

RESILIENT URBAN LANDSCAPES

Landscape as an Evolutionary Socio Ecological System



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Department of Urbanism - Chair of Landscape Architecture

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Flowscapes Graduation Studio: Miami Lab

Resilient Urban Landscapes
Landscape as an Evolutionary Socio Ecological System

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CONTENT

ABSTRACT	1	-Public transit infrastructures	41
		-Green infrastructure analysis	42
CHAPTER I INTRODUCTION	2	-Blue infrastructure analysis	46
-Urban floods	3	-Transformable & non-transformable infrastructures	48
-Motivation	4	-Site analysis conclusions Hialeah	49
-Problem field	7	-Site analysis conclusions Miami Springs	51
-Problem Statement	8		
-Research objective & research question	10	CHAPTER VI POTENTIAL AREAS OF INTERVENTION	53
-Reading itinerary	11	-Potential areas of intervention (general)	54
		-Description of the potential areas for intervention in Hialeah	57
CHAPTER II METHODOLOGY / RELEVANCE & SCOPE	12	-Description of the potential areas for intervention in Miami Springs	61
-Methodology	13	-Reference list	63
-Scope /Social & scientific relevance	15		
-Reference list (chapters 1 & 2)	16	CHAPTER VII DESIGN	64
		-Vision	65
CHAPTER III THEORETICAL FRAMEWORK	17	-Strategies and design principles	69
-Theoretical background	18	-Phasing plan	70
-Case studies	20	-Stakeholders	71
-Conclusions	22	-Master plan I (Miami Springs)	72
-Reference list	23	-Impression Miami Springs	76
		-Sections Miami Springs	77
CHAPTER IV HYDROGEOLOGICAL SITE ANALYSIS / CAUSES OF URBAN FLOODS IN MIAMI SPRINGS AND HIALEAH	24	-Master plan II (Hialeah - Water town)	80
-Current hydrogeological conditions in the area	25	-Impression Hialeah: Water town	84
-Water management system of the Miami Dade County	28	-Master plan III (Hialeah- Central green and blue system)	85
-Relationship between sea level rise and groundwater under a climate change scenario	29	-Impression Hialeah: Wetland park	90
-Types of drainage systems in the Miami Dade County	30	-Sections Hialeah	91
-Conclusions	32	-Water storage calculations	93
-Reference list	33		
		CHAPTER VIII REFLECTIONS	95
CHAPTER V SITE ANALYSIS HIALEAH & MIAMI SPRINGS	34	-Final reflections and conclusions	96
-General features of Hialeah & Miami springs	35		
-Urban fabric	36		
-Land use analysis	37		

ABSTRACT

Urban flooding is a problem faced by many mayor cities around the world nowadays. That is the case of several areas of the Greater Miami Area. Rapid urbanization and the depletion of natural buffer zones that used to storage rain water, added to climate change effects, specifically the increase of heavy rainfalls and sea level rise have only aggravated the situation during the past two decades. This thesis focuses in the necessity to provide new types of resilient and sustainable landscapes for the cities of Hialeah and Miami Springs in order to deal with this issue. There have been and still on the going, numerous urban regeneration projects throughout the Miami Dade County. However, most of these plans don't contemplate the use of landscape as a mean to deal with water management problems like floods. The goal of this graduation project is to improve the current and future social and ecologic needs of both cities through new types of urban landscapes that will also contribute to water management solutions for the area. The purpose of the research is to gather information to understand the problem and the site in order to establish a comprehensive set of design principles and strategies to guide the design. The key concept of the theoretical framework is the implementation of landscape as water infrastructure through the transformation of existing underused public space and urban infrastructures, as well as future areas for redevelopment within the sites. The expected result is to achieve responsive socio environmental local solutions to create an evolutionary landscape in the cities of Hialeah and Miami Springs.

Keywords: landscape as infrastructure, public space, water management, floods



I . INTRODUCTION

- Urban floods
- Motivation
- Problem field
- Problem Statement
- Research objective & research question
- Reading itinerary

URBAN FLOODING

Urban flooding is the consequence of the reduction of the drainage capacities of urban landscapes during heavy rainfalls due to the elevated amount of impervious surfaces. (Uitgave, H., p. 65).

Besides population growth and urban expansion, climate change effects like sea level rise and the increase in the amount and intensity of precipitations are only aggravating the situation since they disrupt and interfere with the proper functioning of current urban water management systems. As a result, many cities around the world are already facing or are soon expected to deal with water related issues, such as floods and water pollution.

According to the Carbon Disclosure Project (CDP) 2011 Global Report, cities like Rotterdam, New Orleans, Rio de Janeiro and Jakarta have already been affected by climate change consequences. The latter two experienced one of their worst natural disasters events in history due to heavy rainfalls and subsequent flooding, in 2007 and 2011 respectively (CDP 2011 Global Report, p. 29). Moreover, on April 11th 2019, another unexpected heavy rainfall in Rio de Janeiro resulted in damages of catastrophic proportions to the built environment and at least 10 casualties (image 1). Mayor Marcelo Rivera stated that "In two hours it rained what was expected for the whole month" (Andreoni, New York Times, 2019).

The consequences of urban floods can be measured in monetary and non tangible direct and indirect losses (chart 1), such as property damage, disrupt of transport and physical and psychological damage, respectively (What are the consequences of floods?, 2018).

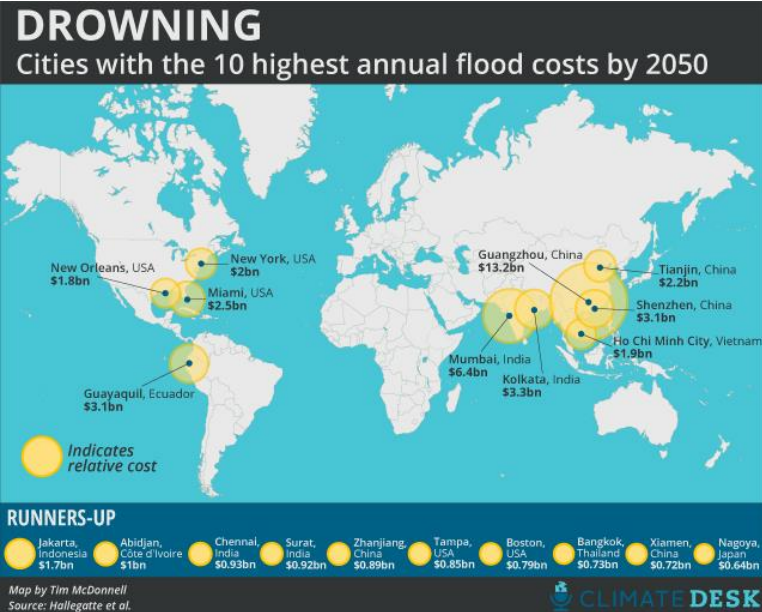


Image 1. Brazil flood April 2019. Photo credit: Camila Vargas/ Source: Vila Velha City hall

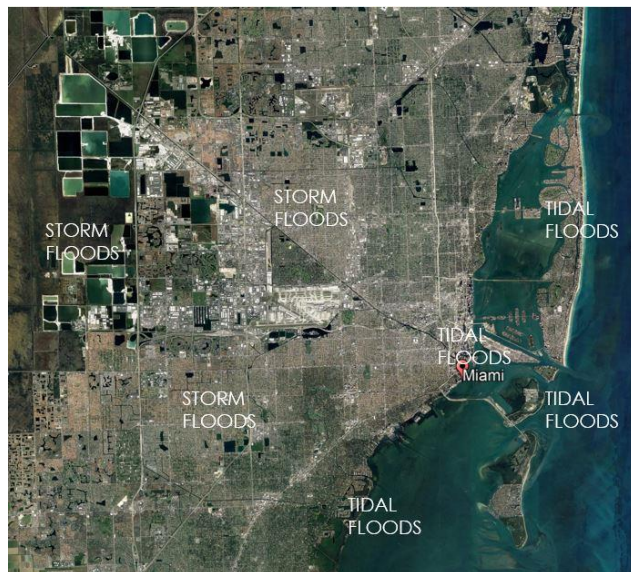
Table 1. Types of loss from floods. Modified from Disaster Loss Assessment Guidelines

Can the lost item be bought and sold for dollars?	Direct loss: Loss from contact with flood water	Indirect loss: No contact – loss as a consequence of flood water
Yes – monetary (tangible)	e.g. Buildings and contents, vehicles, livestock, crops, infrastructure	e.g. Disruption to transport, loss of value added in commerce and business interruption, legal costs associated with lawsuits
No – non-monetary (intangible)	e.g. Lives and injuries, loss of memorabilia, damage to cultural or heritage sites, ecological damage	e.g. Stress and anxiety, disruption to living, loss of community, loss of cultural and environmental sites, ecosystem resource loss

Chart 1. Types of loss from floods
Source: <https://www.chiefscientist.qld.gov.au/publications/understanding-floods/flood-consequences>



Map 1. Cities with the highest annual floods by 2050. Source: <https://www.motherjones.com/environment/2013/08/map-top-cities-billion-dollar-floods/>



Map 2. Types of floods in the Miami Dade County. Source: author.
Background image source: Google earth pro

MOTIVATION: MIAMI DADE COUNTY

Cities located in coastal areas are especially vulnerable to climate change effects (map 1). According to Fenster and Dolan, (as cited in Balica, S. et al, 2011, p.74) "Climate change is expected to cause accelerated sea-level rise with elevated tidal inundation, increased flood frequency, accelerated erosion, rising water tables, increased saltwater intrusion, increasing storm surges and increasing frequency of cyclones" in coastal cities. That is the case of the Miami Metropolitan area, located in the region South Florida, where different types or urban floods have increased in the last decades. Renowned members of the international scientific community have agreed that Southern Florida is one of the most susceptible zones to climate change (Climate Change, 2018).

TYPES OF URBAN FLOODS IN THE MIAMI DADE COUNTY

Urban floods in the Miami Dade County can be classified in tidal floods and storm floods. Tidal floods occur in the coastal areas and are currently increasing due to global sea level rise. Storm floods occur both in coastal and inland areas (map 2).

Even though sea level rise posts a direct threat to the coastal shorelines of Miami, this thesis project is going to focus on the problematic of inland floods in two cities of the Miami-Dade County: Hialeah and Miami Springs. Inland floods are the consequence of prolonged average rainfalls that last for a couple of days or heavy rainfalls that occur within a short period of time. (Inland flooding, 2017). According to the U.S. Resilient Toolkit regarding to inland floods, "Whenever the volume of water on land overcomes the capacity of the natural and built drainage systems to carry it away, flooding can result" (Inland flooding, 2017).

Regardless of the different types of floods that occur within the Greater Miami Area, current city actions to deal with current and prognosticated climate change effects rely mostly on the upgrade of grey urban infrastructures. Whether it is tidal floods, like in the case of Miami Beach, or inland floods, like in the case of Hialeah or Doral, no alternative solutions to engineering water management solutions to deal with this problem has been really taken into account.

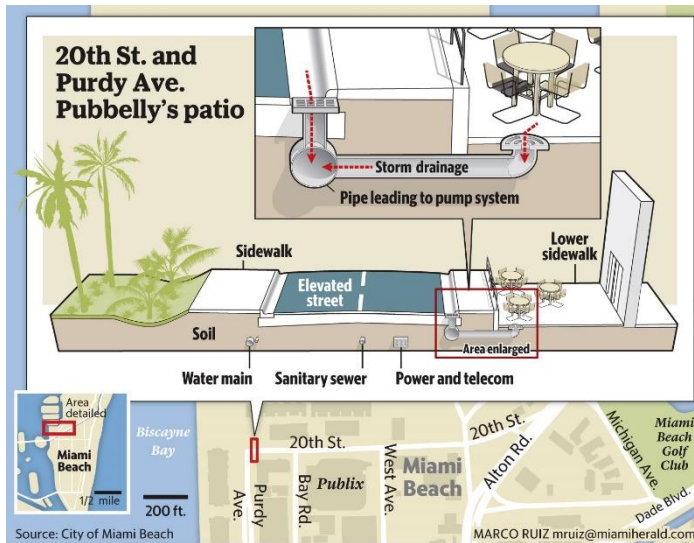


Image 2. Elevated roadway and new grey city infrastructure in front of Pubblelly restaurant. Source: <https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article41141856.html>

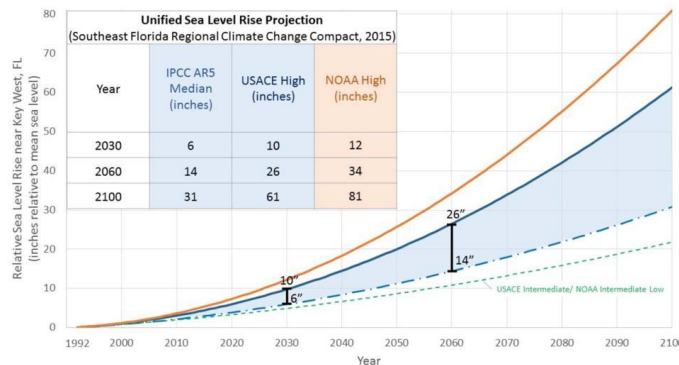


Chart 2. Sea level rise projection for the Miami Dade County from South East Florida Regional Climate Change Compact
Source: <https://www.wlrn.org/post/south-florida-doomed-sea-level-rise-experts-say-no-fact-theyre-optimistic>

MOTIVATION: THE MIAMI BEACH CASE

In order to fight against the rising sea and to mitigate the effects of urban floods (rain and sunny day flooding during high tides), the city of Miami Beach is investing more than 500 million dollars to raise streets & sidewalks (images 2 & 3) and to install 80 pumps around the city (Miami Beach's battle to stem rising tides, 2015).

Another actions that the city is taking is to build more sustainable buildings, promote the use of electric automobiles, and increase the amount of trees in order to reduce the carbon footprint, which is linked to global sea level rise.

However, these measurements, instead of actions, could be consider more as reactions to the ongoing problem (image 4). As stated by Phillip Levine, major of Miami beach: "We have learned as we went along. We of course realize that everything we did could have been better and everything we've done can certainly be improved." (Levine is campaigning on climate change. But his sea-rise legacy is complicated, 2018)
The lack of a resilient and sustainable plan to reduce climate changes effects that involves alternative solutions rather than grey infrastructure upgrades is becoming evident.

Chart 2 shows the estimated sea level rise projections in the Miami Dade County during the next 80 years:

- 30,48 cm by 2.030
- 86,36 cm by 2.060
- 205 cm by 2100

Moreover, since 1992, sea level has risen about 7,62 cm until the present time (Is South Florida Doomed By Sea-Level Rise? Experts Say No. In Fact, They're Optimistic, 2018).



Image 3 Elevated road and sidewalk adjacent to Pubblelly restaurant. Source: <https://www.miamiherald.com/latest-news/7stqat/picture41119947/binary/Beachraised+Road+03+EKM.JPG>



Image 4. Elevated road and sidewalk public works in a residential area of Miami Beach. Source: <https://www.yaleclimateconnections.org/2017/05/miami-beach-is-spending-millions-to-hold-back-the-sea/>

MOTIVATION: HIALEAH AND MIAMI SPRINGS

Hialeah and Miami Springs are two inland adjacent cities of the Miami Dade County, divided by the Miami Canal. Even though both municipalities are affected by inland floods, they face different levels of risk and vulnerability response in relation to this natural hazard. The reasons are that the two cities possess different physical, ecological and socio-economical features. In that sense, between the two cities, Hialeah is more susceptible to natural disasters related to flooding due to the lack of natural and pervious surfaces to percolate water into the ground (Sukop, M, interview). Moreover, the population recovery capacity from natural disasters is lower in Hialeah since their inhabitants belong to a lower socio-economic status, as shown in charts 3 and 4 (Data USA, 2019)



Charts 3 & 4. Miami Springs and Hialeah median household income and property value. Source: <https://datausa.io/profile/geo/hialeah-fl/?compare=miami-springs-fl>



According to a research report by Climate Central, Hialeah is one of the top 25 U.S. cities that are most vulnerable to coastal flooding today (position number 10, chart 5) and by 2050 (position number 2, chart 6). Moreover, it is ranked number 1 in the list of high social vulnerability populations most at risk by 2050, as shown in chart 7 (These U.S. Cities Are Most Vulnerable to Major Coastal Flooding and Sea Level Rise, 2017).

Another cities of South Florida and the Miami Dade County are included in this list. Miami Springs isn't part of it; however, the city is at risk of increasing floods in the near future due to climate change effects, as most inland areas in the Miami Dade County. Moreover, each property requires annual mandatory flood insurance by FEMA.

Cities Most Vulnerable to Coastal Flooding Today

Top 25 cities and their populations at risk (thousands) within FEMA's 100-year coastal floodplain

1. New York	245	14. Lauderdale, Fla.	66
2. Miami	126	15. Charleston, S.C.	64
3. Pembroke Pines, Fla.	116	16. Cape Coral, Fla.	59
4. Coral Springs, Fla.	115	17. Tamarac, Fla.	58
5. Miramar, Fla.	93	18. Margate, Fla.	50
6. St. Petersburg, Fla.	88	19. Tampa, Fla.	50
7. Davie, Fla.	87	20. Fountainebleau, Fla.	48
8. Fort Lauderdale, Fla.	85	21. Miami Gardens, Fla.	44
9. Miami Beach, Fla.	85	22. Country Club, Fla.	43
10. Hialeah, Fla.	76	23. Atlantic City, N.J.	37
11. Sunrise, Fla.	74	24. North Lauderdale, Fla.	37
12. Pompano Beach, Fla.	73	25. Kendale Lakes, Fla.	37
13. Hollywood, Fla.	69		

Chart 5. Cities most vulnerable to coastal flooding today
Source: <https://www.climatecentral.org>

Cities Most Vulnerable to Coastal Flooding by 2050

Top 25 cities and their populations at risk (thousands) within FEMA's 100-year coastal floodplain as augmented by projected sea level rise

1. New York	426	14. Hollywood, Fla.	76
2. Hialeah, Fla.	204	15. Miami Gardens, Fla.	72
3. Miami	154	16. Norfolk, Va.	66
4. Fort Lauderdale, Fla.	127	17. Lauderdale, Fla.	66
5. Pembroke Pines, Fla.	120	18. Cape Coral, Fla.	66
6. Coral Springs, Fla.	119	19. Boston	62
7. Miramar, Fla.	100	20. Tamarac, Fla.	60
8. St. Petersburg, Fla.	91	21. Virginia Beach, Va.	58
9. Davie, Fla.	90	22. Tampa, Fla.	57
10. Miami Beach, Fla.	87	23. Fountainebleau, Fla.	56
11. Charleston, S.C.	83	24. Margate, Fla.	53
12. Pompano Beach, Fla.	80	25. Kendale Lakes, Fla.	51
13. Sunrise, Fla.	79		

Chart 6. Cities most vulnerable to coastal flooding by 2050
Source: <https://www.climatecentral.org>

High Social Vulnerability Populations Most at Risk by 2050

Top 25 cities and their high social vulnerability populations at risk (thousands) within FEMA's 100-year coastal floodplain

1. Hialeah, Fla.	204	14. Westchester, Fla.	27
2. New York	189	15. Kendall West, Fla.	26
3. Miami	110	16. Sunrise, Fla.	23
4. Fountainebleau, Fla.	56	17. Pembroke Pines, Fla.	22
5. Miami Gardens, Fla.	41	18. University Park, Fla.	22
6. Kendale Lakes, Fla.	38	19. West Little River, Fla.	22
7. Miami Beach, Fla.	35	20. Fort Lauderdale, Fla.	20
8. Pompano Beach, Fla.	33	21. St. Petersburg, Fla.	20
9. Tamarac, Fla.	32	22. Lauderdale, Fla.	20
10. Tamiami, Fla.	30	23. Lauderdale Lakes, Fla.	20
11. Hallandale Beach, Fla.	29	24. Galveston, Texas	19
12. Atlantic City, N.J.	28	25. Hialeah Gardens, Fla.	19
13. Country Club, Fla.	28		

Chart 7. High Social Vulnerability populations Most at risk by 2050
Source: <https://www.climatecentral.org>

PROBLEM FIELD: INLAND FLOODS CAUSES IN SOUTHERN FLORIDA AND THE MIAMI DADE COUNTY

The increase of the amount of impervious surfaces due to a vast horizontal urban sprawl constitutes a contributing factor to urban and inland floods in the Southern Florida region (image 5). According to Dunne & Leopold and Paul & Meyer (as cited in Brody, S. et al, 2011, p.332) "As the area of impervious surface coverage increases, there is a corresponding reduction in water infiltrating into the soil, and an increase in water runoff." This statement derives into two important considerations.

The first one is the type of landscape transformed by impervious surfaces. As stated by Samuel Brody in The Rising Costs of Floods, "The relationship between urban development and flooding depends not only on the amount of impervious surface, but on specifically where in the hydrological landscape that surface is located" (Brody, S. et al, 2011, p.332). Since a great portion of the impervious surfaces of the Miami Dade County have been built in what used to be a continuous stretch of wetlands (Lemaire, J., Sisto, B, p.3), a vast part of the natural detention and retention capacities of the Miami metropolitan area has been lost during the last century (diagram 1).

The second consideration is that any new impervious surface added to the urban landscape constitutes an increase of water runoff volume (Arnold & Gibbons, on Brody, S. et al, 2011, p.332). Moreover, the increase of peak releases has been linked to impermeable surfaces Brezonik & Staldeman, (cited in Brody, S, p. 332) "because water reaches streams more quickly when the ability of the hydrological system to store water is compromised (see diagram 2)." (Hey; Hsu; Chen & Chang, cited in Brody, S. 332)

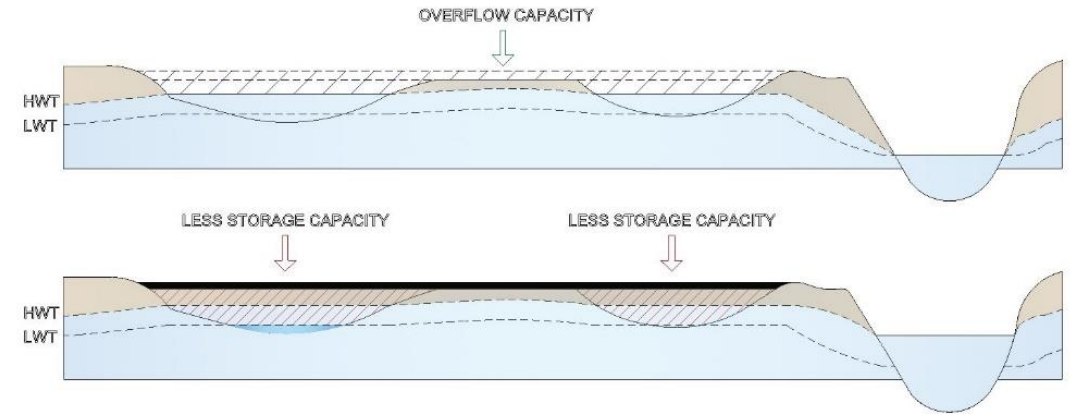


Diagram 1. Relationship between impervious surfaces and how the storage capacities relate to where in the hydrological landscape that surface is located. Source: author



Image 5. Inland flood in suburban Southern Florida neighborhood. Source: Movers Atlas Blog

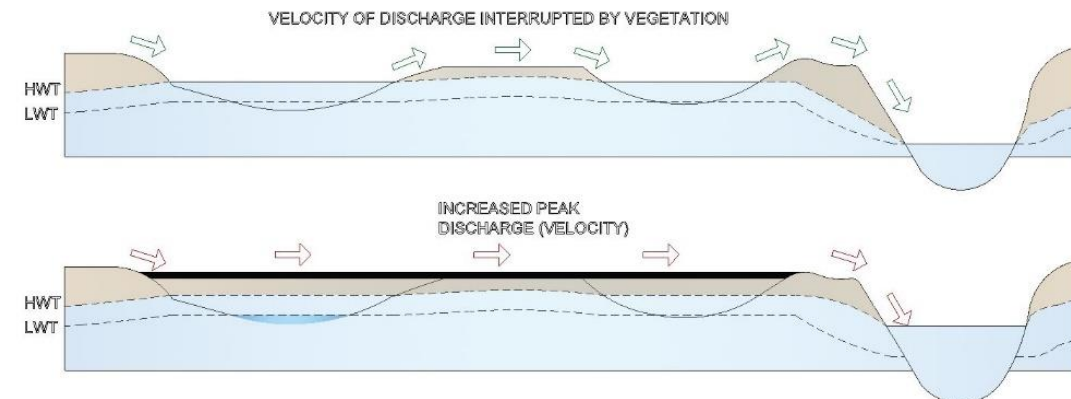
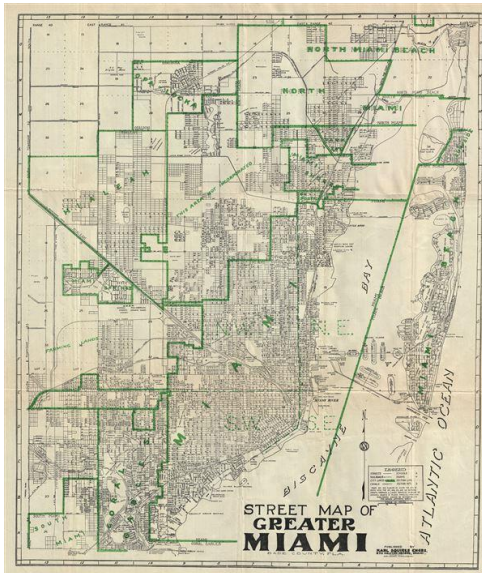
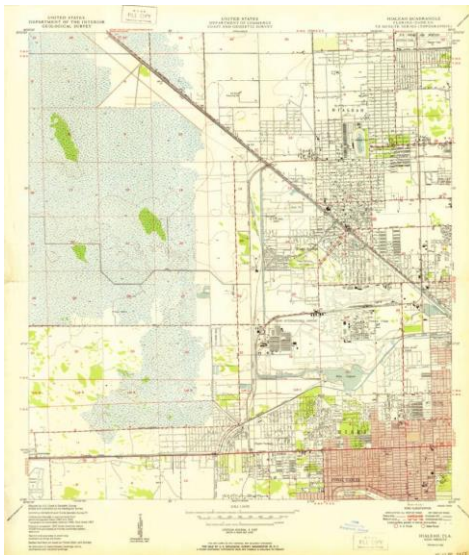


Diagram 2. Relationship between impervious surfaces and increased peak discharge. Source: author



Map 3. Greater Miami Area 1945. Source: <https://www.geographicus.com/P/AntiqueMap/GreaterMiami-newscompany-1945>



Map 4. Hialeah and Miami Springs (everglades to the west). Source: <https://e.org/map/usgs/5624878>

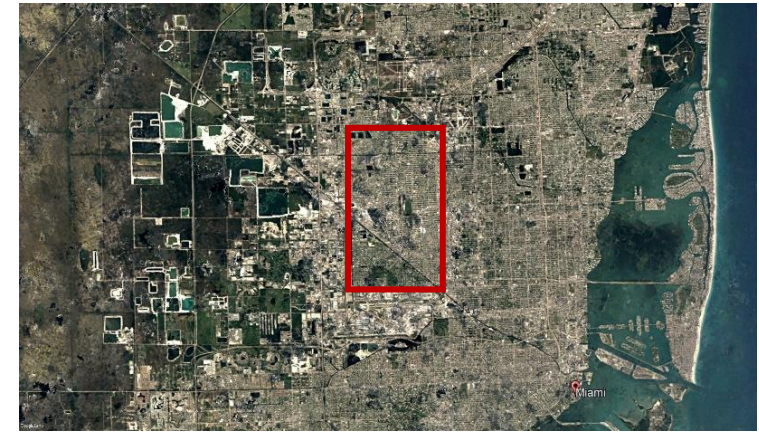
PROBLEM STATEMENT: FLOODS CAUSES IN HIALEAH AND MIAMI SPRINGS

The previously mentioned reasons for inland floods can be extrapolated to the cities of Hialeah and Miami Springs, along with two extra variables that contribute to inland floods: the highly permeable soil of South Florida and its proximity to the water table (Inland flood threat increasing in South Florida, 2017), which would be further analyzed in chapter 3.

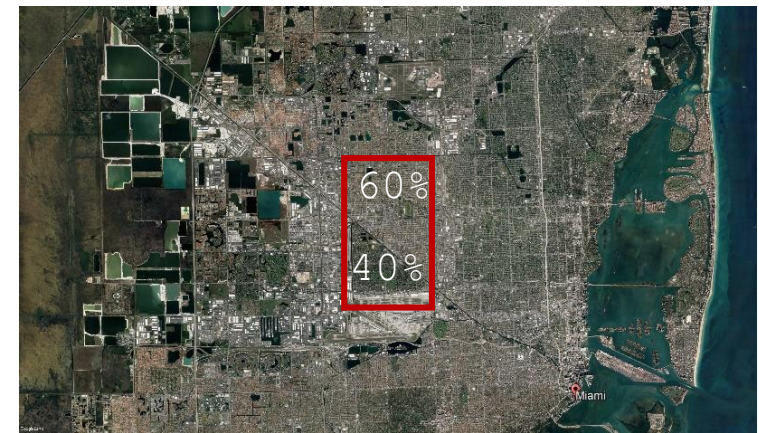
Up to the 1950's, both Miami Springs and Hialeah were perimeter cities, bordered by the everglades ecosystem to the west (maps 3 and 4). As observed in maps 3 and 4, there was an extensive amount of permeable and natural landscape for rainwater infiltration and storage within and around the two cities. However, rapid urban sprawl and urbanization during the following decades have resulted in a dramatic increase of impermeable surfaces, therefore, runoff volumes, and in the loss of local ecosystem services in both areas.

In the words of Tiffany Troxler, director of Science for the Sea Level Solutions Center, "Long ago, Miami's environment provided robust ecosystem services. That's when freshwater springs bubbled up from the middle of Biscayne Bay, the airport was a wetland, and the Atlantic rock ridge (a.k.a. I-95 corridor) was the best way to travel. Mangroves lined much of our shores." (Tiffany Troxler, 2018)

Maps 5 and 6 show the urban expansion, the increase of impervious surfaces and the reduction of natural and semi surfaces in Hialeah, Miami Springs and the rest of the metropolitan area between the last 32 years (1984 and 2016). According to hydrologist Michael Sukop, the current percentage of impervious surfaces in Hialeah and Miami Springs are approximately of 60% and 40%, respectively (interview).



Map 5. Miami Dade County year 1984 (Hialeah and Miami Springs). Source: author. Background image source: Google earth pro



Map 6. Miami Dade County year 2016. Hialeah and Miami Springs percentage of impervious surfaces. Source: author. Background image source: Google earth pro

Part of these percentages constitute urban infrastructure and public space. In addition to the limited responsive qualities to heavy rainfall events and climate change effects (diagram 3), each city's public space network presents its own challenges. Miami Springs's has a considerable amount of green public infrastructure; however, a great portion of it lacks biodiversity and in some areas there are no connections which the Miami Canal. It also counts with a very reduced blue system.

Hialeah's public space network is quite reduced and consists only in a few pocket parks, buffer zones between residential areas and the railroad tracks (including elevated metro system), and some sports facilities, which are in some cases private property, like the equestrian club (see images 6 &7). Therefore, besides these spots and outdoor commercial spaces, there are no gathering areas for the local community. Public green and blue infrastructures are almost nonexistent. This not only post environmental problems like heat island effect within the urban center, but also results in poor urban spatial qualities of the neighborhood.

PROBLEM STATEMENT

In summary, these are the most important problems this thesis project will address:

- The limited rainwater infiltration and surface storage capacities in the public space networks of both Hialeah and Miami Springs.
- An inexistent resilient and long term sustainable urban landscape water management plan to deal with the surplus of water under a climate change scenario.
- Social and socio environmental issues:
 - The lack of public spaces in Hialeah.
 - The lack of socio ecological production landscapes in both Hialeah and Miami Springs.



Image 6. Aerial view of central Hialeah: Race Track. Year:1947.
Source: <https://www.pbase.com/image/78860939>

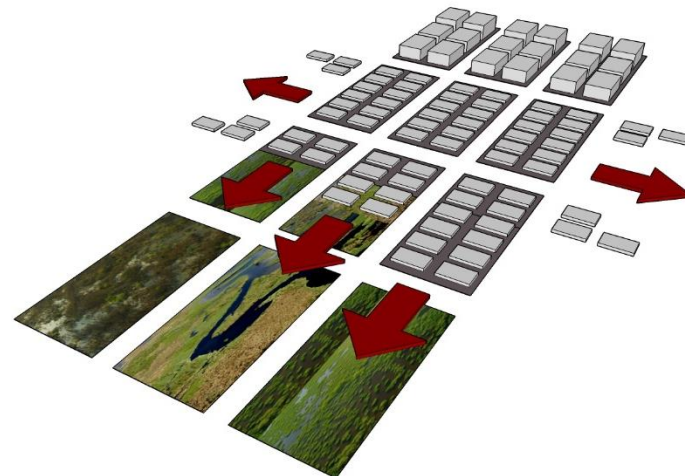


Diagram 3. Horizontal urban sprawl and depletion of wetlands (natural water buffer areas). Source: author



Image 7. Aerial view of central Hialeah: Race track and residential surrounding areas.
Year:2016. Source: Google maps

RESEARCH OBJECTIVE AND RESEARCH QUESTION

Research Objective

To test responsive local landscape solutions in the public space networks of Hialeah and Miami Springs in order to:

- Provide surface room to storage the excess amounts of rainwater.
- Increase the amount of pervious surfaces and reduce storm water runoff during rainfall events.
- Improve the socio ecological qualities of the existing public space.
- Increase the amount usable public space in Hialeah.

Research Question

How can public space provide resilient and sustainable solutions to deal with the surplus of water during the rainy season in Hialeah and Miami Springs and improve their current socio environmental conditions?

Research Sub questions

CONCEPTUALIZE THE PROBLEM

Which theories could provide the guidelines to address the public space transformation needs in Hialeah and Miami Springs? (chapter III)

UNDERSTAND THE PROBLEM

How does the current water management system of the Miami Dade County works and what are the causes behind the increase of hydrological problems in Hialeah and Miami Springs? (chapter IV)

UNDERSTAND THE SITE

What are the current urban conditions of each city and the potentials they offer to mitigate the impact of urban floods and to improve their socio ecological features? (chapter V & VI)

DESIGN QUESTION

What physical changes are needed within the current public space networks and public urban infrastructures in order to improve the infiltration and storage capacities on both sites? (chapter VII)

REFLECTION QUESTION

How could the transformation of public space networks improve the social and socio ecologic wellbeing of Hialeah and Miami Springs and contribute to the current water management system of the County? (chapter VIII)

READING ITINERARY

INTRODUCTION (CHAPTERS I & II)

Chapter I introduces the general topic and problem field of this thesis project, which is urban floods. It also states the motivations for choosing the cities of Hialeah and Miami Springs (Miami). Then it narrows down to the local urban problems of each city: the lack of rain water storage capacities in both cities, the insufficient public space network of the city of Hialeah and the poor ecologic features of both cities. After determining the problem statement, the research objective and main research question and sub questions are formulated. The main research question is answered throughout the research and design portions of the report. The research sub questions # 1, 2 and 3 are answered in chapters III, IV, V & VI. The design question is answered in chapters VI & VII. The reflection question is answered in chapter VIII.

Chapter II sets the methodology applied to conduct the research, as well as the scope and relevance of the project.

RESEARCH (CHAPTERS III, IV, V, VI)

Chapter III sets the theoretical framework that would be applied in the design. The concepts of landscape urbanism, landscape as infrastructure & the recuperation of ecosystem services provide the general strategies and some design principles that would later be applied in the design portion (research sub question #1).

Chapter IV provides guidelines to understand the hydrogeological conditions of the site and the reasons for inland flooding in both cities. This portion provides design principles related to water management solutions (research sub question # 2).

Chapter V consists in the site analysis of both cities, from a public space angle. The analysis includes land use, urban fabric and existing urban infrastructures. The results will show the local spatial, programmatic and hydrogeological needs for each area, as well as the potentials areas for intervention (research sub question # 3)

DESIGN (CHAPTERS VI & VII)

Chapter VI is a crossover between the conclusions of the site analysis and the initial design since it is in part the conclusion of the site analysis, but also a set of different areas suitable for redesign (research sub question # 3).

Chapter VII summarizes the design principles and strategies obtained during the research phase in an overall vision for the area. (research sub question # 4). The design deals with different urban scales, from macro to micro: Vision, master plans and precise spatial qualities (how the user experiments and interacts with the new urban landscape).

REFLECTION (CHAPTER VIII)

Chapter VIII answers research sub question # 5: the relationship between research & design, the potential applications of the results in practice, the outcomes and conclusions related to water management and public space improvement.



II. METHODOLOGY RELEVANCE & SCOPE

- Methodology
- Scope /Social & scientific relevance

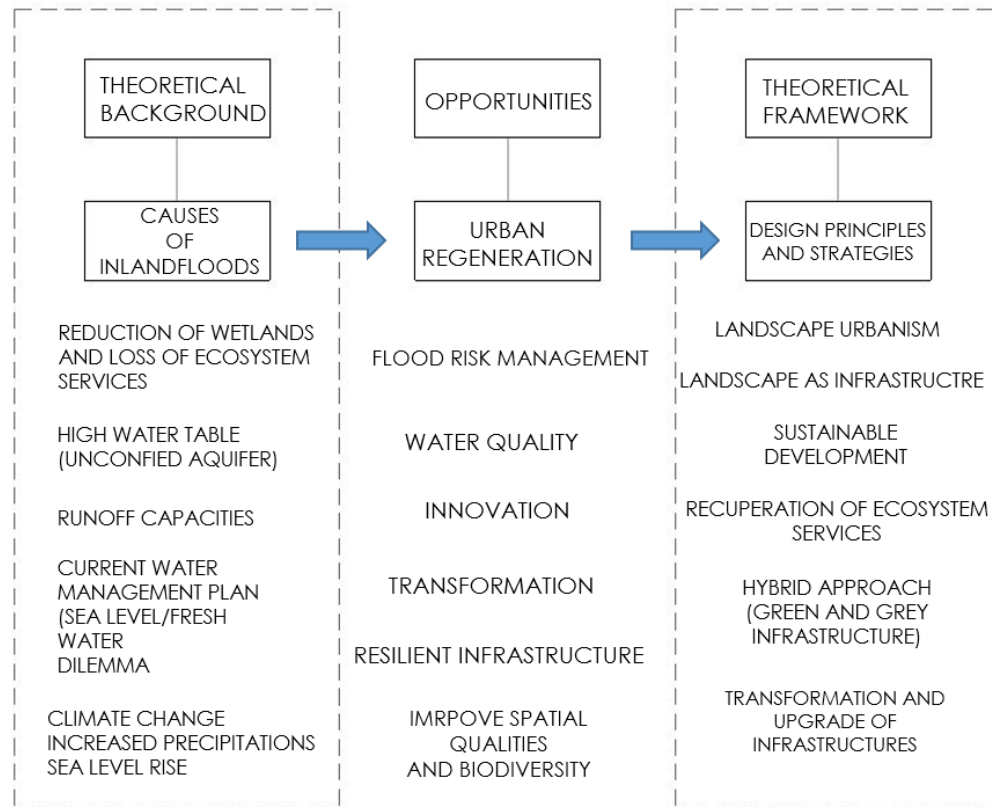


Diagram 5. Research process. Theoretical background. Source: author

-Structure the concept for the design: Landscape Urbanism, landscape as infrastructure, sustainable development and the reintroduction of ecosystem services. The third phase of the design research method is done by mapping the area of study through historic, interpretative maps, drawings and photographs. The fourth phase of the design consisted in two filed visits to the site.

-Research on Design

Research on design is focused in the analysis of case studies in order to define a tactical method or guidelines concerning landscape architectural plans from the regional to local scale (Hill, K, as cited in Hills, M, p. 3). The main purpose of the case study research is to retro feed the research by design method through the extraction of general strategies and design principles. However, the case studies can also contribute to understand how landscape structures work on a technical level and its potentialities in its qualitative levels.

