Passaic Valley
Regional Planning & Design Studio

Junior Studio Fall 2017
Rutgers University
Department of Landscape Architecture

Rutgers

Intermediate Landscape Architecture 550:331,
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Rutgers, The State University of New Jersey
Department of Landscape Architecture

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Introduction

Introduction

This studio addresses real world challenges; the development of an open space system along the Passaic River that can help reduce storm water runoff and clarify polluted water. We were charged with developing cohesive green systems and provide safe and easy access to the river. These designs, where appropriately needed, shall address sewage and wastewater problems, such as Combined Sewage Overflows (CSOs).

The Passaic River, historically Native American lands, was an important resource for early European settlements and industrial development in Northern New Jersey. The river provided necessary drinking water, transportation of goods and people, and created energy for one of the earliest industrial developments in the nation. However, the Passaic River is also a "victim" of heavy use and pollution. One example is the industrial production of Agent Orange in Newark. The pollution in the lower portion of the river has become so severe that it has been declared a superfund site. An additional problem is combined sewage outlets that spill raw sewage into the river when heavy rain overburdens the sewage treatment plants.

The Environmental Planning Studio's main goal was to gain the ability to analyze and interpret ecological processes and real life scenarios at varying scales. Through the interpretation of assorted data, the studio analyzed and designed various areas within the Passaic Valley Region. This was to be done at scales ranging from regional to site specific. This studio set out to understand how to design for sustainability and included challenges such as stormwater management, flood management, societal interactions, policy, planning, and zoning.

The Passaic Valley Sewerage Commission (PVSC) acted as "client" for our class. Established in 1902 by an Act of New Jersey State legislature, the commission began operation of the Newark Bay treatment plant in 1924 as a means to alleviate pollution in the Passaic River and its tributaries. An important aspect of simulating professional practice was a thorough consideration of the client's requests. Representatives of PVSC presented information to the class on the pollutants and current state of disturbance in the Passaic River. The river is highly polluted due to Combined Sewage Overflows, non-point source pollution caused by various factors, and years of industrial waste. The client noted the base solutions to address these problems: reducing flooding and impervious surface, utilizing green infrastructure in combination with current grey infrastructure, and finding alternative solutions to costly traditional wastewater management techniques.

To tackle the challenges of the river and surrounding areas, the class started by defining the relevant problems centered around the conditions of the river. In order to better understand what the core challenges are and how they came to be, the class addressed them through the use of problem trees. That is a method to analyze how built, socio-economic, and political systems are interacting in different ways across different scales. In response, solution trees were created to better understand what can be done to tackle these problems, and what will be the outcome of intervening. Afterwards, information was gathered to foster knowledge and data on the region as a whole.

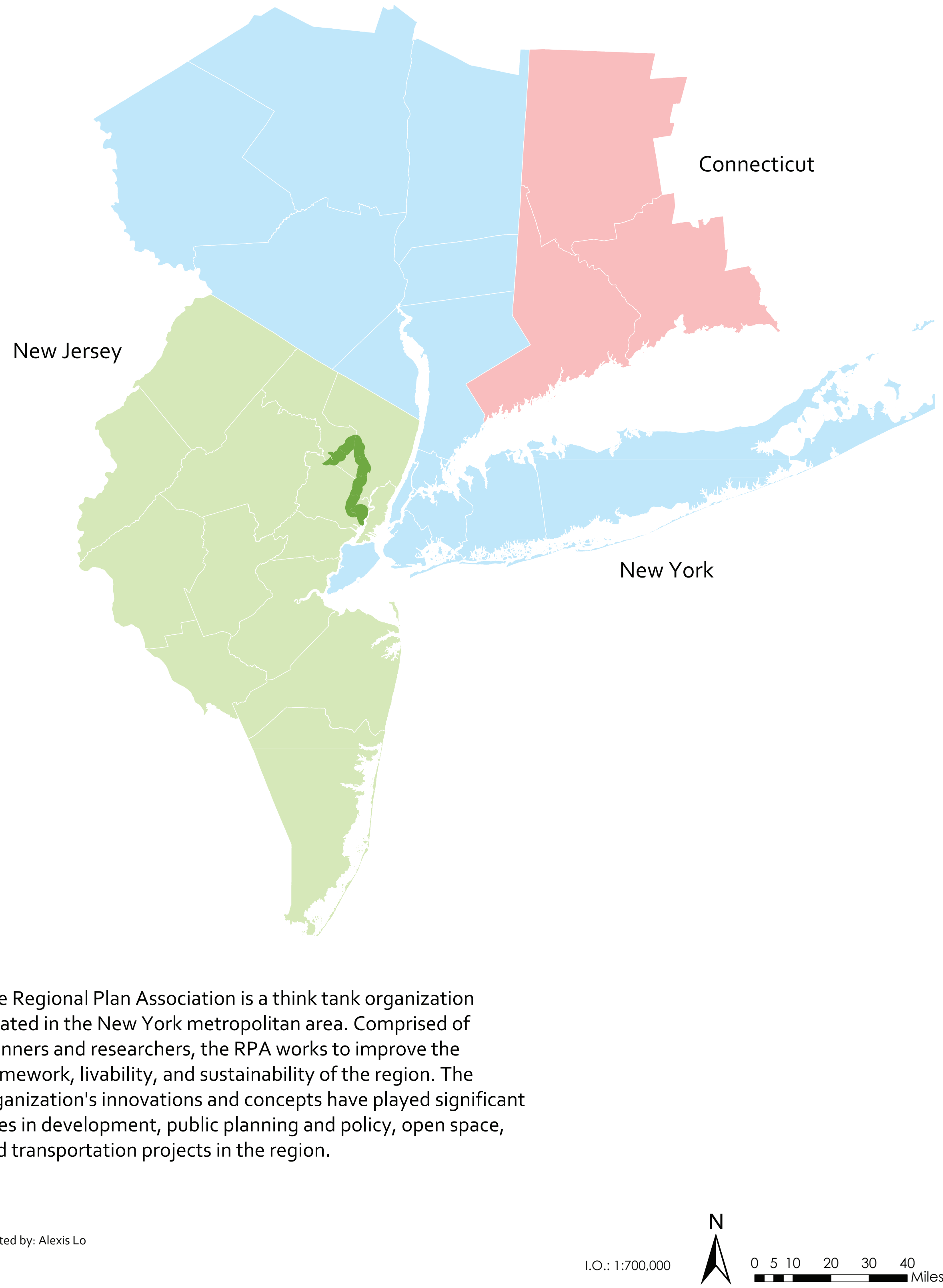
This research included case studies, where each person researched and discussed a particular work of design, engineering, planning, and or any topic that would be relatable to the task at hand. Next, the whole region was split into multiple large scale intervention sites, where groups of designers would form cohesive concepts to deal with the existing problems. Finally, these regional concepts were applied to individual site scale interventions.

Concepts developed by individuals, within group work, and class sessions will help the client to steer future engineering decisions into a more ecological and people friendly direction. Produced maps, diagrams, and designs may support future sustainability practices, regional planning decisions, and future community outreach efforts.

The work displayed in this report has been produced and compiled by undergraduate Landscape Architecture students at Rutgers University. Although this studio focuses on real world problems, applications of the work later presented should be reviewed by professionals before future potential use.

Context Maps

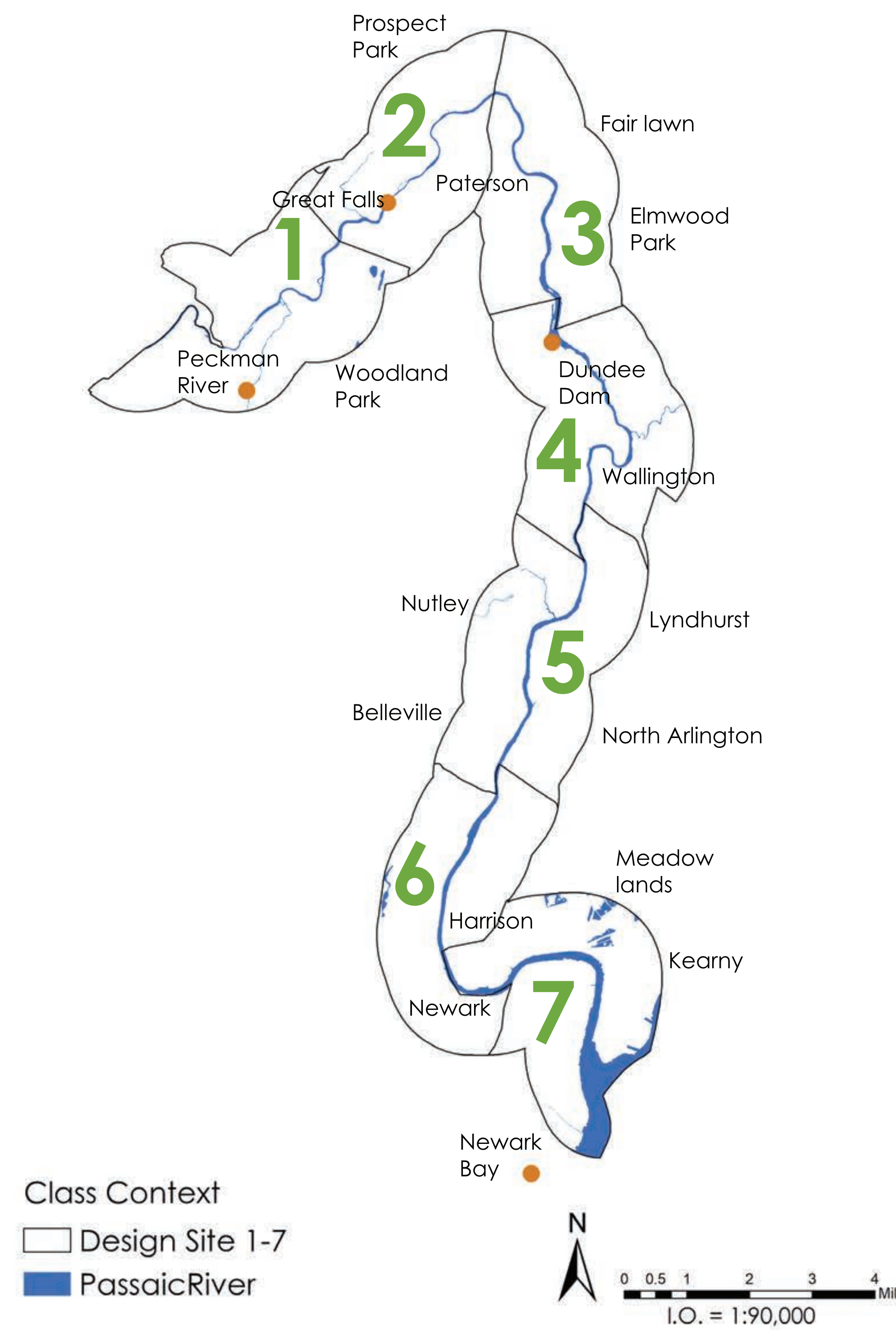
Regional Plan Association Context



The Regional Plan Association is a think tank organization located in the New York metropolitan area. Comprised of planners and researchers, the RPA works to improve the framework, livability, and sustainability of the region. The organization's innovations and concepts have played significant roles in development, public planning and policy, open space, and transportation projects in the region.

Created by: Alexis Lo

Site Intervention Context



The boundaries of the intervention sites are within the Passaic Valley Region, located in northern New Jersey. At a regional scale, a buffer area surrounding the river was split into seven sites. This includes multiple municipalities whose waste water is managed by PVSC. This context map represents the studio's site interventions (in dark green) within the Regional Plan Association of the Metropolitan area.

Inventory

Data inventory
Introduction

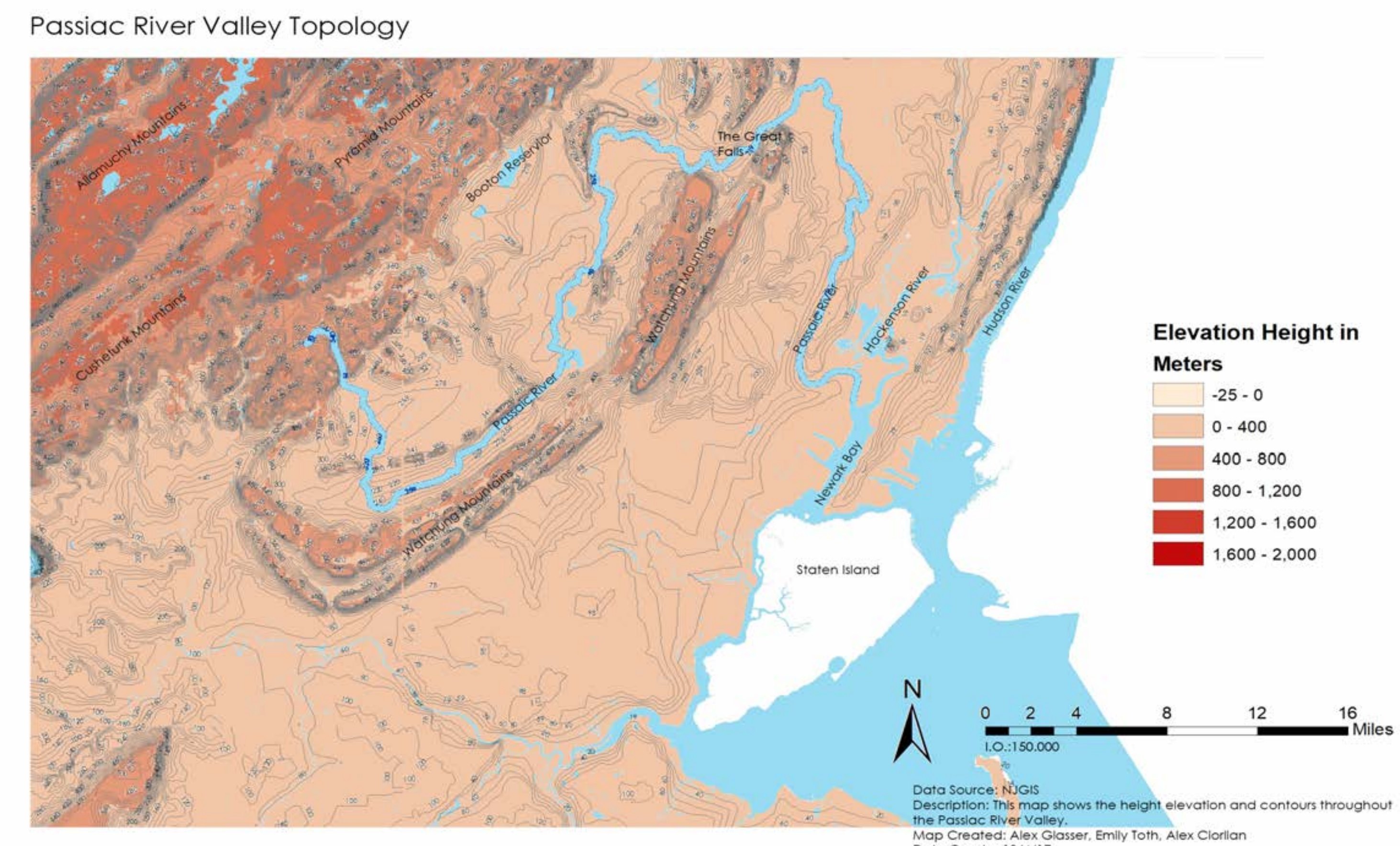
The Passaic River has historically been both the source of great development and prosperity, as well as the victim of the Industrial Revolution it spurred. Cities such as Paterson and Newark boomed in that era with massive silk factories and the first hydroelectric power system created in the Great Falls. But with a fast growing industrialization meant that there will be consequences. These industries needed a place to throw out their waste and that place was the river. Many different chemicals were dumped there and the impact of it could still be seen today.

As large areas began to unite their sewer systems in what seemed to be an innovation, an unfortunate pattern developed that would ultimately lead to a second source of river pollutant. As stormwater runoff accumulated from large areas during storm events from large areas, the excess now all lead to the same sewer system. Pipes began to overflow and release raw sewage directly into the river, with obvious negative consequences.

