# Restoring Balance

A FLOOD RESILIENCY PLAN TO REVIVE DETROIT COMMUNITY THROUGH THE INTEGRATION OF GREEN AND BLUE INFRASTRUCTURES.
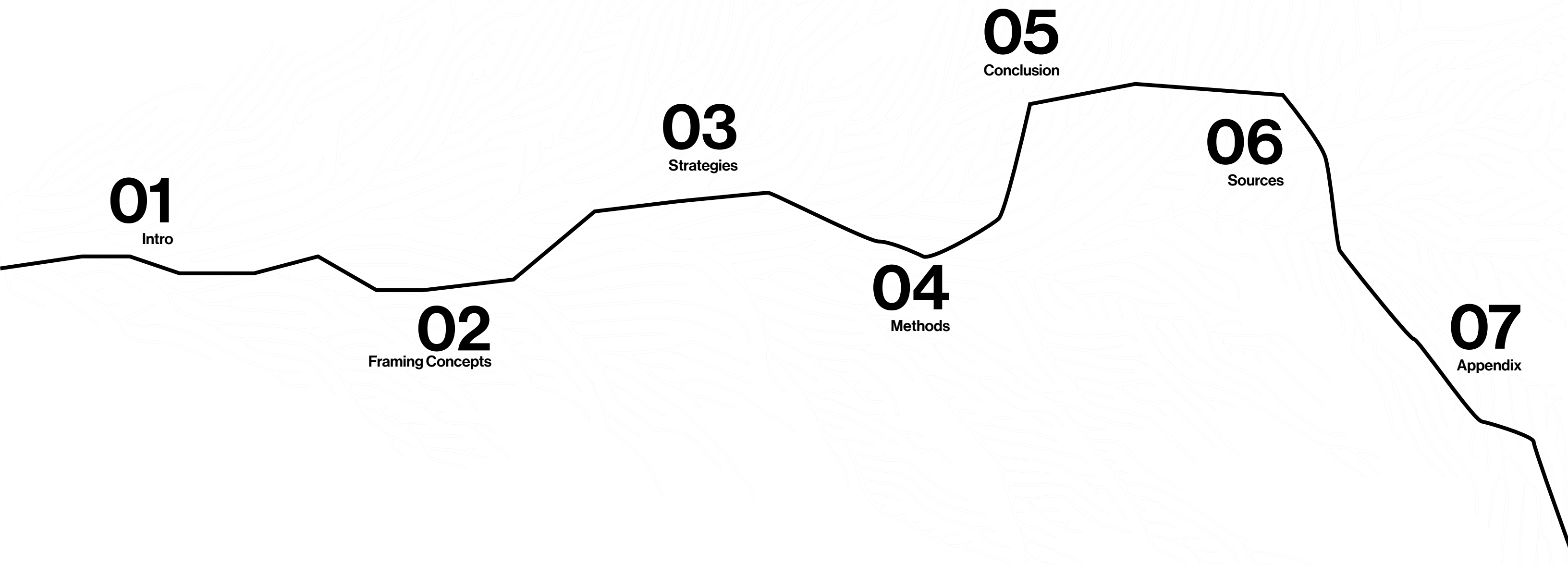
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# Acknowledgment

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# 01

**Intro**

# Thesis Abstract

Detroit has faced multiple damaging flood events throughout its history, particularly due to urban planning mistakes made in the past. This thesis investigation proposes a combination of infrastructures to reconnect natural hydrological systems by envisioning strategies to redirect flood runoff to reconstructed marshes and wetlands through a series of creeks and ponds, providing an equitable urban environment for residents to live and flourish within their communities. Two projects are referenced in this approach: Bloody Run Creek and Renewing Low-Density projects, both by the Detroit Collaborative Design Center, as well as publications by Abas Shkembi titled "Redlined Neighborhoods in Detroit..." and another publication by Larson et al. titled "Recurrent Home Flooding in Detroit...". This thesis investigation aims to address the intersection of flood resilience and equity in urban environments, posing key inquiries that include the economic potential of restoring urban wetlands and water streams on vacant lots, the implications of rezoning policies for parks and wetlands, and practical approaches to restoring wetlands in residential areas without displacing residents. Additionally, considerations are given to the balance of blue and green infrastructure, water and soil remediation strategies, suitable plant species for flooded and polluted environments, and the integration of various infrastructures to effectively manage water systems. The study delves into the significance of indigenous perspectives on land and nature in future design, and the potential contributions of urban wetland restoration to community well-being alongside recreational opportunities. The study employs a multifaceted approach involving mapping of current and historical data linked to flood causations, site analysis of the Boynton neighborhood, visual ethnography using photos of the site that are compared to mapped data, interviews of professionals, and animated projection of interview findings over a 3D layered map of the Boynton neighborhood, and urban design proposal. Amid the exploration of flood causations and mitigation strategies, some findings arose. It is possible to restore nature's balance by connecting different natural cycles and harmonious relationships between living organisms and the elements of the Earth. Some inspired green and blue strategies to mitigate floods include using riparian buffers near rivers and water streams, decreasing the size of sewer sectional areas by daylighting creeks, and restoring wetlands that filter air, soil, and water from acid rain and sewer pollutants by using ponds and native vegetation. To dismantle the systematic environmental injustices in Detroit and have a flourishing future from all angles (economically, socially, and environmentally), it is important to fix past mistakes by restoring nature's balance and maintaining it. In conclusion, flood resiliency is a continuous process that needs to be accomplished on both regional and communal levels.

# Thesis Statement

Introduction Flooding is a rising threat that has become a crisis across many countries. Detroit has faced multiple damaging flood events throughout its history; this is particularly due to urban planning mistakes made in the past that no longer co-op with the location (the Great Lakes region, near major waterways such as the Detroit and Rouge Rivers), neither can co-op with the accelerating climate change. These flood events have been causing residents a lot of health distress and economic loss. Therefore, it is urgent to find a flood resolution to protect Detroit's neighborhoods from sinking into contaminated water.
Restoring Balance is a Flood Resiliency Plan to revive the Detroit community through the integration of green and blue infrastructures. This work is done mainly within a post-positivist framework and contextual framework. Designing for flood resiliency involves landscape design based on flood resistance ecological strategies at a regional or communal scale. This type of design consists of green and blue infrastructure strategies for the prevention and mitigation of future flood damages that require a deep understanding of policy adjustments, and urban settlements, in account of the geographic history of the Great Lakes region.
Green storm-water infrastructure entails using natural approaches such as high-water absorbent plants for flood management, which helps in delaying and mitigating the accumulation of runoff in impermeable urban spots. Water balance is another key concept for this study. It refers to how nature in its original shape and form existed and maintained natural habitats that sustained water in the soil and the outer environment,

how water resources were integrated within this nature before any human intervention and urban development, and how to provide what was provided before in the middle of urban settlements.

This plan can be applied through six framing concepts. The first concept is equity. It is urgent to provide an equitable environment for the underserved population, to provide an equitable environment means giving support to neighborhoods or communities that have been affected by an unjust system. To provide equity, we need to understand what it stands for. Glenn Harris, the director of Colorlines, defines equity as applying justice and a little bit of common sense to a system that's been out of balance."

Some collaborative design firms believe in equity like DCDC. They believe that all people have the right to well-designed, healthy spaces and neighborhoods. Most environmental injustices in Detroit are linked to the history of racial segregation. As we see in this publication by Abas Shkembi (2022) Redlined neighborhoods in Detroit experience higher environmental hazards, residents of these neighborhoods have a higher risk of developing cancer and adverse respiratory health outcomes from industrial pollution.
Whereas a study was conducted by Wayne State University called "Household Flooding in Detroit A Snapshot of Citywide Experiences, Implications for Public Health, and Potential Solution" published in 2021, argues that Detroit's combined sewer system is causing

polluted floods in basements causing health issues. This calls for a double-sided solution for both types of contamination sewer water + industrial heavy metal.
The second concept is the memory of landscape. Going back through time, city planning was influenced by colonialism, these urban plans are the main reason why floods happen mostly in specific areas. Very similar to how first settlers planned the city over indigenous village's locations, main Streets/ highways were built over indigenous rails, and unsurprisingly, they built over historic creeks and ran sewers in the same directions where most surface floods happen.
The connection between the formation of landscape shapes and the history of human activity on it. "The landscape doesn't really forget, it has a memory, and when it's time, water will occupy those spots," Napieralski.
These creeks played a vital role in sustaining wildlife within native nature (wetlands and marshes). (Nature Connection and Native Americans or First Nation People, 2022) There is a physical and spiritual importance of water to the Anishnaabe people and their way of life. Water is not only for drinking and irrigating land to grow food, but it is also a primary means of navigation and movement from one place to another. Indigenous names for the place we now call Detroit honor the area's abundance of water; in Wendat, Karontaen, means "coast of the straits," and in Iroquoian, Teuchash Grondie translates in English as "the place of many beavers." Beavers love creeks! For a place to have had many beavers, it must have had many creeks for them to build their dams, find food, and raise

their families. (Joanne Coutts, 2024)
The Indigenous people had a strong relationship with nature, they believed in land and water stewardship. The lack of native nature cover + and permeable surfaces in urban areas contribute to Detroit's floods. Surface floods in Detroit are mainly caused by mistakes made in history, and these mistakes should be corrected.

The third concept is Resiliency; The ability to absorb, recover, and prepare for future shocks (economic, environmental, social & institutional). Resilient cities promote sustainable development, well-being, and inclusive growth. (Dinara Muldabayeva, Tamara Nikolic, 2023)
We can achieve flood resiliency through a multi-dimensional infrastructure solution along with the change of policies.
Flood resilient design is a construct that stands for a proactive and precautionary approach to increase water resource sustainability while reducing climate change risks (Donald Watson, 2011).
The fourth concept is the balance of nature.
It's part of resiliency, and it stands for the interconnected harmonious relationship between different natural cycles, living organisms, and the elements of the Earth, Based on 2 different articles by Nana Firma, and Daniel Simberlo.
For example, the Water balance construct is "The amount of water within a regional watershed is balanced in a natural cycle of precipitation, vegetation,

evaporation, watercourses, and reservoirs."
Natural systems of vegetation, soils, floodplains, and wetlands provide ecosystem services that maintain water balance and mitigate flooding". "Water balance and watershed resilience to flooding can be correlated to the percent of porous versus impervious cover." Evapotranspiration is the greatest component of the annual water balance in most climates in the United States. (Donald Watson, 2011).
The fifth concept is Sustainability.
Which refers to "the ability to maintain or support a process continuously over time". (Daniel Mollenkamp, 2023).
As well as it stands for "the ability of a community to thrive and prosper in an equitable, green city". (city of Detroit, Sustainability Action Agenda)
The indigenous people encourage water and land stewardship, they treat nature as a family member to cherish and care for. It is derived from the belief that there needs to be a two-way, reciprocal relationship where mankind looks after nature. Water and land stewardship (Nature Connection and Native Americans or First Nation People, 2022)
The sixth concept is community well-being.
It stands for the shared rights of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential. (Wiseman & Brasher, 2008)

Some questions evolved during this thesis investigation such as How can blue and green infrastructure intervention achieve a balanced ecology? What type of plants can be farmed in a neighborhood heavily flooded with sewage and heavy metal pollutants in air, water, and soil? How can the restoration of wetlands and water streams contribute to well-being? How can designing for flood resiliency contribute to equity? How can the restoration of urban wetlands and water streams on vacant lots contribute to a neighborhood's economic subsistence? How does the memory of the landscape inform future flood resiliency design and planning?

Inspired by the indigenous tribe's connection to nature and maintenance of it, this thesis proposes to reconnect natural hydrological systems by redirecting flood runoff to reconstructed marshes, wetland, and community farms through a series of creeks and ponds.
These wetlands will work as a kidney, filtering air, soil and water pollutants providing an equitable environment for Detroit neighborhoods to live and flourish within their communities.  Encouraging land and water stewardship through circular economy.

Multiple methods were used to answer these questions and to investigate the causes of floods in Detroit, specifically Boynton neighborhood. Most of the investigation was Mapping historical maps (redlining map, historic creeks map, historic nature, and historic human activity) and comparing them to on-ground perception. This is done through photo collaging images of the most flooded parcels and placing them on their spots in Boynton's neighborhood map. Mapping layers of information like flood risk and flood factor, topography, building footprint, vacant structures, vacant lots, sewer network, Impervious surfaces, type of soil, green lots, zoning, transportation, and number of occupied houses, to Analyze the site and evaluating the current situation and possible causations of flood in Boynton neighborhood. Interviewing 4 professionals, such As Steve Vogel, Joel Howrani, Joanne Coutts, and Sarah Hoyash. This learning method is a shortcut to resources and inspiration based on different professional experiences. Analyzing numbers and creating graphical Census data. Checking rezoning policies and comparing them to land use, native nature, and restrictions over factories' overflows.  This helps to identify the gaps in the policies system that would help us impose a new policy to preserve and restore native nature. Analyzing local and international precedents and data from scientific publications and creating a summary of flood mitigation strategies to be used. Three scales of Design proposals were implemented over the Boynton neighborhood including a macro scale, a micro-scale, and a selected part of the neighborhood. The macro-scale was created by Projecting animation of an imaginary proposal over a 3d model of Boynton's neighborhood map. This imaginary proposal is inspired by a conducted interview with landscape architect Steve Vogel about the Bloody Run Creek project. This is the visual understanding of concepts, and strategies used in this project based on Steve's expertise to be implemented in the Boynton neighborhood. The micro-scale visualizes the bridging between 3 parcels and daylighting a creek in the middle of a residential block. And the final proposal of a selected part within the Boynton neighborhood.

When first colonial settlers planned the city over indigenous' villages, and main Streets over indigenous' trails. They disrupted native nature by building over historic creeks and marshes and they ran sewers in the same direction where most creeks used to be located, which all contribute to the surface floods that we perceive in Detroit today. These malpractices not only harm nature but also have detrimental effects on human beings. A study conducted by Peter S. Larson in 2021 shows that flood contributes to health risks due to Detroit's deteriorated combined sewer system. Another study conducted by Abas Shkembi in 2022 indicates that environmental injustices are connected to the history of racial segregation. Most areas that are considered at a high risk of flooding were previously part of or close to the redlined areas according to Detroit's redlining map. The solution for flooding in Detroit should be implemented primarily in areas that have faced these environmental injustices.
 Inspired by the sponge city concept implemented in many East Asian cities and the concept of the broadacre city created by Frank Lloyd Wright, this plan offers a big-scale solution where the green and blue infrastructures work together with the gray system in prompt to restore and maintain the balance of nature and community wellbeing.

A limitation of this thesis is that the application of natural soil and water remediation strategies is limited to seasonal changes, this requires thinking about a substitute plan in winter seasons. Another limitation is the community maintenance of farmed wetlands. To provide a sustainable solution, each neighborhood's community should have gardening clubs with planned tasks for each member of the community to sustain community subsistence. meanwhile daylighting creeks in residential areas creates another issue for stakeholders, where part of the process is to retreat people in some areas. This requires the approval of residents to have water streams and ponds near their houses and to be part of a gardening club.

In conclusion, this study is much needed to dismantle systematic environmental injustices in Detroit and fix the malpractices of the past, to reflect a flourishing future economically, socially, and environmentally. We are obligated to design healthy environments for all people. The Boynton neighborhood revitalization project proposes a comprehensive approach to rejuvenating the area, focusing on both environmental restoration and community involvement. By restoring wetlands and implementing green stormwater infrastructure, the project aims to enhance sustainability and resilience. Proposed changes to land use policies include rezoning for wetlands and urban farms, alongside creating urban forestry buffers for safety and well-being. Pathways inspired by indigenous navigation prioritize pedestrian-friendly spaces and recreational amenities. Repurposing

railroads into greenways further promotes connectivity and outdoor activities. The project also encourages community participation through opportunities in the cut flower industry and farmers markets, fostering economic vitality and local engagement. Overall, the project seeks to create a more livable and environmentally conscious neighborhood through a combination of urban agriculture, flood management, and inclusive planning strategies.

## Thesis Scope

Flood isuue has a huge scope of work which it can be approached from. This investigation mainly focuses on Ecology, well-being, economy, and landscape design within post-positivist and partially contextual frameworks.

## The purpose of the thesis

Inspired by the indigenous tribe's connection to nature and maintenance of it, this thesis proposes to reconnect natural hydrological systems by redirecting flood runoff to reconstructed marshes, wetland, and community farms through a series of creeks and ponds.

These wetlands will work as a kidney, filtering air, soil and water pollutants providing an equitable environment for Detroit neighborhoods to live and flourish within their communities.  Encouraging land and water stewardship through circular economy.

Emergency Management

Policy and Governance

Civil engineering

Architectural

**Landscape**

**Economic**

**Urban Planning**

**Land Use**

Built Environment

## Thesis scope

**Ecological**

Political

Hydrological

Cultural

Geological

Educational

**Wellbeing**

Meteorology

Geographical

Sociology
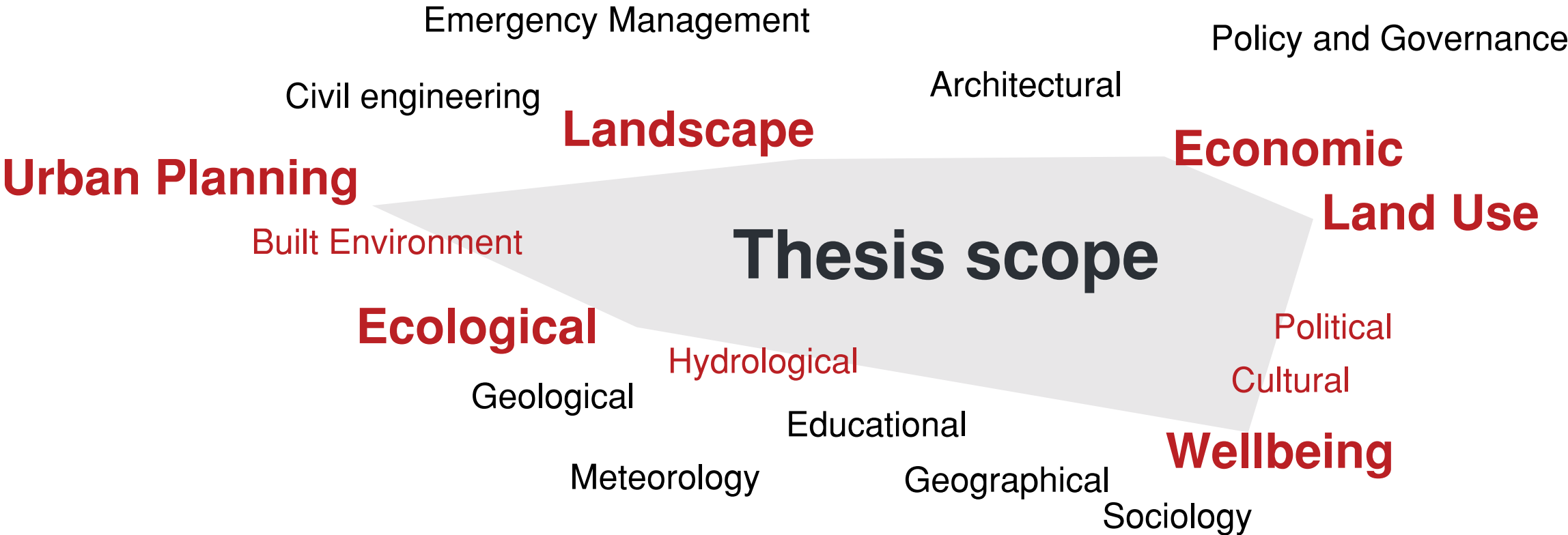
**Figure 1.1**. Thesis Scope. Credits: Author.

# Why Detroit Floods?

**Causes**

**Global warming**

**Detroit's history of Racial and economic inequity**

**Inadequate house structures** (the ones built before 1910 and the ones built after 1960)

**Impervious surfaces (Changes in land use** Building over marches/natural habitats)

**Combined sewer system**

Aging inadequate **infrastructure**

**Location** in the middle of the Great Lakes hydrological system and **type of soil (Clay n Loams)**

Historical **buried creeks** in Detroit (a break of water cycle within the natural landscape)

Climate Change

Transportation of moisture from the gulf of Mexico to the Midwest.

Inadequate policies

2013 bankruptcy

Public hazardous investments in minority neighborhoods

The principal authorities and local government is a fragmented system in Detroit

People of color living in low income neighborhoods are the most affected of floods

DWSD grants public investment in water infrastructure development to wealthy, primarily white neighborhoods over minority neighborhoods

The need for designing beyond minimum requirements

Sewer backups/ overflows

Sewer system malfunctions and breaks

Clogged sewer system

Urban sprawl

Diverting the flow of creeks to the sewer system

The replacement of farms by factories after the civil war

Higher temperatures> the increased amount of precipitation rates specially in the great lakes region> longer duration of storm.

Allowing building structures over marshes

Most homeowner & rental Insurance policies do not cover flooding.