Research by Design

Research by design consist in the application of the design research into the landscape design challenge through strategic actions derived from the conceptual, spatial and technical design principles and strategies formulated after understanding the main reasons for the problem.

SCOPE

Urban flooding is a problem that many cities worldwide are currently dealing with due to population growth, urban expansion and climate change patterns. Therefore, this project can be used as a reference on how the transformation of public space and urban infrastructures could provide resilient and sustainable measures to mitigate floods and create socio ecological production landscapes, while regenerating neglected areas of a city.

Moreover, it could offer some guidelines related to the causes and the certain actions that could be taken to reduce the problematic in inland neighborhoods, trapped between the urban fabric.

SOCIAL RELEVANCE

The consequences of urban floods bring up social, health, economic and environmental problems. The socio ecological based urban regeneration that this project aims to achieve in order to mitigate floods, increase biodiversity, improve spatial quality and provide more public space for the community could also be used as a reference on how to reconfigure and plan new urban areas from a public landscape point of view

SCIENTIFIC RELEVANCE

From a scientific point of view, this thesis project could offer certain broad guidelines in how to analyze the causes of urban floods according to the particular physical, ecological and hydrological conditions of a specific site. Moreover, it could be used to better understand the causes of floods in areas with the same or similar hydrological characteristics and urban characteristics. It also provides an example on how the theories of landscape as infrastructure and the recuperation of ecosystem services are applied in combination with current urban redevelopment and urban regeneration city plans.

The landscape as infrastructure theory is applied in a tangible manner through a set of implementation actions to follow in order to transform and upgrade the existing public space and urban infrastructures.

Another relevant input of the project is that it focuses in the functional qualities that the design project delivers.

Moreover, it raises the question of exploiting public open space as a complementary water management solution for climatological hazards.

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III. THEORETICAL FRAMEWORK

- Theoretical background
- Case studies
- Conclusions (initial strategies and design principles)

LANDSCAPE URBANISM

The theory of landscape urbanism proposes a different urban model to plan cities that prioritizes the design of urban landscapes (image 8) over buildings (Frampton, K., 1994, p. 90, cited in Pollack, L., 2005, p. 127).

Instead of common urban design practices that prioritize "geometry over geomorphology, topology over topography, or even conceptual interests over perceptual ones" (Czerniak, J., p.108), landscape urbanism potentials are focused on "the ability to shift scales, to locate urban fabrics in their regional and biotic contexts, and to design relationships between dynamic environmental processes and urban form" (Corner, J., p.24).

One of the main objectives of landscape urbanism is to understand what happened to the city landscape in the past decades to subsequently act upon it (Girot, C., p. 89). In the words of Peter Frampton (Frampton, P, quoted on Waldheim, C., p. 42):

"The dystopia of the megalopolis is already an irreversible historical fact: It has long since installed a new way of life, not to say a new nature... I would submit that instead we need to conceive of a remedial landscape that is capable of playing a critical and compensatory role in relation to The ongoing, destructive commodification of the man-made world"



Image 8. Example of landscape urbanism: Superkilen, Copenhagen. Creation of urban public space. Source: author.



Image 9. Example of landscape as infrastructure: Provenierssingel. Source: author.

LANDSCAPE AS INFRASTRUCTURE

Landscape as infrastructure can be demarcated "as a goal-oriented approach, where landscape is treated as an operative field that defines and sustains the urban development and ecological and economic processes are employed as formative design tools." (Nijhuis, S. et al, p. 20). This notion implies the fact that a specific site can host complimentary functions addressed to solve current urban problems and enhance its overall performance. According to Stan Allen, Dean of the School of Architecture at Princeton University (Allen, S., quoted on Waldheim, C., p. 37):

"Increasingly, landscape is emerging as a model for urbanism. Landscape has traditionally been defined as the art of organizing horizontal surfaces...By paying attention to these surface conditions-not only configuration, but also materiality and performance-designers can activate space and produce urban effects without the weighty apparatus of traditional space making.

" *Flowscales: Designing Infrastructure as Landscape*, points out three main potentials for urban landscape infrastructure in design that can work in an interdisciplinary way: transport, green, and water landscape infrastructures (image 9). The interaction of these three types of infrastructures within the landscape can perform the task of implementing creative strategies and tangible solutions for traffic, public space connectivity, ecologic and water management issues (Nijhuis, S. et al., p. 26-28).

RECUPERATION OF ECOSYSTEM SERVICES

“Ecosystem services are the benefits provided to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services e.g. clean air, water, and food” (Constanza et al, cited on Ecosystem Services: key concepts and applications).

Ecosystems deliver a various range of services (diagram 6), “which often overlooked or degraded, can provide multiple hazard regulation functions” (Depietri, Y., McPhearson, T., p. 91). The Ecological Society of America summarizes them into 14 main categories, which include such as water purification and increase biodiversity.

Although grey infrastructure can provide numerous benefits, it can collapse when challenged by extreme weather events (Depietri, Y., McPhearson, T., p. 98). Engineered systems are little or non-reversible and often maladaptive. Therefore, these types of infrastructure are unreliable in the sense that they don’t provide the necessary resilient and sustainable measures to completely eliminate risks in the long term (diagram 7). Regardless of its durability, they are low cost effective due to high upfront building costs and depreciation. (Depietri, Y., McPhearson, T., p. 97).

On the other hand, healthy green and green-blue infrastructures (image 10) provide ecological services that are highly cost effective, more flexible and reliable than grey infrastructures (Depietri, Y., McPhearson, T., p. 98).

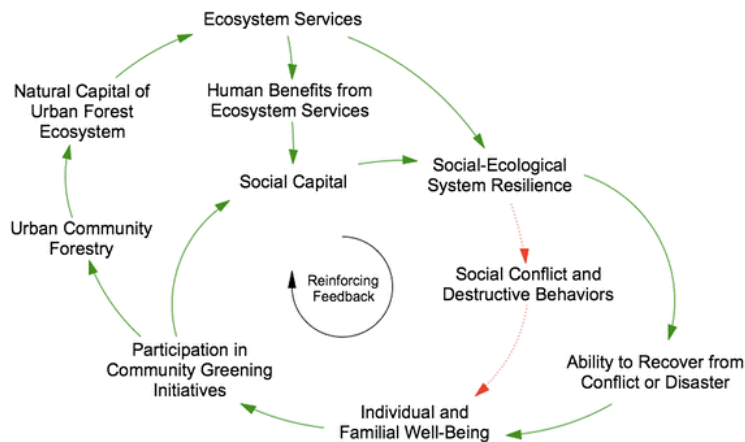


Diagram 6. Ecosystem services flow diagram. Source: <https://stockholmresilience.org/research/research-news/2017-11-28-after-disasters-look-for-the-virtuous-cycle.html>



Image 10. Example of landscape urbanism: Superkilen, Copenhagen. Creation of urban public space. Source: author.

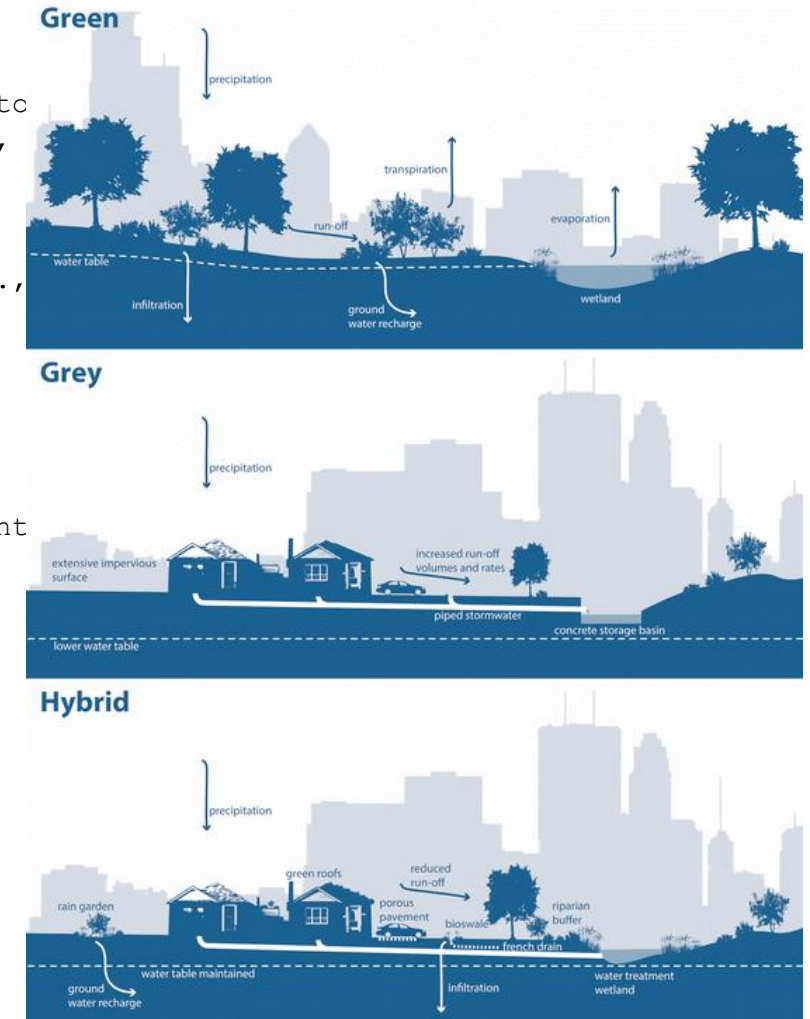


Diagram 7. Green, grey and hybrid model for the recuperation of ecosystem services. Source: Integrating the Grey, Green, and Blue in Cities: Nature-Based Solutions for Climate Change Adaptation and Risk Reduction

CASE STUDY I: TANNER SPRINGS PARK, PORTLAND, OREGON

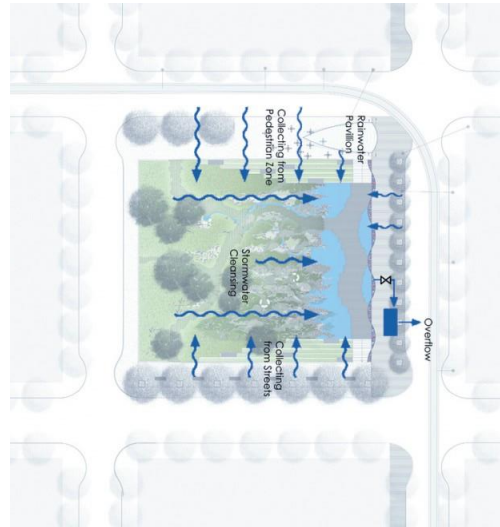
DESIGNER: Atelier Dreiseitl

Tanner Springs Park is a sunken wetlands urban park, located in mixed-use Pearl District, in Portland, OR. The Pearl District has been developed in a former industrial zone that used to be wetlands before urbanization, during the mid 1800’s. The wetlands were drained around 1890 in order to establish an industrial area.

It is a small scale example of wetlands restoration within an urban environment. Two of the main ecologic features are the reintroduction of groundwater and former local vegetation. The 1 acre (0.48 ha) park provides additional surface area for rainwater detention, infiltration and seasonal storage in the densely populated neighborhood (map 7).

The blue infrastructure is comprised of a pond and a wetland area (image 11). The green infrastructure consists mainly on grassland and native tree species. The artificial components of the park consist in permeable route and a wooden boardwalk over the pond (image 12).

Stormwater runoff from adjacent street are conducted into the pond and wetlands area, which is located 1.80 m below street level. It has a retention capacity of 260 cubic meters and the maximum buffer height is 50 cm. The park doesn’t only contributes with the local water management drainage system, but also increases biodiversity and introduces a new type of blue and green infrastructure in the urban area (map 8).



Map 7. Tanner Springs Park rainwater flow. Source: <https://www.urbangreenbluegrids.com/projects/tanner-springs-park-portland-oregon-us/>



Image 11. Tanner Springs Park: wetlands and artificial pond. Source: author.



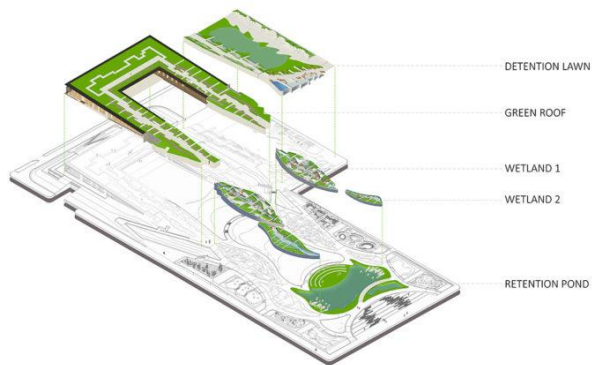
Image 12. Tanner Springs Park: wooden boardwalk over pond. Source: author.



Map 8. Tanner Springs Park floor plan . Source: <https://ramboll.com/~media/Images/RDE/Environment/STU/Tanner/Tanner5.jpg>



Map 9. Master plan of Chulalongkorn University Centenary Park.
Source: https://worldlandscapearchitect.com/chulalongkorn-centenary-park-green-infrastructure-for-the-city-of-bangkok/#.Xal_cG5uJPY



Map 10. Axonometry of Chulalongkorn University Centenary Park.
Source: https://worldlandscapearchitect.com/chulalongkorn-centenary-park-green-infrastructure-for-the-city-of-bangkok/#.Xal_cG5uJPY

CASE STUDY II: CHULALONGKORN UNIVERSITY CENTENARY PARK, BANGKOK, THAILAND

LANDSCAPE ARCHITECTURE DESIGN: Landprocess
ARCHITECTURAL DESIGN: N7A architects Co., Ltd.

Chulalongkorn University Park design responds to the critic demand of open public space and green and blue urban infrastructures in the highly impervious city of Bangkok (image 13). It was also designed in order to cope with current climatologic hazards and future climate change effects.

The vast green infrastructure (map 9) contributes to mitigate the heat island effect, while providing recreational spaces with multiple areas for different activities for the city inhabitants. The park includes a series of open classrooms through the landscape to be used as learning spaces for different target population.

The 12 acre sunken park also includes a water management plan to mitigate floods, detain, purify and storage rainwater. The blue system is comprised by two central wetland areas (image 14) and a retention pond. The green infrastructure related to water management includes a detention lawn area and a green roof (map 10). The park also contains an artificial rain water reservoir, water storage tanks and a water treatment system to reutilize the water.

It also provides an extensive pedestrian and bicycle transportation network that extends beyond the area of the park and connects to adjacent streets. A series of linear rain gardens were also built in one the streets adjacent to the park.



Image 13. Chulalongkorn University Centenary Park: urban context. Source: https://worldlandscapearchitect.com/chulalongkorn-centenary-park-green-infrastructure-for-the-city-of-bangkok/#.Xal_cG5uJPY



Image 14. Chulalongkorn University Centenary Park: wetlands area. Source: https://worldlandscapearchitect.com/chulalongkorn-centenary-park-green-infrastructure-for-the-city-of-bangkok/#.Xal_cG5uJPY

CONCLUSIONS

LANDSCAPE AS INFRASTRUCTURE AND CHULALONGKORN UNIVERSITY CENTENARY PARK

In the urban tissue, where several hydrogeological and climatological variables can interfere with the proper functioning of current water management systems, public city landscape can become a supportive vehicle to the existing system in order to mitigate floods (image 15). Moreover, public space could be used to improve pedestrian and bicycle connections.

From this theory, the two strategies for the overall design approach are extracted:

- Water strategy: A supportive water management system through public urban landscapes.
- Land strategy: physical connection of public spaces through alternative transit systems.

RECUPERATION OF ECOSYSTEM SERVICES AND TANNER SPRINGS PARK

From the recuperation of ecosystem services study one complimentary compound to the water strategy is added:

- The implementation of resilient and sustainable public spaces in order to deal with natural hazards.

Moreover, two design principles for this strategy were extracted:

- The creation of blue and green public infrastructures through the public space network.
- Natural water detention, retention, purification and infiltration.

CONCLUSIONS

LANDSCAPE URBANISM AND CHULALONGKORN UNIVERSITY CENTENARY PARK

From the landscape urbanism theory, the social /socio-ecological strategy is extracted:

- The implementation of new programmatic spaces and functions through the private and public urban landscape.

The design principles for this strategy will be provided by the conclusions of the site analysis.



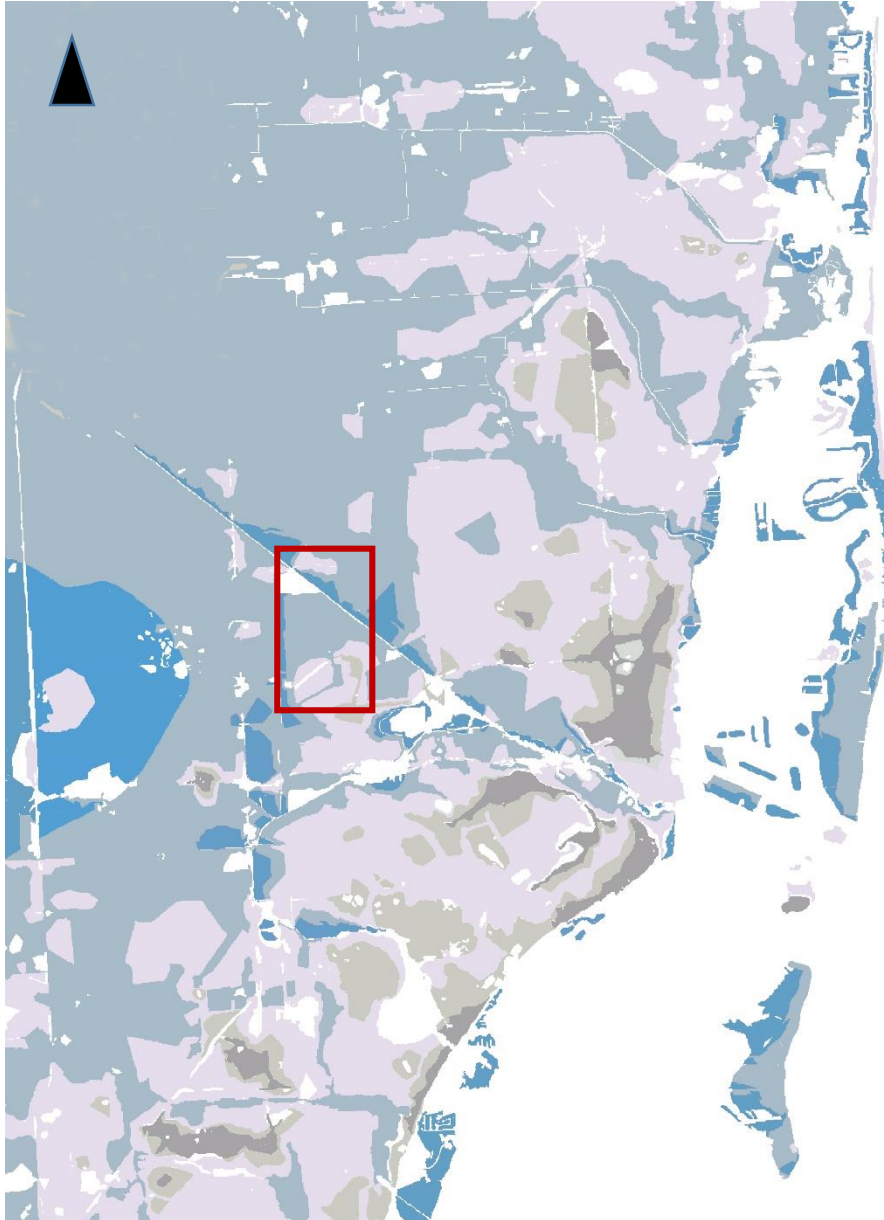
Image 15. Urban landscape as infrastructure: Water Square in Rotterdam by the Urbanisten.
Source: author.

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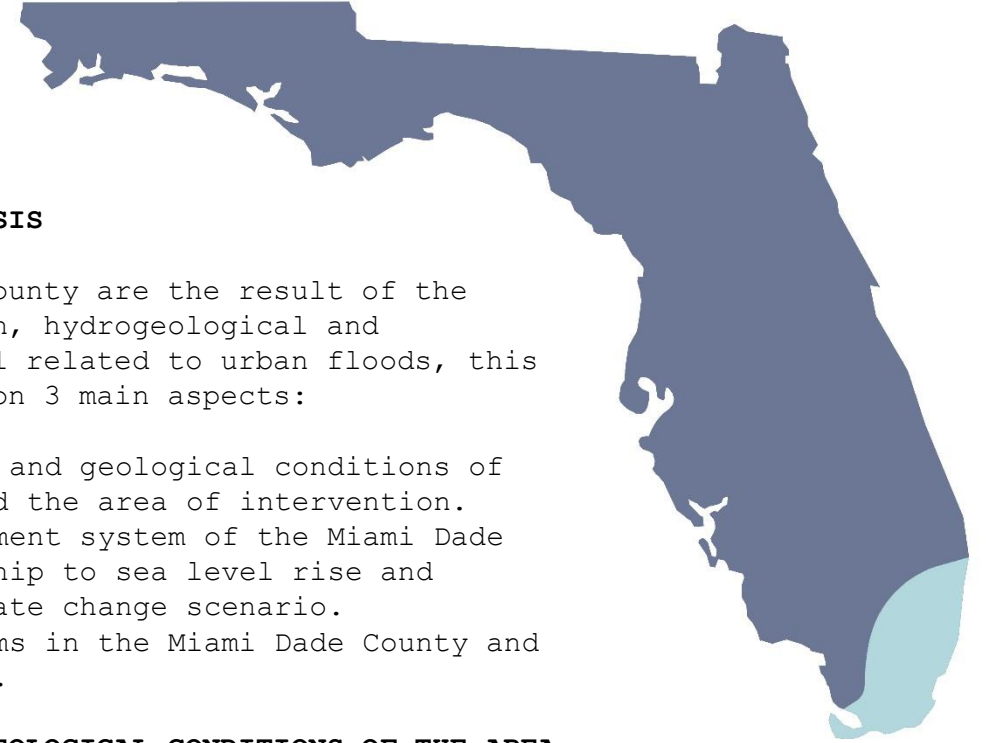
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IV. HYDROGEOLOGICAL ANALYSIS

- Current hydrogeological conditions in the area
- Water management system of the Miami Dade County
- Relationship between sea level rise and groundwater under a climate change scenario
- Types of drainage systems in the Miami Dade County
- Conclusions (design principles)



Map 11. Miami Dade County elevation map: Depth to water table.
Source: author



Map 12. South Florida Map: Biscayne Aquifer. Source: author

HYDROGEOLOGICAL SITE ANALYSIS

Floods in the Miami Dade County are the result of the combination of urbanization, hydrogeological and climatological factors. All related to urban floods, this chapter is going to focus on 3 main aspects:

- The current hydrological and geological conditions of the Miami Dade County and the area of intervention.
- The current water management system of the Miami Dade County and its relationship to sea level rise and groundwater under a climate change scenario.
- Types of drainages systems in the Miami Dade County and the area of intervention.

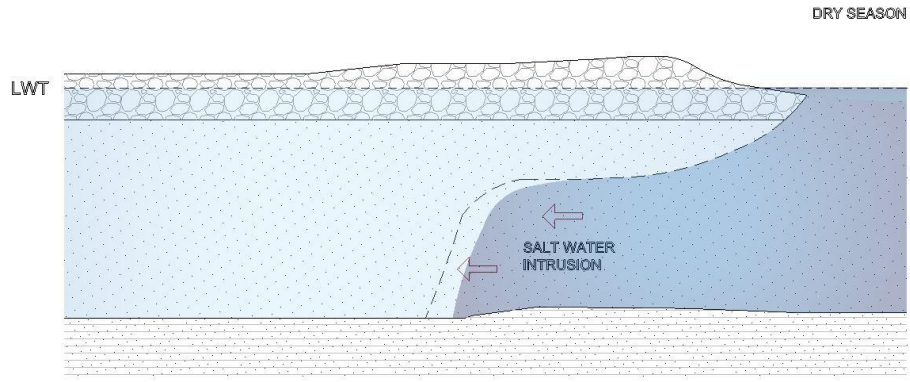
CURRENT HYDROLOGICAL AND GEOLOGICAL CONDITIONS OF THE AREA

THE BISCAYNE AQUIFER

The Biscayne aquifer is a surficial unconfined slow moving “river” located beneath the surface of four South Florida counties, including the Miami Dade County. It is mainly composed of limestone soil, which makes it very permeable and easily rechargeable. It also constitutes one of the main drinking water supplies for the Miami Dade County consumption.

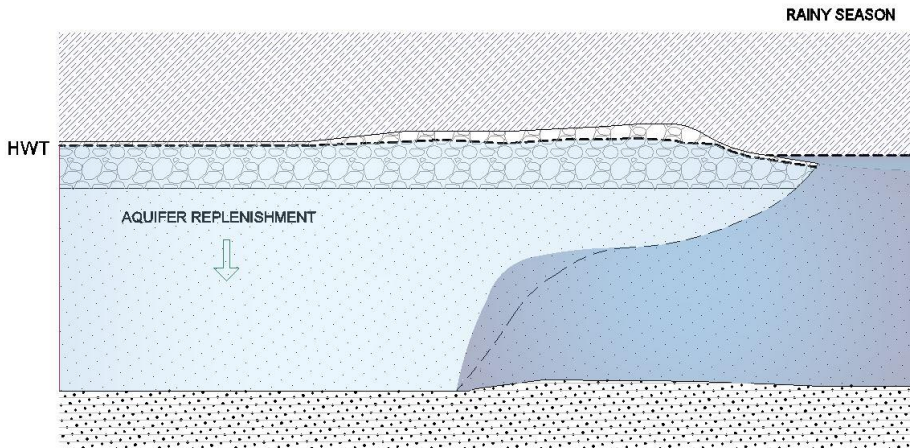
Since it is an unconfined aquifer, the top part constitutes the water table, which varies during the dry and rainy seasons.

WATER TABLE OF THE AQUIFER DURING THE DRY AND RAINY SEASONS



DRY SEASON

The water table drops during the dry season due to the decrease of rainfall events. There is higher risk of salt water intrusion during this season.

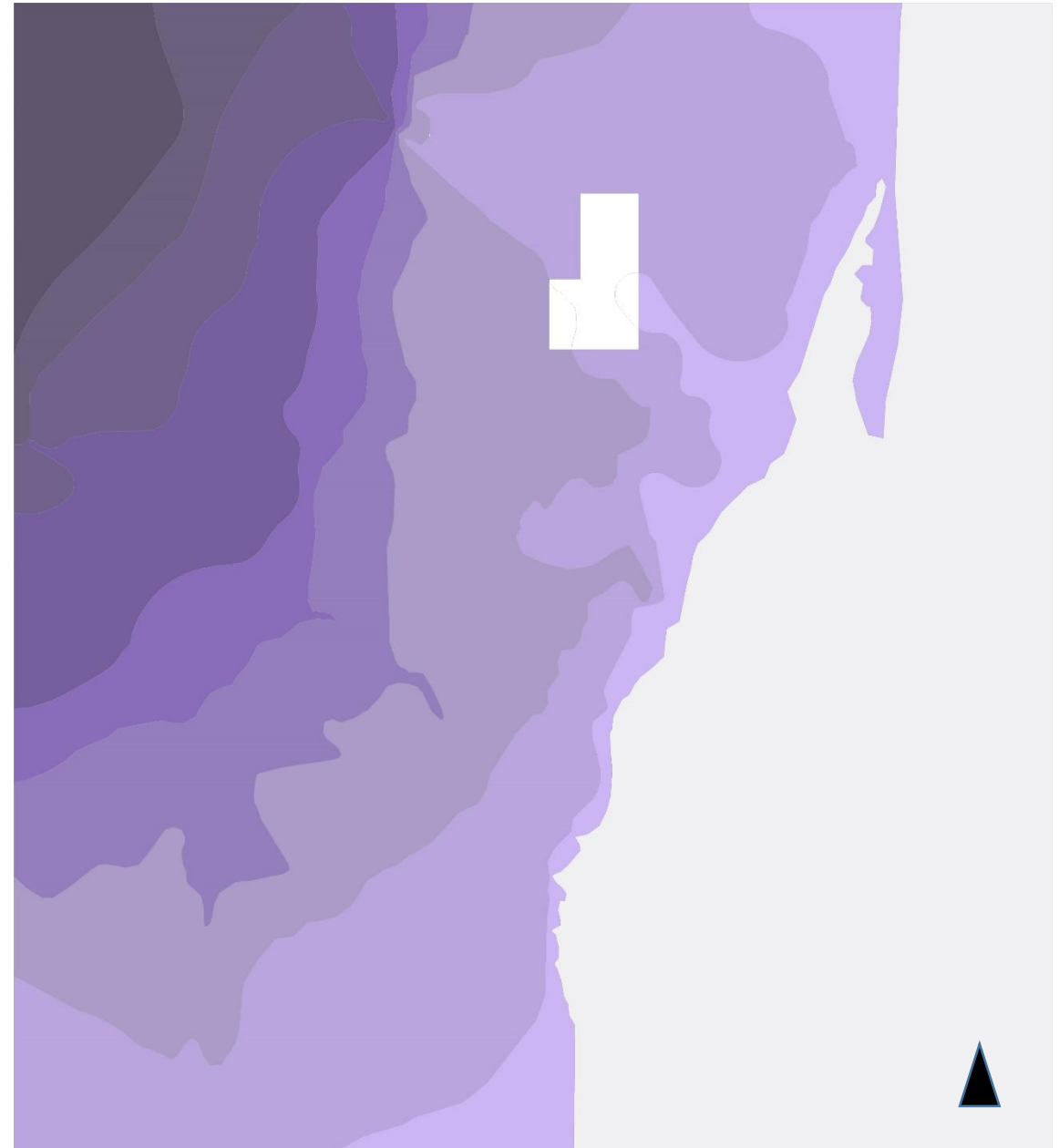


RAINY SEASON

The water table level rises very close to the surface during the rainy season. There is a very high risk for groundwater related floods.

Diagram 8. Miami Dade County water table behavior during the dry season (November - May). Source: author.

Diagram 9. Miami Dade County water table behavior during the rainy season (May - December). Source: author.



Map 13. Water table contour lines: dry season. Source: author

Previous (PRE DRAINAGE) AND CURRENT HYDROLOGICAL AND GEOLOGICAL CONDITIONS OF HIALEAH AND MIAMI SPRINGS

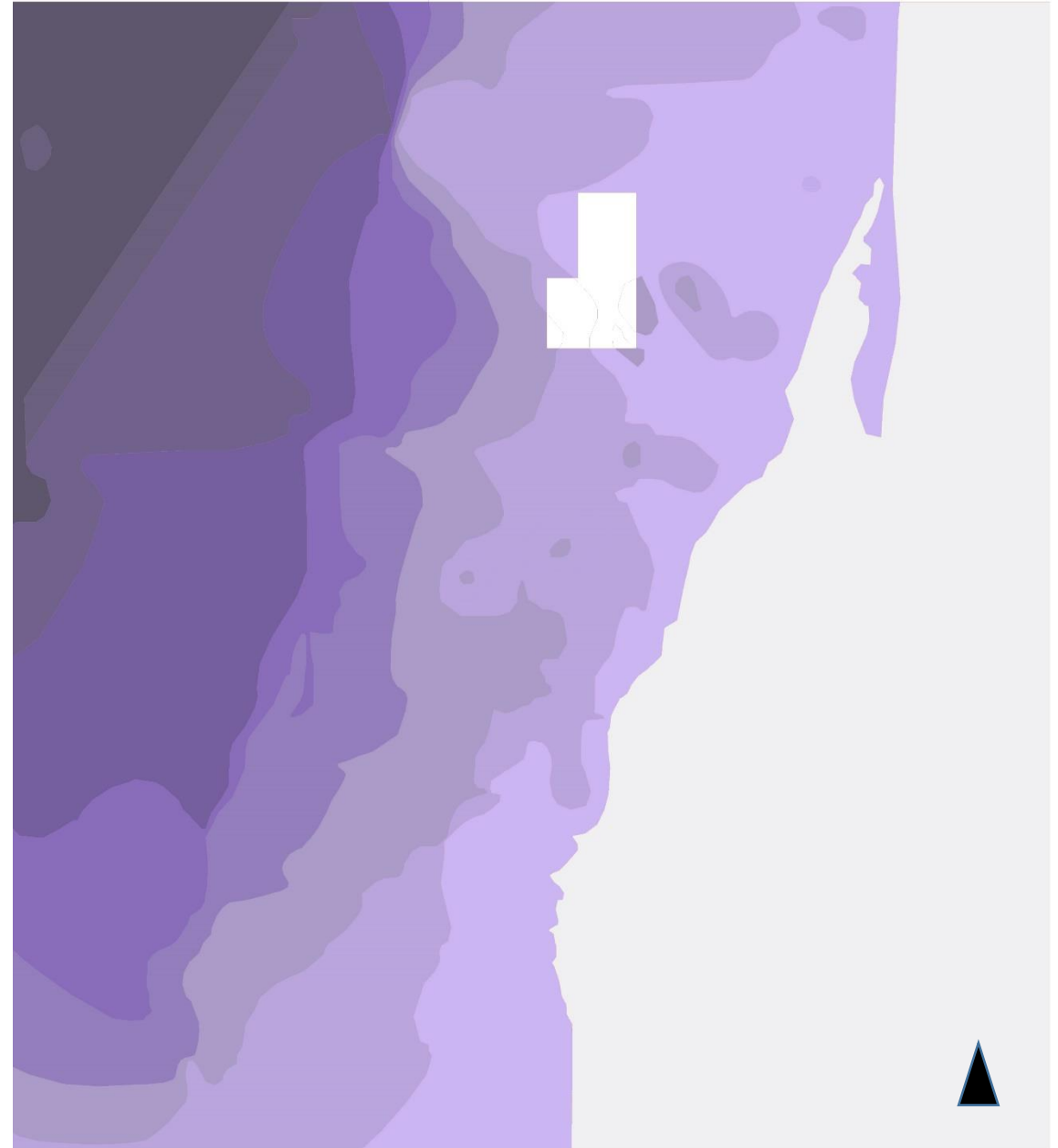
THE BISCAYNE AQUIFER

The cities of Hialeah and Miami Springs, like many other areas of the Miami Dade County, are located in flat lowlands that used to be marshes and fresh water wetlands before urbanization. The average height on these 2 cities is 2 meters above sea level.

Both cities are located above the Biscayne Aquifer. The water table in this areas fluctuates from 0.3 m above mean sea level during the dry season up to 1.5 m during the rainy season. Therefore, during the wet season the water table is just 0.5 m below the surface.

Before the city expanded from east to west towards Hialeah and Miami Springs, the former marshes and wetlands ecosystems gradually absorbed rainfall water. Moreover, there were vast amounts of natural surface areas to store rainwater. However, current urbanization makes the water percolation process slower at the present time.

The disruption of the natural systems, in combination with the high groundwater levels underneath, and the increasingly heavier rainfalls in the area due to climate change and the heat island effect, are the main causes for both cities to flood in a regular basis during the last years. Moreover, the water that permeates into the aquifer during heavy rainfalls is of less quality since it infiltrates from urban soil, which carries all sort of pollutants to the underneath fresh water reservoir.



WATER MANAGEMENT SYSTEM OF SOUTH FLORIDA AND THE MIAMI DADE COUNTY

The South Florida and Miami Dade County water management system is composed by:

- A system of main, secondary and tertiary canals.
- A system of levees, pumps and lock structures (salinity control structures).

The main purposes of the canal system are to:

- Replenish the aquifer during both seasons.
- Discharge the excess of rain water during the wet season to the Biscayne Bay and water conservation areas in order to lower the water table and prevent floods.
- To keep the water table higher during the dry season in order to prevent salt water intrusion.

Therefore, the lock structures are closed during the dry season and most of the times open during the rainy season (The Biscayne Aquifer, 2009). During King Tides (high tides), the control structures may be closed during the wet season in order to prevent salt water intrusion due to high salt water levels on the Biscayne bay.

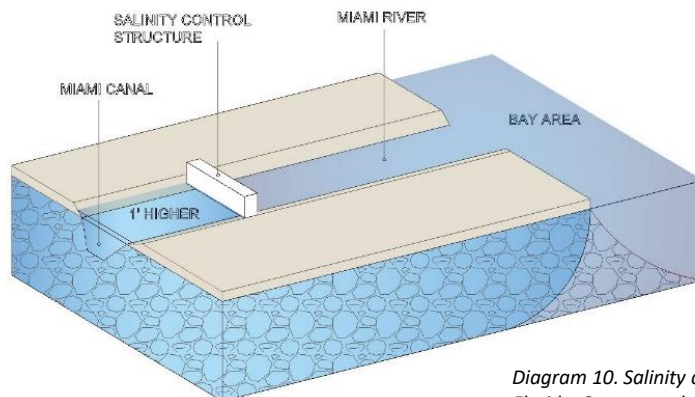
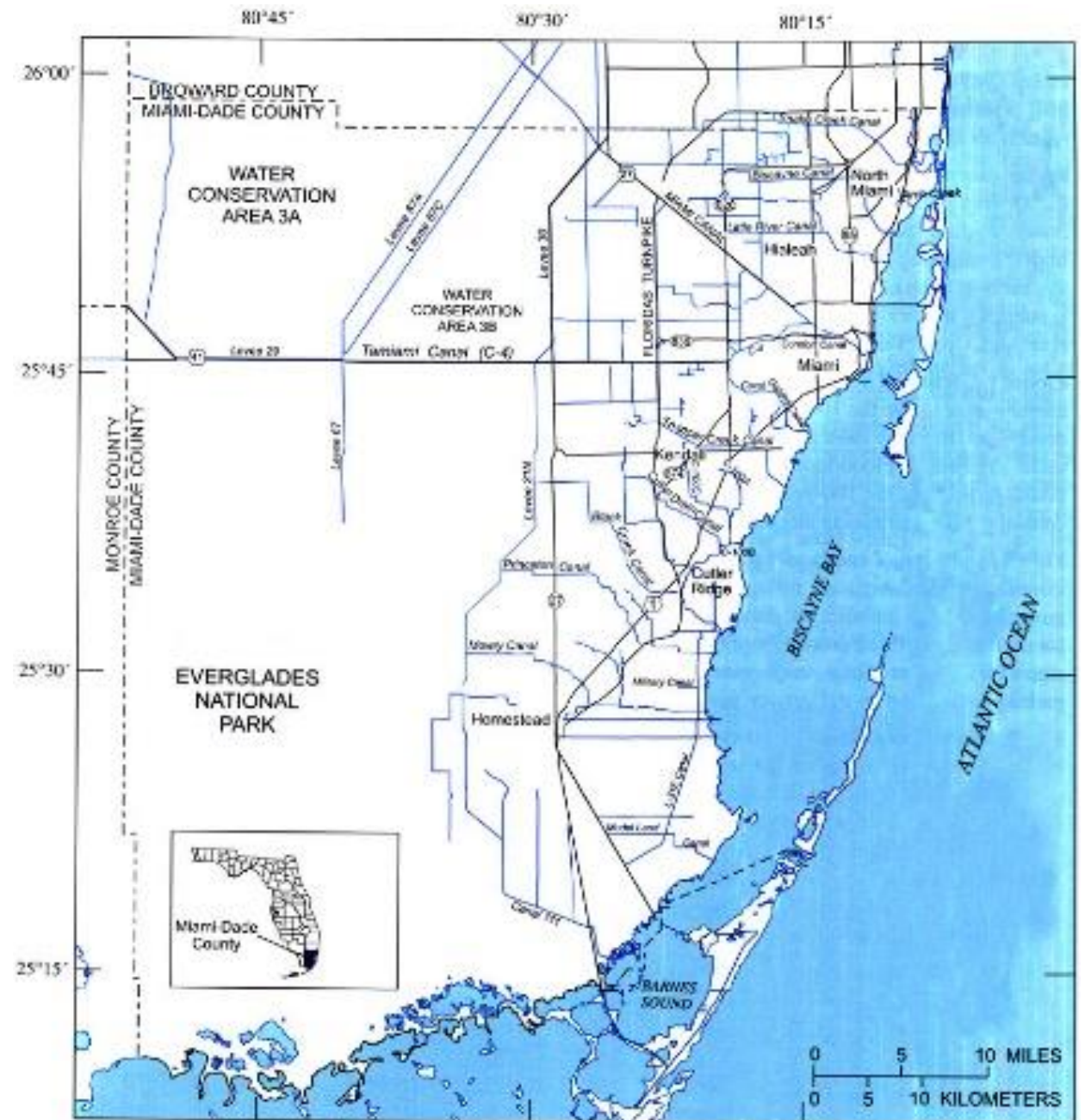


Diagram 10. Salinity control structures diagram of South Florida. Source: author, based on an image found at: <https://pubs.usgs.gov/circ/2003/circ1262/>



Map 15. Miami Dade system of primary, secondary and tertiary canals. Source: <http://fcit.usf.edu/florida/maps/pages/9000/f9069/f9069.htm>

RELATIONSHIP BETWEEN SEA LEVEL RISE AND GROUNDWATER UNDER A CLIMATE CHANGE SCENARIO

Higher groundwater levels reduces the capacities of underground retention of stormwater, which could upsurge water to the surface, causing flooding. (Sukop, M, p. 1690). Since a great portion of the Miami Dade County is located in low laying areas above the unconfined Biscayne Aquifer, this limited underground storage capacity might become a more severe problem as sea level rises.

