axis and cross-axis design parti. In arranging the buildings about these axes there were two initial design strategies. In the research bar parti seen in Figure 81, there is a clear private cross-axis bar which would be used by the students and researchers. The public components, in blue, remain outward of the research bar and are more fluid in shape. The living units are designed in a horseshoe shape to orient views out to the river. In the public square parti also seen in Figure 81, the design begins to show how the buildings are oriented about a cross-axis and create a space at the center which is a crossing of the public and private realm. These partis evolved into a design strategy with elements from both of these sketches.

The research bar parti is successful in that it the two public building were outward of the private bar and engaged with the bridge and water's edge. The

common open space that the student housing forms, is an idea that was carried further, as it is important that there are community spaces for the students to gather separate from their individual units.

The public square parti became essential in furthering the idea of a common space for both the research students and the public to interact. In further development, the buildings began to line a central space and emphasis is given to the common space rather than a wall of building façade. The landscape becomes a stronger element in this parti as the main plaza space is outdoors, and acts as a uniting factor for both the public and private buildings.

Developed Parti Design Sketches:



**Figure 82: Site Plan, Process 1**  
**Source: Image by Author**

Figure 82 is a later iteration of the parti, which begins to further develop both the building orientation and landscape design. The parti has evolved to create an

outdoor plaza space which is lined by both the public and private buildings. A critique of this site plan sketch is the lack of definition in the plaza space. Since the great hall space is pulled off of the main space, there seems to be a lack of hierarchy in the outdoor spaces. The housing to the left of the plan is also lacking a defined community space.



**Figure 83: Site Plan, Process 2**  
**Source: Image by Author**

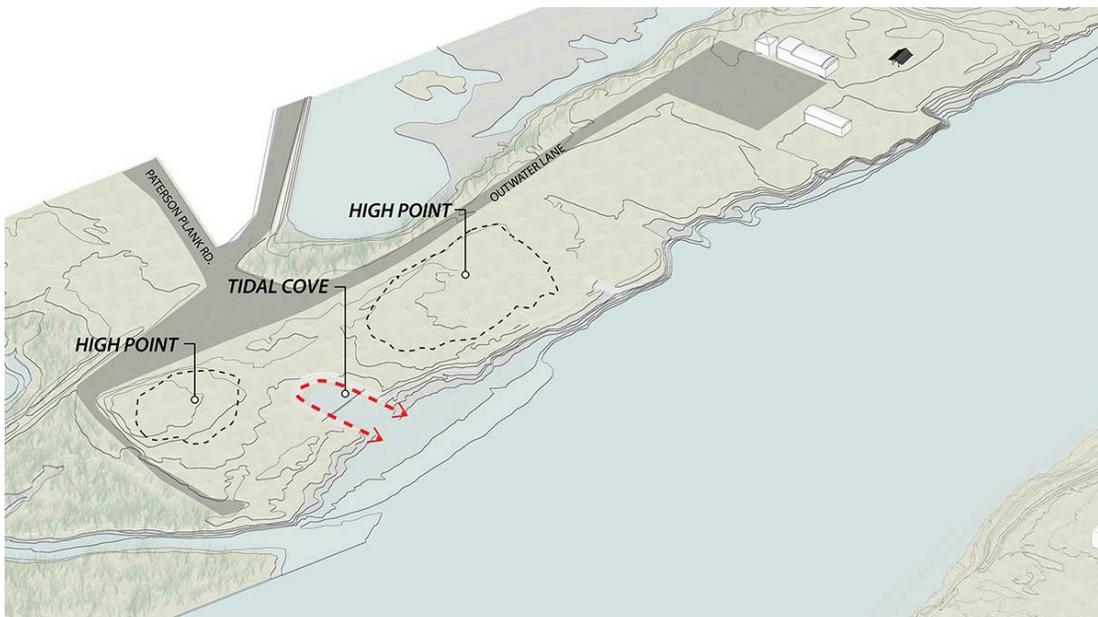
Figure 83 is a later iteration of the site plan which responds to the lack of defined spaces in the earlier iterations. The living community has evolved into a circular shape to indicate a clear common space for the students. The main plaza space is enclosed with two public pieces sitting outward, closest to the bridge, and the research bar to the north of the site. The great hall has evolved in shape to extend out towards the river and orient users to fantastic views. The academic building to the

right has evolved to reflect the typical modular unit of a laboratory, which is reflected on to the landscape through the design of a constructed wetland sequence. This site plan process sketch further informed design decisions regarding how to further integrate the landscape and built form.