**Vacant / abandoned properties, the more vacancies the wore the flood.**

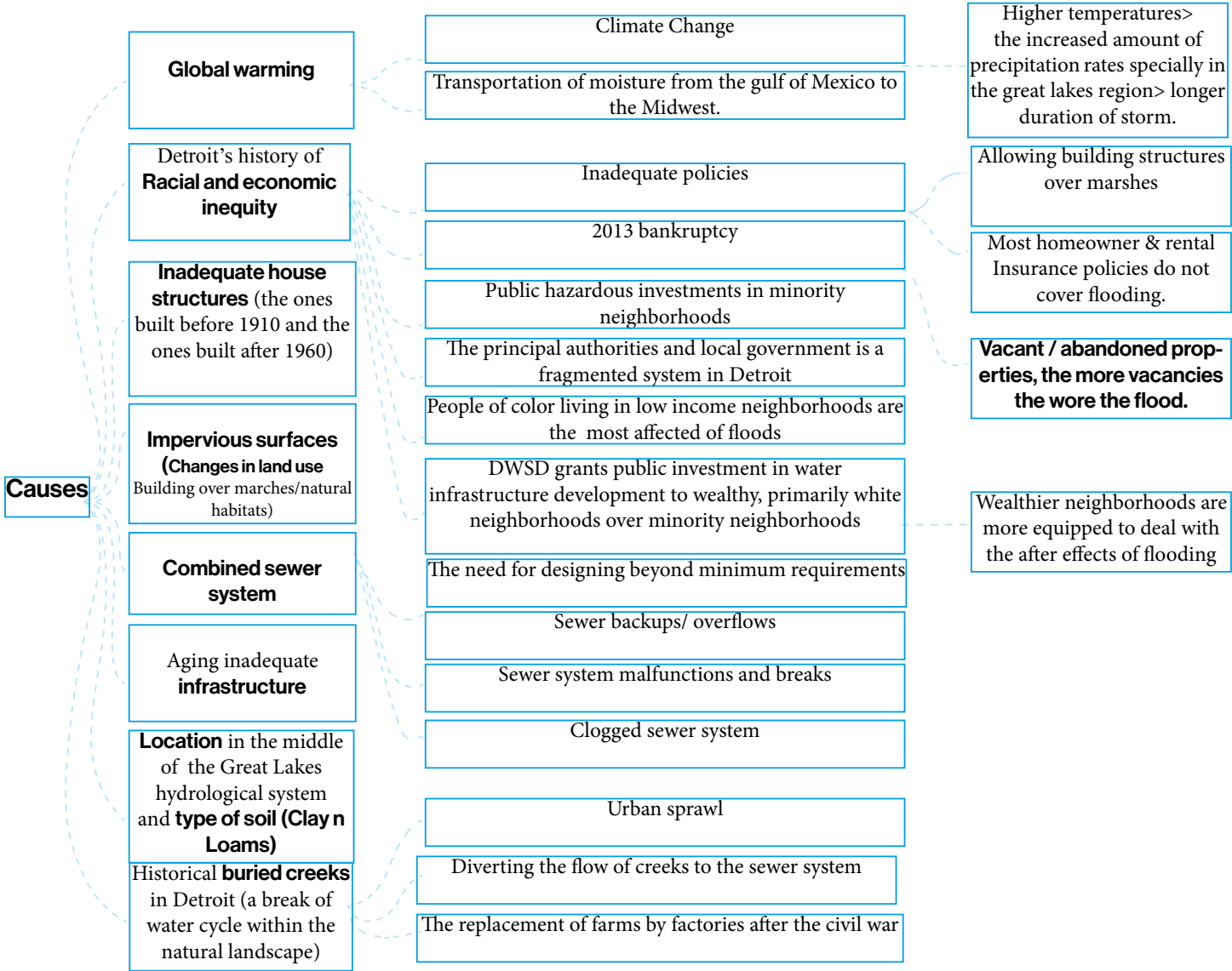Wealthier neighborhoods are more equipped to deal with the after effects of flooding

**Figure 1.2**. Why Detroit Floods?. Credits: Author.



**Figure 1.3**. Collage of Detroit Floods. Credits: Author.

# 02

**Framing Concepts**

## Thesis Definition

# Restoring Balance

A flood resiliency plan to revive Detroit's community through the integration of green and blue infrastructures

## Assumptions

It is urgent to find a flood resolution to protect Detroit's neighborhoods of sinking.

Flood resiliency can be achieved by a multi-dimensional infrastructure solution along with the change of policies.
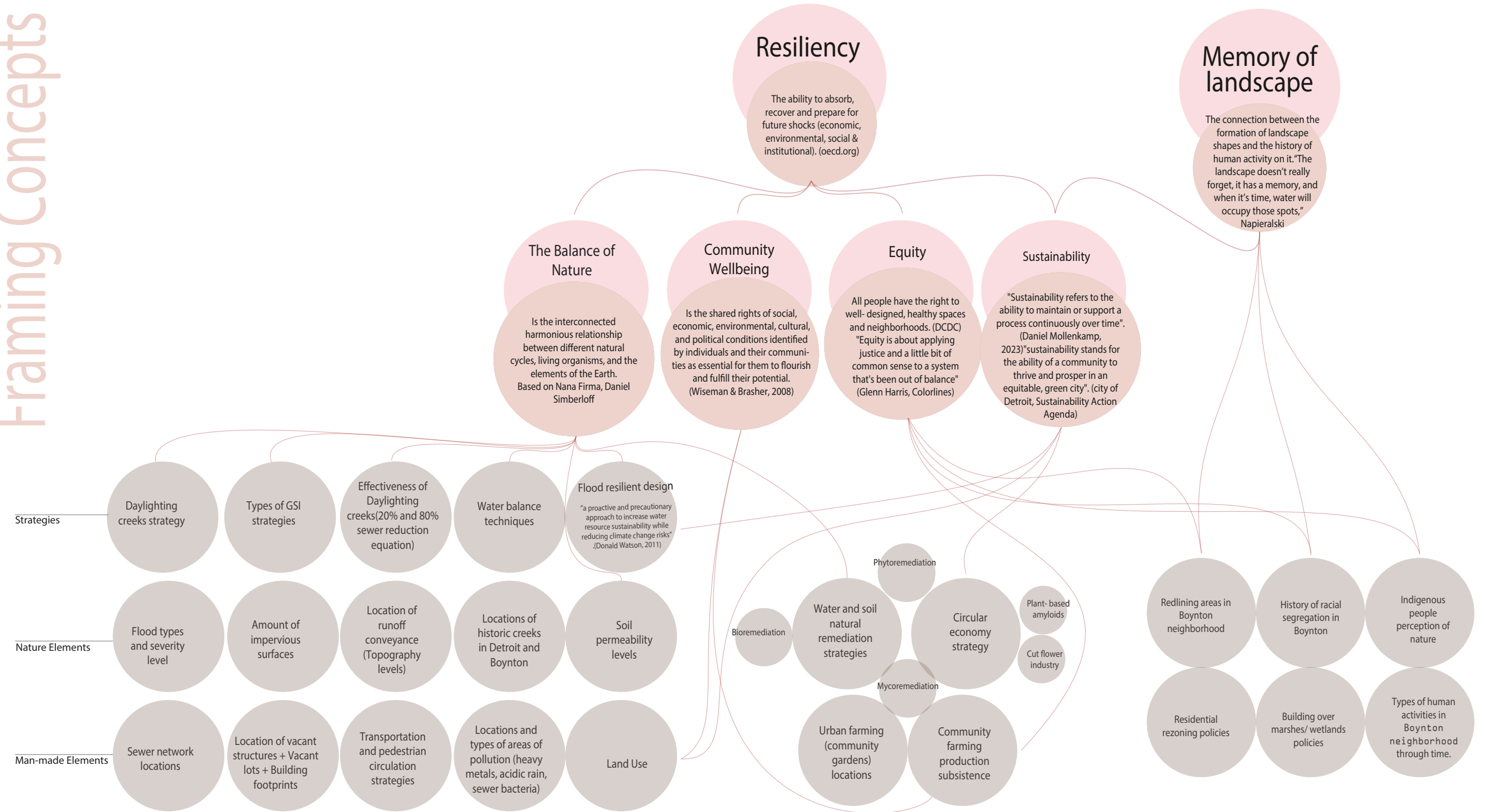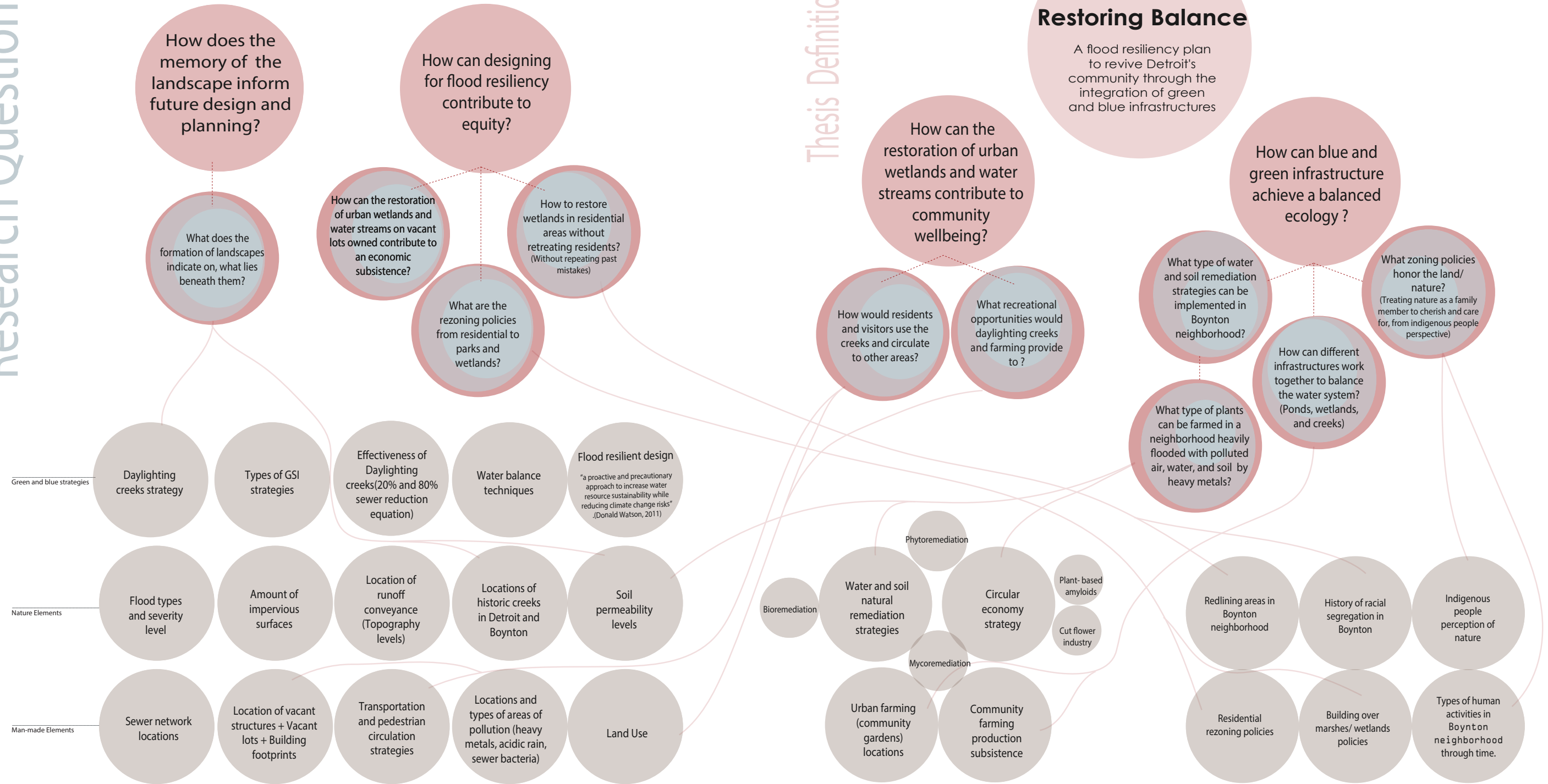
## Framework

Post positivist

Contextual

Natural/ green approaches can improve neighborhoods' wellbeing.

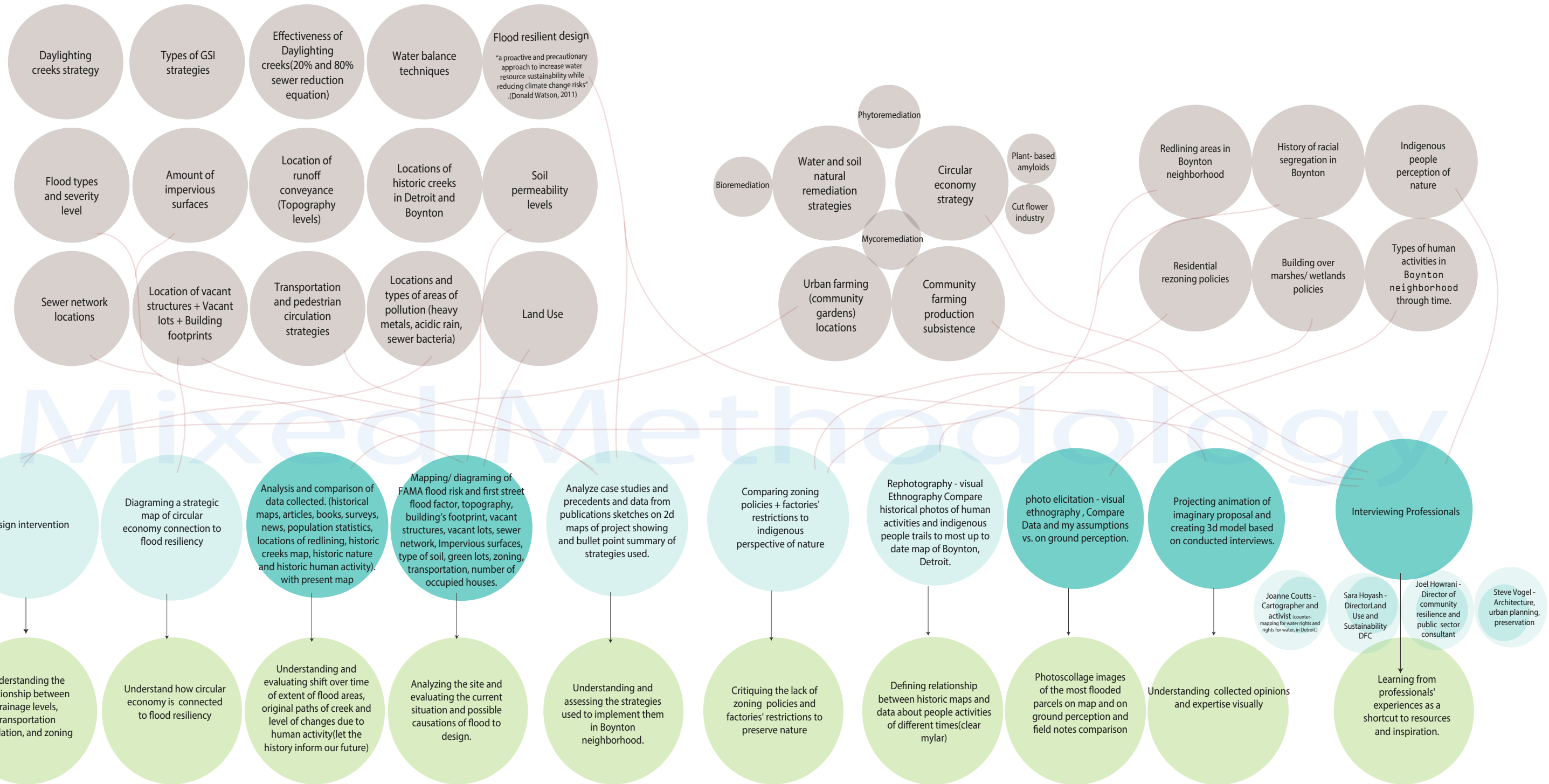It is important to provide an equitable environment for the under served population.

**Figure 2.1**. Assumptions Diagram. Credits: Author.

**Resiliency**

The ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional). (oecd.org)

**Memory of landscape**

The connection between the formation of landscape shapes and the history of human activity on it."The landscape doesn't really forget, it has a memory, and when it's time, water will occupy those spots," Napieralski

**The Balance of Nature**

Is the interconnected harmonious relationship between different natural cycles, living organisms, and the elements of the Earth. Based on Nana Firma, Daniel Simberloff

**Community Wellbeing**

Is the shared rights of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential. (Wiseman & Brasher, 2008)

**Equity**

All people have the right to well- designed, healthy spaces and neighborhoods. (DCDC) "Equity is about applying justice and a little bit of common sense to a system that's been out of balance" (Glenn Harris, Colorlines)

**Sustainability**

"Sustainability refers to the ability to maintain or support a process continuously over time". (Daniel Mollenkamp, 2023)"sustainability stands for the ability of a community to thrive and prosper in an equitable, green city". (city of Detroit, Sustainability Action Agenda)

Strategies

Daylighting creeks strategy

Types of GSI strategies

Effectiveness of Daylighting creeks(20% and 80% sewer reduction equation)

Water balance techniques

Flood resilient design
"a proactive and precautionary approach to increase water resource sustainability while reducing climate change risks" .(Donald Watson, 2011)

Nature Elements

Flood types and severity level

Amount of impervious surfaces

Location of runoff conveyance (Topography levels)

Locations of historic creeks in Detroit and Boynton

Soil permeability levels

Phytoremediation

Bioremediation

Water and soil natural remediation strategies

Circular economy strategy

Plant- based amyloids

Cut flower industry

Mycoremediation

Man-made Elements

Sewer network locations

Location of vacant structures + Vacant lots + Building footprints

Transportation and pedestrian circulation strategies

Locations and types of areas of pollution (heavy metals, acidic rain, sewer bacteria)

Land Use

Urban farming (community gardens) locations

Community farming production subsistence

Redlining areas in Boynton neighborhood

History of racial segregation in Boynton

Indigenous people perception of nature

Residential rezoning policies

Building over marshes/ wetlands policies

Types of human activities in Boynton neighborhood through time.

**Figure 2.2**. Framing Concepts Diagram. Credits: Author.

**Restoring Balance**

A flood resiliency plan to revive Detroit's community through the integration of green and blue infrastructures

How does the memory of the landscape inform future design and planning?

What does the formation of landscapes indicate on, what lies beneath them?

How can designing for flood resiliency contribute to equity?

How can the restoration of urban wetlands and water streams on vacant lots owned contribute to an economic subsistence?

How to restore wetlands in residential areas without retreating residents? (Without repeating past mistakes)

What are the rezoning policies from residential to parks and wetlands?

How can the restoration of urban wetlands and water streams contribute to community wellbeing?

How would residents and visitors use the creeks and circulate to other areas?

What recreational opportunities would daylighting creeks and farming provide to ?

How can blue and green infrastructure achieve a balanced ecology ?

What type of water and soil remediation strategies can be implemented in Boynton neighborhood?

What zoning policies honor the land/ nature? (Treating nature as a family member to cherish and care for, from indigenous people perspective)

How can different infrastructures work together to balance the water system? (Ponds, wetlands, and creeks)

What type of plants can be farmed in a neighborhood heavily flooded with polluted air, water, and soil by heavy metals?

**Green and blue strategies**

Daylighting creeks strategy

Types of GSI strategies

Effectiveness of Daylighting creeks(20% and 80% sewer reduction equation)

Water balance techniques

Flood resilient design
"a proactive and precautionary approach to increase water resource sustainability while reducing climate change risks" .(Donald Watson, 2011)

**Nature Elements**

Flood types and severity level

Amount of impervious surfaces

Location of runoff conveyance (Topography levels)

Locations of historic creeks in Detroit and Boynton

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Phytoremediation

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Water and soil natural remediation strategies

Circular economy strategy

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History of racial segregation in Boynton

Indigenous people perception of nature

**Man-made Elements**

Sewer network locations

Location of vacant structures + Vacant lots + Building footprints

Transportation and pedestrian circulation strategies

Locations and types of areas of pollution (heavy metals, acidic rain, sewer bacteria)

Land Use

Urban farming (community gardens) locations

Community farming production subsistence

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Building over marshes/ wetlands policies

Types of human activities in Boynton neighborhood through time.

**Figure 2.3**. Research Questions Diagram. Credits: Author.

**Constructs row 1:**

Daylighting creeks strategy

Types of GSI strategies

Effectiveness of Daylighting creeks(20% and 80% sewer reduction equation)

Water balance techniques

Flood resilient design
"a proactive and precautionary approach to increase water resource sustainability while reducing climate change risks" .(Donald Watson, 2011)

Phytoremediation

Redlining areas in Boynton neighborhood

History of racial segregation in Boynton

Indigenous people perception of nature

**Constructs row 2:**

Flood types and severity level

Amount of impervious surfaces

Location of runoff conveyance (Topography levels)

Locations of historic creeks in Detroit and Boynton

Soil permeability levels

Bioremediation

Water and soil natural remediation strategies

Circular economy strategy

Plant- based amyloids

Cut flower industry

Mycoremediation

Residential rezoning policies

Building over marshes/ wetlands policies

Types of human activities in Boynton neighborhood through time.

**Constructs row 3:**

Sewer network locations

Location of vacant structures + Vacant lots + Building footprints

Transportation and pedestrian circulation strategies

Locations and types of areas of pollution (heavy metals, acidic rain, sewer bacteria)

Land Use

Urban farming (community gardens) locations

Community farming production subsistence

**Mixed Methodology**

**Methods row:**

Design intervention

Diagraming a strategic map of circular economy connection to flood resiliency

Analysis and comparison of data collected. (historical maps, articles, books, surveys, news, population statistics, locations of redlining, historic creeks map, historic nature and historic human activity). with present map

Mapping/ diagraming of FAMA flood risk and first street flood factor, topography, building's footprint, vacant structures, vacant lots, sewer network, Impervious surfaces, type of soil, green lots, zoning, transportation, number of occupied houses.

Analyze case studies and precedents and data from publications sketches on 2d maps of project showing and bullet point summary of strategies used.

Comparing zoning policies + factories' restrictions to indigenous perspective of nature

Rephotography - visual Ethnography Compare historical photos of human activities and indigenous people trails to most up to date map of Boynton, Detroit.

photo elicitation - visual ethnography , Compare Data and my assumptions vs. on ground perception.

Projecting animation of imaginary proposal and creating 3d model based on conducted interviews.

Interviewing Professionals

Joanne Coutts - Cartographer and activist (counter-mapping for water rights and rights for water, in Detroit.)

Sara Hoyash - DirectorLand Use and Sustainability DFC

Joel Howrani - Director of community resilience and public sector consultant

Steve Vogel - Architecture, urban planning, preservation

**Understanding row:**

Understanding the relationship between drainage levels, transportation circulation, and zoning

Understand how circular economy is connected to flood resiliency

Understanding and evaluating shift over time of extent of flood areas, original paths of creek and level of changes due to human activity(let the history inform our future)

Analyzing the site and evaluating the current situation and possible causations of flood to design.

Understanding and assessing the strategies used to implement them in Boynton neighborhood.

Critiquing the lack of zoning policies and factories' restrictions to preserve nature

Defining relationship between historic maps and data about people activities of different times(clear mylar)

Photoscollage images of the most flooded parcels on map and on ground perception and field notes comparison

Understanding collected opinions and expertise visually

Learning from professionals' experiences as a shortcut to resources and inspiration.