According to Ellen Plane, a student at the College of Environmental Design at UC Berkeley, "In areas where you have a shallow unconfined coastal aquifer, as sea level rises and intrudes farther inland, the interface between the salt water and fresh water will rise and push the fresh water lens upward, potentially causing emergence and inundation in areas that you wouldn't expect from salt water inundation alone, because they are not directly connected." (Ellen Plane, quoted on Maven, 2018).

This correlation is already happening through artificial means in the Miami-Dade County, where an "extensive network of salinity control structures is intended to maintain higher inland water levels in the canals and the groundwater system to prevent saltwater intrusion via the subsurface or via movement up the canals" (Sukop, M, p. 1671) in order to protect the aquifer integrity. However, the same artificial water management system is used "to move water out to the sea quickly and to adjust groundwater levels to better accommodate impending storms" (Sukop, M, p. 1670-1671). Therefore, there is a dilemma between these two water management strategies, which belong to the same system.

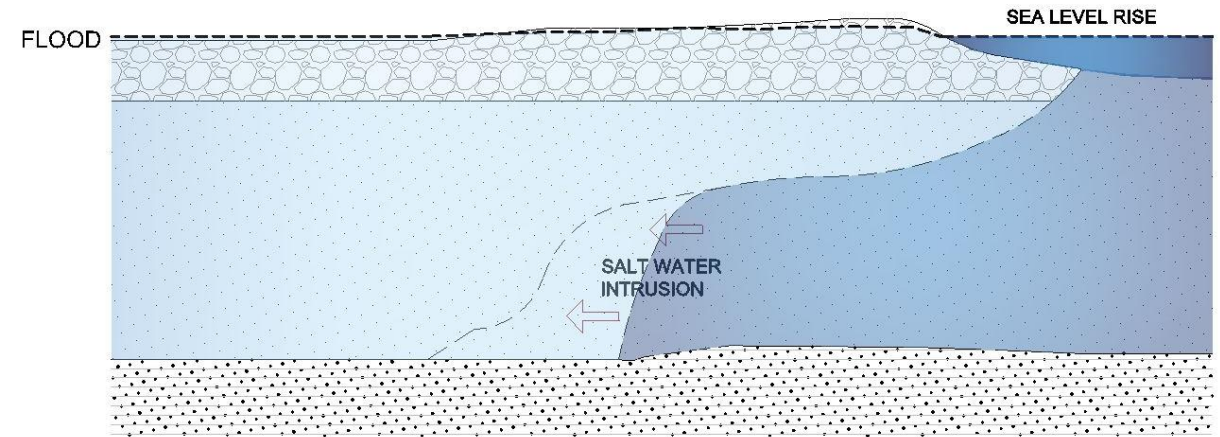


Diagram 11. Miami Dade County water table behavior during high tides / future sea level rise scenario. Source: author.

PRESENT AND FUTURE SCENARIO

The consequences of sea level rise doesn't necessarily constitute a problem to be seen in the near future (diagram 11). They are already happening during high tides season, when water returns to the surface via drainage pipes. Moreover, it has been estimated that sea level will rise 0.61 m by the year 2060 (Sukop, M, p. 1687).

On the other hand, the amount of precipitations is also prognosticated to keep growing. In fact, there was a 10% intensification of rainfall in the year 2016 (Sukop, M, p. 1687). An even more saturated water table in subsequent years in combination with the increase of heavy rainfall events will only provoke more severe floods in the near future.

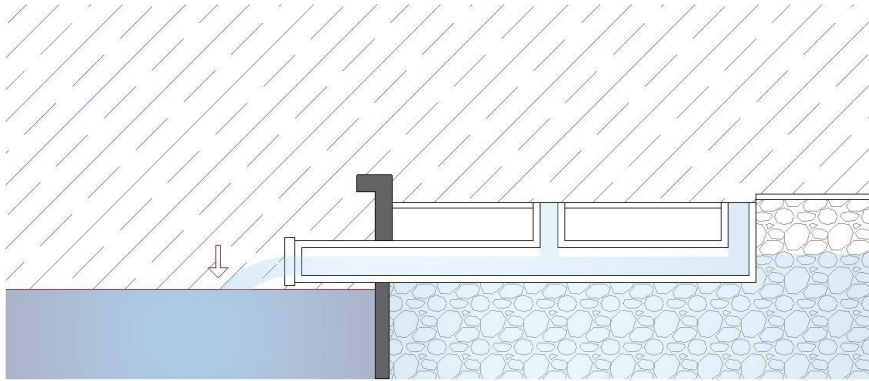


Diagram 13. Miami Dade County drainage system type: network of underground pipes that discharge the rainwater to the Biscayne Bay and water basins .
Source: author.

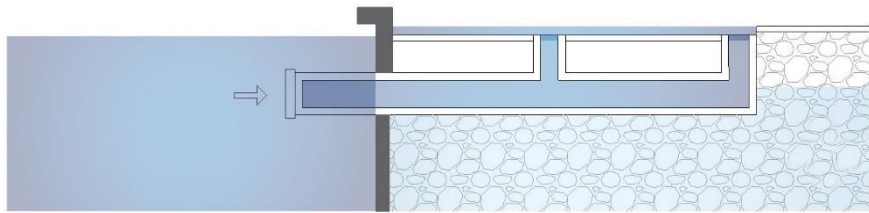


Diagram 14. Sunny day flooding due to high tides on the Biscayne Bay area (sea level rise).
Source: author.

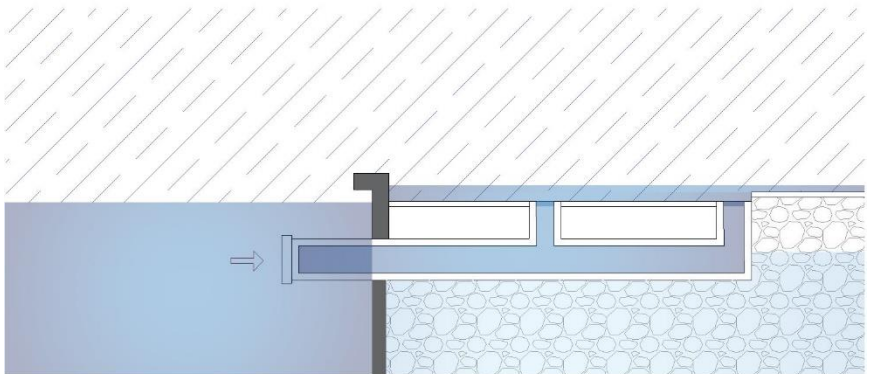


Diagram 15. Flooding during high tides on the Biscayne bay area, accompanied by heavy rainfalls.
Source: author.

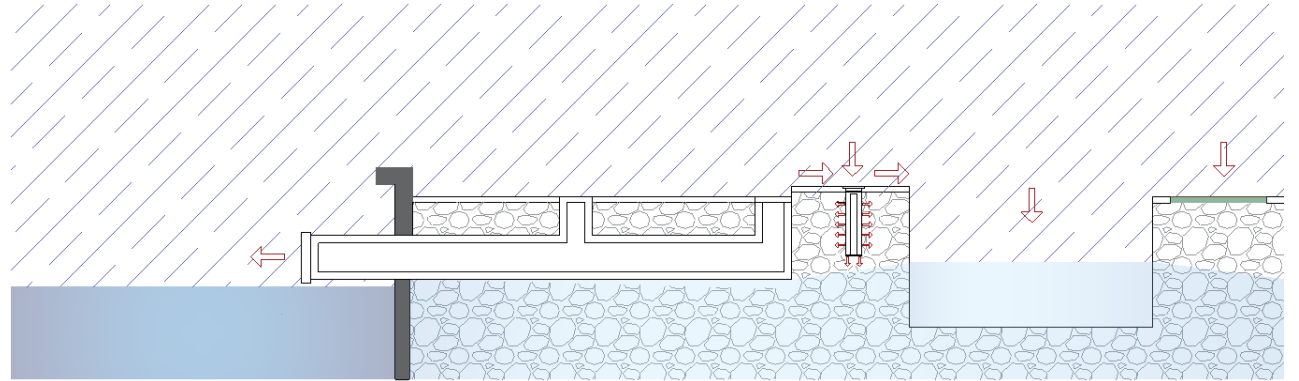


Diagram 12. Types of drainage systems in the Miami Dade County. Source: author.

TYPES OF DRAINAGE SYSTEMS IN THE MIAMI DADE COUNTY

There are 4 types of drainage systems in the Miami Dade County (diagram 12):

- A network of underground pipes that discharge the rainwater to the Biscayne Bay and water basins (diagram 13).
- A system of unconfined canals that percolate the rainwater into the Biscayne Aquifer.
- A system of inlets and pipes that infiltrate the water directly into the Biscayne Aquifer.
- Through natural or artificial pervious surfaces slower into the Biscayne aquifer.

As sea level rises, the system of pipes that discharge the water into the bay is increasingly collapsing during high tides, when the water levels on the bay surpass the heights of the pipes (diagram 14). This situation happens even in sunny days, without the presence of rainfalls and its known as sunny day flooding. When the tides are high and there are heavy rainfalls the floods become even worse (diagram 15).

This situation also applies to the pipes that discharge the rainwater into the system of canals behind the salinity controls structures when the tides are high (Since the ground water is kept higher than the salt water).

DRAINAGE SYSTEM IN HIALEAH AND MIAMI SPRINGS (INLAND NEIGHBORHOODS)

The drainage systems in Hialeah and Miami Springs consist in inlets and pipes that discharge the rainwater directly into the groundwater (images 16, 17 & 18). When the water table is high the system collapses and the water returns through the pipes into the surface. This is the result of the combination of the depletion of natural buffer zones, the increase of impervious surfaces and runoff and the need to keep an elevated water table to fight salt water intrusion.

Decades ago, when both Hialeah and Miami Springs were perimeter cities and urban sprawl was moderate the system worked because of the vast surrounding natural permeable areas. Nowadays, the saturated groundwater aquifer don't provide room to storage water in the area between the surface and the water table. Hence, the system collapses. The city of Hialeah have taken measurements like the installation of check valves: however during extended periods of rain, the solution only provides a temporary solution.



Image 16, 17 & 18. Drainage system of inlets and pipes in Hialeah. Source: Michael Sukop.

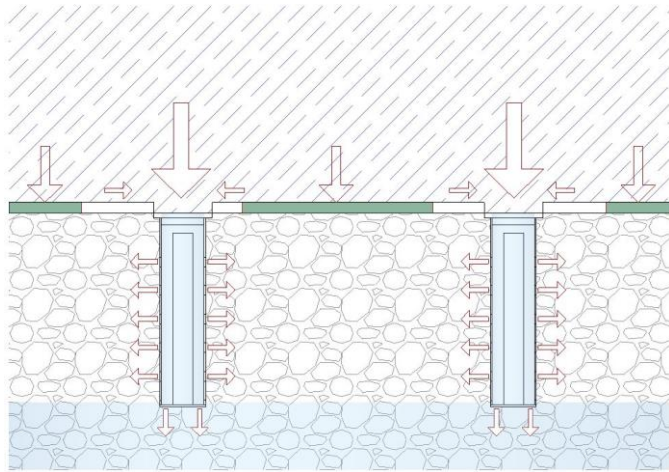


Diagram 16. Hialeah and Miami Springs drainage system of inlets and pipes. Rainwater is directly discharged into the groundwater system (Biscayne aquifer) Source: author.

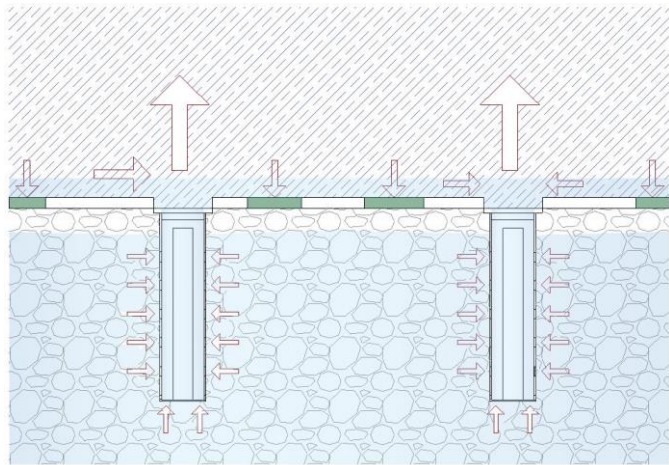


Diagram 17. Collapse of Hialeah and Miami Springs drainage system of inlets and pipes during heavy rainfalls. Source: author.

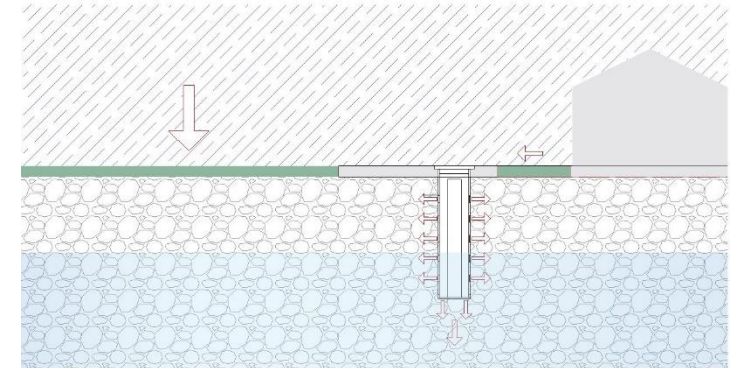


Diagram 18. Hialeah and Miami Springs drainage system of inlets and pipes around 1.950. Both cities were located adjacent to the Everglades. Source: author.

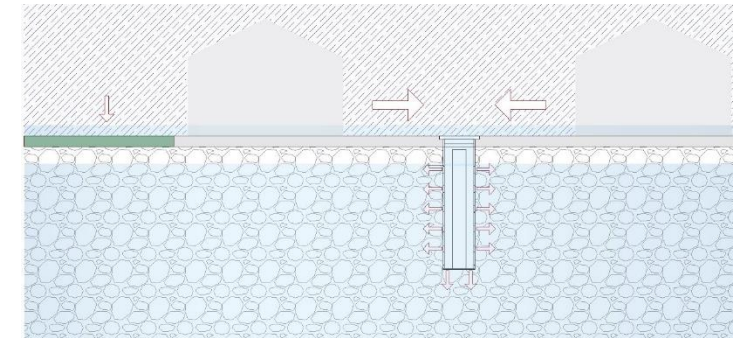


Diagram 19. Hialeah and Miami Springs drainage system of inlets and pipes nowadays. Both cities are trapped in the urban tissue. Source: author.

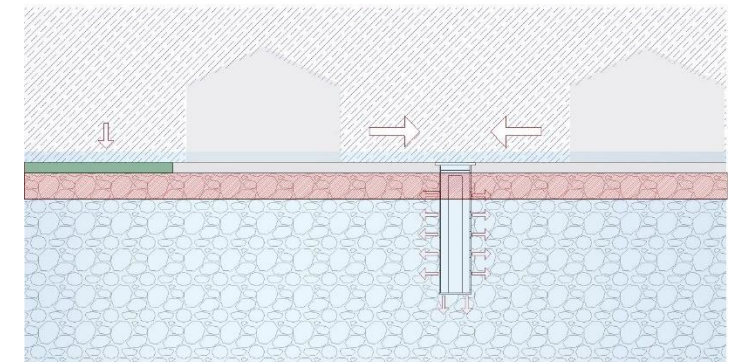


Diagram 20. collapse of grey drainage systems of Hialeah and Miami Springs due to a saturated subsoil. Source: author.

CONCLUSIONS

The high water table of the Biscayne aquifer and its potential rise due to natural or artificial circumstances related to sea level rise suggests that flood related to heavy rainfall events is a problem mostly related to the water table than to surface absorbency (Sukop, M, p. 1669). Within this scenario, it would become not only important the reduction of the amount of impervious surfaces and stormwater runoff capacities along the urban landscape, but also to provide buffer areas to detain and storage stormwater in order to avoid the saturation of the marginal space between the land surface and the water table.

In other words, to provide surface room for water. This strategy will not only delay the percolation of the water into the aquifer, but will also reduce runoff capacities. The latter is becoming more urgent since urban development is still ongoing and current water management grey infrastructure is becoming insufficient to drain the surplus of rainwater during the wet season due to its limited capacity.

In summary:

"The combination of rapid population growth and related development, the alteration of hydrological systems through building and channelization, and large amounts of annual precipitation associated with tropical and subtropical climate have made many local jurisdictions across the state vulnerable to repetitive flooding and flood damage."

Samuel Brody et al.

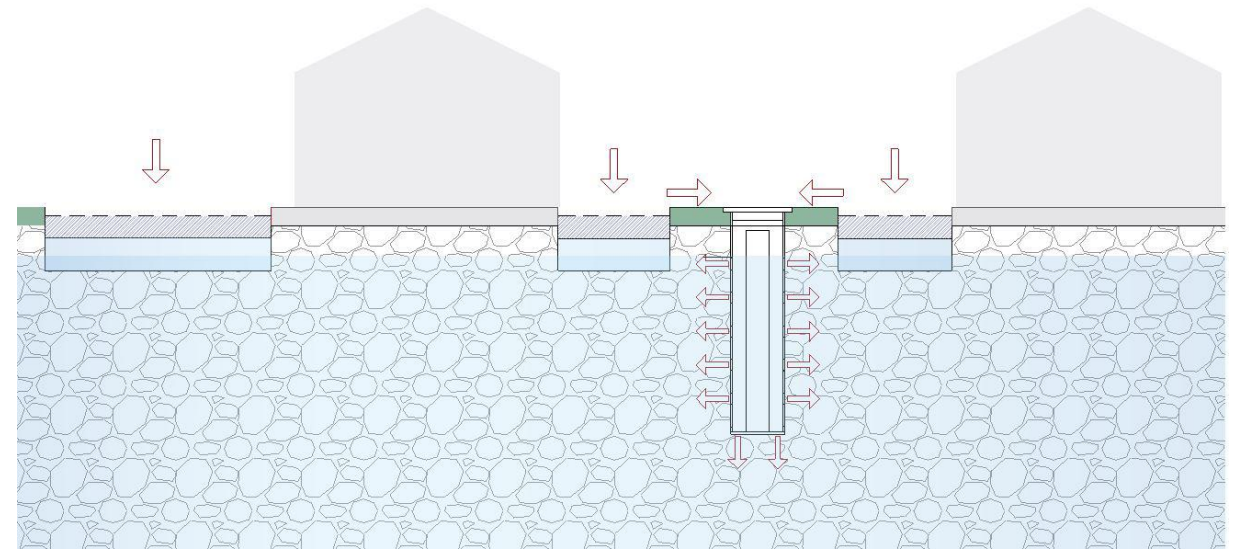


Diagram 21. Hydrogeological conclusions and design principles for the new water strategy. Source: author.

DESIGN PRINCIPLES FOR THE OVERALL APPROACH

From the conclusions of the hydrogeological site analysis 3 design principles for the water strategy were extracted (diagram 21):

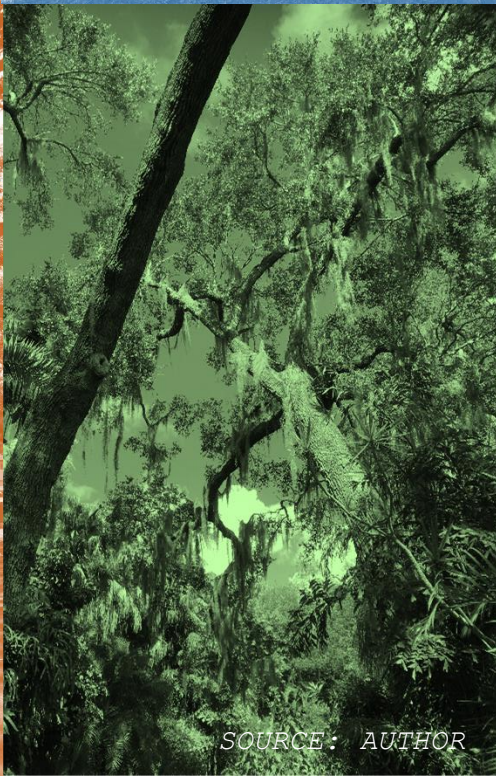
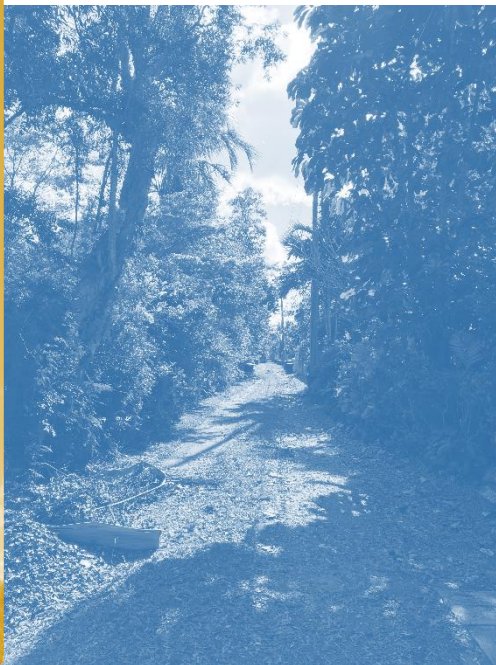
- The creation of public green and blue areas surface areas to provide room for water.
- The new blue infrastructure will be connected to the water management system of canals.
- The new blue infrastructure will be connected to the water table in order to:

An educational design principle related to the social and socio-ecological strategy is also extracted:

- Reveal the flood dynamic the public:
 1. To raise awareness to the people.
 2. To activate local adaptive strategies.
 3. To recognize the current regenerative actions and expand its scope in an evolutionary adaptation process.

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V. SITE ANALYSIS

- General features of Hialeah & Miami Springs
- Urban fabric
- Land use analysis
- Public transit infrastructures
- Green infrastructure analysis
- Blue infrastructure analysis
- Transformable & non-transformable infrastructures
- Site analysis conclusions Hialeah
- Site analysis conclusions Miami Springs



HIALEAH AND MIAMI SPRINGS GENERAL FEATURES

Hialeah and Miami Springs are two inland adjacent cities of the Miami Dade County, divided by the Miami Canal. Around 90% of the inhabitants of both cities are of Latin American origins or have a Latin background. The socio economic characteristics of the inhabitants of each city are different. Property value and household incomes in Miami Springs almost double the ones from those living in Hialeah (charts 3 & 4). The median property value in Miami Springs is 340.000 dollars, vs. a 175.000 dollars average property value in Hialeah.



Images 19 & 20. Main entrance to Miami Springs through the main commercial strip. Source: author.

Image 21. Main entrance to the city of Hialeah, adjacent to the downtown area. Source: author.



Chart 3. Miami Springs median household income and property value. Source: <https://datausa.io/profile/geo/hialeah-fl/?compare=miami-springs-fl>

NUMBER OF INHABITANTS AND CITY DIMENSIONS

The population size and physical dimension of both cities is also very different. Miami Springs has only 14.453 inhabitants, vs. 237,523 inhabitants in Hialeah. Part of the reason for this was the massive exodus from Cuba during the decades of the 60's & 70's, which led to a vast horizontal expansion of Hialeah towards the north and west. On the other hand, Miami Springs was bounded by the airport to the south and two canals to the north and west. Therefore, the latter followed, the original master plan for urban growth. The city of Hialeah grew in a more disorganized way (Michael Sukop interview).



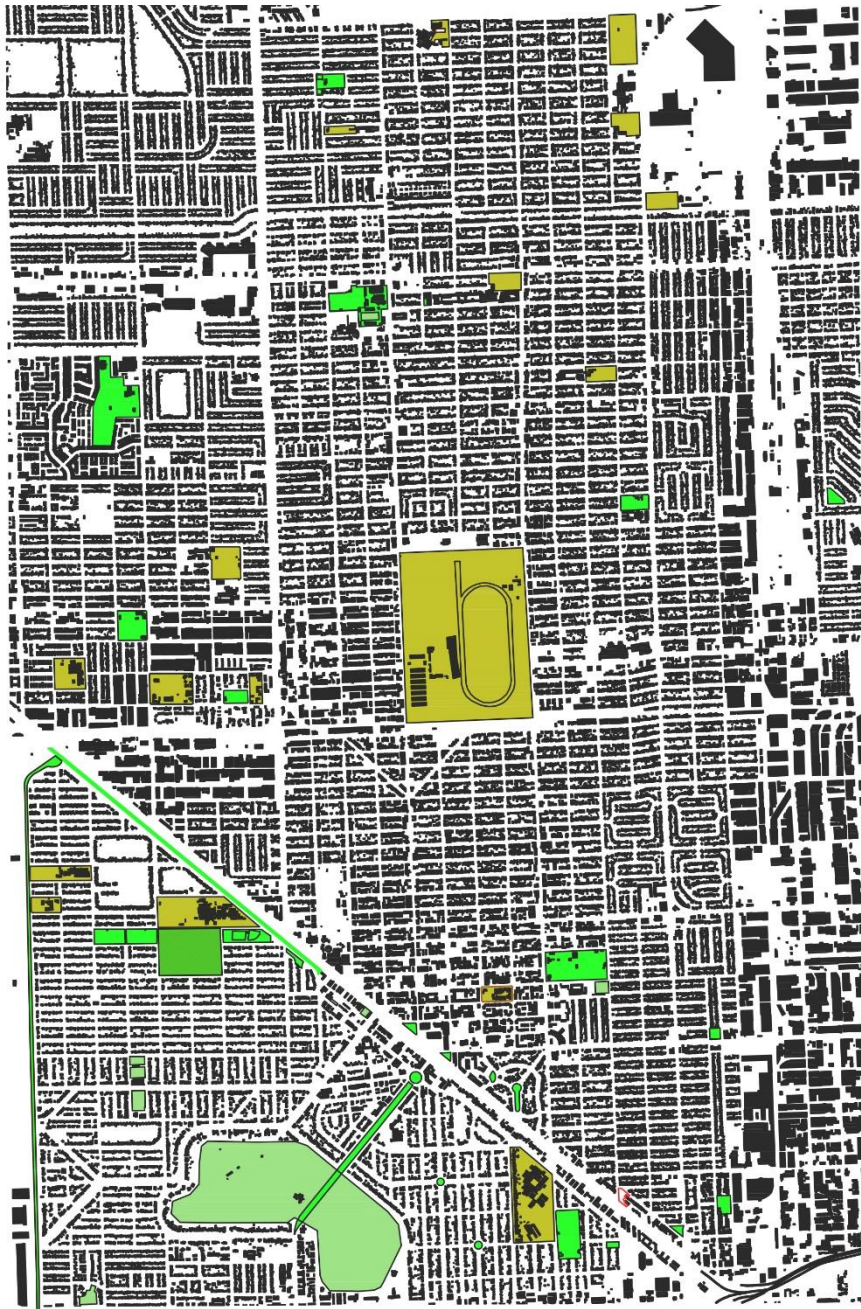
Chart 4. Hialeah median household income and property value. Source: <https://datausa.io/profile/geo/hialeah-fl/?compare=miami-springs-fl>

MIAMI SPRINGS POPULATION

Miami Springs initial population was mainly composed of English speaking White Americans. Therefore, the spatial qualities of the city resemble a typical all American town (images 19 & 20). This trend changed through the years and the city became a hot spot for Latin American locals and immigrants with medium high to high income.

HIALEAH'S POPULATION

After the Cuban revolution of 1.959, Hialeah became the middle class neighborhood for Cuban immigrants that left the island in search of a better future. The massive Latin American immigration had a moderate impact on the physical qualities and architectonic style of the city in the earlier decades (image 21) Throughout the years, it has maintained a high Cuban and Cuban descendant population; however, nowadays is home for immigrants of many different Latin American Countries.



Map 16. Urban fabric map of Hialeah and Miami Springs. Source: author

URBAN FABRIC OF HIALEAH AND MIAAMI SPRINGS

The urban fabric of the cities of Hialeah & Miami Springs is shaped mostly by private and public buildings and open private, semiprivate and public spaces (map 16). It consists mainly in horizontal constructions distributed in orthogonal city blocks. Downtown Hialeah and the southern strip of blocks of Miami Springs are composed by medium density buildings (6 to eight stories of height). There are also some new vertical redevelopments on the east side of city of Hialeah.

HIALEAH'S BLOCK STRUCTURE

The typical city block of Hialeah has an average area of 2 hectares. It consists on a rectangular of 200 m x 100 m. The access to the dwellings are on the 200 m sides, which are usually adjacent to major or more transited roads (diagram 22). Few of them have central alleys, and when they do, these alleys are of 1,50 m to 2,50 m wide (image 22).

MIAMI SPRINGS'S BLOCK STRUCTURE

The typical city block of Miami Springs's have the same characteristics of the Hialeah block, with the difference that they are divided on the shorter side of the block (100 m) by back service alleys (diagram 23). These service alleys belong to public space and reach from 4 to 8 m wide (image 23).



Images 22 & 23. Central block alleys in Hialeah and Miami Springs, respectively. Source: author.

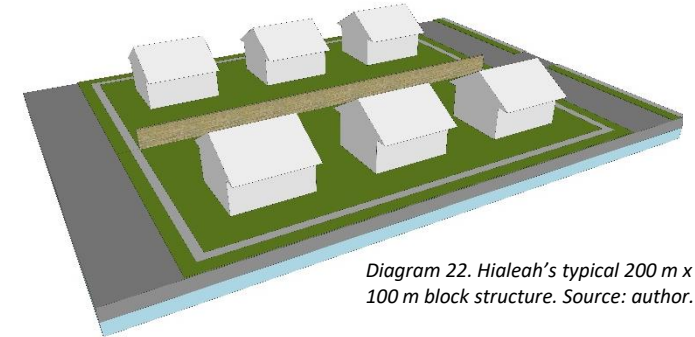


Diagram 22. Hialeah's typical 200 m x 100 m block structure. Source: author.

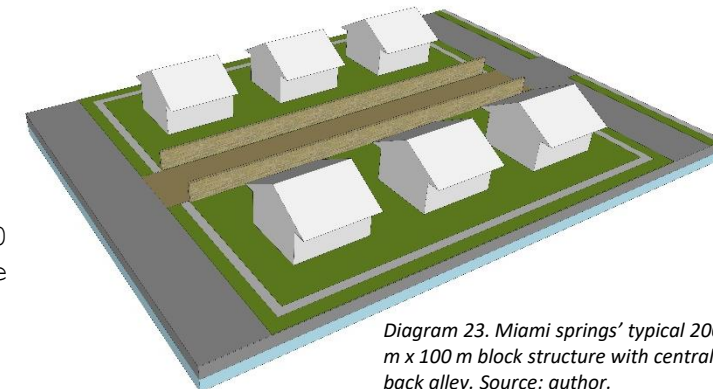
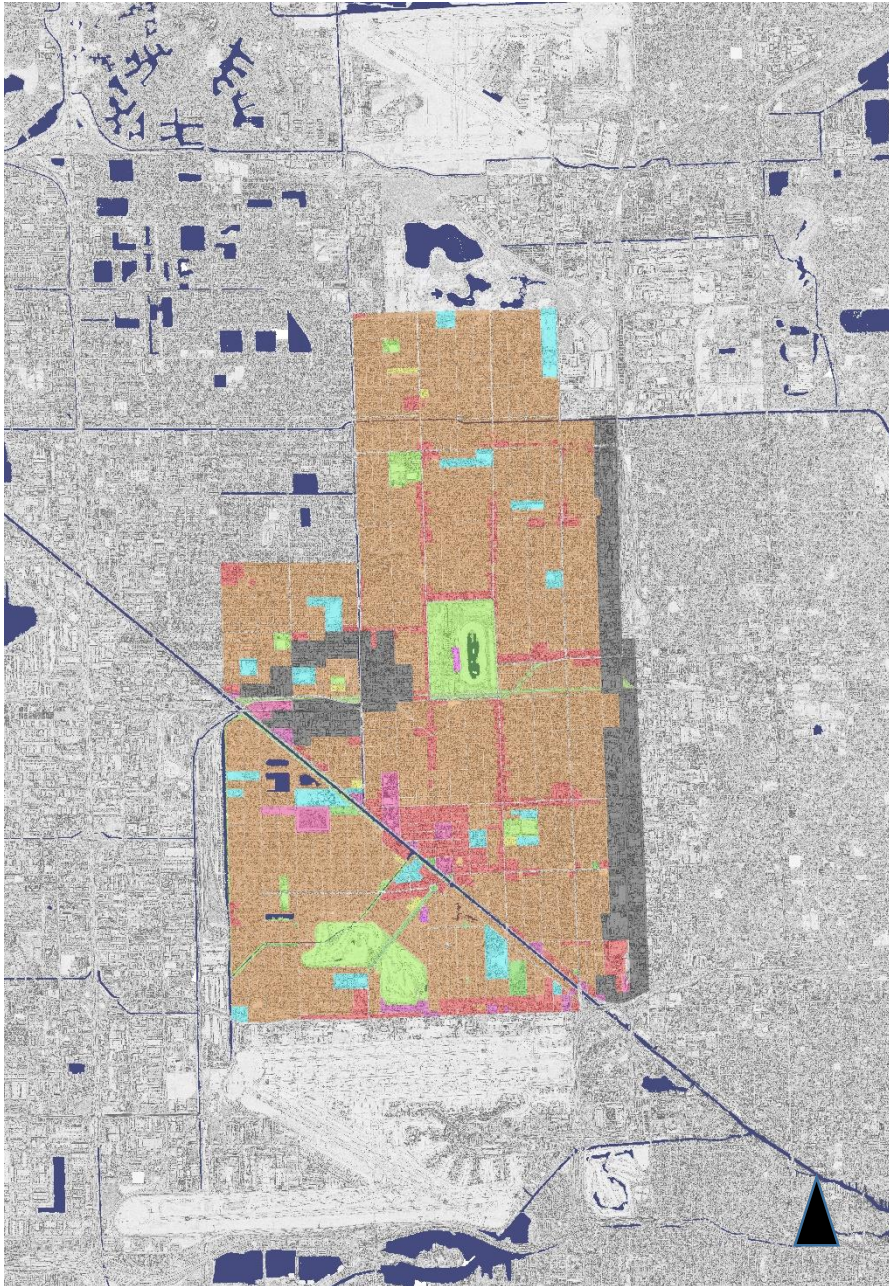


Diagram 23. Miami springs' typical 200 m x 100 m block structure with central back alley. Source: author.



Map 17. Land use map of Hialeah and Miami Springs. Source: author

FREE STANDING BUILT FORM ANALYSIS

LAND USE MAP

CITY OF HIALEAH

In terms of program or land use (map 17), the cities of Hialeah and Miami Springs are mainly divided into:

- Residential areas
- Educational buildings
- Religious buildings
- Community centers
- Government buildings (image 24)
- Cultural buildings
- Recreation public and private spaces: clubs and parks (image 25)
- Commercial areas (image 26)
- Sports facilities
- Hotels

The city of Hialeah has two industrial areas and several service oriented buildings throughout the neighborhood (malls, gas stations, business plazas, car shops, among others). It also has an elevated number of small hotels and motels.



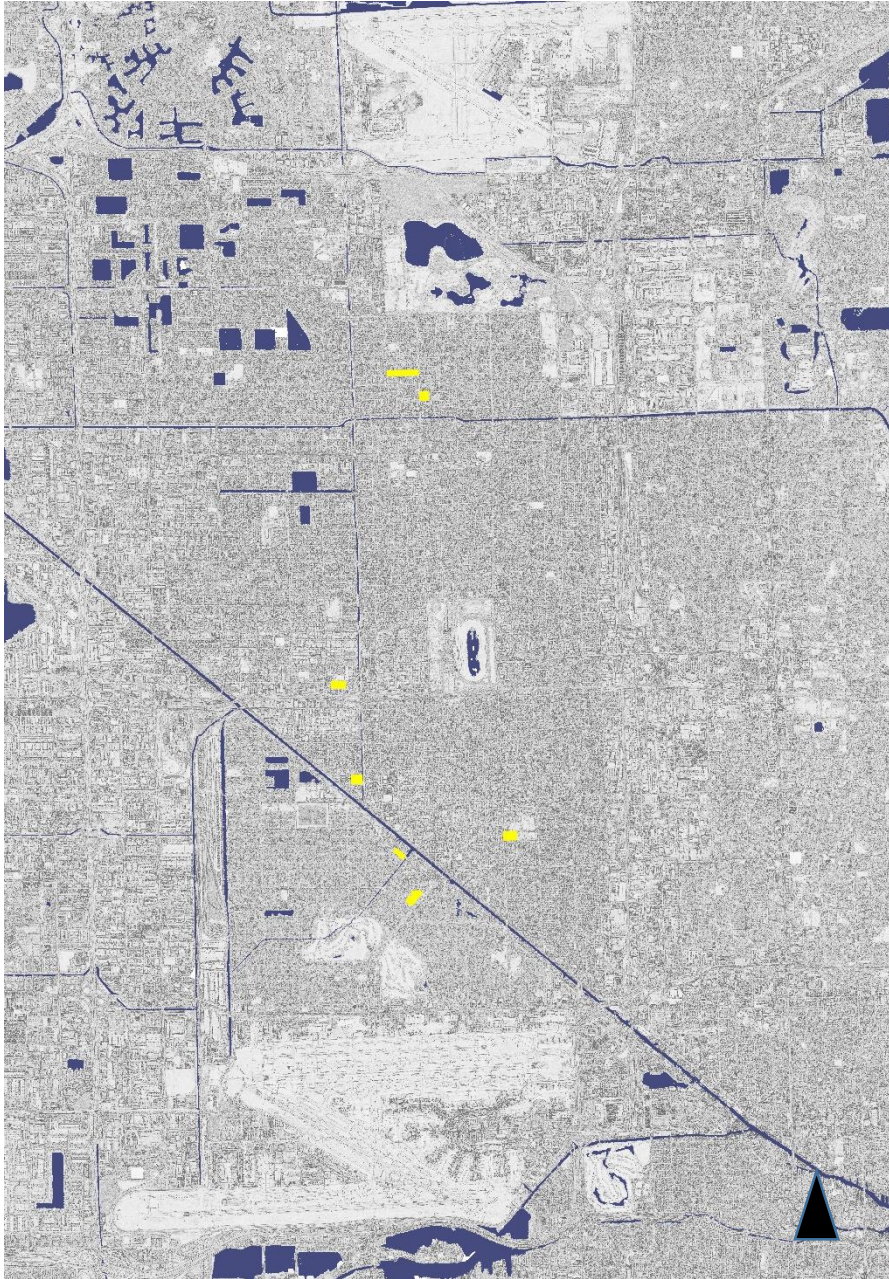
Image 24. Government buildings in Hialeah.
Source: author.



Image 25. Linear park Miami Springs.
Source: author.



Image 26. Pedestrian boulevard in Miami Springs commercial area. Source: author.



