

SEA LEVEL SOLUTIONS

INTERDISCIPLINARY RESEARCH
& DESIGN STUDIO

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Landscape Architecture	LAA6970 (Graduate)
Topics in Biology	BSC6936 (Graduate)
Special Topics	EVR5935 (Graduate)
Topics in Ecology	PCB4932 (Undergraduate)

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01_THE PROJECT

This research on sea-level rise was comprised by graduate students at Florida International University through the Sea Level Solutions Center and the Department of Architecture to coproduce (design, research and assess) a largescale engineered wetland to optimize resilient and sustainable performance for positive energy generation, water supply, and water and waste management in the face of climate change in Miami Beach. The research shows the impact that sea-level rise will have on a local level, specifically the North Beach area of Miami Beach.

Our plan incorporates guiding principles that the City of Miami Beach includes in their plans, such as the idea that local decisions have regional and global impacts and Miami Beach intends to lead by example (Miami Beach Sustainability Plan).

The course provides an innovative and creative platform to work collaboratively across disciplines to design and produce sea level solutions that are at once functional and visionary in their approach, in addition to serving as a model for our region and beyond. Faculty from multiple FIU colleges are among instructors and will provide weekly lectures (open to the public), training and analytical tools.

FIU LAA 6970 Graduate Masters Project: Coursework under the direction of faculty for the completion of project by candidate for the degree Master of Landscape Architecture. The studio will pay particular attention to infrastructural solutions that are concurrently functional, aesthetic, and contextual in their design approach. Students will be expected to deliver projects that are formally resolved in macro and micro scales, and will conduct research and analysis, site investigation, mapping and interpretation of the existing context. They will carry out studies aimed at exposing important site qualities and relationships. Ideas will be discussed in the form of desk crits and formal reviews, with special emphasis on frequent, inclass pinups and interdisciplinary group work.

Studio Vision

Students from multiple disciplines worked together to co-produce (design, research and assess) a large-scale engineered wetland to optimize resilient and sustainable performance for positive energy generation, water supply, and water and waste management in the face of climate change in Miami Beach. The course provided an innovative and creative platform to work collaboratively across disciplines to design and produce sea level solutions that are at once functional and visionary in their approach, in addition to serving as a model for our region and beyond. Faculty from multiple FIU colleges were among instructors and provided weekly lectures (open to public), training and analytical tools.

The disciplines that worked together in this studio include landscape architecture, public administration, biology, economics, environmental engineering (INSERT).



BASELINE INFORMATION

Our baseline analysis covers much of the information missing from existing plans (see City of Miami Beach’s Sustainability Plan). In the city’s sustainability plans, they included indicators, baseline data, targets, existing initiatives, and future initiatives on their plans. However, most of their items were left blank as of the time we worked on this project, 2018.

Our team has put together a scorecard and rubric to assess each model’s viability to sea-level rise and the issues that arise from it.

Vulnerabilities to Site

As portrayed in the “Living with Water” Project (Model 3), vulnerabilities to the site include: waste, energy, and water (CITE). Each model addresses all or some of these vulnerabilities (CHECK IF THEY ALL DO WASTE/ENERGY).

“The flooding would be a challenge for any community, but it poses particular risks here. One recent report estimated that Miami has the most to lose in terms of financial assets of any coastal city in the world, just above Guangzhou, China and New York City. This 120-mile (193km) corridor running up the coast from Homestead to Jupiter – taking in major cities like Miami, Fort Lauderdale and West Palm Beach – is the eighth most populous metropolitan area in the US. It’s also booming. In 2015, the US Census Bureau found that the population of all three counties here was growing – along with the rest of Florida – at around 8%, roughly twice the pace of the US average. Recent studies have shown that Florida has more residents at risk from climate change than any other US state. It has more property at risk, too. In Miami-Dade County, developers had 1.6 million sq ft (149,000 sq m) of office space and 1.8 million of retail space under construction in the second quarter of 2016 alone. Sunny Isles Beach, home to 20,300 people, has eight high-rise buildings under construction; swing a seagull in the air, and you’ll hit a crane. As you might imagine, the value of development in this

sun-soaked part of the country is high, too. Property in Sunny Isles alone is now worth more than \$10 billion. Many of the wealthiest people in the US reside in Florida, including 40 billionaires on the Forbes 400 list of richest Americans; on a recent week, the most expensive real estate listing in the US was a \$54 million mansion in Palm Beach.” (BBC, Amanda Ruggeri)

“Even without floods, the rising water table affects everything. The cities here are built on porous limestone. The water doesn’t just come over seawalls; it seeps up from beneath the streets. Nearly 90% of the drinking water in south Florida comes from aquifers, and these are finding their fresh water pushed further and further inland as the salt water exerts more and more pressure. Take Hallandale Beach, a small city of just under 40,000 residents. Saltwater already has breached five of the eight freshwater wells that the city draws from, says Vice Mayor Keith London. And around a quarter of Miami-Dade residents use septic tanks. If these don’t remain above the water table, the result could be thoroughly unpleasant.” (BBC, Amanda Ruggeri)

Transportation

The Miami average cost of transportation is \$8,344, of which 89.3% was spent buying and maintaining private vehicles. Miami-area households spend 14.8% of their budgets on transportation, which is significantly less than the national average of 16.4% but more than the average of other major metropolitan cities like New York at 11.4%, San Francisco at 11.9%, D.C. at 12.8%, and Chicago at 14.5%. (source: bls.gov)

The City of Miami Beach’s transportation is important to discuss as sea-level rise will force the city to make changes. Currently, the trolley is highly effective and used frequently by both locals and tourists. The busses are also frequently used (CITE) as are the bikes. Moreover, the city is highly walkable (CITE). However, there is a lack of a proper connection to the mainland. Also, as sea-levels rise, alternative options to transportations must be entertained.

The City of Miami Beach plans to introduce Baylink, streetcar, and rail service in their plan as potential future public transportation initiatives. Our models envision using sky-rail and shweeb transportation, among other alternatives.

Housing

This was the largest expenditure category for Miami-area households and averaged \$20,501. Housing accounted for 36.4 percent of the area’s household budget, significantly higher than the 32.9-percent U.S. average. Housing expenditure shares among the 22 areas nationwide for which data were available ranged from 40.3 percent in San Francisco to 30.3 percent in Detroit. (source: bls.gov) (to be reworded)

Food

The portion of a Miami household’s budget spent on food, 12.3 percent, was not significantly different from the 12.6-percent U.S. average. Miami-area households spent \$4,120, or 59.5 percent, of their food dollars on food at home and \$2,810 (40.5 percent) on food away from home. In comparison, the average U.S. household spent 56.7 percent of its food budget on food at home and 43.3 percent on food away from home. (source: bls.gov) (to be re-worded)

Job Creation

Preserving the community by preemptively adjusting for sea-level rise will create an abundance of jobs throughout all levels of the projects. It will also create new spaces for businesses which,in-turn, has a domino effect on the local economy.

Tourism

“A Food Truck Night has also become a popular event, which is used to promote Bandshell events and local businesses. These type of events could help continue to draw more people to the area.

In Spring of 2016, Friday Night Live at the Fountain was launched and happens every first Friday of the month. It is a free event that draws in local residents. It has the potential to draw in more people, particularly as 71st Street turns in to a true main street in which the Town Center vision comes to fruition.” - Plan Nobe 2.108

Population

Residents want increased density, as stated in Plan Nobe p.3.2.

