ABSTRACT

Title of Thesis:	REPAIRING THE TEAR Restoring the Anacostia River for Inclusive Urbanism
	Daniel Pantoja, Master of Architecture, 2026
Thesis Directed By:	Professor Georgeanne Matthews, School of Architecture, Planning, and Preservation

Once a vital ecological and cultural resource, the Anacostia River is now among the nation's most polluted rivers. The rapid growth of urban areas, centuries of industrial use, loss of wetlands, and aging wastewater infrastructure, have transformed the river from a natural asset to a dividing line within Washington, D.C. The ecological collapse of the river has resulted in geographical barriers, preventing access to healthy ecosystems, equitable development, and public resources for marginalized communities. The problem is both social and environmental. How can architectural and ecological design begin to foster social ties?

Conventional wastewater treatment systems are often too expensive and energy-intensive. On the other hand, wetlands offer a low-cost, climate change resilient, and nature-based solution. They also provide social and cultural benefits, such as recreation, education, and overall human well-being. By 2050, 68% of the world's population is projected to live in urban areas so it's imperative to implement sustainable solutions.

This thesis will investigate urban strategies, looking into how architecture can play a role in place making. This thesis will also integrate case study analysis and examine existing wetland and green infrastructure projects. By combining socially responsive design with ecological infrastructure, this thesis explores transforming urban green planning from a tool of environmental privilege into one that actively bridges communities and dismantles inequalities.

REPAIRING THE TEAR:
Restoring the Anacostia River for Inclusive Urbanism

by

Daniel Pantoja

Thesis submitted to the Faculty of the Graduate School of the
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Advisory Committee:
Professor Georgeanne Matthews, Chair
Professor Brittany Williams
Professor Juan Burke

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Chapter 1: Introduction

Introduction

The Anacostia River is one of Washington, D.C.'s most environmentally and socially complex landscapes. Once a thriving freshwater ecosystem and major cultural resource for Indigenous communities, the river has paid the price of the growth of the nation's capital. It has spent more than a century burdened by industrial pollution, dredged fill, highway construction, and uneven investment. The effects of these physical and political decisions have impacted surrounding communities unequally. Neighborhoods east of the river, home to predominantly low-income Black residents, have disproportionately absorbed the consequences of environmental degradation and disinvestment. They're also faced with limited access to public resources and recreational or ecological amenities. While the city has recently begun investing in river cleanup initiatives and waterfront redevelopment, the benefits of such improvements remain unevenly distributed. In many cases, new "green" or "sustainable" infrastructure risks reproducing the very inequities they aim to address, making the waterfront accessible primarily to those already positioned to benefit from rising land values and not those who have long resided in these neighborhoods.

This thesis positions Poplar Point, located along the eastern bank of the Anacostia River, as a site to examine how architectural and environmental design can begin to repair these layered histories. Poplar Point is physically degraded, socially disconnected, and ecologically fragile, but simultaneously rich with potential. It's one

of the few remaining large waterfront parcels in the city that has not yet undergone major redevelopment. The site's condition illustrates the tensions between ecological restoration, public access, social equity, and urban revitalization. In many ways, Poplar Point is a representation of both the problem and the opportunity that define the broader Anacostia watershed.

This thesis argues that architecture can play a critical role in bridging ecological systems, public space, and community needs. Rather than focusing solely on formal buildings or isolated landscape strategies, the proposal explores an integrated approach, one in which constructed wetlands, living-machine systems, community-led programming, and civic spaces work in tandem to shape an equitable and restorative waterfront. The goal is not simply to create green infrastructure, but to ask how such interventions can foster belonging, expand access, and promote environmental stewardship across historically divided neighborhoods.

Aims and Objectives

This thesis aims to explore how architectural and ecological interventions can restitch long-divided communities, remediate a degraded riverfront, and cultivate inclusive access to the Anacostia River. The thesis question asks… *How can architecture reconnect a divided riverfront community through civic and ecological restoration?* The proposed response is situated at three interconnected scales: building / urbanism, ecology, and community. Each of these scales frames a different dimension of intervention, allowing the thesis proposal to respond holistically to the river's ecological and social challenges.

Building / Urbanism

At the architectural and urban scale, the thesis examines how buildings, public spaces, and circulation networks can reconnect people to the river in meaningful and equitable ways. This includes exploring how built structures, such as education centers, community pavilions or market spaces, can operate as civic anchors rather than isolated destinations. The design also considers the broader urban fabric, including but not limited to things like pedestrian pathways, boardwalks, and transit connections that physically stitch neighborhoods to the waterfront by enhancing accessibility and visibility. By thinking across both architecture and urbanism, this scale asks how the built environment can counteract decades of infrastructural barriers, from highways to fragmented or segregated parcels, and transform Poplar Point into an active and publicly accessible landscape.

Ecology

At the ecological scale, the thesis investigates how nature-based systems can support the restoration of the Anacostia River while shaping educational and experiential opportunities. Constructed wetlands, bioremediation landscapes, and "living machine" wastewater systems offer a low-cost and resilient way to improve water quality, support biodiversity, and reduce stormwater pollution from entering the river. These ecological interventions are at the forefront of this thesis proposal. They are integrated into the spatial and programmatic life of the site. Visitors can learn from them, move through them, and witness ecological processes that often remain

invisible in urban environments. This approach frames ecological health not as a technical problem alone, but as an integral part of civic life and environmental justice.

Community

At a social scale, the thesis emphasized community centered design, environmental education, and cultural connection. For decades, communities east of the Anacostia have been excluded, both physically and symbolically, from the environmental benefits seen elsewhere in the city. This project responds by imagining spaces that invite gathering, learning, collaboration, and stewardship. Whether through outdoor classrooms, community workshops, event spaces, or gardens, the design aims to create a sense of belonging at the river's edge. This thesis ingrains community into the waterfront's future. This scale asks how architecture can support shared identity, honor histories, and provide platforms for local empowerment.

Chapter 2: Literature Review

Origin of the Anacostia River

The Anacostia River's history begins with its Indigenous inhabitants, the Nacotchtank, who occupied its banks long before Washington, D.C. was established. As Charles Burr explains, "Anacostia appears on the oldest map of Captain John Smith, published in 1612; it is there called 'Nacotchtank'" (Burr, Charles R). The Nacotchtank maintained a central role in the region's trading networks. Burr further describes that the name of the river itself derives from the word Anaquashetankik, a version of the name for the Nacotchtank people and means "town of traders", which signals the significance of the river as a hub of exchange among Indigenous communities.

The arrival of European colonists altered this dynamic. Charles Burr explains how Henry Fleet, who lived among the Nacotchtank after being taken captive in 1621, noted their expansive relationships and referred to them as "Anacostines". Early accounts emphasize both the river's abundance, rich in fish and arable land, and its strategic location as a crossroads of exchange. Burr notes that "the Eastern Branch ferry connected with Upper Marlborough Road, where it crossed with the Piscataway Road" and that bridges soon followed, facilitating connections between the Navy Yards and surrounding settlements. These crossings anchored the river to Washington D.C's industrial and residential growth.

This transformation culminated in the creation of Uniontown, later known as Anacostia, in the mid 19th century. Developed as one of Washington's first suburbs,

Uniontown was marketed specifically to white working-class residents, particularly employees of the Navy Yard. Thomas Cantwell observes that it was “a deliberately segregated community designed for white workers”, with housing agreements prohibiting sales to African Americans. This suburban development underscores the racialized use of the river, as the very banks that once served Indigenous communities and traders became a segregated area for Washington D.C’s white labor force. The Anacostia, then, embodied both continuity and rupture. It was still tied to commerce and transportation, but its social fabric was remade by exclusionary urban planning.

Wetlands and Dredging

If the 19th century marked the Anacostia’s suburbanization, the early 20th century redefined its ecology. Historically, the river was bordered by expansive wetlands that provided natural flood control, habitat, and water filtration. However, as Washington D.C. urbanized, these wetlands were targeted for dredging and reclamation projects.

Figure 1 - US Army Corps of Engineers vessel dredging mudflats along the river edge across from the Washington Navy Yard (1912). Credit: KingmanIsland.com

According to the Kingman Island history site, “The U.S. Army Corps of Engineers degraded the Anacostia to control flooding and improve navigation, depositing degraded sediment to create Kingman and Heritage Islands”. Similarly, PoplarPointDC notes that “Poplar Point sits on degraded land, created when natural wetlands were filled with sediment during large-scale river engineering projects”. To this day, much of Poplar Point sits on dredged land within the 100-year floodplain, as it lays lower than naturally elevated ground. These projects, carried out in the 1910’s and 1920’s, were meant to stabilize riverbanks, reduce malaria by eliminating marshes, and expand land available for development.

Figure 2- Aerial of progress on dredging the Anacostia River's mudflats to create Kingman Island and Kingman Lake. Note that construction stopped at Benning Rd NE. in this image (1922). Credit: KingmanIsland.com

Figure 3 - Aerial of the completed dredging of the Anacostia River's mudflats to create Kingman Island and Kingman Lake at Benning Rd NE (1931). Credit: KingmanIsland.com

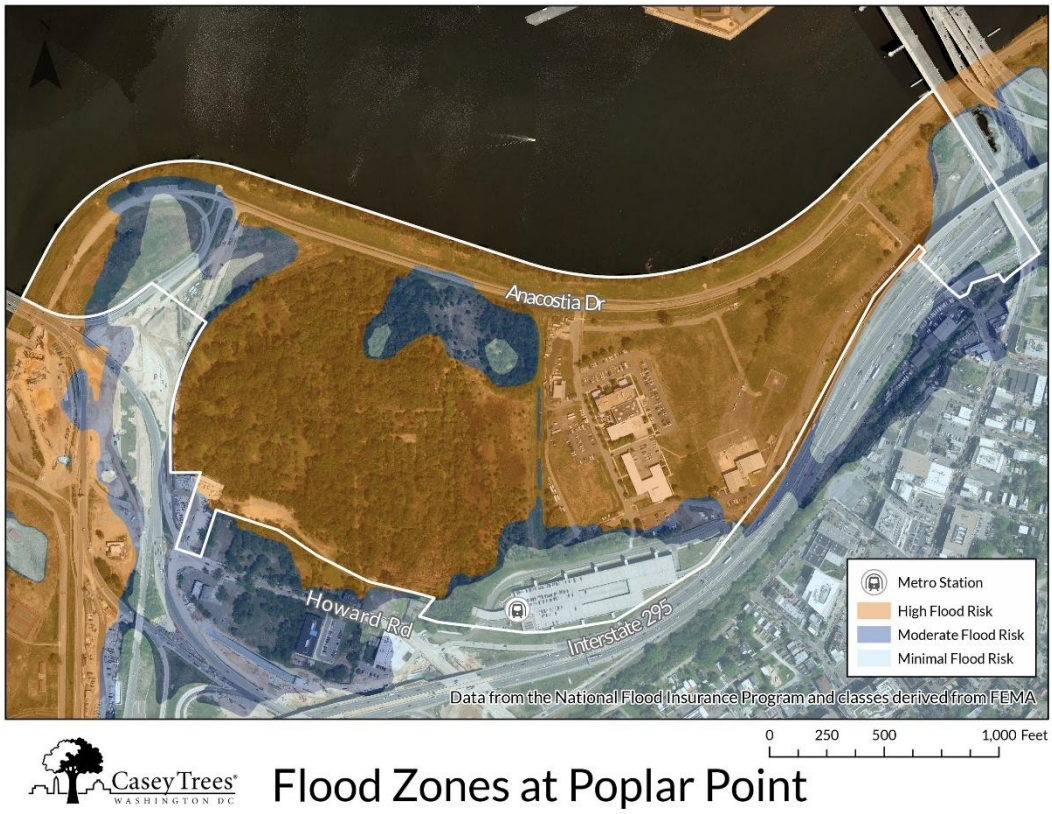

Figure 4 - 100-year flood plain. Credit: PoplarPointDC.org

This era marks a crucial turning point. The same century that brought the Anacostia into modern Washington D.C's orbit also stripped away its ecological defenses, setting the stage for the pollution crisis that would dominate the late 20th century. In this way, the dredging of the river is not just an engineering story, but also the foundation of the river's later environmental inequities.

Industrial Use

The Anacostia's decline as an ecological resource is closely tied to its industrial use. Beginning in the 19th century, factories, the Washington Navy Yard, and municipal waste facilities treated the river as a dumping ground. Dwyer describes

that “the Anacostia has borne the legacy of Washington’s industrial footprint, with contaminants embedded in its sediment for over a century”.

Figure 5 - Incinerator waste being dumped in Kingman Lake (1967). Credit: KingmanIsland.com

Recent studies confirm the persistence of these legacies. Ventresca, et al. identify widespread polycyclic aromatic hydrocarbons (PAHs) in river sediments, noting that “pyrene, flouranthene, bibenzyl, and phenanthrene were found in the Anacostia and some of its tributaries, with concentrations increasing downstream”. These compounds, which are byproducts of fuel combustion and petroleum runoff, pose serious health risks to aquatic ecosystems, as well as human health. The Anacostia River, exemplifies the toxic aftermath of industrial modernization in urban waterways.

Stormwater Runoff

Alongside industry, stormwater runoff remains a primary driver of contamination. With three-quarters of the watershed now impervious, rainfall delivers a consistent stream of pollutants. Ventresca, et al. emphasize that "seventy-five percent of the Anacostia's watershed is urban or impervious" and that stormwater carries "street runoff, leaking sewage infrastructure and lawn treatments" directly into the river.

Dwyer situates this phenomenon within the broader concept of "urban stream syndrome", where "alteration of the urban landscape [is] inextricably linked to the geochemistry of the river system". Unlike industrial discharges, stormwater represents a broad and ongoing contamination source that's resistant to regulation. Each rainfall thus reactivates the river's pollution cycle, ensuring that legacy contaminants are continually supplemented by new ones.

Wastewater Management

Wastewater and combined sewer overflows (CSOs) further compound these problems. Historically, Washington D.C's outdated sewer system funneled both stormwater and raw sewage into the Anacostia during heavy rains. Dwyer records that "millions of gallons of raw sewage mixed with stormwater were discharged annually into the Anacostia". Infrastructure improvements have mitigated but not eliminated this issue. Ventresca, et al. note that "98% of CSO is now diverted to the area's water treatment facilities rather than flowing into the area's rivers". However, the problem of aging infrastructure persists, and even with the Blue Plains Advanced

Wastewater Treatment Plant (Blue Plains Advanced WWTP), untreated discharges remain a recurring threat. For many communities along the river, particularly low-income Black neighborhoods, these sewage overflows represent not just an environmental hazard, but a public health crisis.

Policy Failures

Despite decades of legislation, policy efforts have repeatedly fallen short. The Clean Water Act of 1972, which dramatically improved water quality in many U.S. rivers, did not deliver the same results for the Anacostia. Dwyer states that "decades of piecemeal policies failed to produce meaningful restoration, leaving the Anacostia one of the nation's most impaired rivers". In fact, according to Ventresca, et. al. point out that the Anacostia River has "historically been one of the nation's ten most contaminated rivers, as it contains metals, sewage, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAHs), and excess nutrients".

Even Washington D.C's more recent pledge to make their river "fishable and swimmable by 2032" faces skepticism. One example is highlighted by Ventresca, et al., pointing out that emerging contaminants such as siloxanes, unregulated in the U.S., but restricted in Europe, complicate restoration efforts, as "studies examining water pollutants do not typically test for siloxanes". Policy, in other words, lags behind science, leaving the river vulnerable to overlooked hazards.

The rapid growth and urbanization of Washington D.C. has come with a huge ecological cost. Unfortunately, those disproportionately affected are low-income, Black communities who reside along the Anacostia River.

Displacement of Black Communities

Washington, D.C. has been shaped by policies and planning decisions that have systematically displaced Black communities. Once concentrated in Southwest D.C., Black residents have gradually been pushed eastward across the Anacostia River through urban renewal, disinvestment, and gentrification.

Displacement to East D.C.

Urban renewal in mid 20th-century Washington, D.C. provides a clear example of how public health was used as a rationale for displacing Black and low-income residents. Carolyn Swope explains that after the 1949 Housing Act, public health officials "viewed urban renewal as an unusual opportunity for benefiting the health of the nation". The idea was that by clearing "blighted" areas, the city could reduce disease and improve living standards. In practice, however, renewal efforts devastated thriving Black communities and neighborhoods. Swope writes that "far more housing units were destroyed than were created to replace those displaced families, thereby disproportionately affecting Black and low-income residents". Out of the families relocated during the 1950's urban renewal projects, 78% were nonwhite.

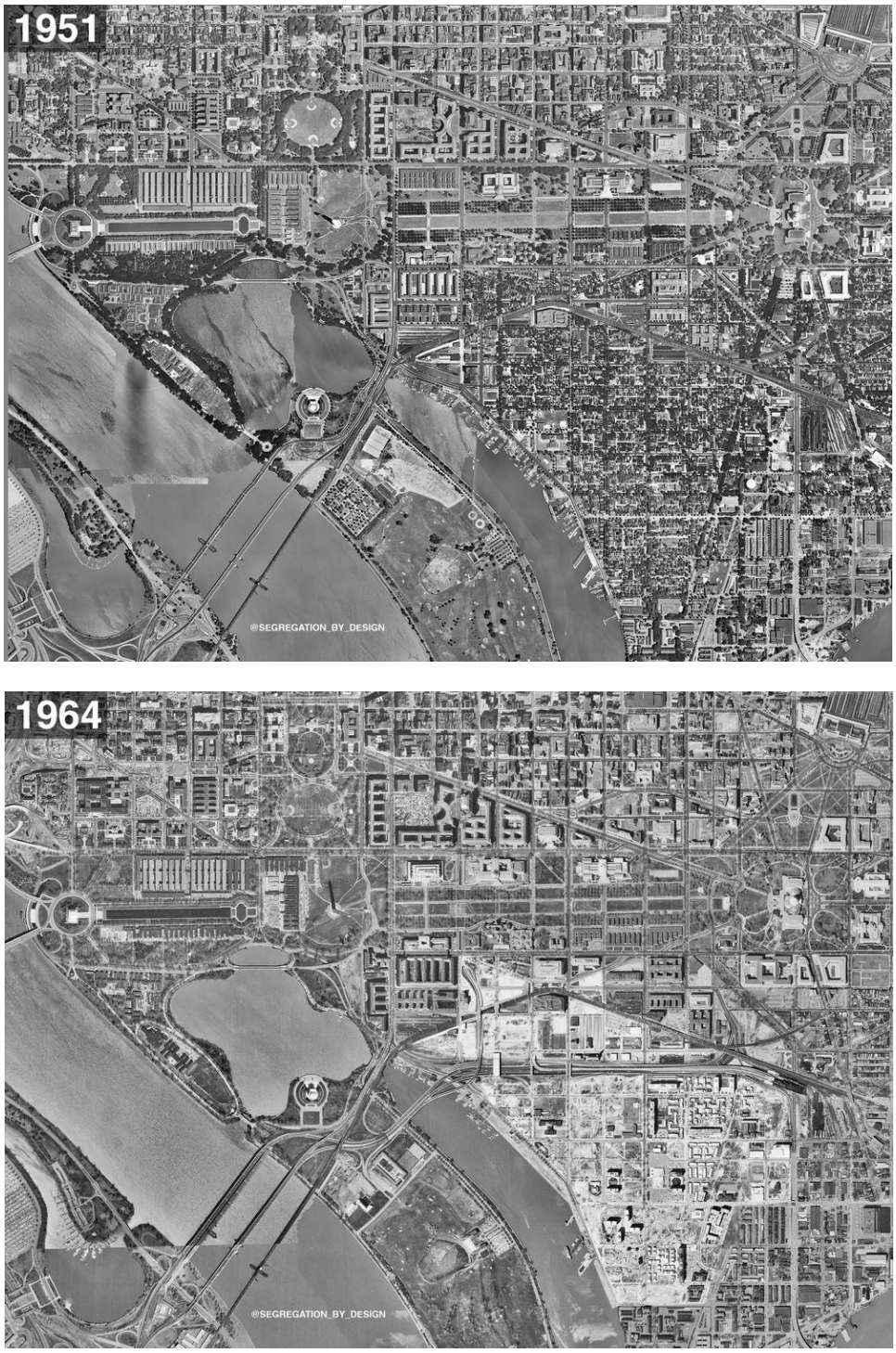

Figure 6 - Urban Renewal in Washington, D.C. that resulted in 99% of structures torn down in Southwest DC and displacing existing communities. Source: SegregationByDesign.com

The case of Southwest D.C. demonstrates the self-contradiction of these urban renewal efforts. Nearly "99% of existing buildings were destroyed, displacing 1,500 businesses and 23,000 residents" (Swope, Carolyn). Few people could afford to return once the neighborhood was redeveloped, as "the mean gross rent rose by 392% while the median income nearly quadrupled" (Swope, Carolyn). The outcome was, what was justified as an improvement for public health, instead functioned as a racial and economic cleansing of the area.

Swope's study notes that public health officials collaborated with redevelopment agencies to frame poor Black neighborhoods as "injurious to the public health, safety, morals, and welfare". These statements were strategically used to transform Black communities into sites of profit for developers. As Swope concluded, "the active cooperation of health and redevelopment officials" legitimized displacement under the guise of progress.

Similarly, Justin Shapiro's research highlights how "urban renewal disproportionately displaced African American communities and eroded social cohesion", pushing residents across the Anacostia River in search of affordable housing. Many displaced families relocated to neighborhoods in Wards 7 and 8, areas that would later become synonymous with disinvestment. The Anacostia River thus became both a physical and social boundary, a geographic dividing line that separated newly affluent, redeveloped parts of the city from the marginalized communities that redevelopment expelled.

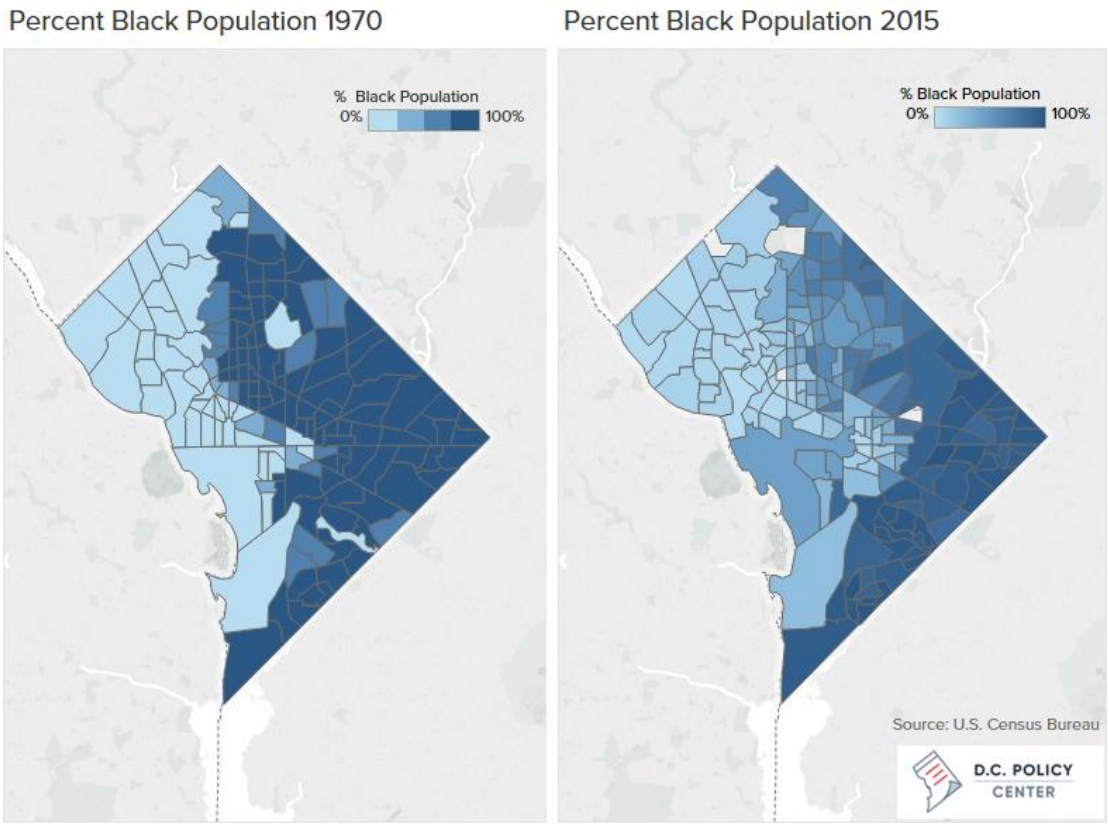

Figure 7 - Displacement of Black Population to East DC. Source: DCPolicyCenter.org

The consequences of these displacements were not only spatial, but were also generational. Families who once lived near the urban core of D.C. lost access to jobs, transit, and healthcare services. In their new neighborhoods East of the river, residents faced limited public infrastructure, underfunded schools, and deteriorating housing conditions. As Swope and Shapiro both make clear, public health rationale and urban renewal were combined to produce a geography of exclusion that continues to define D.C.'s racial landscape today.