*Design Approach:*

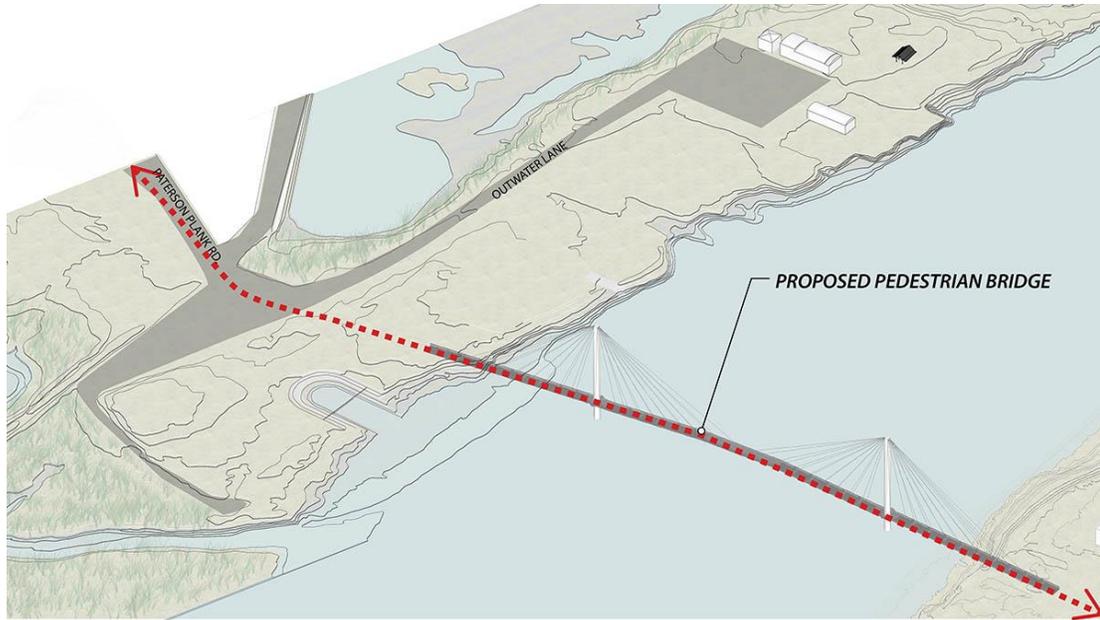
Final Parti build-up sequence:

Figure 84 through Figure 87 display the final design sequence and overall landscape/building design strategies.



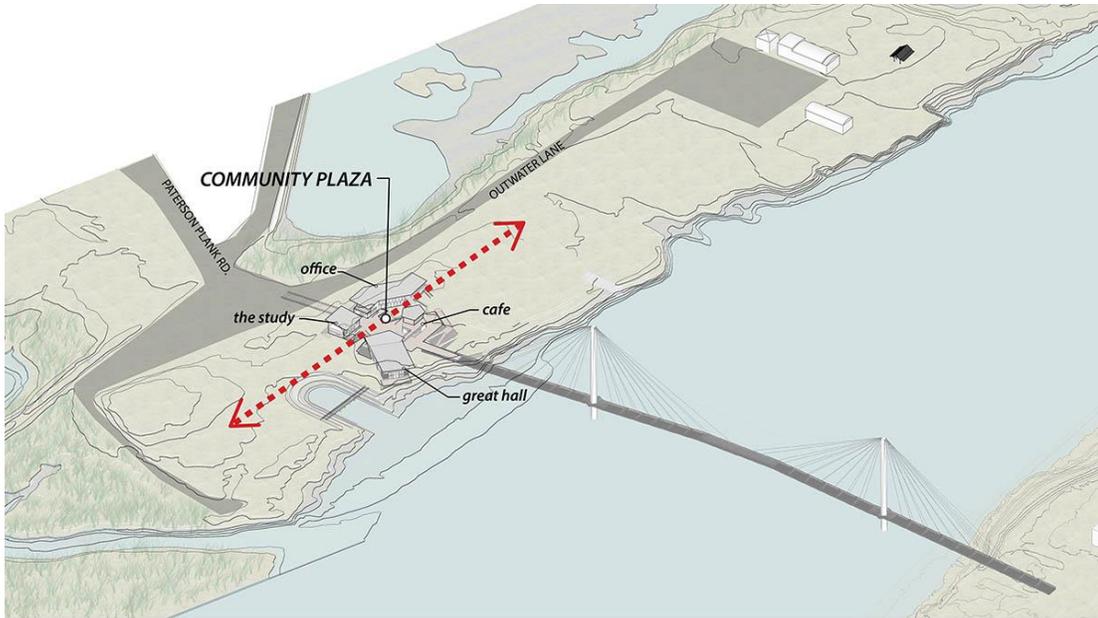
**Figure 84: Tidal Cove**  
**Source: Image by Author**

As seen in Figure 84, by carving out a tidal cove between the high points, this allows for the landscape to become more dynamic and for the public and researchers to engage with the hydrology flows on the site.