Affordable Housing

Affordable housing is important for LGBTQ seniors, immigrants, and overall residents of Miami-- an area with low minimum wage and overcrowded homes and high housing rates.

“The result of this immigration push into Miami is that these new residents are not only living in substandard housing but they are also being challenged in their ability to attain homeownership. This problem is com pounded by a lack of knowledge of the housing market, low income, credit issues, and an inability to speak English.²⁶ Ultimately, this problem manifests itself in homeownership for all blacks and Hispanics statewide being marginally lower as compared to the white population”

Plan Nobe states city should tihnk about more private-public partnership to have affordable housing “As an alternative to HACMB developing new affordable housing, the City should also explore the possibility of more public-private ventures by financing an affordable housing developer who will build appropriate smaller-scale projects in acceptable locations.” (p.3.4)

“The City should consider zoning, land development regulations, and permitting incentives to assist the creation of non-subsidized workforce/ affordable housing, that include additional building height, reduction in minimum unit sizes, reduction (or even elimination) of parking requirements and potential FAR bonuses. Specific areas near transit should be prioritized for workforce/ affordable housing.” (Plan Nobe p.3.6)

“Confusingly, two entities in Miami Beach operate affordable homes: The city itself owns four complexes and is renovating a fifth. The Miami Beach Community Development Corporation (MBCDC), meanwhile, operates 340 units, mostly for people who are elderly or disabled.” (Jerry Ianelli, Miami New Times, March 2018)



AHEAD OF THE CURVE, ABOVE THE RISE

Aurora Alcaide
Teresita García
Andy Donohue
Jasmine Locke-Rodriguez

With a huge influx of global populations moving towards urbanized areas often located alongside the world's oceans, sea level rise and climate change are beginning to impact nations globally. South Florida is no exception. Across Miami-Dade County, heavy flooding occurring from rain events and the dreaded King Tide regularly leave residents literally "up to their waists" in traffic nightmares, property losses and mayhem. Our project brings together students of different levels and fields to work together in an effort to increase diversity in design, through effective quantitative and qualitative research methods. Sea level rise will undoubtedly change South Florida and its identity, but through innovative and forward-thinking solutions, the future does not have to be so bleak.

The vision is a gradual, multi-phase approach to strategically adapt the inevitable fact that sea level rise will affect our area in the near future. Each of these phases will respond to the water level rising within the site, from now until the site is permanently inundated. The different phases will implement strategies of awareness, adaptation and resiliency - ultimately embracing the water into the site through urban tidal parks, while adapting with floating homes, water and suspended transportation, elevated buildings and infrastructure, establishing a new paradigm and a new way of life.

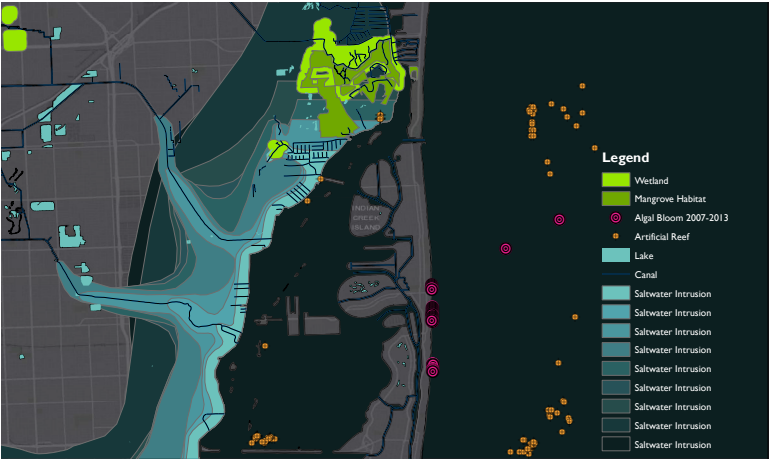
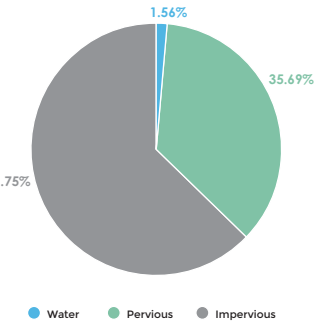
Phase 1: Awareness



- Legend**
- 1. Proposed Bioswales Canals
 - 2. Proposed Vertical Multi-Use Garden
 - 3. Proposed Mangrove Forest
 - 4. Proposed Floating Wetlands
 - 5. Proposed Amphibian Housing Pilot
 - 6. Pedestrian Artificial Reefs
 - 7. Proposed Rooftop Solar Panels

Phase I would begin now and to lay groundwork for later phases.

The proposal gives the public a glimpse of the changes to come in the future by letting some water in through the existing medians, implementing a floating home pilot program, a solar power system, ecological restoration with the implementation of mangrove forests, floating wetlands and artificial reefs, and by addressing some food security issues by designing a vertical garden on higher grounds.



Saltwater Intrusion

Data sets on environmental vulnerability where collected and analyzed. As represented in the map, saltwater intrusion has already put well drinking water in peril, altered our natural ecosystems and degraded aquatic life. Algae blooms are flourishing all through the coast where people go swim and tourist visit



Vertical Garden

By replacing a small space of asphalt with a mangrove forest and floating wetlands, we begin to restore an ecosystem that would be resilient in today's and future conditions while creating habitats for wildlife. This in turn benefits the proposed vertical vegetable garden by creating the biodiversity needed to create a whole web of life while increasing food independence and security.



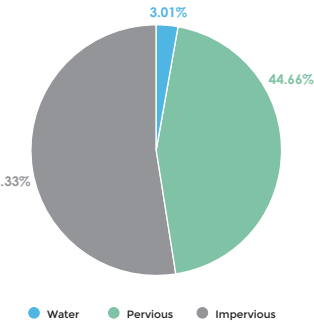
Section through median bioswale

By retrofitting the current medians to bioswale canals, we begin to manage stormwater in a more natural and sustainable way and expose the public to more water within the site. The water get cleanse before percolating to the aquifer.