Socioeconomic Disparities from Disinvestment

Once relocated East of the Anacostia River, Black communities have experienced decades of neglect. Disinvestment in Wards 7 and 8 have perpetuated

socioeconomic disparities that manifest in food insecurity, inadequate healthcare, and limited access to public services. These inequities are a result of system urban planning decisions that prioritized development in white and affluent areas while ignoring predominantly Black neighborhoods.

Food Deserts

Researchers Ashat, et al., found that food insecurity is “most prominent in the Southeast side of the district”, where D.C. “has a series of food deserts, more prominent in Wards 7 and 8”. They note that “31% [of food deserts are] located in Ward 7 and 51% in Ward 8”, underscoring the racial and spatial concentration of food inequity. The study defines food deserts as areas where "households with low incomes, inadequate access to transportation, and a limited number of food retailers providing fresh produce and healthy groceries” create structural barriers to nutrition.

The relationship between race and food insecurity is striking. Wards 7 and 8, which are “majority African American with median household incomes of $40,963 and $36,397 respectively”, have only four grocery stores combined across more than 17 square miles (Ashat, et al). Residents often have to travel long distances to be able to buy affordable, quality food. This is an everyday burden that reveals how infrastructure neglect translates directly into health disparities.

Other studies further emphasize that food insecurity in Southeast D.C. is not only an issue of access but of systemic inequality. Davis, et al. write that “Wards 7 & 8 are the district’s two lowest income wards [and] have less access to fresh, nutritious, healthier foods”. Their study connects food insecurity to “diet-related

conditions like obesity, diabetes, and cardiovascular disease", pointing out that over half of D.C.'s food deserts lie in these two wards.

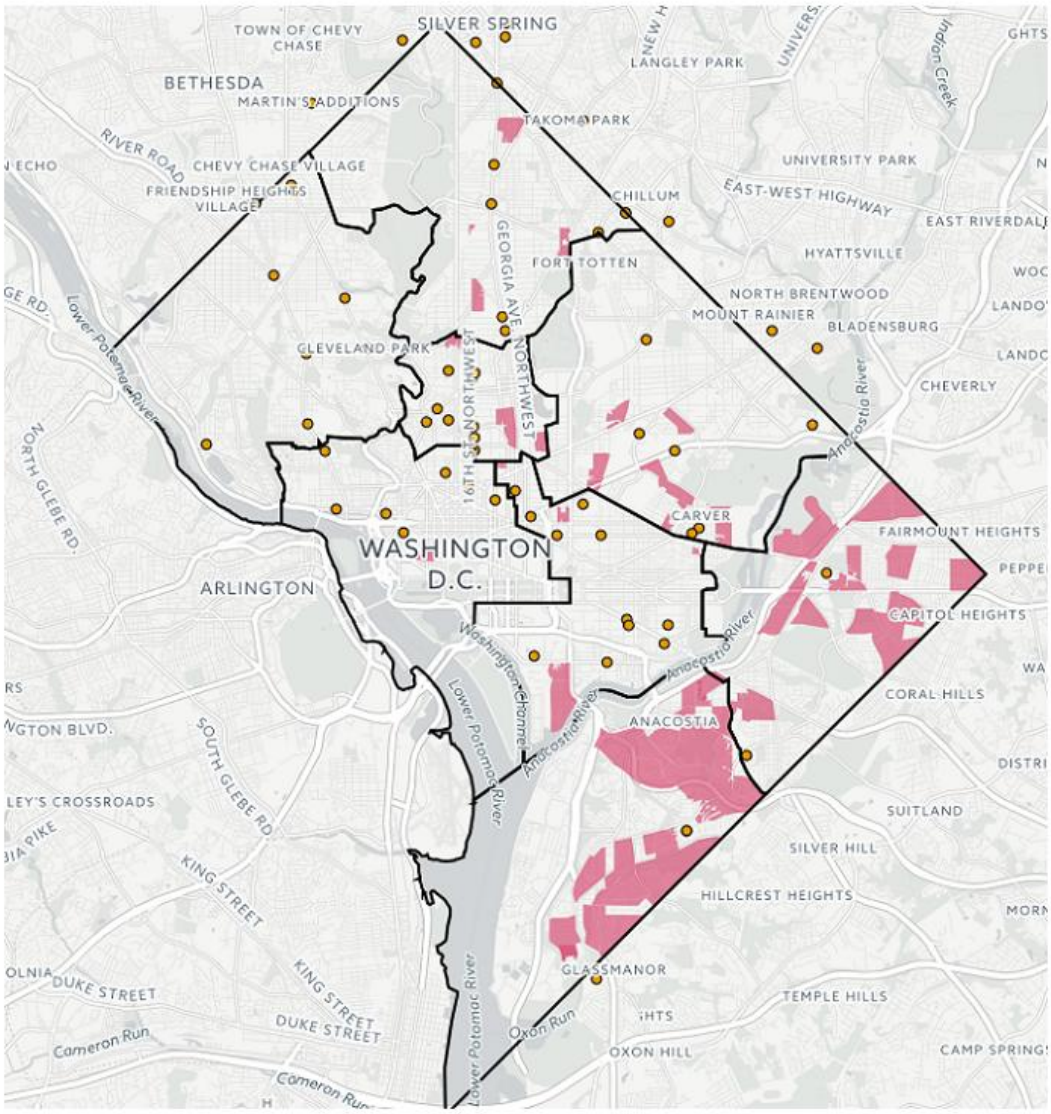

Figure 8 - Areas of limited food access (red) based on grocery or supermarket locations (orange). These areas are 1) located more than half a mile from a grocery store or supermarket, 2) have low rates of car access, and 3) have a high poverty rate. Most food des

These findings show how disinvestment has transformed basic necessities, like buying groceries and healthy food, into markers of inequality. The scarcity of grocery stores in predominantly Black neighborhoods contrasts sharply with the

abundance of retail and organic markets West of the river, revealing how geography, once again, reinforces economic and racial inequalities.

Healthcare Access

Healthcare inequity in Washington, D.C. mirrors the city's racial geography pointed out previously. King, et al. argue that "Black men and Black women in Washington, D.C., can expect to live seventeen and twelve years less than their White counterparts, respectively". These disparities, they note, are "among the largest in the nation and have persisted for decades". The divide is starkest East of the Anacostia River, where "there is a sixteen-year gap in life expectancy between Ward 8, which is majority Black, and Ward 3, which is majority White" (King, et al).

King, et al. attribute these differences to systemic racism embedded in local and federal policies, explaining that "race-based residential segregation undergirds and helps explain contemporary racial disparities in health". Socioeconomic disparities, ranging from unequal education and employment opportunities to exposure to pollution, combine to produce chronic health inequities that persist even in the face of medical advances.

Building on this, Pugazhendhi, et al. reveal through their study how hospital access itself is stratified by race. They find that "Black patients experience a 37.3% higher incidence of adverse safety events relative to White patients", driven primarily by "unequal access to the safest hospitals". This gap is not due to individual choices, but to what the authors call "racially segregated neighborhoods [that] function as structural determinants of health" (Pugazhendhi, et al).

Thus, both at neighborhood and institutional levels, systemic disinvestment has ensured that Black residents of D.C., especially those in Wards 7 and 8, continue to face unequal access to basic health and safety. Whether through food deserts or healthcare access, inequity has been embedded in the city's physical and social infrastructure.

Public Resource Access

Beyond green development, Black neighborhoods East of the Anacostia continue to face barriers in accessing essential public resources, like schools, retail, transportation, and investment. Joyce Doyle describes Ward 8 as a "historically underinvested neighborhood experiencing a rise in Black homeownership", yet is still marked by "limited local retail options, safety concerns, and perceptions of poor service quality". Her study introduces the idea of "Small Spatial World", where disinvestment restricts residents' daily routines, forcing them to travel outside their community for basic goods and services.

Doyle argues that these patterns "reflect the ongoing impact of racial capitalism and spatial disinvestment, which limit consumer choices even among middle-class residents". In other words, even those who achieve economic mobility remain constrained by the geography of exclusion produced by decades of unequal urban policy.

A study by Erickson, et al. reached similar conclusions, showing how D.C.'s economic growth has deepened inequality. The authors find that "Wards 7 and 8 never recovered, having been left out of D.C.'s economic success story" while "Ward

3—D.C.'s 'whitest'—has not only been the wealthiest ward but registered the highest increases in household incomes since 1980".

Together, these findings depict a cycle of exclusion, where disinvestment limits public resources, which suppresses mobility, which in turn makes gentrification appear as progress. Yet without equitable planning, such redevelopment simply replaces one form of exclusion with another.

Gentrification

In recent decades, D.C. has prompted "green development" and sustainability as hallmarks of progress. Yet, as Anguelovski, et al. warn, such initiatives can "reinforce racial and class inequalities rather than dismantle them" when they cater primarily to wealthier, white residents. This circumstance, what the authors term environmental privilege, occurs when environmental amenities like parks, waterfronts, or greenways become tools of gentrification rather than restoration.

Part of the author's research highlights the Anacostia River's 11th Street Bridge Park as a key example. While designed as a symbol of environmental equity, Anguelovski, et al. note that projects of this kind can "produce new forms of displacement under the banner of sustainability". When green investments increase property values without protecting longtime residents, the result is environmental gentrification, where those who have lived in these communities for decades and have endured pollution and disinvestments, are priced out of the very improvements meant to repair their neighborhoods.

The authors caution that “equity-oriented planning must go beyond aesthetics and include measures to ensure housing affordability and community stability”. In D.C., where development often arrives without sufficient safeguards, environmental improvement risks becoming another mechanism of exclusion. The authors ultimately call for transforming urban “green” planning from a tool of privilege into one that actively addresses historical injustices and supports inclusive, equitable cities and doesn’t simply remake urban nature into luxury commodities.

The displacement of Black communities in Washington, D.C. is a story of intertwined forces, such as public health rhetoric, systemic disinvestment, and inequitable development. This history offers lessons for building a more just city. Addressing D.C.’s racial inequities require not only repairing its physical environment but also confronting the systems that produced exclusion in the first place. True revitalization must ensure that the residents who have faced the costs of disinvestment are not displaced by its remedies but are instead centered in shaping the city’s future.

Ecology

The environmental degradation of the Anacostia River and the displacement of Black communities in Washington D.C. reveal how ecological neglect and social inequity are deeply intertwined. Restoring the river’s health therefore extends beyond environmental remediation, it also represents an opportunity to repair relationships between people and place. Ecology, particularly through constructed wetlands and

other nature-based systems, can serve as both an environmental and social framework for renewal.

Constructed Wetlands and the "Living Machine"

Constructed wetlands, often described as "living machines", represent one of the most promising low-cost, nature-based solutions for addressing environmental challenges related to water quality, carbon storage, and the loss of biodiversity. By mimicking the processes of natural wetlands, these systems integrate vegetation, soil, and microorganisms into engineered landscapes to purify water, store carbon, and support living ecosystems. They exemplify a growing ecological model, where infrastructure is not separate from nature, but functions in collaboration with it. As both scientific tools and living systems, constructed wetlands demonstrate how ecology, engineering, and sustainability can intersect in accessible and meaningful ways.

Figure 9 - Living Machine at The Living Building (Omega Institute) Source: AIATopTen.org

Water Purification

Constructed wetlands are designed to treat and recycle wastewater through the same mechanisms that have allowed natural wetlands to cleanse the Earth's water for millions of years. Allison, et al. explain that "constructed wetlands remove pollutants by filtering wastewater through a complex interaction of plants, microorganisms, and substrates that mimic the processes of natural wetlands". Water flows through gravel beds and plant roots where bacteria break down organic matter, while plants absorb nutrients like nitrogen and phosphorus. These processes can significantly reduce suspended solids, heavy metals, and pathogens, making them a cost-effect and low-energy alternative to conventional wastewater treatment.

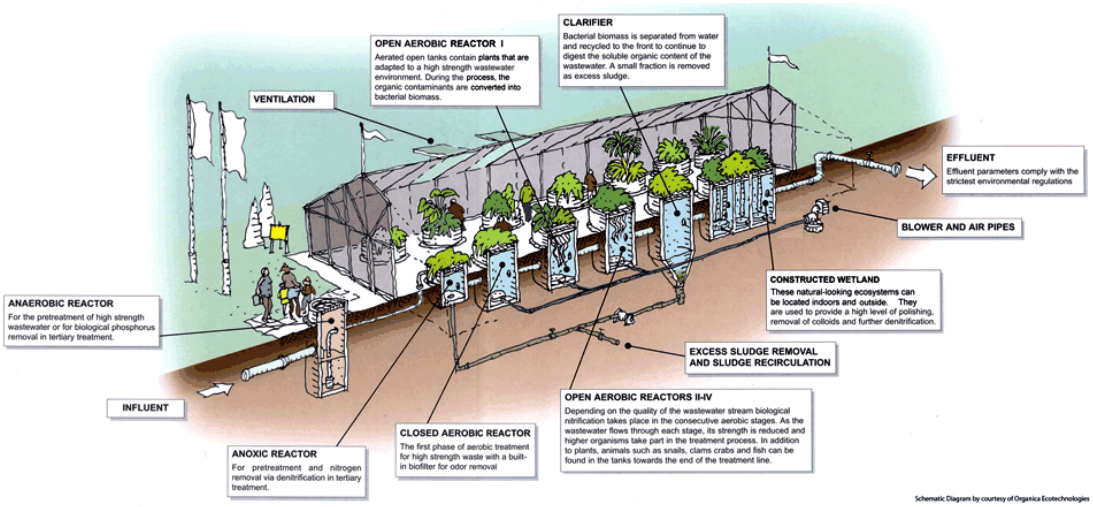

Figure 10 - Schematic Design of the Living Machine at the Findhorn Foundation. Source: TheEcologist.org

Chunzhen, et al. reinforce this as they describe constructed wetlands as "an environmentally friendly technology that relies on the synergistic action of soil, microorganisms, and plants to purify wastewater". They note that pollutant removal occurs through physical, chemical, and biological pathways. This process is described as "sedimentation and filtration remove solids; absorption and ion exchange eliminate

chemical contaminants; and microbial decomposition converts organic pollutants into harmless forms" (Chunzhen, et al). This combination of natural and engineered functions allows wetlands to treat various water sources, from agricultural runoff to municipal sewage, without relying heavily on energy-intensive mechanical systems.

Allison, et al. conclude that "these systems can be tailored to meet local environmental and economic needs while maintaining low operational costs". In this way, constructed wetlands embody an accessible form of ecological engineering. They provide communities with a sustainable method of water purification that operates through self-regulating processes.

Eutrophication

Eutrophication, the over-enrichment of bodies of water with nutrients, represents one of the most damaging effects of modern urban and agricultural runoff. MacAvoy, et al. describe eutrophication as "the process by which nutrient enrichment, primarily from nitrogen and phosphorus, causes excessive algal growth and degrades aquatic habitats". This process also leads to oxygen depletion in water, which overall results in the collapse of aquatic ecosystems as wildlife can't survive in these conditions.

Figure 11 - 25,000 dead fish at Baltimore Harbor due to eutrophication 09/04/25. Credit: bluewaterbmore on Instagram

Constructed wetlands can counter eutrophication by intercepting nutrient runoff before it reaches rivers or lakes. MacAvoy, et al. explain that “wetland systems remove nutrients through plant uptake, sedimentation, and microbial denitrification, effectively acting as buffers between land and water”. This natural process not only improves water quality but also restores ecological balance in degraded waterways.

Importantly, these systems are adaptive to urban contexts. The authors note, “wetlands situated along riverbanks or in stormwater retention zones can significantly reduce nutrient loading to nearby streams” (MacAvoy, et al). The reintroduction of

such systems within cities transforms pollution management into an ecological opportunity, turning wastewater from a liability into a catalyst for regeneration.

Biodiversity

Constructed wetlands also provide critical habitat that supports biodiversity. Middleton, et al. explain that “wetlands are biodiversity hotspots that sustain unique plant and animal assemblages, many of which depend entirely on wetland hydrology for survival”. The fluctuating water levels, vegetation diversity, and microhabitats of wetlands foster conditions for amphibians, fish, birds, and invertebrates.

Reinforcing this ecological role, Alikhani, et al. note that “wetlands promote ecological resilience by maintaining complex food webs and [serve] as refugia during climate fluctuations”. The vegetation and sediment surfaces of constructed wetlands provide nesting and feeding grounds for migratory birds while supporting microbial communities that underpin nutrient cycling.

Biodiversity is not simply an aesthetic benefit, it also strengthens ecosystem stability. Middleton, et al. explain that “species diversity enhances the capacity of wetlands to recover from disturbance, stabilize soils, and regulate water flows”. These processes create a feedback loop, where healthy biodiversity enhances water purification and carbon sequestration, which in turn supports further ecological health.

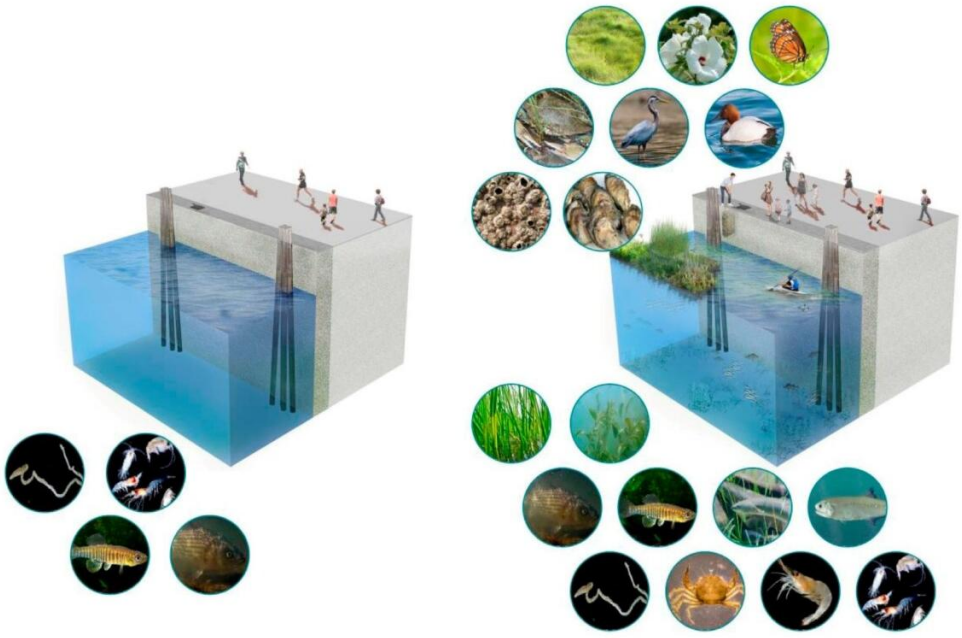

Figure 12 - Reintroduction of biodiversity thanks to wetlands. Credit: AyersSaintGross.com

For cities, incorporating biodiverse constructed wetlands can reconnect fragmented urban ecologies. Middleton, et al. explain that “the conservation and restoration of wetland ecosystems are essential for maintaining both ecological integrity and human well-being”. Restoring even small wetland ecosystems can attract pollinators, birds, aquatic life, which in turn enrich urban landscapes while improving environmental quality.

Sustainability

Constructed wetlands represent an inherently sustainable model for environmental management because they rely on renewable processes, require little energy, and can be maintained at low cost. As Salimi, et al. explain, “constructed wetlands are sustainable wastewater treatment systems with low operation and maintenance requirements compared to conventional technologies”. Once established,

their vegetation continues to function without mechanical inputs and maintenance involves only periodic harvesting or clearing.

A major component of sustainability in wetland systems involves the utilization of biomass, which is the plant material generated through natural growth. Sertolli, et al. describe biomass as a "resource found in large quantities and a basis for many different industries", noting that it "plays the most prominent role in meeting human energy needs among renewable sources". The authors emphasize that the total annual global biomass production is "equivalent to approximately 1260 EJ/year, representing vast untapped potential for energy and material recovery".

When vegetation in constructed wetlands is harvested, it can be repurposed as bioenergy feedstock, compost, or construction material, which in turn close ecological loops and reduce waste. Sertolli, et al. write that "organizing and coordinating biomass use efficiency is key to mitigating competition among food, feed, and energy production". This circular approach aligns directly with sustainable development principles by integrating waste treatment, energy recovery, and habitat creation into a single system. Wetlands can be the catalyst for a shift in design thinking, from isolated technical fixes to integrated, regenerative systems.

Constructed wetlands illustrate how ecological systems can be engineered to meet human and environmental needs in harmony. They filter polluted water, sequester carbon, prevent eutrophication, and nurture biodiversity. They achieve all this while operating through self-sustaining natural processes. In doing so, they represent a model of ecological infrastructure that is both scientifically effective and socially accessible.

Chapter 3: Research Methodology

Introduction

Understanding Poplar Point and its relationship to the Anacostia River requires a research approach that is both structured and flexible. Due to the involvement of architectural intervention, ecological repair, and community-centered design in this thesis, the methods must account for physical systems, human experience, historical injustice, and infrastructural complexity. Research methods are not just tools for collecting information, they shape how we see the site and how we can synthesize the information we gather to imagine a variety of possible futures. As Lucas notes in Chapters 5 and 14, fieldwork, observation, and diagramming are integral forms of architectural thinking. They help translate what we learn from observing and analyzing the world into drawings, ideas, and ultimately, design. For a site as layered as Poplar Point, these methods are essential for grounding the project in real conditions rather than assumptions.

This chapter outlines the methodological framework guiding this thesis. It consists of four primary methods: Physical Context Analysis, Infrastructure Analysis, Sociocultural Context, and Behavioral and Experiential Analysis. Each method contributes by providing different forms of knowledge and informs distinct design decisions. Working in tandem, they create an interdisciplinary approach that supports the thesis aim, which is to understand how architectural and ecological interventions can restitch long-divided communities and transform the Anacostia Riverfront into a shared civic and ecological landscape.

Physical Context Analysis

This methodology provides foundational knowledge of the site's environmental and spatial conditions. This includes studying topography, hydrology, climate, vegetation, and other ecological factors that shape the landscape. For Poplar Point, understanding these physical conditions is especially important because the site is composed of dredged fill, majority of the site is prone to flooding, the site has a history of industrial use, and the part of the river directly in front of the site has high levels of contamination.