Map 18. Religious buildings in Hialeah and Miami Springs. Source: author

RELIGIOUS AND EDUCATIONAL PRIVATE FACILITIES

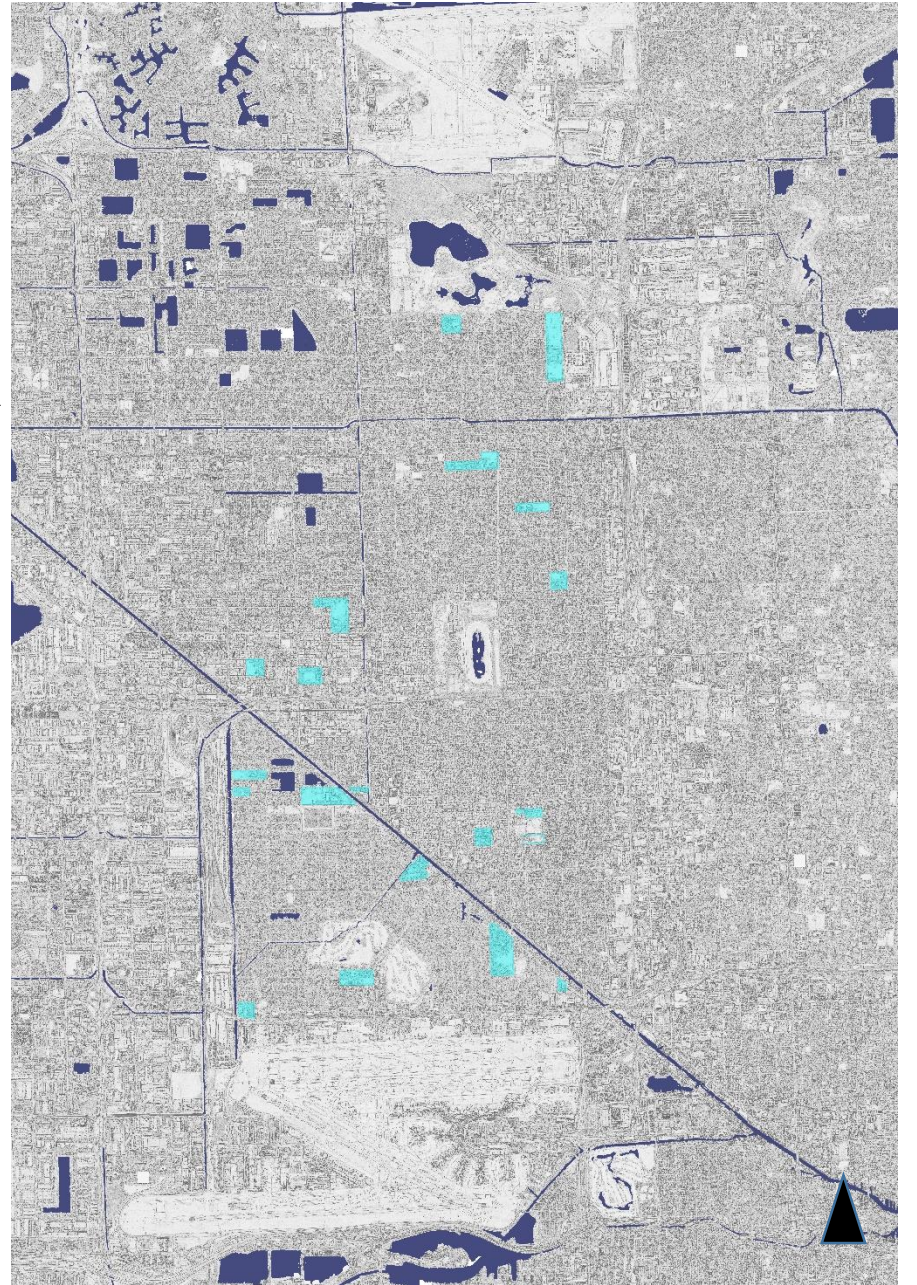
There are sufficient religious and educational buildings in both cities. Several churches and educational facilities include green private areas (images 27 & 28). Elementary schools and high schools are well equipped with open green space and some of them include sports facilities.



Image 27. Educational facility in Hialeah. Source: author.



Image 28. Church in Miami Springs. Source: author.



Map 19. Educational buildings in Hialeah and Miami Springs. Source: author

HIALEAH AND MIAMI SPRINGS COMMERCIAL AREAS

Miami Springs has a small, but very picturesque and vibrant commercial district, with a pedestrian boulevard located on the center of the main commercial street (image 29). Hialeah's downtown, despite of having acceptable spatial conditions, is amore car oriented district due to the unattractive pedestrian connections and wide vehicular avenues (image 30). Moreover, there is a commercial strip east to Hialeah's Downtown with very poor spatial qualities. (image31)

In both Hialeah and Miami Springs, besides a few restaurants and coffee shops, there are no commercial facilities that promote social interaction like cinemas, theaters, museums or any privately owned spaces for cultural and recreational activities.



Image 29. Commercial area in Downtown Miami Springs. Source: author.



Image 30. Commercial area in Downtown Hialeah. Source: author.

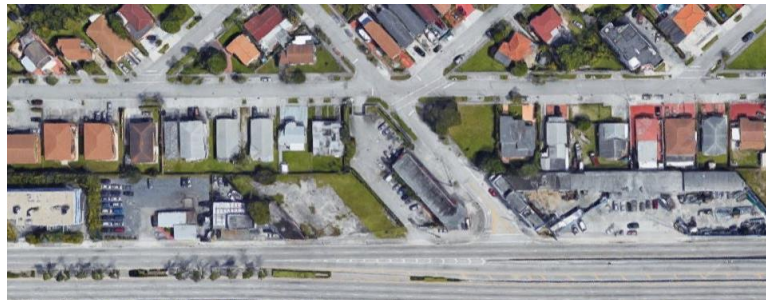
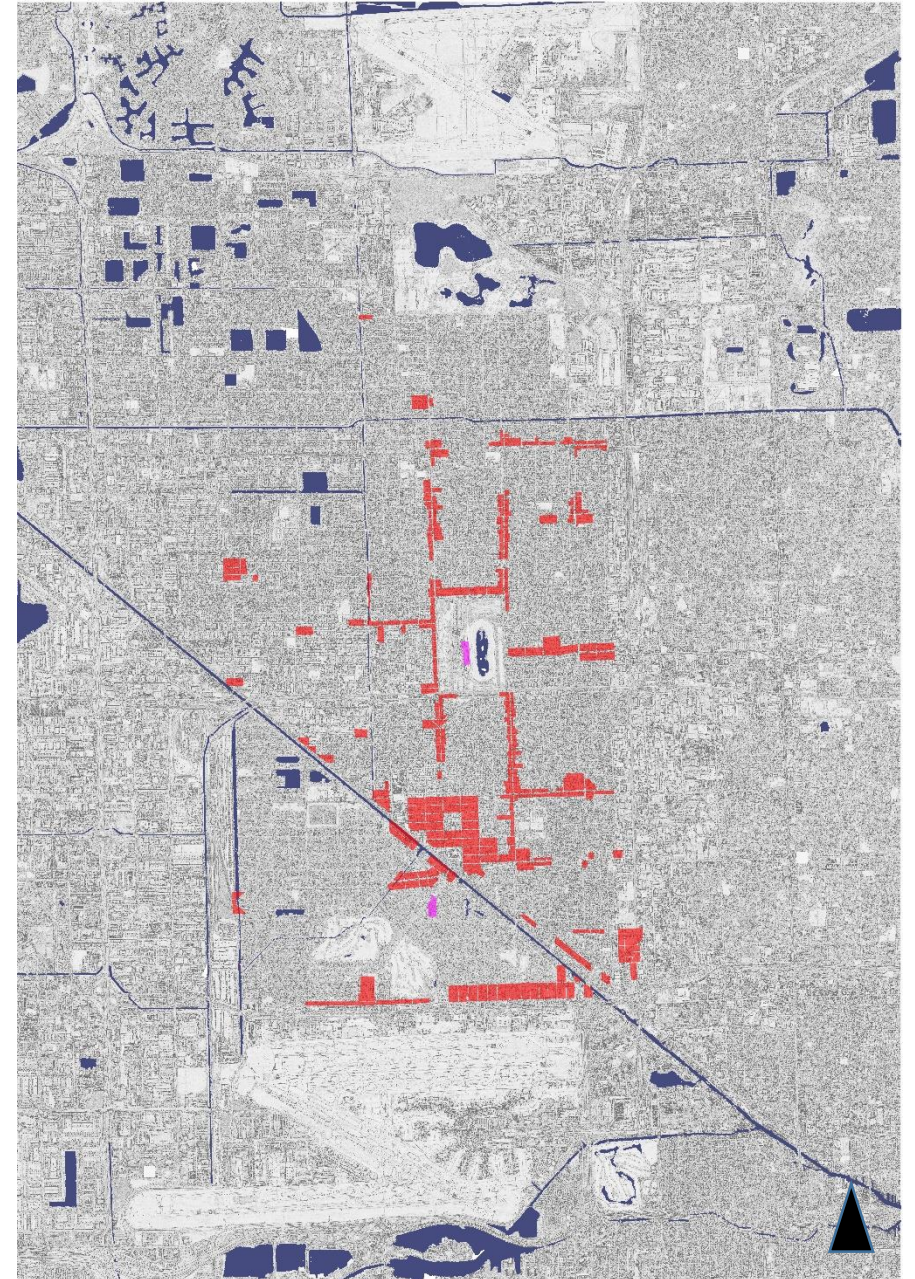


Image 31. Decayed commercial strip located on south Hialeah, adjacent to Okeechobee Rd. The commercial area is mainly composed of car mechanical facilities for automobiles and run-down small hotels and motels.. Source: Google maps.



Map 20. Commercial buildings in Hialeah and Miami Springs. Source: author

HIALEAH'S INDUSTRIAL AREAS

There are two industrial and manufacturing areas in the city of Hialeah. Both industrial complexes are surrounded by residential and commercial areas.

The west industrial complex covers an area of approximately 101 hectares and its located close to the Miami Canal. Currently, there are no municipal plans for redevelopment of the area in the short term.

The East Hialeah Industrial complex covers an area of approximately 203 hectares. It is a vertical strip that runs north to south, located on the east boundary of the city of Hialeah. It is comprised by small warehouses, with an average height of 4 m height (image 32). There are poor vehicular connections with the adjacent neighborhoods of West Little River and Gladeview to the west. There are current city plans to redevelop 48 hectares in the short term. There is also an integral master plan for the redevelopment of the whole east industrial area designed by the architectural and urban firm Plusurbia.

The two industrial areas have poor spatial and socio-ecological qualities (image 33). The train tracks transverse the west industrial complex from east to west and the east industrial zone from north to south (image 34).



Image 32. East industrial zone warehouses in Hialeah. Source: author.



Image 33. Spatial qualities of the east industrial area in Hialeah. Source: author.

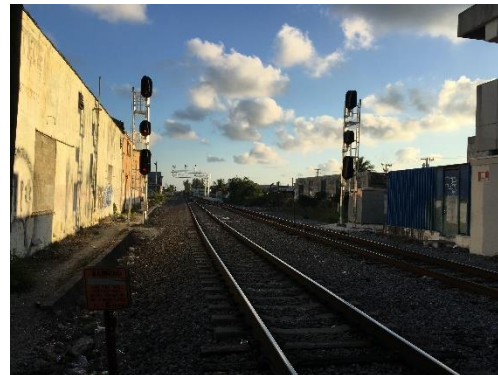
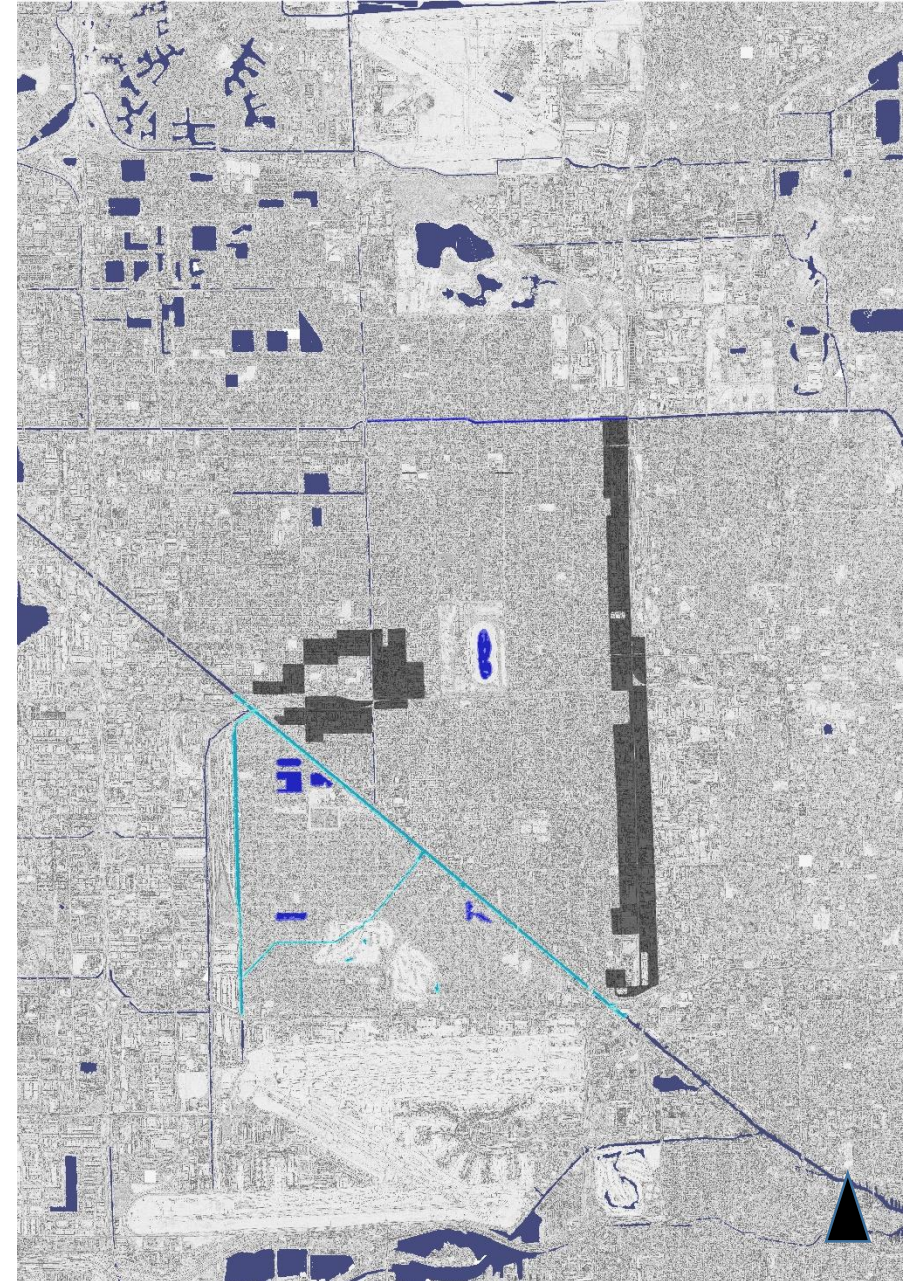


Image 34. Train tracks that pass through the east industrial zone in Hialeah. Source: author.



Map 21. Industrial areas in Hialeah. Source: author

PUBLIC SPACE: INFRASTRUCTURE ANALYSIS

PUBLIC TRAFFIC NETWORKS

The public vehicular traffic networks of Hialeah and Miami Springs are composed by:

- A system of major and secondary roads:
 1. The major vehicular arteries of Miami Springs are located adjacent to green and blue public infrastructures:

-NW 67th Ave. is connected with a linear park adjacent to a tributary of the Miami Canal.

-N Royal Poinciana Boulevard is connected to linear park adjacent to the Miami Canal

-Curtiss Parkway is located adjacent to the central linear park of the city.

Esplanade Drive is connected to the South Side Canal (the one that transverses the golf course).

2. The only major road connected to a blue infrastructure (Miami Canal) in Hialeah is Okeechobee Road. Okeechobee road constitutes an urban hard edge in terms of pedestrian connectivity between the city of Hialeah and the Miami canal and between the two cities.

- There are no highways that pass through the cities.
- A train and elevated metro rail systems that transverses through the central area of the city of Hialeah (images 35 & 37). The train constitute a hard pedestrian edge for pedestrians. The elevated metro rail is a softer edge for pedestrian, but clearly divides the public space through its massive structural system of concrete columns.
- There are no bicycle lanes in the cities and there is only one pedestrian boulevard in the city of Miami Springs.



Image 35. Elevated metro rail Hialeah. Source: author.

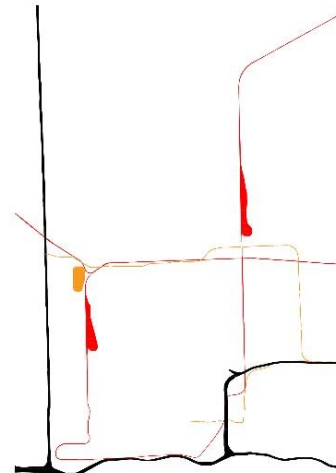
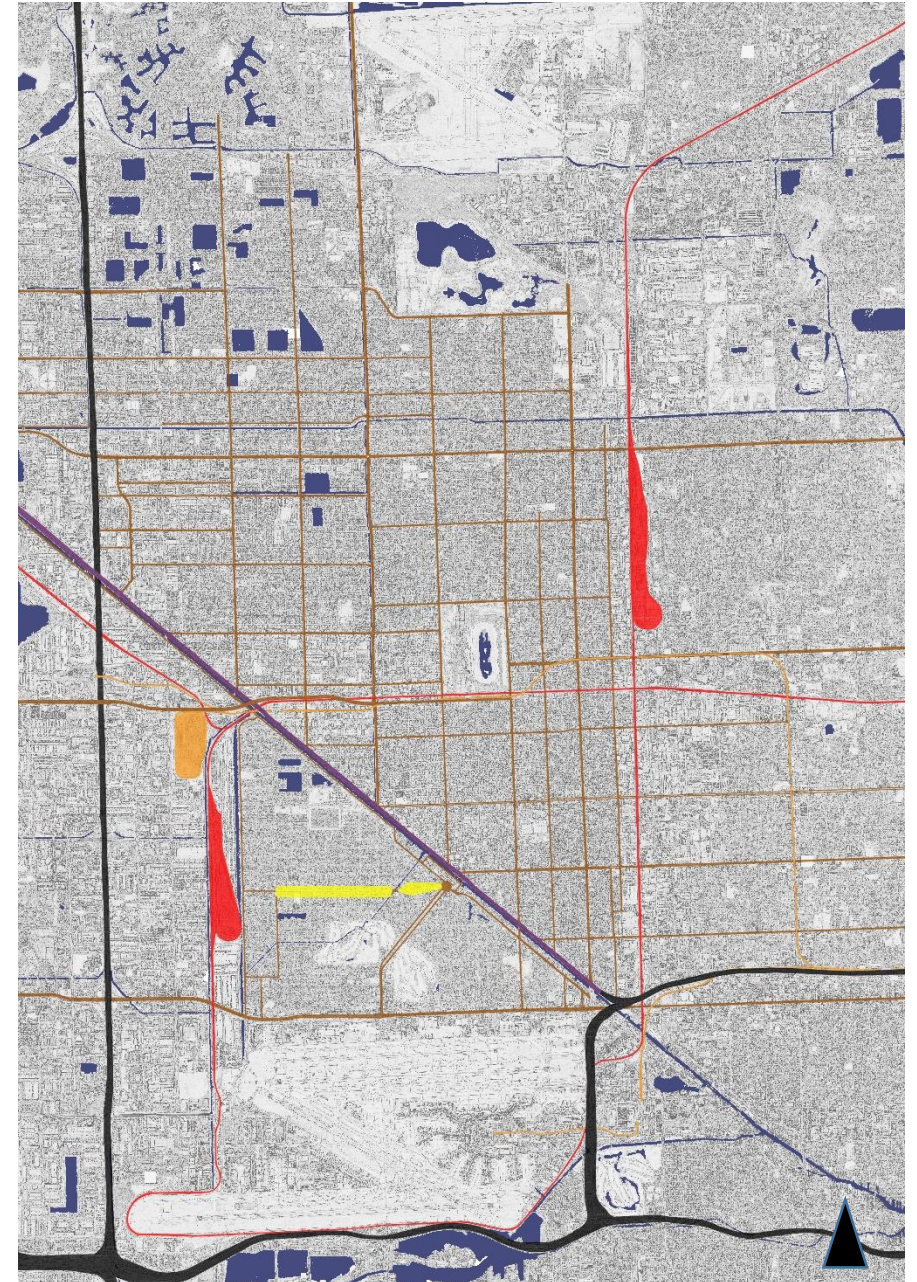


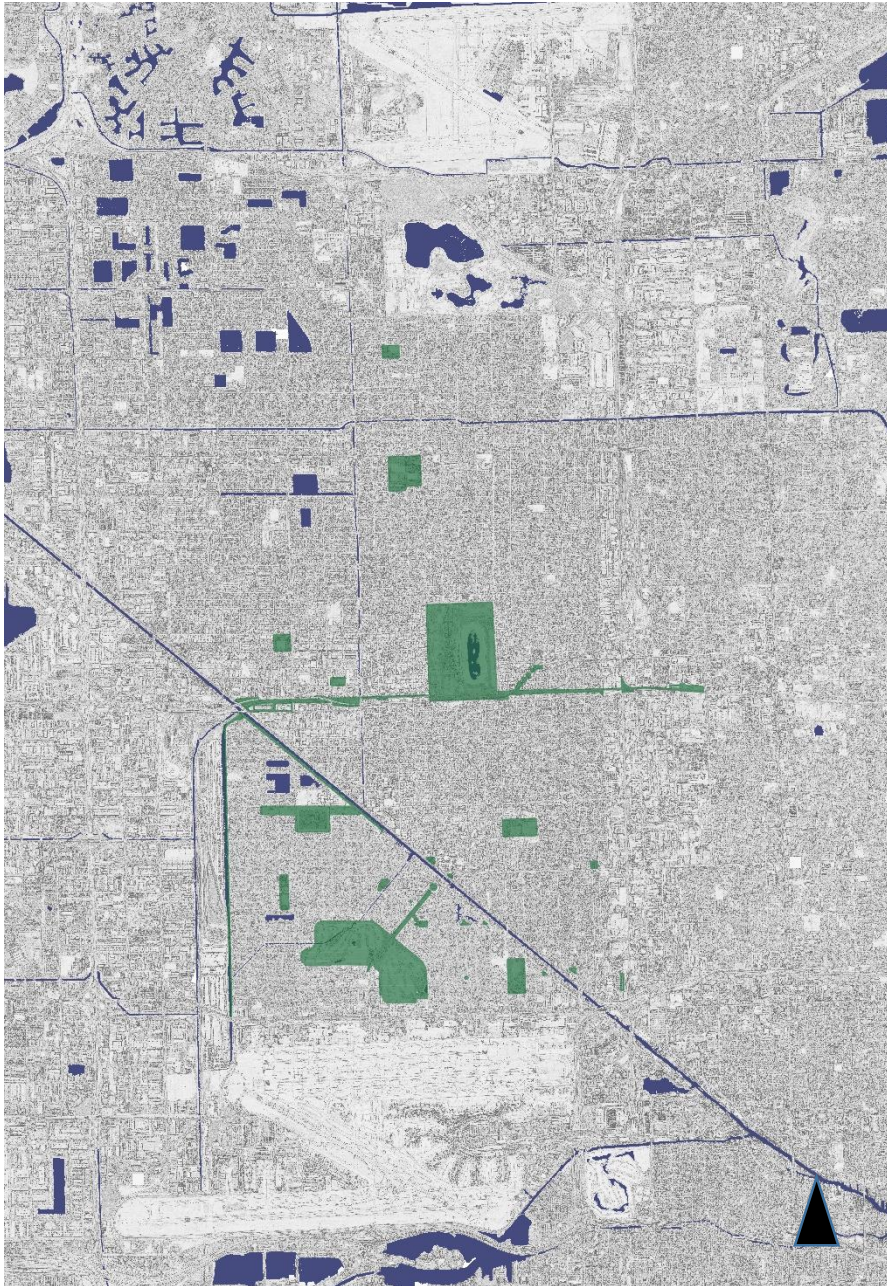
Image 36. Traffic physical hard edges. Source: author.



Image 37. Train tracks and buffer zone Hialeah. Source: author.



Map 22. Public Traffic networks in Hialeah and Miami Springs. Source: author



Map 23. Existing green infrastructure in Hialeah and Miami Springs. Source: author

GREEN INFRASTRUCTURE

The green infrastructure of Hialeah and Miami Springs is mainly composed of grassland and it's disconnected from the blue infrastructure, with the exception of two narrow linear parks adjacent to the Miami Canal and one its tributaries on the side of Miami Springs.

The following maps analyze the green infrastructure in terms of:

- Ownership
- Types of green areas
- Types of urban parks



Image 38. Wetlands in the center of the race tracks of Hialeah's equestrian club. Source: author.



Image 39. Roundabout in Miami Springs commercial area. Source: author.



Image 40. Central linear park Miami Springs. Source: author.

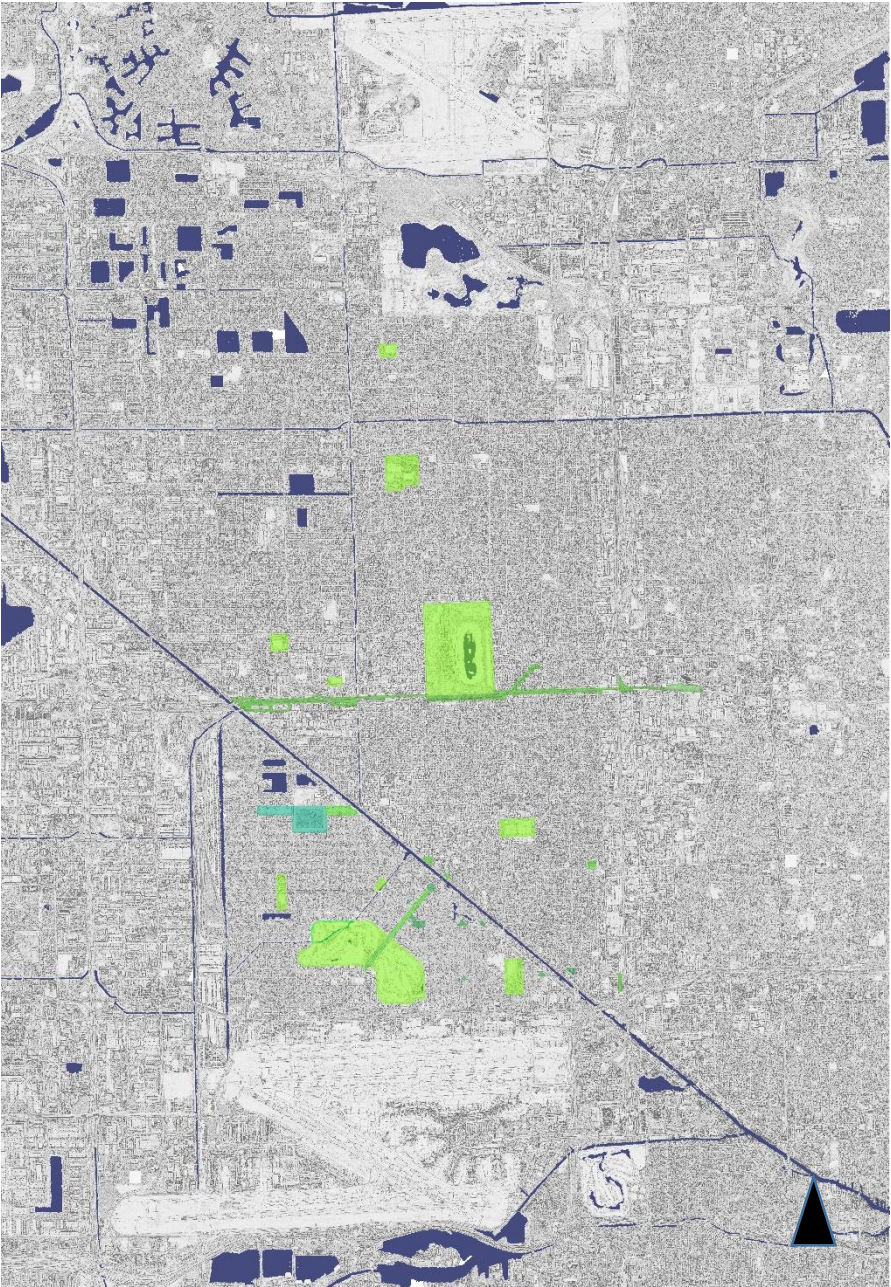


Image 41. Buffer water zone behind Walmart in Hialeah. Source: author.

GREEN INFRASTRUCTURE

TYPES OF PUBLIC SPACES

There is an alarming lack of public natural areas in the city of Hialeah. The public green infrastructure of the city is mostly unusable since it's composed by buffer zones adjacent to the train and metro rail (image 43 & 44). The rest are mostly either private parks (image 42) or fenced public sports facilities. The city of Miami Springs has a sufficient network of public natural areas that include canal linear parks, a central city park, pocket parks, dog's park and accessible public sports facilities (images 45 & 46).



Map 24. Types of green public spaces in Hialeah and Miami Springs. Source: author



Image 42. Semi public park (race track) in Hialeah. Source: author.



Image 43. Buffer zones adjacent to railroad tracks in Hialeah. Boundary between the east industrial complex and a residential strip. Poor maintenance Source: author.



Image 44. Grassland beneath elevated metro rail in Hialeah. Source: author.



Image 45. Fenced lot adjacent to the Miami Canal in Miami Springs. Source: author.

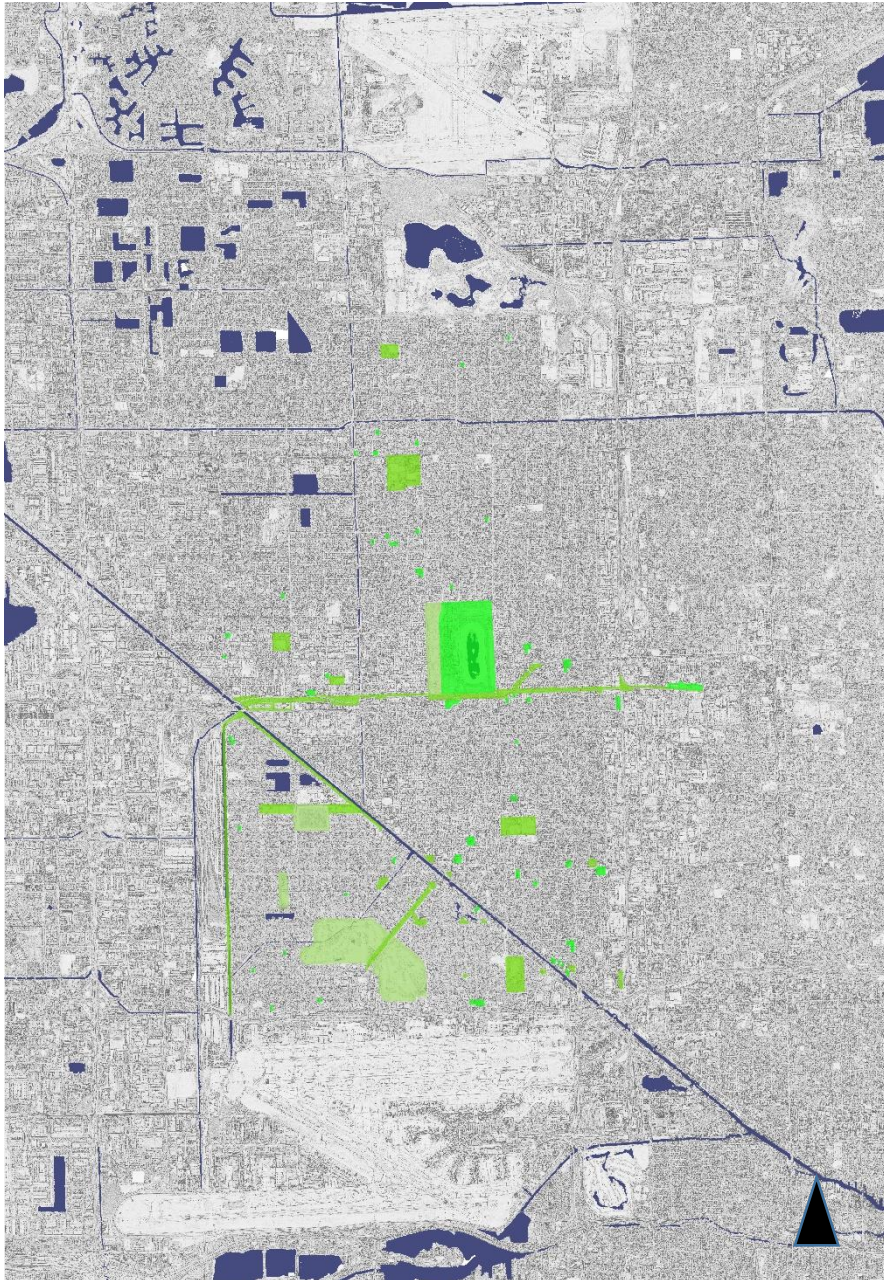


Image 46. Public space adjacent to the golf course of Miami Springs. Source: author.

GREEN INFRASTRUCTURE

OWNERSHIP OF GREEN AREAS

The biggest green area in Hialeah (equestrian club) is privately owned, however, some parts have public access (image 47). There is a considerable amount of empty private lots covered with grass in Hialeah. Unfortunately, most of them are in highly bad conditions in terms of maintenance (image 48). Most of the parks in Hialeah are fenced sports facilities to play baseball and other sports. Some of them are in bad conditions and have limited access to the public (image 49). On the other hand, Miami Springs has a system of public parks. The main park is connected to the semi public golf course of the city (image 50) and several public green areas, which don't qualify as pocket parks (image 51). There are few empty lots covered with grass, but they are in very good conditions and have trees in most cases (image 52).



Map 25. Ownership of green infrastructure in Hialeah and Miami Springs. Source: author



Image 47. Hialeah's equestrian club semi public space. Source: author.



Image 48. Empty private lot in Hialeah. Source: author.



Image 49. Fenced public sports facility (park) in Hialeah. Poor maintenance Source: author.



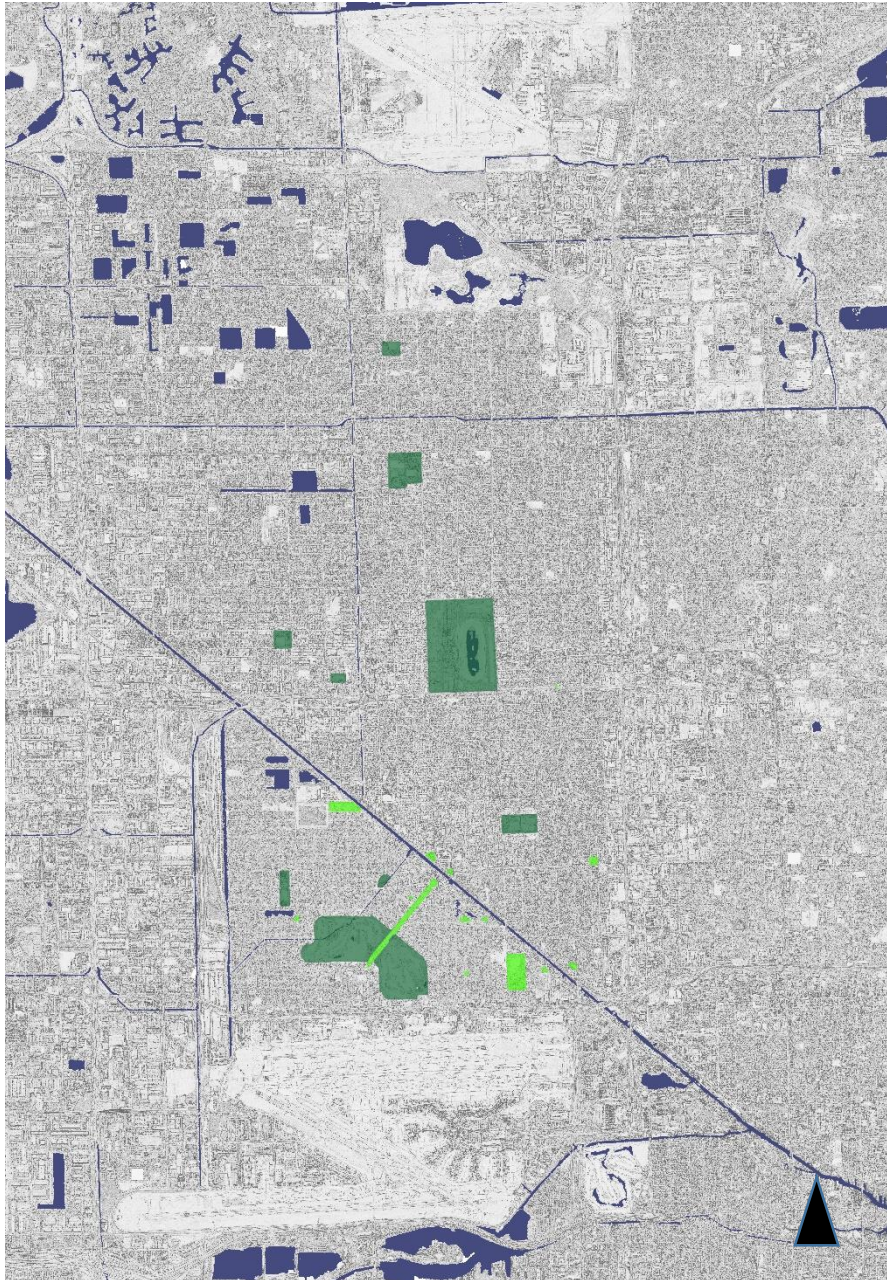
Image 50. Miami Springs golf course is a semi public space. Source: author.



Image 51. Miami Springs public grassland Source: author.



Image 52. Empty lot in Miami springs adjacent to the Miami Canal Source: author.



Map 26. Types of parks in Hialeah and Miami Springs. Source: author

GREEN INFRASTRUCTURE

PARKS IN HIALEAH

Even though listed as parks, most of Hialeah's park network consist in sports facilities with limited activities and time slots. The only true parks that promote outdoor living and social interaction besides playing sports are the Aviation Memorial Park (image 53) and two small pocket parks. Aviation Memorial Park has an area of 3.442 m2 and Hialeah Monument Park (one of the two pocket parks) has an area of 5.256 m2.

Therefore, the park network of Hialeah is quite reduced; moreover, there is a lack of arborized public areas in the city.

PARKS IN MIAMI SPRINGS

Miami Springs park network is comprised by a series of green public spaces with walkways and few tree species (image 54). Most of these public natural areas lack biodiversity. The green heart of the city is the golf course, which is mainly grassland (image 55).

The only parks connected to a water system are the canal linear parks on the side of Miami Springs; however, their vegetation is not properly maintained. Moreover, the canal park adjacent to the Miami Canal is fenced in some areas, which difficult public access.



Image 53. Aviation Memorial Park in downtown Hialeah Source: author.



Image 54. Miami Springs central park Source: author.



Image 55. Miami Springs golf course. Source: author.