Phase 2: Adaptation



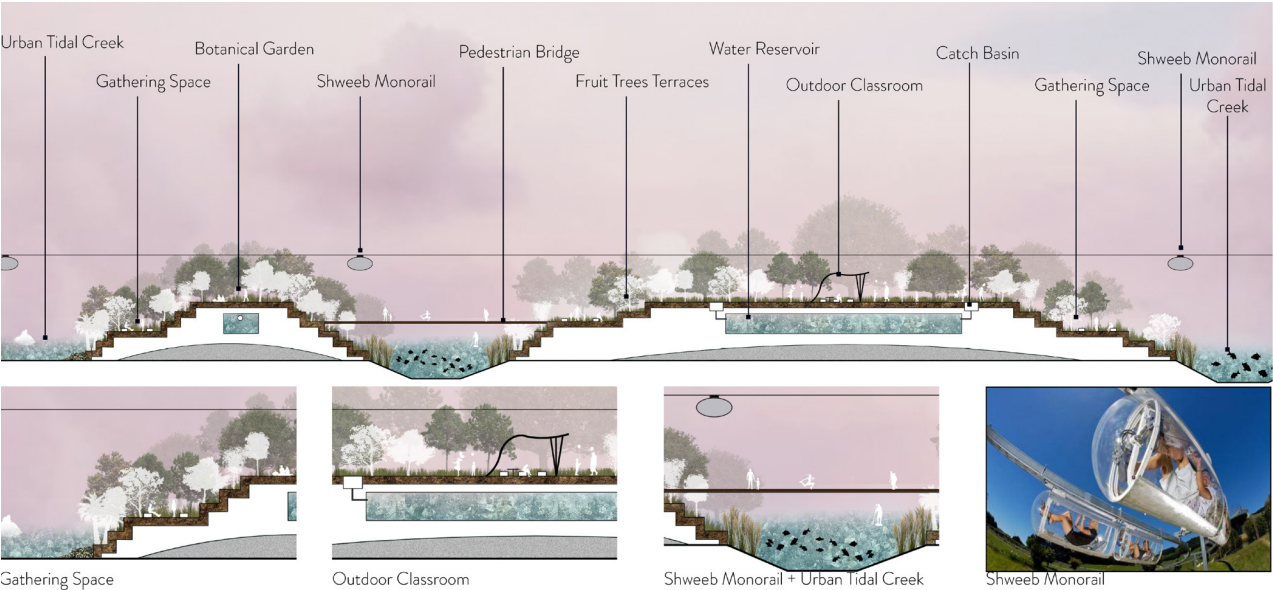
- Legend**
- 1. Proposed Terraced Berm (Botanical Garden)
 - 2. Proposed Terraced Berm (Cultural)
 - 3. Proposed Terraced Berm (Educational)
 - 4. Proposed Multi-Use Floating Activity Piers + Seaweed Farms
 - 5. Urban Tidal Creek for Fish Life Cycle and Flood Management
 - 6. Proposed Amphibious Housing
 - 7. Saltwater Swale
 - 8. Proposed Artificial Reefs
 - 9. Proposed Rooftop Solar Panels



Phase II will have to be finalized around the year 2050.

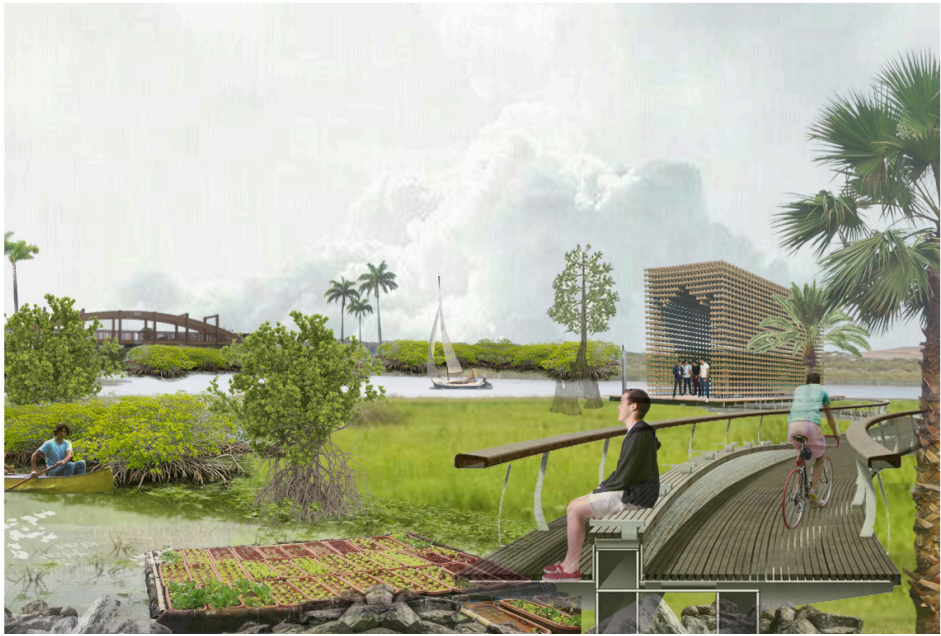
Here we propose adapting to more permanent flood waters by letting the water in completely through an ephemeral urban tidal creek. By connecting the canal, the creek, and the ocean, this system would serve as a breeding grounds for fish. Beginning on the west with the mangrove forest for nurseries, the creek as pre-adults, and the ocean once they mature and become adults.

There would be mounds that would serve as higher grounds for public use activities and each would have its own character. We would keep sports facilities as floating piers and add more floating housing within the edge.



Section Through Fruit Tree Terraced Berms

These berms would be constructed in part by the rubble from the site, and terraced for additional farming and water conservation and collection. It would also have a variety of uses for the public such as gathering spaces, outdoor classrooms, and botanical gardens. A new method of mobility can be implemented, elevated from the ground as we begin to adapt and live above water.



Floating Piers

Wetlands moored to the ocean floor off the east coast are not only a buffer, but are safe to fail in their abundance if a storm occurs and provide a new experience for patrons as surface land is submerged.

In order to add more public spaces and food security, a pier system would provide space for seaweed farming, research and educational facilities. The site would be interconnected by a system of elevated bridges connecting the north to the south and vice versa.

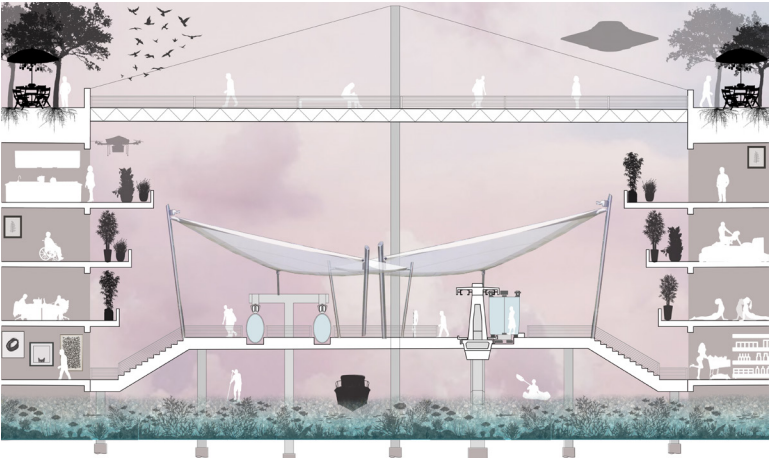
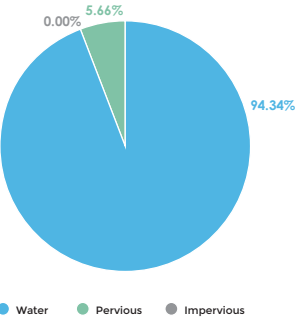
Phase 3: Embracement



- Legend**
- 1. Proposed Mixed-Use I Shelter in Place
 - 2. Proposed Suspended Rail
 - 3. Proposed Shweeb Monorail
 - 4. Proposed Transportation Hub
 - 5. Proposed Amphibious Housing
 - 6. Pedestrian Bridges

Phase III will have to be finalized by year 2100.

During this phase the proposed vision is to embrace water in its totality. This will be in a constant state of becoming, where everything is in flux with the ocean. This will be a new Miami of what it is now. In addition to tourism, many new fields will become ubiquitous as Miami physicality changes. Technology, transportation, architecture, design, research and innovation are envisioned to be the pillars of this economy, and many other professions that are yet to be invented.



Intermodal Transportation Hub

As ground transportation becomes obsolete an intricate system of major and minor circuits of circulation is critical linking together residential, commercial and other zones easily without the sea's hinderance. A combination of regional and local transportation becomes intertwined with multi-use buildings in this new shared economy. Different programs would be linked between a network of pedestrian bridges, suspended mass transportation, and shared riding whether they be air or water borne.