This methodology involves hydrological analysis to understand how water moves on site and identify opportunities for bioremediation. This includes analyzing topography, mapping high points and low points on site, and analyzing drainage patterns to determine why and where flooding occurs and where constructed wetlands might be the most effective. Not only acting as a buffer during flooding, but as a filter for stormwater runoff. This methodology also involves climate analysis which helps inform building orientation, natural ventilation, and areas of outdoor comfort. Vegetation and biodiversity studies reveal existing ecological pockets and sensitive areas that should be protected or strengthened. This includes analyzing if there are any living organisms in this area of the river and if there are any invasive species in the landscape. Field documentation is also essential. In alignment with Lucas Chapter 5, repeated site visits allow for observing changes over time and understanding the "everydayness" of the site. This really helps understand the site in as many conditions as possible so that any design decisions can be informed based on more than just

"ideal" site conditions. Photographs, sketches, and quick diagrams capture conditions and patterns that can't be understood through maps alone.

This methodology informs decisions about environmental strategies, flood adaptation, and the placement of both architectural and ecological interventions. It also helps ensure that the proposal responds to the realities of the landscape and supports ecological restoration.

Infrastructure Analysis

Poplar Point is deeply shaped by the infrastructural systems surrounding it. Infrastructure Analysis examines the roads, transit networks, pedestrian paths, trails, bridges, public amenities, and existing structures that influence how people reach and interact with the waterfront. For a site historically cut off from adjacent neighborhoods by highways, this methodology is critical to understanding the barriers that have contributed to social and environmental isolation.

This analysis includes mapping accessibility routes. It evaluates how people get to and from the site, whether it's by car, by foot, or by public transit. It also evaluates how highways and major roads limit visibility and walkability, especially for residents east of the river. Understanding these barriers helps identify where new or improved connections are most needed. These could come in the form of boardwalks, trails, crossings, or civic anchors. Utilities and environmental systems, such as stormwater infrastructure, also play a major role in determining how constructed wetlands or living-machine systems can be integrated into the site.

By examining the limited existing structures on site and their conditions, this methodology helps determine what can be reused, adapted, or removed. Infrastructure Analysis directly shapes decisions about circulation, access, program placement, and the feasibility of ecological systems. It ensures that the proposed design not only imagines a more connected riverfront but also responds to the realities of D.C's urban systems.

Sociocultural Context

Since this thesis is centered on environmental justice and community reconnection, Sociocultural Context is essential. This methodology examines demographic patterns, community histories, environmental injustice, and cultural relationships to the Anacostia River. It positions this project within a broader social and political context rather than treating the site as an isolated intervention. This thesis can almost be treated as the framework for intervention along different parts of the Anacostia River or other degraded or segregated waterfronts.

Demographic analysis helps reveal income levels, racial distribution, poverty rates, and population trends. Historical research examines the evolution of the waterfront, past environmental harm, and the policies that contributed to the division between east and west of the river neighborhoods. Environmental justice literature deepens the understanding of how marginalized communities have been disproportionately burdened by pollution and excluded from waterfront amenities.

Community insight is also part of this methodology. Informal conversations with experts and organizations, such as ecologists, nonprofit groups, or planning

professionals, help identify community needs, historical tensions, and aspirations for the site. Reviewing master plans and policy documents contextualizes how current efforts align or conflict with equitable development. The master plans for the 11th Street Bridge Park, Navy Yard East, and Poplar Point all include input from surrounding communities so they also help inform community needs.

This methodology informs decisions about programmatic elements, cultural spaces, and grounds the design through community engagement. It also ensures that the project doesn't unintentionally reproduce patterns of displacement and inequity.

Behavioral and Experiential Analysis

This methodology focuses on how people perceive and use space. This methodology is shaped strongly by Lucas's discussion of fieldwork, which involves observing people in their environment, paying attention to movement, and recognizing that patterns emerge through repeated visits.

For Poplar Point, this analysis involves studying how people currently engage with nearby trails, parks, and river overlooks, as well as identifying where activity drops off due to barriers or lack of amenities or infrastructure. This also involves ethnographic observation and watching circulation, noting where people linger, and recording feelings of safety, and comfort or discomfort. This all helps create a deeper understanding of the site's experiential qualities.

Temporal observations help reveal how the site shifts throughout the day, week, or season. These observations influence decisions about where to place gathering spaces, viewpoints, educational nodes, and moments of rest. This method

ensures that design proposals reflect how people actually move through the landscape, not how we imagine they do.

Conclusion

Together, these four methodologies, Physical Context Analysis, Infrastructure Analysis, Sociocultural Context, and Behavioral and Experiential Analysis, create a comprehensive framework for understanding Poplar Point. Each method offers unique insights, but their value lies in how they intersect. Physical analysis reveals ecological opportunities, infrastructure analysis uncovers access and visibility challenges, sociocultural research grounds the project in historical context and equity, and experiential analysis ensures that design decisions support meaningful, inclusive engagement with the river.

By integrating these methodologies, the thesis builds a foundation for a design proposal that is ecological, equitable, and responsive to both people and place. The methodologies not only guide research, but also shape the design strategies that follow, ensuring that the project contributes to a more connected and just Anacostia Riverfront.

Chapter 4: Case Studies

Introduction

Case studies are essential for grounding this thesis in both established ecological design strategies and community-centered approaches to environmental justice. Five precedents selected are Harbor Wetland, The Living Building, The Nature Place, Haoxiang Lake Park, and Sidwell Friends Middle School. They collectively offer a diverse range of lessons across sustainable infrastructure, ecological restoration, environmental education, and socially connective landscapes. While these projects share some similarities, they illuminate different dimensions of the design ambitions at Poplar Point, where the goals include ecological remediation, public environmental learning, and bridging long-standing socioeconomic and spatial divisions along the Anacostia River.

Each precedent addresses a core question that this thesis must confront. Harbor Wetlands provides a deeply studied model for floating wetlands and demonstrates how aquatic ecologies can be restored through modular and replicable systems, while also revealing what will require adaptation for the Anacostia's distinct conditions. The Living Building offers insight into how "living machine" technologies can be fully integrated into a building's design, making wastewater treatment a visible, educational, and participatory experience. The Nature Place shows how flexible, community-oriented design can blur the boundaries between indoor and outdoor ecological engagement while embedding architectural interventions into larger trail networks. Haoxiang Lake Park illustrates how

revitalized waterfronts and restored water bodies can reconnect communities that have been historically divided, echoing the justice-driven aspirations of this thesis. Finally, Sidwell Friends Middle School reveals how small-scale ecological systems, when made visible and educational, can cultivate environmental stewardship within everyday experiences.

Collectively, these precedents allow for a multifaceted inquiry: How can architecture and ecological systems become tools for restoration, learning, and justice? What methods, technologies, spatial strategies, and community interfaces have proven effective elsewhere? And how can these insights translate into a site as historically burdened and socially complex as Poplar Point?

The following sections delve into each precedent individually, examining their design intentions, ecological strategies, community engagement approaches, and outcomes. Each study concludes with a reflection on how the precedent advances or clarifies design possibilities for this thesis.

Figure 13 - Harbor Wetland, Baltimore, MD

Harbor Wetland

Harbor Wetland is a widely studied prototype for floating wetland systems, offering a valuable model for understanding how modular ecological interventions can restore degraded waterways. Situated within the Baltimore Harbor, the project has been subject to numerous scientific evaluations measuring its impacts on water quality, biodiversity, and habitat productivity. Its longevity and extensive research base make it an ideal precedent for this thesis, especially since the design proposals for Poplar Point will incorporate floating wetlands systems without necessitating the creation of new engineering solutions. Harbor Wetlands functions not as a blueprint to copy, but as a framework that demonstrates what is ecologically, technically, and practically possible within an urban water environment.

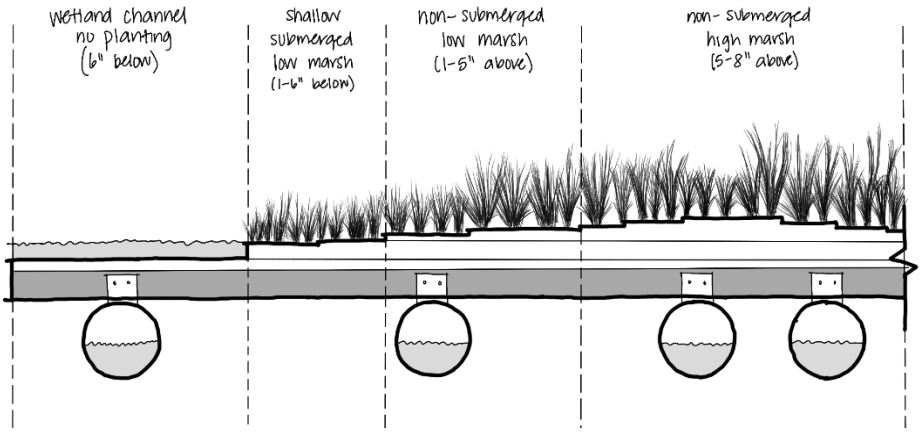

Figure 14 - Diagrammatic section of planting bed. Diagram by Author.

A key strength of Harbor Wetland is its modular construction, which allows for flexibility in scale, placement, and maintenance. The buoyancy systems, planting media, and root penetration strategies demonstrate how floating wetlands can remain structurally stable while supporting vigorous plant growth. Importantly, these systems are designed to thrive in contaminated waters, which is an essential parallel to the Anacostia River's ongoing pollution issues. Long-term monitoring has shown improvements in dissolved oxygen levels, increased presence of small aquatic species, and the establishment of robust root systems that naturally filter pollutants. These measurable ecological benefits provide a strong foundation for understanding the potential performance of floating wetlands at Poplar Point.

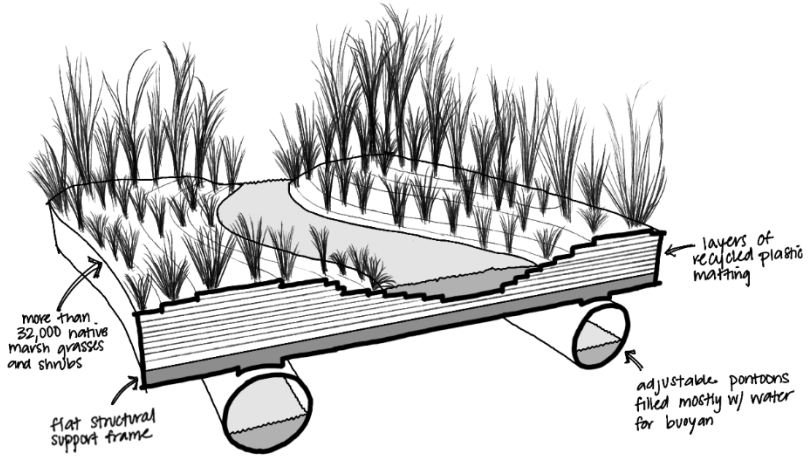

Figure 15 - Diagrammatic section showing all components of constructed wetlands. Diagram by Author.

However, the difference between the Baltimore Harbor and the Anacostia River requires careful attention. While Harbor Wetland offers transferable knowledge and modularity, structural systems, and ecological performance, the exact planting palette and some water-quality assumptions cannot be directly adopted. The two water bodies differ in hydrology, nutrient loads, sediment behavior, and contamination. Rather than limiting the precedent's usefulness, these differences strengthen the precedent by demonstrating the need for site-specific ecological research. Harbor Wetland therefore informs not just design choices, but also the methodological approach to studying plant viability, maintenance strategies, and community stewardship programs for Poplar Point.

For this thesis, Harbor Wetland ultimately serves as a scientific and practical framework that demonstrates how floating wetland systems can be successfully deployed in urban waterways. The precedent clarifies which elements, such as modular construction and buoyancy systems, are readily transferable, and which require further investigation. Its real value lies in offering a credible ecological foundation upon which the design at Poplar Point can responsibly build on.

Figure 16 - The Living Building at The Omega Institute, Rhinebeck, NY.

The Living Building

The Living Building at The Omega Institute provides a compelling example of how "living machine" technology can be incorporated into architectural design in a way that is both functional and educational. The building is organized around a visible, accessible wastewater treatment system that showcases ecological processes typically hidden below urban surfaces. This design choice serves not only to sustain the building's operations, but also to educate visitors and users about water cycles, ecological remediation, and the potential for buildings to actively heal the environments they occupy. This thesis is centered around ecological education and visible environmental infrastructure, so this project serves as a valuable precedent.

A notable aspect of the Living Building is its commitment to transparency. The living machine is positioned so that it can be viewed from circulation paths, gathering areas, and even the exterior of the building. This visibility transforms the

wastewater treatment process into a learning experience, demonstrating how natural systems can purify water through a series of planted tanks, microbial activity, and filtration stages. The project's educational mission aligns closely with the goals of this thesis, including making ecological processes understandable, accessible, and engaging for the public. The Living Building demonstrates that infrastructure can be both functional and educational and that buildings can serve as living textbooks for environmental stewardship.

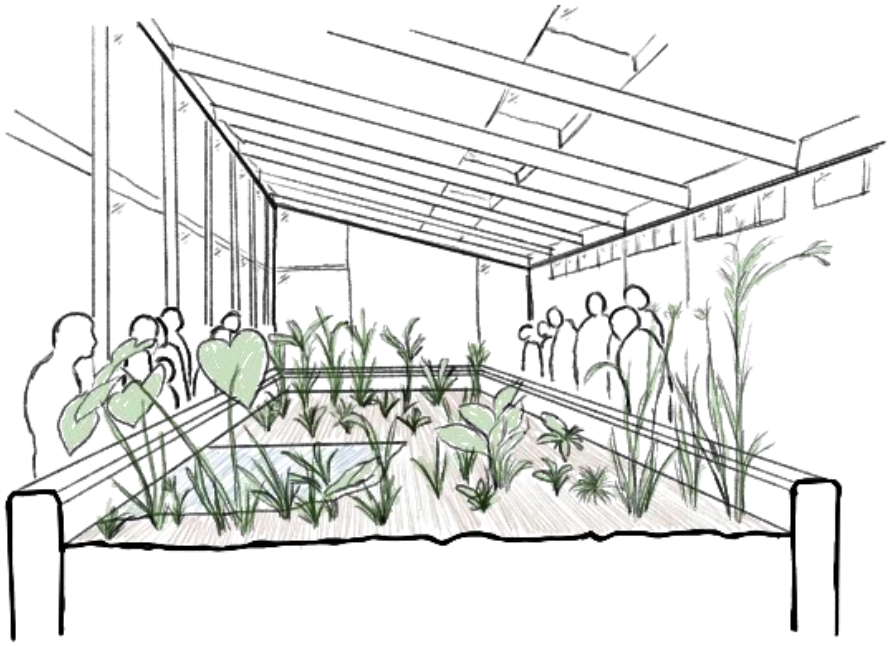

Figure 17 - Diagrammatic section through "eco-machine" displaying wastewater treatment infrastructure. Diagram by Author.

The simplicity of the building's overall program also makes this precedent highly relevant. While the living machine is part of a sophisticated system, the layout of the building is intentionally straightforward. Spaces are arranged to support community functions and environmental learning without excessive complexity. This approach aligns with the thesis goal of designing an ecologically driven community learning center at Poplar Point that feels welcoming, intuitive, and human scaled. The

Project proves that impactful environmental education doesn't require an overwhelming architectural footprint, rather, it requires clarity of intention and intelligent integration of ecological systems.

For Poplar Point, The Living Building highlights the value of making water treatment processes public-facing. It suggests opportunities for integrating a living machine or similar systems into both indoor and outdoor spaces, potentially creating a series of visible ecological moments along circulation paths. This precedent reinforces the idea that environmental infrastructure can be simultaneously functional, beautiful, and educational, all qualities that will shape the design strategies proposed for this thesis.

Figure 18 - The Nature Place, Reading, PA

The Nature Place

The Nature Place, located in Reading, PA, functions as a flexible, community-oriented environmental education center that seamlessly integrates indoor and outdoor experiences. Located within a natural setting and connected to an active trail system, the project is anchored by the idea that environmental learning should occur through immersive, hands-on encounters with nature. This precedent offers a useful model for how design at Poplar Point might blend enclosed community spaces with outdoor ecological pathways, shifting between structured programs and informal exploration.

One defining feature of The Nature Place is its emphasis on flexibility. The building accommodates multipurpose rooms, adaptable gathering spaces and program areas that can serve a range of activities, from workshops to community meetings to school field trips and nature camps. The building design has ample glazing, uses

natural materials, and has strong indoor-outdoor connections to reinforce its educational mission. The effectiveness of these design decisions aligns strongly with the goals of the proposal for this thesis, which seeks to serve diverse communities through accessible environmental engagement rather than complex or exclusive architectural forms.

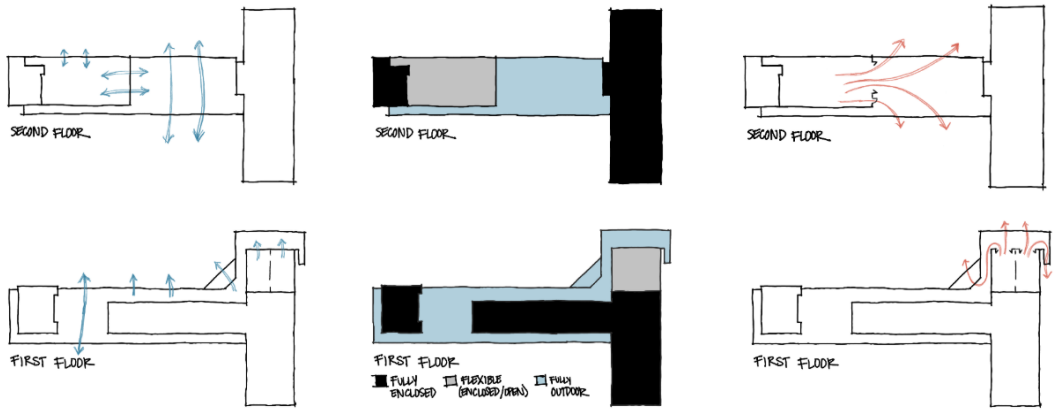

Figure 19 - Diagrams showing indoor and outdoor connectivity (left), fully enclosed, flexible, and fully outdoor spaces (middle), and circulation to the outdoors from main learning spaces (right). Diagrams by Author.

Equally important is The Nature Place's integration with the surrounding trail system. The building serves not as an isolated object, but as a node within a larger ecological and recreation network. This approach supports the proposal of experiential "moments" along the Anacostia Riverwalk Trail at Poplar Point, each highlighting different aspects of the constructed wetlands, river ecology, and local history. The ability to embed architectural interventions within a broader landscape supports the interest of this thesis in environmental justice, as it begins to provide equitable access to ecological learning by providing open, public spaces that invite exploration for all.

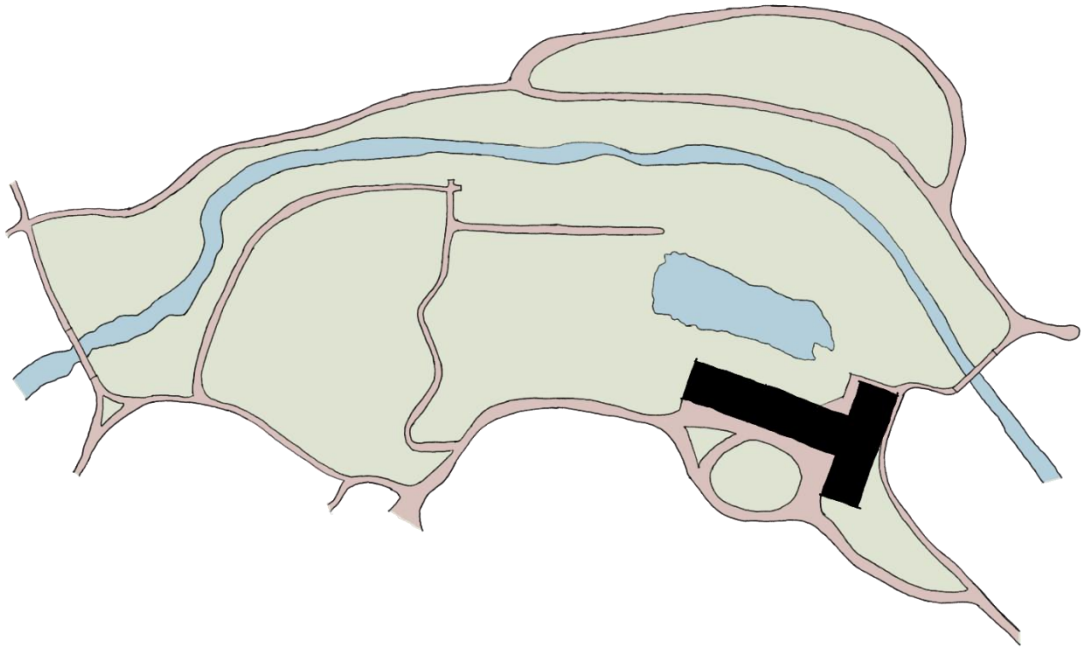

Figure 20 -The Nature Place connection to wetlands, river, and overall trail system. Diagram by Author.

This precedent also demonstrates how environmental education can be supported without relying on high-tech systems. A lot of the program simply relies on access to nature, thoughtful design choices, and community programming. This reinforces a key idea of this thesis, which is that environmental justice is not only about infrastructure, but also about creating opportunities for meaningful engagement with the environment.

For the design proposal at Poplar Point, The Nature Place suggests strategies for designing flexible, community-centered spaces that extend beyond a building's walls into a rich landscape network. It underscores the value of combining architectural design with ecological pathways to create an inclusive, education, and justice-focused waterfront.

Figure 21 - Aerial of Haoxiang Lake Park, Shenzhen, China.

Haoxiang Lake Park

Haoxiang Lake Park, located in Shenzhen, China, is a significant example of how ecological restoration and waterfront enhancement can serve as catalysts for social and cultural reconnection. Once a degraded waterbody, Haoxiang Lake was transformed into a vibrant public landscape through a comprehensive restoration process that improved water quality, strengthened ecological functions, and created a series of recreational and educational spaces. The project demonstrates the power of ecological design to bridge historically divided communities, an issue that directly parallels the social context of Poplar Point and the communities surrounding it.

The restoration of Haoxiang Lake is centered on reestablishing natural hydrological processes, introducing native planting, and reshaping the shoreline into soft, accessible edges. These interventions provided ecological benefits such as

increased biodiversity and improved water filtration, while simultaneously creating public spaces that encourage gathering, recreation, and cultural exchange. The project illustrates how environmental improvements can become social infrastructure, reinforcing the idea that ecological justice and community connection are deeply intertwined.

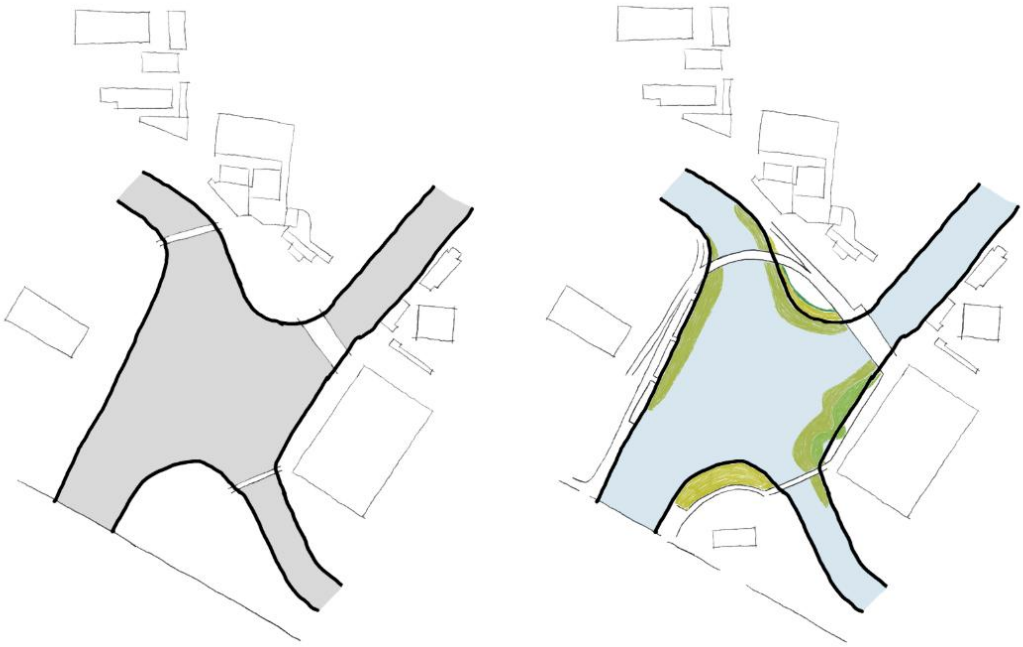

Figure 22 - Diagrammatic site plan showing before (left) and after (right) of intervention. Diagram by Author.