BLUE INFRASTRUCTURE

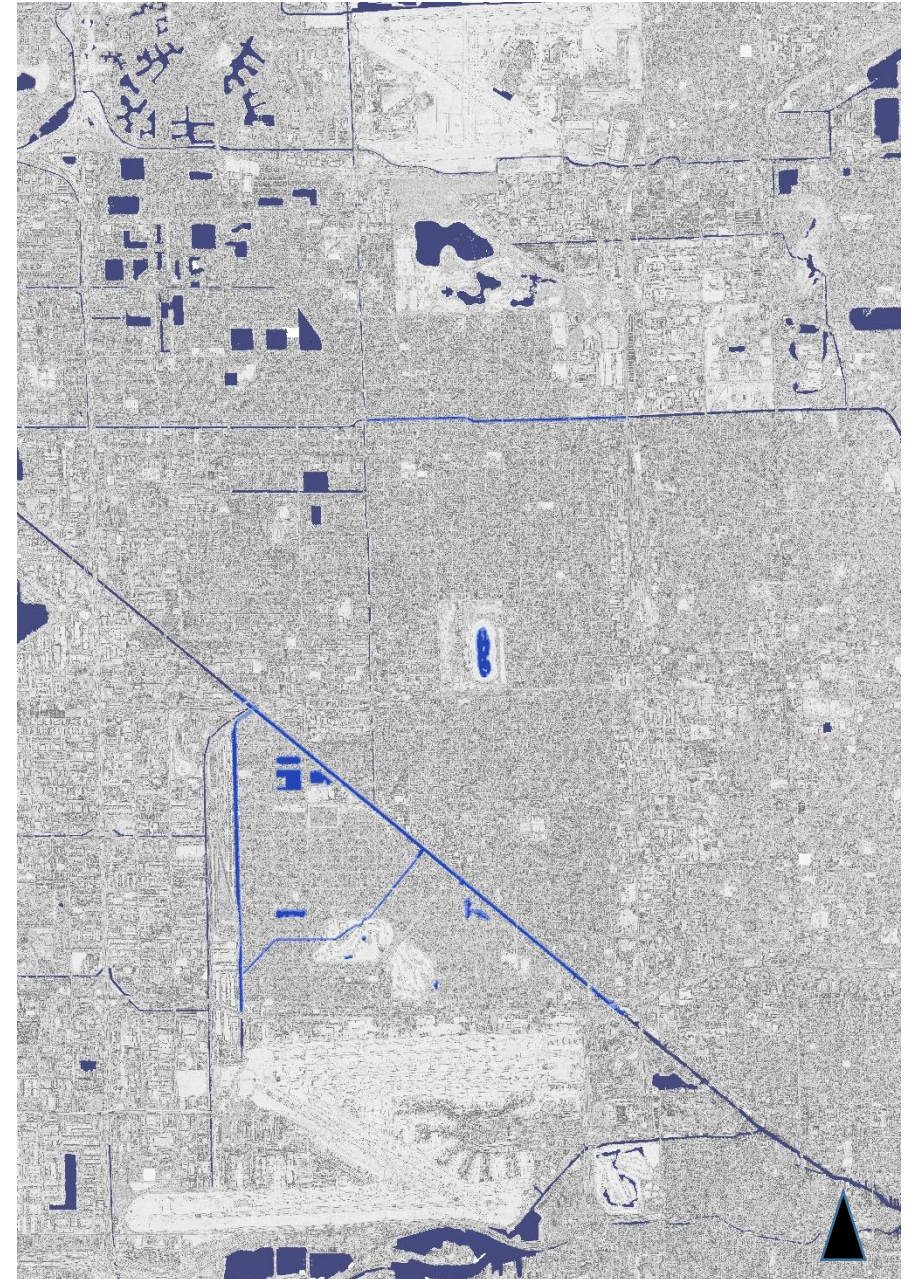
The blue infrastructure of Hialeah and Miami Springs consists on 5 canals that are part of the water management system of the Miami Dade County and a few lakes.

From those 5 canals, The Little River Canal and one of its tributaries are located in Hialeah and two tributaries of the Miami Canal are located in Miami Springs. The Miami Canal passes through both cities and it's the physical border between them (image 56).

With the exception of one, all of the lakes are located in Miami Springs. These bodies of water are connected to the water table and contribute to replenish the aquifer during rainfalls.



Image 56. The Miami Canal divides the cities of Hialeah and Miami Springs. It is connected to the secondary canals that transverse both cities. Source: Google maps.



Map 27. Blue Infrastructure of Hialeah and Miami Springs. Source: author

PUBLIC AND PRIVATE BLUE INFRASTRUCTURE

The Miami Canal and two of its tributaries (adjacent to NW 67th Ave. and the one that crosses the golf course) on the city of Miami Springs constitute the only two existing public blue infrastructures connected to green infrastructures in both cities. Moreover, they are the only two with pedestrian access for public use. Even though the little river canal on Hialeah is considered a blue public space, the only way to access it is by navigation since it adjoins with private property.

The pedestrian access to the Miami Canal from the side of Hialeah is very difficult because it is bordered by Okeechobee road, a 6 line high transited vehicular artery and the green infrastructure adjacent to the canal is not accessible for public use. From the Miami Springs side, the canal is bordered by private property and 2 narrow linear parks.

The rest of the blue infrastructure of both cities consist in a group of lakes that belong to enclosed residential complexes of Miami Springs and the one located in the private Hialeah Park: Racing and Casino. Therefore, great portion of the existing blue areas of Hialeah and Miami Springs are for private visual and recreational use only.



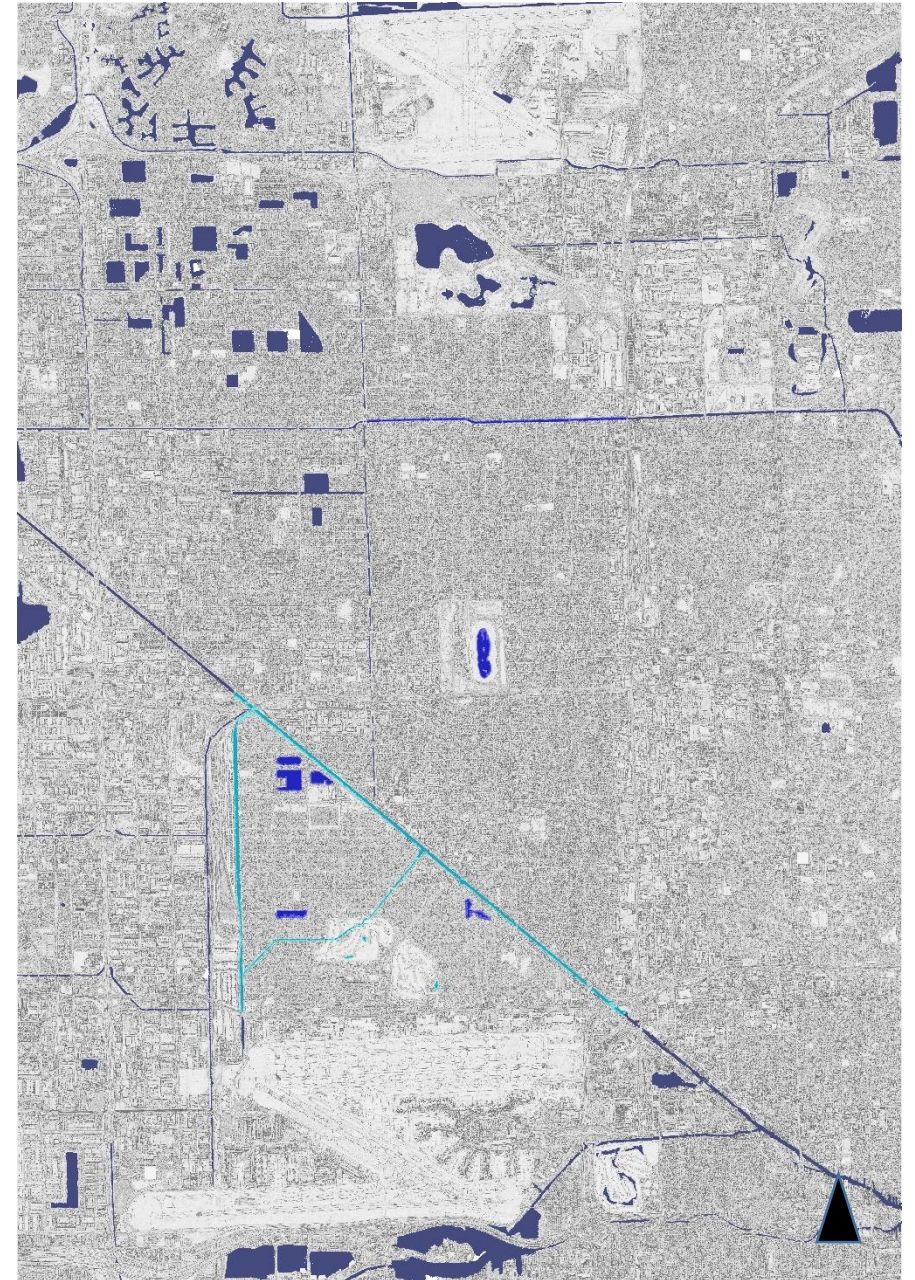
*Image 57. Miami Springs: empty private lot adjacent to the Miami Canal.
Source: author.*



*Image 58. Small wetland area in Hialeah's equestrian club (near to the clubhouse).
Source: author.*



*Image 59. Miami Canal. On the side of Hialeah is bordered by Okeechobee road and in Miami Springs is adjacent to a linear canal park.
Source: author.*



Map 28. Public and private blue infrastructure of Hialeah and Miami Springs. Source: author

TRANSFORMABLE AND NON TRANSFORMABLE INFRASTRUCTURES

Based on the site analysis, it can be concluded that regarding to public city infrastructures, these can be divided in transformable and non-transformable areas (map 29 & image 60).

In the case of Hialeah, minor secondary roads with lower traffic, as well as buffer zones for the train and elevated metro rail can be transformed into different types of spaces (map 31 & 32).

The vast green infrastructure of Miami Springs and a network of vehicular service alleys also offer potentials for transformation (maps 30 & 31).

Most of the blue infrastructure is non transformable since it is bounded by private property and it is also part of the Miami Dade water management system. Moreover, there is an urgent need to expand the blue system in both cities.



Map 29. Urban public infrastructures of Hialeah and Miami Springs. Source: author

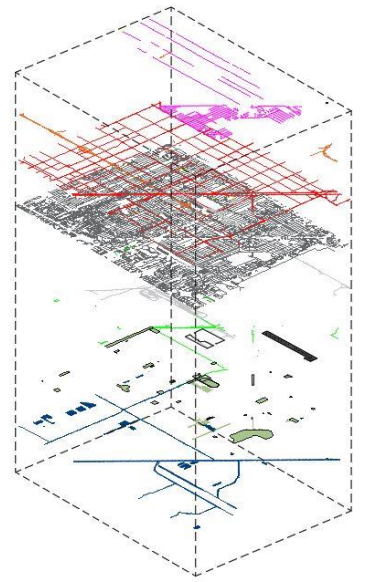
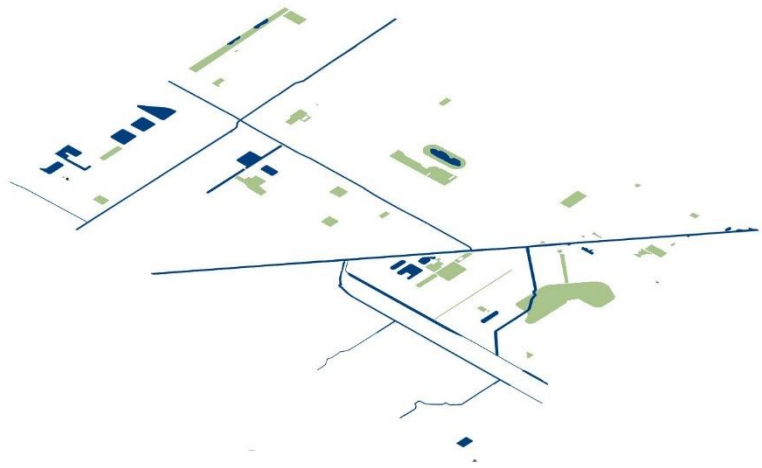
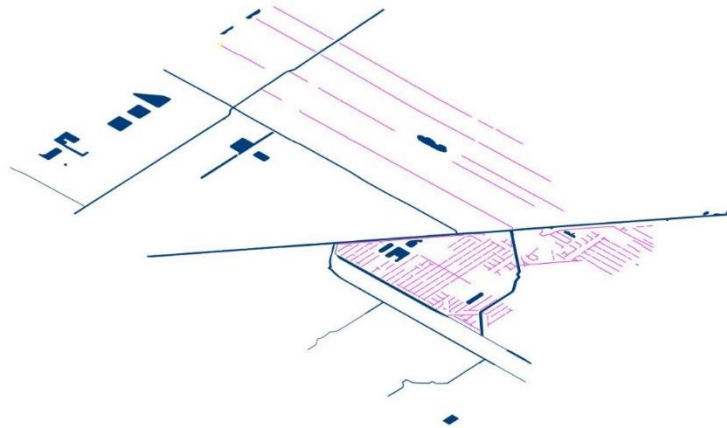


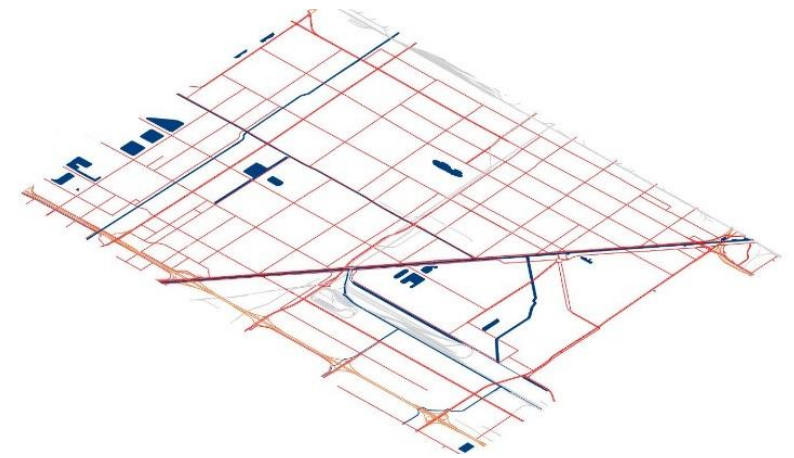
Image 60. Layers of urban infrastructures of Hialeah and Miami Springs. Source: author



Map 30. Green and blue public and semi public infrastructures of Hialeah and Miami Springs. The blue infrastructure is non transformable, while there is a major opportunity for the transformation of the green infrastructure into a more sustainable and ecologic urban landscape. Source: author



Map 31. Transformable public vehicular infrastructure of Hialeah and Miami Springs. Hialeah: secondary north to south two way secondary roads. Miami Springs: back service alleys for garbage recollection Source: author



Map 32. Non transformable public traffic infrastructures of Hialeah and Miami Springs. The train and metro rail transportation systems, as well as the main roads are non transformable urban structures. However, the buffer zones adjacent to the train tracks and the space beneath the elevated metro line constitute an opportunity to improve the urban landscape Source: author

SITE ANALYSIS CONCLUSIONS HIALEAH

Map 33. Urban public infrastructures of Hialeah.
Source: author

HIALEAH PUBLIC SPACE NETWORK

Hialeah's public space network (map 33) is mainly composed of:

1. Transportation infrastructure:

- Vehicular transit infrastructure composed of an orthogonal grid of mayor and secondary roads.
- Railroad infrastructure adjacent to residential and industrial zones
- An elevated metro rail track



Image 61. Decayed buffer zones. Source: author



Image 62. Unused wide secondary roads. Source: author



Image 63. Unused wide secondary roads. Source: author



Image 64. Lack of pedestrian connections. Source: author

CONCLUSIONS: Transportation Infrastructure

- There is a vast amount of unused and decayed buffer areas adjacent to the train and metro systems (image 61).
- There is an extensive amount of two way secondary roads in the horizontally sprawled residential areas (images 62 & 63).
- There are no pedestrian boulevards and bicycle lanes in the city and no pedestrian friendly connection with the city of Miami Springs since Okeechobee Road constitutes a major physical barrier (image 64).

2. Green and blue infrastructures:

- The green infrastructure consists on neighborhood parks, sports facilities and pocket parks.
- The blue infrastructure is composed by a part of the Little River Canal and one of its tributaries and the Miami Canal.

CONCLUSIONS: Green and blue infrastructures

- Besides the Aviation Memorial and two smalls parks, there are no public green gathering spaces in the city. The rest of the park city networks consist in fenced sports facilities to play team sports. There is a lack of any kind of public space in the city (including nature or not).
- A blue public infrastructure is almost nonexistent in the city. The areas adjacent to the only canal that passes through the city (Little River Canal) are bounded by private property (images 69 & 70).



Image 65. . Dwellings located adjacent to the train tracks in Hialeah. Source: author



Image 66. Decayed commercial area located adjacent to Okeechobee road . Source: Google earth

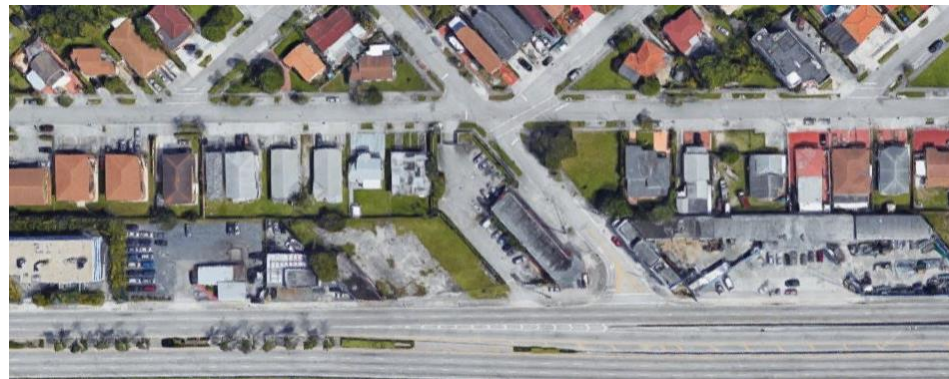


Image 67. Aerial view of the commercial area located on Okeechobee road. Source: Google maps

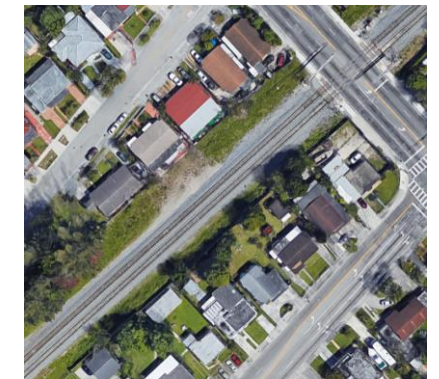


Image 68. Dwellings located adjacent to the train tracks in Hialeah. Source: Google maps



Image 69. Private backyard adjacent to one of the canals that form part of the water management system of Miami. Source: author



Image 70. Private lot adjacent to one of the canals that form part of the water management system of Miami. Source: author

HIALEAH' S PRIVATE PROPERTY CONSIDERATIONS

The conclusions related to private property are:

- There is an unfavorable commercial area located on a portion of Okeechobee Rd. that comprises a strip of motels and automobile workshops (images 66 & 67).
- There are 81 dwelling units in the central part of the city that are inconveniently located next to the train tracks (images 65 & 68).

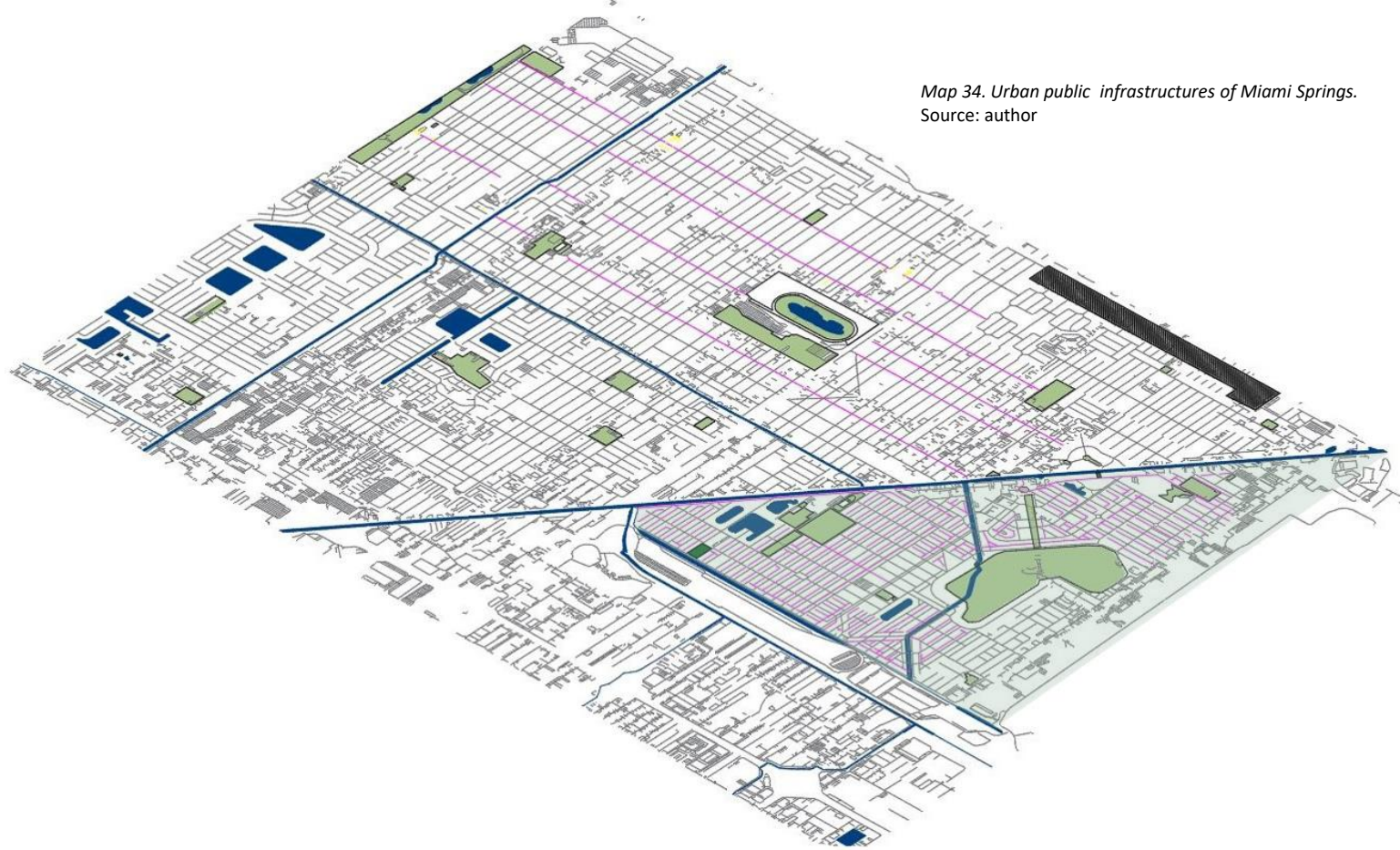
SITE ANALYSIS CONCLUSIONS MIAMI SPRINGS

MIAMI SPRINGS PUBLIC SPACE NETWORK

Miami Springs's public space network (Map 34) is mainly composed of:

1. Transportation infrastructure:

- Vehicular transit infrastructure composed of an orthogonal grid that shifts in the center of the city. It consists in mayor roads and an ancillary system of unpaved service alleys on the back of each property, which divides each block into two residential strips. The purpose of these secondary alleys is for garbage collection.



Map 34. Urban public infrastructures of Miami Springs.
Source: author



Image 71. back service alleys in Miami Springs. Source: author



Image 72. Pedestrian boulevard in Miami Springs commercial district. Source: author

CONCLUSIONS: Transportation Infrastructure

- The service back alleys have limited vehicular and pedestrian circulation and their main purpose is garbage recollection (image 71). Moreover, they are not formally included as part of the vehicular traffic system of city (traffic maps and online live traffic programs).
- The only pedestrian boulevard, located in the main commercial strip of the city, is unattractive and not properly maintained. There are no exclusive lanes for bicycles in the city (image 72).
- There is no pedestrian friendly connection with the city of Hialeah.

2. Green and blue infrastructures:

- The green infrastructure consists in a central city park that ends on a golf course, sports facilities, pocket parks and residential parking space. It is mostly composed of grassland and trees.
- The blue infrastructure is composed by 3 major canals. A central canal that traverses the Miami Springs's golf course and ends up in the Miami Canal and one of its tributaries.

CONCLUSIONS: Green and blue infrastructures

- There is sufficient green public space in Miami Springs; however, the green infrastructure lacks biodiversity (image 73).
- The only public blue infrastructure accessible to the people are the two adjacent city canals. There is not an existing public blue system in the city.

3. Electrical infrastructure and waste management infrastructure:

- Two grassland empty blocks under high voltage electric infrastructure and a macro block destined for waste water treatment.

CONCLUSION: Electrical infrastructure

- The two empty blocks adjacent to the waste water treatment facility lack biodiversity and socio ecological landscape features (image 74).

SITE ANALYSIS CONCLUSIONS FOR BOTH CITIES

- There are not pedestrian and bicycle transit connections systems between the two cities.
- There is an insufficient amount of surface water in both neighborhoods.
- The public space network of both cities is not resilient and sustainable to deal with flood related problems.
- There is a lack of cultural amenities in the two cities.
- There is a lack of biodiversity in both green infrastructure networks, being the problem increasingly more serious in the city Hialeah.



Image 73. Central park in Miami Springs, mainly composed by grassland and trees

Source: Author



Image 74. Empty blocks with high voltage electric infrastructure and waste water treatment facility in Miami Springs.

Source: Google maps

VI. POTENTIAL AREAS OF INTERVENTION



- Potential areas of intervention (general)
- Description of the potential areas for intervention in Hialeah
- Description of the potential areas for intervention in Miami Springs

POTENTIALS

POTENTIAL AREAS OF INTERVENTION

Based on the conclusions from the site analysis, there are several potential areas of intervention on each city:

POTENTIALS AREAS OF INTERVENTION IN HIALEAH:

- The east and west industrial and manufacturing districts.
- The buffer zones and residential strip located next to the train tracks.
- Certain minor vehicular city roads that run north to south.

POTENTIAL PROGRAMMATIC FUNCTIONS

There is the potential to introduce cultural open spaces and buildings in the redevelopment east industrial district of Hialeah for recreational and educative purposes. The new designated areas will also supply the demand of spaces and structures for cultural and leisure activities for the inhabitants of Miami Springs. These cultural spaces should include a city museum, library, micro theater and an open botanical park related to wetlands and the former ecosystems of the area. A public city square and a space for a city market could be a great contribution to promote social interaction.

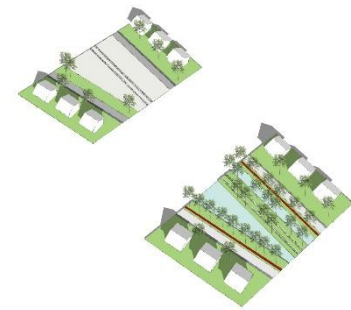
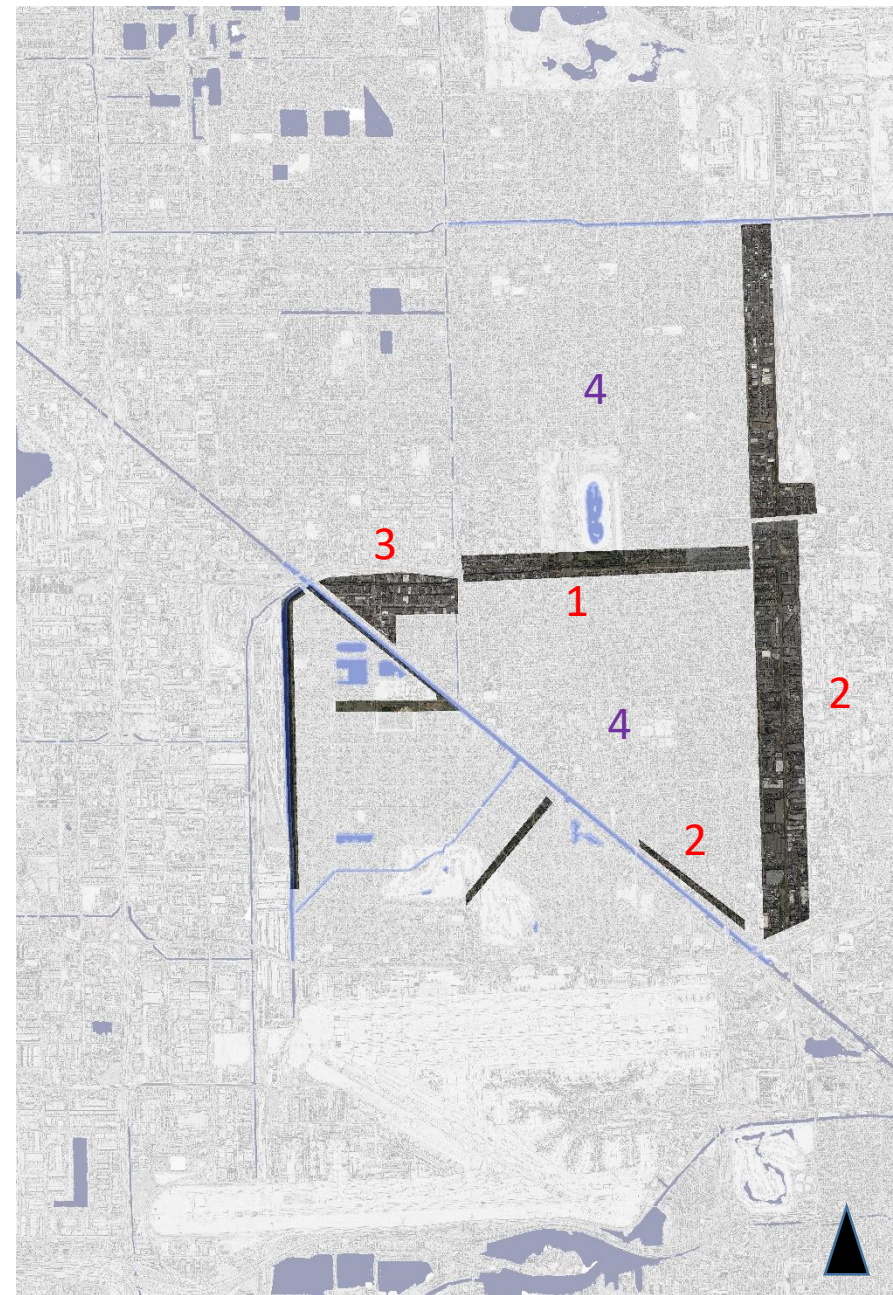


Diagram 24. Potential # 1: Buffer zones located next to the train tracks. Source: author.

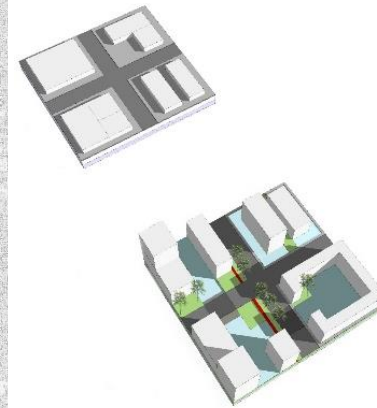


Diagram 25. Potentials # 2 & 3:
-East industrial district.
-West industrial district.
Source: author.

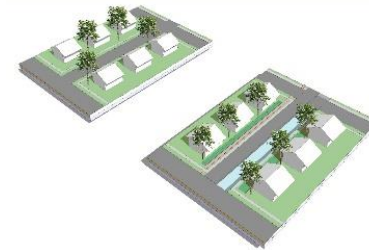


Diagram 26. Potential # 4: Minor vehicular city roads that run north to south. Source: author.

POTENTIALS AREAS OF INTERVENTION IN MIAMI SPRINGS:

- The central linear park, pocket parks and square parks.
- The grassland blocks located below the high voltage electricity infrastructure.
- The three narrow linear canal banks adjacent to the city canals.
- The back alley service roads.

The following pages further describe the potentials and general action plan for these areas.

RELATIONSHIP BETWEEN POTENTIALS AREAS FOR INTERVENTION AND SOCIO ECOLOGIC NEEDS IN HIALEAH Vs. MIAMI SPRINGS

The potential areas for intervention that the site analysis propitiated respond to the different socio ecologic needs of each city. In the case of Hialeah, the need to reconfigure the urban landscape is becoming an urgent need in order to provide immediate resilient solutions and a long term sustainable plan for flood prevention.

In Hialeah, which floods on a regular basis, it is imperative to introduce a water receptive urban landscape and store as much water as possible. Therefore, these potential areas also include a mid and long term reconfiguration of the private property.

In the case of Miami Springs, more than introducing a remedial landscape in order to deal with current water management problems, the potential areas for intervention would respond to the need of creating a long term sustainable climate change adaption plan through the urban landscape.

Moreover, it is not imperative to increase biodiversity in Miami Springs, its just an added value; however, there is an urgent need to create public natural spaces in Hialeah, which are completely scarce at the present time.

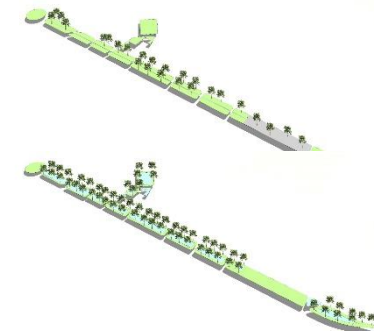
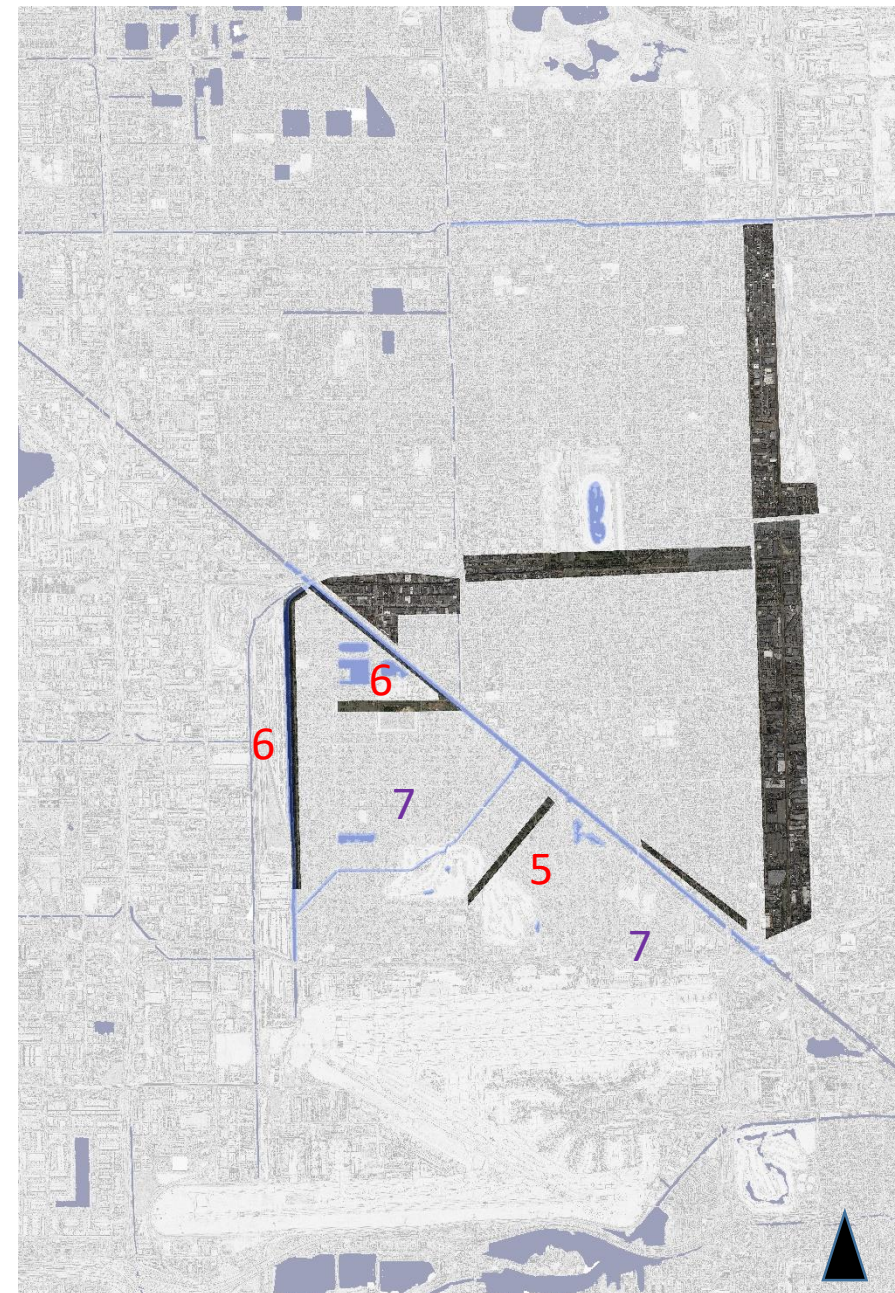


Diagram 27. Potential # 5: Central linear park, pocket and square parks. Source: author.

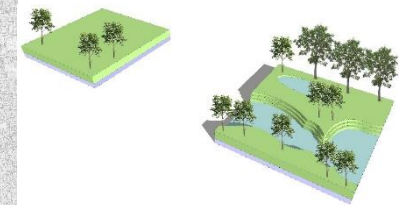


Diagram 28. The blocks located below the high voltage electricity and canal banks. Source: author.



Diagram 29. Potential # 7: The back alley service roads. Source: author.

POTENTIAL AREAS FOR INTERVENTION IN BOTH CITIES

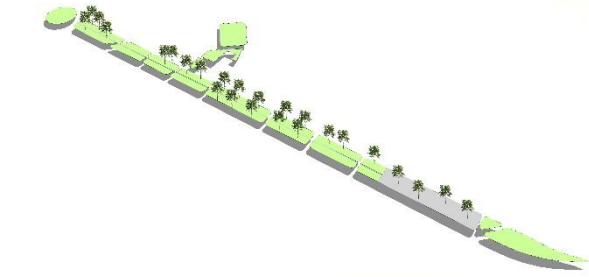


Diagram 27. Potential # 5: Central linear park, pocket and square parks. Source: author.

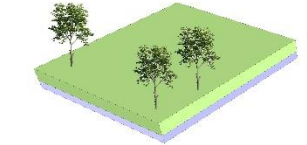
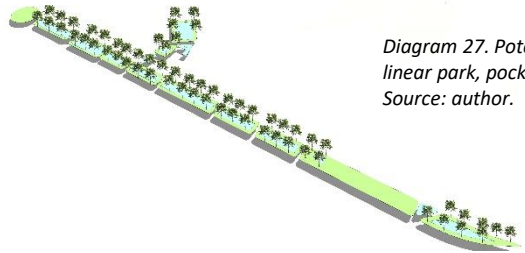


Diagram 28. Potential # 6: The blocks located below the high voltage electricity and canal banks. Source: author.