Sky Bridges

Change is inevitable. However, the character and the spirit of Miami Beach can live on with the right interventions. Vibrancy, acceptance and culture can continue to be part of who we are regardless.



Night Scene

As we moved into the future we won't be able to rely on established norms, we will have to come up with new and creative ways to tackle the problems of the future such as sea level rise. We will need to create a whole new paradigm where architecture and nature come together to protect the exposure to risk and vulnerabilities.

Scorecard

<i>Social</i>	Baseline	Phase 1	Phase 2	Phase 3
Jobs (unit)	350	1450	700	700
Urban Farming (sqft)	23,240	886,410	1,641,410	763,410
Social Events (event per year)	45	45	45	35
Open Space (sqft)	1,691,000	60,000,000	7,500,000	7,500,000

<i>Ecological</i>	Baseline	Phase 1	Phase 2	Phase 3
Pervious vs Impervious (%/%)	20/80	46/54	94/25	90/10
Pervious cover (sqft)	1,727,505	3,857,300	488,836	488,836
Impervious cover (sqft)	6,909,600	4,519,500	8,148,000	8,148,000
Wetland area (sqft)	20,350	20,350	25,380	27,450
Herbaceous cover (sqft)	2,066,110	2,066,110	4,300,130	3,126,750
Oopen water (sqft)	75,670	75,670	2,347,800	75,670
Agricultural (sqft)	45	45	45	35

<i>Technological</i>	Baseline	Phase 1	Phase 2	Phase 3
Pervious vs Impervious (%/%)	20/80	20/80	75/25	90/10
Pervious cover (sqft)	1,727,505	1,727,505	6,533,705	8,112,015
Impervious cover (sqft)	6,909,600	6,909,600	2,103,400	525,000
Wetland area (sqft)	20,350	20,350	25,380	27,450
Herbaceous cover (sqft)	2,066,110	2,066,110	4,300,130	3,126,750
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<i>Social</i>	Baseline	Phase 1	Phase 2	Phase 3
Jobs (unit)	350	350	350	350
Urban Farming (sqft)	23,240	23,240	23,240	42,640
Social Events (event per year)	45	45	45	35
Open Space (sqft)	1,691,000	1,691,000	1,944,650	1,528,045

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Oopen water (sqft)	75,670	75,670	2,347,800	75,670



LIVING WITH WATER

Jana Read
Francesca Fernandez
Thimothy Kirby

One of the main ideas for the “Living with Water” project, is to address several vulnerabilities to the site: energy, water, and waste.

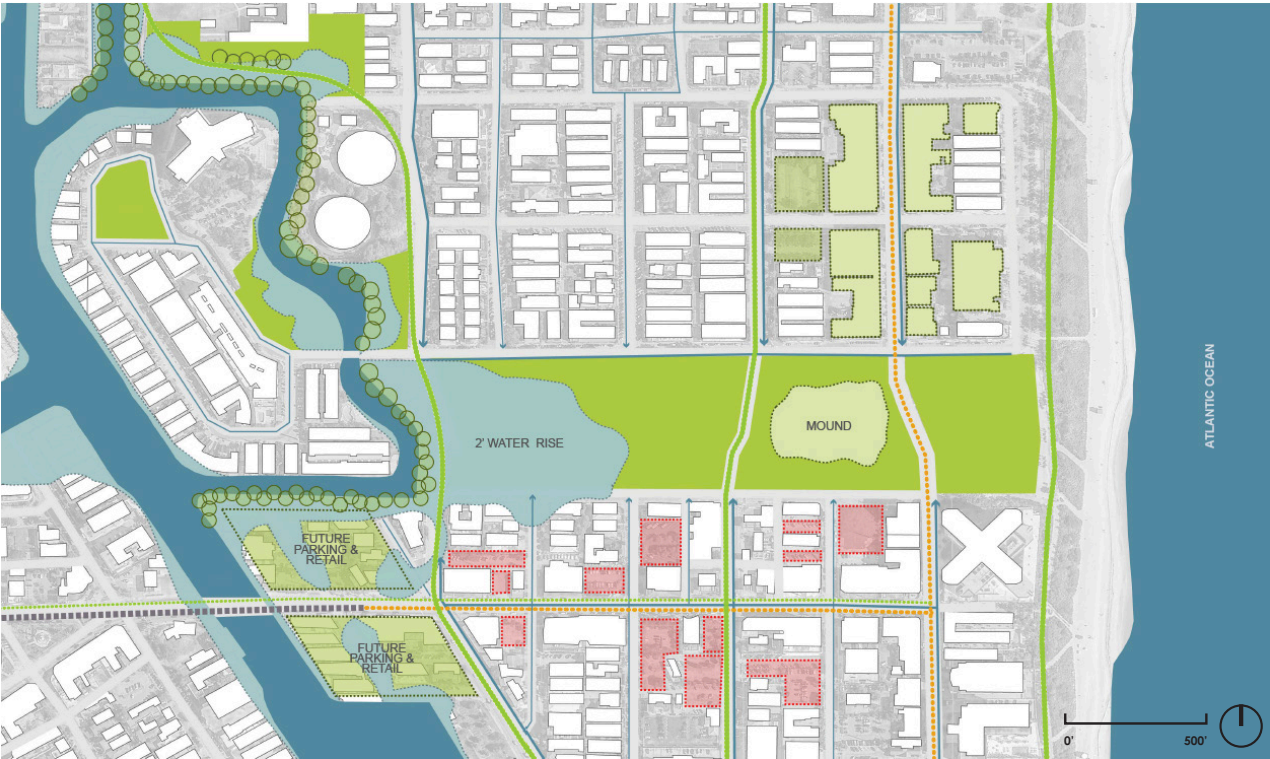
The goal for this project is to generate awareness, create a path towards adaptation for people, buildings, roadways, and communities; improve social, ecological, and transportation connections; and, generate sustainable resources in advance rather than continuing current consumption practice.

This project incorporates innovative, thought-provoking methods of food production.

Retrofitting buildings to be more sustainable and resilient to sea-level rise

Reduced vehicular access

Phase 1 : Awareness



- Large rooftops ideal for activity
- Vacant lots repurposed for art installations
- Existing & new Bike Paths
- Reduced vehicular access
- Trolley access
- Swale

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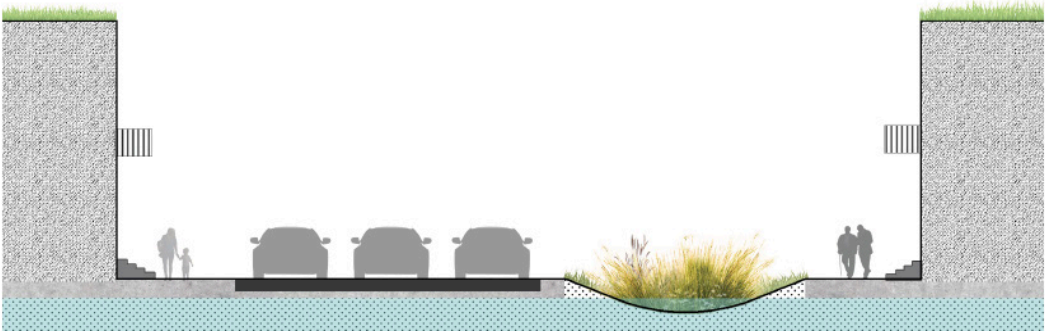
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Food Production
Existing vacant lots become parks
and gathering spaces to explore new
methods of food production, energy
capture, and rainwater reuse.