One of the most relevant lessons from Haoxiang Lake Park is its use of green infrastructure as an educational tool. Accessible wetlands, boardwalks, and viewing platforms allow visitors to understand the ecological processes unfolding around them. The park supports informal environmental education by immersing users in functioning ecological systems rather than separating them from the landscape. This aligns with the goal of this thesis of creating an ecologically driven community learning center where individuals of all ages can observe, interact with, and learn from the Anacostia River's natural systems.

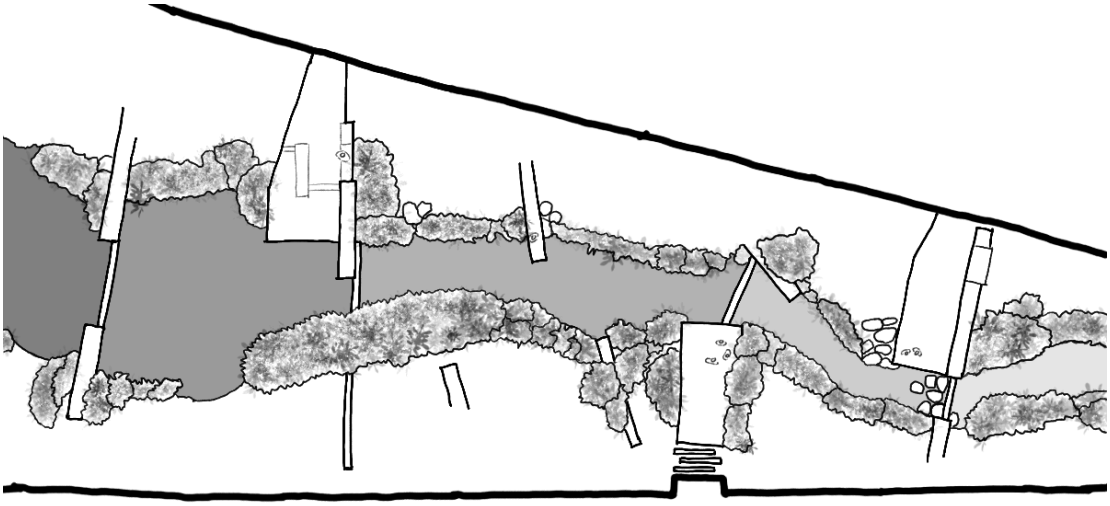

Figure 23 - Diagrammatic plan showing how wetlands help filter water (from left to right). They play a role in ecological restoration as well as environmental education. Diagram by Author.

Moreover, the park's success in reconnecting socially and economically disparate neighborhoods demonstrates how restored water bodies can become shared grounds for community building. In the context of Poplar Point, a site historically shaped by racial and economic divides, this precedent shows how ecological intervention can also be a form of social intervention. A revitalized waterfront becomes an equitable public space, offering access and amenities to all communities rather than only privileged ones.

For this thesis, Haoxiang Lake Park reinforces the importance of designing ecological systems that are not just scientifically sound, but also socially meaningful. It provides a clear model for how restored ecosystems can reshape urban identity, foster community cohesion, and position nature as an active participant in public life along the Anacostia River.

Figure 24 -Sidwell Friends Middle School, Washington, D.C.

Sidwell Friends Middle School

Sidwell Friends Middle School, located in Washington, D.C., represents a holistic approach to sustainable design, where ecological systems are made visible, accessible, and are deeply integrated into educational experiences. The school employs strategies such as constructed wetlands, stormwater gardens, daylit interiors, and material transparency to foster environmental awareness among students and visitors. As a precedent for this thesis, Sidwell Friends offers lessons in how ecological interventions, at different scales, can meaningfully shape daily experiences and foster a culture of stewardship.

A defining feature of the project is the visibility of its ecological processes. Water flows through a series of terracing constructed wetlands that treat stormwater on-site, allowing users to follow the movement of water across the landscape. These

systems are not hidden behind walls or underground, but woven directly into outdoor circulation and gathering areas. This approach parallels the goal of this thesis of ensuring that ecological infrastructure at Poplar Point, whether constructed wetlands or a “living machine”, is not merely functional but legible and educational.

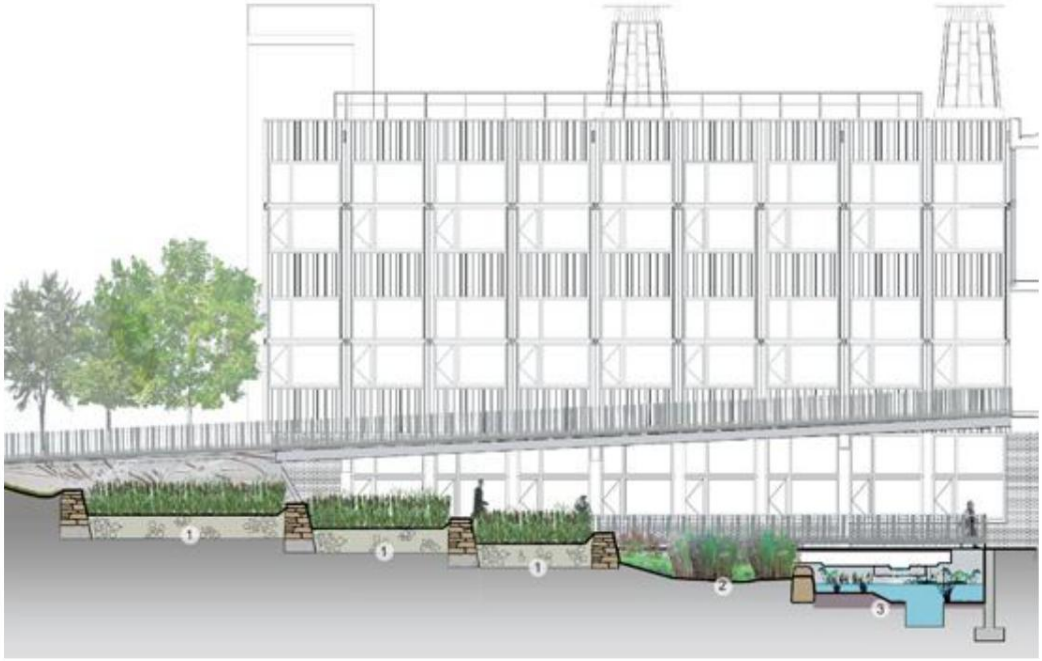

Figure 25- Site section showing how terraced wetlands are part of the wastewater treatment system on site.

Sidwell Friends also embodies an ethic of environmental responsibility that extends beyond its technical systems. The building’s material choices, daylighting strategies, and integration of gardens and learning spaces foster a culture of environmental respect and curiosity. This precedent, once again, demonstrates that environmental education doesn’t always require large, complex systems. It’s feasible to emerge from small, carefully designed features that invite observation and engagement.

For the design proposal at Poplar Point, Sidwell Friends illustrates how ecological processes can become an everyday part of community life, teaching values

of stewardship through exposure rather than instruction alone. It emphasizes the potential of small-scale interventions to create meaningful educational experiences, suggesting opportunities for integrating visible ecological features throughout the site.

Conclusion

Together, the five precedents examined in this chapter illustrate the diverse strategies through which design, ecology, and community engagement can intersect to support environmental justice. Harbor Wetland provides a scientifically grounded understanding of how floating wetlands can improve water quality and biodiversity, offering an adoptable framework while also highlighting the need for site specific ecological research in the Anacostia. The Living Building demonstrates how ecological infrastructure, living machines in particular, can become an integral and visible part of architectural design, transforming water treatment into an educational experience. The Nature Place emphasizes the value of flexible community spaces that extend seamlessly into the landscape, supporting both structured and informal environmental learning. Haoxiang Lake Park shows how ecological restoration can foster connection and equity. Finally, Sidwell Friends Middle School proves that even small-scale ecological interventions, when made visible and accessible, can cultivate stewardship and awareness in daily life.

These precedents, collectively influence the direction of this thesis by offering replicable frameworks and conceptual clarity. They reinforce the central idea that environmental restoration and community empowerment are intertwined goals, and

that architecture can serve as a catalyst for ecological literacy and social cohesion. The lessons from these case studies will inform spatial strategies, programmatic decisions, and approaches to ecological integration at Poplar Point, ensuring that the proposed interventions are not only environmentally effective, but also socially meaningful, educationally rich, and deeply rooted in justice.

Chapter 5: Program

Program Abstract

The purpose of this thesis is to address the socioeconomic and environmental disparities that have long affected marginalized communities along the Anacostia River. Architecture is positioned as a catalyst for awareness, restoration, and dialogue, aiming to bridge ecological repair with social equity.

The program is organized into three interconnected zones: a primary zone centered on a Living Machine Hall and flexible educational spaces. A secondary zone acting as the ecological counterpart to the architectural intervention, demonstrating resilience and community-oriented nature access. A tertiary threshold zone that unites architectural and landscape systems and supports all community, educational, and ecological operations. Together these zones create a continuum between built and natural environments, creating opportunities for learning, fostering stewardship and enabling everyday community use.

Rooted in research on ecological history and social inequity, this thesis responds to ongoing calls for inclusive, justice-oriented approaches to waterfront redevelopment and green infrastructure. It centers community voices, promotes historical accountability, and challenges superficial “green” solutions that overlook deeper systemic issues.

Ultimately, the program acts as community-based intervention, a continuation of restoration efforts along the Anacostia River that seek to reconnect historically divided neighborhoods. While architecture alone can’t dismantle deeply-rooted

inequities, this thesis will test whether design-led ecological and civic frameworks can spark broader conversations and actions toward environmental justice and community empowerment.

Precedent Selection

To ground the program of this thesis in real world examples and expand on its architectural and ecological logic, the five precedents mentioned in the previous chapter were analyzed. Each precedent offered distinct insights into ecological education, community engagement, landscape integration, and environmental infrastructure. However, The Nature Place in Reading, PA emerged as the most relevant precedent to look further into detail and reverse engineer.

The Nature Place aligns closely with the fundamental goals of this thesis, which are to cultivate environmental literacy, strengthen community ties, and immerse visitors in learning environments that shift fluidly between the indoors and the outdoors. The Nature Place's primary program consists of its education spaces, which include a nature preschool, indoor and outdoor classrooms, and a multipurpose room. These spaces are connected to the outdoors through a series of breezeways, covered walkways, amphitheater, and overall trail network. Collectively, these zones are supported by administrative spaces like offices and conference rooms, along with support spaces like restrooms and mechanical / storage rooms.

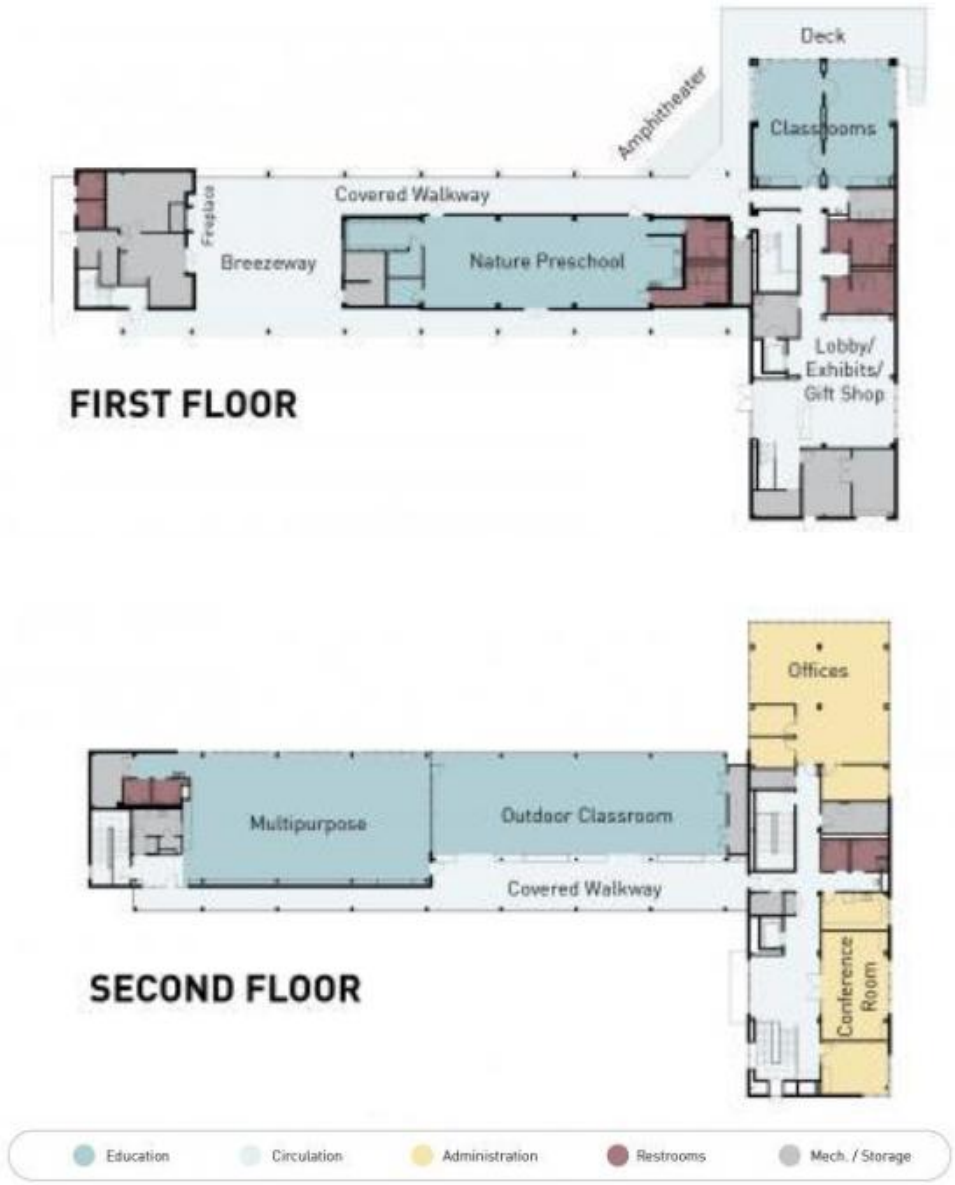

Figure 26 - Floor Plans of Nature Place

First Floor	Function	SF
	Classroom	1,200/ea
	Preschool	3,500
	Lobby / exhibit	2,000
	Restrooms	1,500
	Storage / mech	3,100

Second Floor	Function	SF
	Multipurpose	4,400
	Outdoor classroom	3,900
	Administrative	5,000
	Restrooms	500
	Storage / mech	1,200

Figure 27 - The Nature Place First and Second Floor Program Tabulation. Chart by Author.

Reverse Engineering

For this thesis, primary, secondary, and tertiary zones are being proposed for hierarchy and to give the program clear organization. The project's flexible classrooms and multipurpose spaces directly inform the spatial strategies envisioned for the primary zone. At The Nature Place, education isn't confined to walls, instead, the architecture invites visitors to step outside and learn from the landscape. This promotes the understanding of ecology through active engagement. This mirrors the core intention of a proposed Watershed Forum at the primary zone, where a Living Machine Hall and flexible rooms open toward the wetlands and where learning is strengthened through immediate access to the outdoors.

The Nature Place also incorporates wetland features that complement the landscape strategies of this thesis. While it doesn't include a "living machine" system like the one used in The Living Building, its integration of ecological processes into the educational setting demonstrates how natural systems can become embedded components of environmental learning. For this thesis, the Living Machine Hall expands on this idea by making water treatment processes visible and participatory. In this way, The Nature Place serves as a conceptual foundation rather than a complete technical model, allowing the thesis to merge both ecological engineering, inspired by The Living Building, and flexible environmental education, rooted in The Nature Place.

Additionally, The Nature Place is connected to a broader regional trail system, demonstrating how educational architecture can anchor itself within larger ecological and recreational networks. This connection supports the idea that learning doesn't

occur solely in designated rooms, but across landscaped and along trails where ecological systems can be experienced firsthand. This precedent directly informs the approach to the proposed secondary zone of this thesis, the Riverfront Resilience Park. This zone is where constructed wetlands, river overlooks, and ecology stops build upon this model to form a continuous educational experience across Poplar Point's waterfront.

Finally, The Nature Place's commitment to serving its local community resonates with the goal of this thesis. Its programming, spatial layout, and site integration demonstrate how architecture can create welcoming and inclusive environments that support stewardship, volunteer work, and public engagement. These values directly inform the "middle" ground in the proposed tertiary zone of this thesis. This is a zone where administrative spaces, community kitchens, gardens, and civic plazas support programming, food sharing, and community operations. By studying The Nature Place, this thesis draws from a precedent that balances architectural simplicity with ecological ambition, providing a grounded, but adaptable framework for designing an environmentally and socially responsive program for Poplar Point.

Watershed Forum - Primary Zone

As mentioned previously, the programmatic proposal for this thesis is divided into three zones, a primary, secondary, and tertiary one. The primary zone, The Watershed Forum, will serve as the central architectural anchor for this project. As an ecologically driven community learning center, it makes water systems visible,

participatory, and accessible to everyday users. The zone is organized around the Living Machine Hall, an atrium-like space that functions as the primary entry experience. Upon arrival, visitors are greeted by water treatment tanks, planted systems, and interpretative walkways that reveal the processes of filtration, cleansing, and ecological transformation. By confronting this infrastructure upfront, the design challenges the invisibility of environmental systems, particularly those historically neglected in marginalized neighborhoods, and reframes water treatment as a shared civic resource.

Flexible classrooms and multipurpose rooms branch from the Living Machine Hall and open toward the surrounding landscape. These spaces are designed to dissolve the boundary between the indoor and the outdoor, encouraging activities such as workshops, ecology lessons, and community gatherings to spill out onto adjacent courtyards, plazas or trail edges. A proposed Wet Lab Studio could provide hands-on opportunities for water testing, environmental monitoring, and youth-led research, reinforcing a participatory model of ecological literacy.

The Watershed Forum is ultimately defined by its approachability. It's designed not as an exclusive educational facility, but as a community hub where residents, students, and visitors can learn collectively, exchange knowledge, and participate in stewarding the river.

Riverfront Resilience Park – Secondary Zone

The Riverfront Resilience Park forms the ecological counterpart to the architectural intervention. Consisting of constructed wetlands, marsh edges, planting,

boardwalks, and overlooks, this zone transforms the degraded riverfront into an immersive landscape of ecological restoration. It can serve as an outdoor classroom where natural filtration systems expand upon the processes introduced in the Living Machine Hall. Visitors can observe how wetland vegetation supports habitat creation, stormwater management, and water-quality improvement, establishing a clear relationship between built systems and natural ones.

This zone connects directly into the Anacostia Riverwalk Trail, forming a continuous public realm that links communities on both sides of the river. Along this trail, a series of cultural, memorial, and identity-based nodes anchor the project in local histories and community narratives. These nodes serve as moments of pause, remembrance, or gathering, acknowledging the layered histories along the Anacostia, from Indigenous heritage to African American resilience to contemporary environmental activism.

Throughout this zone there could be moments where visitors encounter marsh platforms, river overlooks, or sculptural shade structures that signal both ecological and community identity. As a whole, the Riverfront Resilience Park reinforces the idea that environmental restoration and cultural recognition are intertwined components of equitable waterfront design.

The "Middle" Ground – Tertiary Zone

The Middle Ground operates as the support and operations hub for this thesis, providing the infrastructural backbone needed to sustain ecological and educational programming. As a threshold between the building and the landscape, it unites

architectural and ecological systems while accommodating practical needs such as restrooms, mechanical areas, storage, loading, and utility rooms.

Administrative offices and volunteer spaces offer areas where environmental organizations, park rangers, nonprofits, and community groups can coordinate activities, plan events, and collaborate on stewardship efforts. This supports a long-term vision in which local residents and organizations share ownership over the site's programming and maintenance.

A community kitchen, with both indoor and outdoor spaces, ties food systems to environmental education. Paired with a rooftop garden, it offers opportunities to fill in the gaps with food deserts in the area. Adjacent to these spaces, is a large civic plaza, envisioned as a flexible platform capable of hosting farmers markets, distribution events, performances, festivals, and everyday gathering. The Middle Ground thus becomes an engine of community activity, operational support, and cultural exchange, revealing that stewardship is not solely ecological, but also social and communal.

Conclusion

Together, the three program zones form an integrated architectural and ecological framework that supports environmental justice, community empowerment, and river restoration along the Anacostia. The Watershed Form makes environmental infrastructure visible and participatory, the Riverfront Resilience Park immerses visitors in living landscapes of restoration, and the "middle" ground enables social, cultural, and operational activities that make long-term stewardship possible.

Informed by the lessons of The Nature Place and grounded in research in history, ecology, and inequity, this program establishes a multifaceted model of waterfront development, one where education, restoration, and community identity work in tandem to repair the environmental and social divides that shape this region.

Chapter 6: Site Selection

Introduction

Selecting a site for this thesis required identifying a place along the Anacostia River where environmental challenges, social inequities, and opportunities for public space come together in a meaningful way. Poplar Point, located along the eastern edge of the Anacostia River, represents one of the most complex and revealing landscapes in Washington, D.C. The site carries the physical traces of dredging, industrial use, and ecological degradation, while also sitting within a community shaped by decades of disinvestment and displacement.

These overlapping conditions make Poplar Point a powerful location for exploring how architecture and landscape can support both ecological restoration and community well-being. This chapter outlines the reasoning behind selecting Poplar Point, the methods used to analyze it, and how the site's conditions helped shape the type of program developed for this thesis.

Site Selection / Positioning

To make a decision for site selection, several potential sites along the riverfront were compared using a set of criteria that reflected the goals of the thesis. These criteria included environmental conditions such as contamination levels and riverfront access, social factors such as location within Wards 7 or 8, and practical considerations like visibility and proximity to public transportation. Poplar Point emerged as the only site that met all of these criteria.

	Potential Sites Along the Anacostia Riverfront		
	Poplar Point	Kingman Island	Kenilworth Park Landfill Site
Criteria			
High PCB concentration	☑	☑	☑
Proximity to public transport	☑	☐	☐
In Ward 7 or 8 (food deserts and historical displacement)	☑	☑	☑
Visibility	☑	☐	☐
Riverfront access (for constructed wetlands)	☑	☑	☑
Stark contrast between investment and disinvestment	☑	☐	☐

Figure 28- Site selection criteria.

Environmental Conditions

The environmental challenges at Poplar Point are significant. The riverfront edge contains degraded wetlands, an eroding seawall, trash, and contaminated soils. There are also high levels of PCBs found in the river throughout this stretch of the Anacostia. These conditions highlight the need for ecological restoration strategies such as constructed wetlands, soft-edge treatments, and flood-adaptive landscapes. Rather than viewing these challenges as limitations, they became opportunities to rethink how public space and ecological systems, such as nature-based solutions, can work together.