**Figure 2.4**. Methods Diagram. Credits: Author.

# Memory of Landscape
## (MEMORYSCAPE)

"Sometimes people are subjected to flood risk and they don't even know why, and it could have something to do with history", "The landscape doesn't really forget, it has a memory, and when it's time, water will occupy those spots," Jacob Napieralski

The Memory of Landscape concept stands for the connection between the current state of landscape shapes and the history of land formation, native nature and the human activity on it.

The Kitichigumi (Great Lakes) region was inhibited by the Anishinaabe people, the three fires confederacy of Ojibwe, Odawa, and Potawatomi tribes. The indigenous people believe that human beings are just an equal part of nature, rather than separate from it, or more important than it, but that everything forms "a symbiotic cycle in which we are an integral part of the whole system". (Nature Connection and Native Americans or First Nation People, 2022)



Ojibwe tribe



Potawatomi tribe



Ottawa tribe

**Figure 2.5**. The Anishinaabe People. Credits: Nature Connection and Native Americans or First Nation People.
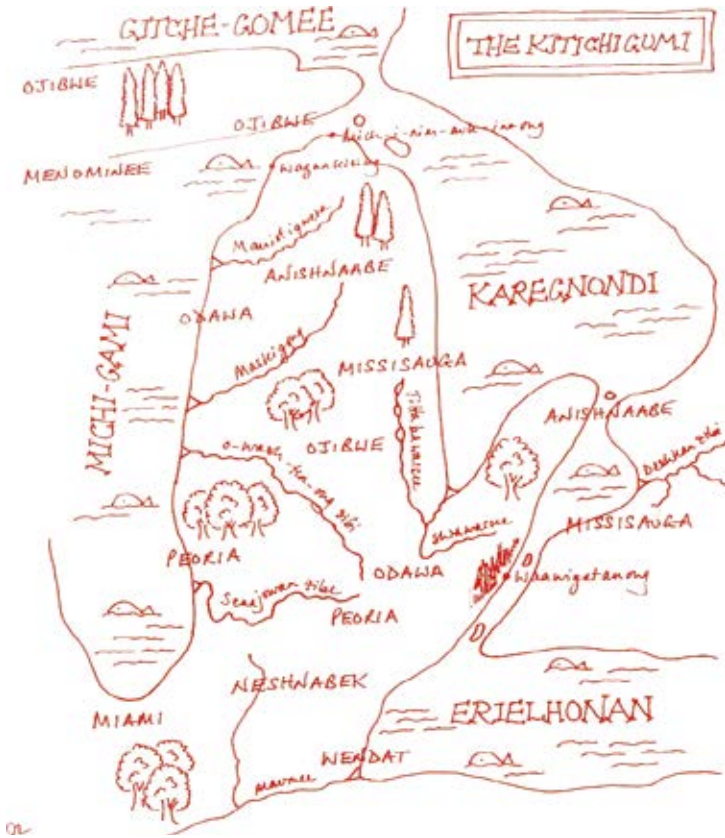


**Figure 2.6**. Kitichigumi Region map. Credits: Joann Coutts.

# Resiliency

Flood events are getting worse every year worldwide, and it's causing a wellbeing crisis, therefore, it is urgent to find a flood resilience resolution. Resiliency is manifested in the ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional).
Resilient cities promote sustainable development, well-being and inclusive growth. (Dinara Muldabayeva, Tamara Nikolic, 2023)
Flood resilient design Is a proactive and precautionary approach to increase water resource sustainability while reducing climate change risks. (Donald Watson, 2011)

# Equity

"All people have the right to well-designed, healthy spaces and neighborhoods." (DCDC)

"Equity is about applying justice and a little bit of common sense to a system that's been out of balance" (Glenn Harris, Colorlines)

Equity can be achieved by identifying structural racism and housing inequity, economic racial justice, developing businesses of minorities, and changes in policies.
In more detail it is a requirement to enroll city officials in change processes, To mitigate existing penalties of high drainage fees, Fund projects that are working on areas that usually flood, prioritize the most flooded, Change zoning, Reinvest in minority neighborhoods, Coordinate across agencies to track and analyze flood-related reports and claims, Collaboration between planners, designers, and community leaders to provide a city-wide planning framework for Detroit, City officials should work on funding green, blue and gray infrastructure, Develop strategic neighborhood planning based on community engagement activities, Reinvest in open space and public ownership, Beautify neighborhoods through greening and water conveying, Provide grants & technical assistance programs to support household flood.
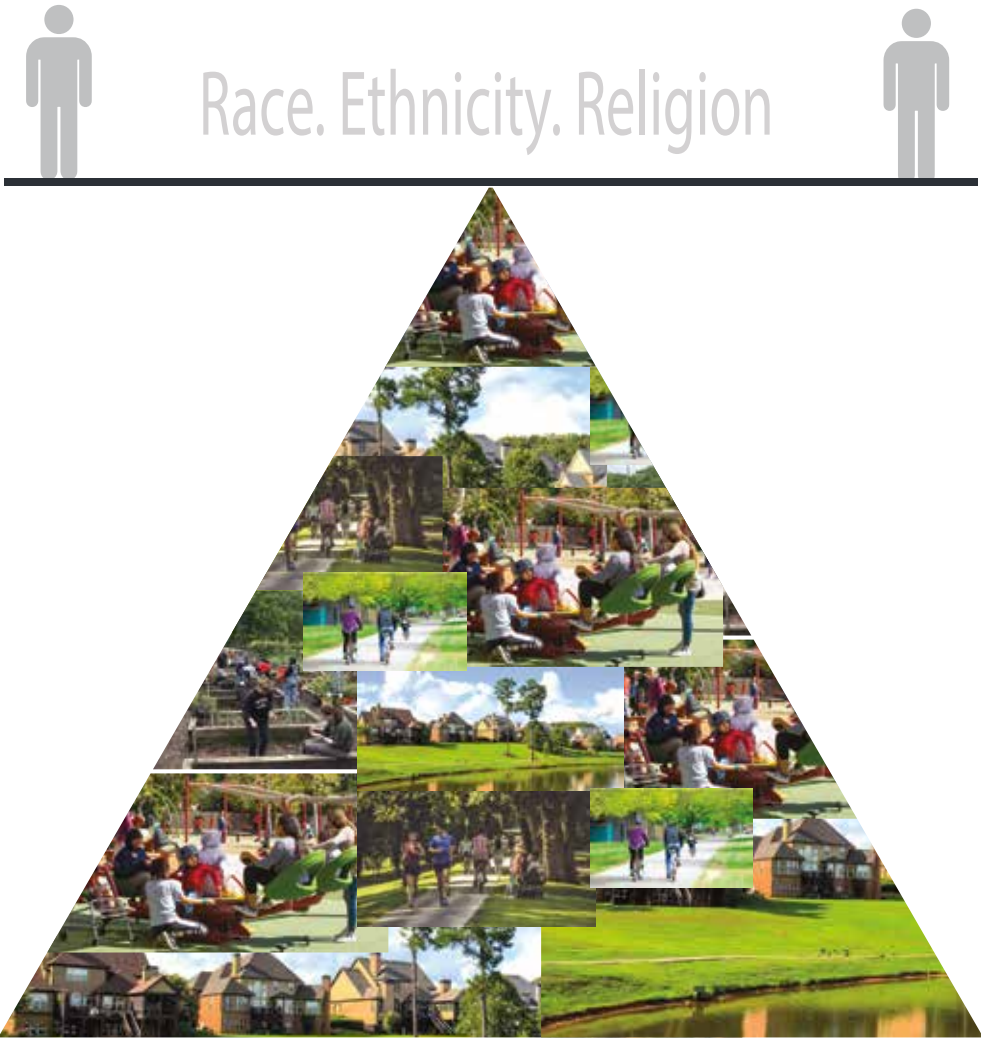


**Figure 2.7**. Equity Concept. Credits: Author.

# Sustainability

"Refers to the ability to maintain or support a process continuously over time". (Daniel Mollenkamp, 2023)"sustainability stands for the ability of a community to thrive and prosper in an equitable, green city (City of Detroit, Sustainability Action Agenda)

Working towards Detroit's goal of becoming the greenest city in the nation, pursuing urban/ landscape interventions on a large scale, having a balanced water system, and finding a long-living solution to mitigate flood effects. This can be achieved through Providing ecological and educational value, The use of productive landscape, Changing zoning, Collaboration between planners, designers, and community leaders to provide a city-wide planning framework for Detroit, Urban farming, Daylight creeks, Improving both intersecting green and blue infrastructures, utilize GSI practices, Restore Detroit's hydrologic system (watersheds, wetlands and river basins), Grade the Lawn Away from Structures, The water balance concept, Updating sewerage infrastructures (separating stormwater from sewage water).

Maintenance of gardening by the community is inspired by indigenous perception. The indigenous people treat nature as a family member to cherish and care for.
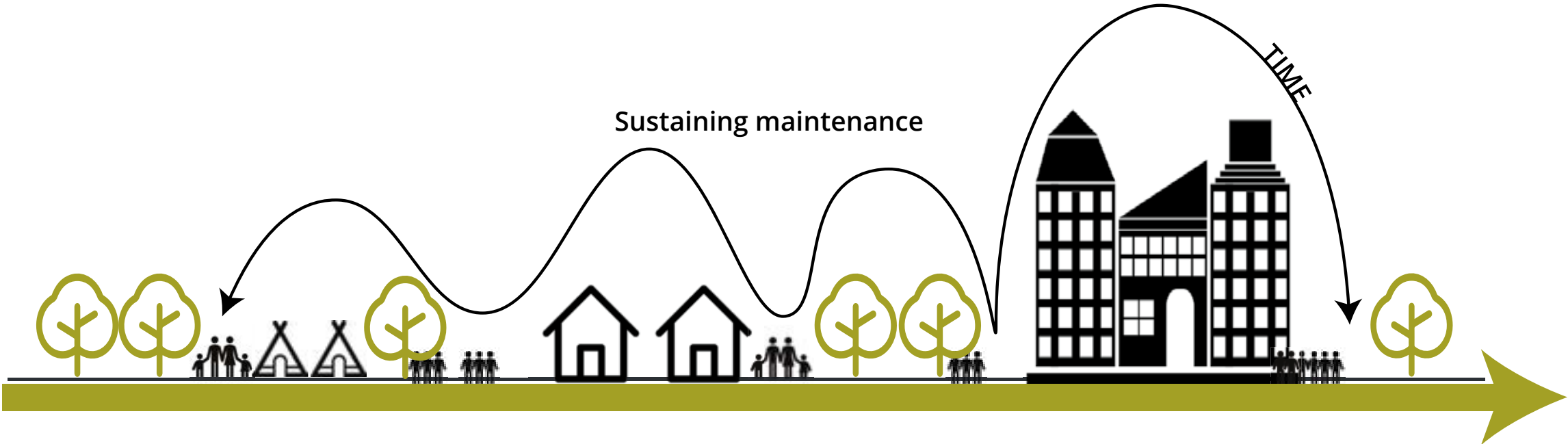


**Figure 2.8**. Sustainability Concept. Credits: Author

# Community Wellbeing

This concept is manifested in the shared rights of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential. (Wiseman & Brasher, 2008)

Natives believe that there needs to be a two-way, reciprocal relationship where mankind looks after na-ture. Which can be done with Water and land stewardship. (Nature Connection and Native Americans or First Nation People, 2022))
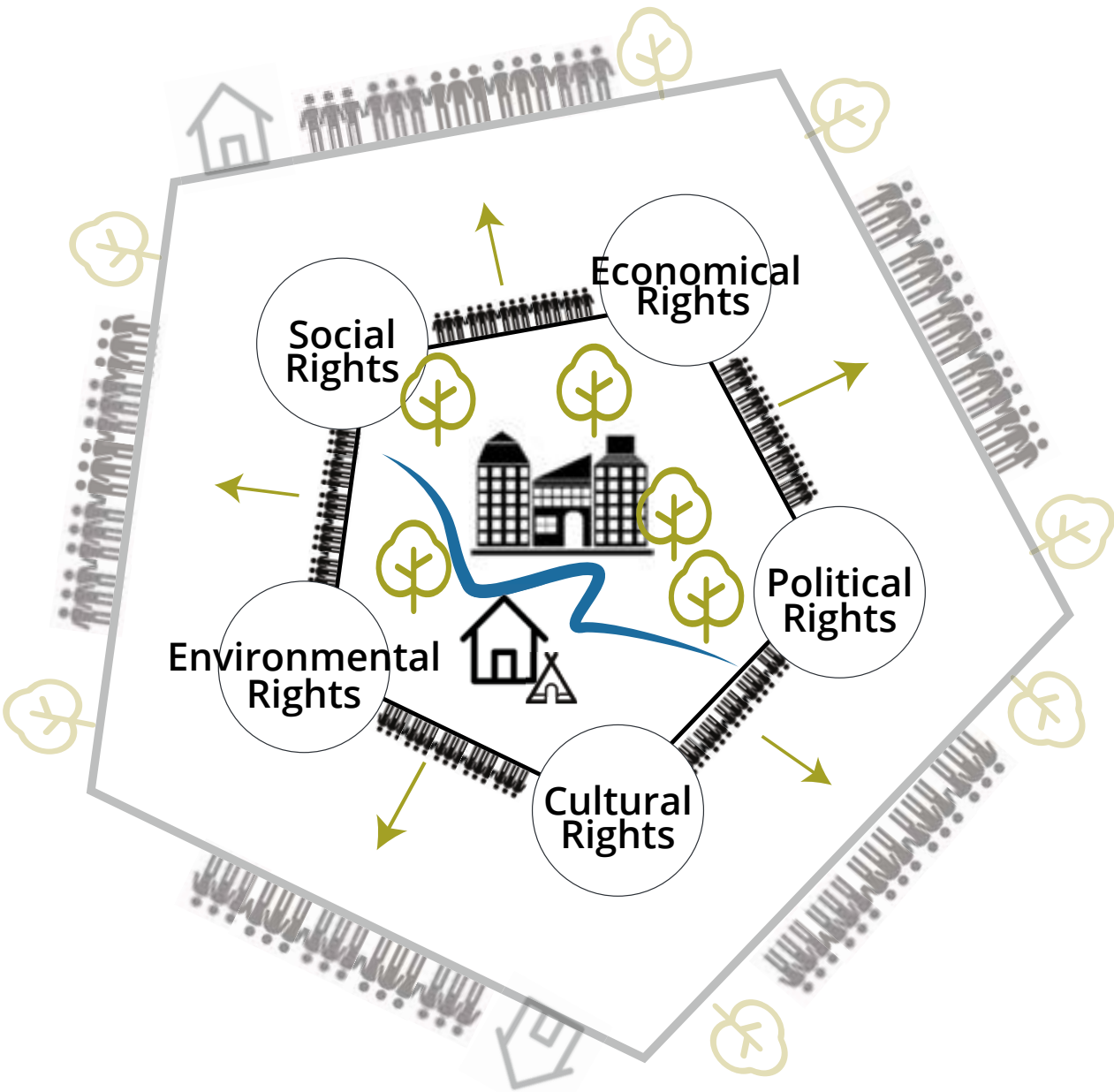


**Figure 2.9**. Community Wellbeing Concept. Credits: Author

# 03

Strategies

# Strategies

The Figure shows strategies inspired by multiple urban/ landscape projects, research articles, books, and interviews (see Fig. 13). These Strategies were the starting point for the framing concepts of Resilience which are implemented in the planning of the final design intervention. Steve Vogel was interviewed on the radio where he talked about daylighting buried creeks and how it's possible in Detroit since there are a lot of buried creeks under man-made impervious surfaces. And my interview with Sara Hoyash where she explained that floods can be mitigated if the city takes action to develop the sewer system while applying green and blue infrastructure strategies and reducing impervious surfaces. She urged the importance of funding the landowners to make and maintain their water-green infrastructure. Donald Watson's book talks about the water balance between soil and air and the importance of natural habitats in mitigating floods, which naturally have the best ability to absorb the amount of exceeding water while stabilizing the soil through the prevention of soil erosion. There is also the Performance Evaluation of a Bioretention System report that talks about the concept of water balance and the role of evapotranspiration in this concept. Also, the Recurrent Home Flooding in Detroit research report by Peter Larson talks about household flooding and surface flooding and how it's related to racial injustice, where most floods happen mostly in minorities and people of color neighborhoods, while it goes back to wrong construction practices. The Renewing Low-Density Neighborhoods Through Off-site GSI Investments proof of concept project of DCDC has very interesting

planning methods for conveying precipitation flows into vacant green lots while working beyond zoning policies as a foundation of resiliency planning.
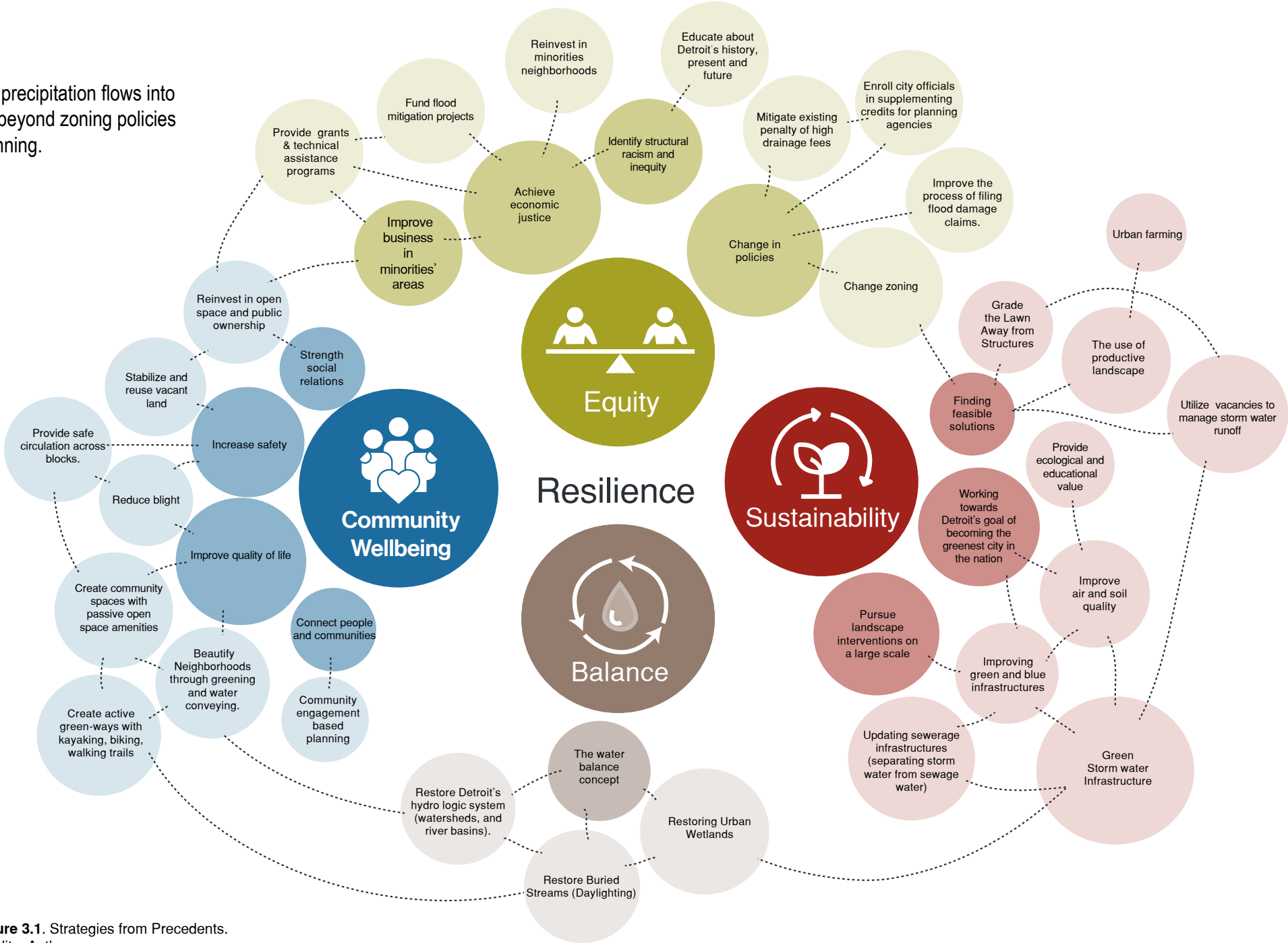


Figure 3.1. Strategies from Precedents.
Credits: Author.

## 03.1 Strategies

"GSI is an innovative, cost-effective approach to storm-water management. Rather than transporting water through conventional and costly pipes to wet weather treatment systems, GSI treats storm water where it falls using nature". (according to Detroit storm-water Hub)

"GSI is forest landscapes that improve air quality by capturing air- anti pollutions from industry, vehicular exhaust along interstates, and infrastructure facilities like the greater resource recovery facility, which incinerates household waste." (Detroit Future City)

"Green infrastructure also includes greenways, paths, and dedicated lanes for bicycling, walking, and running." (Detroit Future City)

Blue Infrastructure is a water-based landscape like retention ponds, and lakes that capture and clean stormwater, reducing the quality and improving the quality of water that enters the combined storm-water sewage system. (Detroit Future City, 2012)

Creek Daylighting calls to restore water streams, embracing topography to sustain native nature within urban cities. It can be done „if you put a creek in a sewer and open up the sewer, you're daylighting, "said Stephen Vogel.

Wetlands are blue and green infrastructure, some call them nature's kidneys because they play a key role in balancing ecological processes (according to Urban Wetlands Restoration Builds resilience and Livability publication, SEI.org)



**Figure 3.2**. Green Stormwater Infrastructure. Credits: Author.

**Figure 3.3**. Creek Daylighting within a Residential Block. Credits: Author.

## Circular Economy

Most city's investors invest in projects that will bring back profit and benefit neighborhood business. Circular Economy is a needed strategy that combines urban agriculture components with flood management strategies.