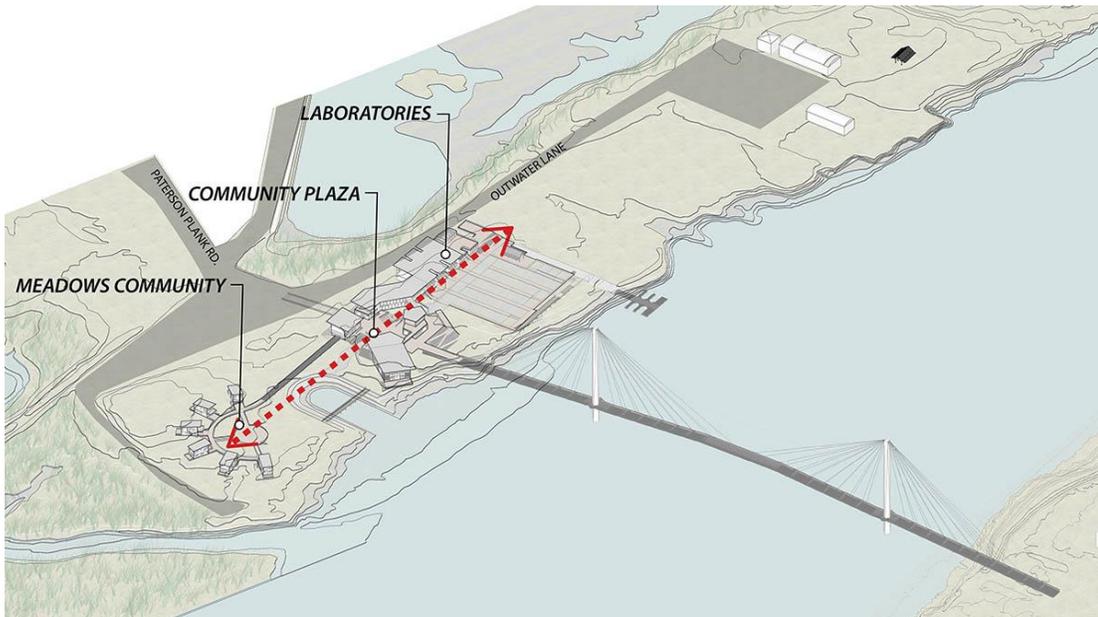
**Figure 85: Pedestrian Bridge**  
**Source: Image by Author**

As seen in Figure 85, the main axis of the design comes in re-connecting the two ends of Paterson Plank Road through a new cable-stayed pedestrian bridge. The massive size of the pylons will allow the bridge to act as a marker in the landscape, and draw the passerby on the Turnpike toward the site. The axis will serve as a connection for the local Secaucus residents to come into the site and engage with the landscape and other research students for educational purposes. Currently there isn't any pedestrian access across the river, as the Route 3 bridges lack pedestrian accommodations. With the new bridge, it will only be a 3.5 minute walk across the river and into the site. It will also serve as an educational connection since Secaucus High School is across the river and with a new pedestrian bridge would only be a ten minute walk.



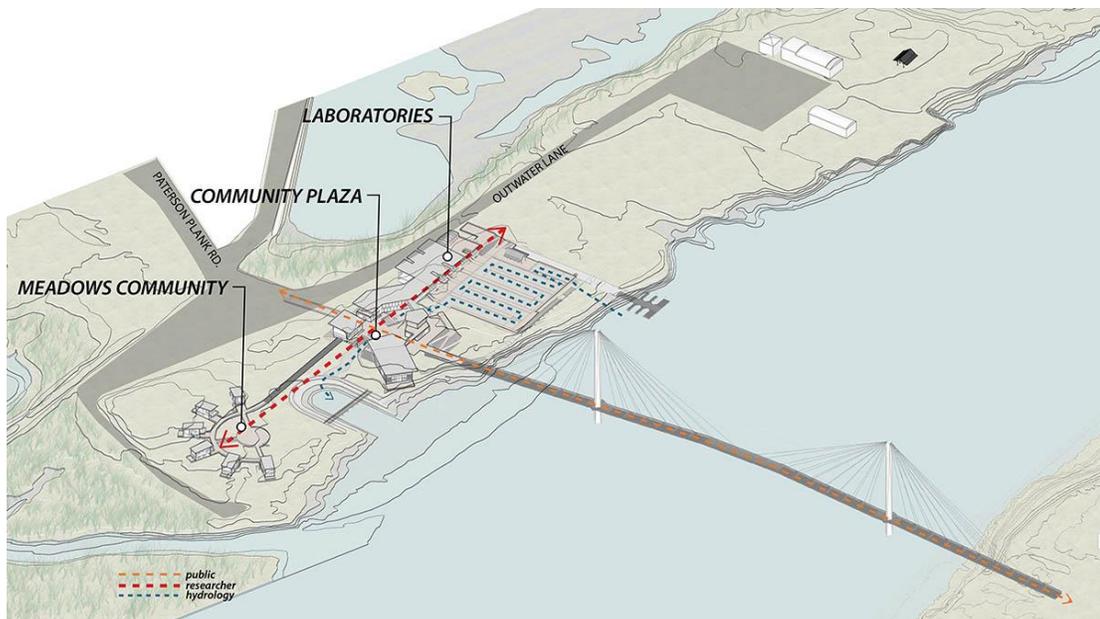
**Figure 86: Community Plaza**  
**Source: Image by Author**

As seen in Figure 86 along the end of the axis on the site is the Community Plaza, which is a space configured of two public buildings and the start of the research bar of buildings. The Community Plaza is the start of the cross-axis which re-orientates the public and the researchers to the landscape.