Food Production
Existing vacant lots become parks
and gathering spaces to explore new
methods of food production, energy
capture, and rainwater reuse.



Street section
These berms would be constructed in part by the rubble from the site, and terraced for additional farming
and water conservation and collection. It would also have a variety of uses for the public such as gathering

Phase 2 : Adaptation



-  Large rooftops ideal for activity
-  Vacant lots repurposed for art installations
-  Existing & new Bike Paths
-  Reduced vehicular access
-  Trolley access
-  Swale
-  New density

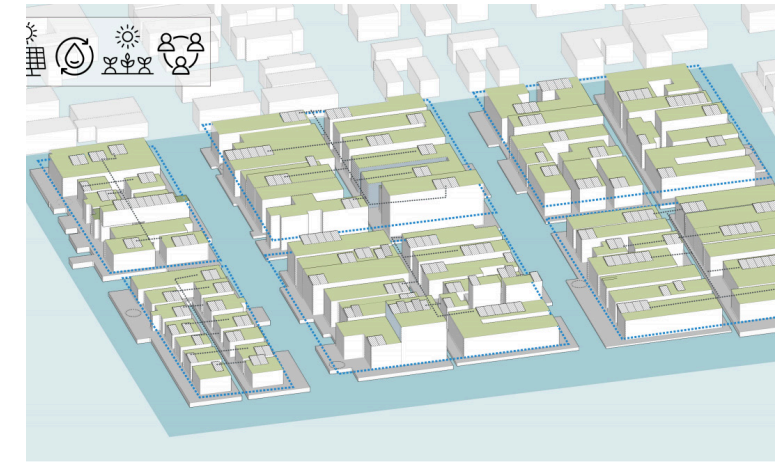
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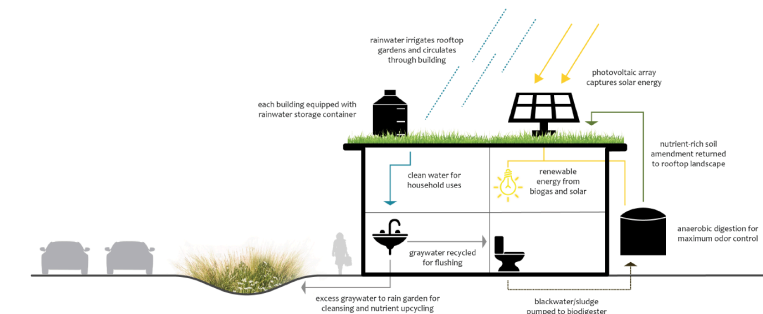
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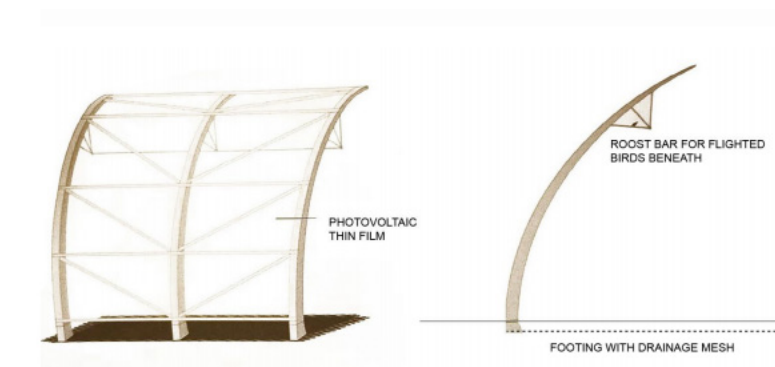
Food Production

Existing vacant lots become parks and gathering spaces to explore new methods of food production, energy capture, and rainwater reuse.



Food Production

Existing vacant lots become parks and gathering spaces to explore new methods of food production, energy capture, and rainwater reuse.



Food Production

Existing vacant lots become parks and gathering spaces to explore new methods of food production, energy capture, and rainwater reuse.

Phase 3 : Connectivity



- Large rooftops ideal for activity
- Vacant lots repurposed for art installations
- Existing & new Bike Paths
- Reduced vehicular access
- Trolley access
- Swale
- Productive rooftop
- Sky Bridges

Phase III centers on the premise that we must be resilient as our cities sink. New terraforming creates areas that are able to shelter residents in place in storm and flood events and roof circuits create new circulation

As ground transportation becomes obsolete an intricate system of major and minor circuits of circulation is critical linking together residential, commercial and other zones easily without the sea's hinderance.Ed esed quam, totatem re, vitatio. Ovit hit vel im reperum excepta simolorecum eario eveniet optat voloris el in excereseque ent quodit eos dolori cuptass incillo repratem illabor rest quiamusdae volorem. Nam in peris am quam, que venessu ntiandit, secas parum volorit empores suntis volendit et aut voluptatur?

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Food Production
Existing vacant lots become parks and gathering spaces to explore new methods of food production, energy capture, and rainwater reuse.

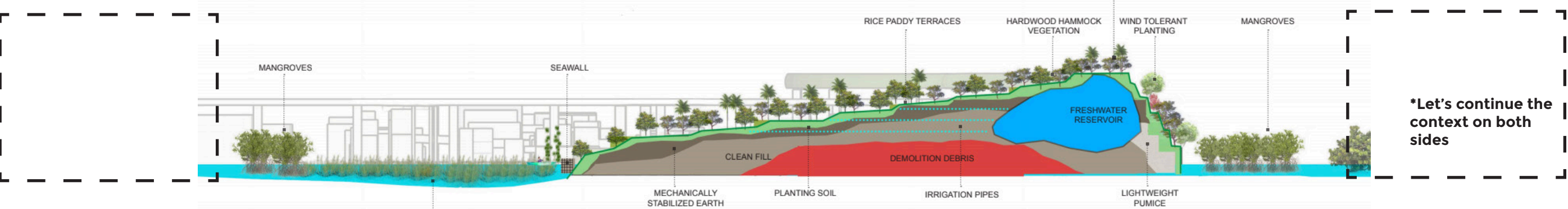


Food Production
Existing vacant lots become parks and gathering spaces to explore new methods of food production, energy capture, and rainwater reuse.

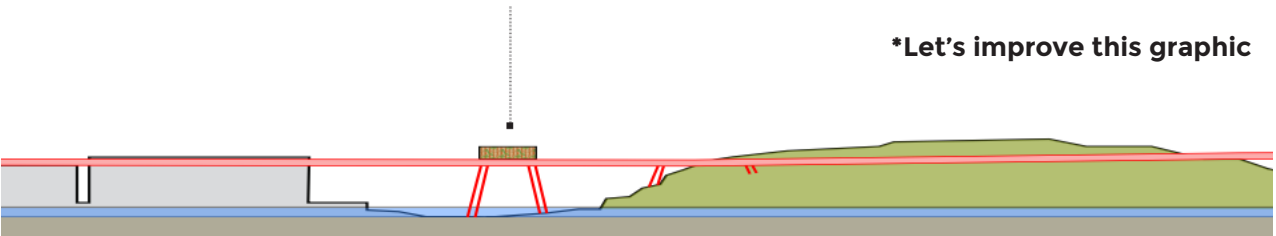


Section Through Fruit Tree Terraced Berms
These berms would be constructed in part by the rubble from the site, and terraced for additional farming and water conservation and collection. It would also have a variety of uses for the public such as gathering

Overlook hill



*Let's continue the context on both sides



*Let's improve this graphic

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PLIANT LANDSCAPES

Maria Adeyefa
Raunak Rasal
Ron Hariprashad
Valeria Quintanilla

This model focuses on a synergistic unity of community, education, public space, and the environment.