Historical and Social Context

Poplar Point is located in Ward 8, an area deeply shaped by the history of urban renewal, highway construction, and the displacement of Black communities. The Anacostia River has long acted as a dividing line in the city, separating areas of concentrated investment from neighborhoods that have experienced decades of neglect. Poplar Point sits directly at this threshold. To the north, across the river, are rapidly developing areas like Navy Yard and Capitol Hill. To the south lies Anacostia, where access to public resources, healthy environments, and economic opportunity remains limited. These limitations have resulted in a variety of different socioeconomic disparities, such as food deserts.

This contrast is visible from the site itself. Standing at Poplar Point, one can see the difference in investment across the river. This makes the site not only environmentally important, but symbolically significant. It's a place where the city's inequities are physically present and where new forms of public space could help dismantle a legacy of division and inequity.

Visibility and Transit Access

Poplar Point is highly visible from major corridors such as I-295 and the Frederick Douglass Bridge. It is also directly adjacent to the Anacostia Metro Station, making it one of the most transit-accessible sites along the river. This combination of visibility and accessibility positions Poplar Point as a potential civic landmark. It's a place where ecological restoration and community programming can be experienced by residents, commuters, and visitors alike.

Methodologies: Lessons Learned

The research methods used in this thesis, Physical Context Analysis, Infrastructure Analysis, Sociocultural Context, and Behavioral & Experiential Analysis, helped build a clear understanding of Poplar Point and its potential. Through these lenses, much of the design decisions were revealed as studying the site made clear what sort of interventions were needed.

Physical Context Analysis

This analysis revealed the site's environmental conditions, including its low elevation and vulnerability to flooding.

Figure 29- Site topography – low elevation conditions.

Marked in yellow are areas of the site that sit at 6 feet of elevation or lower. Large parts of the site sit within this low elevation, putting it at high risk of flooding.

Figure 30- Flood risk during a 100-year storm.

This low elevation also puts the entire site at high risk of flooding, as most of Poplar Point sits within the 100-year storm floodplain, which would create an 11-foot storm surge. Point B shows the lowest areas, where flooding is most severe, while Point A shows higher ground that is at lower risk.

The riverfront edge showed signs of ecological decline, reinforcing the need for restoration strategies that could improve water quality, support biodiversity, and create a more resilient shoreline.

Infrastructure Analysis

Studying the site's infrastructure highlighted both its challenges and opportunities. Today, access into Poplar Point is extremely limited. There are only two ways into the site, through Marion Barry Avenue and Anacostia Drive. While the Anacostia Metro station is close, there are no bus routes that go directly into the park. The nearest bus stop leaves you at the edge of the site. Even the water taxi only stops across the river at Nationals Park, and only on game days.

Figure 31- Connectivity: Access Points & Transit Gaps

Movement into the site is constrained and most of that is shaped by the presence of I-295. To understand that barrier, let's look at points A and B. At point A, entering the site from Marion Barry Avenue means passing under a series of elevated ramps. Here, I-295 is at its highest point, creating a heavy overhead condition. As you move toward the Metro garage, the highway drops closer to grade and becomes less

visually dominant. At point B, the only way to reach the riverfront from Historic Anacostia and Barry Farm is again by going under I-295, either at Howard Road or Suitland Parkway. Here the highway again forms a physical and visual barrier between neighborhood and water.

Figure 32- Barriers: Infrastructure & Visibility

While highways and fragmented pedestrian routes create barriers, the presence of the Anacostia Metro Station offers a strong foundation for transit-oriented public space. This analysis helped identify where connections could be strengthened and how the site could become more accessible and welcoming, including the proposal of new main access roads and a pedestrian bridge.

Sociocultural Context

Understanding the social and historical context of Ward 8 was essential. This area of DC faces food insecurity, limited healthcare access, and a long history of disinvestment. These conditions shaped the need for community-centered programming that supports gathering, learning, recreation, and cultural expression. The site's location within this context made it clear that any intervention should prioritize inclusivity and local benefit.

Behavioral & Experiential Analysis

Observing how people move around, experience, and use the site revealed gaps in comfort and amenities along this stretch of the river. Poplar Point itself is underused, despite its size and location. This analysis helped identify opportunities for creating spaces that feel welcoming, active, and connected to the broader riverfront network and the other sections of Anacostia Park. The goal of this thesis would be to create a closed loop system between Anacostia, Poplar Point, and the Navy Yard across the river.

Site and Program

The program for this thesis grew directly out of the site's environmental conditions, community needs, and spatial opportunities. While early ideas explored more technical ecological facilities, the deeper site analysis shifted the focus toward a program that supports everyday community life while still addressing the river's

ecological challenges. The final program is organized into three zones that respond to the site's flood conditions and patterns of access.

The Overlook at Anacostia Commons

The primary zone is located near the Anacostia Metro Station, where the site is most accessible. This area became the natural location for a marketplace, atrium, and community center. This is a program that supports local vendors, cultural events, workshops, and everyday gatherings. The elevated position of this zone offers views toward the river, reinforcing its role as a welcoming entry point and civic anchor.

This program emerged from the site's social context. In a community affected by food deserts, limited public amenities, and historical disinvestment, a marketplace and community center provide opportunities for economic activity, cultural expression, and social connection. The site's visibility and transit access make it an ideal location for such a hub.

The Resilient River Edge

Closer to the water, the site transitions into a zone shaped by ecological restoration and flood resilience. This area includes constructed wetlands, soft and hard edge conditions, and a 100-foot buffer designed to safely accommodate flooding during major storm events. The river edge becomes a place where ecological processes are visible and accessible, offering opportunities for learning, recreation, and environmental stewardship.

This zone responds directly to the site's environmental conditions. The degraded shoreline and floodplain status made it clear that any program here must work with the river rather than against it. The wetlands and buffer zone help improve water quality, support habitat, and create a more resilient landscape.

The Riverfront Park

The tertiary zone extends into the interior of the site, where the land rises slightly and becomes more suitable for recreation and flexible public space. This area includes an amphitheater, playground, tennis courts, a small soccer field, a volleyball court, open seating areas, a flexible event lawn, and a bike trail that connects to the Anacostia Riverwalk Trail.

This part of the program emerged from the behavioral and experiential analysis. With a legacy of federal uses, contamination, and segregation, the site has never been able to serve as a community asset. The site's size and open character make it well-suited for active recreation and community events. The park provides spaces for everyday use, supporting health, play, and social interaction. It also strengthens connections to the broader riverfront trail system, helping integrate Poplar Point into the city's network of public spaces.

Conclusion

Poplar Point was selected because it brings together environmental urgency, social needs, and spatial opportunity in a way that aligns with the goals of this thesis. Its history of dredging, contamination, and disinvestment makes it a compelling site

for exploring how architecture and landscape can support ecological restoration and community well-being. The research methods used in this chapter helped reveal the site's challenges and potential, guiding the development of a program that responds directly to its conditions.

The final program, The Overlook at Anacostia Commons, the Resilient River Edge, and the Riverfront Park, reflect how the site itself shaped the direction of the project. These zones emerged naturally, informed by the site's topography, flood conditions, access points, and community context. They set the foundation for the design explorations in Chapter 7, where the spatial and architectural decisions are developed in greater detail.

Chapter 7: Discovery Phase

Site Analysis

The conceptual phase of this thesis began by synthesizing all the research done and their findings into a cohesive understanding of Poplar Point and its potential. The site's environmental fragility, social context, and scale demanded a design approach that could operate at multiple levels, ranging from ecological restoration to community programming. At roughly 110 acres, Poplar Point is not a single-building site but a landscape that requires coordination, hierarchy, and long-term vision. Early analysis made it clear that any successful development here would require a master plan. This would be essential to organize the different typologies of future development, establish connectivity, and ensure that the proposed civic anchor would not stand isolated within such a vast area.

The master plan became a framework for integrating ecological, infrastructural, and social systems. Part of the master plan proposes mixed-use multi-family housing and townhomes, creating a new urban edge on site that offers different forms of home ownership and affordability to support a diverse community. This housing strategy helps activate the site beyond the civic anchor, creating a lived-in environment that connects to surrounding neighborhoods. The plan also extends the logic of nearby developments, the Bridge District to the south and the 11th Street Bridge Park to the north, ensuring that Poplar Point becomes part of a continuous network of public spaces along the Anacostia River rather than an isolated intervention. By tying to its local context, this master plan ensures that intervention

on the site can succeed in conjunction with surrounding development projects and existing communities.

Connectivity was a major guiding principle. The master plan introduces new circulation routes that link the site to its context, improve access to the riverfront, and establish clear relationships between residential, civic, and ecological zones. These moves respond directly to the site's fragmented infrastructure and limited public access identified in earlier research. The master plan also acknowledges areas of the site with contaminated soil that will remain closed to the public to allow for remediation to occur over time. This integrates these zones into a long-term environmental strategy rather than treating them as voids.

In essence, the master plan serves as both a design and planning tool. It's a way to translate the thesis's broader goals of inclusion, resilience, and ecological repair into spatial form. It sets the stage for the conceptual explorations that follow, defining how the site's scale and complexity can be addressed through a series of deliberate, interconnected design decisions.

Emerging Design Decisions

The early conceptual explorations focused on establishing the "big moves" that would define the spatial and experiential structure of the master plan. These moves were not arbitrary gestures but responses to the site's physical conditions, historical context, and civic potential.

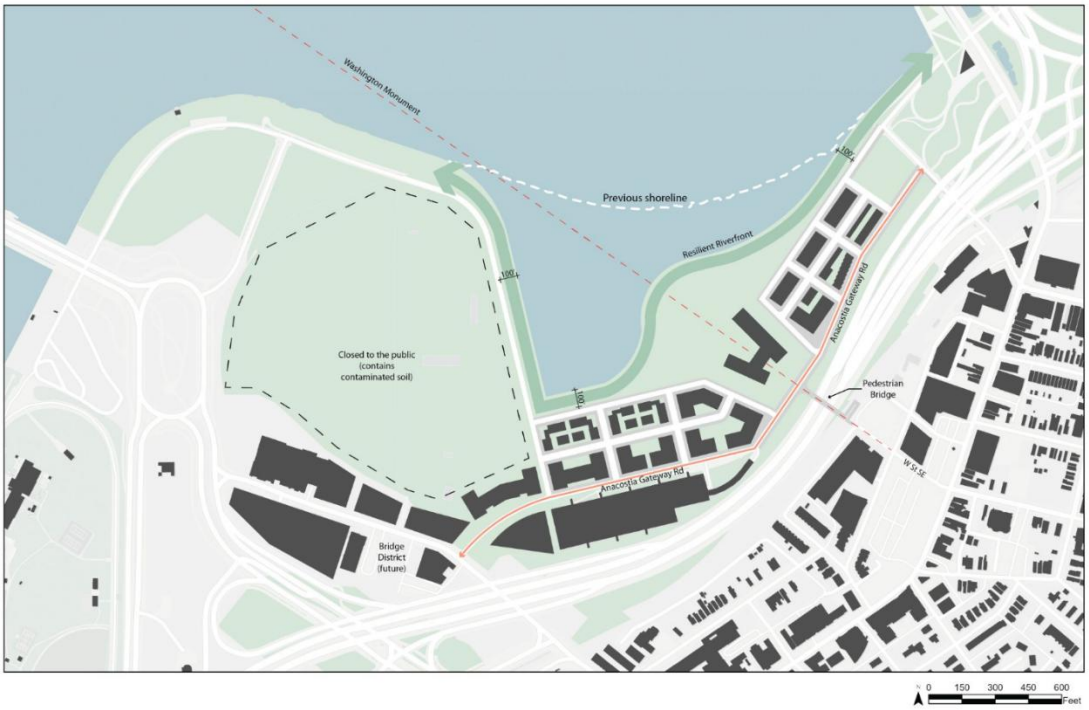

Figure 33 – Master Plan: Big Moves

The big moves for this thesis and the master plan include the introduction of Anacostia Gateway Road, a new main road that improves access and circulation across the site. It also includes the reconfiguration of the shoreline in response to flood and sea-level rise risks, the introduction of a 100-foot buffer, and a Resilient Riverfront Park designed for future climate adaptation. Lastly, it also includes an alignment with the Washington Monument, where the plan creates a visual axis that orients both the proposed pedestrian bridge and civic anchor. Each one contributes to reconnecting Historic Anacostia to Poplar Point, Poplar Point to the river, and the overall project to its surrounding developments, neighborhoods and the larger identity of Washington, D.C.

Anacostia Gateway Road

The first major move was the introduction of Anacostia Gateway Road, a new primary corridor that organizes circulation across the site. This road provides a clear east-west connection between the Bridge District and the Anacostia Metro Station to Marion Barry Ave and the site of the 11th Street Bridge Park, improving access and visibility. It also establishes a defined urban edge along the southern boundary of the site, where mixed-use buildings and housing can front the street to create an active, walkable environment.

Anacostia Gateway Road functions as both infrastructure and identity. It reclaims the fragmented edge created by I-295 and transforms it into a civic frontage and gateway that welcomes residents and visitors. The road's alignment supports multimodal movement, vehicles, bicycles, and pedestrians, and connects directly to the proposed pedestrian bridge. This reinforcing the idea of Poplar Point as a gateway between Historic Anacostia and the river and for communities on either side of the river.

Reconfigured Shoreline & 100-Foot Buffer

The second big move addresses the site's most pressing environmental challenge, flooding and sea-level rise. The master plan reconfigures the shoreline to create a Resilient Riverfront Park that integrates a 100-foot buffer zone designed to flood safely during major storm events. This reconfiguration is critical because this site is bound to be inundated in the future. This reconfiguration offers more than just

a temporary solution. It offers a solution that can ensure the resilience of this site for any possible climate future.

This buffer acts as a transitional landscape between the built environment and the river, combining ecological restoration with public access. The new shoreline replaces the rigid, engineered edge with a softer, more natural profile that supports wetlands, native vegetation, and habitat diversity. This approach allows for the restoration of nature-based systems that once thrived on site, while also offering solutions that can help restore the river's health and work towards a future where the river can once again be swimmable and fishable. It also restores portions of the river's historical geometry, acknowledging the previous shoreline while adapting to future climate conditions. The buffer zone becomes a living system, a place where water management, recreation, and education coexist. Paths and boardwalks weave through the wetlands, allowing visitors to experience the river's ecology up close while maintaining safety and resilience.

This move transforms the riverfront from a barrier into an asset. It demonstrates how design can respond to environmental risk through adaptation rather than avoidance, turning the floodplain into a dynamic public space that celebrates the relationship between people, land, and water.

Alignment of Civic Anchor and Pedestrian Bridge

The third major move establishes a visual and spatial axis that aligns the civic anchor and pedestrian bridge with the Washington Monument across the river. This alignment creates a powerful connection between Poplar Point and the monumental

core of the city, situating the site within Washington's broader civic landscape. The axis is not merely symbolic, it also organizes the master plan's geometry, guiding the placement of buildings, streets, and open spaces.

The pedestrian bridge serves as both a physical and visual link, connecting the Historic Anacostia neighborhood to the riverfront and beyond. Its alignment reinforces the idea of continuity across the river, bridging historical divides and creating a shared public experience. The civic anchor, positioned along this axis, becomes the focal point of the site. It's a marketplace, atrium, and community center that embodies the thesis's goals of inclusivity and connection.

Together, the pedestrian bridge and civic anchor form a sequence of spaces that lead visitors from the neighborhood to the river, framing views of the city and establishing a sense of orientation. This move ties the local scale of community life to the regional scale of Washington's urban identity, making Poplar Point both a neighborhood destination and a civic landmark.

Building Conceptual Design

The proposed schemes would be for the design of the civic anchor within the overall master plan. The civic anchor, The Overlook at Anacostia Commons, would have a marketplace, atrium, and community center.

Program			
	Market Place	(~18,000 / floor, ~36,000 total)	
	~35 vendors		
	- (6) vendors at 10'x10' (100sq ft)	600	
	- (16) vendors at 10'x20' (200 sq ft)	1,200	
	- (4) vendors at 10'x30' (300 sq ft)	1,200	
	- (2) vendors at 30'x30' (900 sq ft)	1,800	
	- (7) at unique configurations	~1,500-2,000	
	- Bathrooms	1,400	700 sq ft / floor. Could be all gender netural or not
	- Storage	200	Food storage @ each vendor stall, this is for furniture / equipment
	- Janitor closet	60	
	- Demo kitchen	3,000	
	- Circulation @ 15%	5,400	
	- Indoor seating @ 50%	18,000	
	Subtotal	34,360	
	Community Center	~12,000	
	- Event space / Flex Hall	2,500	
	- Storage	300	Furniture, equipment for events
	- Office	750	
	- Study / conference rooms	900	6 @ 150 sq ft ea.
	- Multi-purpose rooms	1,300	2 @ 650 w/ storage closet. For children's program, arts and crafts, senior nights
	- Technology lounge	650	
	- Fitness	650	
	- Bathrooms	600	
	- Janitor closet	60	
	- Circulation @ 15%	1,800	
	Subtotal	9,510	
	Joint (Atrium)	(~5,700 upper, ~9,500 lower, 15,200 total)	
	- Gallery / Exhibit	1,000	
	- Lobby / front desk	200	
	- Circulation @ 15%	2,280	
	- Indoor seating @ 30%	4,560	
	Subtotal	8,040	
	Systems	(~4,500, maybe 3,500 usable)	
	- Loading / service / trash / storage	1,000	
	- Mechanical	300	
	- Electrical	200	
	- I.T.	100	
	- Circulation @ 15%	525	
	Subtotal	2,125	

Figure 34 – Program Chart

Within the marketplace would be a variety of vendor stalls at different standard sizes to accommodate different functions, ranging from smaller purchase stands to larger purchase, display, and consumption stands. These vendor stalls would add up to a total of 35 throughout the entire building. Within the marketplace, there would be dedicated space for a grocery store and a restaurant, as well as a demonstration kitchen and a rooftop garden to foster stewardship in the community.

The community center offered a variety of different spaces and flexible uses to accommodate the different needs of the community. Some of these spaces include a daycare, senior and tech lounges, multi-purpose rooms, conference rooms, a game room, a double height event space, and more.

Lastly, a third space, in this case an atrium, would serve as the connecting piece and threshold between the two program spaces. This space would serve as a gathering area and a place to celebrate community identity.

Proposed Schemes

The different massing schemes for this project drew inspiration from the marketplace typology, usually organized in bars and often paired with a plaza or courtyard. One bar would serve to accommodate the marketplace, while the other would serve the community spaces. The different schemes for this project would align these bars to the Washington Monument to frame views to the D.C. horizon and to the riverfront and landscape.

Scheme 1

Figure 35 – Scheme 1

Scheme 1 proposed a central bar that would serve as the marketplace. Two adjacent bars would serve as community spaces, with plaza spaces in between the bars to accommodate for different types of outdoor functions like farmers markets, festivals, and more. This scheme was not further developed as it didn't fit in with the overall context of the site. When comparing the scale of it to surrounding buildings, it's much larger and out of place. This scheme also came about before the design of the master plan, which created the urban edge on site and helps tie the civic anchor to its surrounding context.

Scheme 2

Figure 36 – Scheme 2

Scheme 2 is the first scheme that developed after the design of the masterplan. It proposed an almost horseshoe shaped design that would have vendor stalls facing into an interior courtyard for visibility and central gathering.

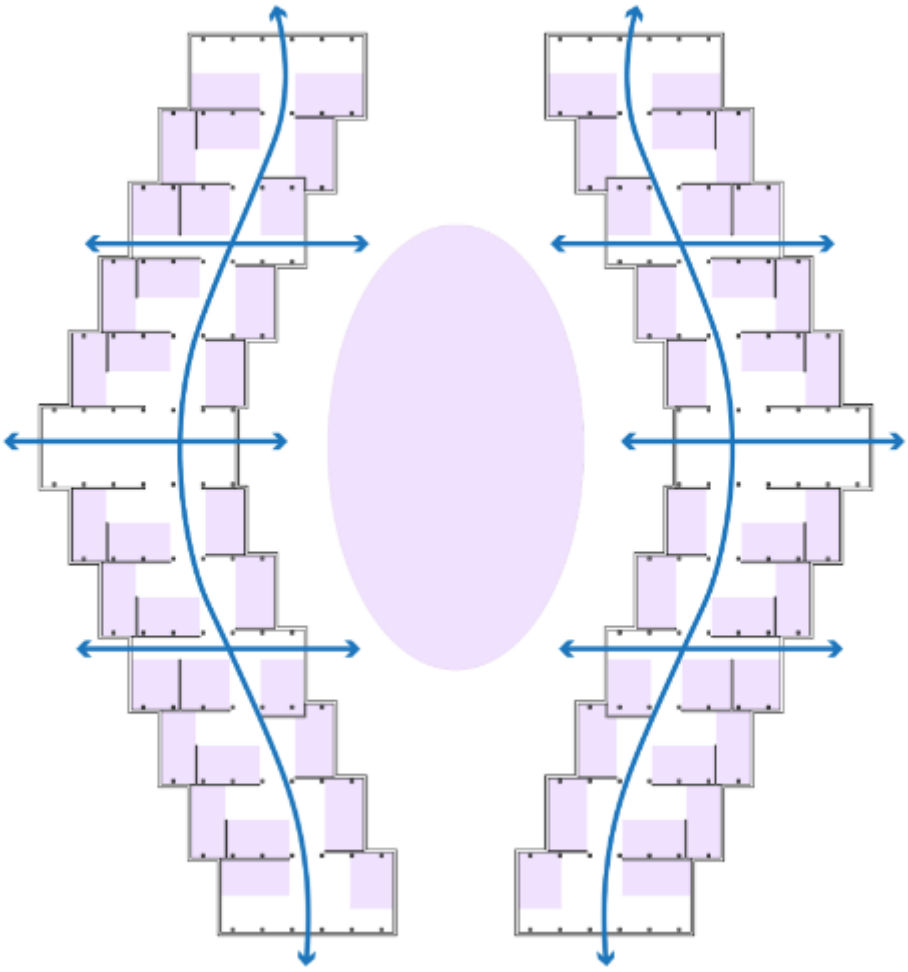

Figure 37 – Scheme 2, parti

The parti for this scheme introduced the approach of standard vendor stall sizes so there could be an almost modular approach to the organization of the floor plan. This scheme offered 40+ vendor stalls and community spaces on the second floor. This scheme had an inward facing organization, and for the site, it's program, and how this project aims to enhance connectivity, this was not the right approach.

Scheme 3

Figure 38 – Scheme 3, ground floor left, upper level right

Scheme 3 is the closest to the final iteration of the thesis project, where 2 bars are proposed and joined together by an atrium. This scheme proposed an approach that could help deal with the grade change on site, where users could either enter the building by going up a ramp and enter on the second floor of the community center, or go down some steps and enter at the ground floor of the atrium.