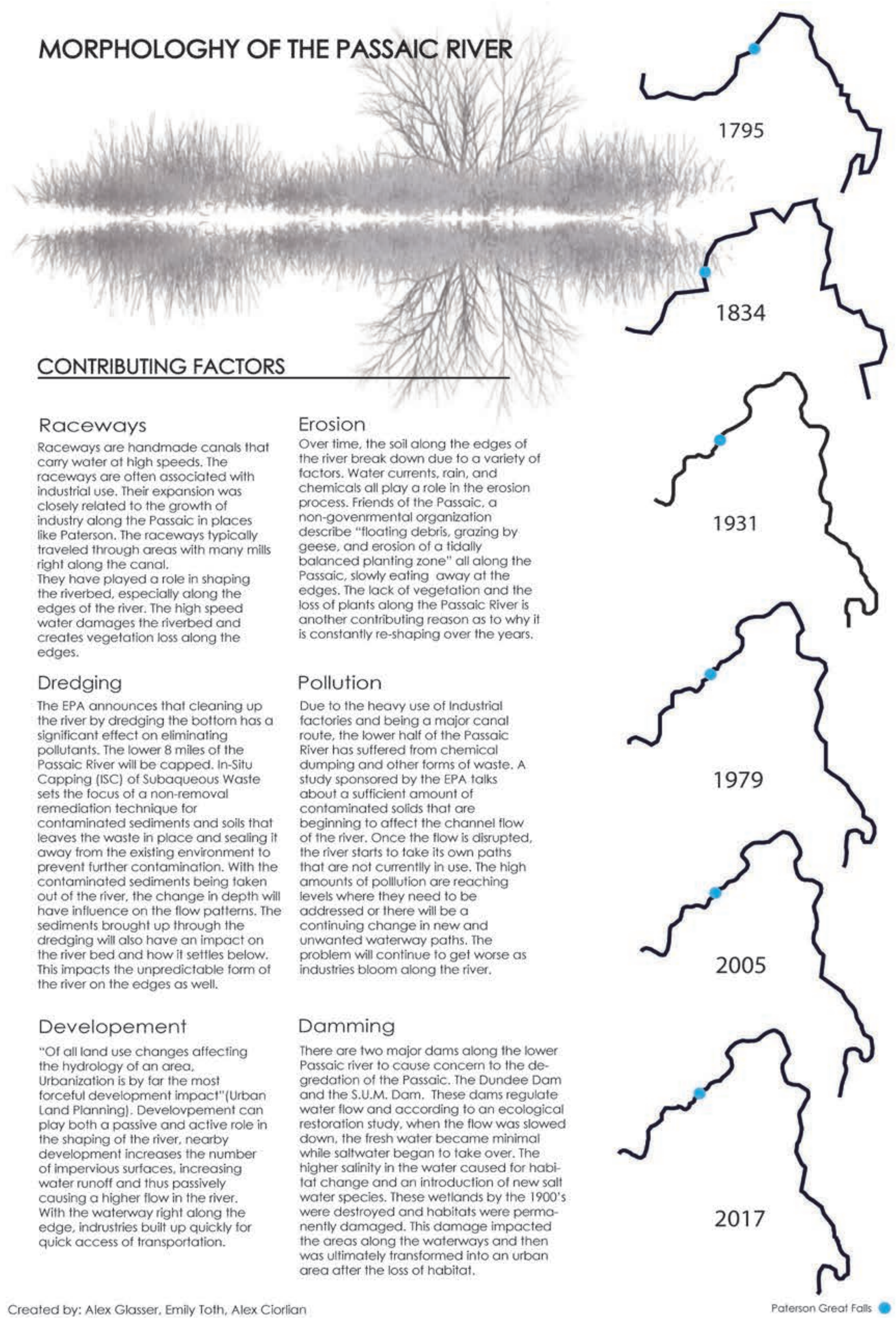
The Passaic Valley Sewerage Commission, (PVSC), was established in 1902 by the New Jersey State Legislature. Within twenty-two years this firm began to acknowledge the need to correct pollution with water treatment efforts in Newark. As concerns continued to mount, the PVSC approached the Landscape Architecture department of Rutgers University as a client seeking a park proposal. The proposal was to entail an open space system that addressed both the pollution in the Passaic River and the need for easy access to the body of water for local residents.

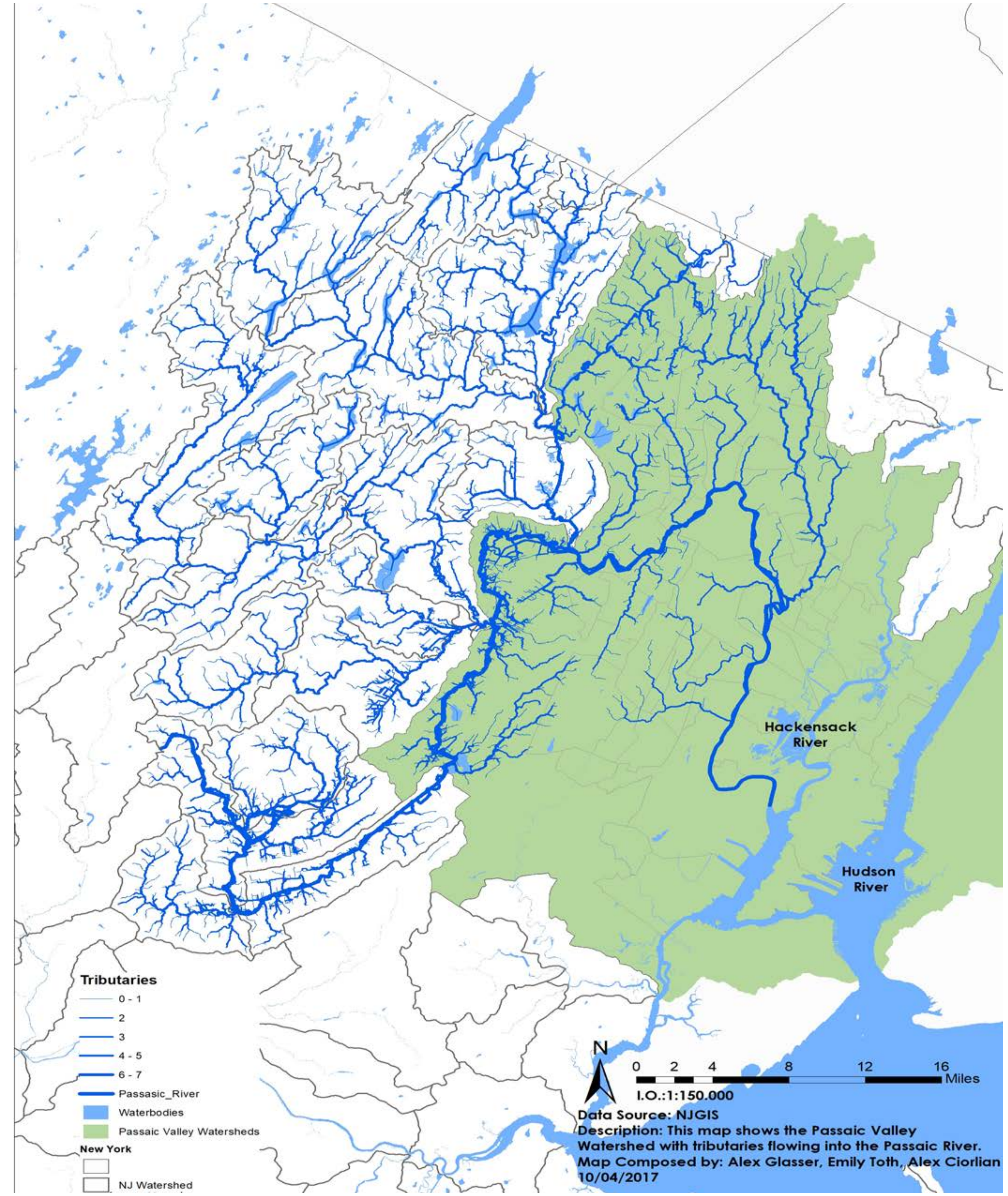
The first step in creating effective interventions along the river was to research the natural, cultural, and social systems that characterize the areas to be developed on. Investigations were divided into nine distinct categories including topography and hydrology, flood zones, open space and ecology, demographics, government, development, industrial, pollution, and waste management.

2.1 Topology and hydrology
By: Alex Ciorlian, Alex Glasser, Emily Toth



The Passaic River is located within different landforms and elevations starting in the south of the Cushetunk Mountains as it flows north and around the Watchung Mountain Range. The Watchung Mountain Range diverts the Passaic River from flowing directly south into the Raritan River.The first portion of the river is higher elevation and gradually lowers as the river flows through Patterson, Newark, and then empties out into the Newark bay. A significant elevation change of 77ft is at the Great Falls in Patterson.





The shape of the Passaic River has changed significantly over time. since the Industrial Revolution, pollution, damming, new development and natural phenomena have expidited the rate of its transformtion. New development has stripped the river of its wetland buffers and hurt its ability to maintain a healthy ecosystem. Gradually, the bends of the river have become less dramatic as erosion straightens it course.

Though the Passaic River is part of the Passaic Valley Watershed, other rivers and tributaries outside this watershed flow into the Passaic River. This is important to know because the focus around the Passaic River revolves around cleaning up the pollutants within the river. It is important to take into consideration that other waterbodies also contribute to the pollutants that flow downstream.

2.2 Floodzones

By: Emily Otterbine, Wes Masco

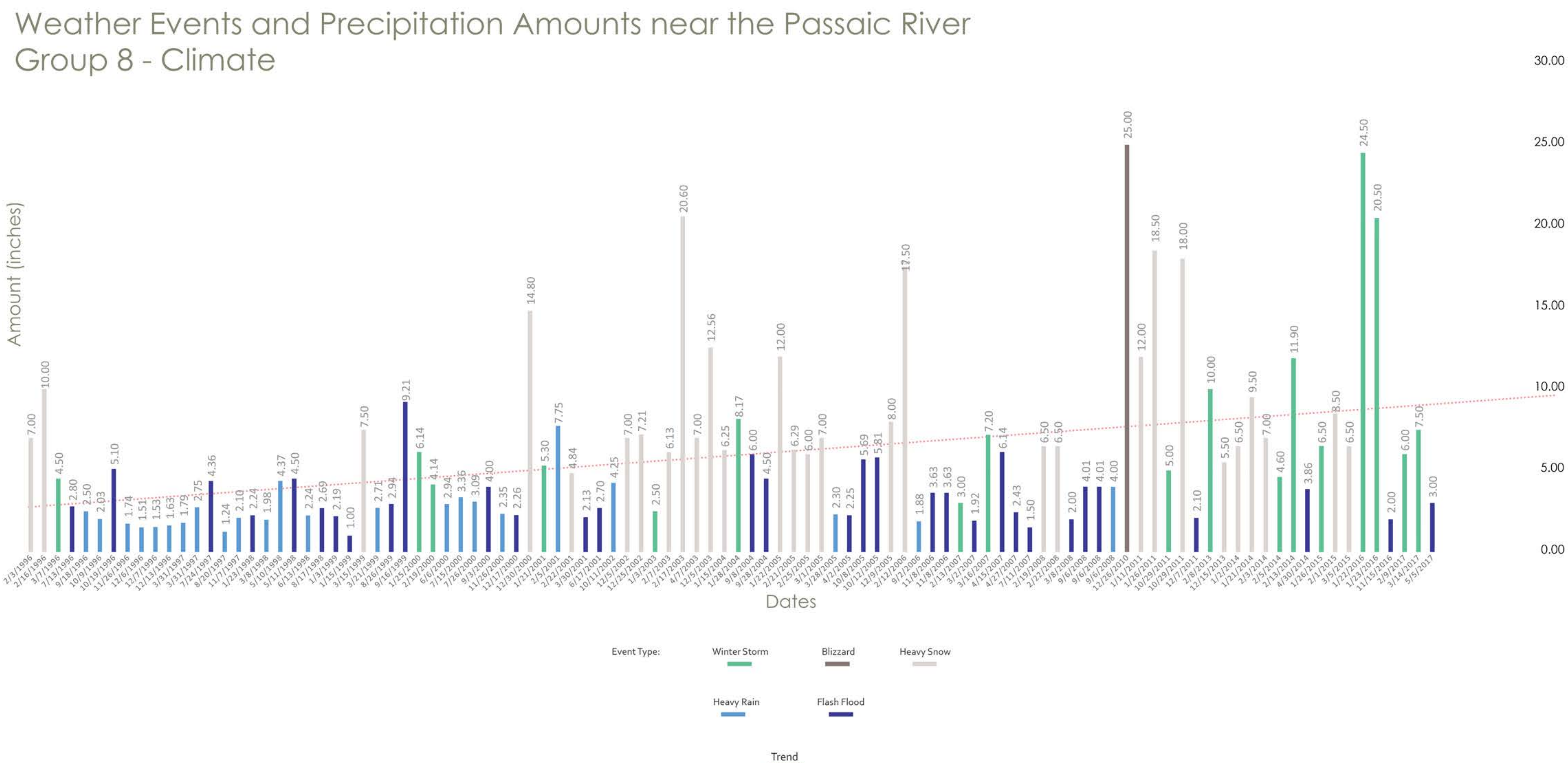
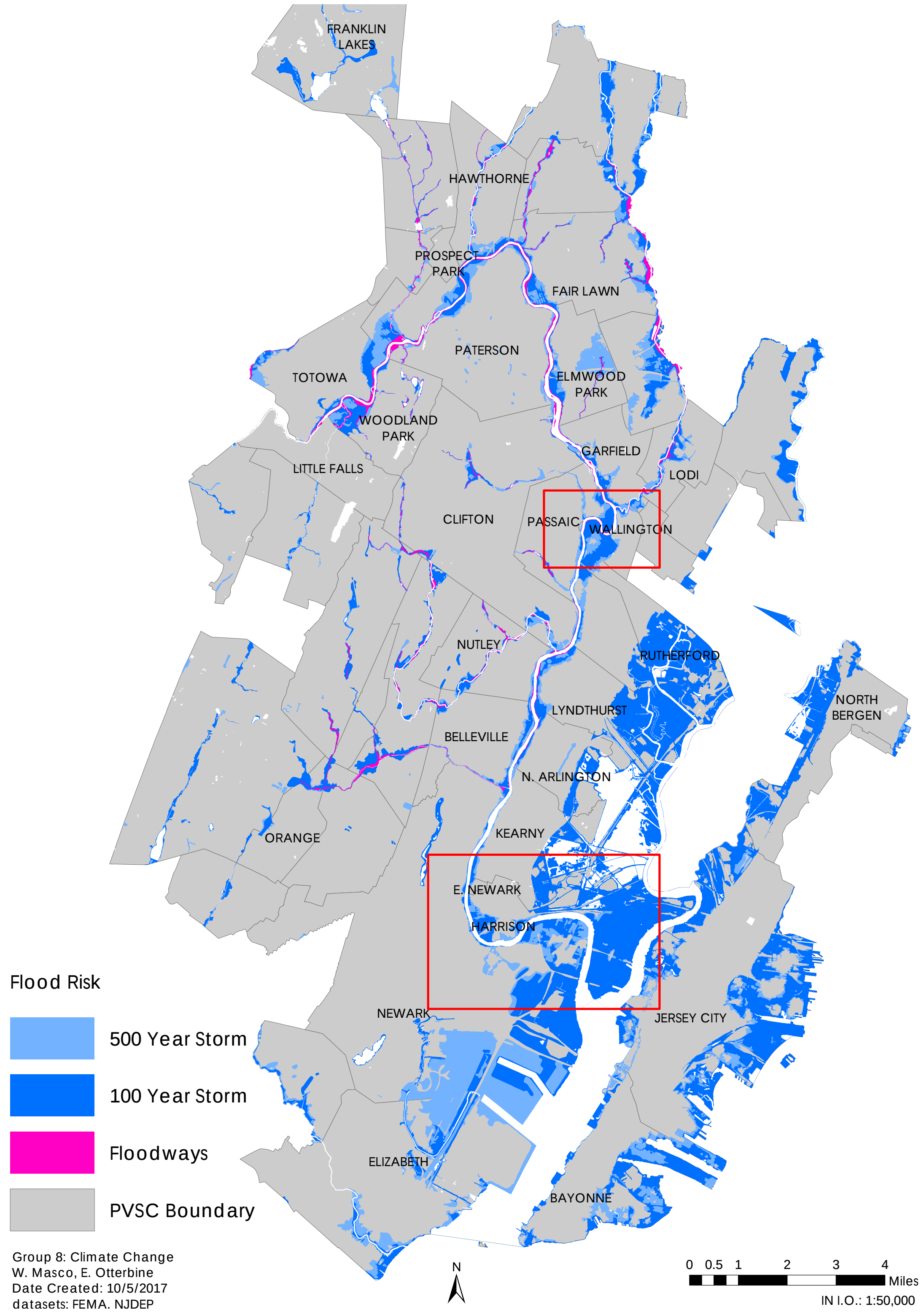