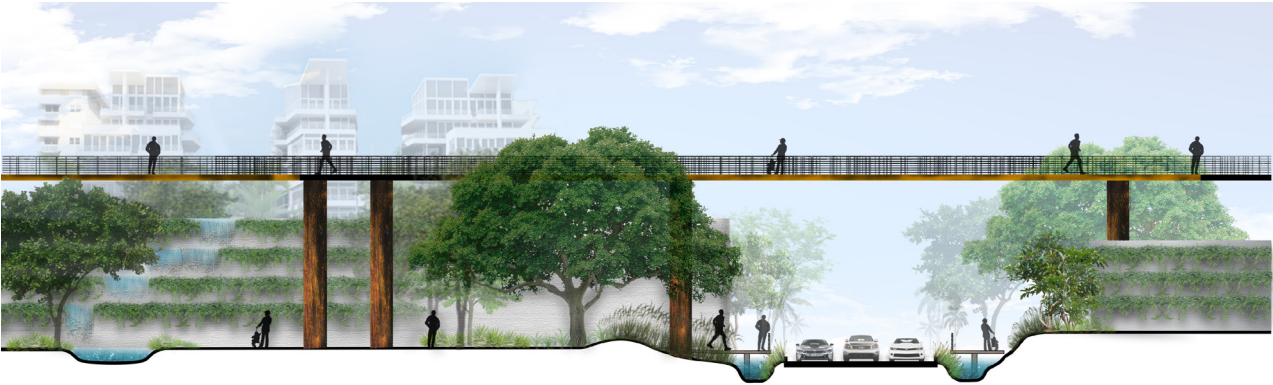
The goal is to have increased natural habitats, stormwater reception management, educational spaces, recreational spaces, and sustainability within existing infrastructure.

Phase 1



- Large rooftops ideal for activity
- Vacant lots repurposed for art installations
- Existing & new Bike Paths
- Reduced vehicular access
- Trolley access
- Swale

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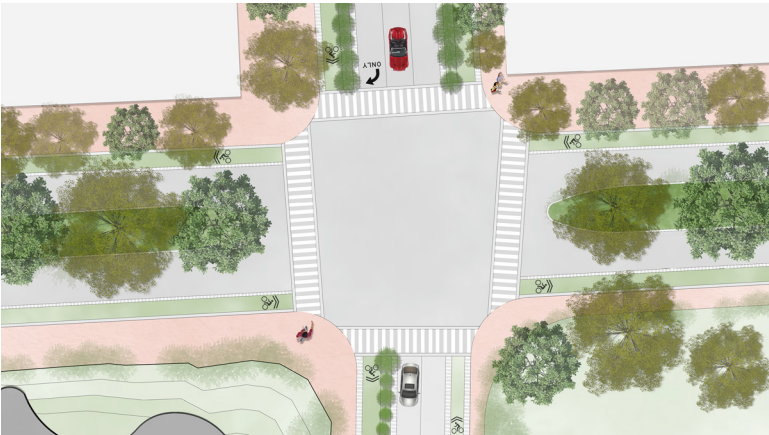
Section A-A: Section through parking garage

New spaces are productive, and aid in the site's water and food security independence. These spaces are not only beautiful, but productive and offer modern transportation options away from the now submerged roads.



Section B-B: Section through wetlands

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Intersections

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Phase 2

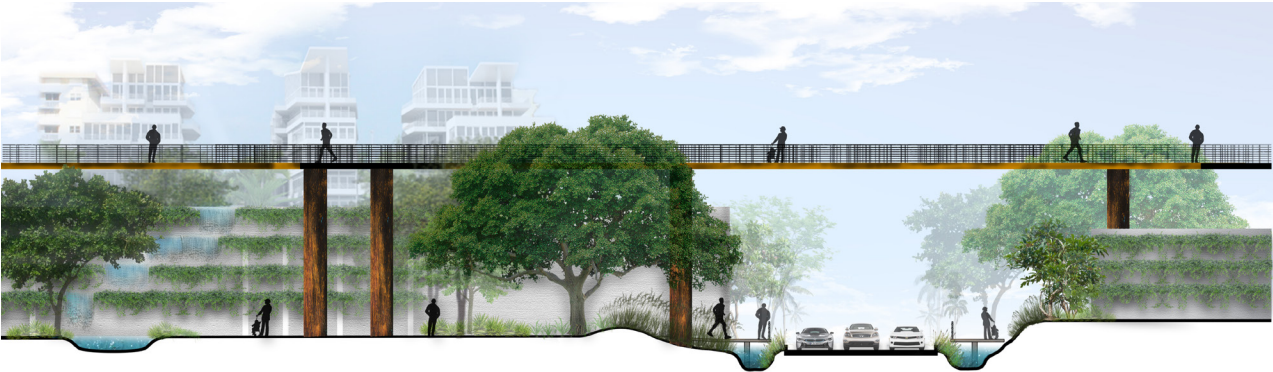


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Phase III centers on the premise that we must be resilient as our cities sink. New terraforming creates areas that are able to shelter residents in place in storm and flood events and roof circuits create new circulation

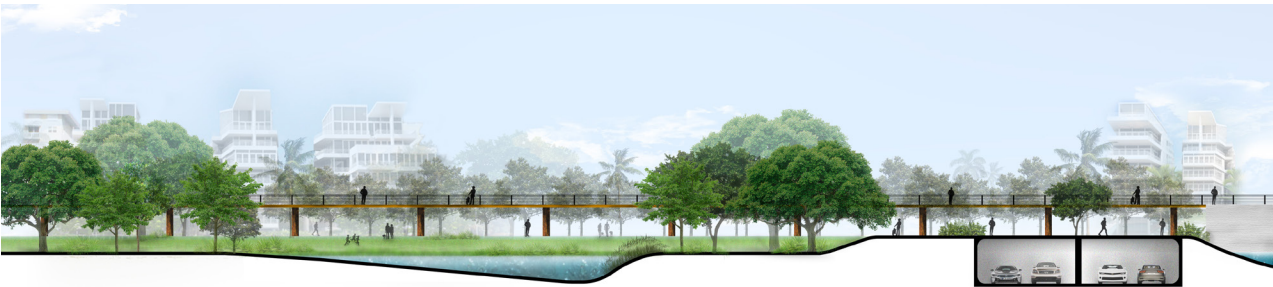
As ground transportation becomes obsolete an intricate system of major and minor circuits of circulation is critical linking together residential, commercial and other zones easily without the sea's hinderance.Ed esed quam, totatem re, vitatio. Ovit hit vel im reperum excepta simolorecum eario eveniet optat valoris el in excereseque ent quodit eos dolori cuptass incillo repratem illabor rest quiamusdae volorem. Nam in peris am quam, que venessu ntiandit, secas parum volorit empores suntis volendit et aut voluptatur?