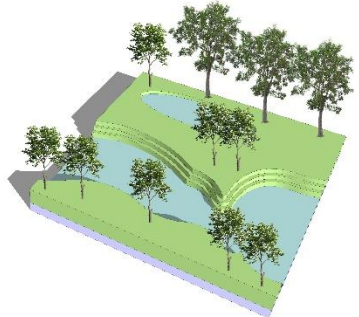
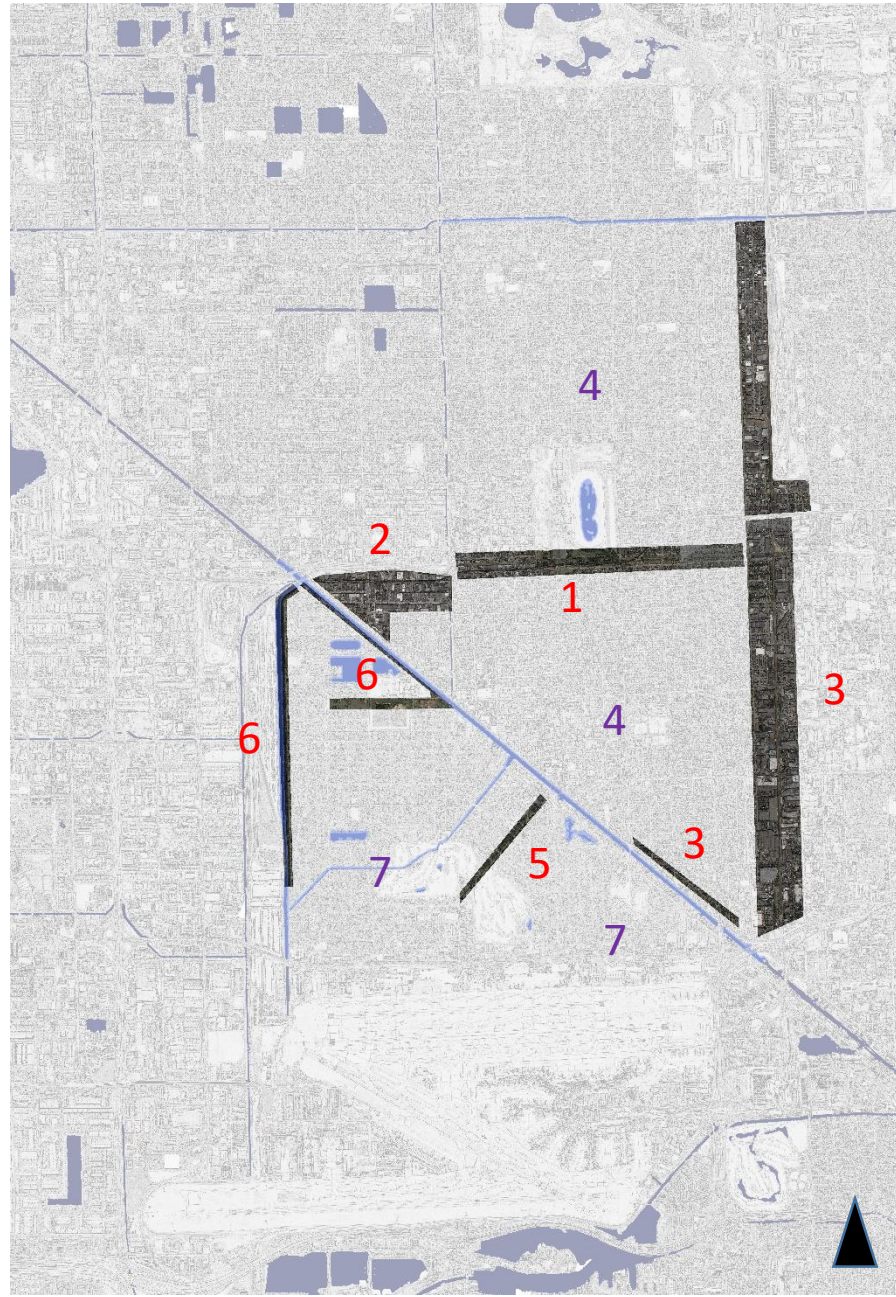


Diagram 29. Potential # 7: The back alley service roads. Source: author.



Map 37. Potential areas for intervention in Hialeah and Miami Springs. Source: author

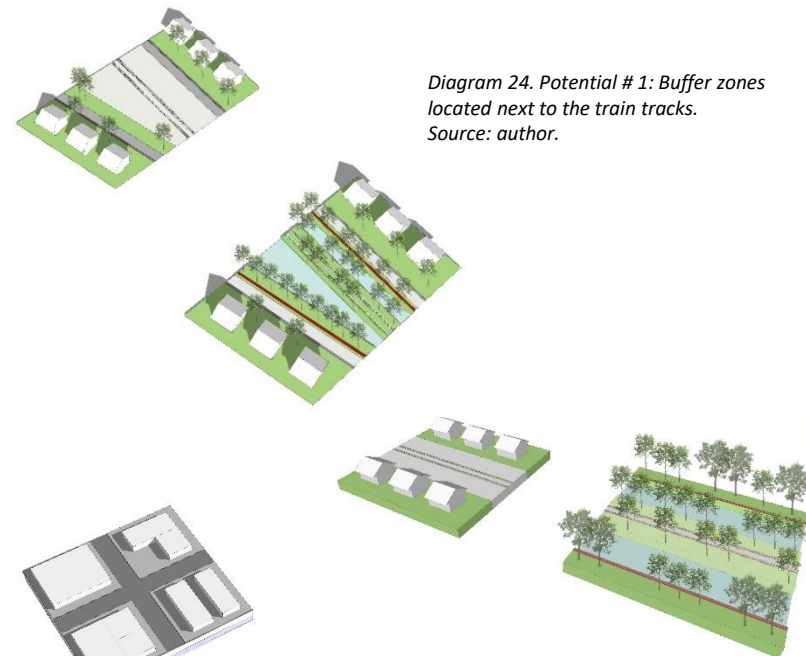


Diagram 24. Potential # 1: Buffer zones located next to the train tracks. Source: author.

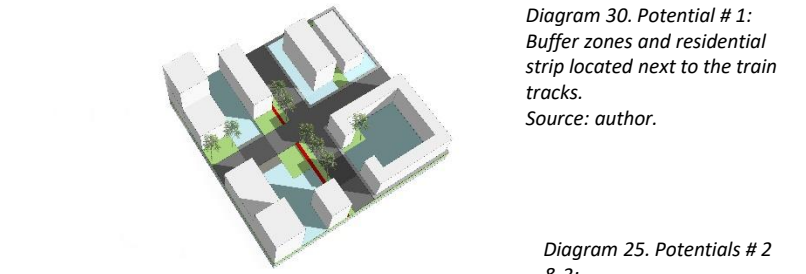


Diagram 30. Potential # 1: Buffer zones and residential strip located next to the train tracks. Source: author.



Diagram 26. Potential # 4: Minor vehicular city roads that run north to south. Source: author.

Diagram 25. Potentials # 2 & 3: -East industrial district. -West industrial district. Source: author.

POTENTIALS HIALEAH:

PUBLIC SPACE TRANSFORMATION: EXISTING BUFFER ZONES NEXT TO TRANSIT INFRASTRUCTURES

There is the potentiality to transform decayed buffer zones adjacent to the train tracks and the elevated metro rail line into a green and blue linear community park, on both sides of the tracks (diagram 24). This new blue and green infrastructure will be connected to the new green and blue infrastructure of the east industrial complex and the existing canals that are part of the water management system of the Miami Dade County.

The abandoned strip has the potential to introduce a central linear green and blue infrastructure for the city of Hialeah. The linear system will be connected with all the additional green and blue areas to be introduced in the city. It will also create a connection with the city of Miami Springs to the west side. The goal is to link the Hialeah's new natural linear system with two of the three existing linear parks adjacent to the canals in Miami Springs. The linear new public space will also act as a buffer zone between residential areas and the railroad system.

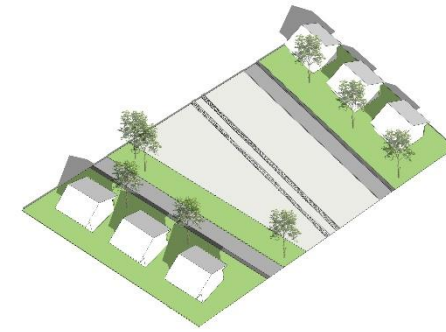


Diagram 24. Potential # 1: Buffer zones located next to the train tracks.
Source: author.

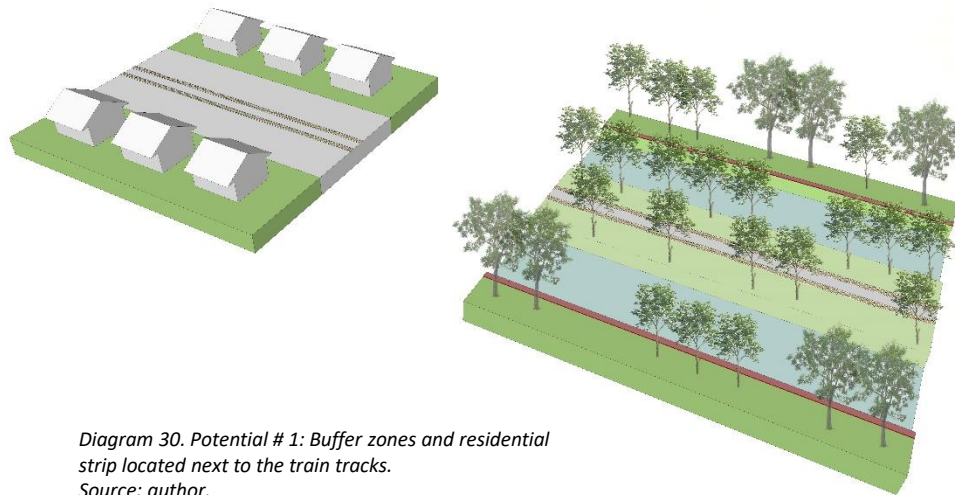
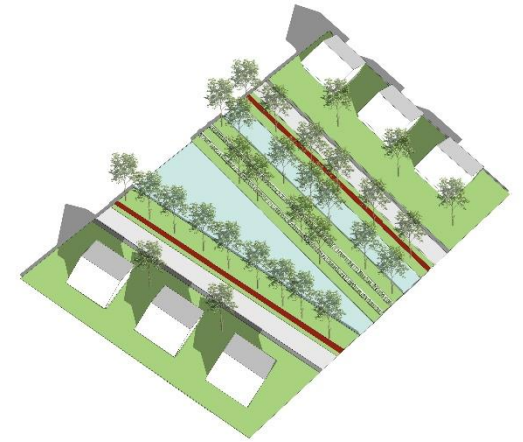


Diagram 30. Potential # 1: Buffer zones and residential strip located next to the train tracks.
Source: author.

PRIVATE SPACE TRANSFORMATION: RESIDENTIAL STRIP ADJACENT TO THE TRAIN TRACKS

There is also the potential to include the residential strip located adjacent to the railroad infrastructure to become part of the long term expansion plan for the new planned green and blue infrastructure (diagram 30). This action would also achieve the goal of relocating the people currently living next to the train tracks into the new residential redevelopment areas within the city. It includes 87 one story dwellings

This potential transformation would most likely be beneficial for the stakeholders involved. A fair economic arrangement between the municipality and the homeowners will most-likely benefit the latter since it results very unlikely that these properties could be sold at market value since they are located near to a decayed ancillary area adjacent to a railroad system with no sound barriers. Moreover, an affordable option of relocation to the new redevelopment areas of the city could be provided. This action would help the local government to gain public recreational space and to expand the proposed water management strategy plan for the city.

POTENTIALS AAREAS OF INTERVENTION IN HIALEAH:

PRIVATE SPACE TRANSFORMATION: REDEVELOPMENT OF INDUSTRIAL AREAS

There is a big potential of the transformation of two industrial zones of Hialeah into mixed-use districts with an extensive green and blue system that will contribute to the water management plan of city (diagram 25) . Due to its size, the transformation of the east Hialeah industrial area into a mix-use sustainable neighborhood could become part of the strategy to increase the amount of green and blue public space and to reintroduce ecosystem services to the grey city.

The goal is to provide the new area with green and vast blue infrastructures, combined with sustainable residential and commercial constructions. The new redevelopment are will consist on a mix of low, middle and high density buildings. A trade off system of heights between the tallest constructions and sustainable landscapes will be implemented in order to reduce building's footprints and, therefore, facilitate the creation of more bodies of water.

FEASIBILITY FOR THE TRANSFORMATION OF THE EAST INDUSTRIAL AREA

This action is feasible since the city of Hialeah and the Miami-Dade County Commission already "approved a redevelopment agency for 121 acres in east Hialeah" (Alvarado, 2017), which belong to the east industrial area (image 76 shows part of the east industrial complex).

CITY REDEVELOPMENT PLAN FOR THE EAST INDUSTRIAL AREA

According to Carlos Hernandez, current major of Hialeah, the plan is to create a mix-use neighborhood (images 77, 78 & 79) with affordable housing for young adults (Alvarado, 2017). The urban regeneration already started with the transformation of 6 blocks into the new Leah's arts district and a few mid-density buildings located on the west side of the industrial area.

Leah's art district tries to replicate the success of Wynwood, a former warehouse area that was regenerated and has become a successful and vibrant neighborhood for locals and tourists in Miami (image 75). Wynwood was redeveloped according to the principles of the New Urbanism.

Image 75. Leah's new art district on the east industrial area.

Source:<https://therealdeal.com/miami/2017/03/17/east-hialeah-on-the-verge-of-a-renaissance-ciaf-speakers/>

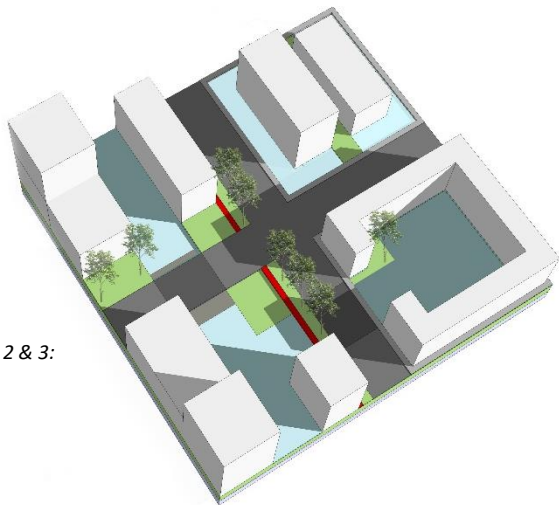
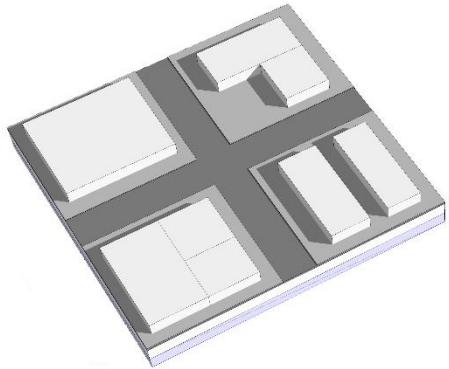


Diagram 25. Potentials # 2 & 3:

-East industrial district.
-West industrial district.

Source: author.



Image 76. South east industrial area in Hialeah.
Source: Google maps

"New Urbanism is a planning and development approach based on the principles of how cities and towns had been built for the last several centuries: walkable blocks and streets, housing and shopping in close proximity, and accessible public spaces. In other words: New Urbanism focuses on human-scaled urban design".

Congress of New urbanism

The New urbanism movement follows 10 main principles: walkability, connectivity, mixed-use & diversity, mixed housing, quality architecture & urban design, traditional neighborhood structure, increased density, smart transportation, sustainability and quality of life (newurbanism.org). Even though some of these principles contribute to reduce carbon footprints and to mitigate the causes of climate change, the urban movement doesn't include a sustainable landscape approach.

Therefore, this potential transformation intends to combine the New Urbanism principles, which the city completely lacks, with a landscape as infrastructure approach in order to deliver a positive socio-ecologic landscape. The plan intends to include the arts district and the necessity to provide affordable housing for young adults. However, it will with also target high income groups of the population for the highest towers.

From the stakeholders point of view, the project could be formed as joint venture between the public and private sectors, where developers get tax benefits and the option to trade horizontal ground for buildings stories. Moreover, the public sector will provide a public green and blue network for water management and recreational activities that will be reinforced by private initiatives of green and blue sustainable landscapes.



Image 77. Proposed new pedestrian district on the east industrial area of Hialeah.
Source: <http://www.miamiairportwarehouses.com/hialeah-plans-to-develop-two-transit-oriented-districts/>



Image 78. Aerial view of the proposed plan for the east industrial complex in Hialeah.
Source: <https://plusurbia.com/project/hialeah-transit-oriented-development/>



Image 79. High density mix-use neighborhood proposal by Plusurbia.
Source: <https://plusurbia.com/city-increases-density-on-313-acres-in-two-transit-oriented-development-areas/>

POTENTIALS HIALEAH:

PUBLIC INFRASTRUCTURE TRANSFORMATION: MINOR TRAFFIC ROADS

Another potential public areas for transformation are automobile secondary transit infrastructure. There is the opportunity to modify certain two-ways minor low transit vehicular roads that run north to south into a one way street adjacent to new narrow green and blue strip corridors (diagram 26).

The new green and blue system will be comprised of water canals combined with vegetated areas and pedestrian and bicycle routes. The main goal of the new system of canals is to provide more blue surface space to retain rainwater throughout the city, reduce stormwater runoff and provide a direct connection with the existing systems of canals and the new central blue and green community park.

This potential transportation will also contribute to the social and socio-ecological public space necessities of the city:

- It will help to increase of biodiversity.
- It will create a pedestrian and bicycle transportation network throughout the city.
- It will increase the blue and green recreational space for public use.

FEASIBILITY OF THE TRANSFORMATION OF EXISTING MINOR TRAFFIC ROADS

This type of transformation is feasible since there is a surplus of two-ways north to south secondary transit roads in Hialeah (most dwellings are one story units). Moreover, the access to the dwelling units that run through these streets are located on the roads running east to west. There are few residential units whose vehicular accesses are located north to south. In that case, alternative free parking options will be delivered for the residents that live in those units.

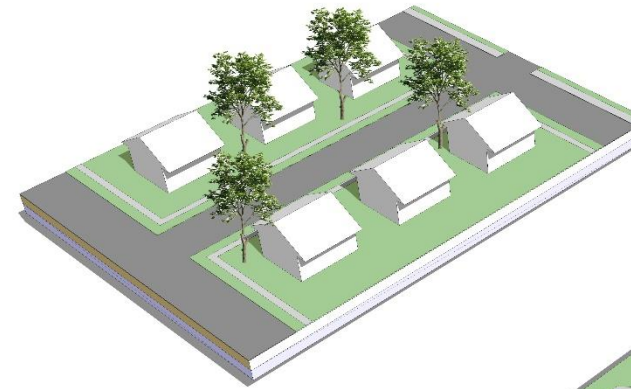


Diagram 26. Potential # 4: Minor vehicular city roads that run north to south. Source: author.



POTENTIALS AREAS OF INTERVENTION IN MIAMI SPRINGS:

PUBLIC SPACE TRANSFORMATION: GREEN EXISTING INFRASTRUCTURE

There is the potentiality to transform part of the existing public green spaces of Miami Springs into a more diverse green and blue system (diagram 27). These potentials include:

- The central linear park, pocket parks and square parks into a blue and green infrastructure system (image 80), connected to the existing canals. This transformation also has the potential to upgrade the existing green infrastructure itself, introducing a system of bioswales and rain gardens through the existing grass land.
- The grassland blocks located below the high voltage electricity infrastructure into an urban wetland park (diagram 28), which will be connected to the existing linear parks adjacent to the Miami Canal. Three goals of the potential transformation of this green unused infrastructure are to increase biodiversity, introduce new types of green and blue landscapes in the city and improve the pedestrian and bicycle connections between the different green public spaces.
- The three narrow linear canal banks adjacent to the city canals into seasonal wetland parks.

PRIVATE SPACE TRANSFORMATION: GREEN EXISTING INFRASTRUCTURE

There is the potential to transform the green golf course into a green and blue structure and to include a bicycle lane in the north west perimeter as part of the new bicycle transit infrastructure. The new blue infrastructure will consist in a perimeter canal connected to additional bodies of water. This potential upgrade of green infrastructure into a green and blue system will not only contribute to the water management strategy of the city, but will also enhance the spatial qualities of the golf course.

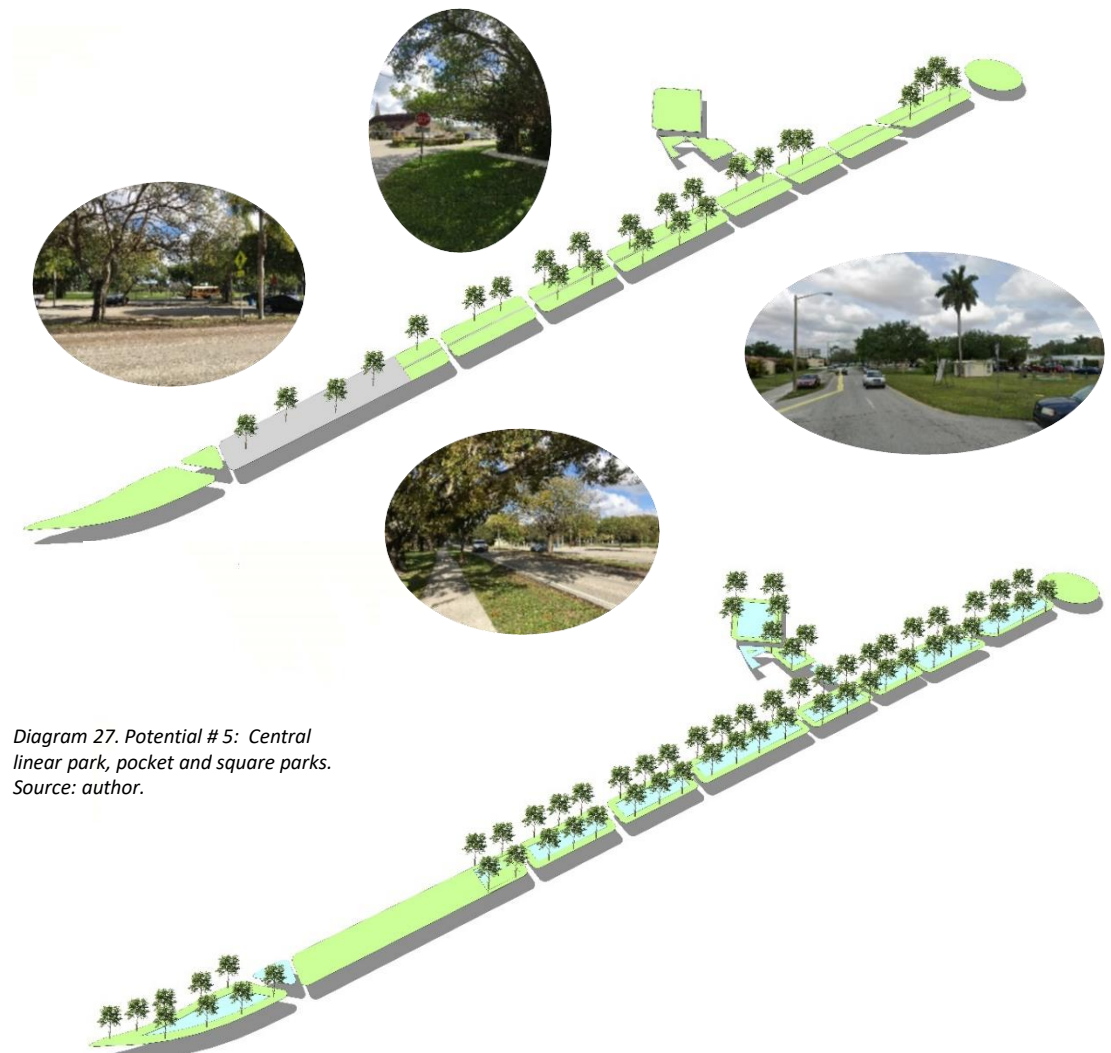


Diagram 27. Potential # 5: Central linear park, pocket and square parks.
Source: author.

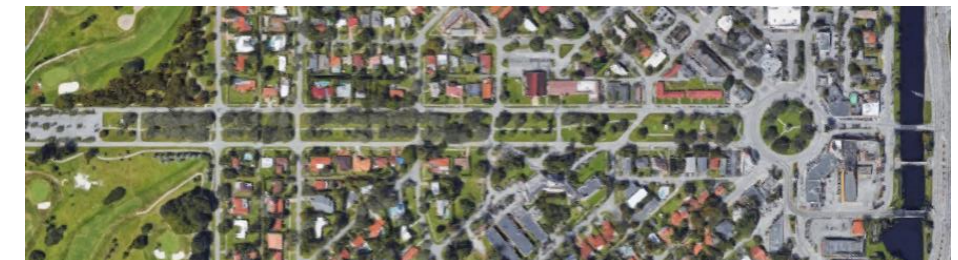


Image 80. Central linear park, pocket and square parks in Miami Springs. Source: Google maps

FEASIBILITY FOR THE TRANSFORMATION OF THE EXISTING GREEN AREAS

The three public space potential transformation areas are highly feasible since they don't require excessive amounts of interventions. The private ownership of golf course transformation would have to be implemented through a joint venture between Miami Springs's municipality and the Miami Spring's Golf Course owners.

POTENTIALS MIAMI SPRINGS: TRANSFORMATION OF THE BACK SERVICE ALLEYS (VEHICULAR INFRASTRUCTURE)

There is the potential of the transformation of the block's back service alleys into a network of water canals throughout the neighborhood (diagram 29). This new system of narrow canals will be connected to the existing city canals.

The main goal of this new green and blue infrastructure will be to introduce more surface water in order to reduce stormwater runoff and provide more room for rainwater. A collateral benefit will be the improvement of the backyards of the privates properties through the inclusion of blue public infrastructure.

FEASIBILITY FOR THE TRANSFORMATION OF THE BACK SERVICE ALLEYS

This strategy is feasible since these alleys are only used for garbage collection and belong to the public space network. An alternative system of garbage disposal would have be implemented in the city, similar to the one in Rotterdam. This potential transformation could be built and implemented in different phases.

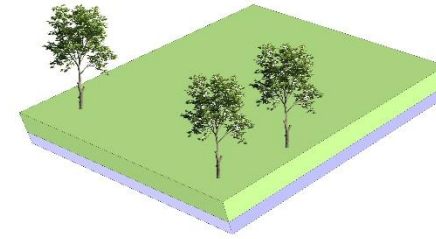


Diagram 28. The blocks located below the high voltage electricity and canal banks. Source: author.

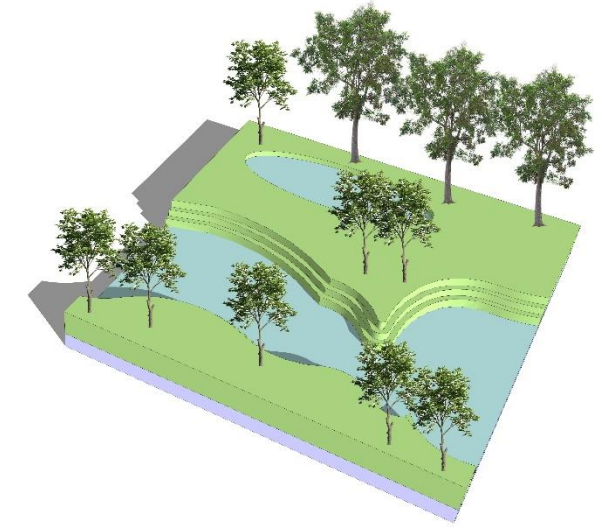


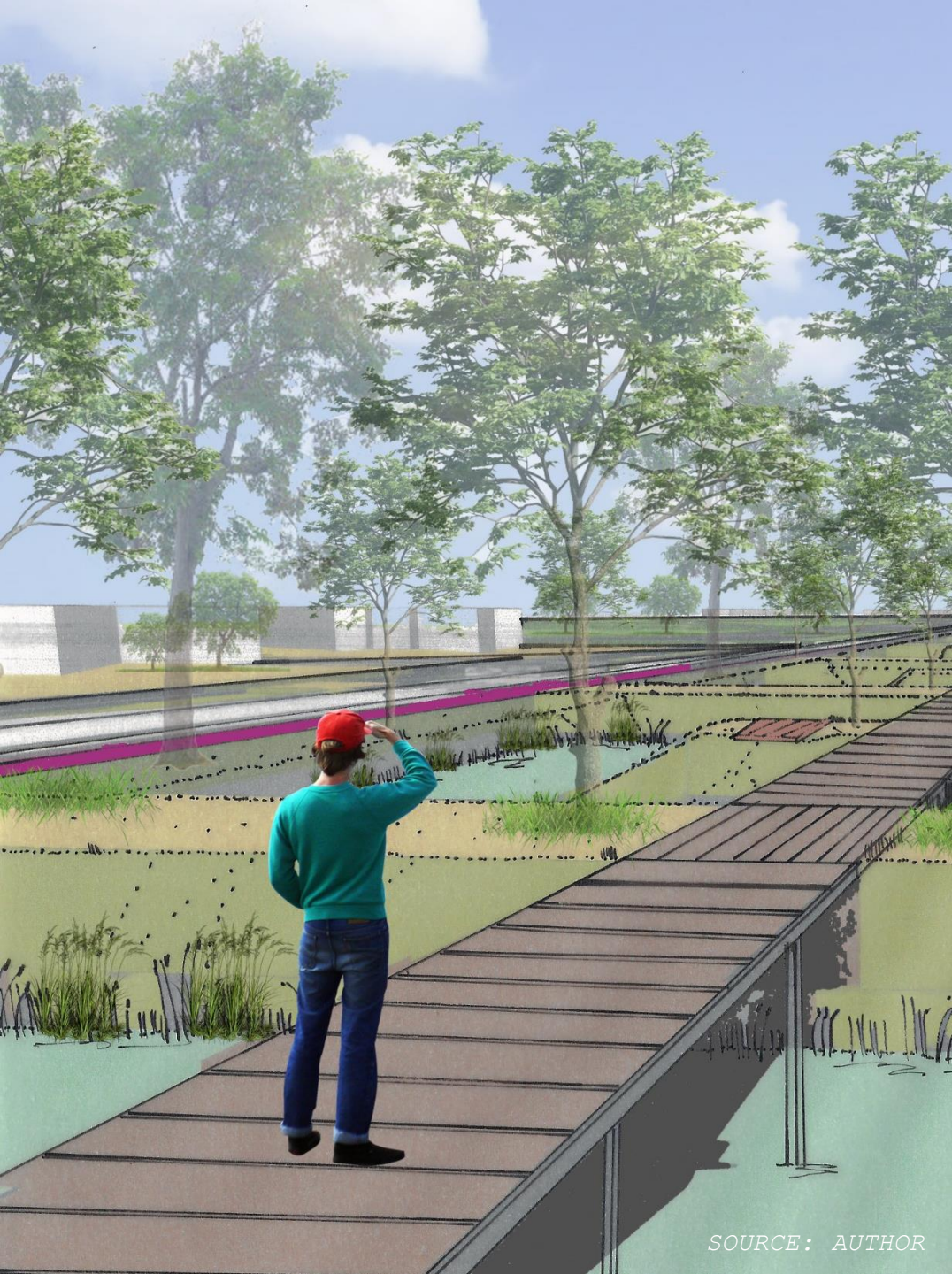
Diagram 29. Potential # 7: The back alley service roads. Source: author.

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VII . DESIGN

- Vision
- Strategies and design principles
- Phasing plan
- Stakeholders
- Master plans
- Sections
- Impressions
- Water storage calculations

VISION

GENERAL DESIGN APPROACH

The conclusions from the hydrogeological site analysis show the importance to introduce natural areas for surface storage and the infiltration of rainwater in both cities. The urban site analysis drop the physical and social and socio ecological potentials and opportunities for both city:

- The potential to provide public recreational and cultural spaces in the city of Hialeah.
- The potential to improve the socio ecological conditions of both cities: to increase biodiversity and introduce new types of natural landscapes.

This thesis project proposes to create a blue-green continuous infrastructure in order to introduce a sustainable natural urban system that would provide:

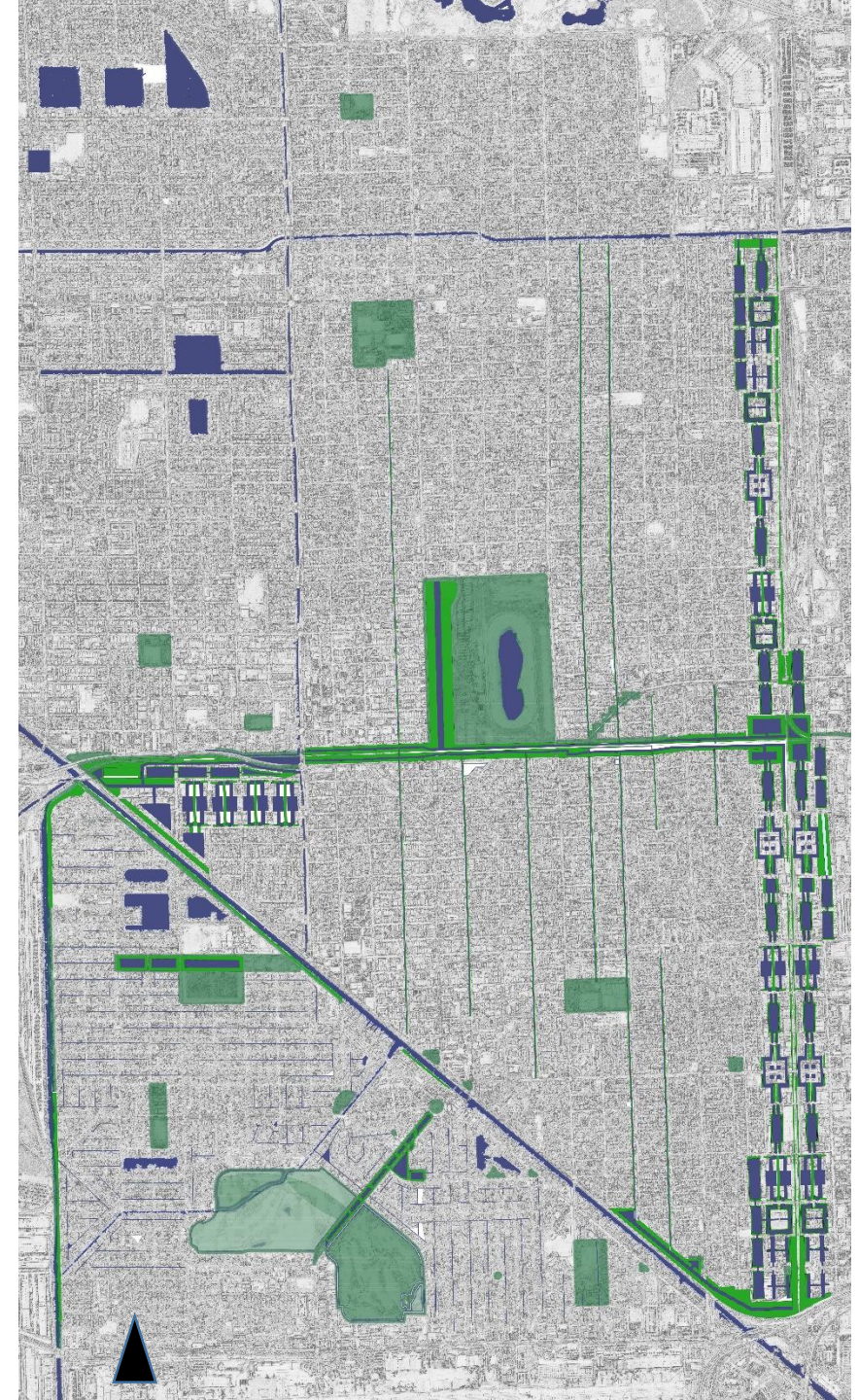
- A resilient and sustainable public space natural infrastructure to mitigate floods
- A pedestrian and bicycle transit network to improve public space connectivity within and between both cities.
- A social and socio ecological change for the inhabitants of both cities through the creation of more and diverse programmatic functions through the landscape. The social strategy includes increasing the amount of public and cultural spaces in Hialeah and increasing biodiversity in both areas.

The new green infrastructure connects the different potential areas of intervention, where predominates:

- The redevelopment of the east industrial complex of Hialeah into a sustainable mixed use high density district with high socio ecological qualities.
- The transformation of the central buffer areas adjacent to the train and metro tracks of Hialeah into a public green and blue corridor with a public botanical wetland park.
- The transformation of the central linear park and golf course of Miami Springs into green and blue more sustainable and diverse natural open spaces.

The vision's execution is divided into short, middle and long term implementation phases.

Plan 1. Vision: General design approach for Hialeah and Miami Springs. Source: author



NEW TRANSIT SYSTEM AND PROGRAMMATIC FUNCTIONS

One of the main goals of the vision for both the cities of Hialeah and Miami Springs is to create pedestrian and bicycle friendly connections throughout the new green and blue systems within and between the two cities. One of the intentions to integrate green, blue and transportation infrastructures is to improve the livability of the inhabitants during their daily commuting.

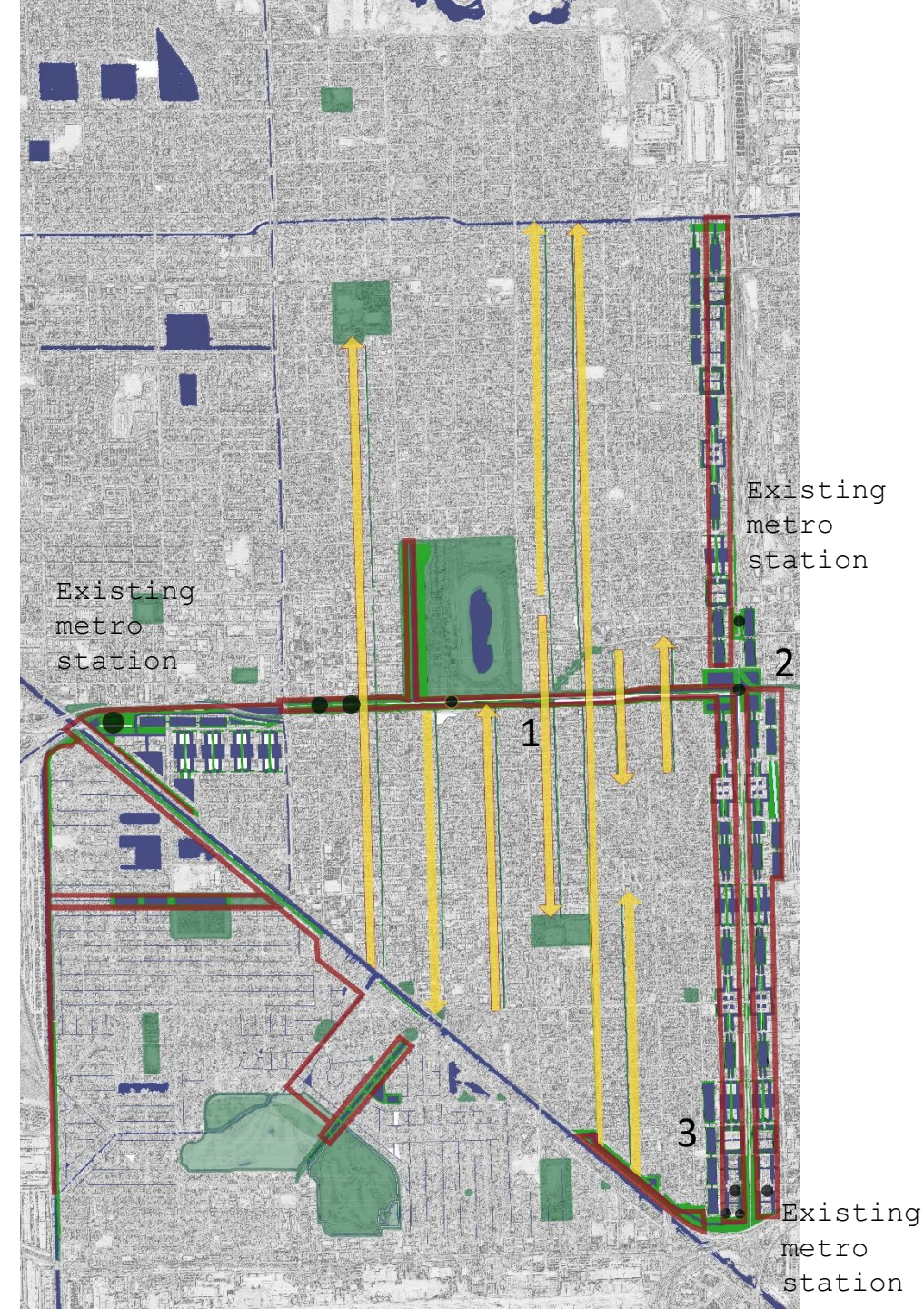
The new route for cyclists not only has a recreational purpose. One of the main intentions is to provide an alternative and more ecologic transportation system to reach the different metro rail stations in Hialeah. Due to the long distances, currently people commute to the stations by automobile. The proposed system will reduce vehicular traffic in both cities and the vast amount of parking spaces that people require in order to leave their cars and take the metro.