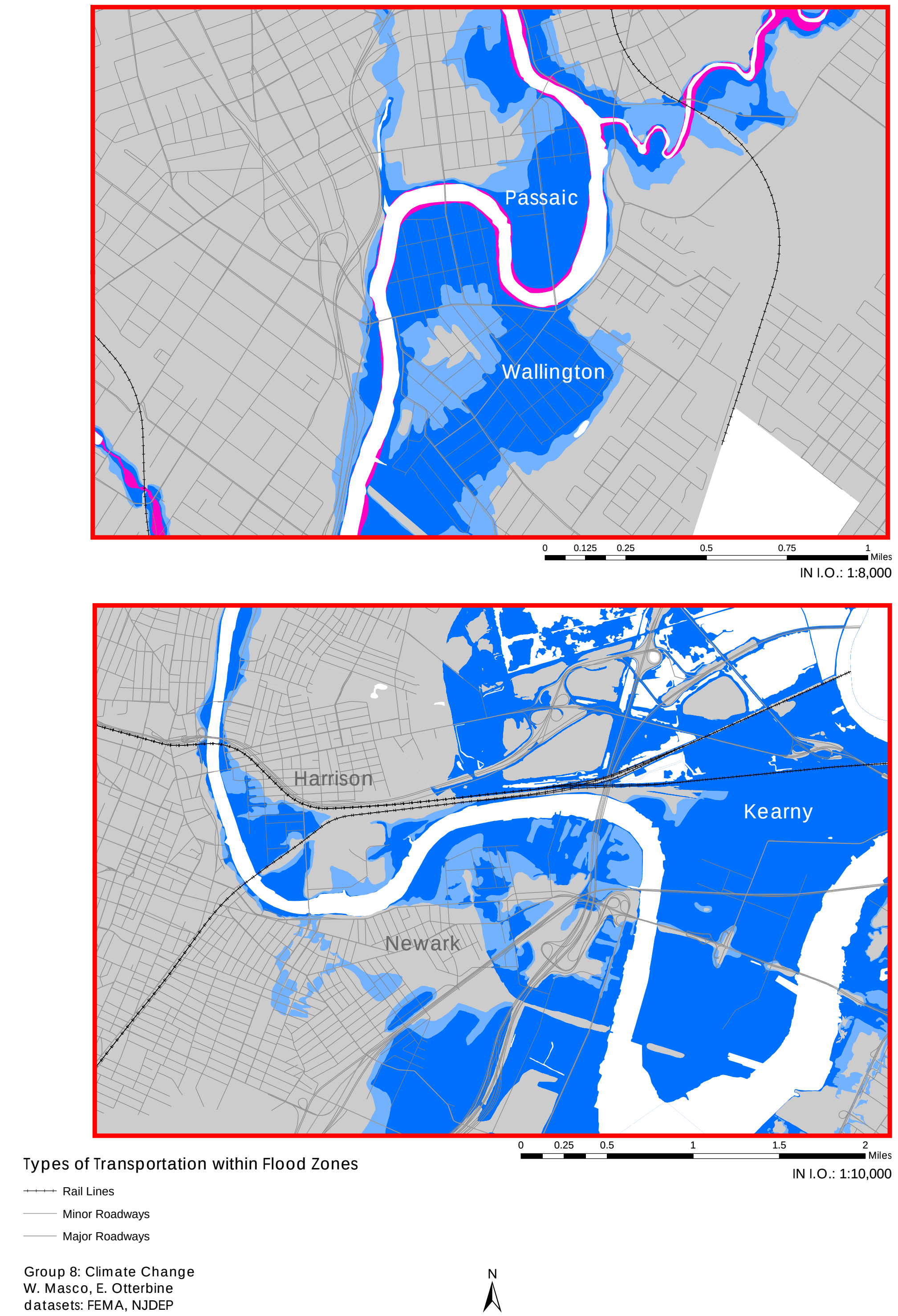
Table created on Excel 2016

Using the Storm Events Database on the National Center for Environmental Information's webpage, this table is intended to show significant weather events that could be linked to flooding from the year 1996 to 2011. These are events that took place in the counties in which the Passaic River runs though: Hudson, Essex, Bergen, Passaic, Morris, Union, and Somerset. The event types include any documentation of heavy rain and snow, blizzards, flash floods and winter storm events. Once the table was completed and a trend line was applied, it was evident that the average percipitation amounts had risen by approximately six inches over the period of fifteen years.

Flood Zones within
PVSC Jurisdiction



Flood Zones within PVSC Jurisdiction

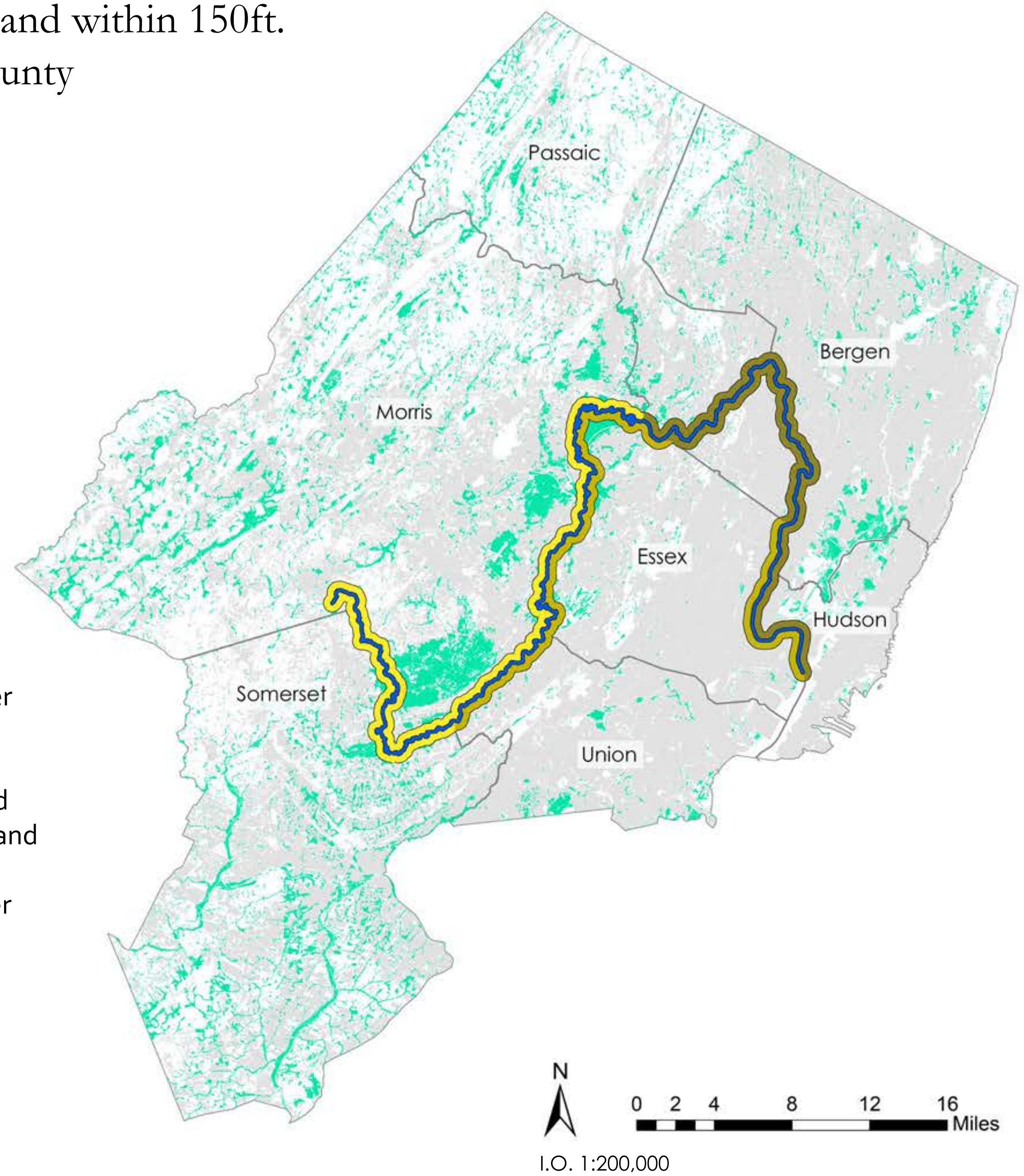


This map was created using FEMA flood data. The datasets were for 100 year and 500 year storm events as well as floodway data. 100 year storms have a 1% chance of occuring in a given year while 500 year storms have a .2% chance of flooding in a given year. Flooding is something that impacts many areas along the Passaic. It is very prominent in the lowlands of the Newark, Kearney Area with other significant areas near bends and where tributaries connect to the Passaic River. The Area of Wallington as well as the Paterson area have significant flooding as well. All groups took into account, the flood data when deciding suitability for their desgn interventions. Flooding is very expensive problem and needs to be takin into account during the planning stages of development. Development in flood zones is a huge problem in this region.

2.3 Open Space and Ecology

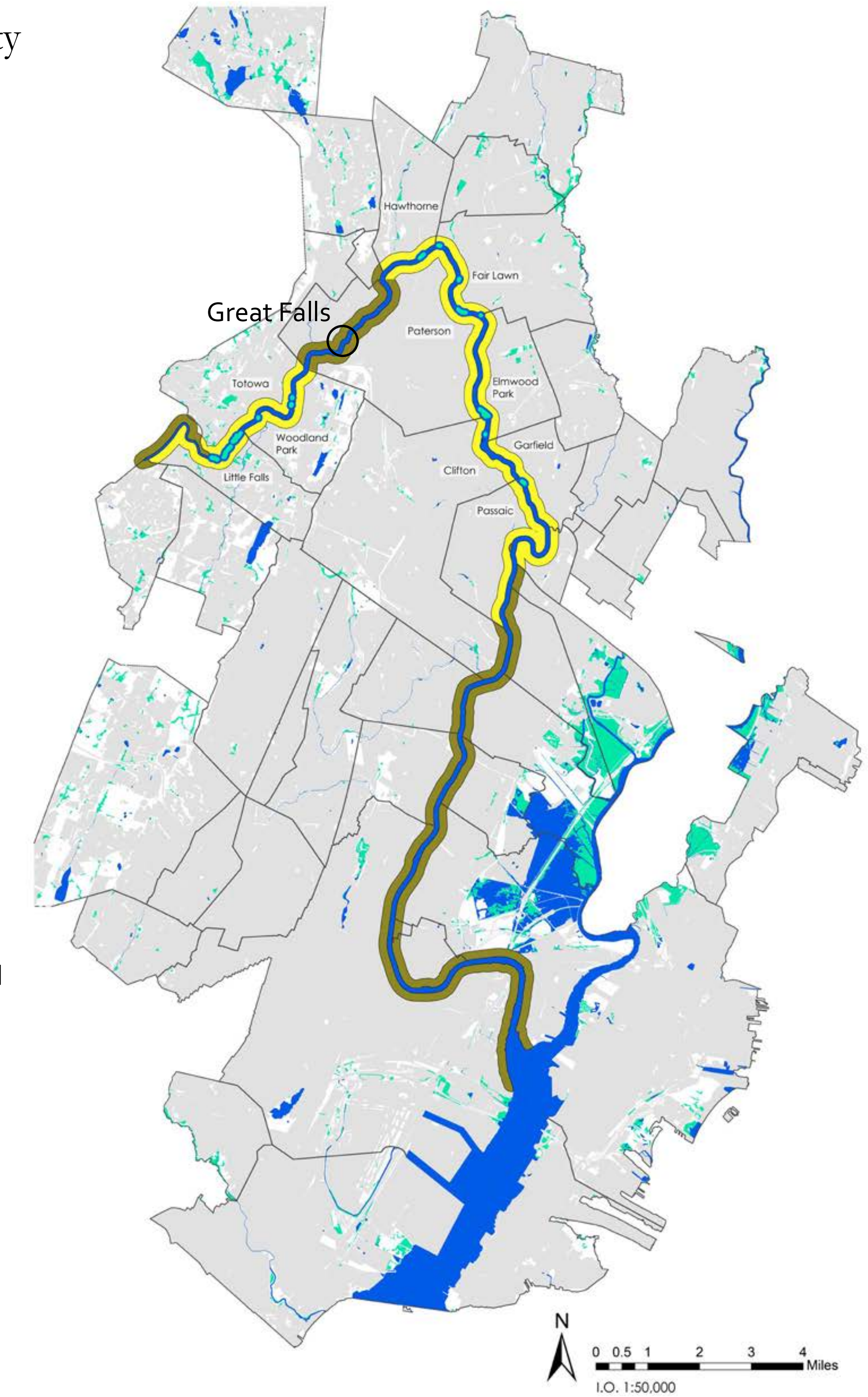
By: Anna Erickson, Grace Li, Giselle Pena

Percentage of Wetland within 150ft. Buffer Zone by County



A comparision of the environmental quality within a 150 ft. buffer surrounding the Passaic shows how the percentage of wetlands adjacent to the river drops sharply from beginning to end. The highest to lowest percentages by county go: Somerset - 45%, Morris - 43%, Essex - 33%, Union - 26%, Passaic - 1.25%, Bergen - .04%, Hudson - 0%. Overall, only 28% of the banks along the Passaic contain wetlands. This is a matter of concern for wildlife in the area that need wetlands to survive. Wetlands also help purify water through phytoremediation of heavy metals and through filtering pollutants such as suspended solids and non-point source pollutants. These are especially important functions for the lower half of the river, where the water quality is most degraded and there are little to no wetlands. Provided by NJ Office of GIS 2012 Land Use Land Cover, 2012 Impervious Surface Estimate in New Jersey

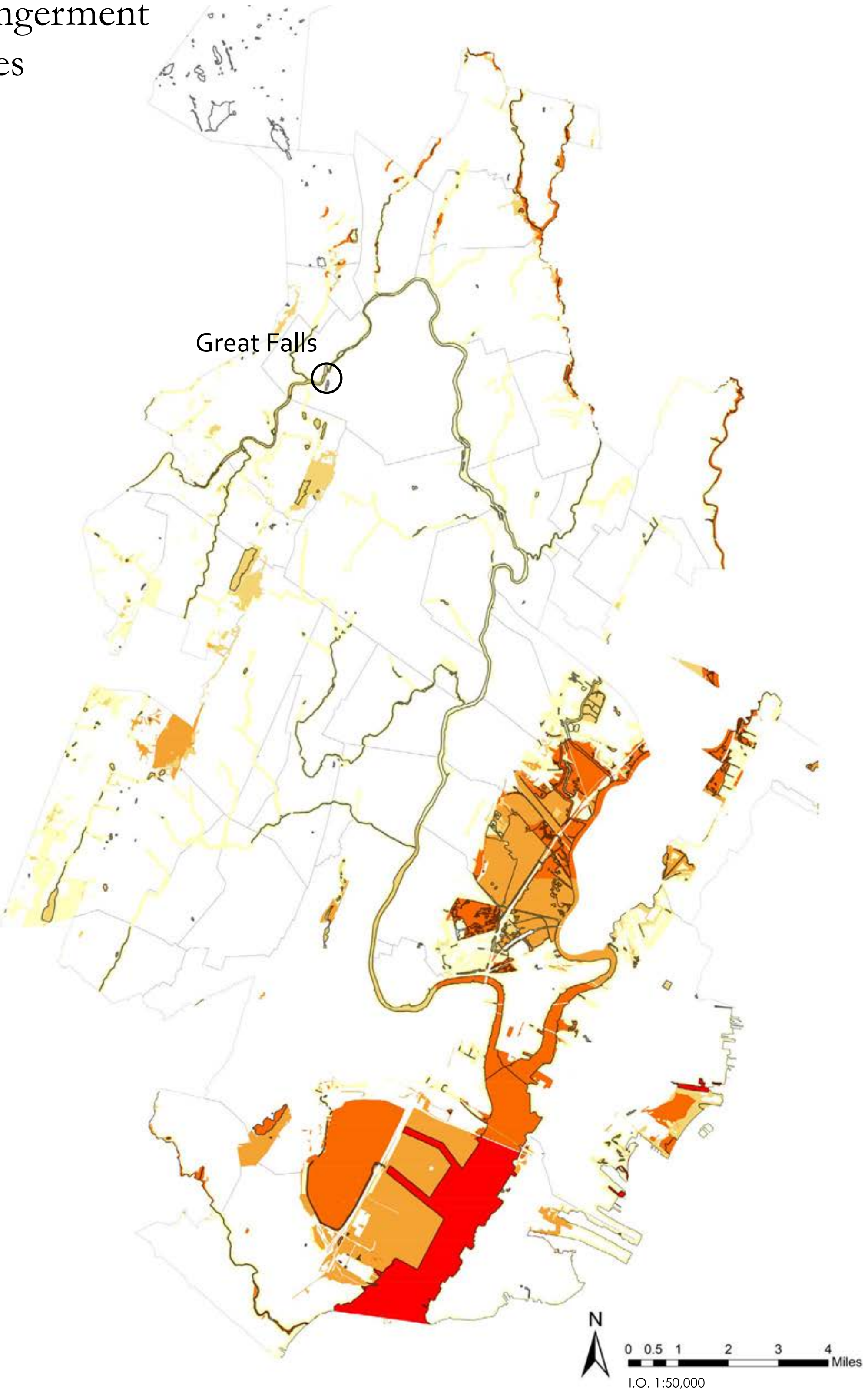
Percentage of Wetland within 150ft. Buffer Zone by Municipality



A zoom in on the lower portion of the river displays municipalities served by PVSC with a more detailed look at where wetlands within the 150 ft. buffer zone lie. Most are located in the north, although there are wetlands in areas outside of the buffer zone near other bodies of water such as Newark Bay and the Meadowlands. The municipalities that contain wetlands surrounding the Passaic River are Little Falls, Totowa, Fair Lawn, Hawthorne, Paterson, Garfield, Clifton City, Woodland Park, and Elmwood Park. These are displayed with the buffer zone highlighted in yellow and the wetlands in green. The heavy grey shows the dense amount of impervious surface in the area, which illuminates the conditions for the Species map to the right.