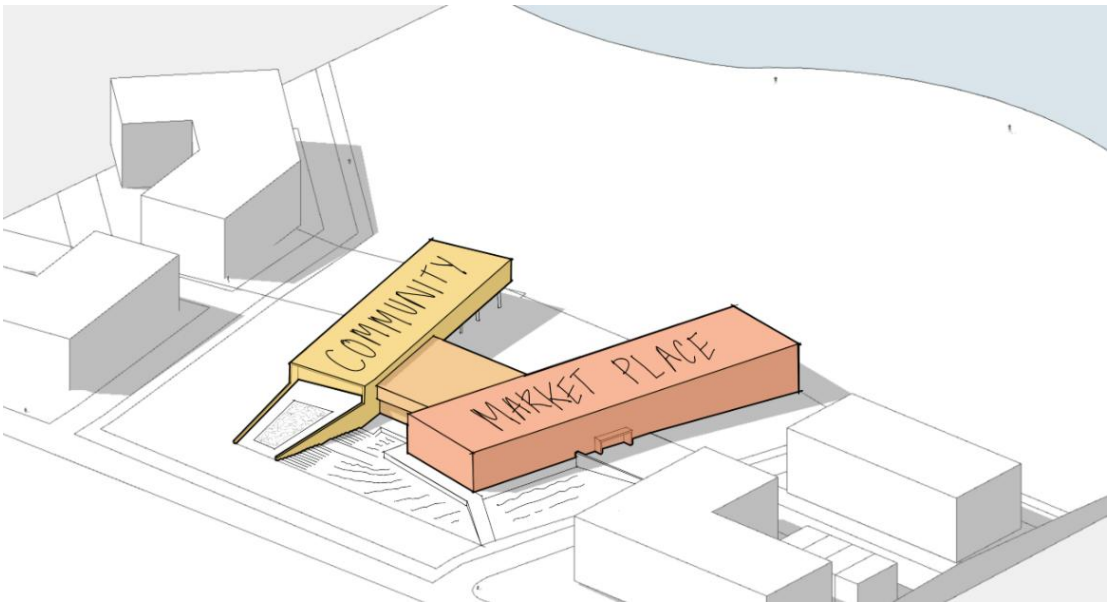

Figure 39 – Scheme 3, program massing diagram

This entry sequence proved to be too difficult for users so a more direct route would have to be designed. What this scheme did though was help develop the final parti and final massing for what ended up being the final project. This scheme also only offered two floors. When the final program was determined, two floors were not enough, and the final design ended up with three floors for each massing.

Conclusion

The discovery phase marked a turning point in the thesis, the moment when research and analysis began to translate into spatial strategy. The master plan provided a framework for addressing the site's scale, complexity, and layered history, while the big moves established clear principles for connectivity, resilience, and civic identity. Together, they outline how Poplar Point can evolve from a fragmented, contaminated landscape into a cohesive, inclusive, and ecologically responsive urban district.

These conceptual explorations set the foundation for the design development that follows. Chapter 8 will build upon these ideas, refining the architectural and landscape components of the project and exploring how the civic anchor and riverfront spaces can embody the thesis's broader vision of repairing the tear and restoring the Anacostia River for inclusive urbanism.

Chapter 8: Thesis Design Solution

Introduction

The design development builds on the conceptual framework established in the previous chapters and translates the project's big moves into a cohesive architectural and landscape proposal. While Chapter 7 focused on understanding the site, defining the master plan, and identifying the major spatial strategies that guide the project, this chapter shifts toward the final design. It presents the project at three interconnected scales: the master plan, the riverfront park, and the civic anchor building. Together, these components form a unified vision for Poplar Point, one that restores the river's ecological health, strengthens community connections, and creates a new public destination along the Anacostia River. The following sections describe how these ideas take shape across the site, beginning with the overall master plan and moving gradually toward the detailed design of the building itself.

Master Plan

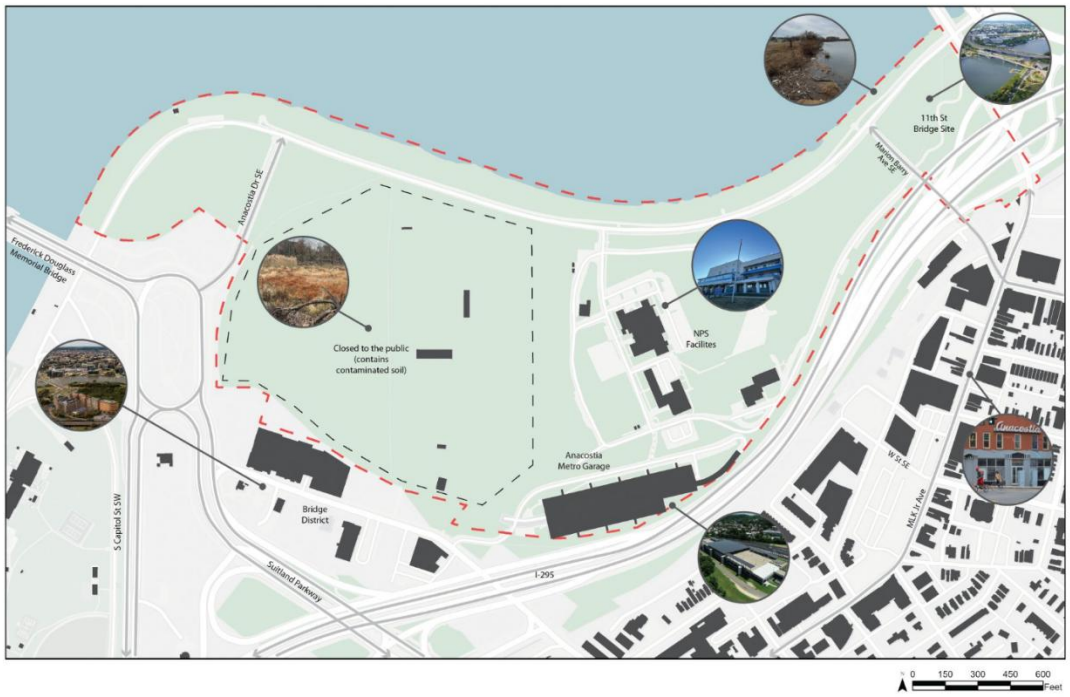

Figure 40 – Current conditions

For a brief recap, here are the site's current conditions. On the west is the Bridge District, a development bringing mixed-use multifamily housing to this edge of Anacostia. Next to it, is a portion of the site that remains closed to the public due to contaminated soils. Moving further east, we reach the metro garage. We also reach the National Park Service facilities, which the RFP for this site notes can be relocated for future development. We also see MLK Jr Ave, the culturally rich corridor at the heart of Historic Anacostia. On the far right is the site for the future 11th Street Bridge Park, designed to connect communities at opposite sides of the river. Finally, we see the river's current edge, which is in urgent need of remediation.

Figure 41 – Master Plan

Here is the master plan, a proposal that reconnects Historic Anacostia to Poplar Point, and Poplar Point back to the river. It establishes a new urban edge that extends the Bridge District, introducing mixed-use multifamily housing, a civic anchor, a resilient riverfront park, and a pedestrian bridge. This thesis will focus on how these layers work together to repair the site's ecological and social connections, culminating with the architectural proposal of the civic anchor.

As mentioned previously in Chapter 7, the master plan establishes "big moves" for the project, which include Anacostia Gateway Road, alignment with the Washington Monument, maintaining portions of the site with contaminated soil closed to the public to allow for remediation to occur over time, and a reconfiguration of the shoreline in response to flood and sea-level rise risks, introducing a 100-foot buffer and a Resilient Riverfront Park designed for future climate adaptation.

Resilient Riverfront Park

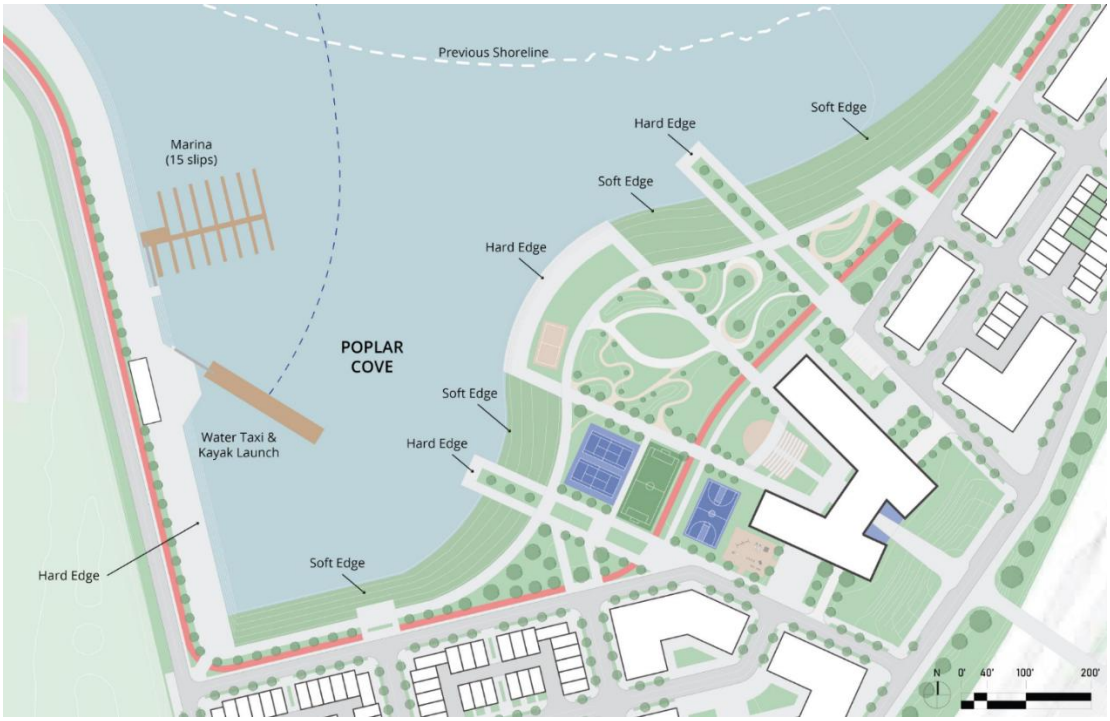

Figure 42 – Master Plan: Resilient Riverfront Park

This park introduces Poplar Cove, a protected waterfront area designed to accommodate a small marina, the first east-of-the-river water taxi station, and a kayak launch. It also features a hybrid edge, combining hard edges to support public access, and soft edges where ecological restoration can thrive. So why take this hybrid approach? A National Park Service survey for the Reimagine Anacostia Park project showed strong community support for nature-based solutions along the river's edge to address flooding. Most respondents favored a natural or combined shoreline, reflecting a shared desire for closer connection to the river.

Figure 43 – Resilient Riverfront Park, programming

Now, the park programming, which is organized into three main zones. First, the Active Recreation Zone, numbers 1 through 5, includes a playground, basketball court, small soccer field, tennis courts, and a volleyball court. Next, the Waterfront Zone, numbers 6 and 7, features waterfront steps and two flanking piers that bring people directly to the river's edge. Lastly, the Community and Gathering Zone, numbers 8 through 11, offers open seating, a bike trail that connects to the existing Anacostia Riverwalk Trail, an amphitheater, and a flexible event lawn at the center.

The flexible event lawn can host just about anything. Today, it's a farmers' market, tomorrow, a festival. In the winter, imagine it glowing with Christmas lights or crowded with an ice-skating rink. On the Fourth of July, people could gather here for fireworks, or in the summer, spread out for movie nights at the park. The possibilities are endless.

Figure 44 – Resilient Riverfront Park, site section

Looking at the park in section, it can be observed that it's designed above the Base Flood Elevation, shown dashed in blue, which represents an 11-foot storm surge during a 100-year storm. The dashed gray line shows the existing site elevation, which sits entirely below that flood level, explaining why the site is at high risk of flooding. It's important to note that the waterfront steps and river edge walk are designed to flood, as they're part of the 100-foot buffer described previously.

Figure 45 – Floor Resilience, 100-year storm

This buffer includes the park's soft edges and piers. It's designed to inundate during severe storm events, acting as a protective barrier for the rest of the park and surrounding buildings. As shown in this diagram, even under peak flood conditions, water levels remain within the buffer zone.

Figure 46 – Normal Conditions (left) vs Flood Conditions (right)

Under everyday conditions, the river edge becomes a living system again. These soft edges support wetlands that once thrived on this site, filtering water, rebuilding habitat, and creating space for native species to return. What you're seeing here is a future where the river is restored to health. During severe storm events, the terraces and planted wetlands absorb and slow the surge, creating a resilient buffer that shields the community from flooding.

The Overlook at Anacostia Commons

We're now going to zoom into The Overlook at Anacostia Commons, the civic anchor at the heart of the project. To understand how the building takes shape, we'll start with the massing development.

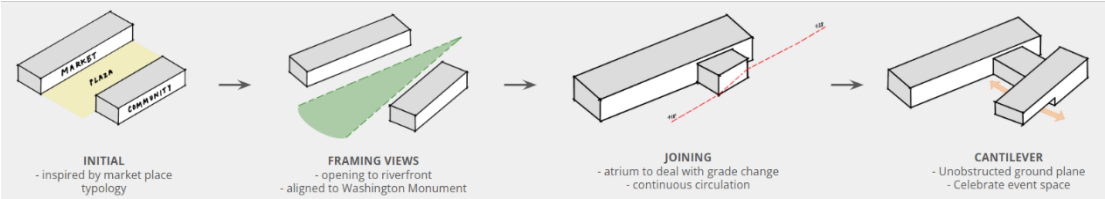

Figure 47 – Massing Development

The massing for this project draws from the marketplace typology, typically organized as bars, often paired with a plaza or courtyard. This thesis proposes two bars: one dedicated for market spaces and the other for community programming, with a central courtyard serving as the shared gathering space. The bars then open outward, framing views to the riverfront and aligning with key landmarks like the Washington Monument and the Capitol. An atrium is then introduced between the two bars to navigate grade change on site and to create continuous circulation. Finally, the river-facing end of the community bar is lifted into a cantilever, creating an unobstructed ground plane and elevating the event space as a symbolic gesture for the community.

Figure 48 – First Floor Plan

On the south side of the first floor, the community center defines this edge of the plan with its lobby, some service spaces, and a daycare. Here, is also the primary entrance for anyone arriving from the Metro garage, creating a gateway into the building. From this approach, visitors can choose to enter the building directly, or continue along the exterior path beneath the cantilever, moving toward the park or the marketplace beyond. After entering the building, visitors are drawn toward the atrium, the central space that introduces the Hall of Heroes and the Reflection Hall.

Figure 49 – Hall of Heroes

The Hall of Heroes celebrates local identity and the community figures who shaped Anacostia, including Frederick Douglass. This space is the threshold in the project, guiding visitors directly into the marketplace. Once visitors reach the marketplace, they're met with a range of vendor stalls that bring the space to life. Most of these stalls line the perimeter walls, shown in the plan in lavender and purple. Together they make up a total of thirty-five vendors throughout the building. The first

floor also offers generous seating areas and, on the east side, a 1,200-square-foot grocery store.

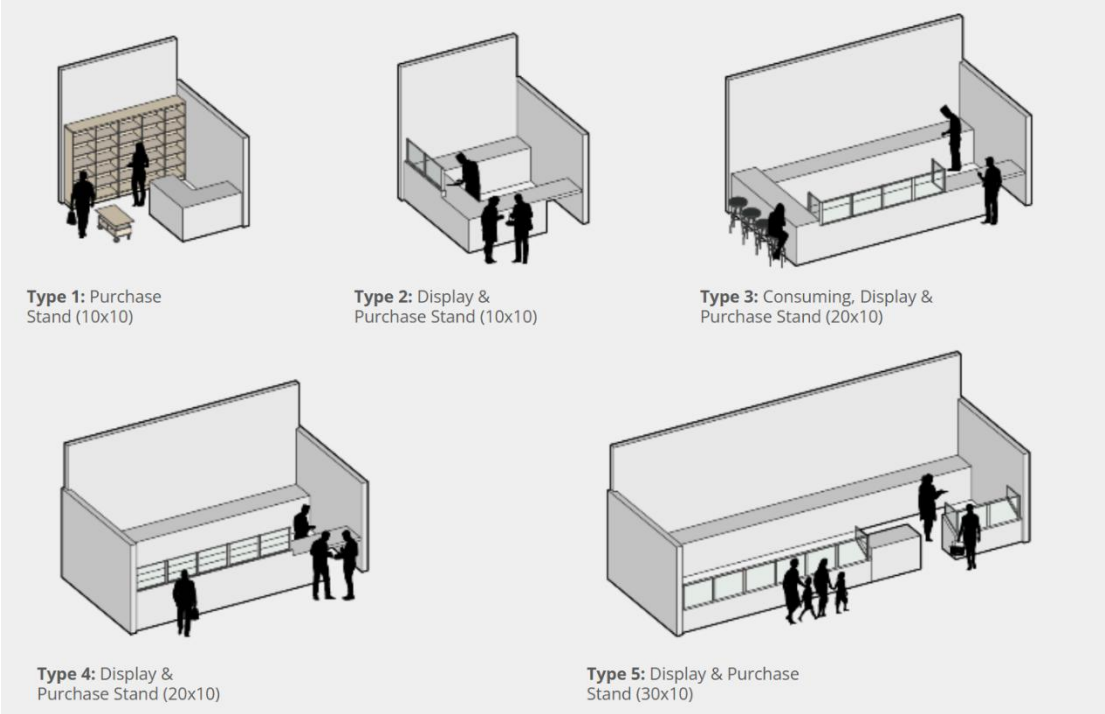

Figure 50 – Vendor Stall, standard sizes

The vendor stalls follow a set of standard sizes that support different types of businesses. Type 1 is a 10×10 purchase stand, ideal for a flower shop, crafts, or small retail. Type 2 is also 10×10, but designed for display and light food service, like bagels or coffee. Type 3 expands to 20×10 and supports cooking, display, and seating, the scale you'd expect for vendors serving things like burgers or pizza. Type 4 is the same size and serves the same function but positioned between other stalls. Lastly, Type 5, at 30×10, accommodates larger food operations such as seafood, meats, an ice cream shop, or even a bakery.

Figure 51 – Interior Perspective, marketplace

The marketplace is envisioned to operate under a community land trust model, ensuring that this space remains community-owned and that vendor rent stays permanently affordable. This structure supports local businesses and establishes the marketplace as an economic engine for Anacostia's community.

Figure 52 – Second Floor Plan

Moving to the second floor. Users arrive to the main entry coming off from the pedestrian bridge on the right, bringing visitors up an elevated path and directly into the atrium.

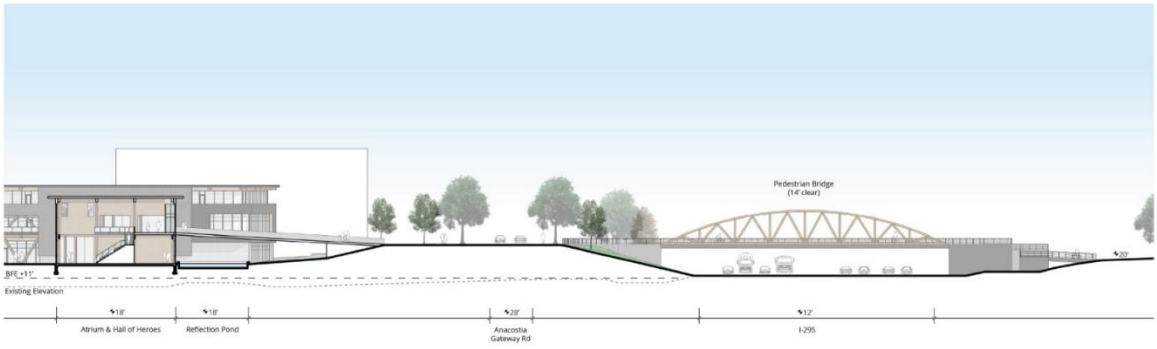

Figure 53 – Site Section, pedestrian bridge and main entry

In section, it can be observed how this entry serves Historic Anacostia, providing a direct, walkable connection over the barrier that is I-295 and onto the site. From the pedestrian bridge, visitors cross Anacostia Gateway Road and enter the atrium, framed by the two bars of the building.

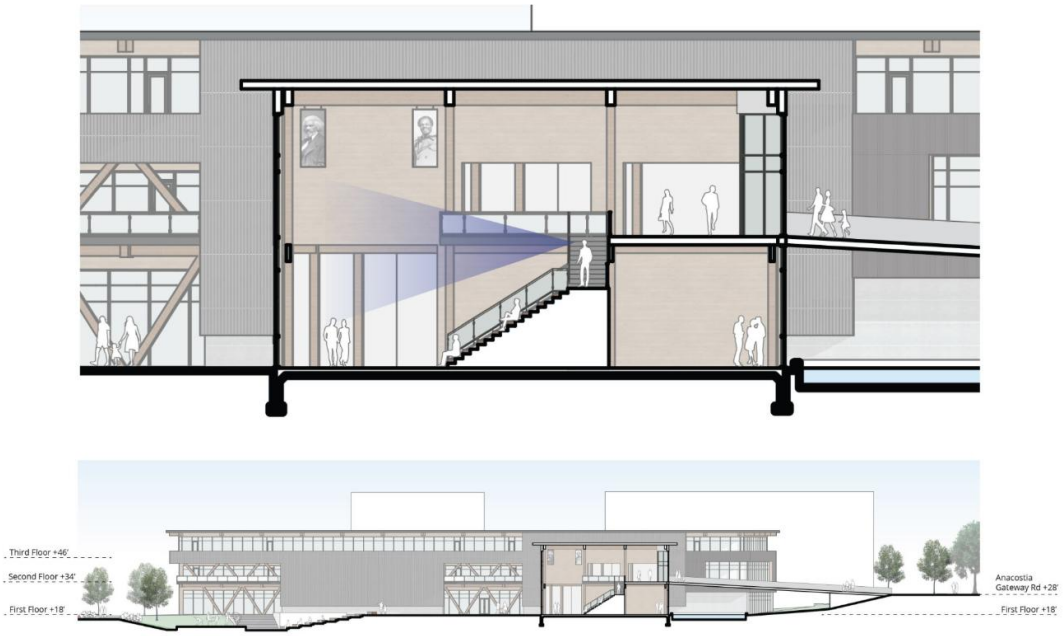

Figure 54 – Section through atrium

Inside the atrium, visitors can head over to either the marketplace or the community center. The grand stair also offers seating with views out to the landscape, the river, and the DC horizon.

On the second floor of the community center, some of the program spaces include a tech and senior lounge, a multipurpose room, open seating, conference rooms, and a double height Event Hall with its own kitchen.

Figure 55 – Section through community center

This double-height event space sits at the cantilevered end of the community center, opening to expansive views of the landscape and the river. It can host everything from birthdays and weddings to graduation parties or community celebrations. It is a flexible space elevated to honor the people it serves.

On the second floor of the marketplace, we continue to see more of the vendor stalls introduced earlier, along with generous seating areas and balconies providing grand views to the landscape. Portions of this level are open to the first floor,

improving visibility to the vendor stalls and creating a more connected market experience. On the east side, this floor also includes a dedicated space for a restaurant.

Figure 56 – Third Floor Plan

Lastly, on the third floor, the community center includes a dance hall and fitness room, a second multipurpose room, open seating, a game room, and offices for staff and operations.

To the north, the third floor of the marketplace offers a demonstration kitchen, and at the center, a rooftop garden. This garden is not intended to supply the market, but rather to engage community members and foster stewardship alongside the demo kitchen. This level also includes a wrap around balcony, additional seating, and office space for marketplace staff, completing the building's program.

Figure 57 – Transverse Section, marketplace

Cutting through the marketplace, vendor stalls can be observed lining the perimeter walls of the first and second floors, as well as the rooftop garden on the third floor. The balcony spaces throughout the marketplace help mitigate the harsh southern sun, reducing heat gain and improving comfort within the building.

Conclusion

The proposed master plan reimagines Poplar Point as the connective tissue between Historic Anacostia and the river, transforming a fragmented edge into a unified civic landscape.