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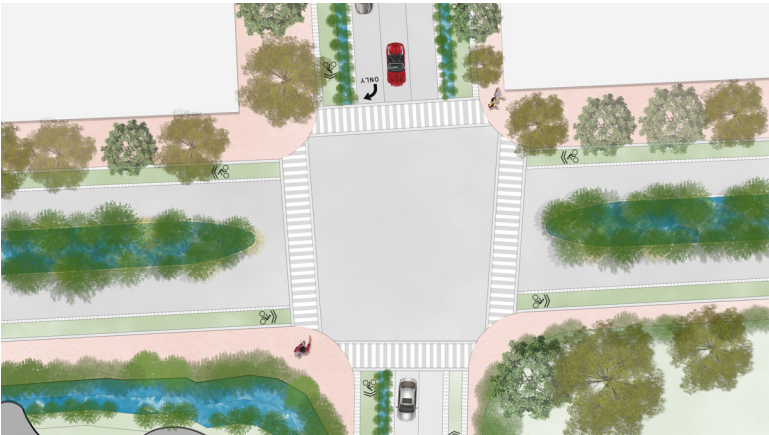
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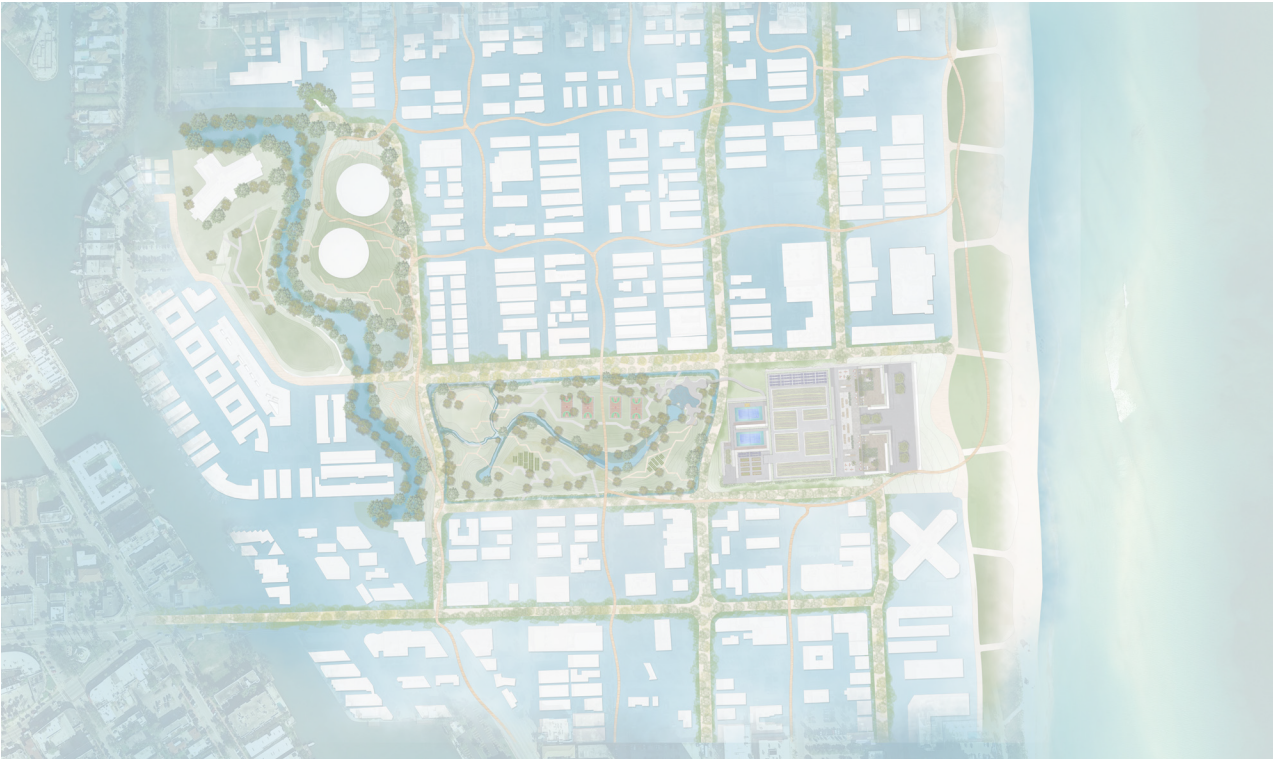
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Phase 3