Provided by Nj-Office of GIS 2012 Land Use Land Cover, 2012 Impervious Surface Estimate in New Jersey

Wildlife and Species Endangerment Within PVSC Municipalities



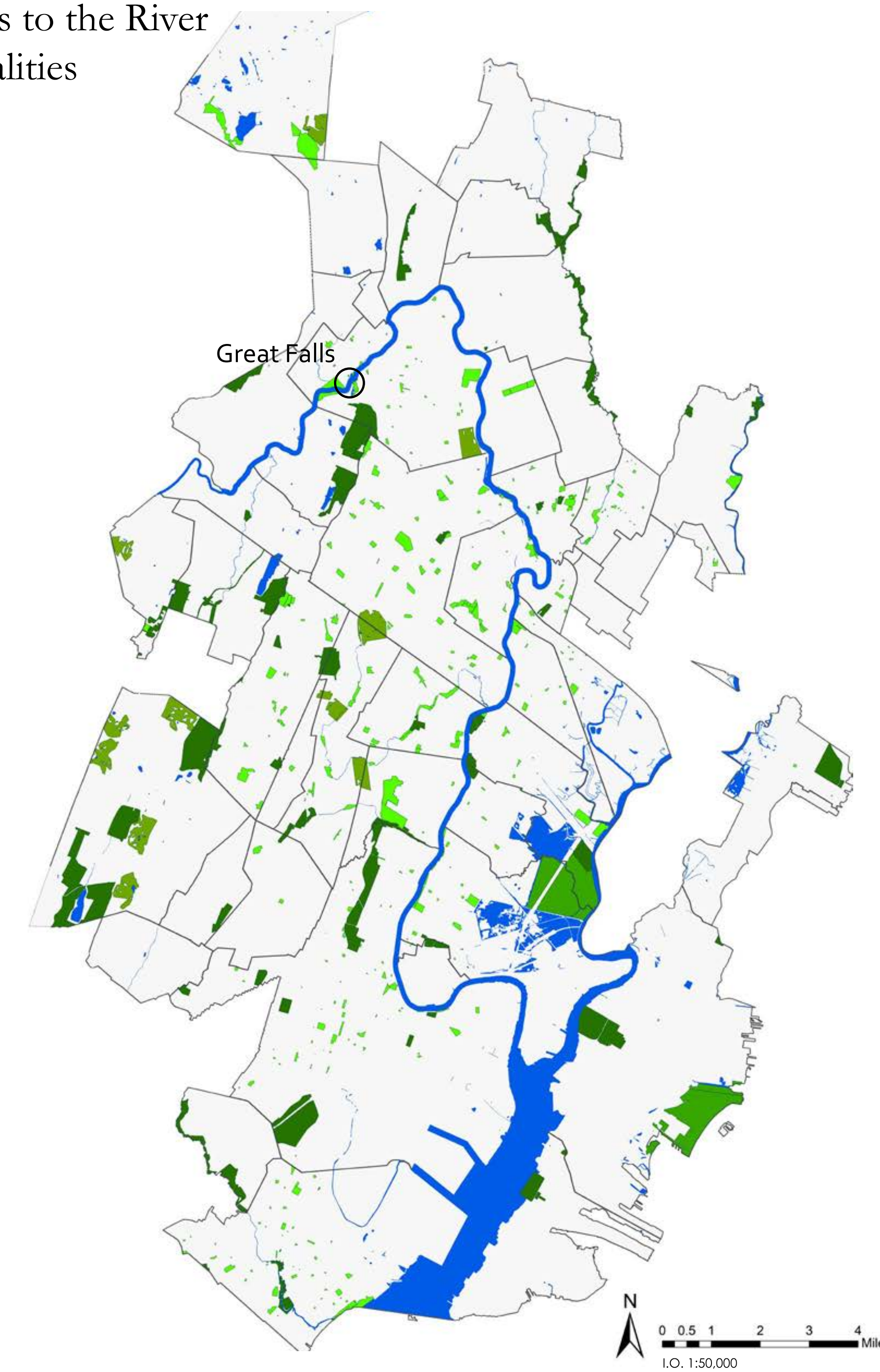
Species Rankings

- Rank 1 Habitat Specific Requirements
- Rank 2 Special Concern
- Rank 3 State Threatened
- Rank 4 State Endangered
- Rank 5 Federally Listed

The wildlife in the area lives primarily in aquatic habitats, making river quality critical to their survival. With the high degree of pollutants and dredging within the river, as well as vehicular collisons, there may be more and more endangered species in the future. The species rankings above represent levels of endangerment. Throughout the river, species that are ranked 1 and 2 populate the area. Towards the bottom of the site, near the Meadowlands, more species that are ranked higher than 2 can be found. The Newark Bay has federally listed species. The area is an important spawning ground and migratory passageway for aquatic and avian species.

Provided by Nj Department of Environmental Planning Bureau of GIS Species Based Habitat Piedmont Plains Region

Open Space and Access to the River Within PVSC Municipalities



Types of Open Space

- Water
- Local Parks and Recreation Space
- County Parks
- State Parks
- Golf Courses

Different types of people-centered open space are shown throughout the site. Local parks make up the greatest number of spaces, serving many residents on a neighborhood scale. County and State parks are less frequent but cover more area and serve as destination points including the Great Falls park and the Meadowlands. Golf courses are abundant as well, making up a large portion of the open space in the area. It is notable that there is not a lot of park space along the river, showing that the area lacks people oriented spaces and well as wetlands.

Provided by US Geological Survey Protected Areas Database Fee Easements, NJ Office of GIS Open Space

2.4 Demographics

By: Jason Cincotta, Alexis Lo, Summer Sprofera

2015 Population Density

This map is depicts the 2015 population density data within the Passaic Valley Sewerage Commission boundary. The census data shows that in urban environments such as Paterson or Newark are more densely populated than the suburban areas. Municipalities adjacent to the Passaic River are also more densely populated. Knowing population data provides insight into the quantities of people one must take into consideration when planning and designing spaces.

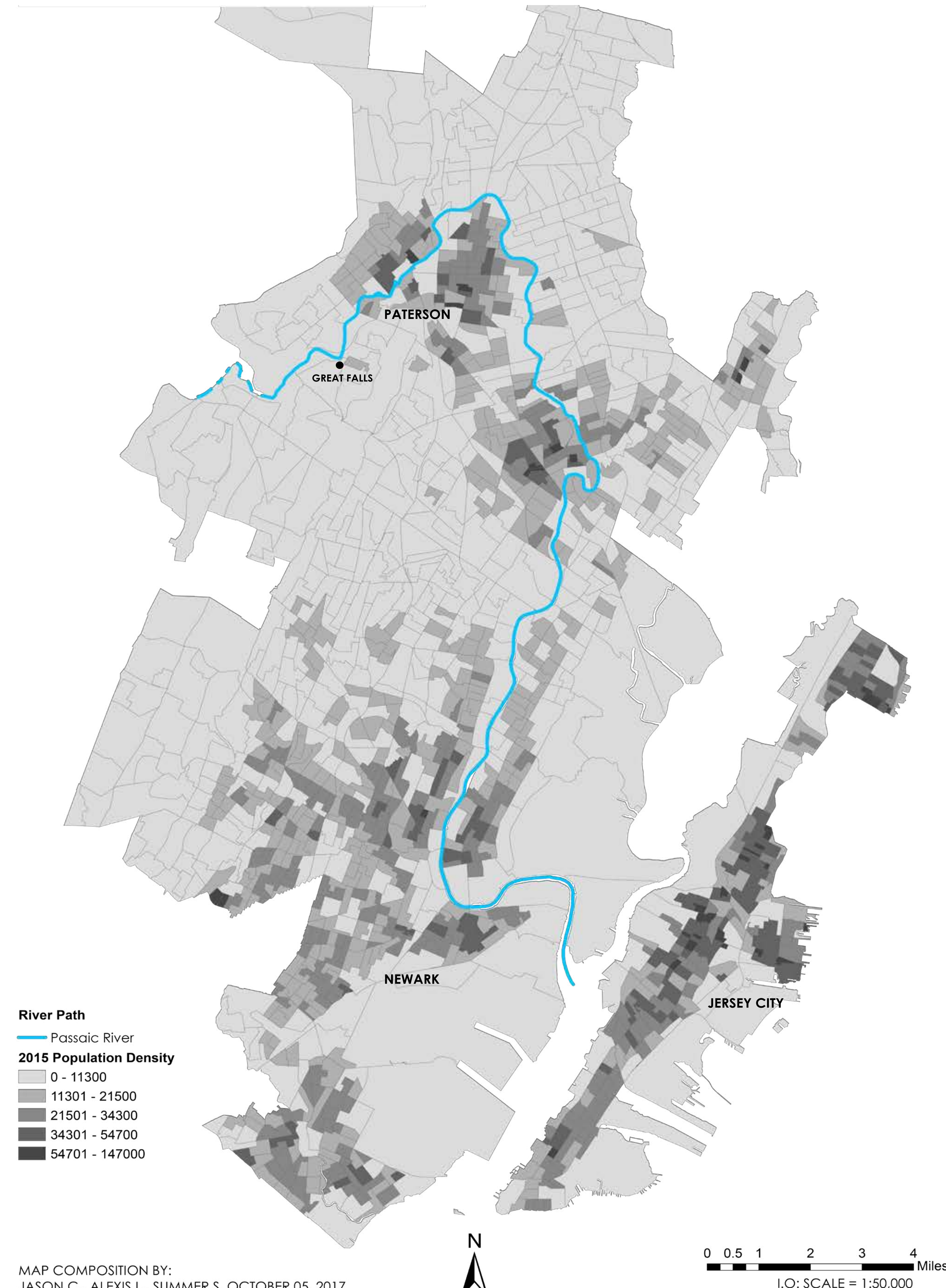
Median Household Income

This map is depicts the median household income within the Passaic Valley Sewerage Commission boundary. Areas that are more urban and or dense, shown in the aforementioned map, have a lower income than the surrounding suburban areas. This data is paramount in the arguments surrounding gentrification and design. Paying attention to the sensitivity of income in certain areas helps form societal planning and policy.

Percent of Children Ages 0-14

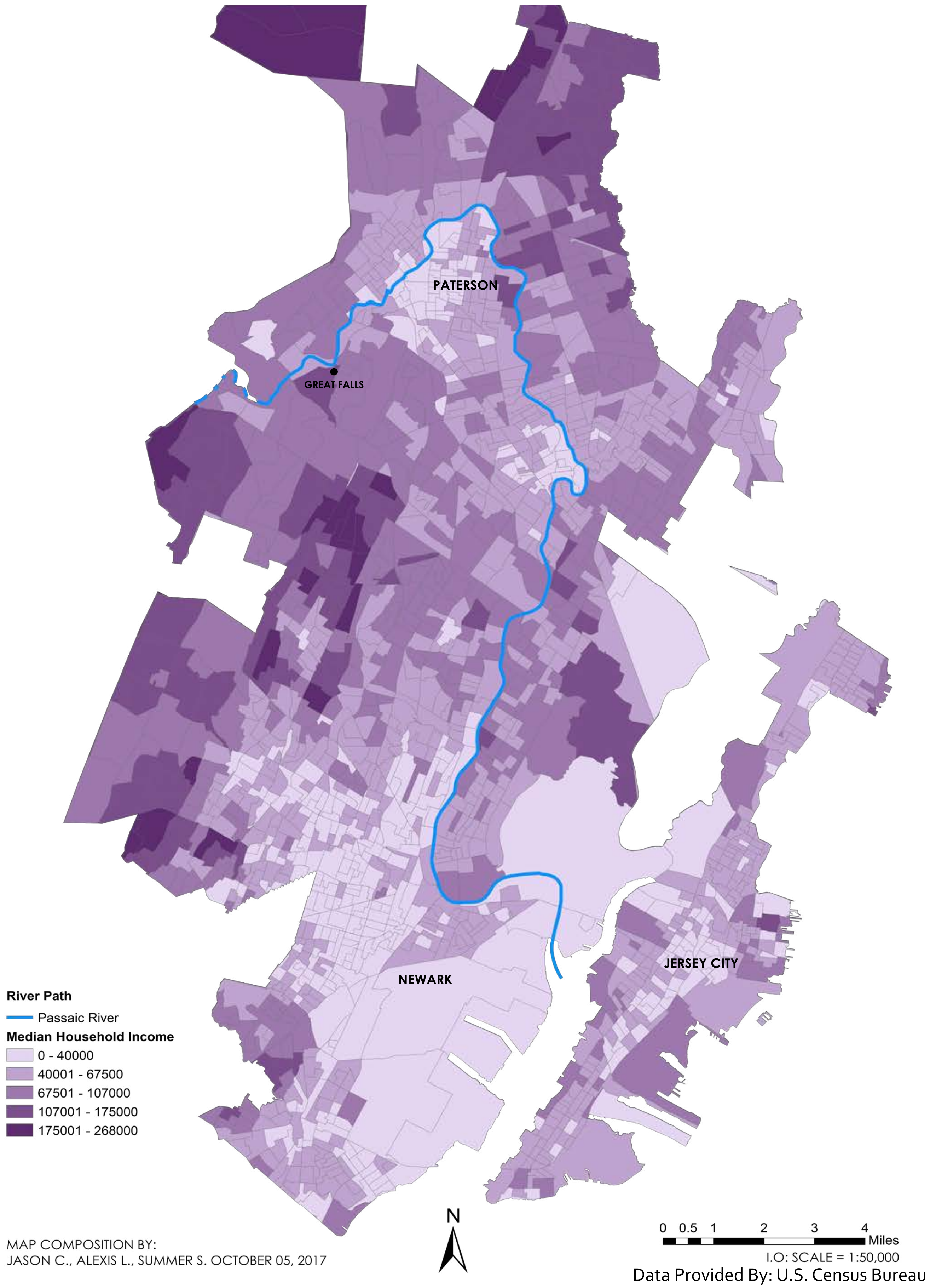
This map is depicts the percent of children within the Passaic Valley Sewerage Commission boundary. Shown is a fairly even spread of median percentages of children throughout urban and suburban areas. The more dense percentage areas of children are located closer to urban areas. Since this studio focuses around pollution and open space, having information on percentage of children is paramount to form decisions within planning and design.