**Figure 87: Cross-Axis, Research Bar**  
**Source: Image by Author**

As seen in Figure 87, the ends of the cross axis have the Meadows Community, the living community for the research students as well as the academic building with the laboratories. The design of the laboratories is rigid and stable, built on a 26' module. There is a duality between the building and the landscape, as a new constructed wetland is designed adjacent to the indoor laboratories. The academic building and the Meadows Community are built on the high points on the landscape, as to avoid damage from storm surge and flooding.



**Figure 88: Flows on site**  
**Source: Image by Author**

In Figure 88, the flows of the public, researcher, and hydrology are seen overlaid on the building design. The flow of the public is on the axis, across the river to the high school and residential Secaucus area. The two public buildings, the great hall and the café create a threshold condition into the Community Plaza. The cross-axis is comprised of the private components, the Meadows Community, the study, the offices and the laboratories. The hydrology flow is significant since it overlaps with both the public and private flows of the site.

Paterson Plank Pedestrian Bridge:

Re-connecting the two ends of Paterson Plank Rd where there was once a drawbridge mid-19<sup>th</sup> century is essential to reviving the communities around the river. In the 1930's when the bridge was removed due to the building of the Route 3 bridges south of the site, the communities and businesses on either end suffered both economically and culturally. The title of an old newspaper clipping about the Paterson Plank Road bridge removal says it all "Residents Hoping Against Hope: Bridge's Closing Makes Area like Deserted Towns."<sup>63</sup>



**Figure 89: Lost Communities Collage**

**Source: Image by Author, Photos from: meadowblog.net, pinterest.com**

In order to revive the surrounding communities, it is essential to re-connect the two ends of Paterson Plank Road with a cable-stayed pedestrian bridge. The bridge is designed with two sleek concrete pylons, protruding 150 feet in the air. The

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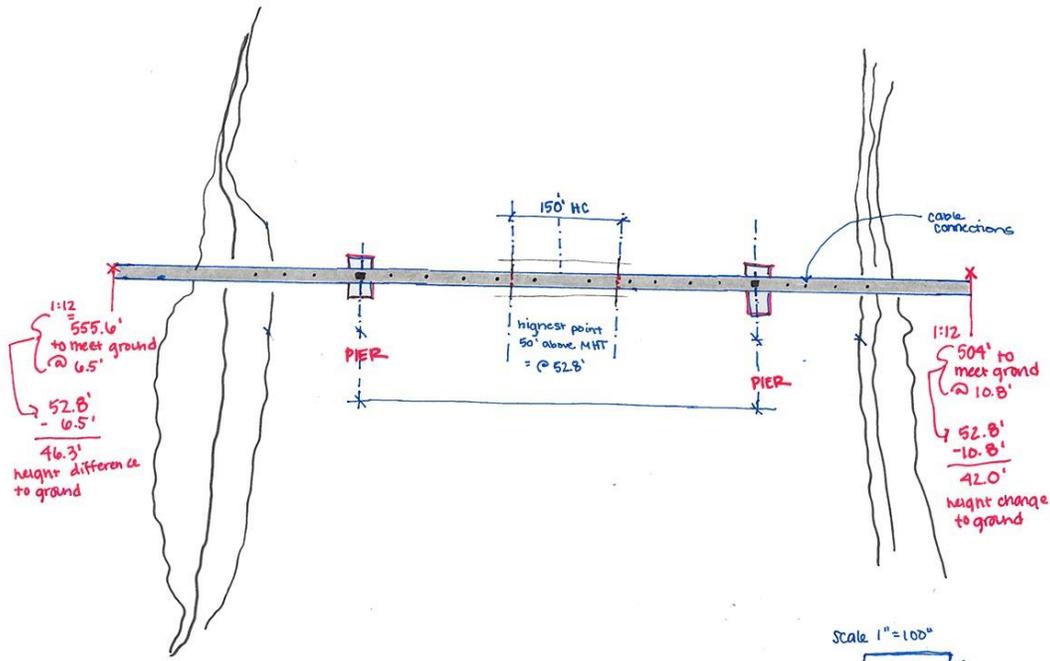
<sup>63</sup> NJMC, "The Lost Communities on the Hackensack River" *The Meadowlands Nature Blog*, March 11, 2009, Accessed January 2016, <http://meadowblog.net/2009/03/a-lost-community-in-east-rutherfordcarlstadt/>

concrete pylons will act as a marker in the landscape, so those passing by on the turnpike, or the Route 3 bridges will be able to see the masses and be drawn into the site. Not only does it help to give the ecological research community an identity among all of the other infrastructure, but it also helps to solve the problem of pedestrian access. As previously mentioned, the Route 3 bridges lack pedestrian access, there are no bike lanes or sidewalks. Creating this new connection will allow for a 3.5 minute walk across the river.