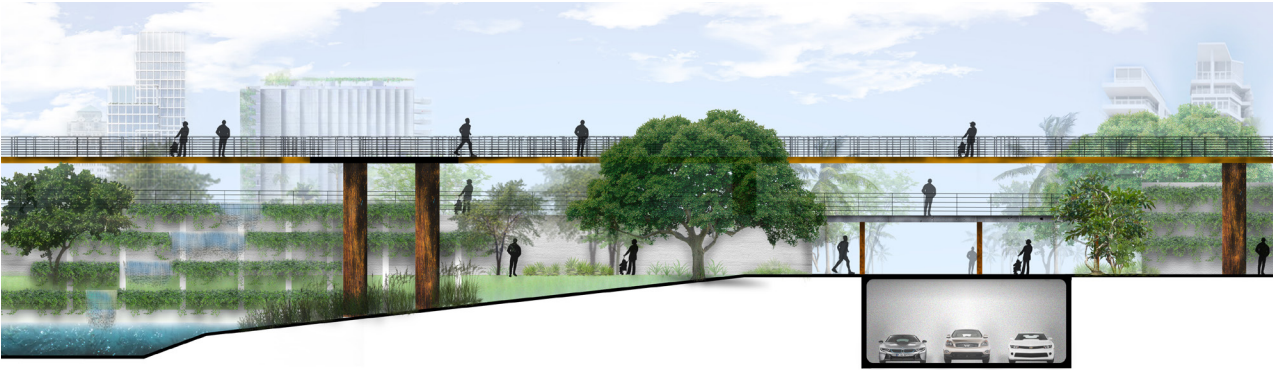


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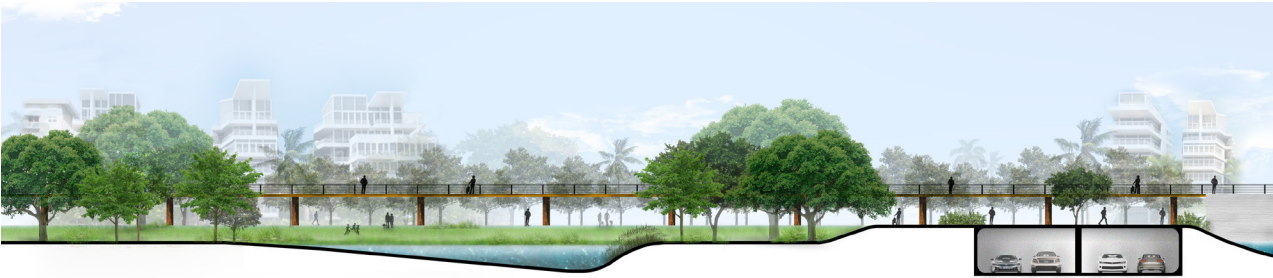
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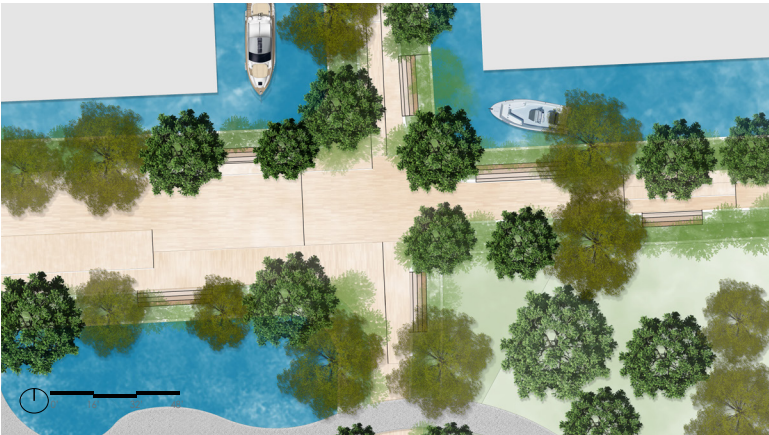
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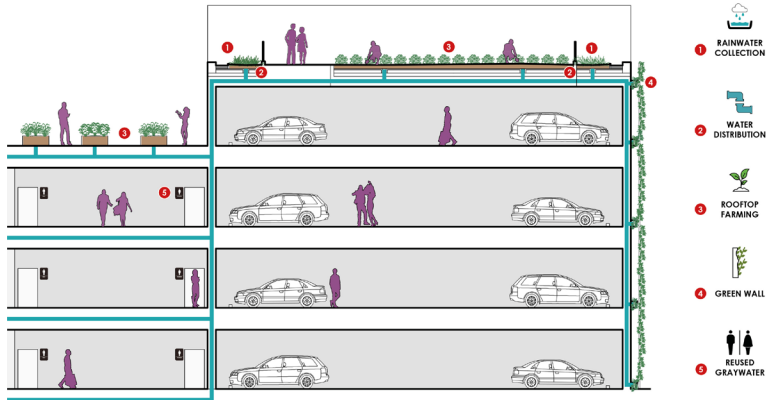
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Parking Garage: Phase 1 + 2

Intermodal transportation Hub

A combination of regional and local transportation becomes intertwined with the multi-use buildings. Commerce and residential are linked between a network of bridges and taxis whether they be air or water borne.

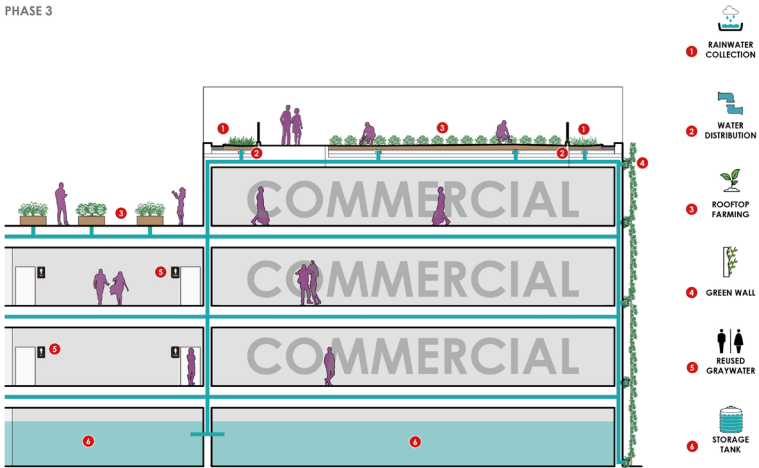


Parking Garage: Phase 3

PHASE 3

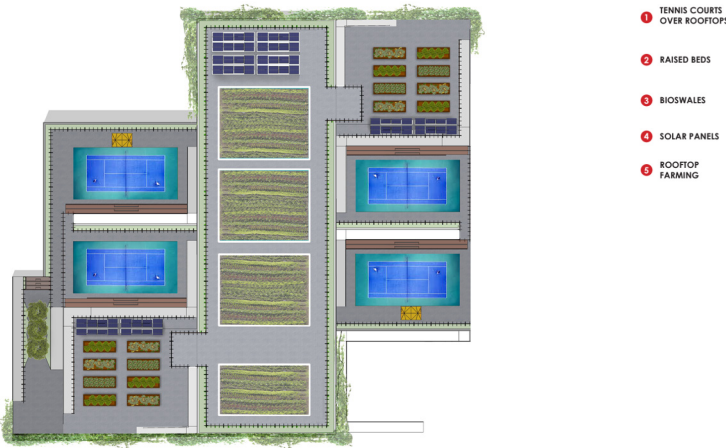
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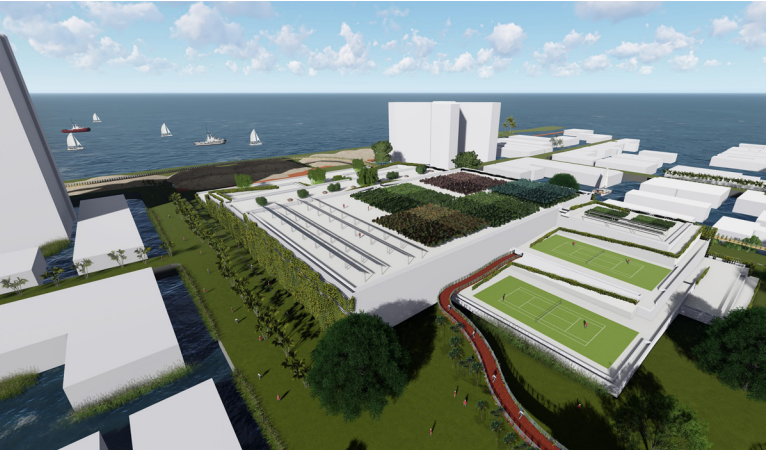
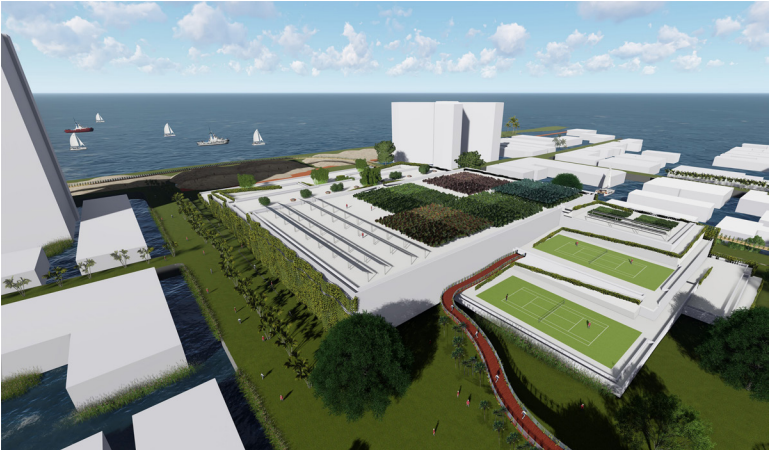


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Miami Beach as a new Paradigm

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OBSERVATIONS

With a huge influx of global populations moving towards urbanized areas often located alongside the world's oceans, sea level rise and climate change are already beginning to impact nations globally and South Florida is no exception. Across Miami-Dade County heavy flooding during rain events and the dreaded King Tide leave residents literally up to their waists in traffic nightmares, insurance losses and mayhem regularly. Our project brings together students of different levels from several fields including public administration, engineering and agriculture to work together in an effort to increase the diversity of the lenses we use to design through effective quantitative and qualitative research methods. Sea Level Rise will undoubtedly change our city and its face but through innovative and forward-thinking solutions, it does not need to be its death sentence.

AHEAD OF THE CURVE, ABOVE THE RISE



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Jasmine Locke-Rodriguez