2015 Population Density

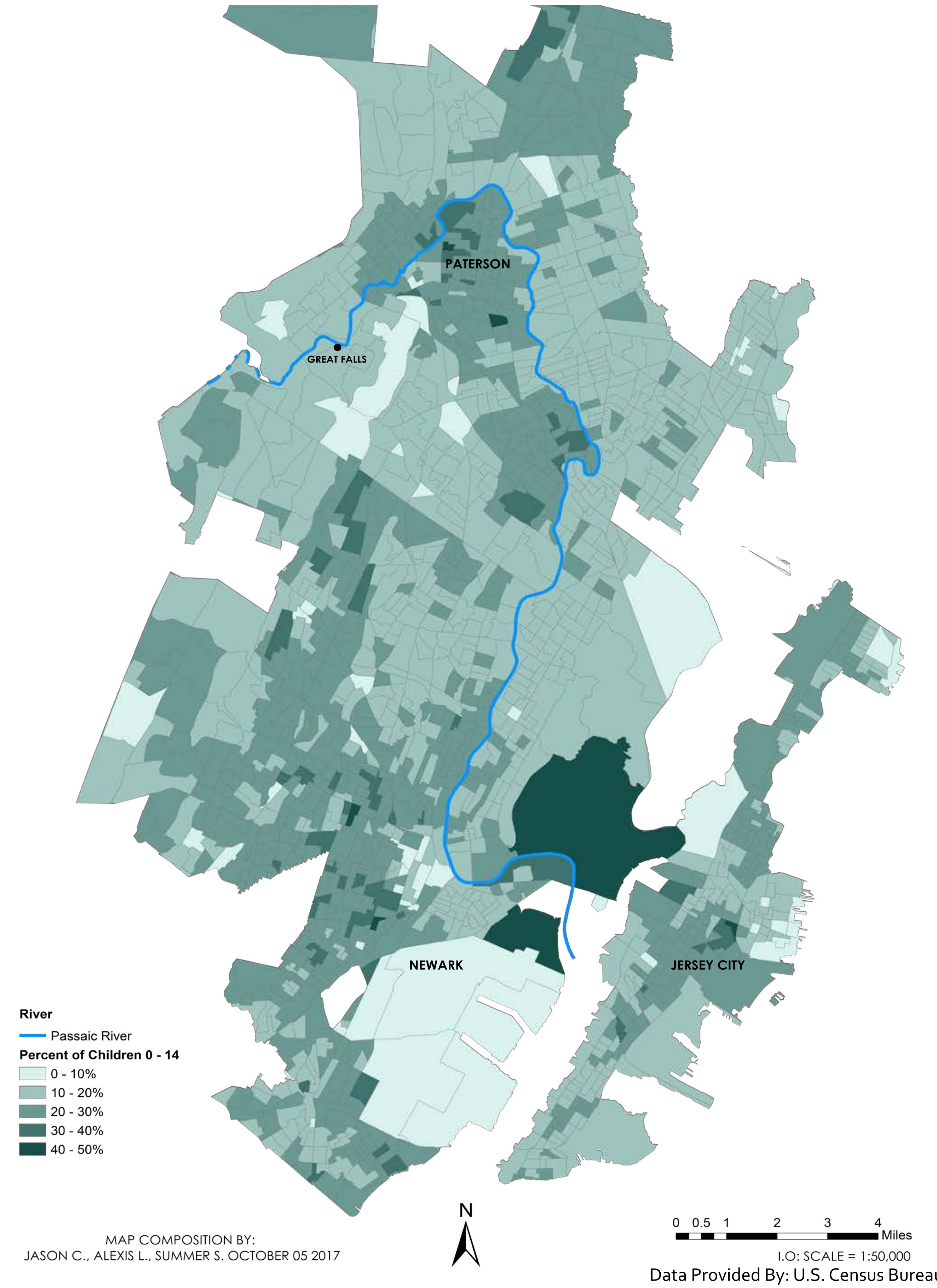


Data Provided By: U.S. Census Bureau

Median Household Income



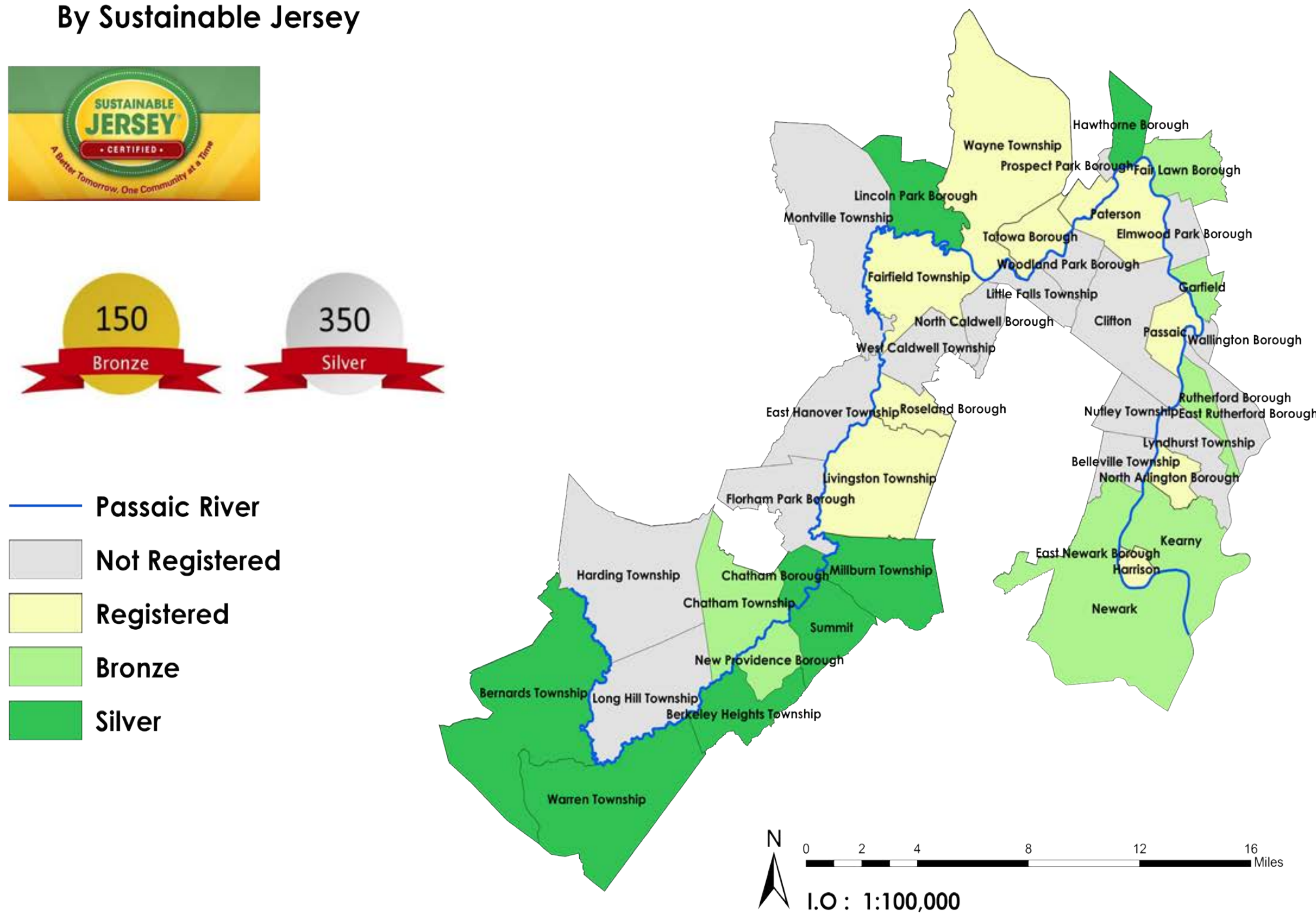
Percent of Children Ages 0-14



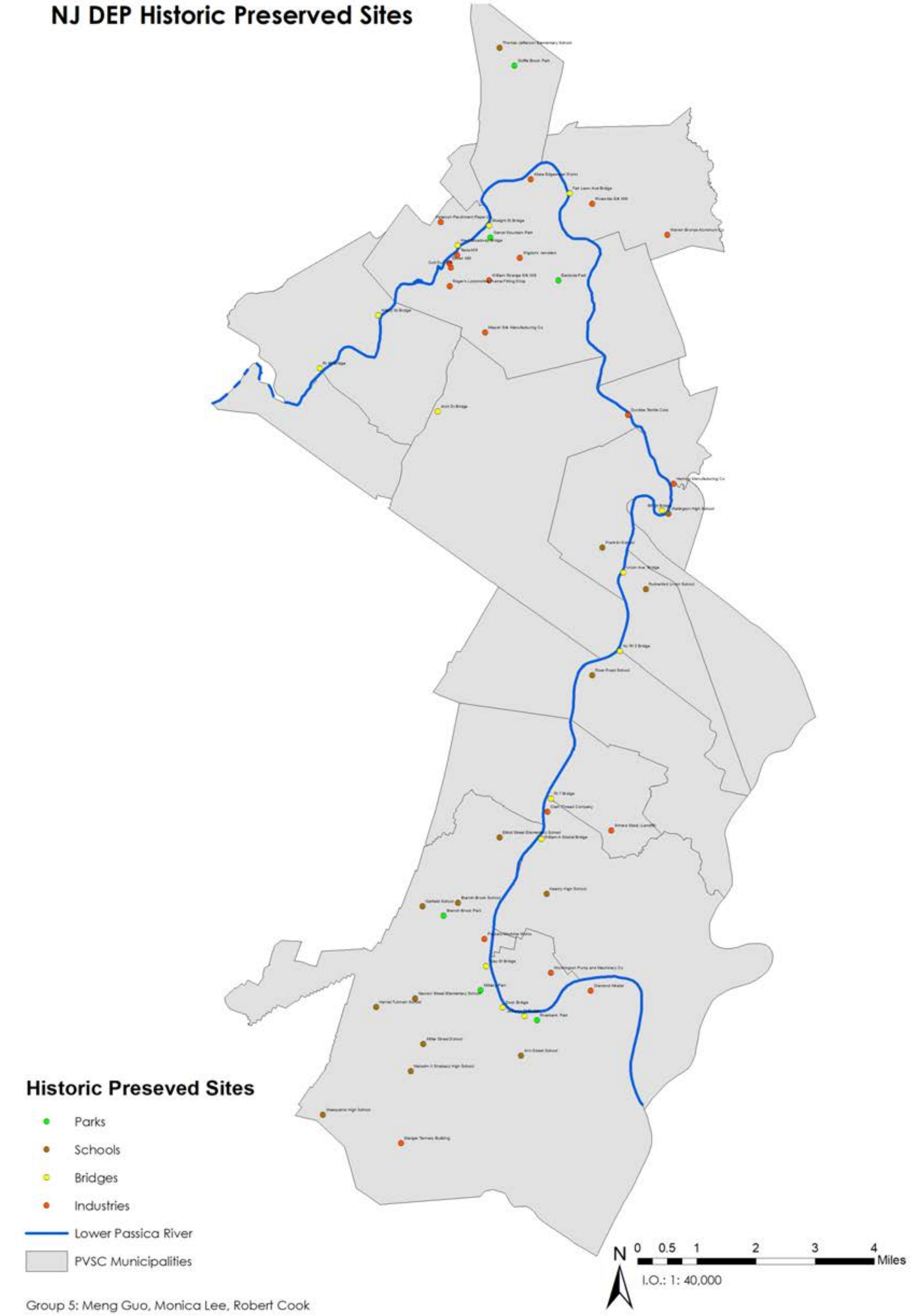
2.5 Government

By: Meng Guo, Monica Lee, Robert Cook

Municipalities Registered and Ranked By Sustainable Jersey



NJ DEP Historic Preserved Sites



"Sustainable Jersey is a nonprofit organization that provides tools, training and financial incentives to support communities as they persue sustainability programs. By supporting community efforts to reduce waste, cut greenhouse gas emissions, and improve environmental equity, Sustainable Jersey is empowering communities to build a better world for future generations." -Sustainable Jersey Mission Statement

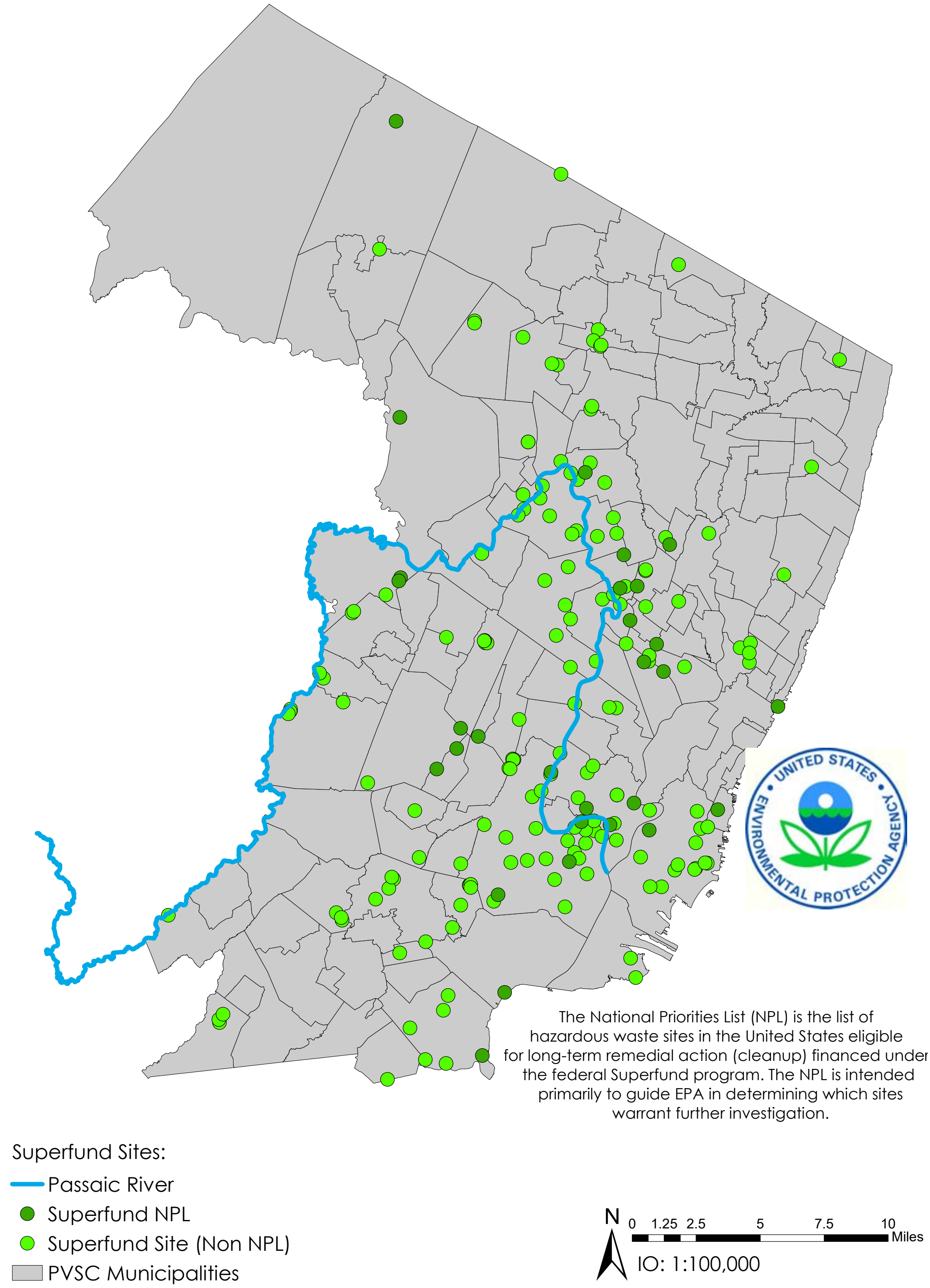
This map shows the ranks of Municipalities along the lower Passaic River in the area of focus. Suprizingly, a lot of the municipalities that border the lower river are not registered with Sustainable New Jersey.

The New Jersey Department of Enviornmental Protection (NJDEP) is a government Program that is responsible for managing the state's natural resources and addressing issues realted to pollution. The DEP historically preserved sites are government agency protected sites, and are not allowed to be de-constructed by individuals.

This map shows the historically preserved sites in the area of focus. It includes bridges, schools, parks, and industrial sites. Being aware of the history of an area when focusing on a site is relevant it shows a period of time that is considered important and may have significance in the future.

Superfund Sites Registered By The EPA

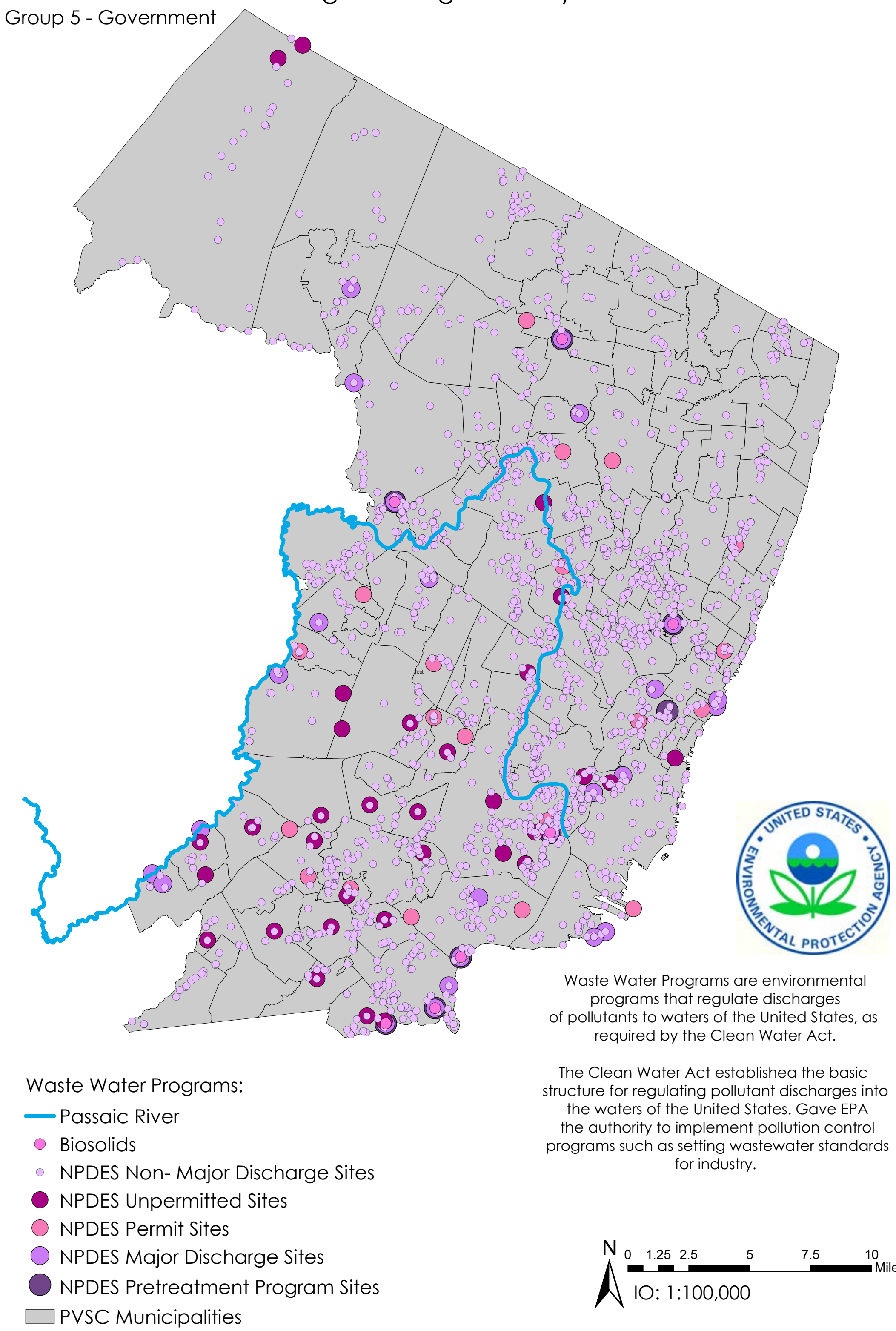
Group 5 - Government



Superfund sites are under The Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This act requires that "Superfund" Sites have a criteria provided by the Hazard Ranking System, which is constructed by the Environmental Protection Agency. This list ranks the certain sites by the release or threatened release of hazardous substances, pollutants, or contaminants in the certain site. Each site gets a score on how threatening it is. If the score is threatening enough, then it is put on the NPL list. The EPA is the policy that monitors each suspected "Superfund" site and gives it a score on the Hazard Ranking System. Sites that are in the NPL list are allowed to be solicited and addressed by the public.