Cut flower industry

Nano protein fibers - plants' waste

Farming

Filtering storm water runoff from heavy metals (Acid rain)

Community subsistence

Clean creek water supply
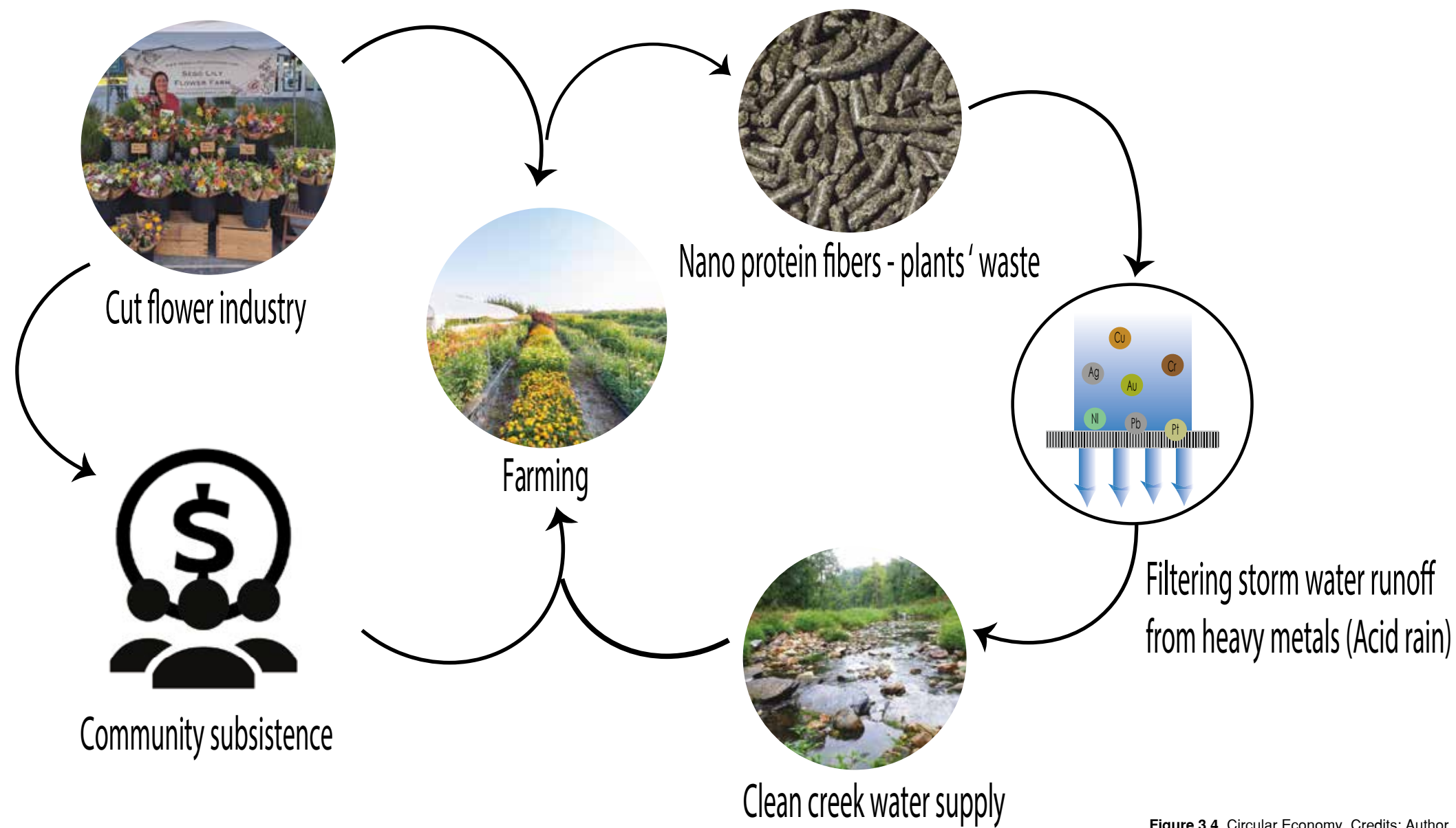
**Figure 3.4**. Circular Economy. Credits: Author.

# Balance of Nature

This construct stands for the interconnected harmonious relationship between different natural cycles, living organisms, and the elements of the Earth. (Nana Firma Daniel Simberlo)

## Nature cycles

Natural creeks filter water and air pollution, reduce flooding, recharge groundwater, provide wildlife habitat, and mitigate climate change.
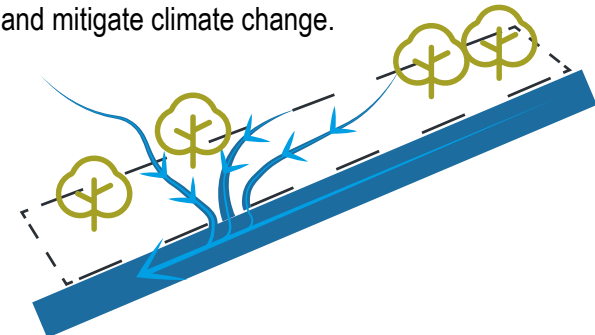


**Figure 3.5**. Natural Cycles. Credits: Author.

## Evapotranspiration
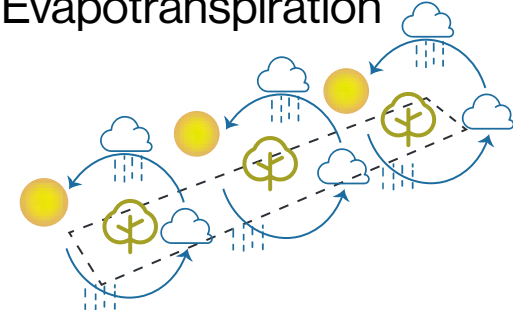


**Figure 3.6**. Natural Cycles. Credits: Author.



**40%** Evaporation
**10%** Runoff
**25%** Shallow Infiltration
**25%** Deep Infiltration

**35%** Evaporation
**30%** Runoff
**20%** Shallow Infiltration
**15%** Deep Infiltration

**30%** Evaporation
**55%** Runoff
**10%** Shallow Infiltration
**5%** Deep Infiltration
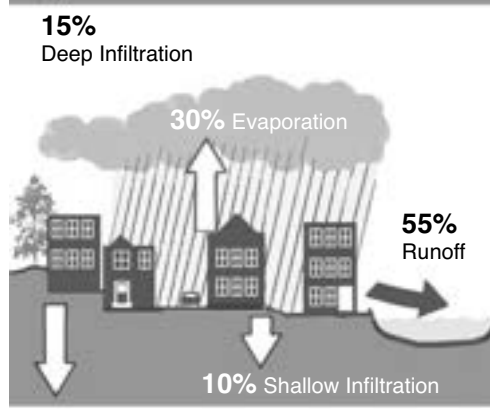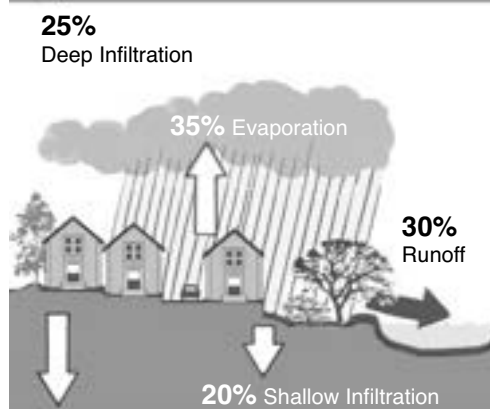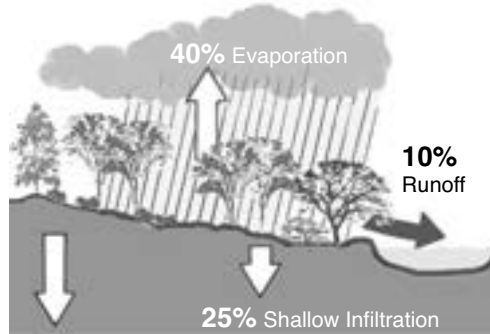
**Figure 3.7**. Stormwater Infiltration. Credits: Donald Watson,

# Elements of the Earth

These processes can help stabilize and purpose vacant land while improving air, soil, and water quality.



Air pollution
Clean air + Filtered water
Floodplain
Brown-field contaminants
Contaminants from combined sewer overflows
Building's sewer connection
Storm drain
Combined sewage and storm water.
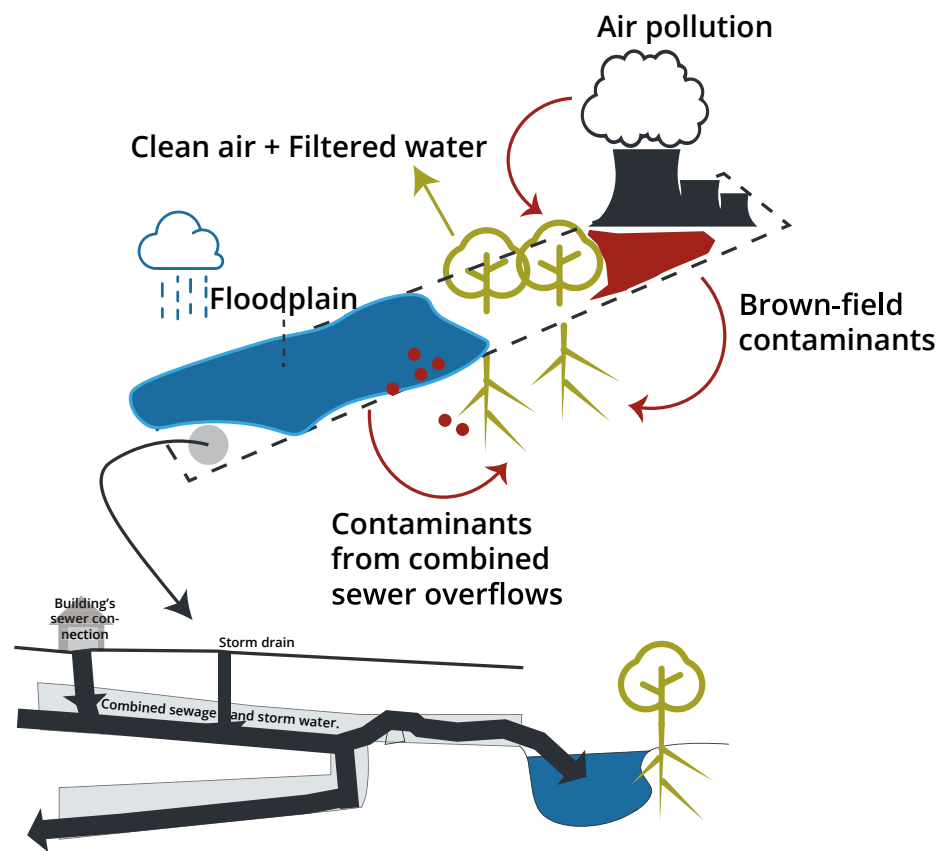
# Living Organisms

Natural remediation strategies in wetlands ecosystem.



Bioremediation    Phycoremediation    Mycoremediation    Phytoremediation

**Figure 3.8**. Elements of the Earth and Living Organisms Diagrams . Credits: Author.

# 04

**Methods**

## Mapping the Greate Lakes Region

The Great Lakes were formed by the carving action of glaciers during the last Ice Age. As the glaciers advanced and retreated, they eroded the landscape and created basins. When the glaciers melted, these basins filled with water, forming the Great Lakes. The ongoing process of post-glacial rebound continues to influence the region's topography.

The continuous movement of water within the Great Lakes, facilitated by various factors such as wind, precipitation, and the interconnected nature of the lakes, plays a crucial role in the hydrology of the region. For instance, Climate change is causing more evaporation of great lakes, causing higher precipitation rates.

The connection of the Great Lakes to the Detroit River further amplifies the dynamics of water flow. The Detroit River serves as a major outlet for Lake St. Clair and Lake Erie, creating a natural linkage in the Great Lakes system. During periods of heavy rainfall or rapid snowmelt, the increased water volume entering the Detroit River can lead to riverine floods. The interconnectedness of the lakes and the river, combined with the potential for high water levels, can result in a downstream surge that exceeds the river's capacity, leading to flooding in surrounding areas. This complex interaction highlights the importance of understanding the hydrological dynamics of the Great Lakes and their connecting waterways for effective water management and flood mitigation strategies in regions such as Detroit.



**Figure 4.1**. Water Movement in The Great Lakes and Watersheds. Credits: Author.

## 04.1.2 Methods

## Mapping Detroit

As a city surrounded by complex hydrological systems and impermeable surfaces, Detroit faces many challenges. It is located within a network of watersheds. Watersheds are essential for directing the flow of water, and Detroit's watersheds add to the city's vulnerability to flooding. Increased surface runoff results from the prevalence of impervious surfaces like pavements, roads, and buildings, which obstruct natural water absorption. The impermeable surfaces of these watersheds increase the pressure on Detroit's drainage systems as water from them converges on the city.

A drainage network is made up of the streams and creeks that make up a watershed. Larger creeks often feed into smaller ones, which may then flow into a river or another body of water.
Every drop of water that enters a watershed through its creeks adds to the watershed's overall water balance. Eventually, precipitation and runoff from the land surrounding the creeks as well as the entire watershed area find their way into the creek system.
Historical creeks (data from Lars Garbner, mapping Detroit book.)

According to the national weather service precipitation data was gathered for the last 50 years from 1970 until 2020 indicating that an average of 3.426 inches accumulates during the month of May each year. They lately stated that on August 24, 2023 Metro Detroit was covered with 3 to 7.36 inches of fallen rain.
Sewer pipelines are connected from upper neighboring cities to the sewer pipelines of Detroit, this creates

pressure on Detroit's pumping station when there is a heavy rain event.
The deteriorated combined sewer system cannot manage the amount of storm-water from the intense rainfall based on data collected from the Great Lakes Water Authority report.
According to the Michigan Chronicle newspaper, the federal government will fund 1.3 billion for water infrastructure in Michigan, part of this is 95 million for Detroit sewer system updates. Meaning that there is actual sewer system development under process.

In parallel the city has done 269 green storm-water infrastructure projects such as vast tree planting, bio-retention and curb extension, bio-retention and impervious area removal, Downspout disconnections, Demolition, and removal of vacant structures, Bioswales along roadways and parking lots, Installation of rain barrels and rain gardens.

The figure on the right manifests information on Detroit's sewer pipeline network layered with flood patterns. The pattern is a result of merged data from the FEMA flood risk map and the First Street Foundation flood risk map.

Impervious surfaces: The spread of urban development requires more impervious surfaces to bury nature's identity, building over marches. All that movement caused more and more urban flood plains, causing blight, structural damage and health and safety concerns.



Legend:
- DWSD Treatment Plant
- Sewer Infrastructure
- Historical Buried Creeks and Existing Rivers
- Flood Risk Areas (Data from Risk Factor + ArcGIS)
- FEMA Flood
- Case Study Area - Boynton Neighborhood
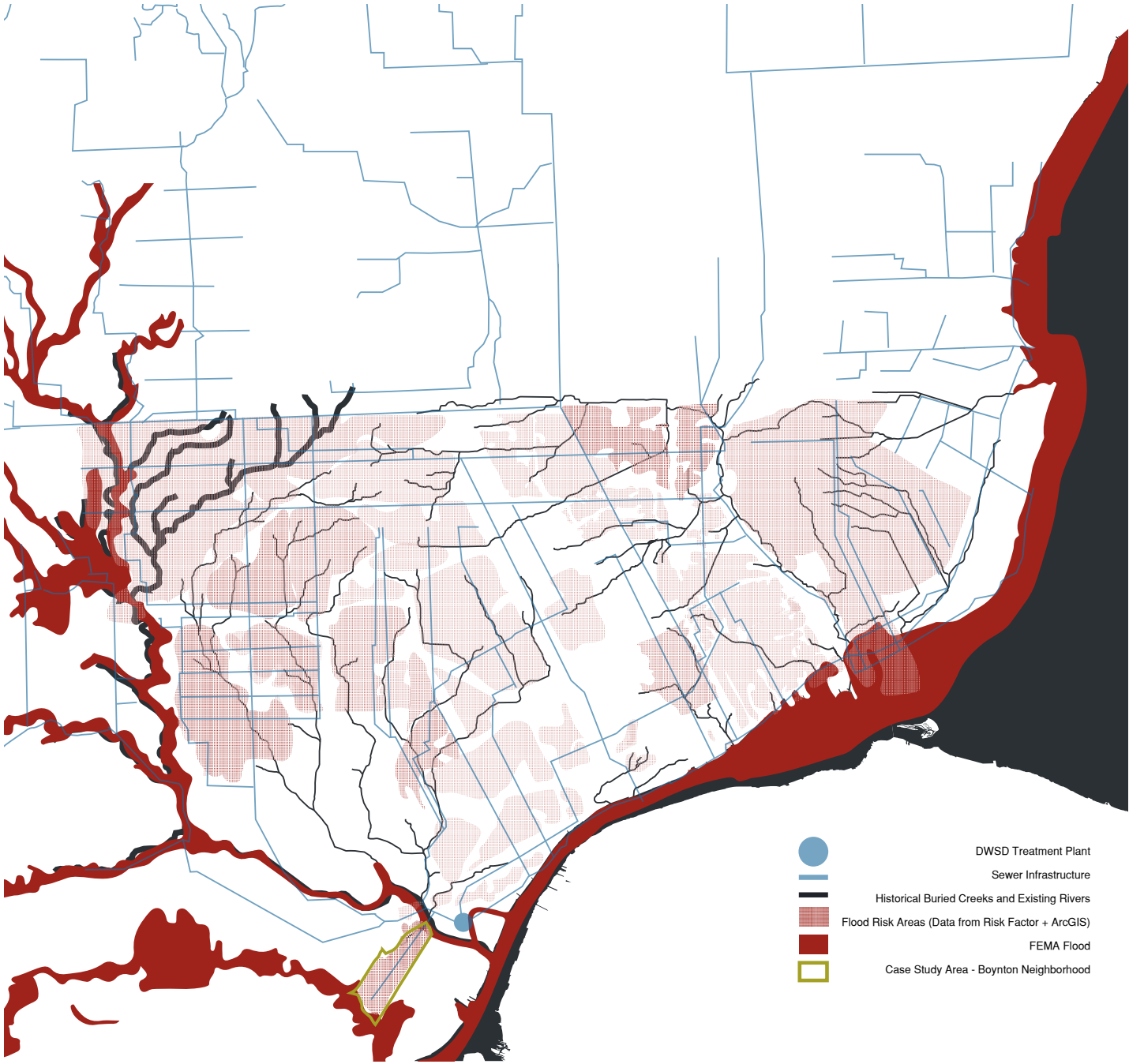
**Figure 4.2**. The Unseen Side of Detroit's Floods. Credits: Author. Data Retrieved at First Street Foundation, ArcGIS and FEMA.
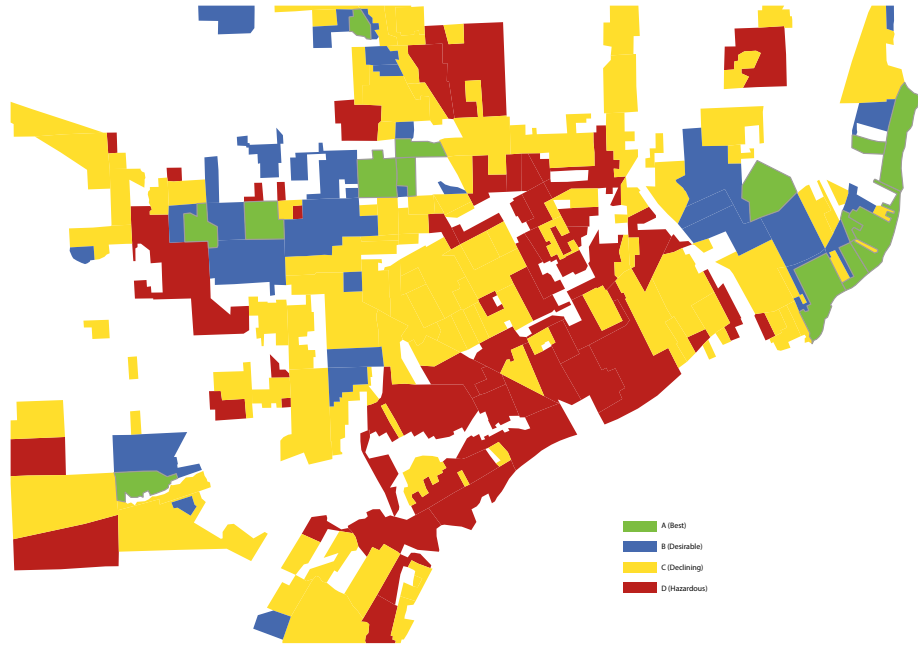
**Figure 4.3**. Redlining Map. Credits: HOLC Neighborhood Redlining Grade, ArcGIS, 2021.
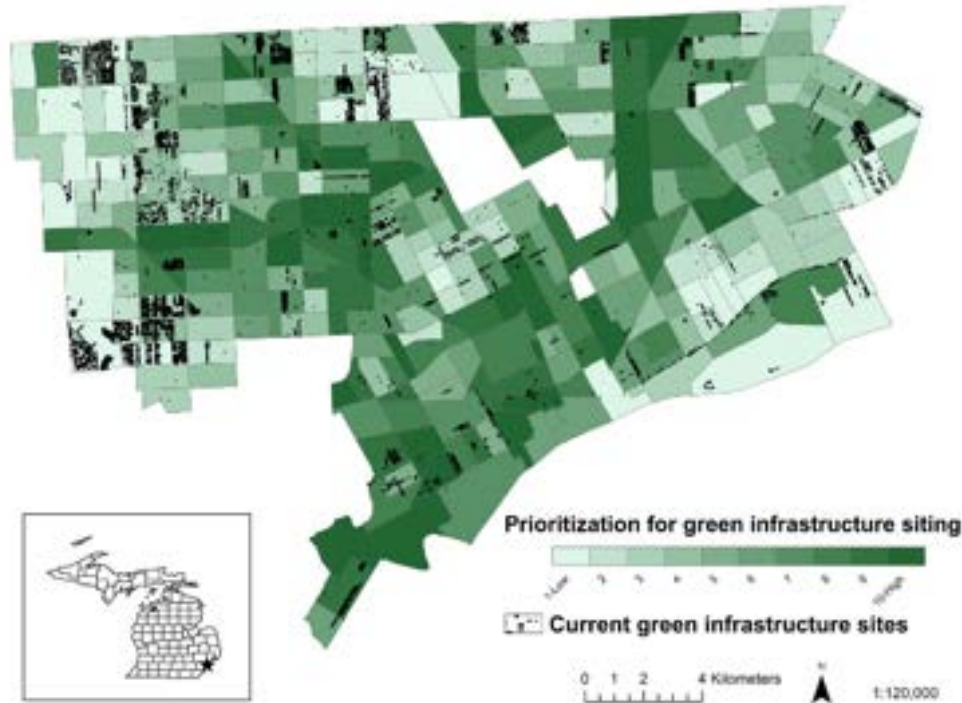