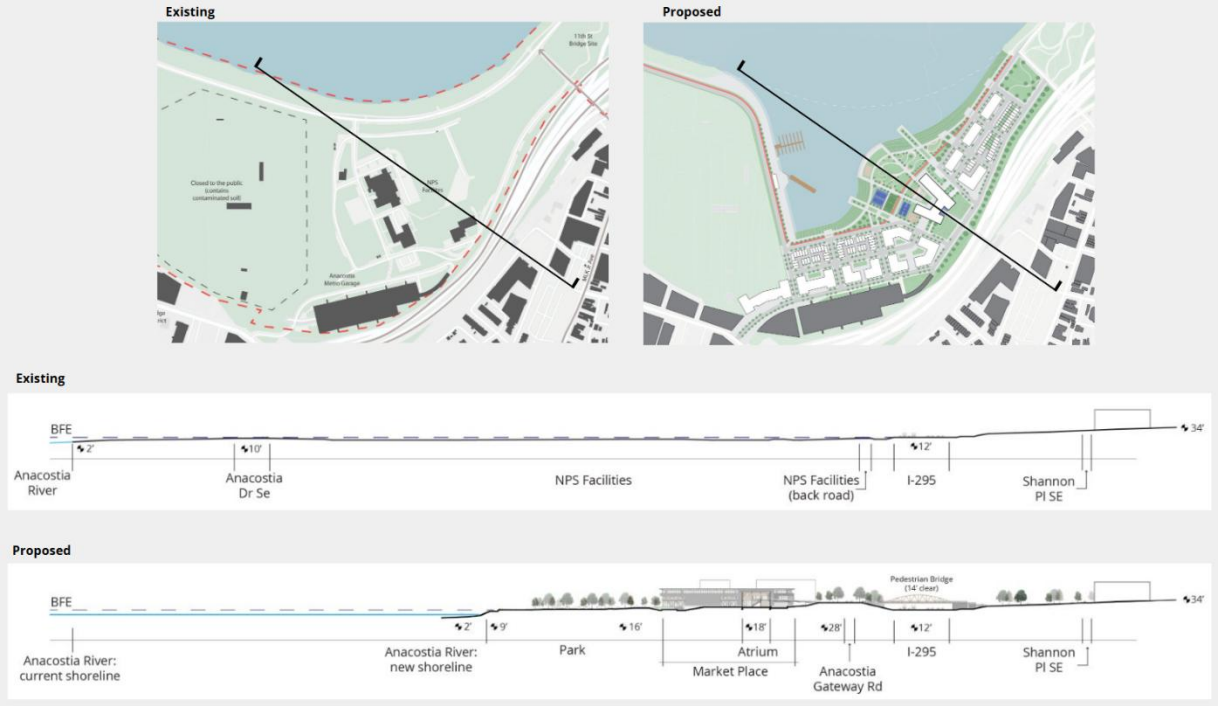

Figure 58 – Site Section, existing vs proposed

Today, the site sits entirely below the base flood elevation. The proposed design introduces a resilient riverfront park, a civic anchor, and a pedestrian bridge, a set of interventions that work together to restore the landscape and reconnect the community.

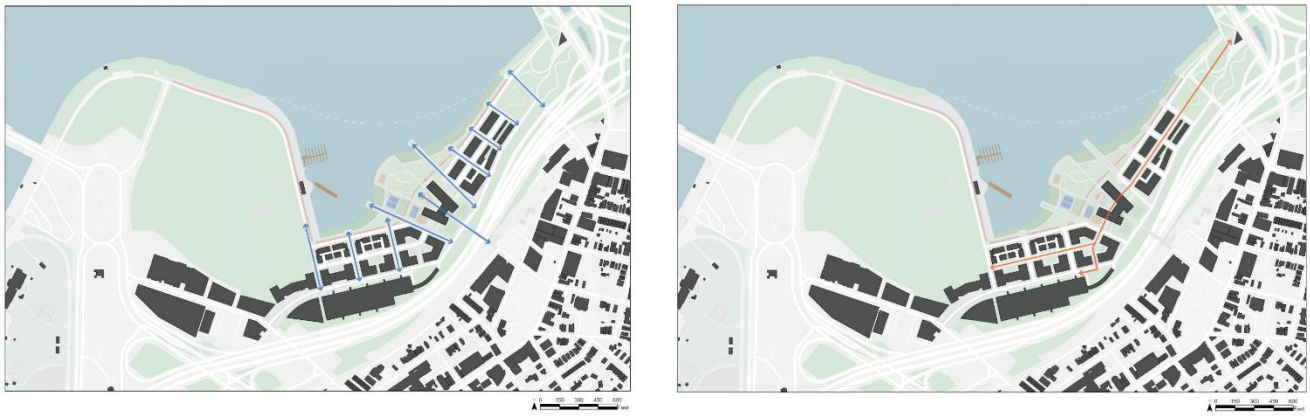

Figure 59 – Riverfront Access (left) and Site Axis (right)

The master plan strengthens access across the site, creating clear, walkable connections from Historic Anacostia into the park, the marketplace, and the riverfront. It also establishes strong visual and spatial axes, aligning with the Bridge District and the 11th Street Bridge Park to integrate this site into the larger landscape.

Figure 60 – Exterior Perspective, Riverfront Approach

Reconnection begins with restoration, of the land, the river, and the public realm. This thesis transforms a site long defined by division and underuse into a community asset, a local economic engine, a resilient landscape, and a riverfront park, one that finally belongs to the people of Anacostia.

Bibliography

Adhya, Tiasa, and Sayan Banerjee. “Impact of Wetland Development and Degradation on the Livelihoods of Wetland-Dependent Communities: A Case Study from the Lower Gangetic Floodplains.” *Wetlands* 42, no. 7 (August 26, 2022). https://doi.org/10.1007/s13157-022-01588-w.

In this study the authors investigate how wetland development and degradation affect the livelihoods of wetland-dependent communities. The study focuses on communities in India, where interviews were conducted and found how residents have connected the severe degradation to wetlands to the reduction of ecological services that reduce the cost of living and sustain diverse livelihoods. Some of these include farming and fishing. This is relevant to this thesis as the Anacostia is currently not fishable or swimmable due to its pollution. The degradation of wetlands in the DC area can be linked to contributing to this issue.

Keywords: wetland, community, ecology, sustainability, agriculture.

Al-Zreiqat, Iyad, Bassim Abbassi, Tom Headley, Jaime Nivala, Manfred van Afferden, and Roland A. Müller. “Influence of Septic Tank Attached Growth Media on Total Nitrogen Removal in a Recirculating Vertical Flow Constructed Wetland for Treatment of Domestic Wastewater.” *Ecological Engineering* 118 (August 2018): 171–78. https://doi.org/10.1016/j.ecoleng.2018.05.013.

The author investigates the performance of constructed wetlands as a sustainable method for treating wastewater, especially in urban and decentralized contexts. The authors evaluate different wetland designs, including vertical flow and horizontal sub-surface flow systems, focusing on their ability to remove pollutants like nitrogen, phosphorus, and organic matter. Constructed wetlands are praised for their low energy use, cost effectiveness, and ecological benefits, making them suitable for small communities and environmentally sensitive areas. The authors present data showing that the systems can achieve high removal rates for key contaminants, though performance varies with design and climate conditions. The authors emphasize the importance of integrating ecological design with technical monitoring to improve long-term outcomes. Overall, the authors

support constructed wetlands as a viable and environmentally friendly alternative to Conventional waste water treatment.

Keywords: constructed wetlands, pollutants, removal rates, contaminants.

Alikhani, Somayeh, Petri Nummi, and Anne Ojala. “Urban Wetlands: A Review on Ecological and Cultural Values.” *Water* 13, no. 22 (November 22, 2021): 3301. https://doi.org/10.3390/w13223301.

The authors investigate the ecological and cultural values of urban wetlands. The article highlights the crucial ecosystems wetlands offer, including water purification, stormwater management, carbon sequestration, biodiversity support, and climate regulation through urban heat island mitigation. Not only do wetlands offer crucial ecosystems, but they also provide social and cultural benefits, such as recreation, education, and overall human well-being. As the authors highlight, by 2050, 68% of the world’s population is projected to live in urban areas so it’s imperative to find solutions to protect natural ecosystems and enhance the human experience. This relates to this thesis as the benefits mentioned above are engraved into this proposal.

Keywords: urban wetlands, green-blue infrastructure, sustainability, ecosystem services, ecology.

Allison, Carley E., and Steven I. Safferman. “Evaluation of a Greenhouse Ecosystem to Treat Craft Beverage Wastewater.” *Sustainability* 16, no. 17 (August 28, 2024): 7395. https://doi.org/10.3390/su16177395.

The authors explore how decentralized wastewater treatment systems can promote environmental justice and community resilience, especially in underserved urban areas. The authors analyze case studies and planning frameworks to see how small-scale, nature based solutions, like constructed wetlands and living machines, can offer sustainable alternatives to large, centralized infrastructure. These systems are praised for their ability to treat wastewater using ecological processes, reduce energy use, and integrate into public spaces for education and engagement. The authors emphasize that equitable access to clean water and sanitation is not just a technical issue but a social one, shaped by policy, race, and geography. They argue that decentralized systems can empower communities by offering locally controlled, adaptable solutions that reflect cultural and environmental needs. Overall, they position sustainable water infrastructure as a key strategy for advancing both environmental and social goals.

Keywords: ecosystem, biological wastewater treatment, wastewater wetland, living machine, nature based solutions.

Andersson, Kim, Sarah Dickin, and Arno Rosemarin. “Towards ‘Sustainable’ Sanitation: Challenges and Opportunities in Urban Areas.” *Sustainability* 8, no. 12 (December 8, 2016): 1289. https://doi.org/10.3390/su8121289.

The authors in this article address the urgent problem of unsustainable sanitation systems in rapidly growing urban areas. They highlight the challenges of such dysfunctional infrastructure, inequitable access, health risks from untreated water, and low political prioritization. The authors make the argument that conventional sanitation approaches focus too narrowly on toilets and sewer systems and neglect long term sustainability, resource recovery, and user needs. They propose a shift towards sustainable sanitation systems that are economically viable, socially inclusive, and environmentally protective. Some key methods discussed include framing sanitation as part of urban development, resource recovery, and applying cost benefit analyses to demonstrate the economic and social benefits of a more sustainable system. Case studies show how resource recovery can improve food security, generate energy, and create business opportunities. The authors conclude with identifying sustainable sanitation as a catalyst for achieving multiple sustainable goals, but needs political will and integrated planning to be effective.

Keywords: Urbanization, sustainable sanitation, resource recovery, urban planning and development, public health.

Anguelovski, Isabelle, Anna Livia Brand, Malini Ranganathan, and Derek Hyra. “Decolonizing the Green City: From Environmental Privilege to Emancipatory Green Justice.” *Environmental Justice* 15, no. 1 (May 26, 2021). https://doi.org/10.1089/env.2021.0014.

The authors of this study ask how we urban greening can enact a more emancipatory green justice in order to address the problem of environmental privilege in urban planning where projects often reinforce racial and class inequalities, rather than dismantling them. This study is in grand part a reflection on the development of the 11th Street Bridge Park in DC, and critiques how “green cities” often cater to wealthier, white residents while displacing marginalized communities through gentrification. The analysis draws on ongoing research in DC, which includes interviews with

neighborhood residents, community activists, and local non-profits. The authors propose a framework to strive for emancipatory green justice, with strategies such as community-led design, recognition of Indigenous and local knowledge, engagement with activist practices to resist exclusionary green policies, and more. The authors ultimately call for transforming urban "green" planning from a tool of privilege into one that actively addresses historical injustices and supports inclusive, equitable cities.

Keywords: green justice, urban planning, environmental privilege, green cities, equity.

Ashat, Daniel, Nicole Tepper, and Caroline Pawlow. "An Evaluation of Food Insecurity in the D.C. Community." *Georgetown Scientific Research Journal* 2, no. 2 (August 27, 2022): 78–86. https://doi.org/10.48091/gsr.v2i2.49.

The authors in this article examine food insecurity in DC, particularly focusing on wards 7 and 8 in Southeast DC, where they point out that food deserts are the most prevalent. The authors point out that these areas only have four grocery stores (across 17.1 square miles) and residents, who are predominantly Black and low-income, face limited access to nutritious and affordable foods. Additionally, the authors highlight how systemic factors like poverty, race, and education contribute to this crisis. A cycle is created that discourages healthy food retailers from entering these communities. The authors also importantly highlight how current policies like the FEED D.C. Act and the Healthy School Act, that aim to improve food access, fall short because their reach is limited. Only two of the grocery stores in ward 8 have received tax exemptions, while none have in ward 7. Ultimately, the authors argue that addressing this issue requires an equity focused approach that goes beyond proximity to grocery stores. Some suggestions are community based solutions such as mobile food pantries and educational resources on food prep.

Keywords: food desert, food insecurity, food access, community based solutions.

Avni, Nufar, and Raphaël Fischler. "Social and Environmental Justice in Waterfront Redevelopment: The Anacostia River, Washington, D.C." *Urban Affairs Review* 56, no. 6 (March 22, 2019): 107808741983596. https://doi.org/10.1177/1078087419835968.

The authors examine how redevelopment along the Anacostia River intersects with issues of equity, displacement, and environmental restoration. The authors analyze planning documents, policy frameworks, and community responses to show how revitalization efforts often prioritize economic growth and aesthetics over the needs of long standing, predominantly Black communities. They argue that while environmental efforts, like river clean up and park creation, are framed as universally beneficial, they also accelerate gentrification and erode local cultural identity. The authors discuss the Anacostia River's history as a polluted and neglected waterway, shaped by industrial use and racialized urban planning, and critiques how its recent transformation is marketed as a "return to nature" without acknowledging past harms. Historical references include the river's role as a boundary and dumping ground, and its symbolic weight in local activism. Ultimately, the authors call for more inclusive and justice oriented approaches to waterfront redevelopment that center community voices and historical accountability.

Keywords: Anacostia, redevelopment, community voices, history, gentrification.

Barman, Anushri, Fulena Rajak, and Ramakar Jha. "Integrating Wetlands as Nature-Based Solutions for Sustainable Built Environments." *Engineering Technology & Applied Science Research* 14, no. 6 (December 2, 2024): 18670–80. https://doi.org/10.48084/etasr.8923.

The authors of this article go in depth about the vital role that wetlands play in ecosystems. The discussion in this article includes the benefits of integrating wetlands as nature-based solutions (NBS) in infrastructure and design strategies and different case studies reveal the successes in implementing wetlands as NBS in development strategies. These case studies also cover natural and artificial wetlands and the different types that exist, such as retention ponds, reed beds, constructed wetlands, and more. The findings in this article are extremely important as they reveal the contributions of wetlands to a sustainable built environment. These contributions include ecological resilience, sustainable stormwater management, biodiversity enhancement, recreational and cultural value, wetlands as a solution to pollution, and more.

Keywords: nature-based solutions, sustainable built environment, ecosystem based adaptions, sustainable urban development, ecological resilience, pollution control.

Batarseh, Feras A., Mehmet Oguz Yardimci, Ryu Suzuki, Md Nazmul Kabir Sikder,

Zhiwu Wang, and W. Mao. "Realtime management of wastewater treatment plants using AI." Virginia Tech & DC Water (2022): 2022-11. https://www.waterrf.org/sites/default/files/file/2022-11/2022_IWS-Challenge-Solution_Virginia-Tech.pdf.

In this 2022 Virginia Tech Report, the authors present data-driven solutions to improve wastewater treatment efficiency and environmental monitoring in DC. The authors focus on the Blue Plains Advanced Wastewater Treatment Plant (Blue Plains Advanced WWTP), highlighting its role as one of the largest and most advanced facilities of its kind in the world. The report examines how Blue Plains processes millions of gallons of wastewater daily, serving the DC metropolitan area and playing a critical role in protecting the Anacostia and Potomac Rivers from pollution. Using machine learning and sensor data, the authors developed predictive models to optimize treatment operations and reduce nutrient discharge, particularly nitrogen and phosphorus, which contribute to river degradation. The document emphasizes the importance of real-time data and intelligent systems in enhancing environmental outcomes and regulatory compliance. Blue Plains is portrayed not only as a technical powerhouse but also as a key player in regional water quality and sustainability efforts. Overall, the report uses Blue Plains as a case study in smart infrastructure.

Keywords: Blue Plains Advanced WWTP, wastewater, Anacostia, nutrients.

Beatley, Timothy. "Ecological Water Management in Cities." *Oxford Research Encyclopedia of Environmental Science.* 30 Jan. 2024; Accessed 15 Sep. 2025.https://oxfordre.com/environmentalscience/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-839.

Beatley explores the challenges that urban areas face in managing water due to things like climate change, urbanization, and the degradation of ecological systems. The main takeaway is the argument that ecological planning, using nature-based solutions like wetland restoration, green roofs, and bioswales, is the most effective approach to improving water quality, reducing flood risks, and ensuring long-term water supply. Beatley highlights many different examples of how cities are implementing and integrating ecological design into water management. He specifically mentions the Anacostia River in DC and the years worth of restoration work that have gone into the river. This is significant to this thesis as the proposal includes floating wetlands to aid in cleaning the river.

Keywords: ecological planning, ecological water management, nature-based solutions, planning for climate change, principles for urban water management.

Bedimo-Rung, Ariane L., Andrew J. Mowen, and Deborah A. Cohen. "The Significance of Parks to Physical Activity and Public Health." *American Journal of Preventive Medicine* 28, no. 2 (February 2005): 159–68. https://doi.org/10.1016/j.amepre.2004.10.024.

The authors of this article link parks to physical activity and public health, urging for the need for environmental approaches to promote physical activity. They discuss how parks contribute to physical, social, economic, and environmental benefits, but highlight the disparity in park conditions among different demographic groups. Six conceptual areas are discussed, features, condition, access, aesthetics, safety, and policies, with the goal of improving park environments. This analysis of park environments is relevant to this thesis as the proposed floating wetlands can be considered a park and the findings from this article will contribute to the approach and design of them.

Keywords: parks, environmental benefits, public health, physical activity.

Burr, Charles R. "A Brief History of Anacostia, Its Name, Origin and Progress." *Records of the Columbia Historical Society, Washington, D.C.* 23 (1920): 167–79. https://doi.org/10.2307/40067143.

The author provides a brief historical account, written in 1920, that outlines the development of the Anacostia neighborhood in DC. He pays particular attention to its early settlement, transportation infrastructure, and civic growth. He points out the area's transformation from a rural landscape into a more urbanized community, highlighting key figures such as John Howard and Frederick Douglass. The author emphasizes the role of bridges, railroads, and streetcars in connecting Anacostia to the broader city, facilitating both economic and residential expansion. Regarding the Anacostia River, the author mentions its significance as a geographic boundary and transportation route, noting that early settlers relied on ferries to cross it before bridges were constructed. The river is portrayed as both a natural feature shaping the community's layout and a challenge to connectivity that was gradually overcome through infrastructure. Additionally, the author touches on the environmental and aesthetic qualities of the river, describing its banks and surroundings as picturesque and historically meaningful. Overall, the author

provides an informative account of the Anacostia River and surrounding communities from 1920.

Keywords: Anacostia, early settlement, urban community, infrastructure.

Cantwell, Thomas J. "Anacostia: Strength in Adversity." *Records of the Columbia Historical Society, Washington, D.C.* 49 (1973): 330–70. https://doi.org/10.2307/40067747.

The author presents a historical and sociological portrait of the Anacostia neighborhood in DC, emphasizing its resilience amid economic and racial challenges. The author traces Anacostia's development from its early days as a white working-class suburb to its transformation into a predominantly Black community. This played a role in shaping housing policies, segregation, and urban renewal efforts. The author highlights the role of community organizations and local activism in confronting poverty, inadequate services, and political neglect. The Anacostia River is discussed primarily as a geographic and symbolic boundary, once a connector via ferry and bridge, later a divider between communities and a site of environmental decline. The river's deterioration is linked to industrial pollution and neglect, reflecting broader patterns of disinvestment in the area. The author also notes efforts to reclaim and restore the river, framing it as part of the community's struggle for dignity.

Keywords: Anacostia, history, transformation, disinvestment.

Davis, Kimaya, Brooke Oliver, Noam Procunier, Kateryn Rivera, and Anthony Ventura. "Feeding the Future: Reducing Food Insecurity in Southeast DC." Health Sciences Research Commons, 2024. https://hsrc.himmelfarb.gwu.edu/dchapp/22/.

This report focuses on food insecurity in Southeast DC, particularly in wards 7 and 8, where access to healthy and affordable foods is severely limited. The authors highlight how historical disinvestment, racial inequities, and economic challenges have contributed to the lack of grocery stores and nutritious food options in these predominantly Black communities. The authors importantly emphasize how food insecurity isn't just about hunger, it's also about the inability to consistently access culturally appropriate and nutritious meals. The authors explore initiatives like community gardens, mobile markets, and nonprofit partnerships that aim to fill in the gaps left by traditional food

systems. Importantly, the authors advocate for community-led solutions that empower residents and begin to address root causes, rather than just temporary fixes. Food insecurity should be treated as a public health and social justice issue.

Keywords: Food insecurity, public health, social justice, community, access.

Doyle, Joyce M. "Essential-Service Shopping and Spatial Disinvestment among Black Homeowners in Ward 8, Washington, D.C." *Urban Science* 9, no. 9 (September 22, 2025): 384. https://doi.org/10.3390/urbansci9090384.

The author of this study explores how urban design and planning can better support communities that face systemic inequalities, with a focus on DC's ward 8 as a case study. The author argues that traditional planning methods often overlook the lived experience of marginalized residents, leading to designs that fail to meet their needs. The author proposes a framework called "radical care", which emphasizes empathy, community engagement, and long-term commitment to place-based justice. Ward 8 is highlighted as a historically underserved era area, where residents face disinvestment, environmental hazards, and limited access to public resources. The study critiques past planning efforts in ward 8 and advocates for co-creative processes that center local voices. Through participatory research and interviews, the author shows how residents of ward 8 envision safer, more inclusive, and culturally affirming public spaces. Ultimately, the study calls for planners to shift from technical solutions to relational practices that honor community knowledge and resilience.

Keywords: black middle class, spatial routines, racial capitalism, urban consumption behaviors, third places, ward 8, Washington DC.

Dwyer, Madeleine. "'Forgotten' by the Clean Water Act: The Anacostia River's Evolving Environmental Justice Problems." *Maryland Law Journal of Race, Religion, Gender and Class* 21, no. 2 (2021): 311–37.

Dwyer looks into the long history of pollution in the Anacostia River, which has been heavily contaminated for over 200 years by sewage, industrial waste, and poor storm water management. This has harmed nearby communities, which are mostly black and low-income. These communities have faced higher health risks, food insecurity, and have limited access to public resources. Although the Clean Water Act was supposed to help improve the

conditions of the river, the Anacostia has received less attention and has had slower progress in comparison to The Potomac River. Even as the Anacostia River's conditions have improved over the past years, many residents worry that cleanup efforts can lead to environmental gentrification. The result being that new developments push out the people who have been working for years to restore the river. Dwyer states that now is the chance to correct the past and ensure that the river's future cleanup includes equity, justice, brings affordable housing, local jobs, and benefits existing residents. This is extremely important to this thesis as it is one of the main goals and hopes for the outcome of the proposal.

Keywords: Anacostia, river, segregation, environmental gentrification, equity.

Erickson, Bradley O., Daniel E. Esser, and Katie L. Turner. "Spatial Dynamics of Racialized Income Inequality in the Washington, DC, Metropolitan Area." *The Professional Geographer* 73, no. 1 (October 12, 2020): 72–84. https://doi.org/10.1080/00330124.2020.1812407.

The authors examine how racialized income inequality is distributed across DC, using spatial analysis to highlight patterns of segregation and economic disparity. The study shows how income inequality is not just a matter of individual wealth, but is deeply tied to geography, race, and historical policy decisions. Ward 7 and 8 are identified as areas with significant lower median incomes and higher concentrations of Black residents compared to other wards in DC. The study emphasizes that these wards have been systematically excluded from economic growth and infrastructure investment, which in turn reinforce cycles of poverty and limit access to opportunity. In contrast, wealthier and predominantly white wards benefit from proximity to job centers, better schools, and public amenities. The authors argue that addressing these disparities requires place-based interventions that consider both racial and spatial dimensions of inequality.