Polluted Waste Water Programs Registered By The EPA

Group 5 - Government

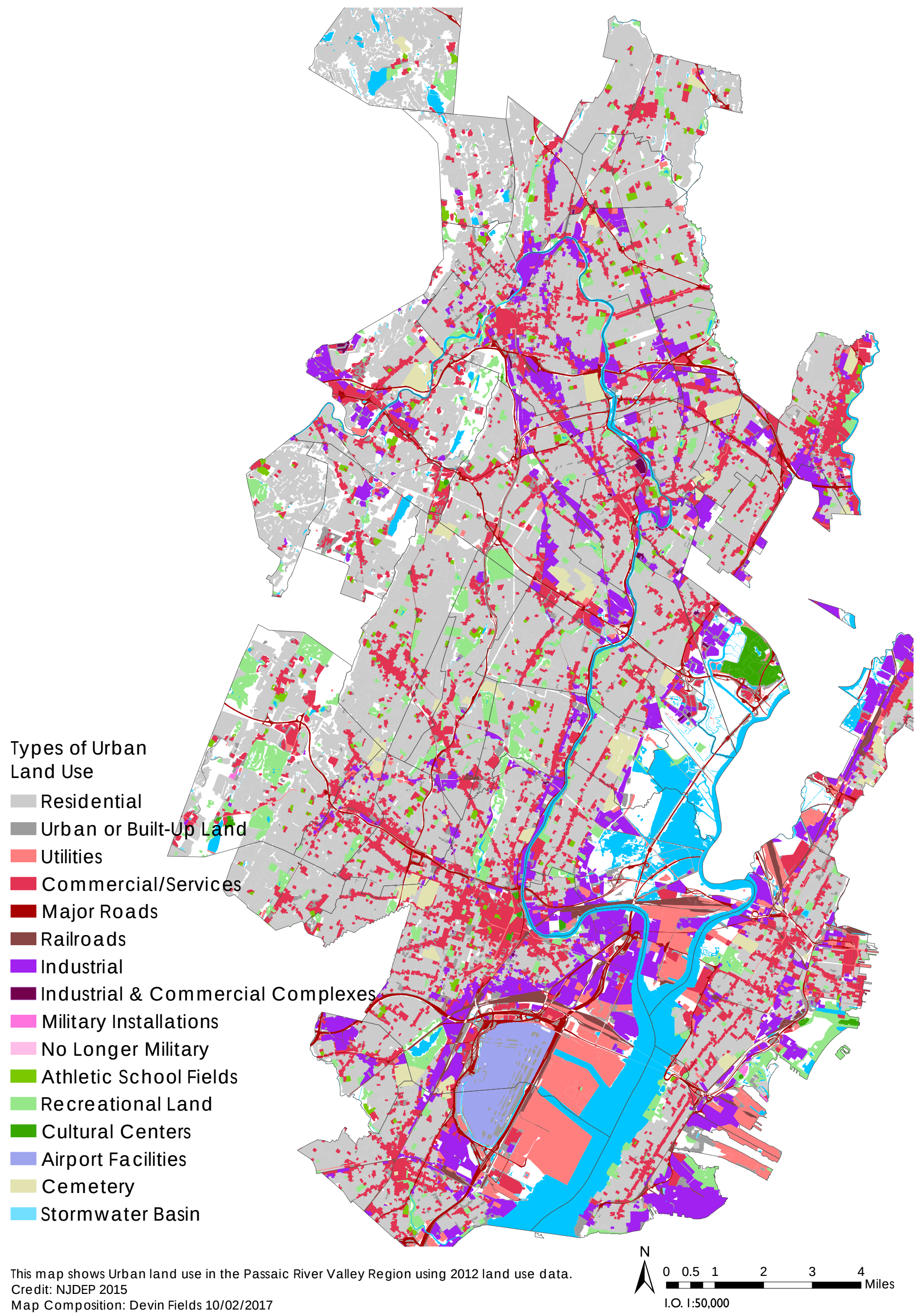


The management practices of wasted water are required by the Clean Water Act, which is regulated by the EPA. To control the discharge of pollutants in the water and to help keep the waters clean and safe, the EPA regulates the National Pollutant Discharge Elimination System (NPDES). Stated by the EPA, "the NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States." In order to discharge pollutants to the water through a "point source" unless they have a permit by the NPDES. "The permit will contain limits on what you can discharge, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or people's health." The map shows many sites under the NPDES programs as well as other waste water programs.

2.6 Development

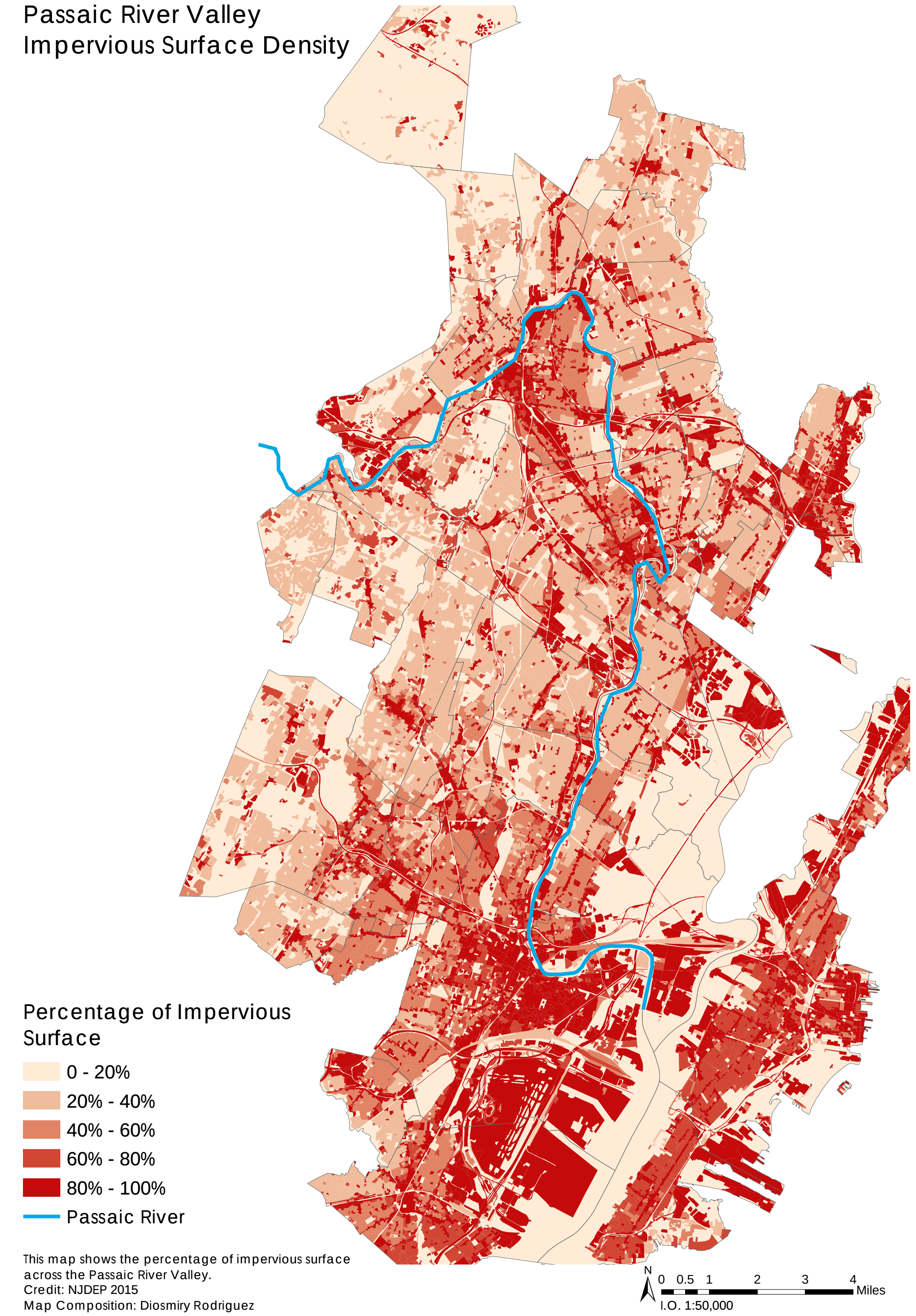
By: Adam Fricke, Devin Fields, Diosmiry Rodriguez

Passaic River Valley Urban Land Use



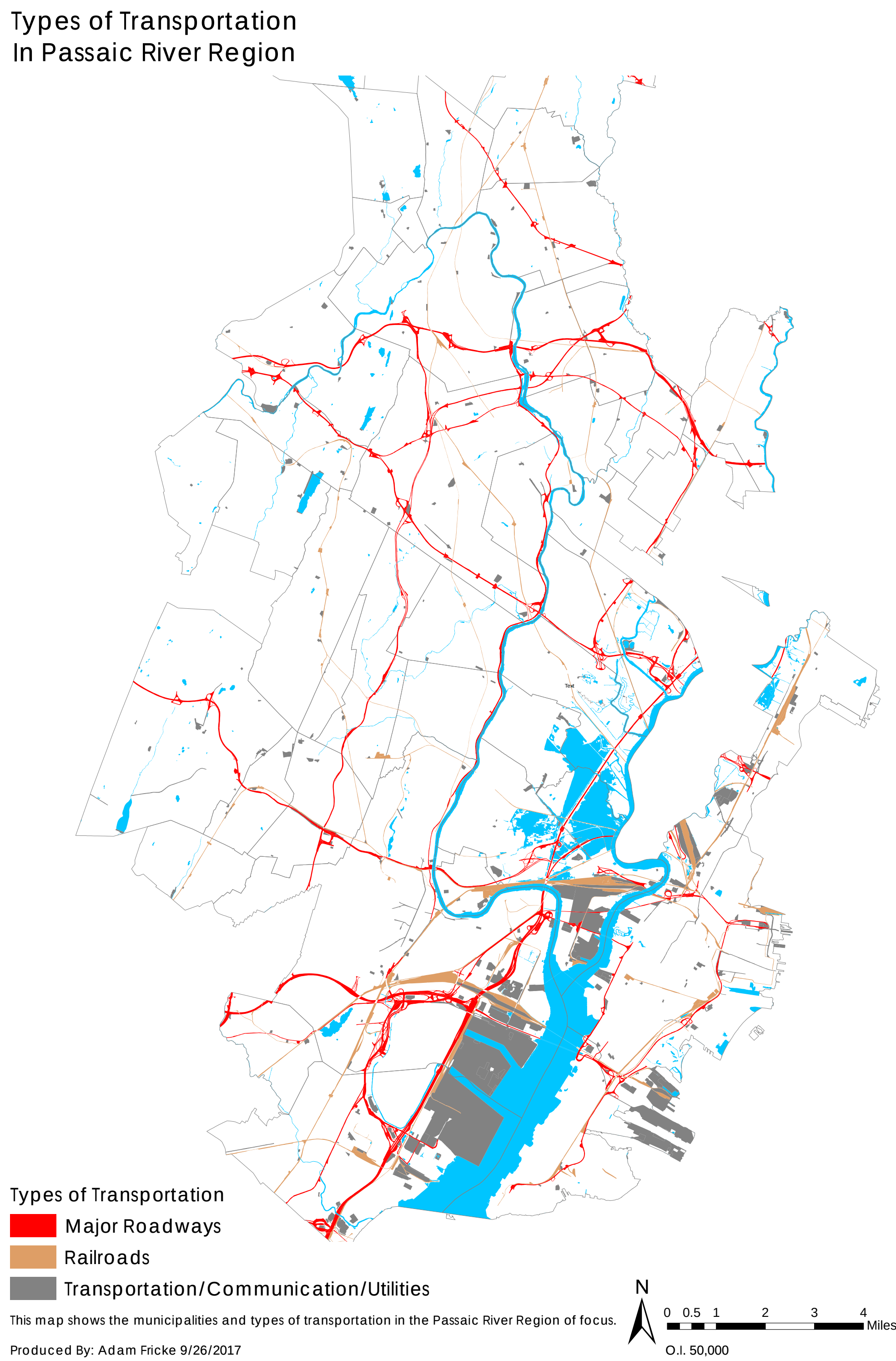
Data Provided By: NJ Department of Environmental Protection 2015

This map shows all of the Urban Land Use categories in the PVSC jurisdiction, also called the "Passaic Valley Region". This map shows a few themes. First, the top half is mainly residential, with industrial and commercial centers and strips throughout. Next, the bottom half of the map, mainly centered on Newark is mostly industrial, with wetlands land use within the Meadowlands area in North Arlington. Below that is a large pink area that consists of the Newark airport. Finally, there constant strips of commercial and industrial following the Passaic River, and shooting out from as roads and railroads. This industrial and commercial strip is from the high industrialization northern New Jersey has seen over history.

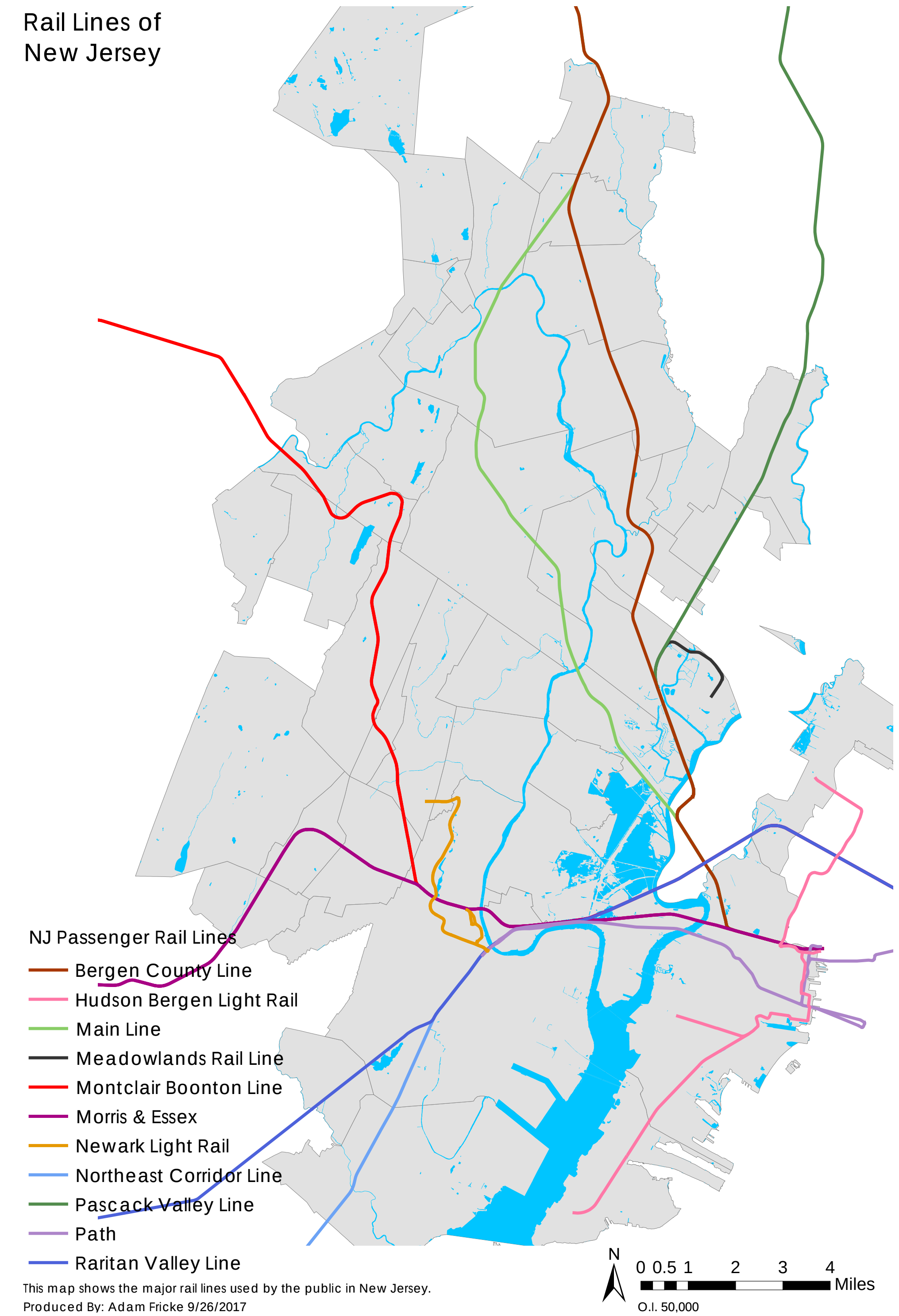


Data Provided By: NJ Department of Environmental Protection 2015, Esri National Atlas of the U.S. 2017, U.S. Geological Survey 2017

This map shows the Percentage of Impervious Surface from light to red in groups of 20% along the Passaic Valley Region. Impervious areas are hard surfaces such as roofs, concrete, asphalt, and compacted soil which prevent the rain and snowmelt from soaking into the ground. The majority of areas with high impervious surface within this map are mostly along the river. City such as Paterson and Newark are mostly covered in red and are also the most populated cities in New Jersey.