Before designing the bridge, there were a few parameters that needed to be met since the Hackensack River is currently navigable by both large vessels and leisure crafts. According to a NOAA 2015 Nautical Chart, the existing route three bridges are fifty feet above high tide, and have a horizontal clearance of 150 feet.<sup>64</sup> The design of the new cable-stayed pedestrian bridge will meet these parameters set forth by the Route 3 bridges.

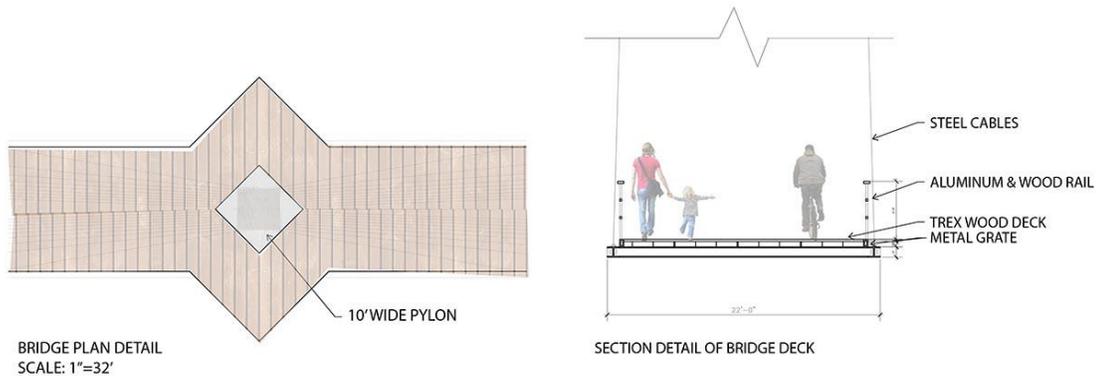
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<sup>64</sup> “Passaic and Hackensack Rivers” Historical Map and Chart Collection, 2013, accessed February 3, 2016, <http://historicalcharts.noaa.gov/historicals/search#searchInput>



**Figure 90: Bridge Calculation Sketch**  
Source: Image by Author

The bridge is designed with a 1,200 foot span; divided into four segments of 300 feet. The free-span between the pylons is 600 feet. The bridge is supported by thirty cables on each side of each tower, and these cables are spaced on thirty foot increments when connecting into the deck. The bridge deck design is constructed of steel beams and girders, with an open box grate and Trex decking as a wood wearing surface. The width of the bridge is twenty feet, to accommodate both pedestrians and designated bike lanes. The cables attach to the girders on either side of the deck. The bridge is ADA accessible and designed in increments of thirty feet, which slope at 1:12 with a 5 foot landing in between each ramping segment.