**Figure 4.4**. Prioritization For Green Infrastructure. Credits: Sara Meerow, Joshua P. Newell. Landscape and Urban Planning Article, 2017.
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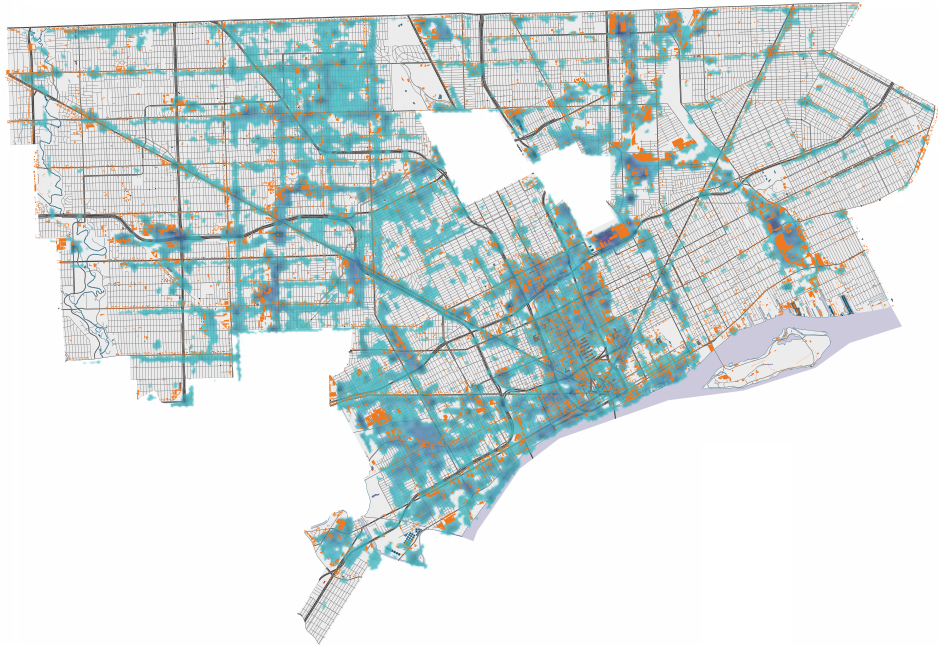


**Figure 4.5**. Parking Map of Detroit+Urban Heat Island Mapping. Credits: Dakota B. Campbell, 2023.

# Green and Blue Infrastructure Measures in Detroit



**Figure 4.7**. Green Stormwater Infrastructure Projects in Detroit.
Credits: Detroit Stormwater Hub.

Many Green Stormwater Infrastructure (GSI) projects are being carried out in Detroit, such as the assembling of land in conjunction with extensive greening programs, like planting trees alongside roadsides to improve uptake and evapotranspiration. In order to improve management, efforts are also being made to include curb extensions and bioretention in right-of-way locations. This will redirect street runoff into specific parcels. To improve local habitats, community enhancement initiatives include impermeable areas with roadway bioretention systems. To further reduce stormwater problems, steps are being made including disconnecting downspouts and demolishing abandoned buildings. In order to efficiently absorb and slow down stormwater runoff, bioswales are being erected alongside roads and parking lots, while rain gardens and barrels are being set up at commercial and residential premises.



Source: Detroit Stormwater Hub

**Figure 4.6**. Green Stormwater Infrastructure Projects in Detroit. Credits: Detroit Stormwater Hub.

# Boynton's Characteristics

An interview was undertaken with Sara Hoyash, the Director of Land Use & Sustainability at Detroit Future City. Sara emphasizes the need for a comprehensive flood mitigation strategy on a large urban scale. According to her perspective, addressing the issue solely at the grassroots level is insufficient; achieving flood resilience requires substantial funding in the billions of dollars. Sara advocates for the separation of sewer systems and the implementation of gray infrastructure solutions, stating that Green Stormwater Infrastructure (GSI) alone is insufficient, particularly in the southern parts of the city. She proposes a combination of gray and green infrastructure, a goal achievable through collaboration between the Detroit Water and Sewerage Department (DWSD) and the Great Lakes Water Authority. Sara advocates for a regional water approach, emphasizing the enhancement of natural habitats to improve soil permeability and the utilization of topography solutions similar to the Dutch Room River project. She also identifies large industrial areas and parking lots as ideal case study sites that would benefit significantly from GSI.

Detroit is known for its rich industrial history. These vast industrial areas are fully covered with a thick layer of impermeable concrete, suffocating the native nature underneath. Therefore, there might be a connection between surface floods and industrial zones. When overlaying a heavy industrial zoning map with flood risk data from the First Street Foundation website and topography data from Regird, one neighborhood pops out with the amount of flood reported by residents

living near a heavy industrial zone. From a map view, the Boynton neighborhood has a high vulnerability to precipitation surface floods and riverine floods, directly from the Rouge Riverside and the Ecorse River, and indirectly from the Detroit River

Some pictures were taken and collaged to reflect the living conditions of Boynton streets and the overall quality of life. The neighborhood is situated near heavy industrial open areas covered with concrete-paved impervious surfaces, surrounded by railroads and factories. Hazardous pollutants emitted into the air are inevitably experienced through the intolerant rotten egg smell circulating in the surroundings. The neighborhood is highly neglected. Many residential properties show signs of vacancies, and many seem to have future demolition plans with blight laying over in front of their yards. Vast vacant lands were found to be randomly separated between the occupied residential blocks. This has raised questions regarding the health and safety conditions of Boynton's residents, such as how we can enhance these aspects through flood mitigation and how to design a safe, flood-free area for a model neighborhood amidst potential hazards.
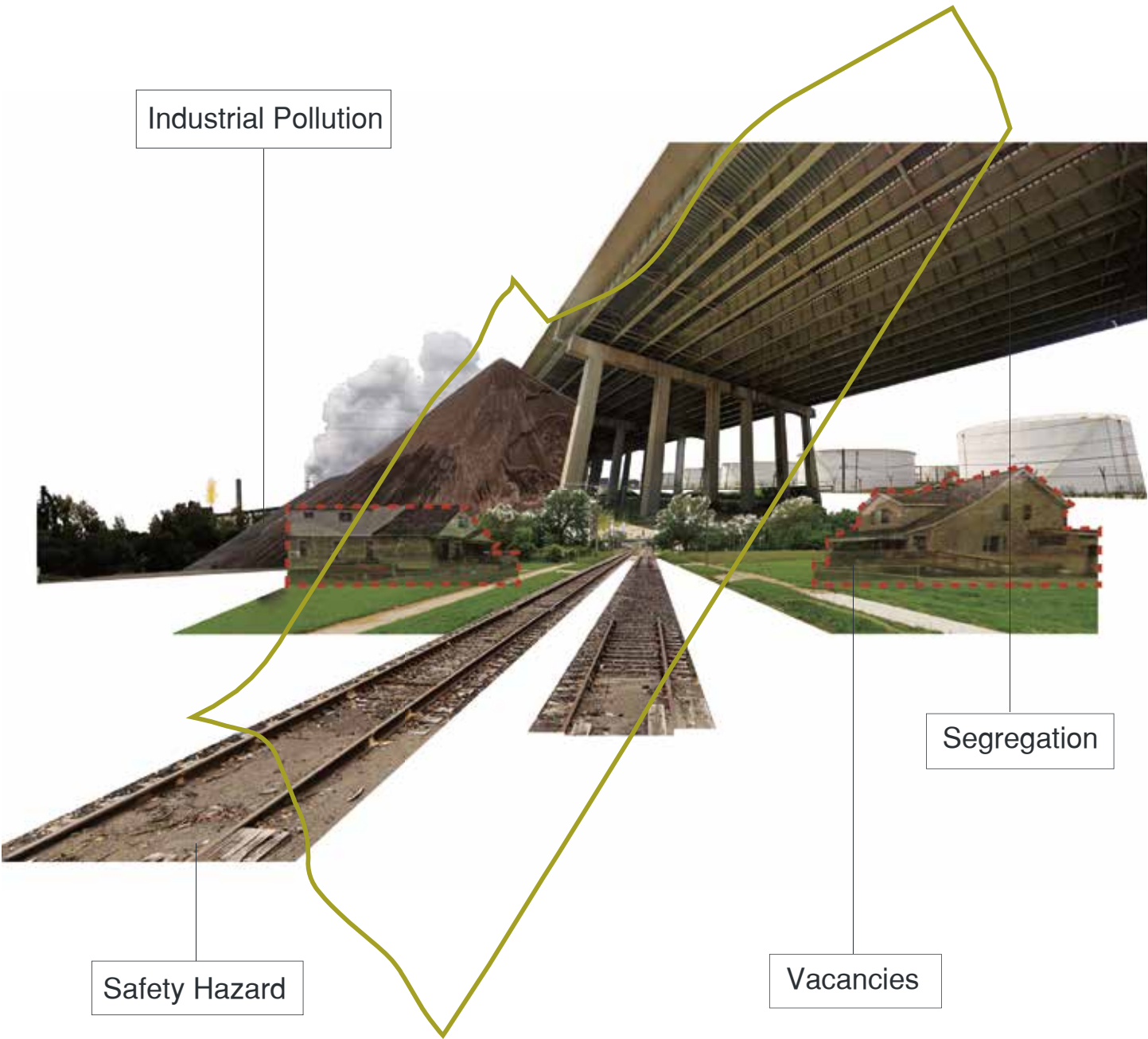


**Figure 4.8**. Boynton Neighborhood Characteristics Collage. Credits: Author.

# Photo Documentation of Boynton

The main observations of the site were how nature is taking over neglected lots and structures. This can be seen across industrial areas surrounding the Boynton neighborhood.



**Figure 4.9**. Photo Documentation. Credits: Author. Data Retrieved from Google Maps.

# Census Data

Boynton has the most polluted ZIP code in Michigan for being surrounded by heavy industrial areas.

In heavy rain events, 42 out of 44 miles of roads become impassable with floods while 2,127 out of 2,860 homes are flooded.

Residents are growing concerned that empty spaces and general neglect of the neighborhood will increase crime.

Median Household Income in Boynton is $31,654

Boynton's total number of properties is 4,265 situated on 879 Acres / 1.37 square miles area. With 2,500 occupied residential structures.
The refinery has received permission for an expansion of its facilities and has sought to buy out properties in the Oakwood Heights community.

Marathon offered 350 homeowners nearly $60,000 per home in the Oakwood Heights community, and a similar offer was requested but not granted to the Boynton community, but not all residents have accepted Marathon's offer,
Boynton neighborhood is separated from the Marathon facility by Interstate 75 and Fort Street.

Massive heavy industrial development surrounding the neighborhood has reportedly raised health concerns for some residents living in Boynton. Many residents have a high chance of cancer rates.

## Properties Status
879 Acres / 1.37 square miles
4,265 properties

Vacant Non Residential (14)
Occupied Residential (2500)
Unknown Status (1276)
Vacant Residential (475)

11.13%
29.9%
58.6%
0.32%

## Population Status
Median Household Income $31,654

White
Other
Latino
BLACK

3.0%
7.34%
0.06% of the neighborhood population are Native Indians (14)
19.9%
69.8%
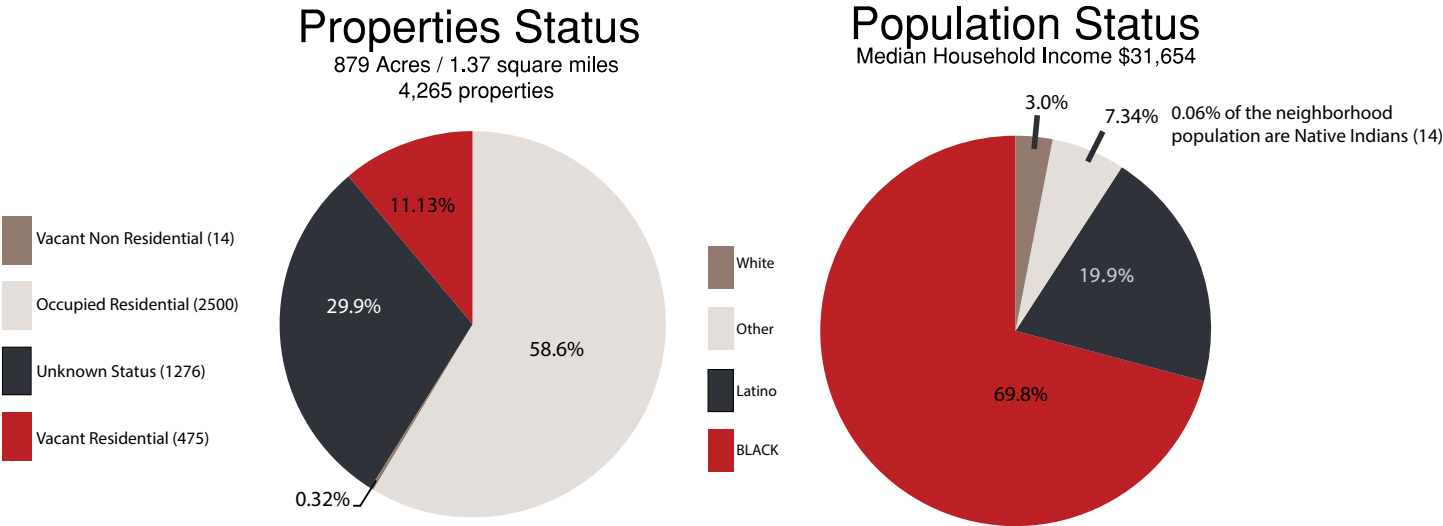
**Figure 4.10**. Census Data of Boynton Neighborhood. Credits: Author. Data Retrieved from CitytData.com.

# Boynton Through Time



**Figure 4.11.** Map of Detroit's settlement and French fortification. Credits: https://www.oldworldauctions.com/catalog/lot/191/296.



**Figure 4.12.** 1905 Map of Detroit. Credits: USGS.



**Figure 4.13.** 1934 Map of          Detroit. Credits: USGS.



**Figure 4.14.** 1985 Map of Detroit. Credits: USGS.



**Figure 4.15.** 2024 Map of Detroit. Credits: USGS.

## 1764

Boynton neighborhood was a marshy land that was part of the wetlands ecosystem. The land was owned by the Anishinaabe people (Ojibwe, Odawa, Potawatomi) before being taken by French settlers.

## 1905

The neighborhood became French ribbon farms surrounded by railroads and a refinery.

## 1934

An influx of minority immigrants settled in this neighborhood as part of the First Great Migration (1910-1940), primarily comprising factory workers, leading to a rise in the residential population and the flourishing of additional factories.

## 1985

The 75 highway was constructed, segregating the neighborhood more from the neighboring communities.

## 2024

A full residential neighborhood with two commercial roads on the edges of main streets, with no access to the Rouge River.

## Mapping Vacancies

The map on the right shows a comparison between the historical condition of the natural habitats in the upper part of Boynton's neighborhood and what is perceived in the current time. It used to be a marshy land with water creeks passing through it. Now most of the land is paved streets surrounded by vacant lots and structures.



A comparison between the present and the past.

River Rouge FEMA Flood
Buried Waterway
Historical Marshes
Neighborhood Boundaries

Rouge River
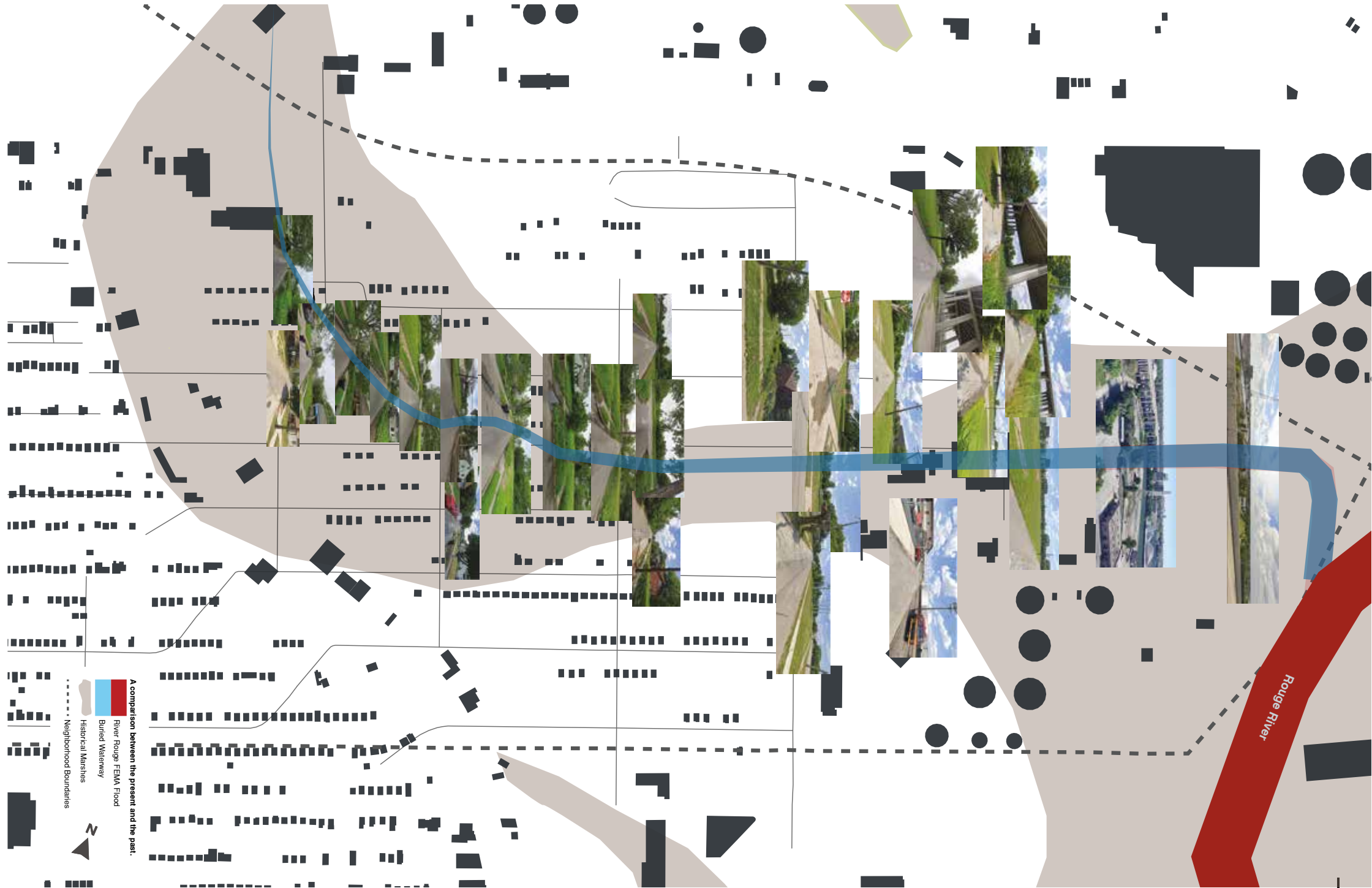
**Figure 4.16**. Mapping Vacancies of Upper Boynton. Credits: Author. Data Retrieved from USGS.com.