Data Provided By: NJ Department of Environmental Protection 2015

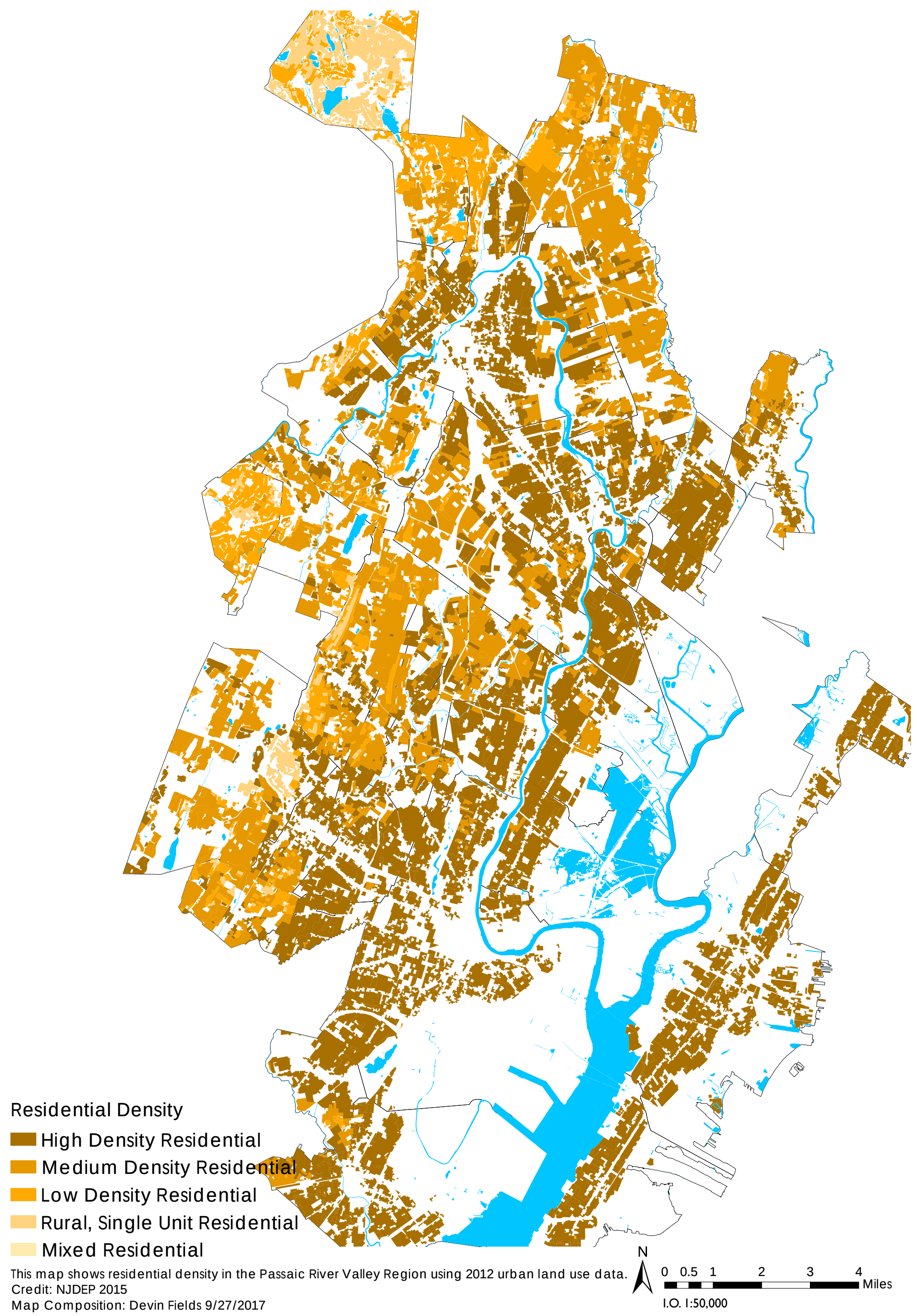


Data Provided By: NJ Office of GIS 2017, NJ Transit - GIS-Transportation 2017

This map shows the major roadways, railroads and transportation-related utilities areas in the Passaic Valley region. The major roadways are dense around both Newark and Paterson, the two major industrial cities in this region. The roadways also run with the Passaic River, preventing local people from having access to the water body. The railroads follow a different pattern. The railroad cross the river multiple times, much more than the roadways do. This puts a large infrastructure piece like a railroad across the river, ruining the beauty of the river, and creating dead ends near the river, which are undesirable places for locals.

This map shows the NJ Passenger Rail Lines that run through the Passaic Valley Region. Many of these rail lines are related to the Passaic River either by intersecting it or by running adjacent to it. This region has almost every passenger rail line in New Jersey bounded inside of it. Because of heavy industrialization, urbanization, and population density, it makes sense why many of the rail lines are found in this area. Rail lines that are still active act as barriers for nature and must be taken under consideration when designing.

Passaic River Valley Residential Density



Data Provided By: NJ Department of Environmental Protection 2015

This map shows the residential density of the Passaic Valley Region. Areas such as Newark, Jersey City, and Paterson have mostly high density residential. This runs with their highly industrialized history. Medium density residential is most prominent in the western side of the region, in municipalities such as the Oranges, Bloomfield, and a few others. The white area to the east consists of industries and wetlands, where there is no housing what-soever. The main theme of this map shows that there is high density residential following the river north. This is directly related to the industrial history of the area of New Jersey. Almost all industries would form near a water source, and workers of these factories would live close to their work for shorter commute times. This reigns true in the Passaic Valley Region as well

2.7 Industrial
By: Tina Mao, Nanik Song, Wenjia Yan

Industrial Areas within PVSC Municipalities

The first map depicts industrial areas within the Passaic Valley Sewage Commission's jurisdiction, which have been separated into categories as defined below, for the purpose of allowing one to visualize the proximity of industrial zones to the Passaic, as well as where it is most concentrated, which seems to have a heavy correlation with the waterways in the area. It is undeniable that industry was and is a source of pollution in the PVSC municipalities. This map can be used to help identify potential areas of focus for future intervention and design.

- Industrial: Places where "manufacturing, assembly or processing of products takes place", including power generation. Both Light and heavy industry included, but not distinguished within dataset.
  - Heavy Industrial: Involves processing of raw materials or the fabrication and assemblage of bulky/heavy parts
  - Light Industrial: "design, assembly, finishing, packaging, and storing of products or materials... produce a relatively small amount of smoke and other effluents, noise, and dust."
- Transportation, Communication & Utilities: Not all-encompassing because this is an area of overlap and is heavily affected by "major transportation routes, utilities... and communication facilities... Major port facilities, roads and solar panel arrays are included in this category".
- Industrial and Commercial Complexes: Includes places with industrial and commercial land in close proximity, commonly referred to as 'Industrial or Commercial Parks'. Includes light manufacturing, administration offices, research and development facilities, computer systems companies, warehousing, wholesaling, retailing, and distributing.

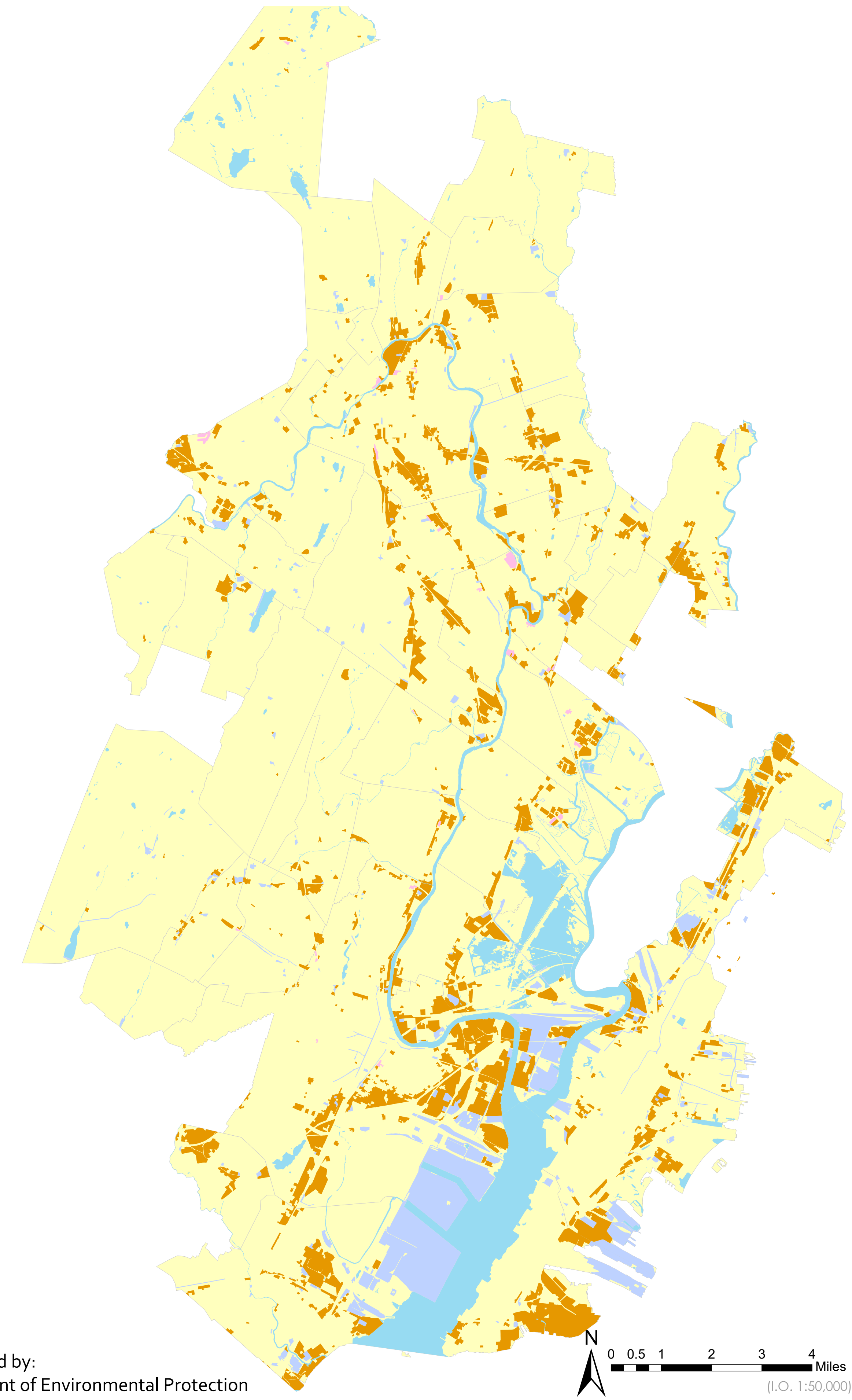
Industrial

Transportation, Communication, Utilities

Industrial and Commercial Complexes

Water Bodies

PVSC Municipalities

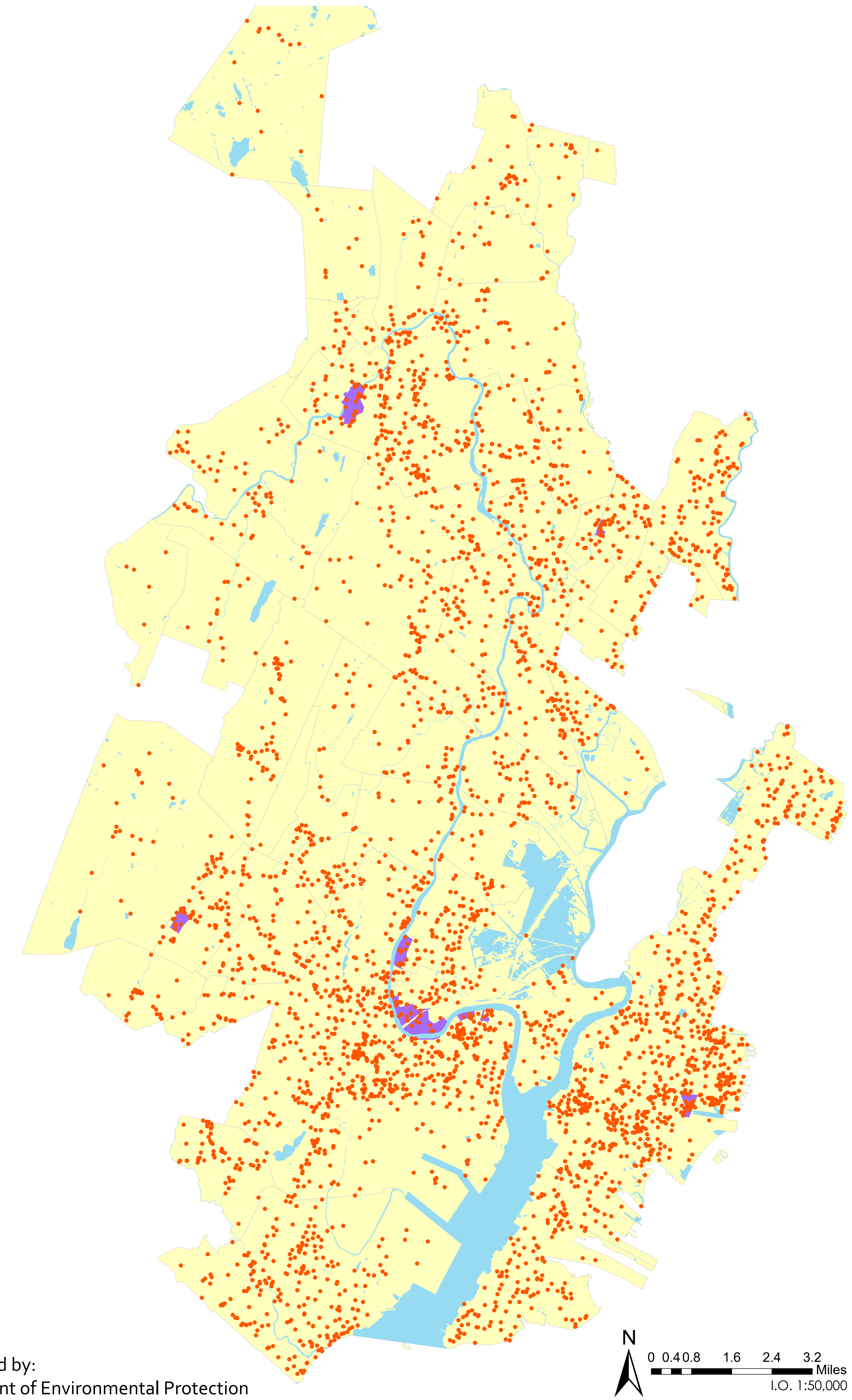


Data Provided by:
NJ Department of Environmental Protection
NJ Office of GIS

Brownfield and Contaminated Areas Within PVSC Municipalities

This map illustrates both brownfield remediation areas and contaminated sites. When this map is compared to the map of industrial zones, there are clear overlaps between brownfield sites and industrial areas. When one overlaps the two maps with each other, one finds that the contaminated sites tend to be near, next to, or in industrial areas, suggesting a direct correlation between industry, industrial waste, and pollution/contamination. Similarly to the map of industrial areas within the PVSC municipalities, this map can be used to identify areas of concern for future intervention and design.

- Overlap of brownfield remediation zones and industrial areas: the industry in the area is no longer active; sites that undergo remediation are no longer able to be used for their original purpose, but are instead put under redevelopment so as to fix the damage done to the area.
- No overlap of brownfield remediation zones and industrial areas: usually a sign of an area that was once industrial but is now being used for other purposes.