Keywords: gentrification, income inequality, space stratification theory, race, Washington DC.

Fan, Chunzhen, Cunhong Lv, Zhiquan Wang, Suqing Wu, Zhan Jin, Ke Bei, Shengbing He, et al. "Influence of Regular Addition of Ore on Treatment Efficiency and Aquatic Organisms in Living Machine System for Black Water

Treatment." *Journal of Cleaner Production* 341 (February 14, 2022): 130928. https://doi.org/10.1016/j.jclepro.2022.130928.

The authors focus on decentralized systems that support environmental justice and community resilience. The authors evaluate various approaches including constructed wetlands and "living machines" as alternatives to large, centralized infrastructure. Living machines are described as engineered ecosystems that mimic natural wetlands, using plants, microbes, and aquatic life to treat wastewater in visually appealing, educational settings. The authors highlight their potential for low energy operation, nutrient removal, and integration into public spaces, making them especially suitable for underserved urban communities. While living machines are praised for their ecological and social benefits, the authors also note limitations such as land requirements and maintenance needs. The authors emphasize the importance of aligning technical innovation with community engagement and equity goals. Overall, the authors position living machines as part of a broader movement towards sustainable inclusive water infrastructure.

Keywords: Living machine, wetlands, community engagement, water infrastructure.

Gibbons, Joseph, Michael S Barton, and Timothy T Reling. "Do Gentrifying Neighbourhoods Have Less Community? Evidence from Philadelphia." *Urban Studies* 57, no. 6 (March 19, 2019): 004209801982933. https://doi.org/10.1177/0042098019829331.

The authors investigate whether gentrifying neighborhoods experience a decline in community cohesion, using Philadelphia as a case study. The authors analyze survey data and neighborhood level changes to assess how residents perceive trust, belonging, and social ties during periods of rapid demographic and economic shifts. Contrary to common assumptions, the findings suggest that gentrification does not uniformly erode community. In some cases, it may even strengthen certain forms of civic engagement. However, the effects vary depending on race, income, and tenure, with long term residents, especially Black and lower income individuals who often feel more disconnected or displaced. The article emphasizes that community is a complex and evolving concept, shaped by both structural forces and individual experiences. The authors call for more nuanced urban policy that recognizes the diverse impacts of neighborhood change. Overall, the study contributes to debates on gentrification by highlighting the uneven social consequences of urban development.

Keywords: gentrification, urban development, community, displacement, urban policy.

Hoch, Patty . “Restoring the Anacostia River.” *Student On-Line Journal, Horticultural Science* 1, no. 1 (1996). conservancy.umn.edu.

Hoch describes the Anacostia River and its watershed and highlights the Anacostia Watershed Restoration Agreement of 1984. The author mentions the challenges of the restoration project, in part due to the bureaucratic process and the different jurisdictions the river is in. The author goes in depth about restoration goals and progress made, particularly in wetland creation and forest cover. This is particularly significant to this thesis as part of the proposal is the introduction of floating wetlands.

Keywords: Anacostia, dredging, watershed, wetland, restoration.

Jeffres, Leo W., Cheryl C. Bracken, Guowei Jian, and Mary F. Casey. “The Impact of Third Places on Community Quality of Life.” *Applied Research in Quality of Life* 4, no. 4 (October 13, 2009): 333–45. https://doi.org/10.1007/s11482-009-9084-8.

The authors of this article explore how neighborhood social capital can improve the well-being of low income urban residents. The authors argue that beyond economic resources, strong social networks and shared community spaces place a vital role in helping individuals navigate poverty and social exclusion. A key concept discussed is “third place”, which are informal gathering spots like cafes, parks, or community centers that are neither home nor work, but foster connection and belonging. These third places are shown to be crucial for building social capital, especially in disadvantaged neighborhoods where formal institutions may be lacking. The study emphasizes how not all social capital is equally accessible and its benefits often depend on factors like race, class, and local history. It also cautions that tight-knit communities can sometimes reinforce exclusion or limit upward mobility. Overall, the authors call for urban policies that support inclusive third places that strengthen community ties.

Keywords: social capital, third place, community, belonging, accessibility, inclusivity.

Kimble, Megan, and Andre D. Wagner. "Can Anacostia build a bridge without displacing its people." New York Times (2022).

Kimble, Megan, and Andre describe the 11th Street Bridge Park Project in DC that aims to repurpose piers from the 11th Street Bridge, which are abandoned infrastructure, to create a pedestrian link between West (central DC) and East DC. This public park is aimed to become a cultural hub and connect predominantly white and affluent neighborhoods on the West of the Anacostia with historically Black and low-income neighborhoods to the East. The authors present the potential for gentrification that the project could bring and compare it to similar projects like The High Line in New York City. The authors also dive into the history of the Anacostia River and note its transformation from a predominantly white suburb to a majority black neighborhood after decades of disinvestment and discriminatory housing policies.

Keywords: gentrification, equitable development, Anacostia, infrastructure, displacement.

King, Christopher J., Bryan O. Buckley, Riya Maheshwari, and Derek M. Griffith. "Race, Place, and Structural Racism: A Review of Health and History in Washington, D.C." *Health Affairs* 41, no. 2 (February 1, 2022): 273–80. https://doi.org/10.1377/hlthaff.2021.01805.

The author explores how systemic racism has shaped health outcomes for Black residents in DC. It traces historical roots of segregation, discriminatory housing policies, and disinvestment in Black communities, showing how these forces have created lasting health disparities. The author emphasizes specific neighborhoods in DC, such as Anacostia and Shaw, are examples of how place and race intersect to influence access to healthcare, environmental safety, and economic opportunity. The report also examines the role of public health institutions and policy decisions in perpetuating and addressing these inequalities. Using data and historical analysis, the authors connect past injustices to present day health gaps, including higher rates of chronic illness and lower life expectancy among Black Washingtonians. The document is grounded in DC specific history and policy, making it a valuable resource for understanding local health equity challenges. Overall, it offers a compelling case for place based interventions and anti-racist public health strategies in the nation's capital.

Keywords: access to care, racism, health equity, hospital closures, health disparities, life expectancy, education.

Logan, John. “Racial Segregation in Postbellum Southern Cities: The Case of Washington, D.C.” *Demographic Research* 36: 1759–1784. doi:10.4054/DemRes.2017.36.57. (June 7, 2017): 1759–84. https://doi.org/10.4054/demres.2017.36.57.

Logan conducts a study that examines residential segregation in Washington DC in 1880. In particular the author highlights the distinctive alley patterns in DC at different spatial scales and their findings. The findings reveal how segregation can also be understood in terms of boundaries between people even when they live in proximity to one another. Maps illustrated depict how black homes disproportionately face alleys or detached structures like sheds or garages, while white homes more often have street front access and views. This is relevant to this thesis as one can make similar findings with current developments in DC at Navy Yards vs Poplar Point and other waterfront parcels in Southeast DC.

Keywords: Segregation, Southeast DC, Anacostia, historically, developments.

MacAvoy, Stephen E., and Alex Lunine. “Anthropogenic Influences on an Urban River: Differences in Cations and Nutrients along an Urban/Suburban Transect.” *Water* 14, no. 9 (April 20, 2022): 1330. https://doi.org/10.3390/w14091330.

The authors investigate nutrient pollution, specifically nitrogen and phosphorus, in the Anacostia River. They focus on how land use and stormwater runoff contribute to water quality challenges. The authors use modeling techniques to assess how different urban spaces, like roads, rooftops, and green spaces, affect nutrient loads entering the river. They find that impervious surfaces significantly increase nitrogen and phosphorus levels, especially during storm events. Through their study, the authors highlight that the Anacostia River has historically suffered from elevated nutrient concentrations, with phosphorus levels often exceeding regulatory thresholds. It also notes that nitrogen levels, while variable, remain a persistent concern due to their role in eutrophication. Both phosphorus and nitrogen play a role in eutrophication, which is when there’s an excess of nutrients in water, leading to algae blooms and the death of animal life due to lack of oxygen. Overall, the authors advocate for targeted green infrastructure and land-use planning to reduce nutrient runoff and improve river health.

Keywords: Eutrophication, Anacostia, phosphorus, nitrogen, stormwater runoff.

Masoud, Ahmed M. N., Amani Alfarra, and Sabrina Sorlini. “Constructed Wetlands as a Solution for Sustainable Sanitation: A Comprehensive Review on Integrating Climate Change Resilience and Circular Economy.” *Water* 14, no. 20 (October 13, 2022): 3232. https://doi.org/10.3390/w14203232.

The authors of this article review the global sanitation challenge, where around 80% of wastewater is released untreated, creating risks for humans and environmental health. Some problems with conventional wastewater treatment systems are they’re often too expensive and energy-intensive. The authors explore constructed wetlands (CWs) as a low-cost, sustainable, nature-based solution. CWs are beneficial as they use natural processes involving plants, microorganisms, and more, to remove pollutants like nutrients, suspended solids, and heavy metals. The authors analyze different types of CWs and highlight their advantages, such as affordability, low energy use, ease of operation, and resilience to climate change. They also highlight how they can be integrated into a circular economy through water reuse, nutrient recovery, and biomass utilization. Finally, the authors also review the limitations of CWs, which include land requirements, accuracy of design, changes in seasons, and varying rates for pollutant removal, but conclude that CWs represent a promising and sustainable sanitation technology.

Keywords: nature-based solutions, sustainable sanitation, constructed wetland (CW), wastewater treatment, climate change resilience, circular economy.

Matthew Powell, "The Anacostia River: Urbanization, Pollution, EPA Failures, and the Collapse of the Public Trust Doctrine," University of Baltimore Law Forum 41, no. 1 (Fall 2010): 68-88

Powell provides a history into the Anacostia River, its pollution levels, and the failed policies to help clean the river. Powell points out the 176 square miles of the river’s watershed, which is the area of land that collects and drains water from rain, snowmelt, and groundwater. The river was once a thriving ecosystem, but is now very shallow and holds some of the most polluted water in the country due to urban sprawl and the construction of the nation’s capital. Most importantly, Powell goes in depth about the Clean Water Act and how it’s more policy rather than enactment. Under the EPA states are required to develop lists of impaired waters that are too polluted to meet water quality standards. The EPA defines TDML (Total Daily Maximum Loads) as a calculation of the maximum amount of a pollutant that a waterbody can

receive and still safely meet water quality standards. The Anacostia doesn't fully meet its TDML, but significant progress has been made. This progress is in great part due to work by the Anacostia Watershed Society and The Chesapeake Bay Foundation.

Keywords: Anacostia, watershed, dredging, Clean Water Act, TDML

Middleton, Beth A, and Jere Boudell. "Salinification of Coastal Wetlands and Freshwater Management to Support Resilience." *Ecosystem Health and Sustainability* 9 (January 1, 2023). https://doi.org/10.34133/ehs.0083.

Middleton and Jere discuss how rising sea levels, storms, and human activities are causing saltwater to spread into coastal wetlands. This process is called Salinification and it stresses plants and animals and causes trees to die off. This is important for this thesis and part of the effort is to either restore wetlands that existed once along the Anacostia River or introduce floating wetlands. The end goal being to restore and protect biodiversity, natural habitats, and support vulnerable ecosystems during climate change. Additionally, wetlands help as barriers or sponges during floods so it can also help protect vulnerable infrastructure in DC.

Keywords: wetlands, floods, ecosystem, biodiversity, natural habitats, restoration.

Parde, Divyesh, Aakash Patwa, Amol Shukla, Ritesh Vijay, Deepak J. Killedar, and Rakesh Kumar. "A Review of Constructed Wetland on Type, Treatment and Technology of Wastewater." *Environmental Technology & Innovation* 21 (November 21, 2020): 101261. https://doi.org/10.1016/j.eti.2020.101261.

The authors of this article examine the problem with treating diverse types of wastewater, ranging from dairy to industrial, municipal, agricultural, and more. Conventional technologies for wastewater management are often costly, energy-intensive, and very complex. The authors present constructed wetlands (CWs) as a sustainable and low-cost alternative and reviews the many different types, including free water surface, horizontal flow, vertical flow, hybrid, and more. They provide different diagrams as to how these different systems work. They also very importantly highlight how different plants and substrates (gravel, sawdust, clay aggregate), enhance pollutant removal. Lastly, the authors identify CWs as a low-cost treatment technology in

comparison with other treatment technologies and call for further research to further optimize the design systems and efficiency of CWs.

Keywords: sewage, wastewater, media, vegetation.

Pugazhendhi, Avani, Anuj Gangopadhyaya, and Stephen Zuckerman. “Investigating Racial, Ethnic, and Neighborhood Disparities in Access to Safe Hospital Care in Washington, DC,” 2025. https://www.urban.org/sites/default/files/2025-02/Investigating_Racial_Ethnic_and_Neighborhood_Disparities_in_Access_to_Safe_Hospital_Care_in_Washington_DC.pdf.

This article investigates racial, ethnic, and neighborhood disparities in access to safe hospital care in DC, particularly focusing on ward 7 and 8. It highlights how the predominantly Black and low-income residents in these areas face significant barriers to receiving high quality hospital services, such as proximity to well resourced facilities and higher rates of adverse health outcomes. Through data analysis, the authors of this article find that the hospitals serving these wards tend to have lower safety ratings in comparison to those in wealthier, predominantly white neighborhoods. This disparity is linked to broader systems such as historical segregation, underinvestment in healthcare infrastructure, and socioeconomic inequality. Overall, the study underscores the urgent need for equity focused reforms to ensure that all DC residents have access to safe and effective hospital care.

Keywords: Socioeconomic inequality, hospital services, historical segregation, underinvestment, reform.

Salimi, Shokoufeh, Suhad A.A.A.N. Almuktar, and Miklas Scholz. “Impact of Climate Change on Wetland Ecosystems: A Critical Review of Experimental Wetlands.” *Journal of Environmental Management* 286, no. 286 (May 2021): 112160. https://doi.org/10.1016/j.jenvman.2021.112160.

The authors of this article identify climate change as a major threat to wetlands, which provide critical services like carbon sequestration, water purification, and floor control. Altered hydrology and rising temperatures can change the biochemistry and function of wetlands, to a degree where their important services can be turned into disservices. Examples of this are how they could no longer offer water purification and instead release nutrients to

surface waters and how a higher rate of decomposition than photosynthesis can lead to a shift from wetlands acting as carbon sinks to acting as carbon sources. The authors analyze constructed wetlands as a potential solution to this issue, in terms of gas emissions, temperatures, water availability, and nutrient release. The study aims to support sustainable wetland management strategies that enhance resilience and maintain pivotal ecosystem services under future climate conditions.

Keywords: constructed wetland, climate chamber, greenhouse gases, mesocosm experiment, peatland, wetland management.

Sertolli, Ardit, Zoltán Gabnai, Péter Lengyel, and Attila Bai. "Biomass Potential and Utilization in Worldwide Research Trends—a Bibliometric Analysis." *Sustainability* 14, no. 9 (May 4, 2022): 5515. https://doi.org/10.3390/su14095515.

The authors of this article explore the concept of biomass utilization as a sustainable strategy for managing organic waste and producing renewable energy. Biomass refers to organic matter, such as plants, that can be harvested for energy, water treatment, and other valuable resources. The authors explain that using biomass helps reduce greenhouse gas emissions, supports circular economies, and offers alternatives to fossil fuels. The authors review different technologies for biomass conversion and also discuss policy frameworks and economic incentives that can encourage wider adoption, especially in urban settings. Overall, the authors highlight the significant role that biomass utilization can play in contributing to environmental sustainability and energy resilience.

Keywords: biomass utilization, sustainable energy, circular economy, environmental sustainability.

Shapiro, Justin. "Infrastructure and Inequality in Washington, D.C.: Environmental Change and Federal Management of the District's Forgotten River." *Journal of Urban History*, November 14, 2024. https://doi.org/10.1177/00961442241286454.

Shapiro examines how federal planning shaped the Kenilworth neighborhood, which the Anacostia River runs along. This planning entrenched environmental and racial inequality, with one main example being pointed out. Shapiro goes into the history of the Kenilworth Dump, a massive

municipal landfill that was placed beside public housing where many displaced Black families lived. The placing of this landfill in this neighborhood is a prime example of how the cleanliness of the city of DC came at the expense of the health and safety of marginalized communities. Shapiro mentions a tragic incident that happened on site and how it sparked the conversation to bring change. Shapiro also highlights how the Anacostia River is the "forgotten" river of DC in comparison to The Potomac. This study is relevant to this thesis as these patterns of urban renewal, displacement, and environmental racism are part of the problem that this thesis wished to address.

Keywords: Anacostia, Kenilworth, displacement, marginalized communities, environmental racism.

Swope, Carolyn. "The Problematic Role of Public Health in Washington, DC's, Urban Renewal." *Public Health Reports* 133, no. 6 (October 9, 2018): 707–14. https://doi.org/10.1177/0033354918794932.

Swope's article examines how public health was used to justify urban renewal policies that displaced thousands of residents. The study focuses on Southwest DC, where a grand majority of buildings were demolished with the pretext that the clearance was needed to combat disease and poor housing conditions. This resulted in the displacement of thousands, majority of them being low-income and black residents. Most residents couldn't move back to new more expensive developments that favored wealthier residents. Additionally, if they were able to move back, they found themselves in a neighborhood that lost its sense of community. This is relevant to this thesis as it can be observed how historically low-income and black residents have been displaced and now mostly live in Southeast DC. A main focus of this thesis is to bridge the gap between central and Southeast DC.

Keywords: urban health, urban renewal, history, housing, health disparities.

Tian, Li, Lu Jinzhong, Yang ShengLin, Ye Zhourong, Zhao Min, Kong Hai-nan, and Zheng Xiangyong. "Treatment via the Living Machine System of Blackwater Collected from Septic Tanks: Effect of Different Plant Groups in the Systems." *Environment, Development and Sustainability* 23, no. 2 (May 26, 2020): 1964–75. https://doi.org/10.1007/s10668-020-00658-5.

The authors explore sustainable water infrastructure through the lens of environmental justice, focusing on decentralized wastewater treatment systems. The authors examine how technologies like the “living machine” can support both ecological restoration and community empowerment. The “living machine” is described as a visually engaging, plant based system that mimics natural wetland processes to treat wastewater, offering low energy, educational, and locally adaptable solutions. The authors emphasize its potential for use in underserved urban areas where conventional infrastructure may be lacking or inequitable. Wetlands are discussed more broadly as essential ecological tools for nutrient removal, habitat creation, and climate resilience, especially when integrated into urban planning. The authors argue that combining technical innovation with participatory design can lead to more just and sustainable outcomes. Overall, the authors position the living machine and constructed wetlands as promising strategies for aligning environmental goals with social equity.

Keywords: living machine, community, social equity, infrastructure, equity.

Velinsky, David J., Gerhardt F. Riedel, Jeffrey T. F. Ashley, and Jeffrey C. Cornwell. “Historical Contamination of the Anacostia River, Washington, D.C.” *Environmental Monitoring and Assessment* 183, no. 1-4 (March 15, 2011): 307–28. https://doi.org/10.1007/s10661-011-1923-z.

Velinsky, Gerhardt, Jeffrey T, Jeffrey C conduct a study into the levels of chemical pollutants in the Anacostia River in Washington DC. Chemical pollution has impacted the river over the past 200 years and as a result has categorized the Anacostia River as one of three environmental "regions of concern" by the US EPA (Environmental Protection Agency). In this study, 6 cores (a long cylindrical sample of layered sediment) were collected from sites along the Anacostia River, including Navy Yards and Poplar Point. Their findings are included at the end of their study, which include the concentration of contaminants from the cores sampled. This study is vital for getting a better understanding of the contamination levels of the water along the proposed site for this thesis.

Keywords: Anacostia, River, pollution, sediment, contaminants.

Ventresca, Olivia, Ashley Acevedo, Kristina Nicholas, Jonathan Craig, Sophia Carpenter, Christia Fisher, Madeleine Danzberger, Cassidy Williams, Barbara Balestra, and Stephen MacAvoy. “Concentration and Distribution of Specific Siloxanes (D5 and D6) and PAHs in the Anacostia and Potomac Rivers,

USA.” *Water* 16, no. 14 (July 20, 2024): 2059–59.
https://doi.org/10.3390/w16142059.

The authors study the Anacostia River and its history with contaminants. Some of these include heavy metals, nutrients, pesticides, and industrial chemicals. To address the issue, DC has adopted policy and taken action to make the river “fishable and swimmable” again. One major change is that now 98% of CSO (Combined Sewage Outflow) is diverted to the area’s water treatment facilities instead of flowing into the area’s rivers. Despite changes, the Anacostia River is still struggling and is one of the nation’s 10 most contaminated rivers. This study examined levels of contaminants at different areas along the Anacostia River and their findings reveal their presence. Some of these contaminants include PAHs (Polycyclic Aromatic Hydrocarbons), which are chemicals formed during the incomplete burning of organic materials like coal, oil, wood, garbage, and tobacco. They can contaminate air, soil, and water. The study also analyzes siloxanes (silicones). This study is important for this thesis because it shows how very close to present day, contaminants are still found in the river.

Keywords: Anacostia, contaminants, chemicals, history, soil.

Verhoeven, Jos T.A, and Arthur F.M Meuleman. “Wetlands for Wastewater Treatment: Opportunities and Limitations.” *Ecological Engineering* 12, no. 1-2 (January 1999): 5–12. https://doi.org/10.1016/s0925-8574(98)00050-0.

The authors of this article explore how wetlands, both natural and constructed, can be used to treat wastewater. It focuses on two types, surface flow wetlands, where water flows over the soil, and infiltration wetlands, where water moves vertically through the sediment. These systems have been proven to be effective at removing organic pollutants, bacteria, and often achieve removal rates above 90%. However, it’s important to point out that they are less efficient at removing some nutrients. The authors highlight how different factors like water flow, plant types, and soil conditions influence purification. They also highlight strategies to improve nutrient removal, such as alternating wet-dry cycles and harvesting vegetation. A case study from the Netherlands shows how a well-managed infiltration wetland can meet most wastewater standards. The authors highlight how constructed wetlands offer a sustainable and low-cost solution for small scale wastewater treatment.

Keywords: wetlands, purification, wastewater treatment, low-cost solutions.

Williams, Brett. “A River Runs through Us.” *American Anthropologist* 103, no. 2

(June 2001): 409–31. https://doi.org/10.1525/aa.2001.103.2.409.

The author explores the social, environmental, and racial dynamics surrounding the Anacostia River in DC. The author uses ethnographic research to show how the river has been both a physical and symbolic boundary, especially for marginalized communities in Anacostia. He discusses the river's historical transformation from a vital natural resource to a polluted and neglected waterway, linking its decline to systemic racism, urban planning decisions, and environmental injustice. He highlights how Black residents have long been excluded from decision making processes that affect the river and their neighborhoods. The author also examines community activism aimed at restoring the river and reclaiming its cultural and ecological significance. The Anacostia River's history is framed not just in terms of environmental degradation, but as a reflection of broader struggles over equity, belonging, and visibility.

Keywords: ethnographic research, Anacostia River, marginalized communities, systemic racism, environmental justice.

Relevant Research Topics:

- Ecology, nature-based solutions, biomass utilization, environmental health, living machine
- Socioeconomic disparities, healthcare access, food deserts
- Gentrification, policy, circular economy, segregation
- Community identity, sense of place, community led-design

Contributions of other fields: Environmental Science, Sustainability, Health Science, Urban Science, Health Affairs, Ecosystem Health and Sustainability, Environmental Technology & Innovation, Environmental Management, Urban History, Public Health, Ecological Engineering.