# The Layers Installation

A visualization was created of 10 layers of mapping information of the Boynton neighborhood that seeks to deepen our comprehension of the neighborhood and its surroundings. Various layers of information are intricately mapped onto clear mylar material, creating a complex interplay of relationships. The resulting map is designed to facilitate a nuanced exploration, allowing us to concentrate on specific areas and formulate targeted flood mitigation strategies. The audience is invited to freely interact with the map's layers, adding or removing elements, to discern the imperative need for introducing green initiatives within the neighborhood. This collection of maps intends to accentuate our understanding of why floods happen in a certain area more than other areas within Boynton's neighborhood, it is a method to compare data found across the Boynton neighborhood to help focus on specific flood mitigation strategies.  This neighborhood will be a model for other neighborhoods in the city of Detroit for flood mitigation strategies. The installation consists of 10 arrayed, suspended cartographic series of layers, illuminated by an encased light source that enables a cohesive interpretation of the collective strata as a singular map. The layers are hung by clips to give the viewers the ability to selectively peruse and compare specific strata based on their preferences.
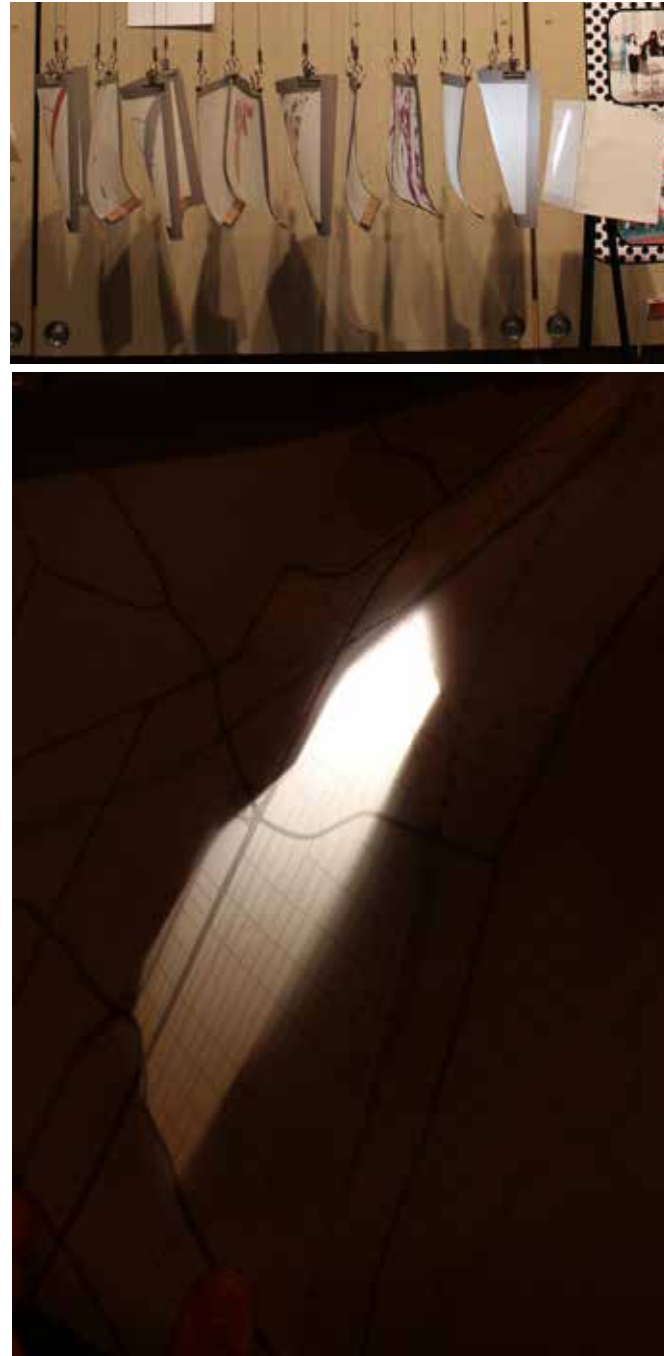


**Figure 4.17**. Boynton Layers Installation. Credits:

## Mapping Flood Contributers in Boynton

This map (See Fig. 4.18) shows a comparison between the zoning and vacant structures of Boynton neighborhood. Most vacancies are within residential and commercial zoning. These vacancies can be rezoned to wetlands and marshes.
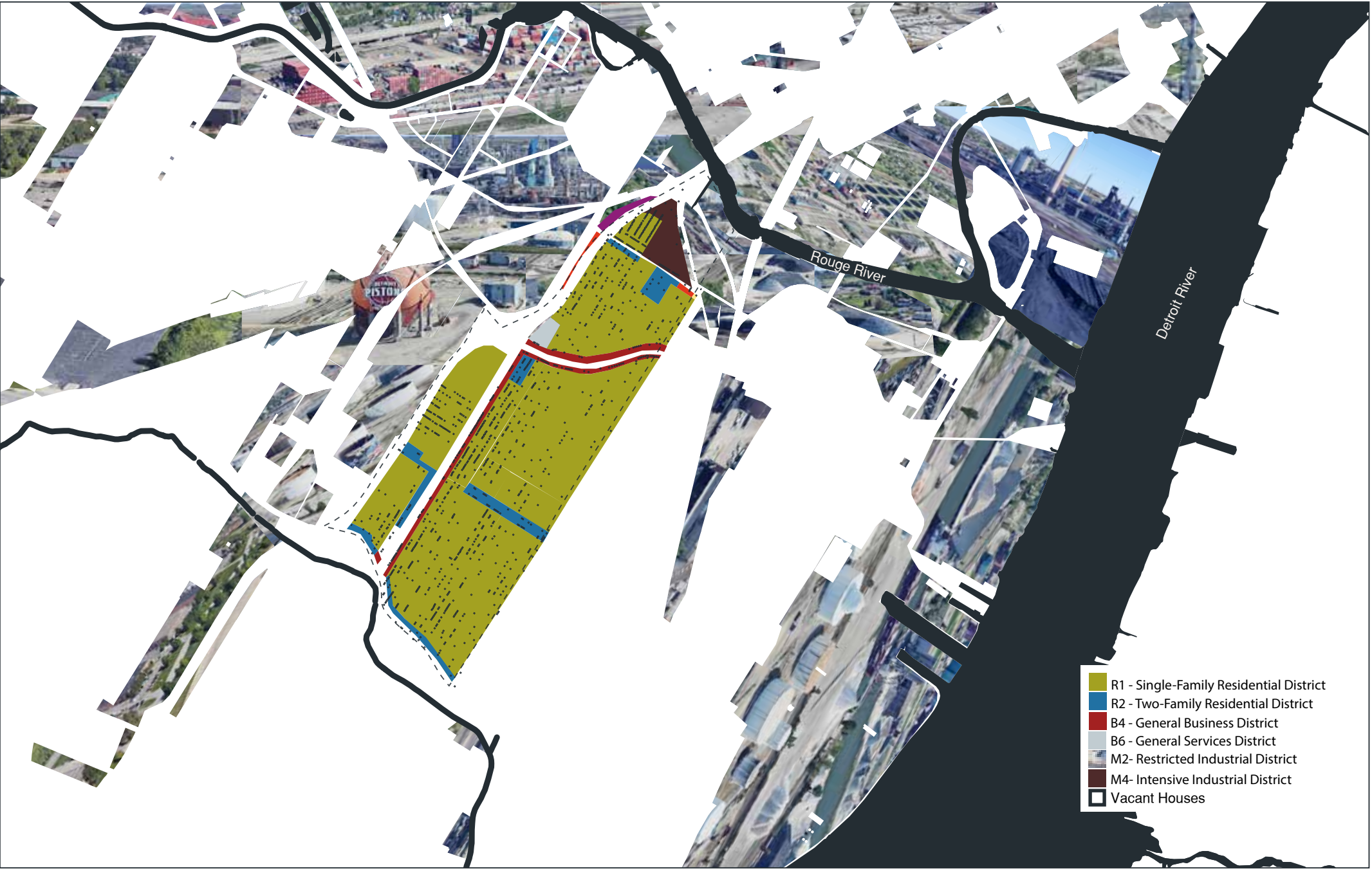


**Figure 4.18**. Land-use and Vacancies Map. Credits: Author. Data Retrieved at Regrid.

R1 - Single-Family Residential District
R2 - Two-Family Residential District
B4 - General Business District
B6 - General Services District
M2- Restricted Industrial District
M4- Intensive Industrial District
Vacant Houses

## 04.2.5    Methods

The map on the right shows the sewer pipeline network of the Boynton neighborhood along with the Detroit pumping stations. The pipelines' locations assist in locating the newly restored creeks that align with their direction.



Detroit Waste water Treatment Plant

Oakwood Pumping Station

Rouge River

Detroit River

Waste Water Treatment Plant

Combined Sewer Overflow Facility

GLWA - DWSD Connections
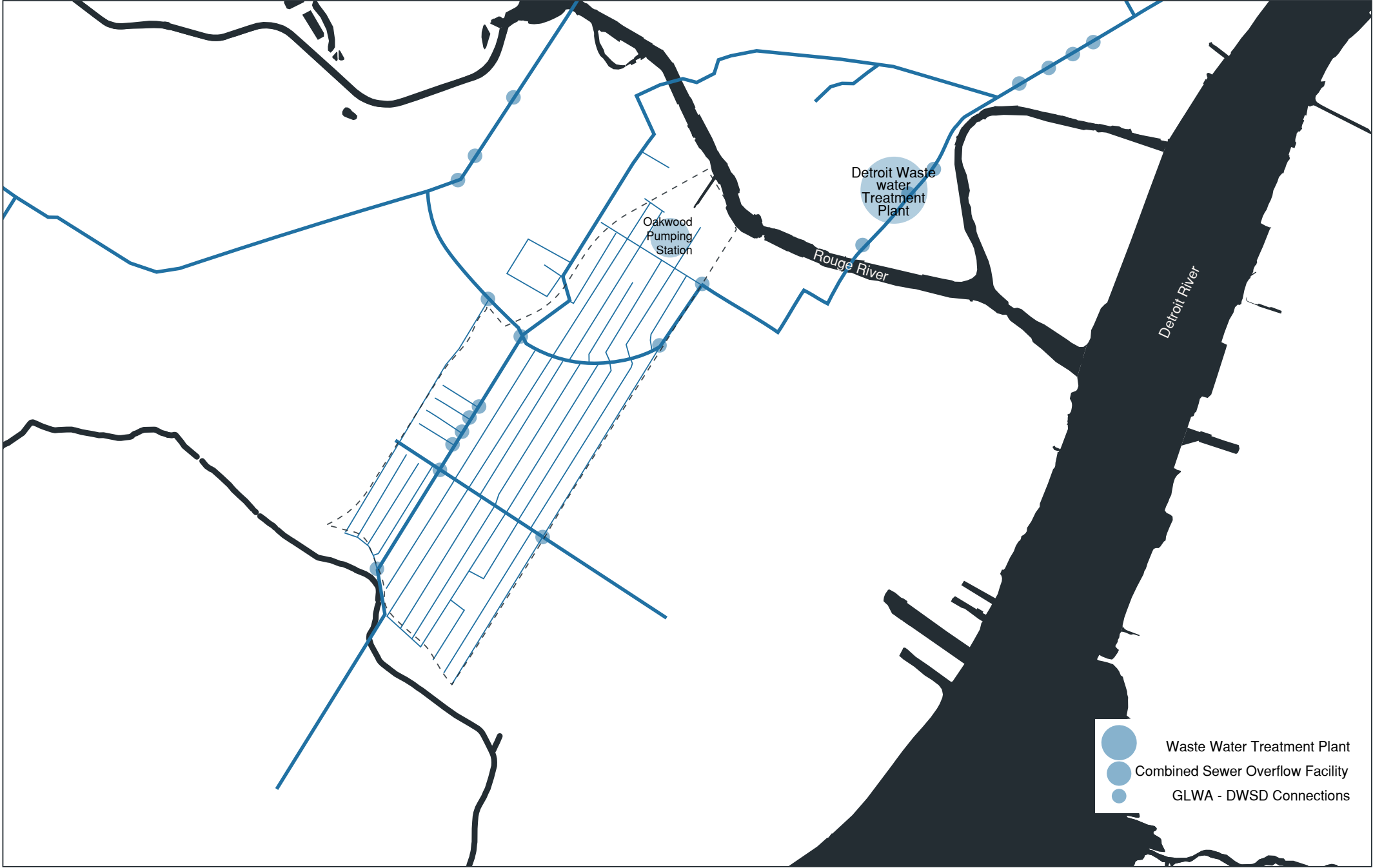
**Figure 4.19**. Sewer Pipelines Netweork Map. Credits: Author. Data Retrieved from DWSD.

## 04.2.5    Methods

The map on the right shows a comparison between green areas and impervious areas and shows the amount of transportation segregating the neighborhood.



**Figure 4.20**. Green areas Vs. Impervious Map. Credits: Author. Data Retrieved from https://detroitmi.gov/.

**Percentage of Impervious Surfaces**

60% - 100% Impervious Surfaces of Land Lot

Impervious Surfaces

**Transportation**

Streets

Major Railways

Minor Railways

Bridges

# Boynton Neighborhood Flood Study

In comparison between the current state of waterways and the natural habitat surrounding Boynton's neighborhood in 1905, the upper part of Boynton neighborhood where marshy land. The creeks played a vital role in sustaining wildlife within native nature (wetlands and marshes).

They were used by indigenous tribes in farming and as a way of path finding based on an article by Joanne Coutts in 2024.

The figure on the right shows a strong correlation between areas of buried creeks and high flood factor areas.



**Flood Hazard Areas - FEMA**
- 1% Annual Chance
- 0.2% Annual Chance

**Flood Factor**
- 6 - 10
- 3 - 5
- 1 - 2

— Recent Water ways
— Historical Water ways
    Historical Marshes
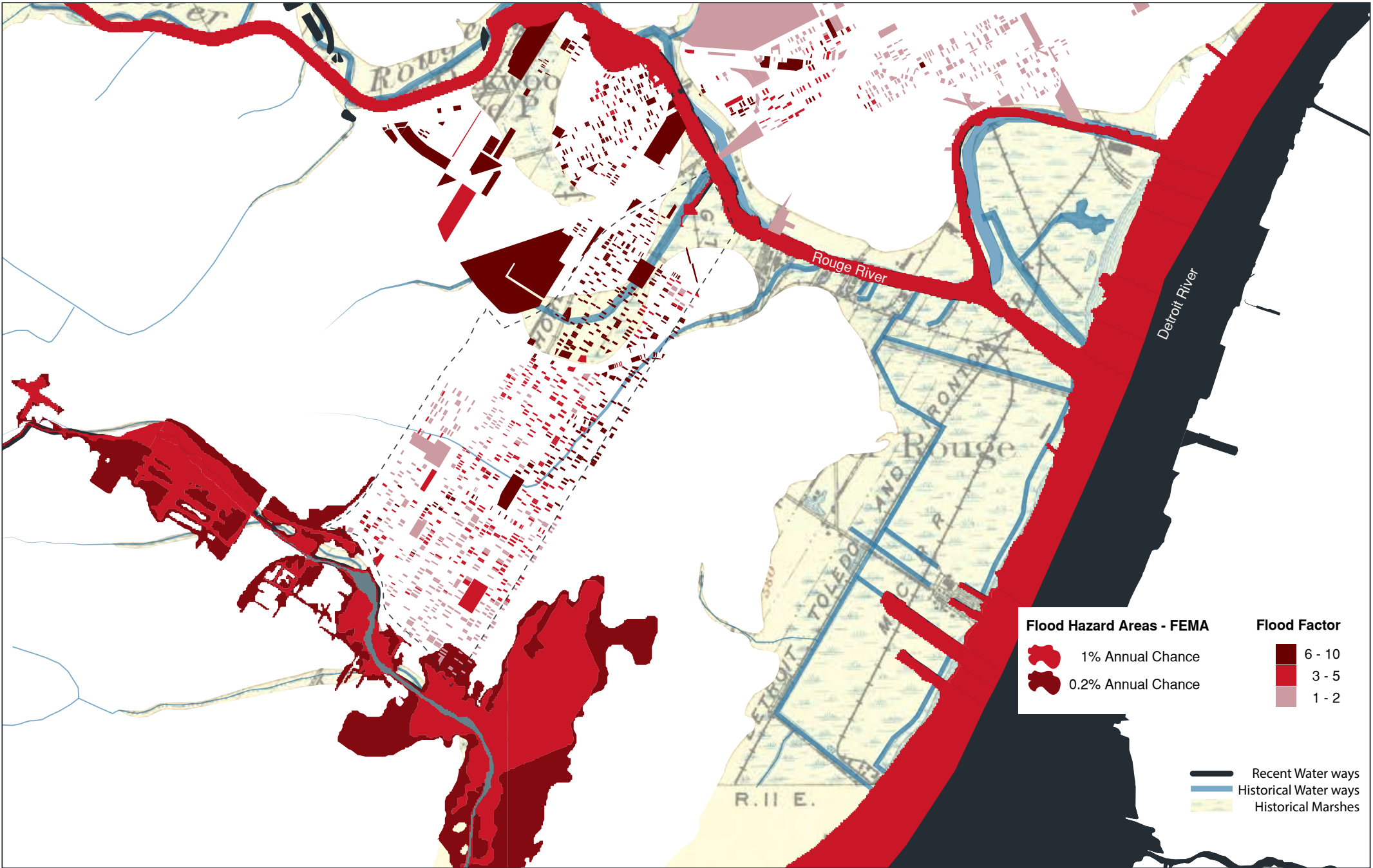
**Figure 4.22**. Flood Vs. Historic Nature. Credits: Author. Data Retrieved from FEMA, First Street Foundation, USGS-1905 Detroit Map.

## 04.2.5 Methods

This figure shows the correlation between areas of soil with high impermeability and high flood factor areas.
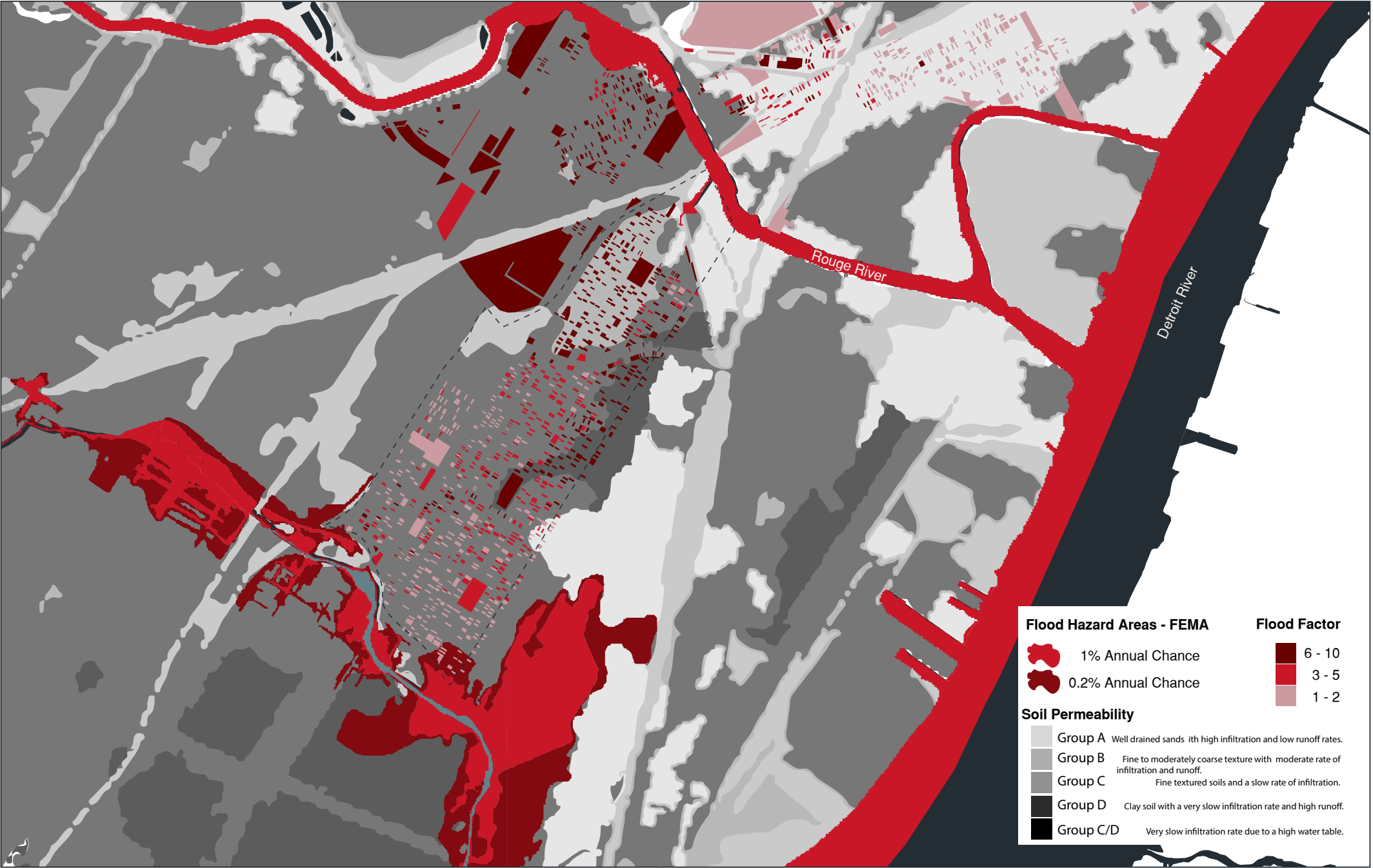


**Figure 4.23**. Flood Vs. Type of Soil. Credits: Author. Data Retrieved from FEMA, First Street Foundation, ArchGIS.

## 04.2.5    Methods

Boynton Neighborhood, in south Detroit, is a sample site that heavily floods every year. 2,127 out of 2,860 homes have a severe risk factor while 42 out of 44 miles of roads are at risk of becoming impassable due to flooding. The risk factor varies from 1 to 9 within this neighborhood due to differences in topography and soil type.



**Figure 4.24**. Flood Vs. Figure Ground Map. Credits: Author. Data Retrieved from FEMA, First Street Foundation, OpenStreet

## 04.2.5   Methods

Flood risk is higher in lower topography areas, which can be a great place to convey water and sustain wild nature.



**Figure 4.25**. Flood Vs. Topography Map. Credits: Author. Data Retrieved from FEMA, First Street Foundation,

## 04.2.5    Methods

Most vacancies are in high flood-risk areas with a nine out of ten-flood factor.