**Figure 91: Bridge Plan Detail (Left) Bridge Deck Section Detail (Right)**  
**Source: Image by Author**

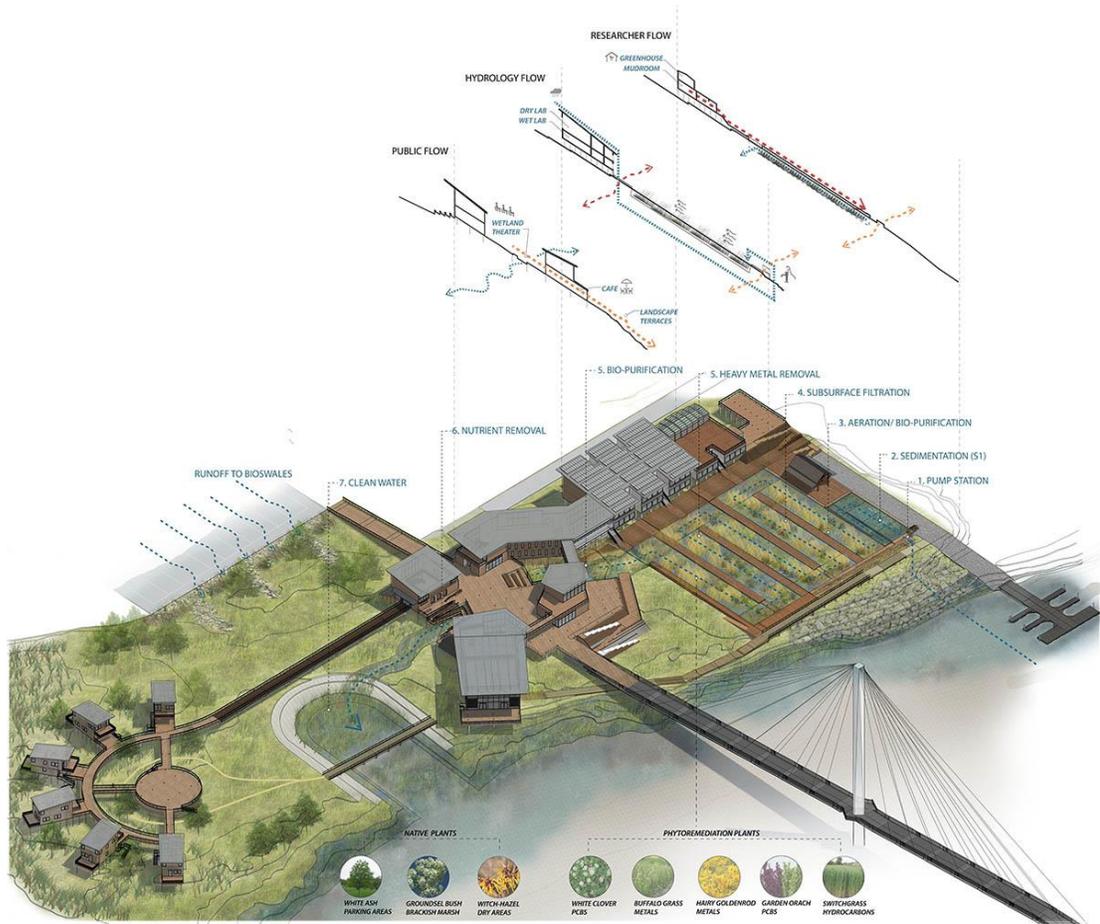


**Figure 92: Elevation of Paterson Plank Pedestrian Bridge**  
**Source: Image by Author**

### Hydrology Design:

The design of a new hydrology flow on the site is essential in addressing how to protect against water as well as design with the water. The polluted water of the Hackensack River allowed for an opportunity to design a constructed wetland system which could clean the water and also act as an educational tool for the research students and public. As seen in Figure 93, the axon of hydrology flows and wetland processes the system works as so: the water is pumped from the river and into the constructed wetland sequence where it first undergoes a process of sedimentation. After three tiers of sedimentation, the water flows through sloped terraces which are designed with phytoremediation plants. The water goes through a process of aeration, sub-surface filtration, heavy metal removal, bio-purification, nutrient removal and flows into the tidal cove as clean water. This new hydrology process acts as an

educational process just as much as a cleansing process. Both the students and public can see the filtration process at work through the living laboratories and begin to understand the cleansing and sense of renewal for the marsh.



**Figure 93: Hydrology Flows and Wetland Processes**  
 Source: Image by Author

Site Plan:



**Figure 94: Site Plan, Urban Context**  
Source: Image by Author

In Figure 94, the site context plan, the Paterson Plank pedestrian bridge can be seen spanning across the Hackensack River and connecting into Trolley Park.



**Figure 95: Immediate Site Plan**  
Source: Image by Author

Zooming in to the immediate site, three distinct zones are seen along the cross axis of the plan.



**Figure 96: Carlstadt Bird's Eye Aerial**  
**Source: Image by Author**

Meadows Community:

Figure 96, the birds-eye aerial depicts the Meadows Community in the foreground, with the pedestrian bridge seen crossing the Hackensack River. The Meadows Community to the far left of the site plan, is a circular shape containing six, four-bedroom units. As seen in the approach, Figure 97, the living units are organized around a common deck space for the student researchers to interact and collaborate within the environment. Below the Meadows Community deck and catwalks is Meadows Park, which is a public park that meanders around the deck and is flourishing with native plants. The circle sits adjacent to the natural Cedar Creek marsh, so when the students return to their units for the night they are inhabiting the wetland in a new way.

To the left of the Meadows Community is a boardwalk which overlooks the tidal cove in the landscape. The boardwalk is private, and connects directly into the study. The students are able to access the Community Plaza through the study. The upper level of the study is a library which has a balcony overlooking the plaza space, as seen in Figure 100.