The bike lanes network connects parks and provides a scenic route. It consists on a loupe that starts in the central linear park of Miami Springs and ends in the new Water District on east Hialeah. Along the route, it connects the new recreational programmatic spaces of Hialeah:

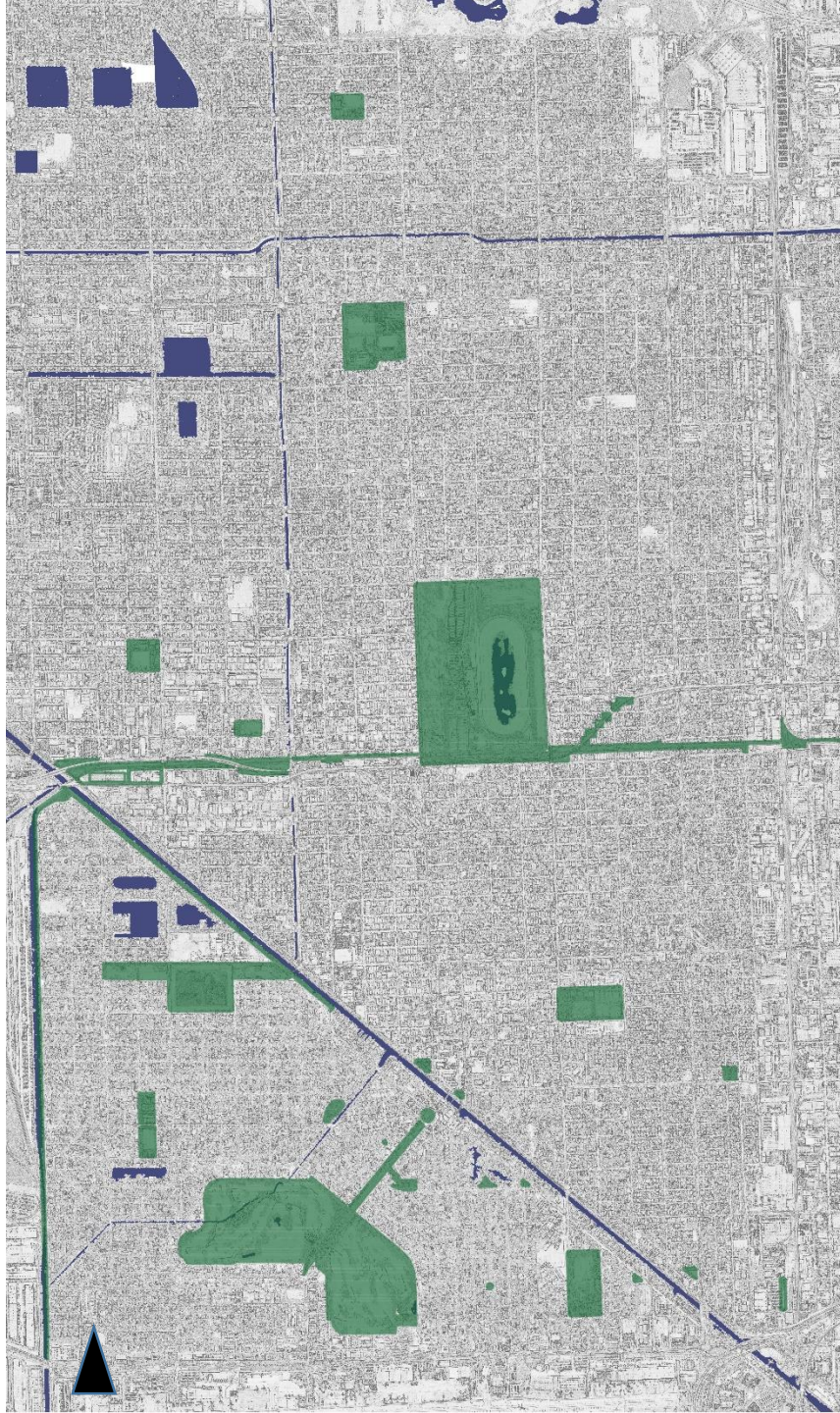
- 1.-A public city market located underneath the elevated metro rails.
- 2.-A wetland botanical and sports parks located on the intersection of the central green & blue system of Hialeah and the new Water Town.
- 3.-A set of cultural public buildings that include a library, micro theater, museum, city square and a sports park, all located on the south area of the Water Town, next to the rail system.

The arrows marked on yellow are the new one way streets adjacent to new canal system adjacent to new narrow pedestrian boulevards and bike lines that run in a north to south direction. The proposed route along the canals connect the most important public and private parks and sports facilities of Hialeah.

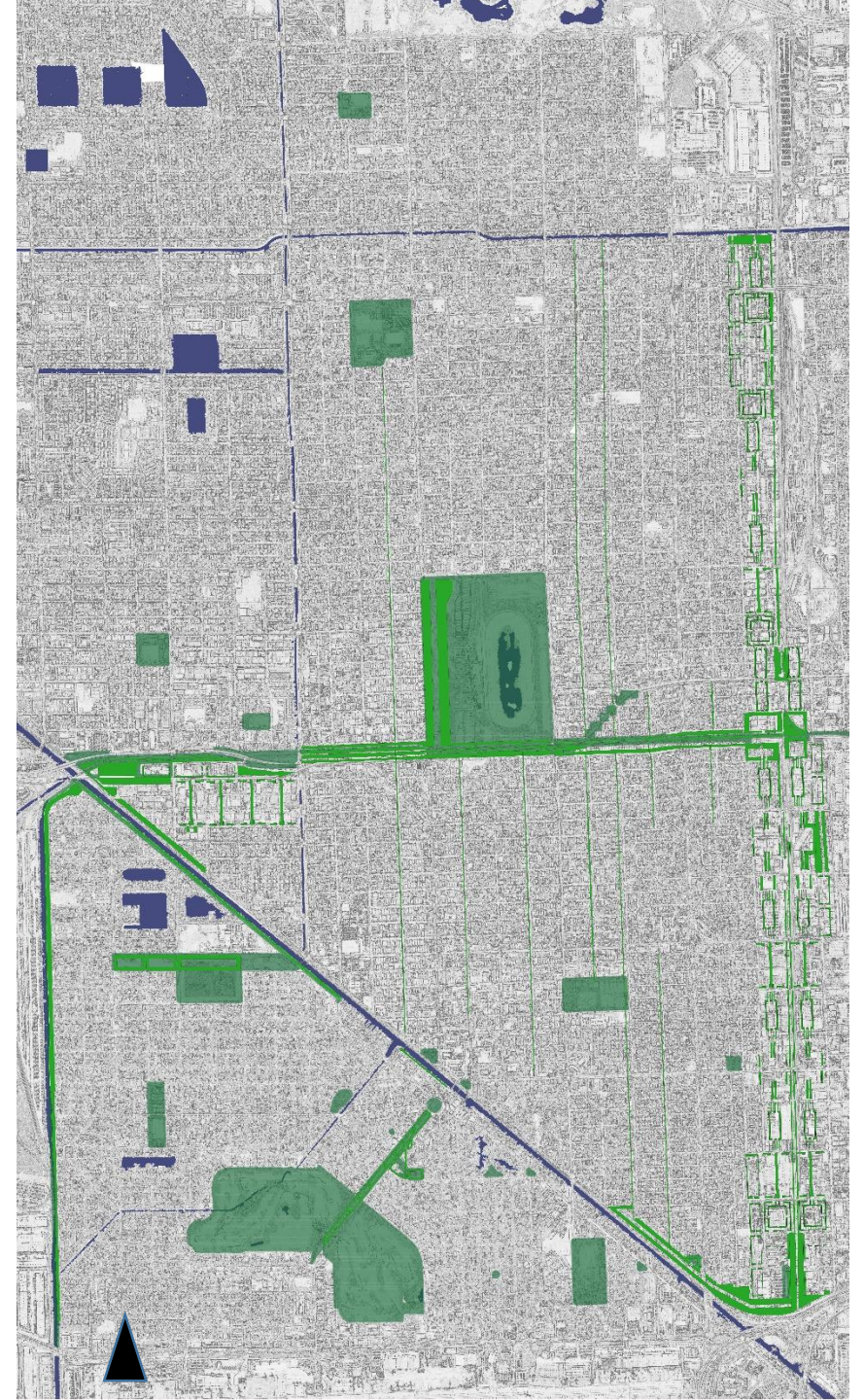
Plan 2. New vehicular, pedestrian and bicycle lanes routes for Hialeah and Miami Springs.
Source: author



**GREEN PUBLIC SPACE
NETWORK**



*Map 38. Existing green infrastructure of Hialeah and Miami Springs (left).
Source: author*



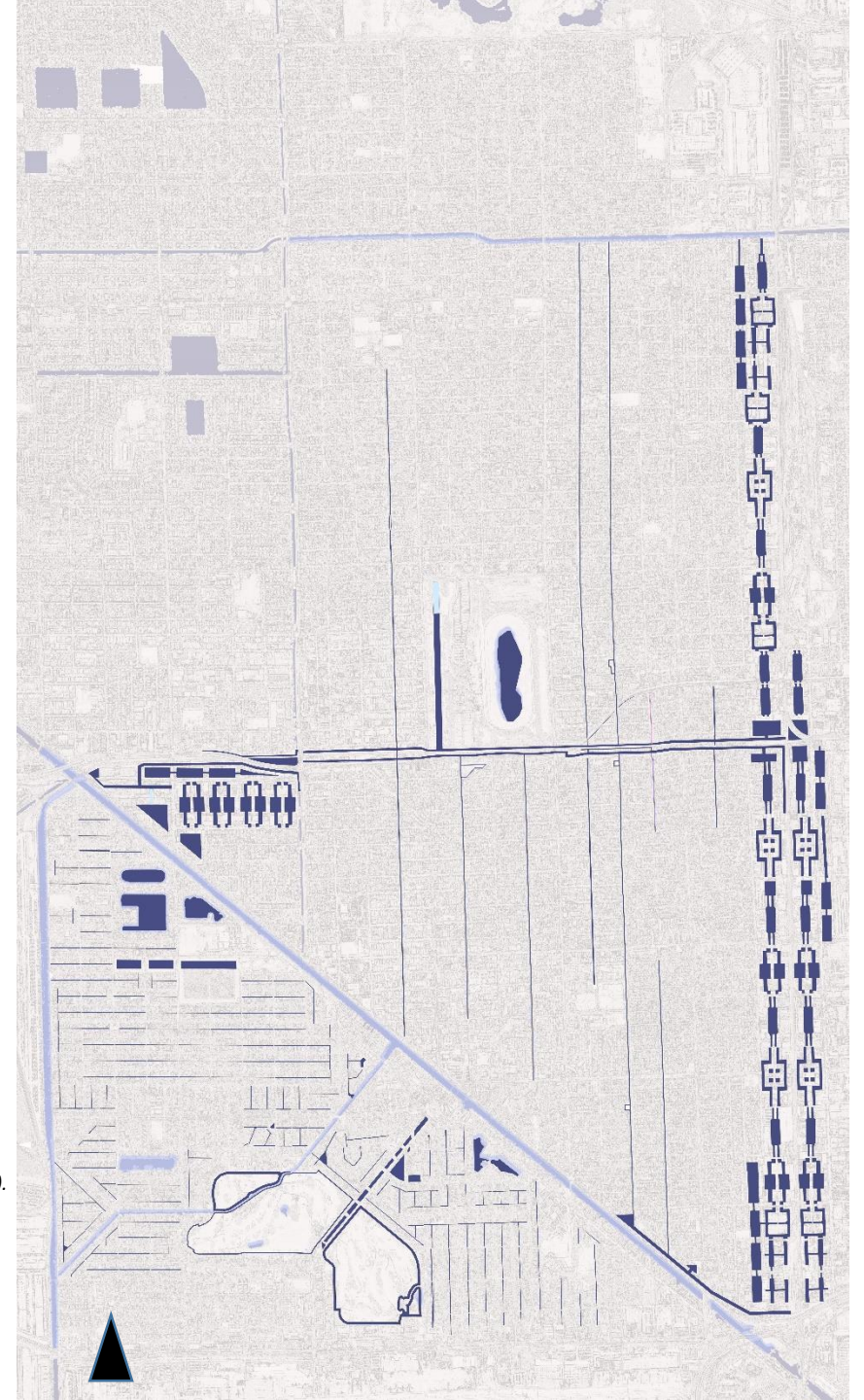
*Plan 3. Proposed new green infrastructure for Hialeah and Miami Springs (right).
Source: author*

BLUE SYSTEM



*Map 39. Existing blue infrastructure of Hialeah and Miami Springs (left).
Source: author*

*Plan 4. Proposed new blue infrastructure (system) for Hialeah and Miami Springs (right).
Source: author*



STRATEGIES AND DESIGN PRINCIPLES

There are 3 strategies to be implemented in the vision, master plans and the design of different spaces of the project, in order to improve the public urban landscape of the cities of Hialeah and Miami Springs:

• WATER STRATEGY (HYDROGEOLOGICAL FEATURES)

This strategy would improve the detention, retention, purification and infiltration capacities of rainwater through the public space network and contribute to produce a resilient and sustainable blue and green system to mitigate urban floods.

The main design principle is the introduction of a blue and green urban system in both cities. Other design principles that derive from the main one are:

- The new blue infrastructure would be connected to the existing water management system of canals.
- The new bodies of water would be unconfined and connected to the water table.
- The creation of blue surface areas to provide room for water.
- The introduction of wetlands to purify and delay infiltration of rainwater

• LAND STRATEGY (PHYSICAL FEATURES)

This strategy would improve the public space physical connections within and between the 2 cities.

The main design principle is to introduce a pedestrian and bicycle transit system for both cities. Other design principles that derive from the main one are:

- bicycle connections to the train and metro stations of Hialeah within the neighborhood and from the city of Miami Springs to avoid driving to the stations.
- The alternative transit system would connect all the potentials areas of redevelopment.

• PROGRAMMATIC STRATEGY (SOCIAL AND SOCIO ECOLOGICAL FEATURES)

This strategy would introduce new programmatic spaces and functions through the private and public urban landscape.

The design principles for both cities are:

- To increase biodiversity in public spaces.

Reveal the flood dynamic the public:

1. To raise awareness to the people.
2. To activate local adaptive strategies.
3. To recognize the current regenerative actions and expand its scope in an evolutionary adaptation process.

The design principles for Hialeah:

- Increase the amount of usable public space.
- Provide affordable housing for young adults
- Create public gathering spaces: public city market and city squares
- Introduce cultural facilities: space for micro theater, museum, and city library.

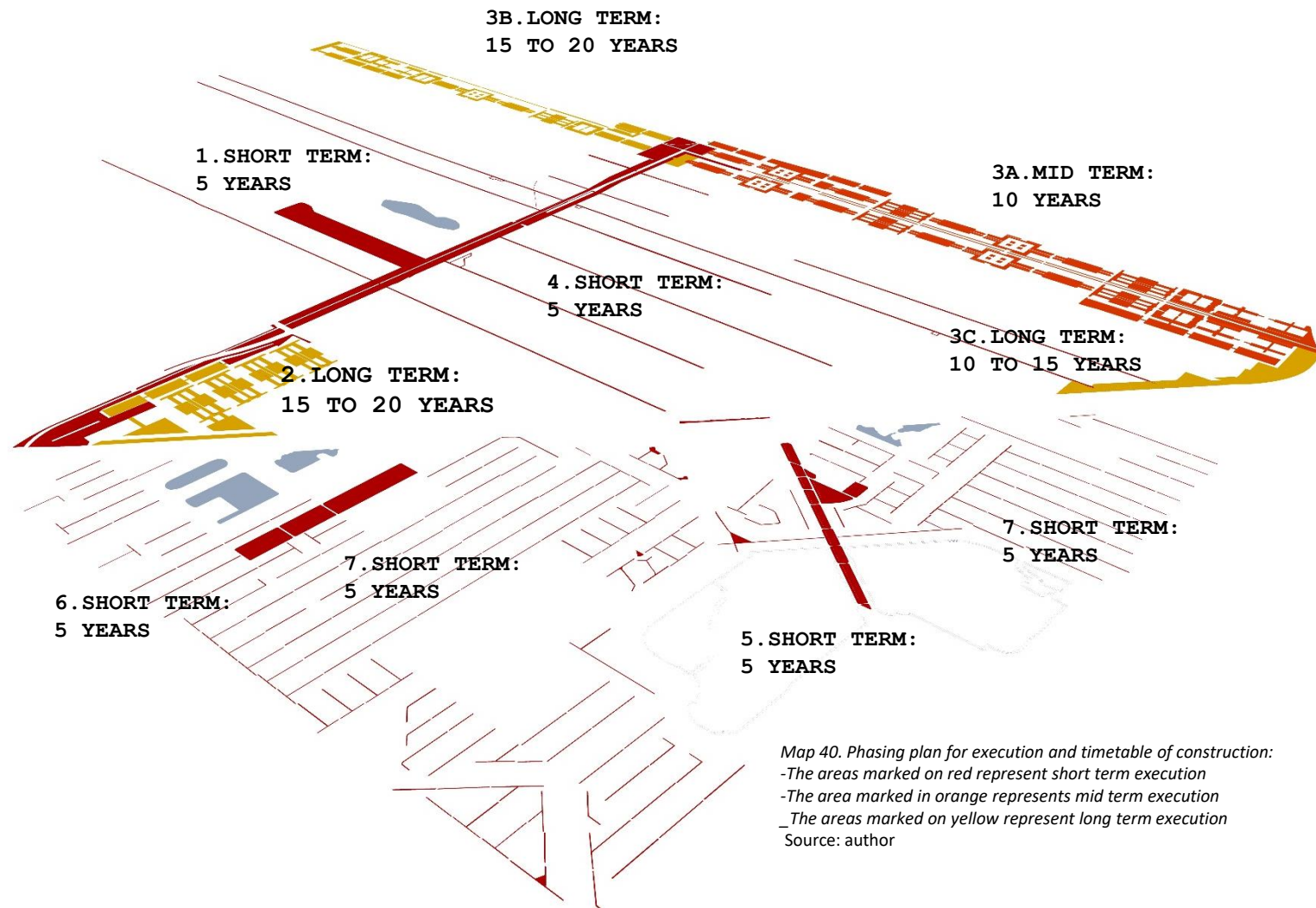
PHASING PLAN

In order to implement the proposed vision and generate the needed socio ecological change through landscape over time, it is necessary to follow a strategic plan and course of action for each city (map 40). This overall plan should take into account the current physical conditions of the potential areas to be intervened, as well as the different actors that would be involved through the development of the different projects.

In that sense, the timeline for the execution of the project is intrinsically linked to the stakeholders that will participate in this evolutionary process. Nonetheless, existing public spaces and infrastructures (especially transportation) will act as the initial catalysts to introduce a blue system in each city, which will further expand to private areas.

Potential areas for redevelopment # 1 & 4 in Hialeah and # 5, 6 & 7 in Miami Springs can be built in the next 5 years. The main reason for this is they are publicly owned. Moreover, potential areas 5 & 6 already constitute part of the public recreational infrastructure of Miami Springs.

Potential area for redevelopment # 3A is already started to be redeveloped. The municipality of Hialeah, private investors and developers have already started the redevelopment process of the east industrial district of Hialeah.

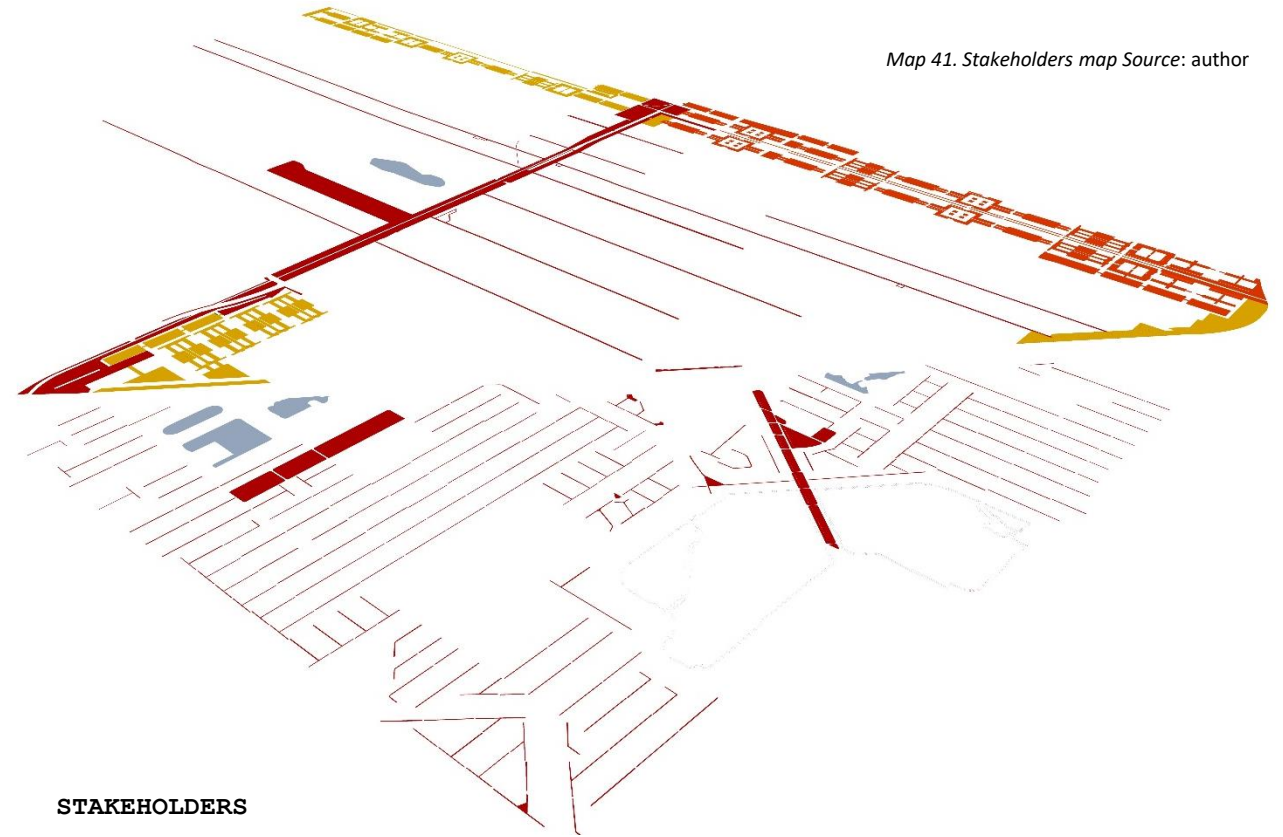


That is the same case of potential area # 3B. Land use policies have been already changed; However, due to the vast amount of land that potential area constitutes, potential area # 3B will take a longer time for redevelopment and will depend on the economical situation of the free market and the public demand for residential and commercial spaces. Potential areas # 2 and 3C will be redeveloped in the long term (10 to 15 years or 15 to years) since there are no current plans for redevelopment of those two areas. Moreover, area 3C would require the acquisition of private property that is not for currently for sale.

“The implementation of long-term solutions will require time, coordination, research, planning and funding, none of which has been dedicated in significant enough quantities to combat this threat.”

- Roman Gastesi, Monroe County Administrator

*Referring to climate change and Sea level rise in Florida



	PUBLIC	PRIVATE	SEMI -PUBLIC
NATIONAL	<ul style="list-style-type: none"> • Parks and Recreation • National Department of transit • U.S department of Intern (National Park System) • U.S. Department of Housing and Urban Development 	<ul style="list-style-type: none"> • Private Investors • Private Developers 	Optional Stakeholders: <ul style="list-style-type: none"> • Open Space Institute (ONG that purchases land for ecologic programs) • National Resilience Institute (ONG- Help the helpers)
REGIONAL	<ul style="list-style-type: none"> • TRI Rail South Florida Regional Transportation Authority • Miami Metrorail • Florida Department of Environmental Protection • Miami Dade Government Office of Resilience 	<ul style="list-style-type: none"> • Private Investors • Private Developers 	Optional Stakeholder: <ul style="list-style-type: none"> • Resiliency Florida
LOCAL (CITY)	<ul style="list-style-type: none"> • Municipality of Hialeah • Municipality of Miami Springs • Sanitation Department of Miami Springs • Public Works • (roads, bridges, canals, sidewalks) 	<ul style="list-style-type: none"> • Homeowners • Private Investors • Private Developers • Golf Course of Miami Springs • Commerce owners of Hialeah 	<ul style="list-style-type: none"> • Golf Course of Miami Springs (receives funds from local government)

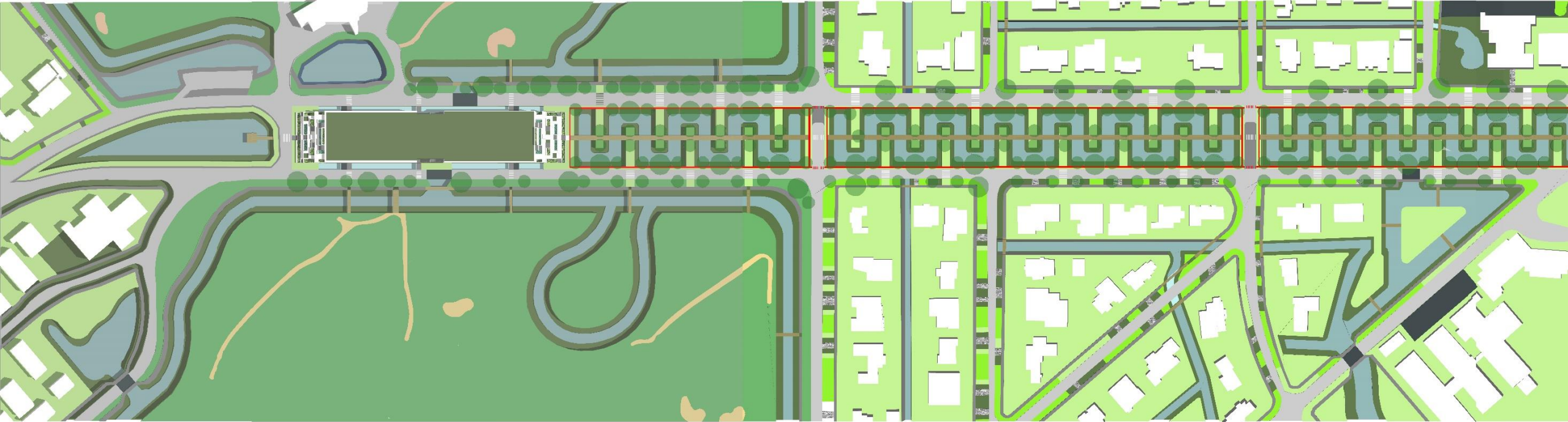
Diagram 22. Stakeholders matrix Source: author

STAKEHOLDERS

The stakeholders matrix (diagram 22) shows the different parties that need to be involved in order to execute the different areas and phases of the vision. Due to the vast areas destined to bodies of water, investors and private developers for the redevelopment of the industrial zone in Hialeah need tax incentives and a change in height permits from the local government in order to achieve higher density units and get the expected economic return for the investment.

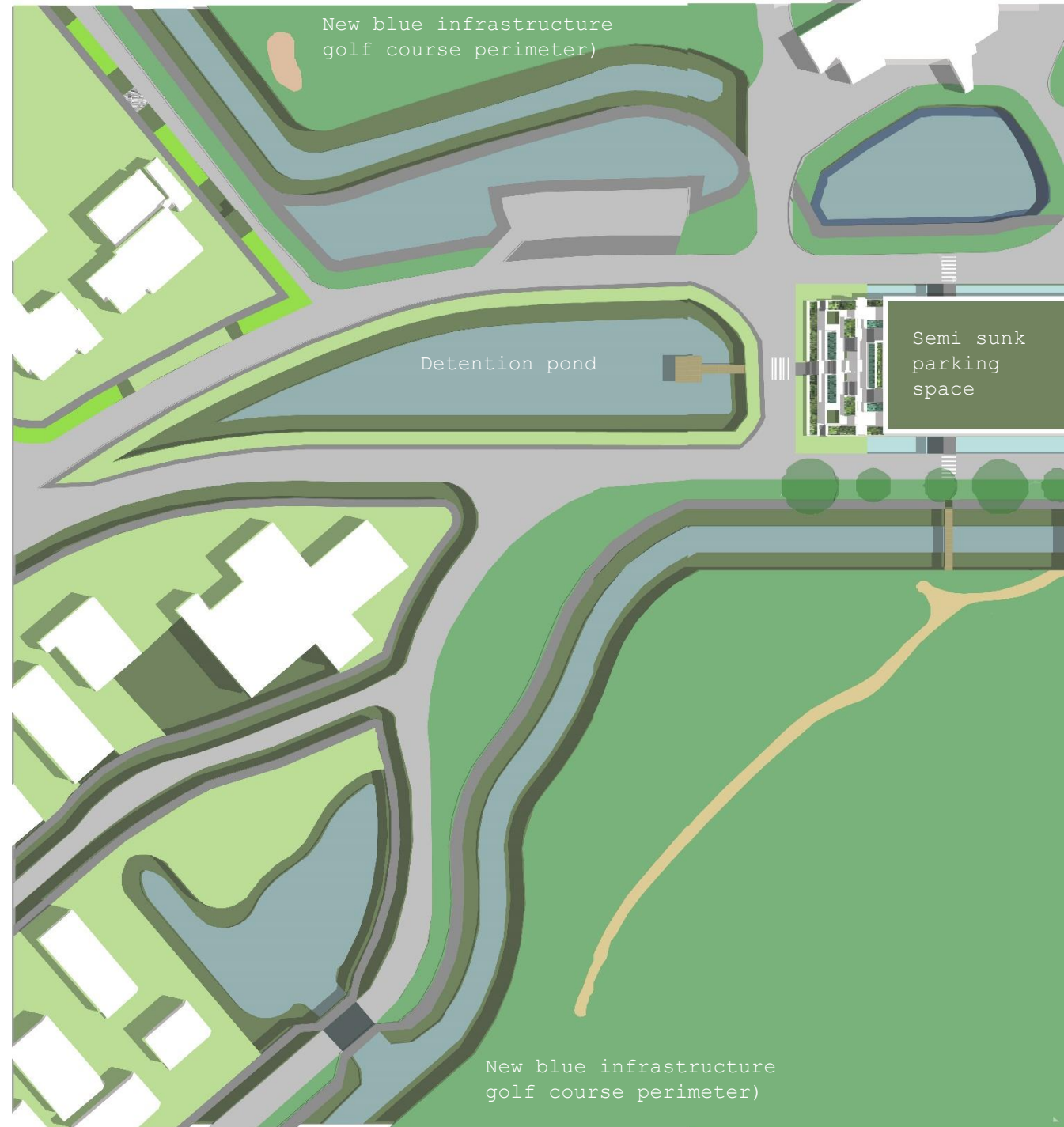
In Miami Springs, the transformation of the back service alleys into a city canal system may affect the homeowners due to a taxation raise product of the public space improvement. However, funds for construction and maintenance can be obtained via government agencies and ONG's. However, the new water management plan also improves the spatial qualities of the house backyards and the city in general, which could also lead to an increase in property value, not to mention livability and the ecologic benefits.

MASTER PLAN MIAMI SPRINGS GREEN AND BLUE SYSTEM



*Master plan 1. Miami Springs new green and blue system.
Source: author.*

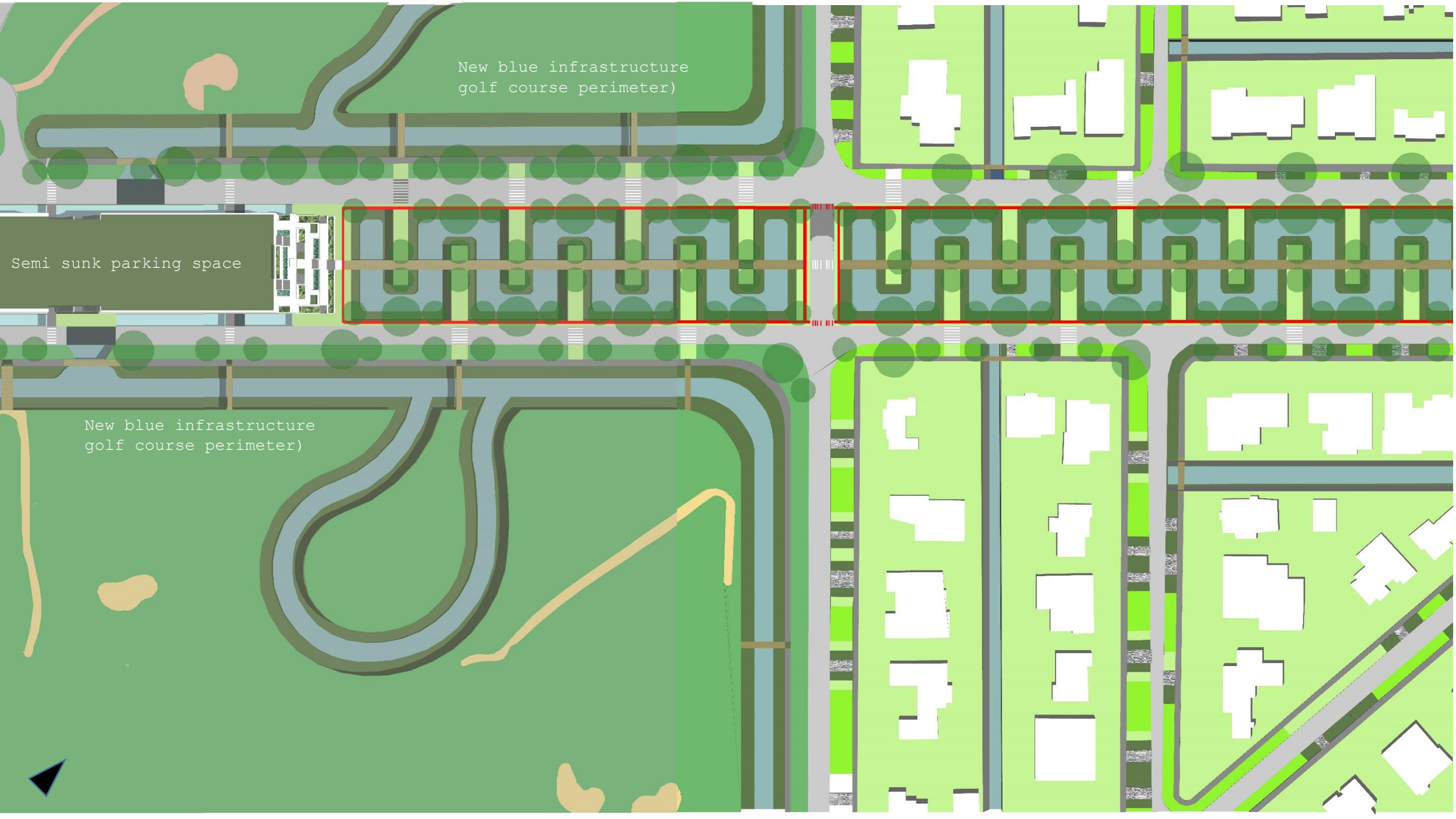
MASTER PLAN MIAMI SPRINGS GREEN AND BLUE SYSTEM



New blue infrastructure
golf course perimeter)

Semi sunk parking space

New blue infrastructure
golf course perimeter)





New canals system
(private and public
property)



• Mahogany tree
(Swietenia Mahagoni)



• Live Oak tree
(Quercus Virginiana)



• Gumbo Limbo
(Bersera Simaruba)

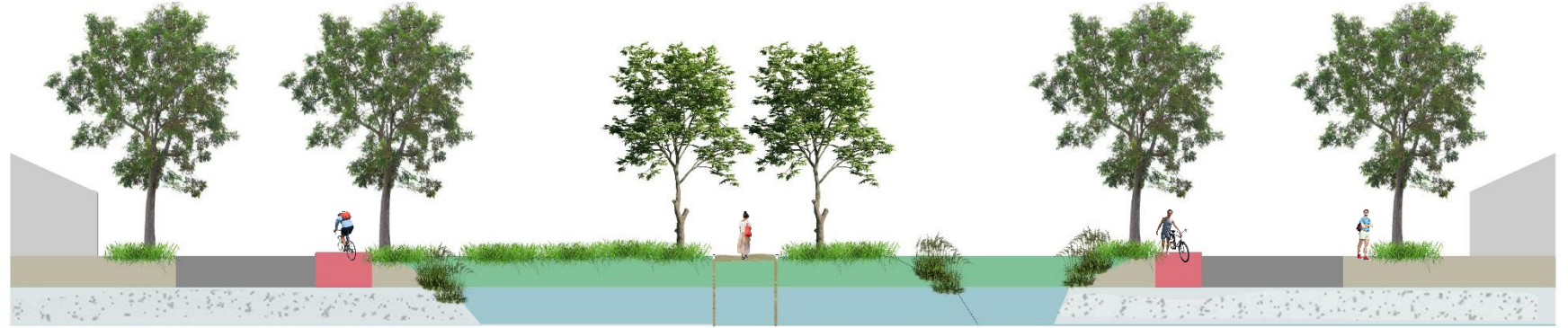


• Black Olive tree
(Bucida Buceras)





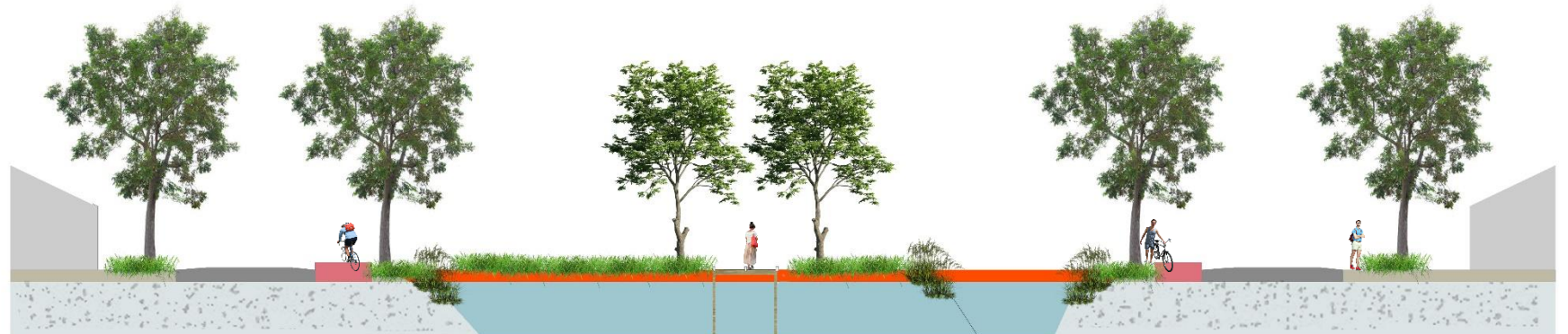
SECTIONS MIAMI SPRINGS NEW
GREEN AND BLUE CENTRAL LINEAR
SYSTEM



LWT

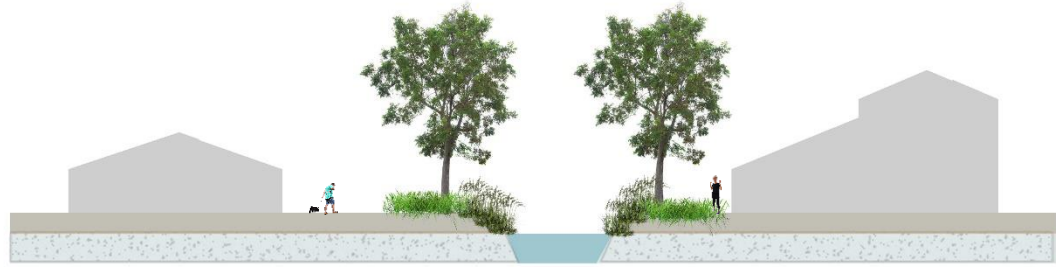


HWT



HEAVY RAINFALL

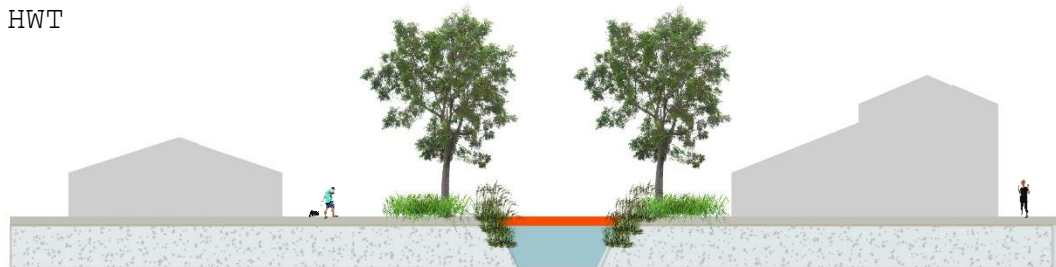
SECTIONS MIAMI SPRINGS NEW BACKYARD CANALS



LWT



HWT



HEAVY RAINFALL

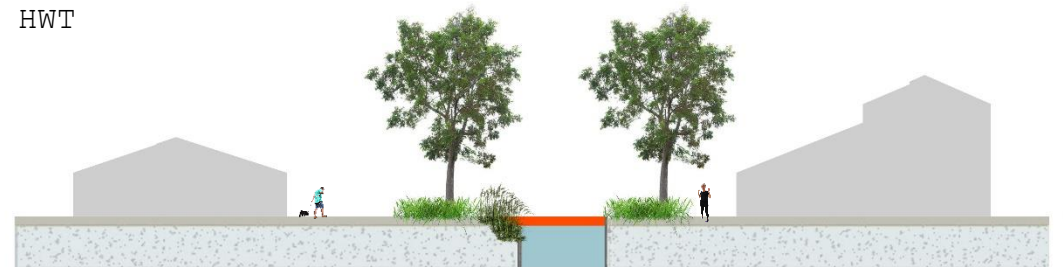
Section 2. Residential canals in Miami Springs with natural banks (former back service alleys)
Source: author