**Figure 4.27**. Flood Vs. Vacancies Map. Credits: Author. Data Retrieved from First Street Foundation,

**Flood Factor**
- 6 - 10
- 3 - 5
- 1 - 2
- Vacant Houses

## 04.3   Methods

# Precedents

## Local

### Bloody Run Creek Greenway Redevelopment Project

Detroit Collaborative Design Center, NTH Consultantants, Ltd., Adi Shamir, The Mannik and Smith Group, Inc., Urban Resource Alliance, Zachary and Associates, Inc.
Year: 2011
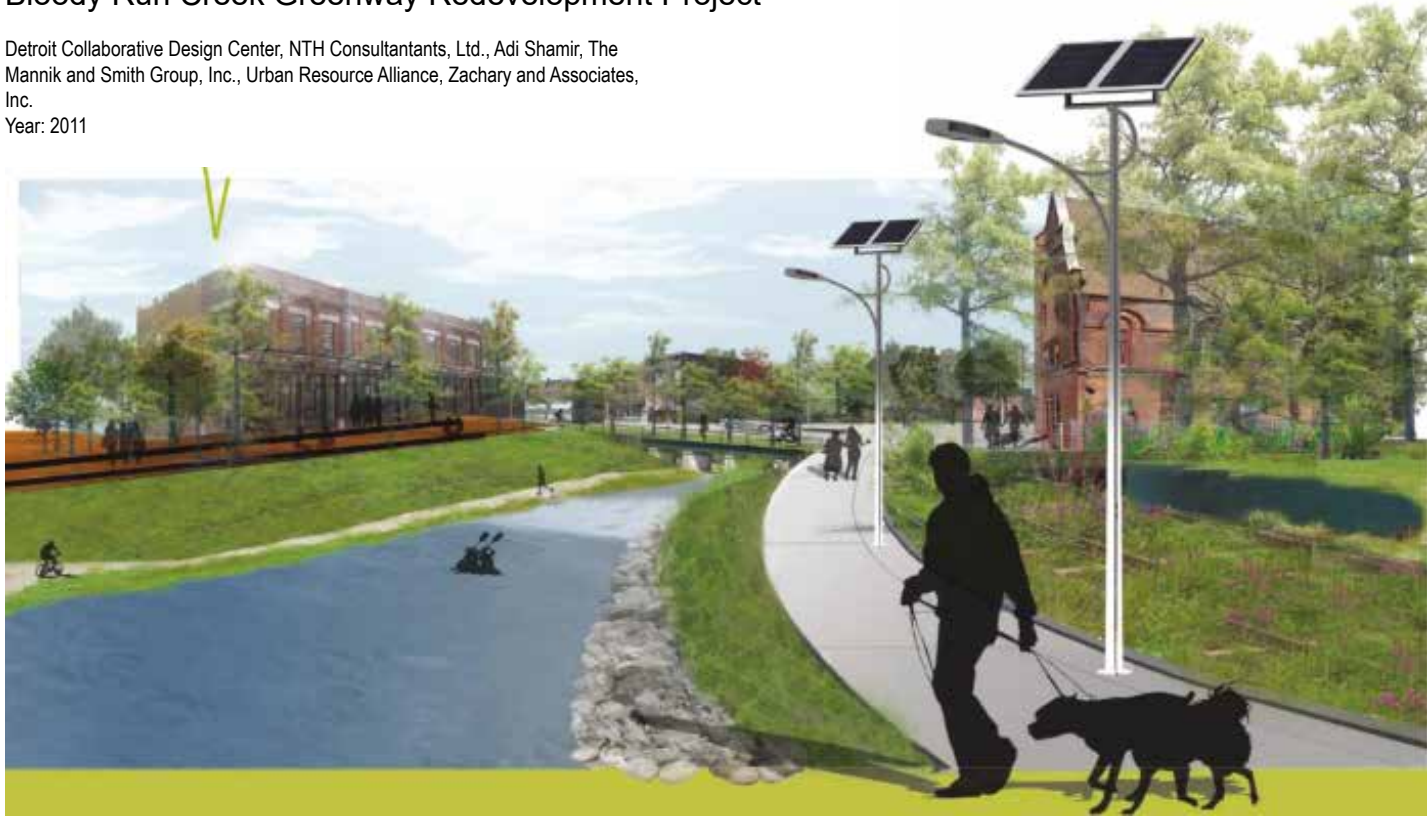


**Figure 4.28**. The Bloody Run Creek Project. Credits: DCDC.

## International

### La Rosa Reserve Stream Daylighting, New Zealand
Architects:  Boffa Miskell (BML)
Year: 2014



**Figure 4.29**. La Rosa Reserve Stream Daylighting Project. Credits: Boffa Miskell, Archdaily.

### Benjakitti Forest Park , Bangkok, Thailand
Architects: Arsomsilp Community and Environmental Architect, Turenscape
Year: 2022



**Figure 4.30**. Benjakitti Forest Park Project. Credits: Arsomsilp Community and Environmental Architect, Archdaily.

## 04.3   Methods

# International

### Chulalongkorn Centenary Park - Bangkok, Thailand

Landscape Architect: LANDPROCESS
Architectural Design: N7A architects
Year:  2017



**Figure 4.31**. Chulalongkorn Centenary Park Project. Credits: ArchDaily.
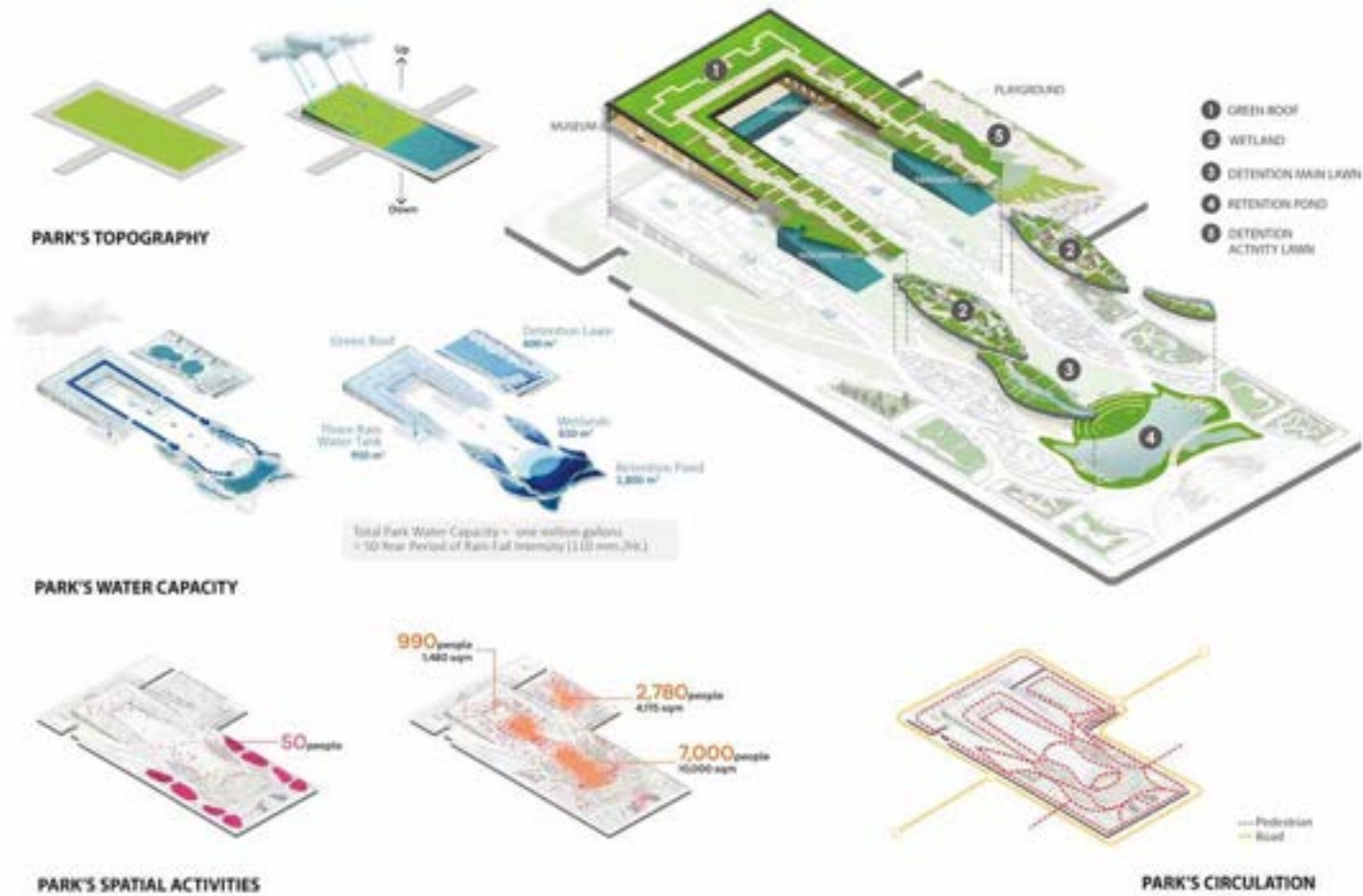


**Figure 4.32**. Chulalongkorn Centenary Park Project. Credits: ArchDai-

# Summaries of Interviews

**Sara Hoyash**
**Director of Land Use and Sustainability**
**DFC.**

- Flood resiliency requires billions of dollars and vast amounts of funding.
- It is not enough to approach the issue from a grass root level.
- The Sewer systems need to be separated aided with gray system solutions.
- Use natural habitats to improve soil permeability and use topography solutions.

**Cartographist and Activist**

- The more we acknowledge the history of the land, the more we understand the situation and make correct decisions.
- The original naming of lands given by the indigenous people tells a lot about the type of native nature and ecology.
- more native nature in urban cities.
- To improve the economy plan for open-air markets and businesses that leverage landscape.

**Joel Howrani**
**Director of Community Resilience and**
**Public Sector consultant.**

- Use riparian buffers near rivers and streams to decrease flooding.
- There should be restrictions on river discharges to decrease pollution.
- There is a lack in policies regarding nature-based solutions, create new policies to sustain and encourage.

**Steve Vogel**
**Architecture,**
**Urban planning, Preservation.**

- The zoning ordinance must be changed, we need to have as many wetlands saved as possible and reclaim native nature in the city.
- Based on the Bloody Run Creek project, the placement of artificial ponds was made in areas of vast vacant lots, original ponds were in the General Motors property.
- Daylighting creeks happen when a creek is parallel in the direction to the existing sewer pipelines, but also any sewer pipes direction can drain into the creek depending on the topography.
- 80% of the sewer is rainwater, creek daylighting conveys runoff in engineered waterways, it reduces the size of the sewer system to 20% for sewage, which saves material and money for any future reparations.
- Natural water and green systems Can filter and clean water.
- The developers in Detroit care about profit, a resilient project makes sense economically.

**Joanne Coutts**

# Rezoning Policies Review

## Zoning Limitations

Checking rezoning policies and comparing them to land use, native nature, and restrictions over factories' overflows were one of the methods used.  This helps to identify the gaps in the policies system that would help us impose a new policy to preserve and restore native nature. There is a huge lack of rezoning policies from residential to productive parks and wetlands.

## Land Based Program

- A land-based project uses land for urban agriculture, gardening, or beautification, whether for profit or as a community-based activity.

- 

- Rezoning a property takes 4-5 months through various hearings and procedures.

- 

- Land Based Program bypasses this process for community-based projects with a landscape focus and criteria.

- 

- The Land Based Program is limited by zoning: particularly R1+R2.
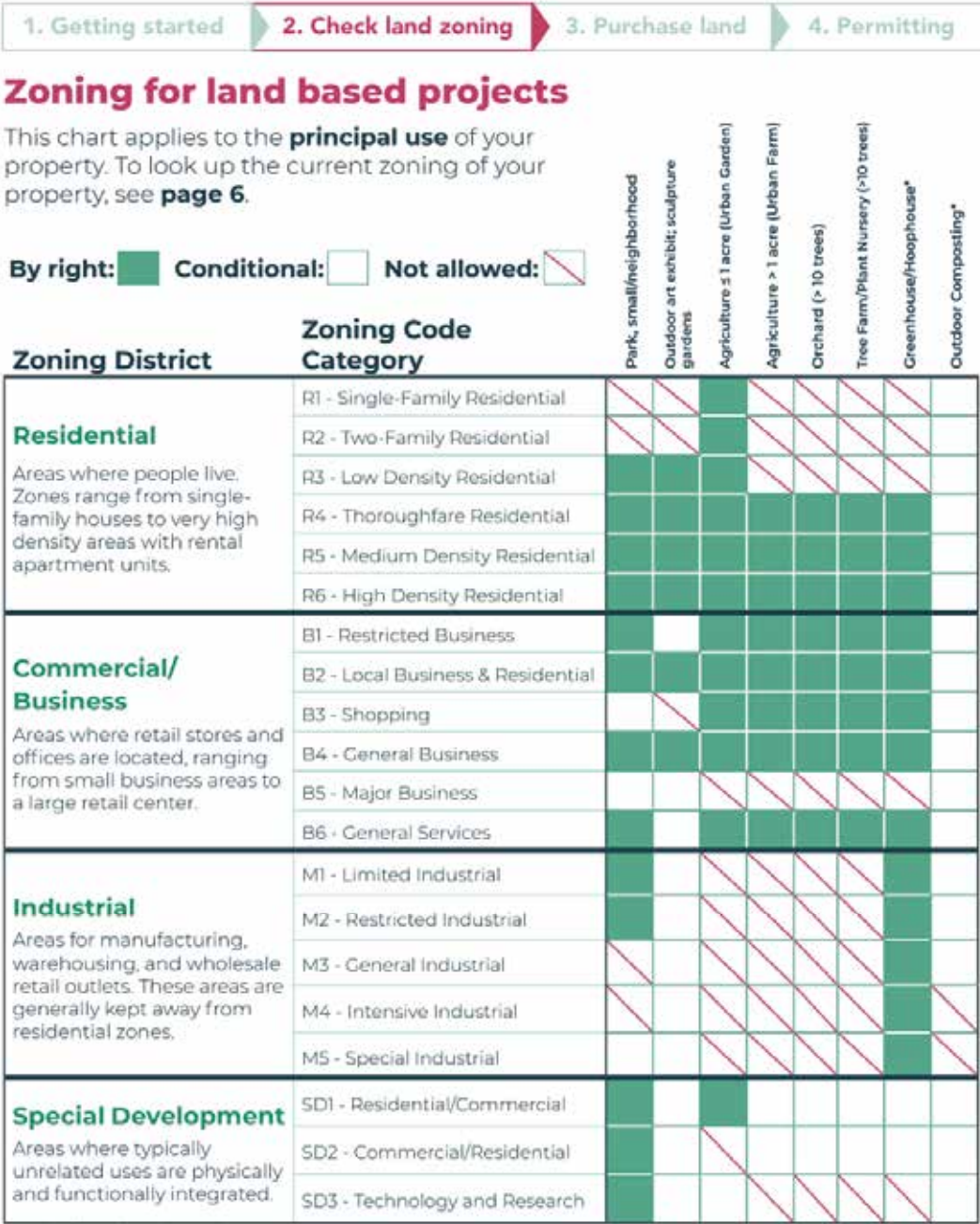


Figure 4.33. Zoning For Land Based Projects. Credits: land@detroitmi.gov.

## 04.6  Methods

# Site Analysis

### Accessibility

• Site surrounded by pollution and noise.
• Segregated by 75 highways and Railroads which makes it a safety issue.



Accessibility
— Foot Way
····· Bicycle Way
•••• Paddling Trail
— Bus Route
▮ Parks
▥ Noise
→ Surface Drainage

10 Minutes walking Radius
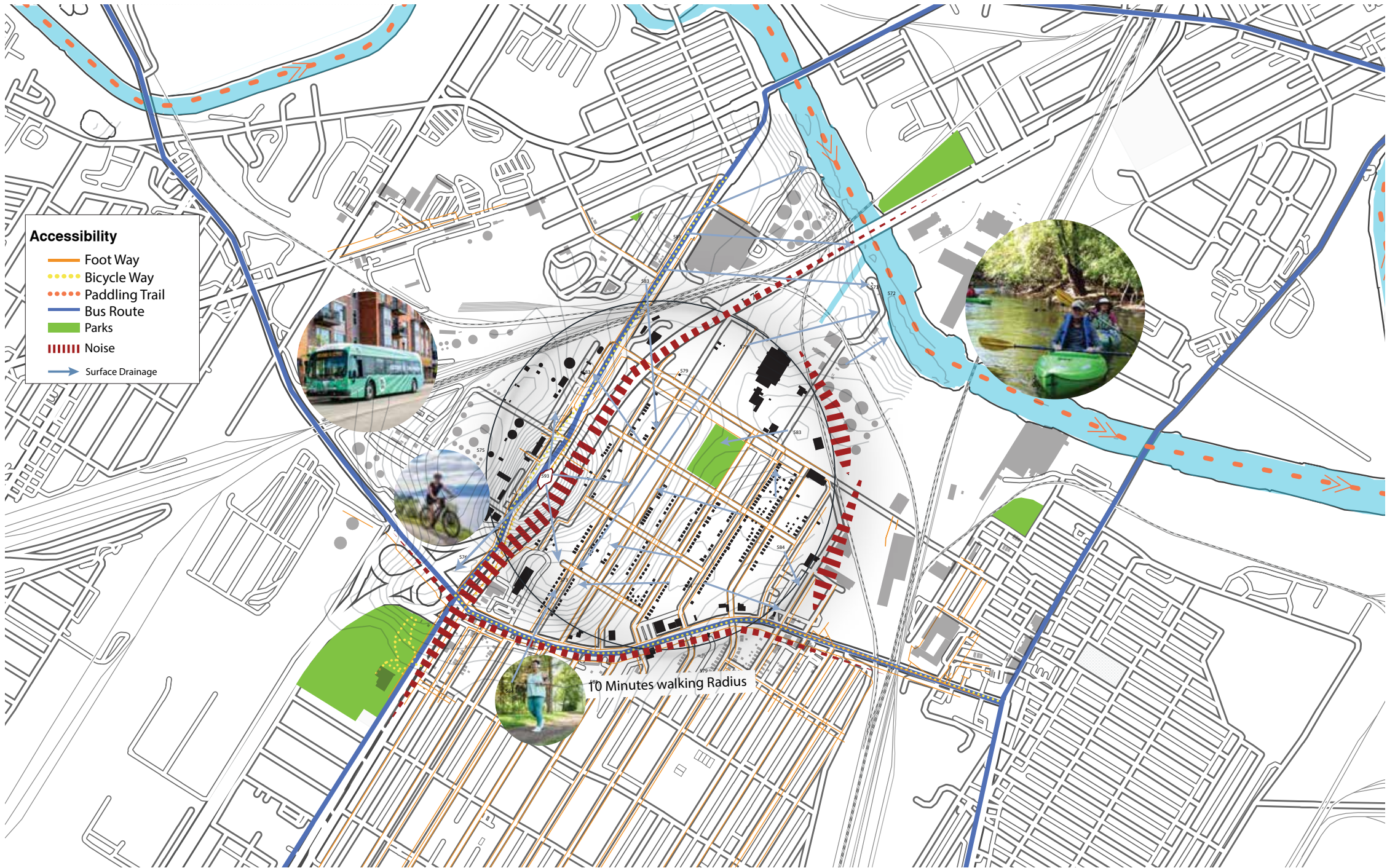
**Figure 4.34**. Accessibility-Site Analysis. Credits: Author.

# Vacancies and Dimensions

• Almost 50% is vacant land and structures, most of them owned by the Detroit Land Bank Authority.



Conditions of Parcels/ Dimensions

Vacant
Occupied
Vacant+Owned by DLBA

111 ft

43 ft

20 ft

36    23

Dimensions

Project Size: 267 Acres
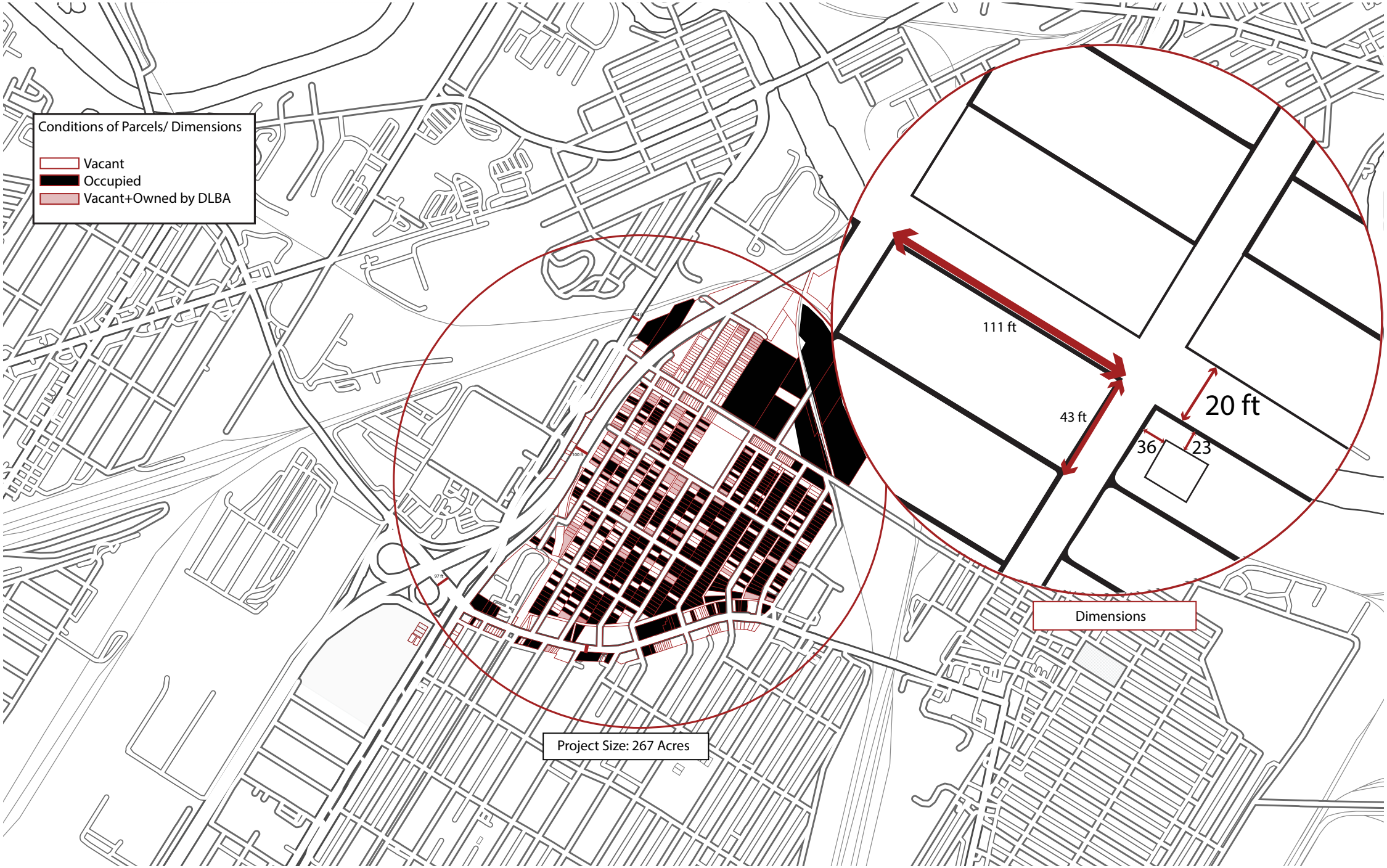
**Figure 4.35**. Vacancies and Dimensions-Site Analysis. Credits: Author.

# Land Use



**Land Use**

- Industrial
- Residential
- Educational
- Commertial
- Parks

Marathon Petroleum Corp.

Ajax Paving Industries

Industrial Fence & Landscaping Inc.

Corrigan Oil Co.

Motor City Materials Co.

Kemeny Recreation Center

Panther Stadium

Rive Rouge High School

Luxury Collection Detroit inc. Used Auto Sales.