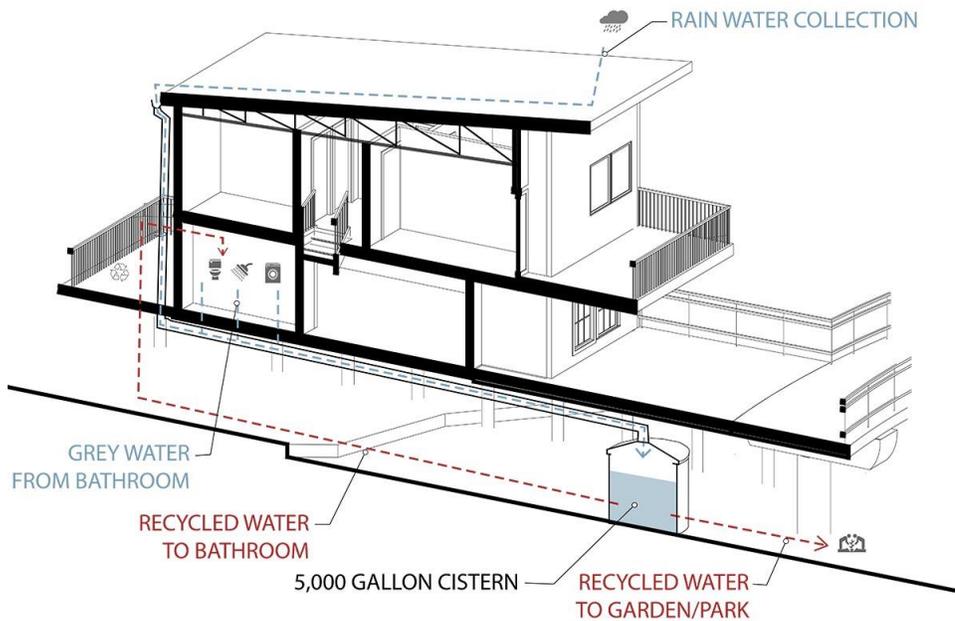
**Figure 97: Meadows Community**  
Source: Image by Author

As seen in Figure 98, the structural design of the living unit is as follows: a hollow steel pipe pile that is concrete filled with a steel structural system of beams and girders and concrete decking on top. The steel base of the design harks back to the industrial history and characteristics of the site. The living unit is a wood framing to relate to the natural characteristics of the site. Sustainability is very important on the site and each living unit is equipped with a 5,000 gallon cistern as seen in Figure 99. Water is collected from the rooftops and stored in the cistern below the deck

space. The water is then recycled into the building and used as grey-water to flush fixtures. It is also used in the community garden for irrigation purposes.



**Figure 98: Living Unit Structural Section**  
 Source: Image by Author



**Figure 99: Living Unit Sustainability Systems**  
 Source: Image by Author

### The Community Plaza:

The community plaza is the second main zone, and is comprised of the study, the office building, the café and the great hall. Figure 100 is a perspective taken from the second level of the study, and show the elevation of the café as well as the pedestrian bridge with extends over the river.



**Figure 100: Community Plaza**  
**Source: Image by Author**

Carved out of the plaza is the wetland walk, as seen in Figure 101, which is a ramp that connects down into the landscape and through the reed grasses. This wetland walk allows both the public and the researchers to connect with the landscape and engage with the tidal cove. Opposite the wetland walk is the wetland theater,

where the public or students can step off the main plaza area and sit overlooking the constructed wetland landscape.



**Figure 101: Wetland Walk**  
**Source: Image by Author**

The Great Hall, seen in Figure 102, is the main building located on the plaza space and is an flexible space for both the public and researchers to engage. The materiality and structure in the Great Hall is a culmination of the past and present of the site. Trussed beams span sixty feet and open up to a double height space, in order to direct views out to the river and New York City skyline. The trussed beams are designed with a wood beam, relating to the natural site, and a steel cable, relating to the industrial past, which integrate together to form one structural member.



**Figure 102: Great Hall**  
Source: Image by Author



**Figure 103: Section through Great Hall**  
Source: Image by Author

Academic Building:

To extreme right of the cross-axis, is the academic building consisting of the wet laboratories as well as the faculty offices. The labs are built on a thirteen foot

module but are designed to be combined for flexible laboratory space. The building sits adjacent to a constructed wetland landscape, called the living laboratories, as seen in Figure 104. The constructed wetland landscape is built on a twenty-six foot module, which mimics the design of the academic building. At the end of the cross-axis, located at the far right is a boat dock, as seen in Figure 105. The boat dock allows easy access for the researchers on to the water in order to collect samples.