LWT



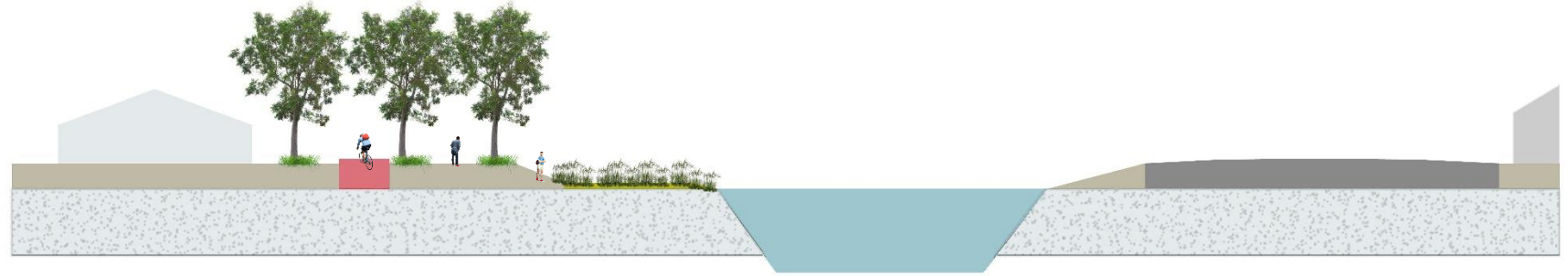
HWT



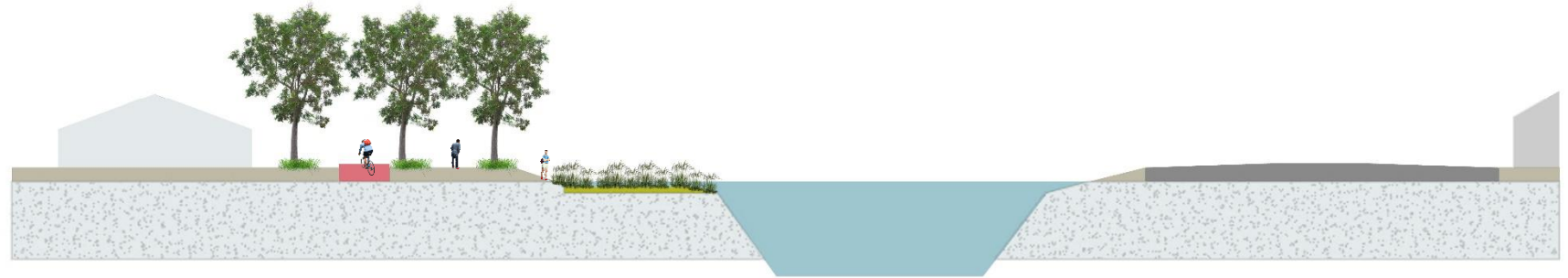
HEAVY RAINFALL

Section 3. Residential canals in Miami Springs with artificial banks due to reduced space for the necessary transformation (former back service alleys)
Source: author

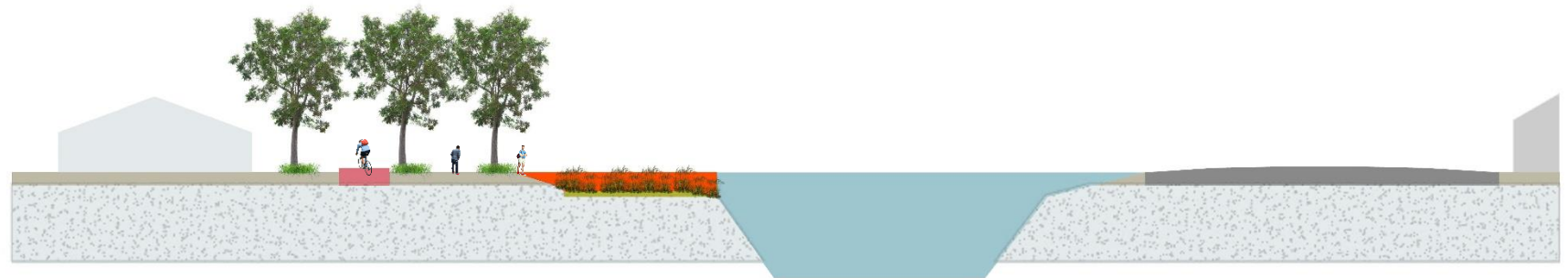
SECTIONS MIAMI SPRINGS
WETLAND PARK



LWT



HWT



HEAVY RAINFALL

MASTER PLAN REDEVELOPMENT EAST INDUSTRIAL AREA (HIALEAH'S NEW WATER TOWN)



*Master plan 2. Hialeah's new water town in the former east industrial district.
Source: author.*



Train tracks





- Mahogany tree (Swietenia Mahagoni)



- Ficus tree (Ficus Aurea)



- Gumbo Limbo (Bersera Simaruba)



- Black Olive tree (Bucida Buceras)



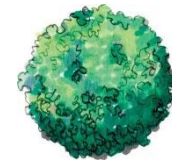


*Impression 2. Hialeah's new mix-use water town in the former east industrial district.
Source: author.*

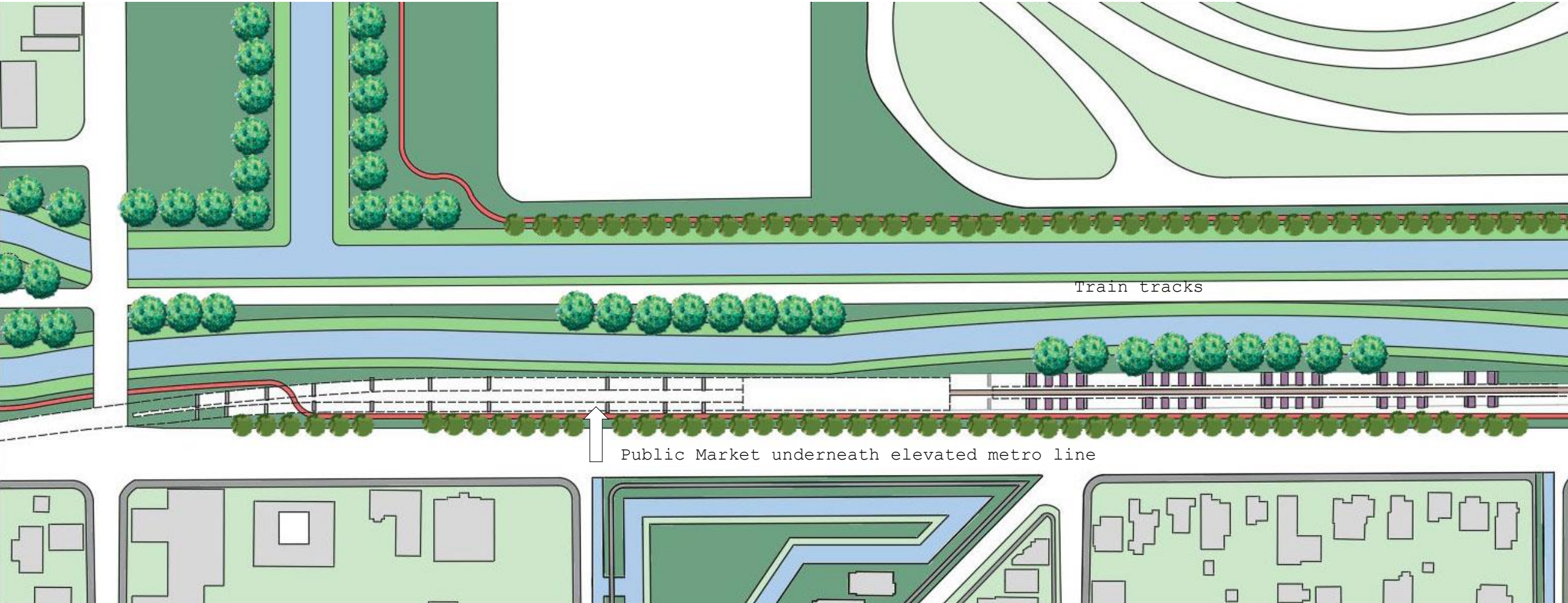
MASTER PLAN CENTRAL LINEAR PARK HIALEAH



- Live Oak tree (Quercus Virginiana)



- Mahogany tree (Swietenia Mahagoni)



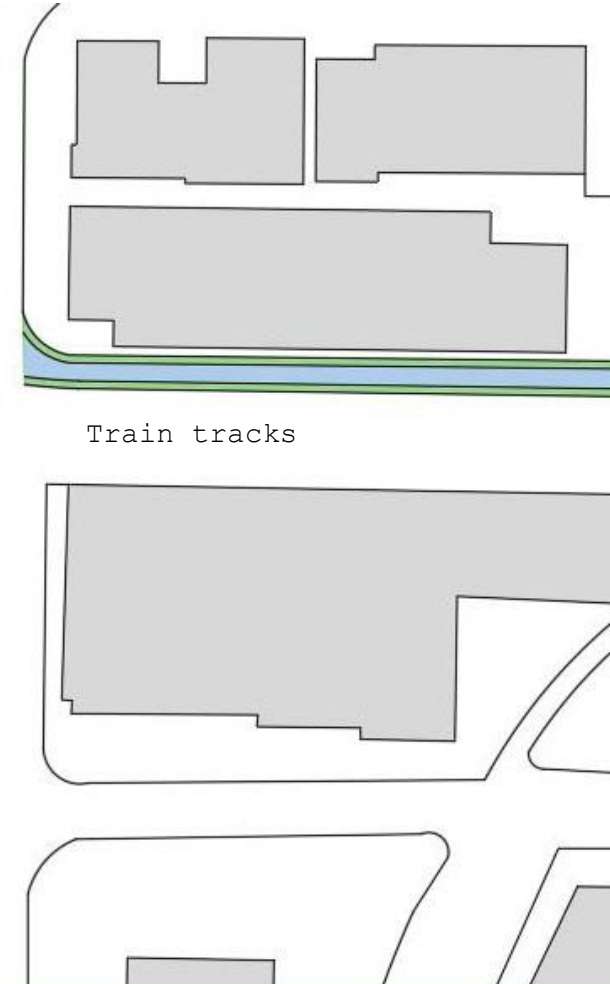
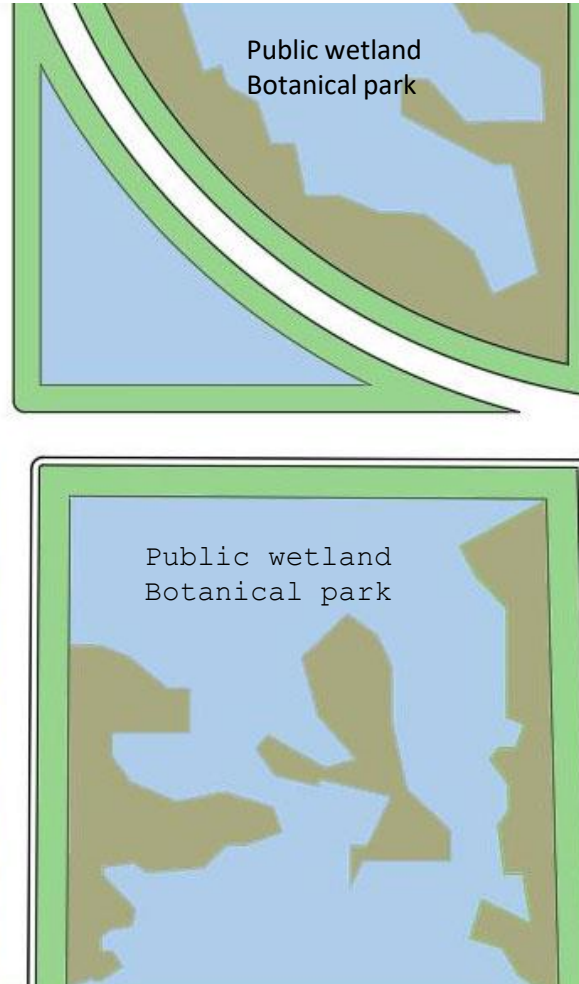
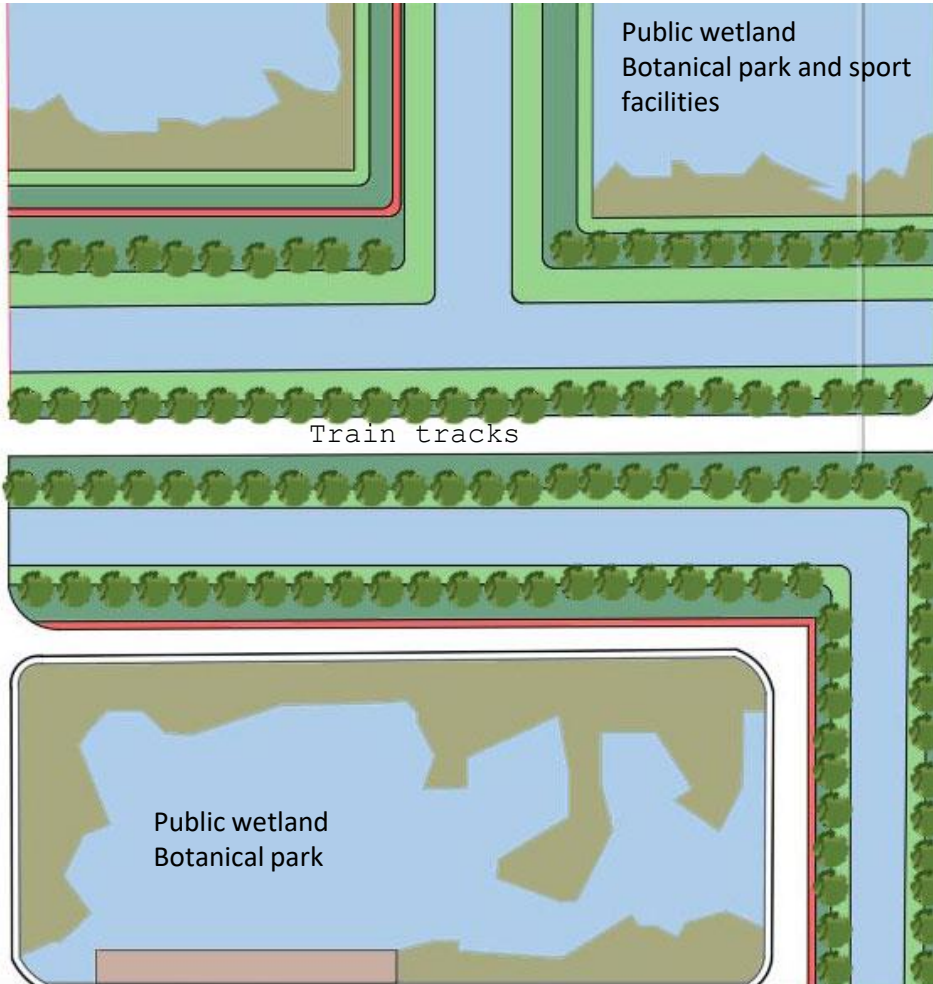
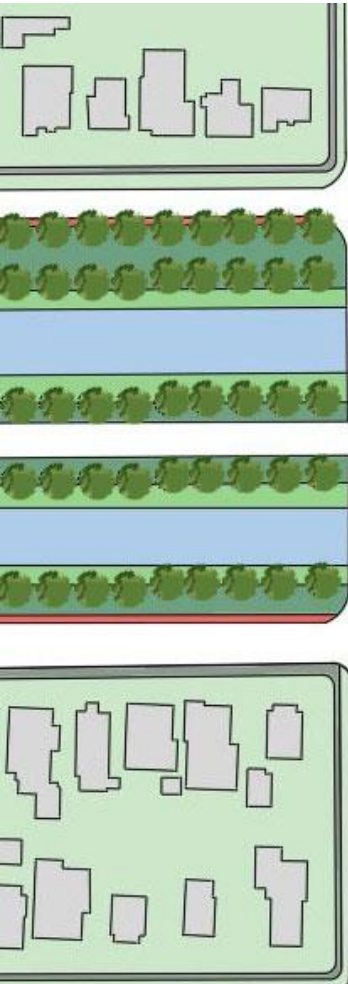
Increase of public space underneath
elevated metro line: shadowed plants
park

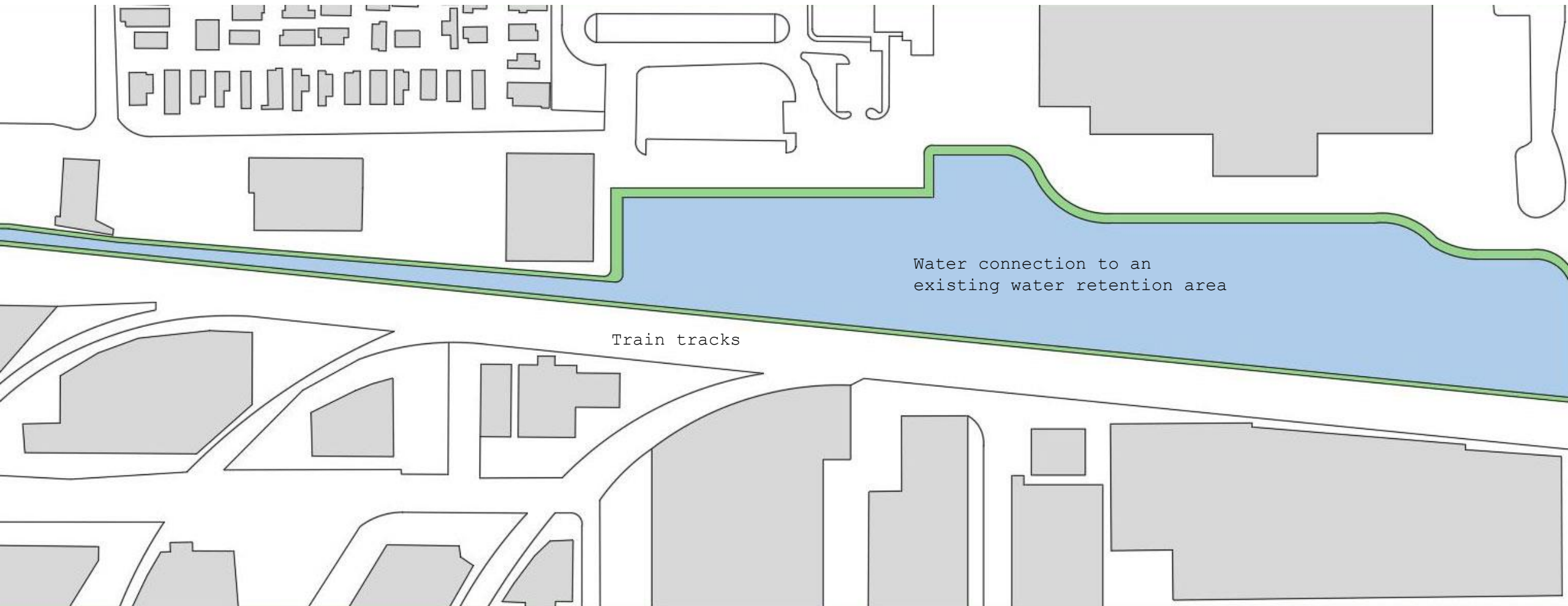


MASTER PLAN CENTRAL LINEAR PARK HIALEAH



MASTER PLAN CENTRAL LINEAR PARK HIALEAH





Water connection to an existing water retention area

Train tracks





Impression 3. Hialeah's sports wetlands park at the end of the central Green and blue new system
Source: author.

SECTIONS HIALEAH CENTRAL LINEAR PARK



LWT



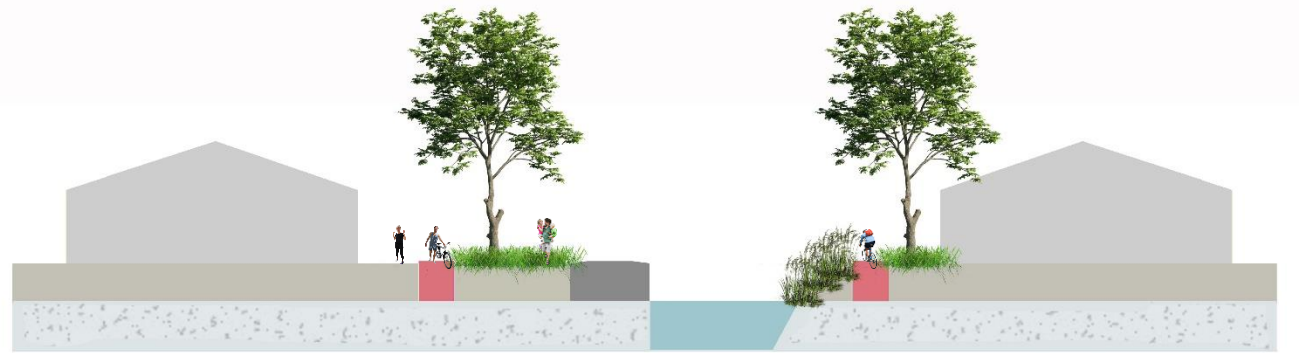
HWT



HEAVY RAINFALL

Section 6. Green and blue system adjacent to the railroad tracks. New central linear park in Hialeah.
Source: author

SECTIONS NEW CANALS IN HIALEAH



LWT



HWT



HEAVY RAINFALL

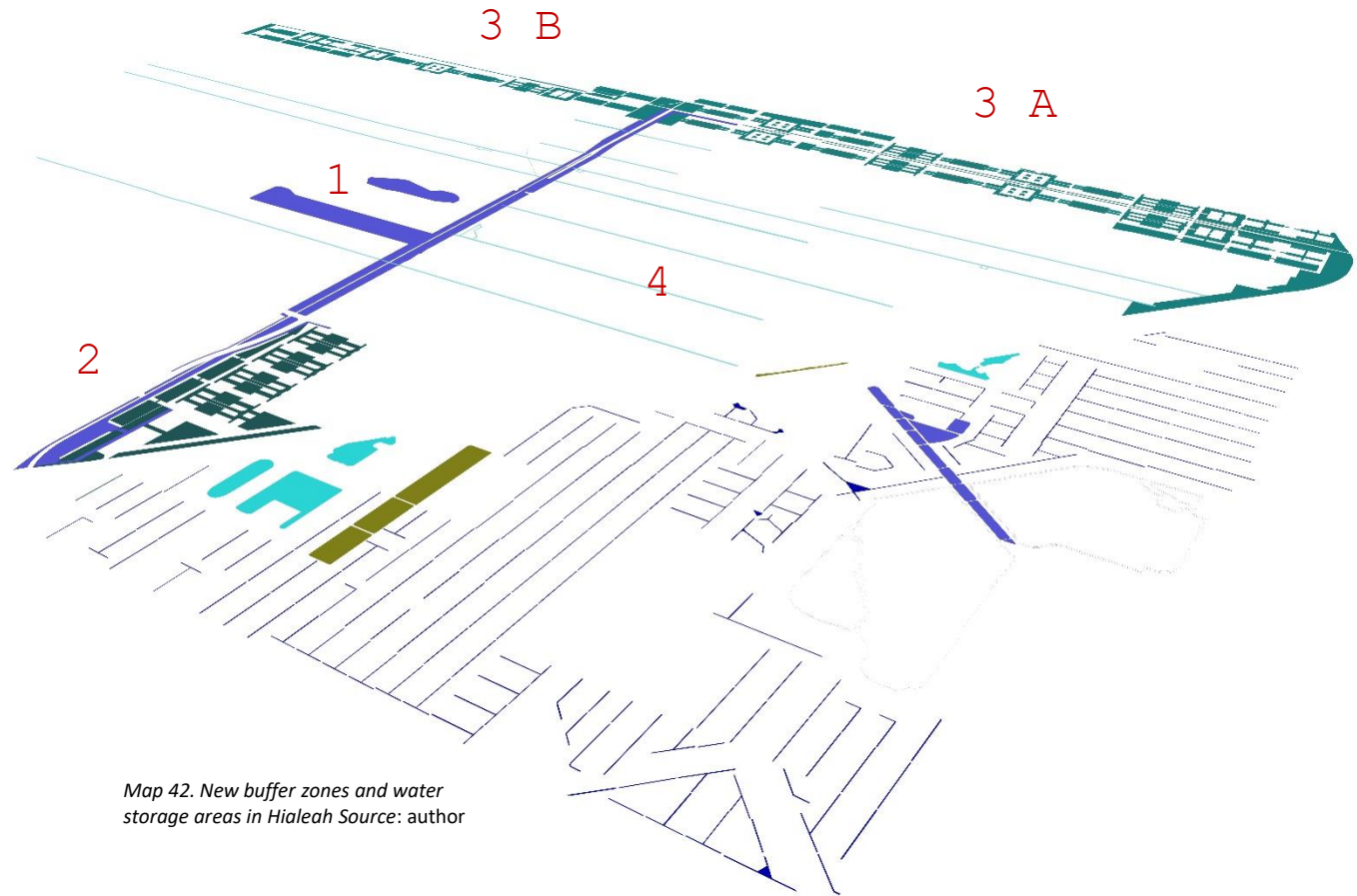
Section 5. North to south canals adjacent to the new one way roads and bicycle lanes in Hialeah.
Source: author

WATER CALCULATION

HIALEAH WATER STORAGE CAPACITY BLUE SYSTEM

- 1.-Central green & blue system = $181.140 \text{ m}^2 \times 0.5 \text{ m} = 90.570 \text{ m}^3$
- 2.-West industrial zone = $209.648,1687 \text{ m}^2 \times 0.5 \text{ m} = 104.824 \text{ m}^3$
- 3A.-East industrial area (south from central green & blue system) = $486.195 \text{ m}^2 \times 0.5 \text{ m} = 243.097,5 \text{ m}^3$
- 3B.-East industrial area (north from central green & blue system) = $224.234,2327 \text{ m}^2 \times 0.5 \text{ m} = 112.117,11 \text{ m}^3$
- 4.-North to south canals = $193.111 \text{ m}^2 \times 0.5 \text{ m} = 96.505,5 \text{ m}^3$

TOTAL HIALEAH = $647.114,11 \text{ m}^3$



Map 42. New buffer zones and water storage areas in Hialeah Source: author

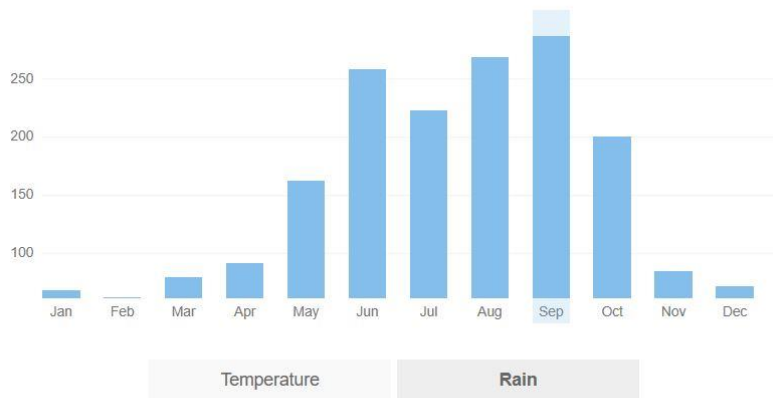
Weather history for Hialeah, Florida

Average rainfall

September

287.01 in|cm

Rain 29 days
Snow 0 days
Avg temps 89° / 76° F



Current forecast - Radar map - Data from Weather Trends

Chart 8. Weather history for Hialeah. Average rainfall during the month of September. Source: Weather trends

September is the month with the highest rainfall events in Hialeah. According to Weather Trends, the average rainfall for that month is 2.87,01 m.

$28'190.284,0933 \text{ m}^2$ (Study area of Hialeah) $\times 2.87,01 \text{ m} = 80'906.115,08 \text{ m}^3$
/ 29 days of rain = $2'789866,037 \text{ m}^3$ of daily rainfall.

$2'789.866,037 \text{ m}^3 - 647.114,11 \text{ m}^3 = 2'142.751,92 \text{ m}^3$

There is the need to storage $2'142.751,92 \text{ m}^3$ of rainwater daily in Miami Springs under current conditions. The new system storages 23,2 % of rainwater per day.

WATER CALCULATION

MIAMI SPRINGS WATER STORAGE CAPACITY BLUE SYSTEM

5.-Central linear green and blue system (park)= 28.215 m² x 0.5 m= 14.107 m³

6.-Wetlands (canal banks & new park)= 135.015 m² x 0.5 m= 67.507,5 m³

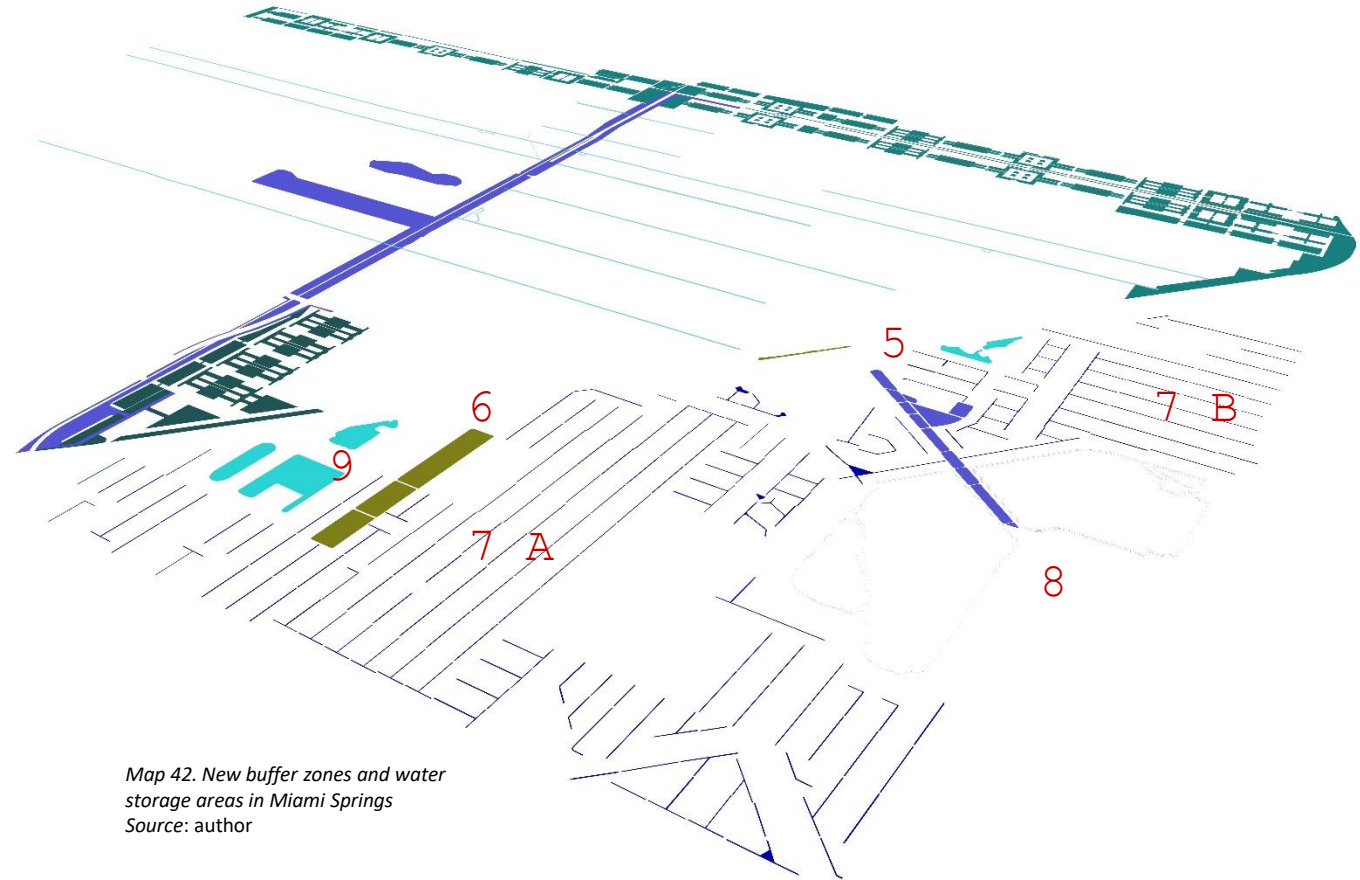
7A.-Residential canal system(north from central green & blue system)= 98.343 m² x 0.5 m= 49.171 m³

7B.-Residential canal system (south from central green & blue system)= 39.068,0138 m² x 0.5 m= 19.534 m³

8.-NorGolf course blue system= 51.700 m² x 0.5 m= 25.850 m³

9.-Existing lakes= 10.985 m² x 0.5 m= 5.492 m³

TOTAL MIAMI SPRINGS= 195.769,5 m³



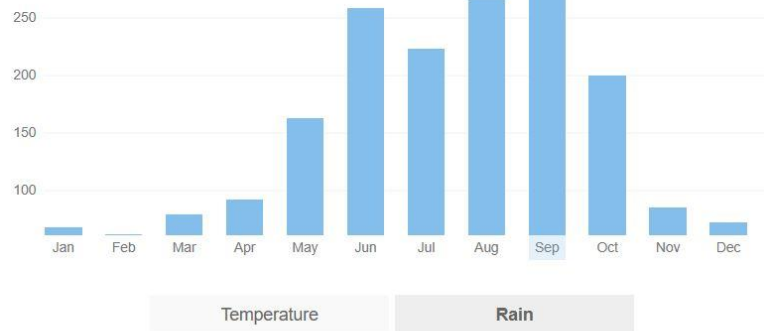
Weather history for Miami Springs, Florida

Average rainfall

September

287.01 in|cm

Rain 29 days
Snow 0 days
Avg temps 89° / 76° F



Current forecast - Radar map - Data from Weather Trends

Chart 9. Weather history for Miami springs. Average rainfall during the month of September. Source: Weather trends

September is the month with the highest rainfall events in Miami Springs. According to Weather Trends, the average rainfall for that month is 2.87,01 m.

7'769.964,331008 m² (Miami Springs area) x 2.87,01 m= 22.300.574,62 m³ / 29 days of rain= 768.985,3317 m³ of daily rainfall.

768.985,3317 m³ - 195.769,5 m³ = 573.215,83 m³

There is the need to storage 573.215,83 m³ of rainwater daily in Miami Springs under current conditions. The new system storages 23,2 % of rainwater per day.



SOURCE: AUTHOR

VIII. REFLECTION

- Relationship Between Research and Design
- Relationship between the Graduation and the Studio Topic
- Potential Applications of the Results in Practice
- Relationship between the graduation project and the wider professional and scientific framework

FINAL REFLEXIONS AND CONCLUSIONS

The Relationship Between Research and Design

There was an intrinsic correlation between research and design in the project, which was not always linear, and that provided the tools to:

- Define the causes of floods in the study area and establish the water management strategy (connection with the protection canal system) to be adopted and the design principles applicable for the blue infrastructure (Physical and technical characteristics: unconfined canals connected to the aquifer and detention and retention qualities).
- Define the theoretical framework to extract design principles and strategies. The design framework consisted in the theories of landscape urbanism, landscape as infrastructure and recuperation of ecosystem services.
- Define the social, spatial and socio ecological deficiencies of both cities during the site visit and the site analysis portion in order to extract the public space connectivity and programmatic strategy through the green and blue infrastructure.

The methodology used provided the guidelines to establish the conceptual framework (literature review of theories and case studies), to understand the hydrogeological features of the site (literature review and interviews) and to conduct the site analysis (site visits, literature review, photographs and mapping of the site).

One of the most hazardous phases of the research was to determine the causes of inland floods in the Miami Dade County and the cities of Hialeah and Miami Springs due to the different amount of theories exposed by researchers and scientists and the lack of specific information related to the specific sites, respectively. A set of phone interviews with hydrologist Michael Sukop provided a lot of clarification and clues on how to interpret and summarize the information and later apply it to the design.

The Relationship between the Graduation and the Studio Topic

The general topic of the Graduation Lab is *Flowscapes*. According to Stefffen Nijhuis et al, the term *Flowscapes* considers landscape as a type of infrastructure and vice versa, where "landscape infrastructures facilitate aesthetic, functional, social and ecological relationships between natural and human systems" (Nijhuis, S. et al, p. 14).

There is a correlation between the graduation topic and the Miami lab since the main objective of the project is to design a functional landscape to mitigate the effects of floods, while improving the social and socio ecological qualities of the public space networks of the cities of Hialeah and Miami Springs.

The concept of landscape as infrastructure is applied through the design of public green and blue systems to provide resilient and sustainable solutions in order to deal with climate change effects in the near future. Moreover, it also aims to provide alternative ways of transportation to the automobile, by the implementation of bicycle lanes and by extending and improving the spatial qualities of the pedestrian transportation network.

Potential Applications of the Results in Practice

- **Whether the design is practical and reliable? Problems encountered during the design process?**

Both cities of Hialeah and Miami Springs are embedded in the center of the urban tissue of the Miami Dade County. In broad terms, natural infrastructures "generally require large amounts of land to deliver the service, which is often in short supply in many built up urban areas" (Depietri, Y., McPhearson, T., p. 101). However, there is a considerable amount of public space and infrastructures that could be transformed into green and blue systems that support the sustainable development of both urban centers.

Nonetheless, there are some factors that could hinder the fully execution of certain areas of the design project:

IN HIALEAH

- The economic revenues for the redevelopers of the East Hialeah Industrial District since the design destines a large amount of areas for green and blue public spaces. In order to make this part of the plan viable, it will probable require a joint venture between the municipality and the private developers (change in heights building permits, a tax incentives plan, acquisition of portions of land by the municipality of Hialeah, among others measures).
- The acquisition of private property next to Okeechobee road and the railroad track in order to complete the long term green and blue vision city plan. However, a convenient economic arrangement and a strategy for relocation could provide a viable solution to the problem. Especially for the dwellings located adjacent to the railroad tracks since it doesn't constitute an attractive and convenient area to live.

- The transformation of certain north to south two-way streets into a one way automobile road with an adjacent canal and a bicycle and pedestrian path. This action requires a further analysis of the internal traffic system of Hialeah. However, the redevelopment of the east industrial complex includes new vehicular roads and better intercity connections with the adjacent cities located to the east that could provide some relieve to the reduction of those roads.

IN MIAMI SPRINGS

- The transformation of the back service alleys destined for garbage recollection into a system of blue canals will contribute with the flooding protection plan, increase biodiversity, environmental and spatial qualities. Moreover, a better garbage disposal system will be implemented and will contribute to the rats problem. However, this action involves the involvement of the edges of private lots and probably a tax increase due to the improvements of public infrastructure.

Relationship between the graduation project and the wider professional and scientific framework

The thesis project has a correlation with the architecture, urbanism and civil engineering professions since it covers spatial and functional aspects that can be applied in an integrated way in combination with these fieldworks.

Especially for the latter, a functional landscape can become an additional tool to be consider as part of a city water management plan. Also for urbanism, it can be a suitable approach for:

- Planning of new city areas.
- The urban regeneration of neighborhoods with decayed public space and vulnerable areas to water related problems.