RollerCade Detroit

Dollar Tree

True Holiness Temple

Green Pharm

River Rouge Auto Sales

**Figure 4.36**. Land Use -Site Analysis. Credits: Author.

# Native Species



**Native Species/Tree Cover**
- Parks
- Meadows
- Tree Canopy

Canvasback Ducks

Lakeplain Wet Prairie

Beavers

Cattails

California Gull

Reed Plants

Marshes

Brent Geese

Sandhill Crane

Blue Jay

King Rail

Rush Plants

Wet-mesic Flatwoods

**Figure 4.37**. Native Species - Site Analysis. Credits: Author.

# 05

**Conclusion**

# Just Imagine Installation - Macro

There are Three scales of Design proposals were
implemented over the Boynton neighborhood including
a macro scale, a micro-scale, and a selected part of the
neighborhood.
Just Imagine is a call for new policies to restore wetlands
in residential areas.
The lack of policies regarding rezoning residential areas
to native landscapes, and the possibility of restoring a
natural hydrological system within residential areas are
the major triggers in this display. Most of land vacancies
in Detroit are zoned as residential areas, which have the
highest restrictions over rezoning. Part of these vacant
lands and structures were built over marshes and creeks
which once played a vital role in absorbing water and
sustaining wildlife within the wetlands ecosystem which
no longer exists.
Detroit's combined sewer system alongside the lack
of native nature cover are the main reasons behind
the increasing rates of surface floods in Detroit
neighborhoods. 80% of Detroit's sewers are stormwater,
adding pressure on sewer pipes and causing flooded
basements and streets, raising the question of why not
let Nature breathe in?
This work persuades the viewer to Imagine wetlands
restoration in Detroit through a projection of Imagination
over reality. A visualization of a connected hydrological
system of ponds and daylit creeks integrated within
urban forestry and productive landscapes within the
Boynton neighborhood. The animated macro scale map
assists in visualizing how the water connects with the
surrounding waterways as a continuous natural cycle.
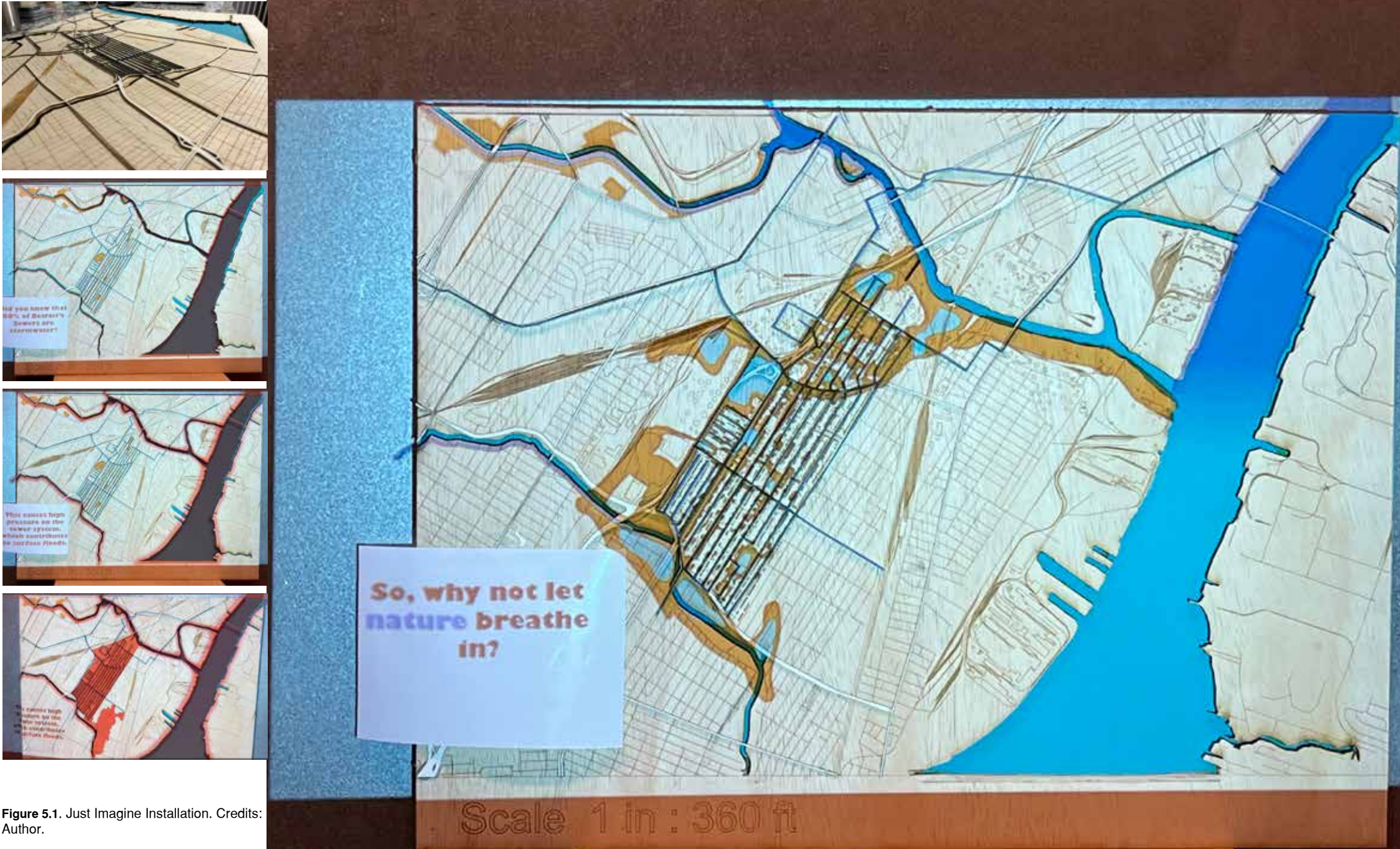


**Figure 5.1**. Just Imagine Installation. Credits:
Author.

## Just Imagine - Micro Scale



**Before:**

**Figure 5.2**. Just Imagine Proposal. Credits: Author.



**Before:**

**Figure 5.3**. Just Imagine Proposal. Credits: Author.

Just imagine is a way to visualize how to combine three vacant lots with vacant structures and how to bridge between them if daylighting creek happens in the middle of a residential block. Berms on sides of the creek planted with reeds and rush to filter water and soil from pollutants while increase soil infiltration. It is also a way to minimize flood runoff from these lots away from the structures if they get repurposed, while being connected to an urban farming lot as part of the flower cut industry.

## 05.2 Conclusion

# Design Intervention

This final proposal of a selected part within the Boynton neighborhood is in a very preliminary phase of visualizing the ideas and concepts from multiple precedents mentioned as The Bloody Run Creek Project.

The Project's Size is 267 Acres. The design intervention is in its very preliminary phase of imaging how this portion of the Boynton neighborhood will look like if we restore wetlands and use GSI to daylight the old creek and connect it to artificial detention and retention ponds. This plan proposes to change the land use policies, to give the ability to residential zoning to rezone wetlands and urban farms fully or partially. This proposal includes planning beyond code minimum, through creating urban forestry buffers on the industrial zone parameters to filter sound and air and to increase safety.

The Pathways are inspired by the indigenous pathfinding that was planned to connect between vacant lots, the creek, and beyond the highway. These pathways help visualize the urban grid from a different angle if we give the soft landscape priority instead of vehicles. The railroads were turned into greenways and urban forestry that buffered the neighborhood and the industrial surroundings in a manner to increase pedestrian safety and community well-being. It also provides them with a variety of choices to walk, cycle, and kayak in the Rogue River where a station will be on the edge of the river to connect with the Rouge River trails planned by Friends of The Rouge.

**Figure 5.4.** Design Intervention. Credits: Author.

## 05.2 Conclusion

This project allows residents and visitors to be part of the cut flower industry, through rezoning residential zoning to mixed-use surrounded by a series of productive parks and wetlands. People can come and enjoy the scenery, sell goods in the farmers markets, and bring profit plus vibrancy to the neighborhood.
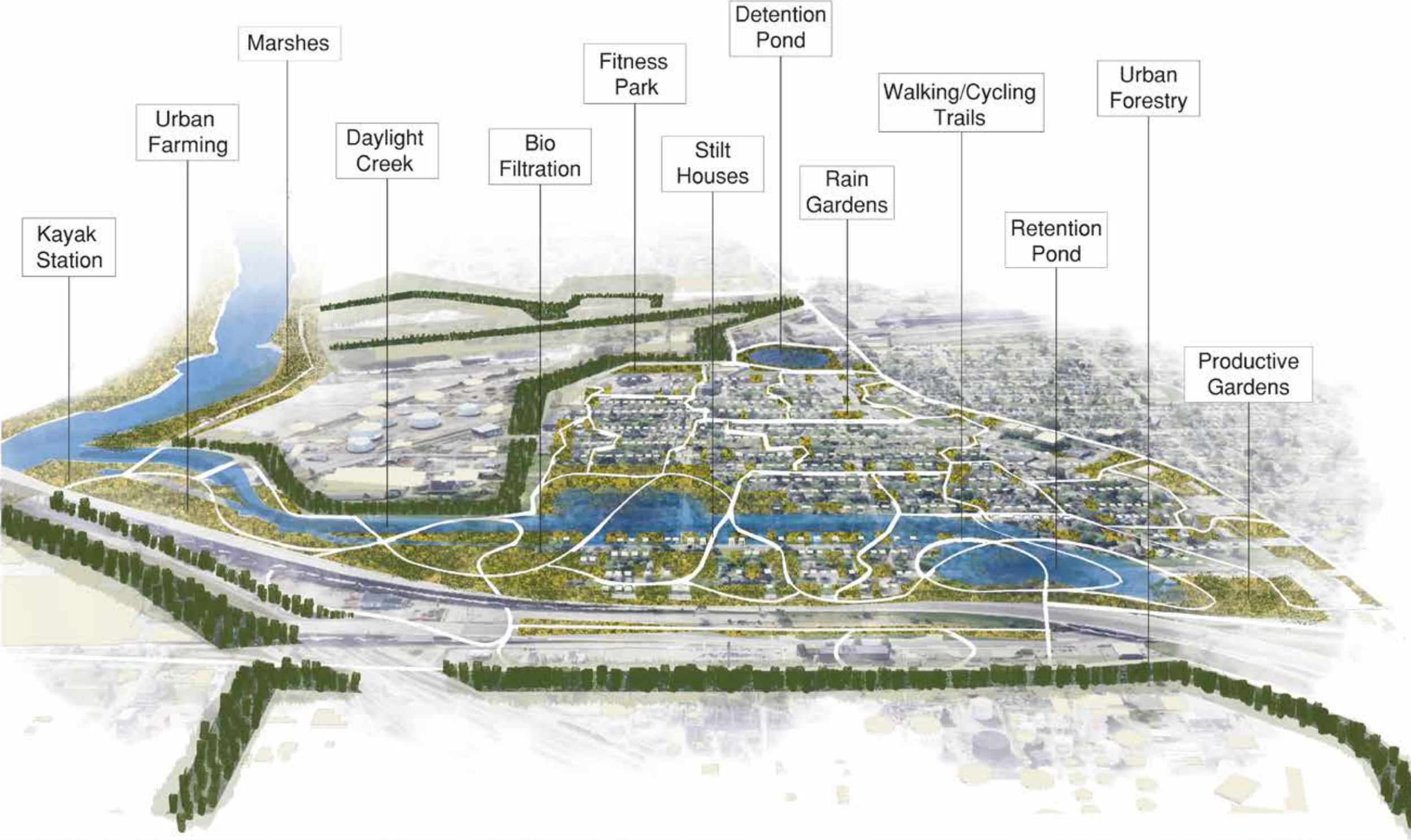


**Figure 5.5.**Just Imagine - Flood Resilient Design Intervention In Upper Boynton Summer Season . Credits: Author.
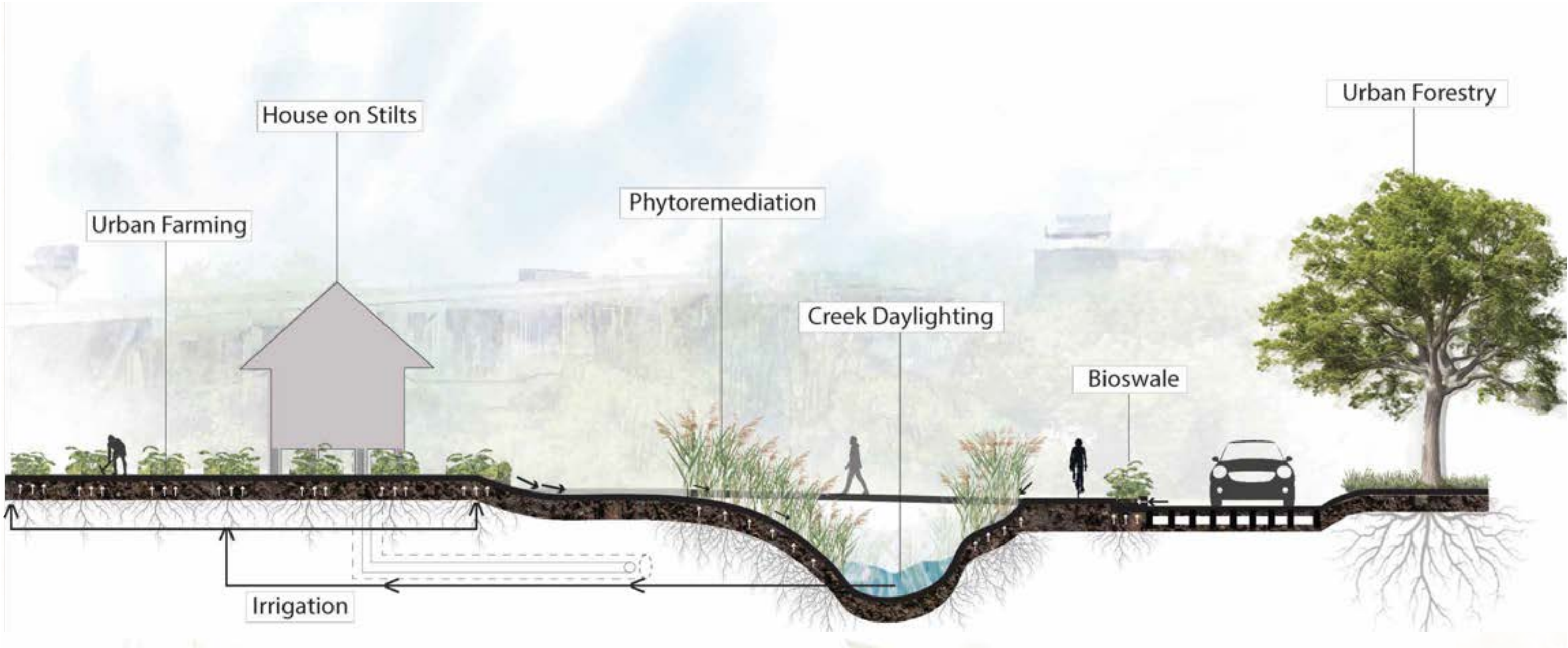
**Figure 5.6.**Design Intervention Section. Credits: Author.

## 05.2 Conclusion

Based on the analysis of three map scales (the Great Lakes region, Detroit city, Boynton neighborhood), it is evident that surface flooding is a complex issue with multiple causative factors. While most survey results stem from reported flooded basements and properties, the most impactful floods occur inevitably on impermeable surfaces within urban areas. Whether caused by impermeable soil or the concrete covering of urban areas, the impact is most pronounced in parking lots and industrial zones. These surfaces act as water barriers, preventing natural circulation through the soil and hindering the absorption and flourishing of water by native plants, along with impeding its return to the air through the evapotranspiration mechanism.

Human-made settlements are disrupting the delicate balance of the earth; water, air, and land are no longer the same. There is an urgent need to restore nature.

habitats in Detroit neighborhoods, predominantly wetlands. The plan involves in re-establishing wetlands in heavily flooded Detroit areas and creating connections between wetlands in different neighborhoods through passive parks and greenways. Therefore, it is essential to plan beyond minimum codes, including the alteration of zoning policies. Boynton neighborhood, like many others in Detroit, suffers from surface flooding with a 9-flood factor, along with industrial polluted air and water. The primary cause of surface flood is an inadequate sewer system with insufficient pumping stations unable to cope with sewer and stormwater pressure from the north, compounded by Detroit's impermeable soil and low infiltration rate, leading to more floodplains in suburban areas. The topography and historical waterways in the neighborhood play a significant role in contributing to surface floods, potentially explaining vacancies. This

emphasizes the need for water balance restoration, which is achieved by daylighting creeks, and the utilization of Green Storm-water Infrastructure. Wetlands surrounded by green ways should be strategically designed to foster connections between Detroit's neighborhoods. The objective is to envision the future of Detroit, incorporating restored streams and urban farms into the urban fabric.
In conclusion, this study is much needed to dismantle systematic environmental injustices in Detroit and fix the malpractices of the past, to reflect a flourishing future economically, socially, and environmentally. We are obligated to design healthy environments for all people. The Boynton neighborhood revitalization project proposes a comprehensive approach to rejuvenating the area, focusing on both environmental restoration and community involvement. By restoring wetlands and

implementing green stormwater infrastructure, the project aims to enhance sustainability and resilience. Proposed changes to land use policies include rezoning for wetlands and urban farms, alongside creating urban forestry buffers for safety and well-being. Pathways inspired by indigenous navigation prioritize pedestrian-friendly spaces and recreational amenities. Repurposing railroads into greenways further promotes connectivity and outdoor activities. The project also encourages community participation through opportunities in the cut flower industry and farmers markets, fostering economic vitality and local engagement. Overall, the project seeks to create a more livable and environmentally conscious neighborhood through a combination of urban agriculture, flood management, and inclusive planning strategies.



**Figure 5.7**.Design Intervention Perspective, Spring Season. Credits: Author

# 06

Sources

# 06 Sources

## References

- Watson, Donald, and Michele Adams. Design for Flooding: Architecture, Landscape, and Urban Design for Resilience to Flooding and Climate Change. Wiley, 2011.
- Manning, June, and Henco Bekkering. Mapping Detroit Land, Community, and Shaping a City. Wayne State University Press, 2015.
- Detroit collaborative design center. "Bloody Run Creek Greenway Redevelopment Project." Issuu, Christina Heximer, 21 Aug. 2012, https://issuu.com/dcdc-udm/docs/bloodyrun.
- "Green Stormwater Infrastructure Projects." City of Detroit, https://detroitmi.gov/departments/water-and-sewerage-department/dwsd-projects/green-stormwater-infrastructure-projects#:~:text=The%20permit%20language%20identifies%20a,tree%20planting%20and%20other%20projects.
- "The 100-Year Flood Completed." The 100-Year Flood | U.S. Geological Survey, www.usgs.gov/special-topics/water-science-school/science/100-year-flood. Accessed 1 Aug. 2023.
- Jensen, Grace. "When Roads Turn to Rivers: Rethinking Detroit's Flood Infrastructure." Midstory, 20 July 2022, https://www.midstory.org/when-roads-turn-to-rivers-rethinking-detroits-flood-infrastructure/#:~:text=Massive%20flooding%20has%20occured%20at,frequency%20has%20been%20much%20higher.
- LARSON, PETER S, et al. Recurrent Home Flooding in Detroit, MI 2012-2020: Results of a Household Survey, 2021, https://doi.org/10.21203/rs.3.rs-459157/v1.
- "Renewing Low-Density Neighborhoods Through Offsite GSI Investments proof of concept." the Detroit Collaborative Design Center, https://drive.google.com/file/d/1xepW0uwaRXgonrnoBBaRiwP14RtOcSjj/view.
- "How were the Great Lakes formed?", eekwi organization, www.eekwi.org/great-lakes/great-lakes-formation-and-physical-features/how-were-great-lakes-formed.
- Detroit Flood Report 2021- Wayne state university, https://huw.wayne.edu/learning-center/detroit_flood_report_2021.pdf.
- Detroit Future City |, 13 July 2023, https://detroitfuturecity.com/ted-countdown-summit-2023/. Accessed 11 Aug. 2023.
- Batcheller, Pat. "Could Detroit's buried streams see the light of day?.", CuriousiD, February 9, 2023, https://wdet.org/2023/02/09/curiosid-could-detroits-buried-streams-see-the-light-of-day/, , accessed August 14th 2023.
- U.S. Army Corps of Engineers (USACE) - Floodplain Management Services Program (FPMS). Lake St Clair Flood Risk Reduction Study For the Jefferson-Chalmers Neighborhood, Detroit, Michigan . City of Detroit , July 2022, https://detroitmi.gov/sites/detroitmi.localhost/files/2022-08/Jefferson%20Chalmers%20FPMS%20Study_July2022.pdf
- Liao, K.-H. (2014). "From flood control to flood adaptation: a case study on the Lower Green River Valley and the City of Kent in King County, Washington." Natural hazards 71(1): 723-750
- Hill, Alex B. "Map: Green Infrastructure Spatial Planning Model Detroit." DETROITography, 28 Jan. 2019, detroitography.com/2019/02/04/map-green-infrastructure-spatial-planning-model-detroit/.

## List of figures

# 07

Appendix

**Figure 4.21**. Historic Waterways Vs Recent Map. Credits: Author. Data Retrieved from USGS-1905 Detroit Map.



**Figure 4.26**. Flood Vs. Sewer Infrastructure Map. Credits: Author. Data Retrieved from FEMA, First Street Foundation, DWSD.

Designing for flood resiliency involves landscape and urban design based ecological strategies at both regional and communal scales. This thesis is a call for designing beyond the code minimum for a more resilient future. It proposes to reconnect natural hydrological systems by redirecting flood runoff to reconstructed marshes, wetland, and community farms through a series of creeks and ponds. These wetlands will work as a kidney, filtering air, soil and water pollutants providing an equitable environment for Detroit neighborhoods to live and flourish within their communities. This thesis encourages a grassroots movement towards land and water stewardship while the community benefits from circular economy powered by farming, inspired by the indigenous tribe's connection to nature. The work was inspired by multiple works as Bloody Run Creek project and Renewing Low-Density Neighborhoods Through Off-site GSI Investments project, both by Detroit Collaborative Design Center and the elements of sponge city in China. A site in Boynton neighborhood was chosen to be a study model for the implementation of green and blue storm-water infrastructure strategies.