**Figure 104: Living Laboratories**  
Source: Image by Author



**Figure 105: Student Boat Dock**  
Source: Image by Author



**Figure 106: Section Looking North**  
Source: Image by Author



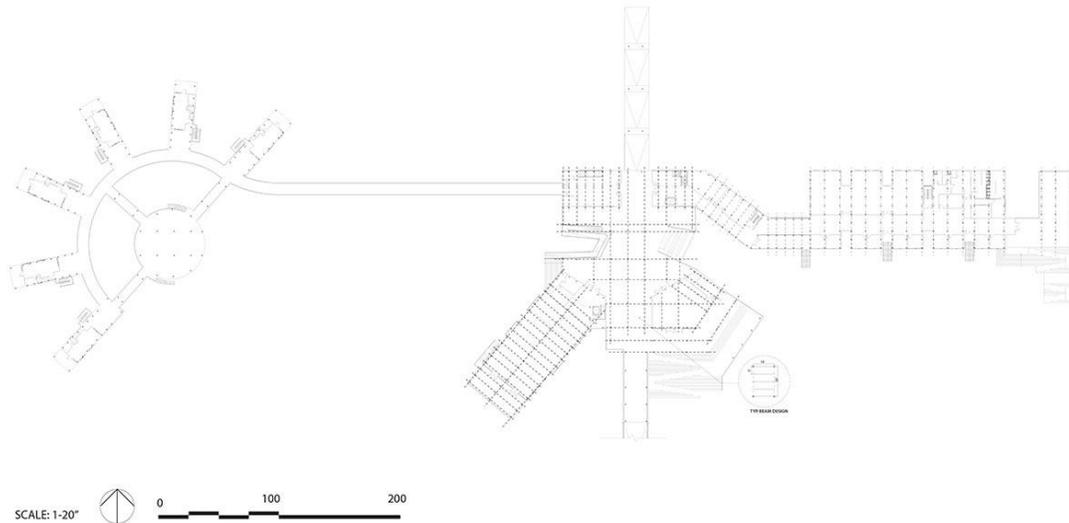
**Figure 107: Bent Section, Looking East**  
Source: Image by Author

**Structural Design:**

In the design of this ecological research community, the building has been elevated off of the ground plane through the use of hollow steel pipe piles that are concrete filled.

The design of these piles is a twelve inch diameter, and they are spaced six feet on center in the living community, and seven feet on center for the academic buildings.

The piles plan and spacing can be seen in Figure 108.



**Figure 108: Structural Piles Plan**  
Source: Image by Author



**Figure 109: Second Floor Plan**  
Source: Image by Author

## Chapter 10: Conclusion

### Reflection:

In conclusion, this thesis in itself has been an adventure and exploration of a seemingly uncharted territory. For years the Meadowlands had always remained a mystery to me, fueling a deeper curiosity for understanding this unique and strange landscape. Through a little risk and danger, kayaking in the Hackensack River, and investigating a derelict and abandoned site, a surreal experience of the site was possible. The Meadowlands is a museum of dereliction, a collection of forgotten artifacts and relics stuck in an earlier time. For years it has gone un-noticed, only by those lucky few who turn off the Turnpike and feel the curiosity to explore. These forgotten, abandoned, empty landscapes are rich with cultural value. This thesis, has explored how to inhabit a weird, forgotten, derelict site by implementing ideas of re-connecting and place-making. By creating a new ecological community with an educational place-based and research focus, a sense of renewal is brought to the marsh.

### Looking Forward:

Looking forward the culmination of this thesis informs the need for a greater effort to revive sites perceived as abandoned, forgotten, neglected, or even as some might call them, wastelands. The Meadowlands is just one site, within a greater context of these landscapes which are ignored and viewed as weird and other-worldly. These landscapes have value and can be revived and re-connected to the

surrounding communities through both environmental and community efforts. This particular thesis was very site specific, and implemented themes addressing the environmental issues of a neglectful past including pollution and wetland loss. It also addressed the social aspect of the site and the lost communities which were on the outskirts of the meadows.



**Figure 110: Reflection**  
**Source: Image by Author**

*The Meadowlands is in a state of regeneration.  
It is a time for renewal, restoration, and growth.*

## Glossary

### **FEMA Classifications:**<sup>65</sup>

**Base Flood Elevation:** The height of floodwaters for your location. Structures must be built about this BFE. The elevation shown on the Flood Insurance Rate Map for Zones AE, AH A1-30 or VE that indicated the water surface elevation resulting from a flood that has a 1-percent chance of occurring in any given year. They are calculated by taking into account 1. storm surge stillwater elevation, 2. the amount of wave setup, 3. the wave height above the storm surge stillwater elevation, and 4. the wave run-up above the storm surge stillwater elevation (where present).

**Zone AE:** Flooded area which along with standing water may include waves heights of less than three feet.

### **Wetland Classification:**<sup>66</sup>

**Palustrine Wetland:** Includes all non-tidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses or lichen, and all such wetlands that are occurring in tidal areas where salinity due to ocean derived salts is below 0.5%

**Estuarine Wetland:** Consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean

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<sup>65</sup> “Glossary” *FEMA Region II Coastal Analysis and Mapping* accessed, May 2016, <http://www.region2coastal.com/resources/glossary/#Zone>

<sup>66</sup> Lewis M. Cowardin and Virginia Carter, *Classification of Wetlands and Deepwater Habitats of the United States* (Washington D.C.: U.S. Government Printing Office, 1992) 4, 10 <http://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf>

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