Contaminated Sites

Brownfields in Remediation

Water Bodies

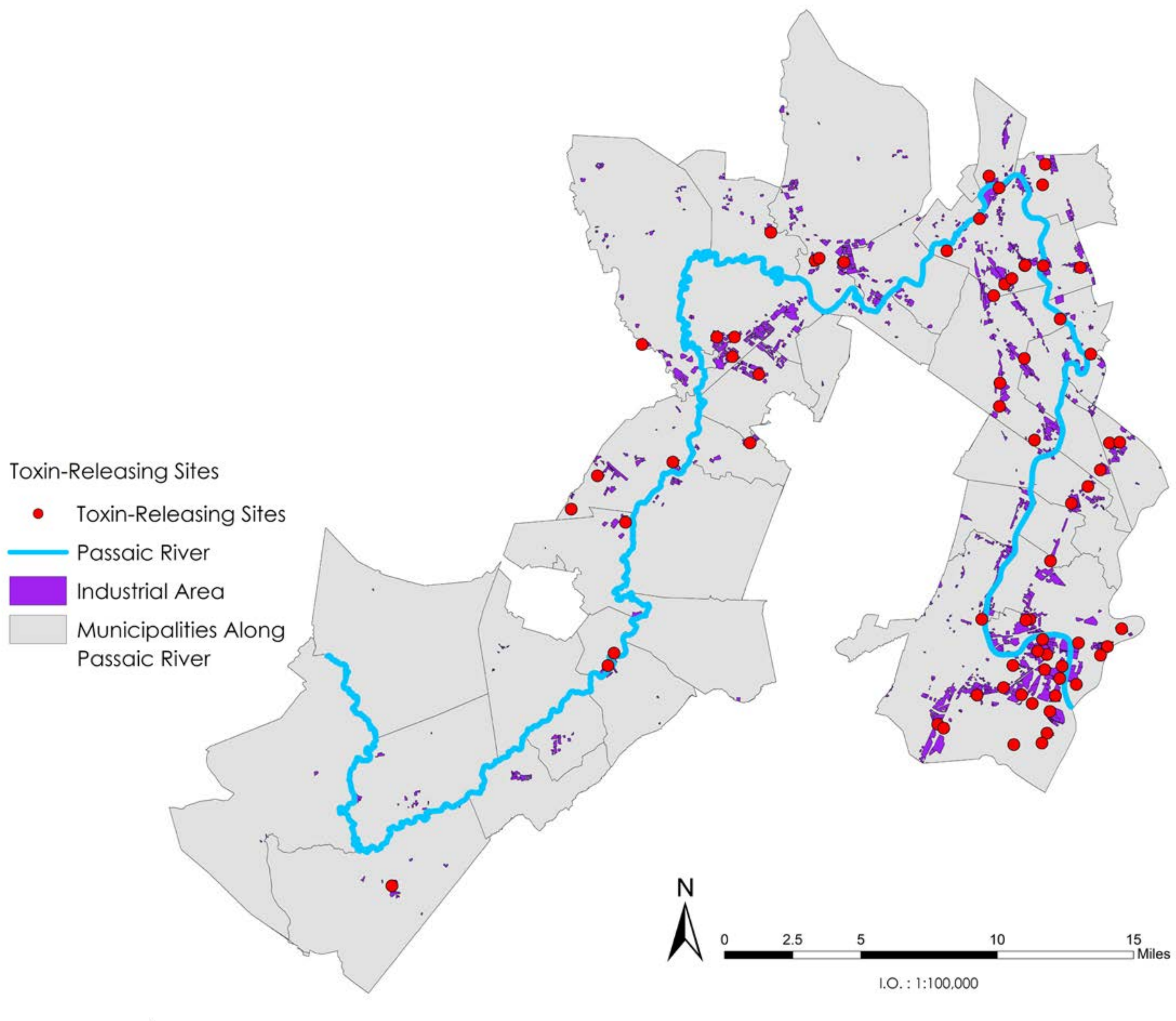
PVSC Municipalities

Data Provided by:
NJ Department of Environmental Protection
NJ Office of GIS

2.8 Pollution

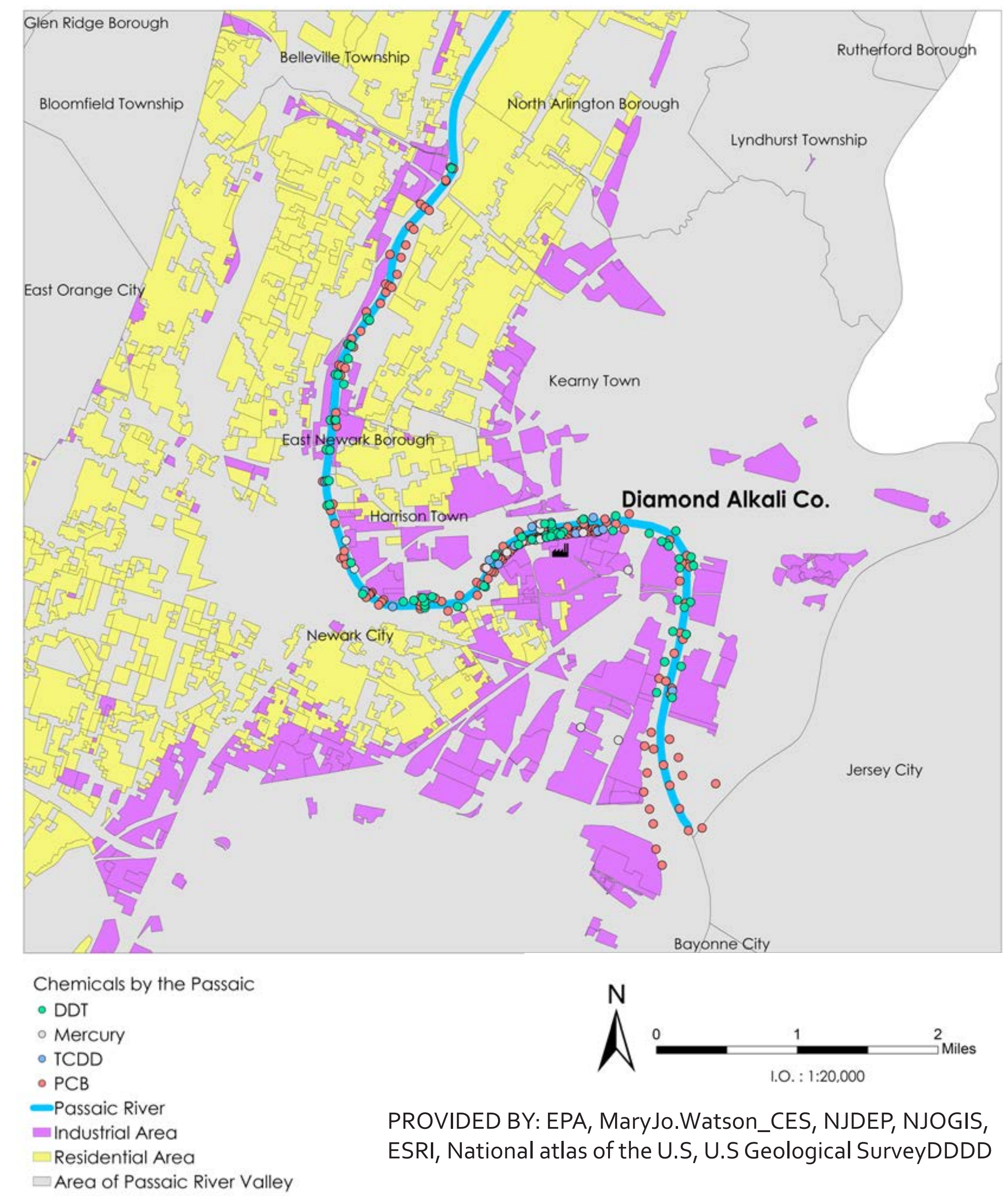
By: Shicheng Ma, Wooseok (Jacob) Choi

Industrial Area and Toxic Releasing Sites Along Passaic River



PROVIDED BY: EPA, ESRI, National atlas of the U.S, U.S Geological Survey, NJOGIS

Existing Toxic Chemicals in Downstream of Passaic River and Industiral Area



PROVIDED BY: EPA, MaryJo.Watson_CES, NJDEP, NJOGIS, ESRI, National atlas of the U.S, U.S Geological SurveyDDDD

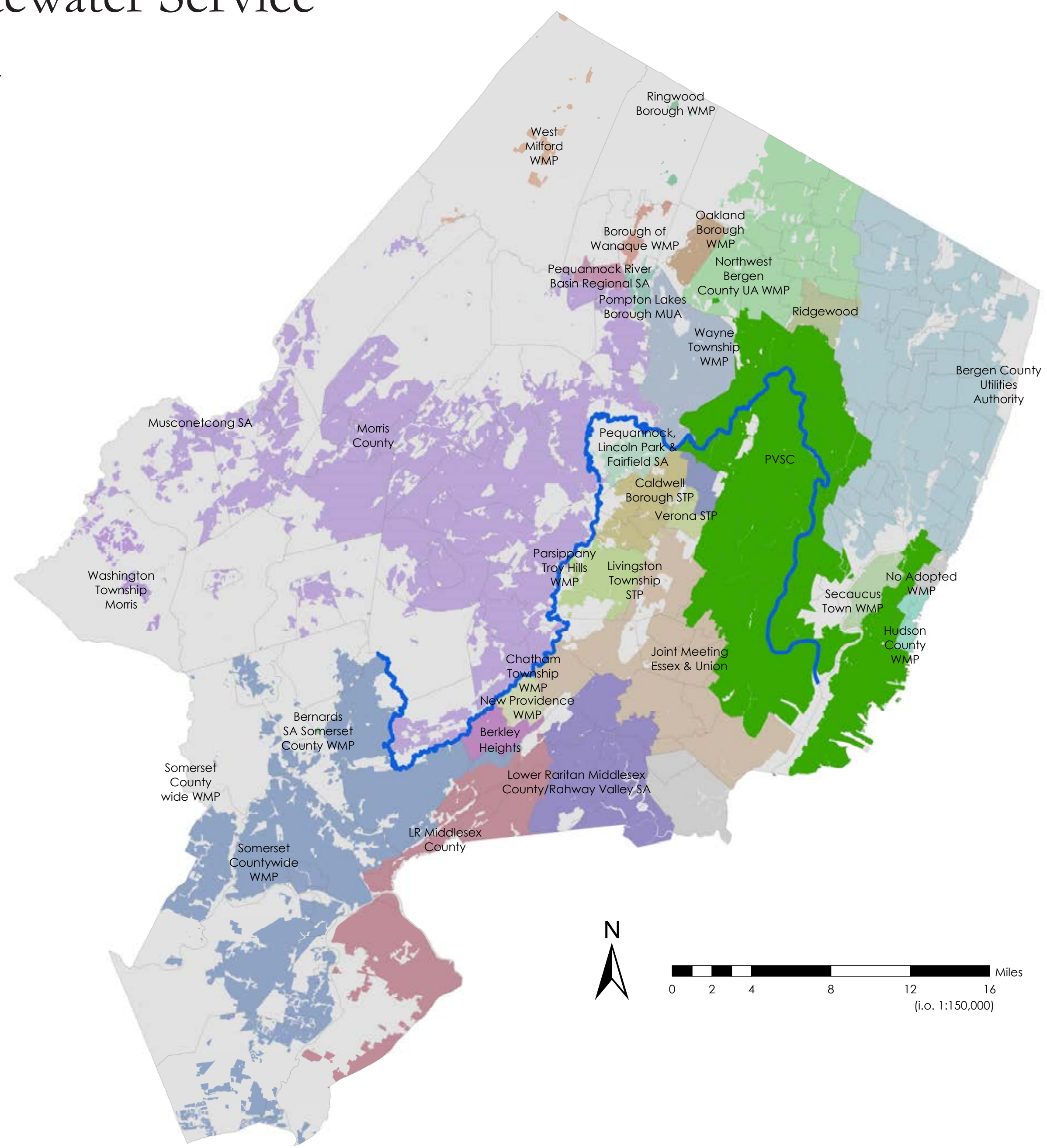
This map shows the toxic releasing sites along the Passaic River recorded by Toxics Release Inventory (TRI) Program from Environmental Protection Agency (EPA). TRI is a resource for learning about toxic chemical releases and pollution prevention activities reported by industrial and federal facilities. Compared to other municipalities along the Passaic River, more toxin-releasing sites cluster together in the lower portion of the Passaic River, especially around Newark industrial area. Heavy industries are the major producers of the toxin pollutants.

This map displays the different kinds of existing toxic chemicals in the lower portion of the Passaic River, where many heavy industries and residential areas are located. This map also points out the original location of "Diamond Alkali Co.", which produced Agent Orange during World War II. "Diamond Alkali Co." was largely responsible for contamination of the lower portion of the Passaic River that was classified as a Superfund site by the EPA.

2.9 Waste Management

By: Eamon C Epstein and Emily McGale

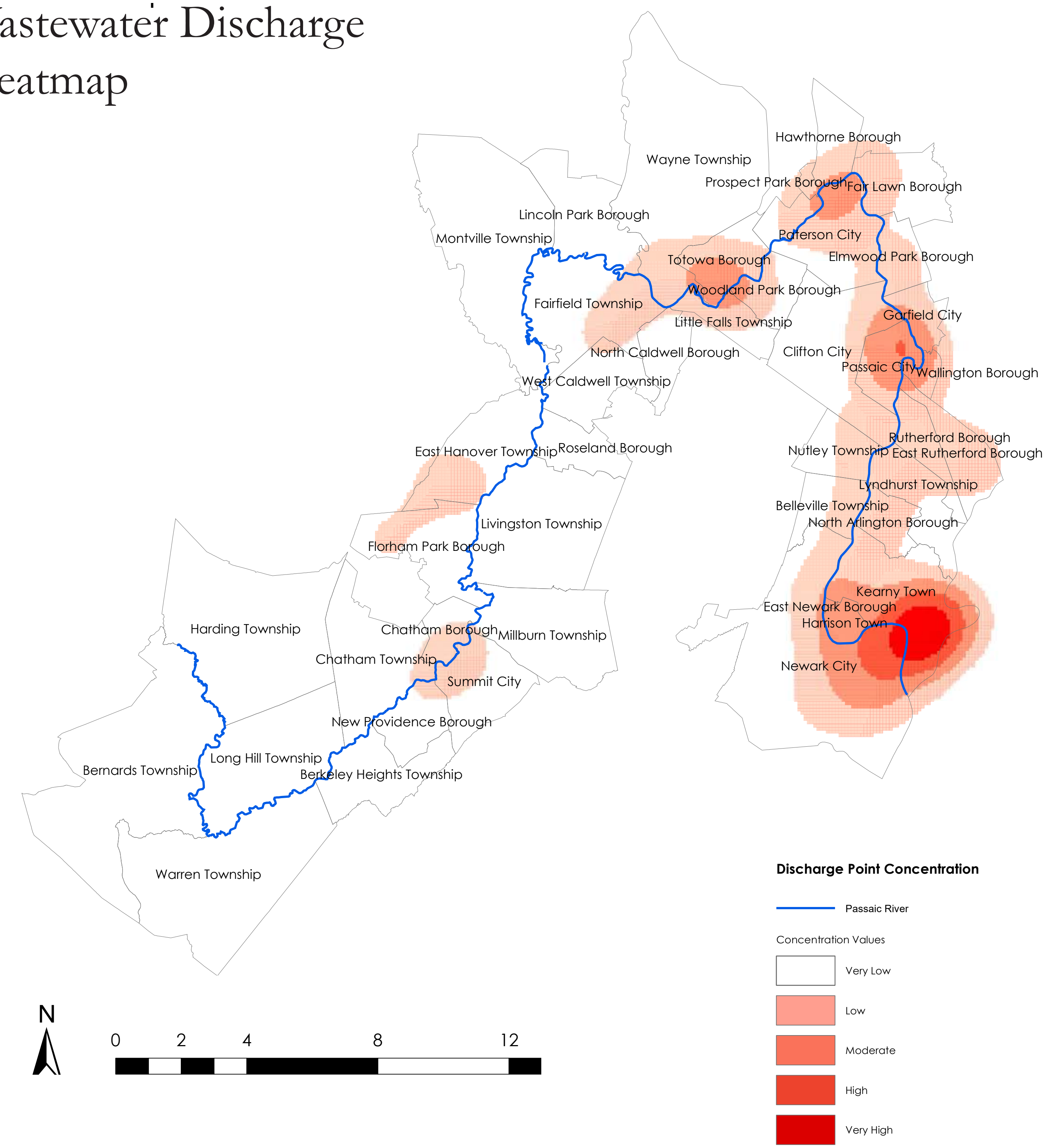
Wastewater Service Area



Map composition by: Eamon Epstein and Emily McGale, 9/27/17
Credit: NJOGIS

The numerous municipalities depicted in colored regions fall under the Sewer Service Area. An almost equally numerous amount of entities are charged with handling the wastewater in this region, as indicated by the variety of colors. The most notable wastewater management company along the Passaic River is the Passaic Valley Sewerage Commission, (PVSC).

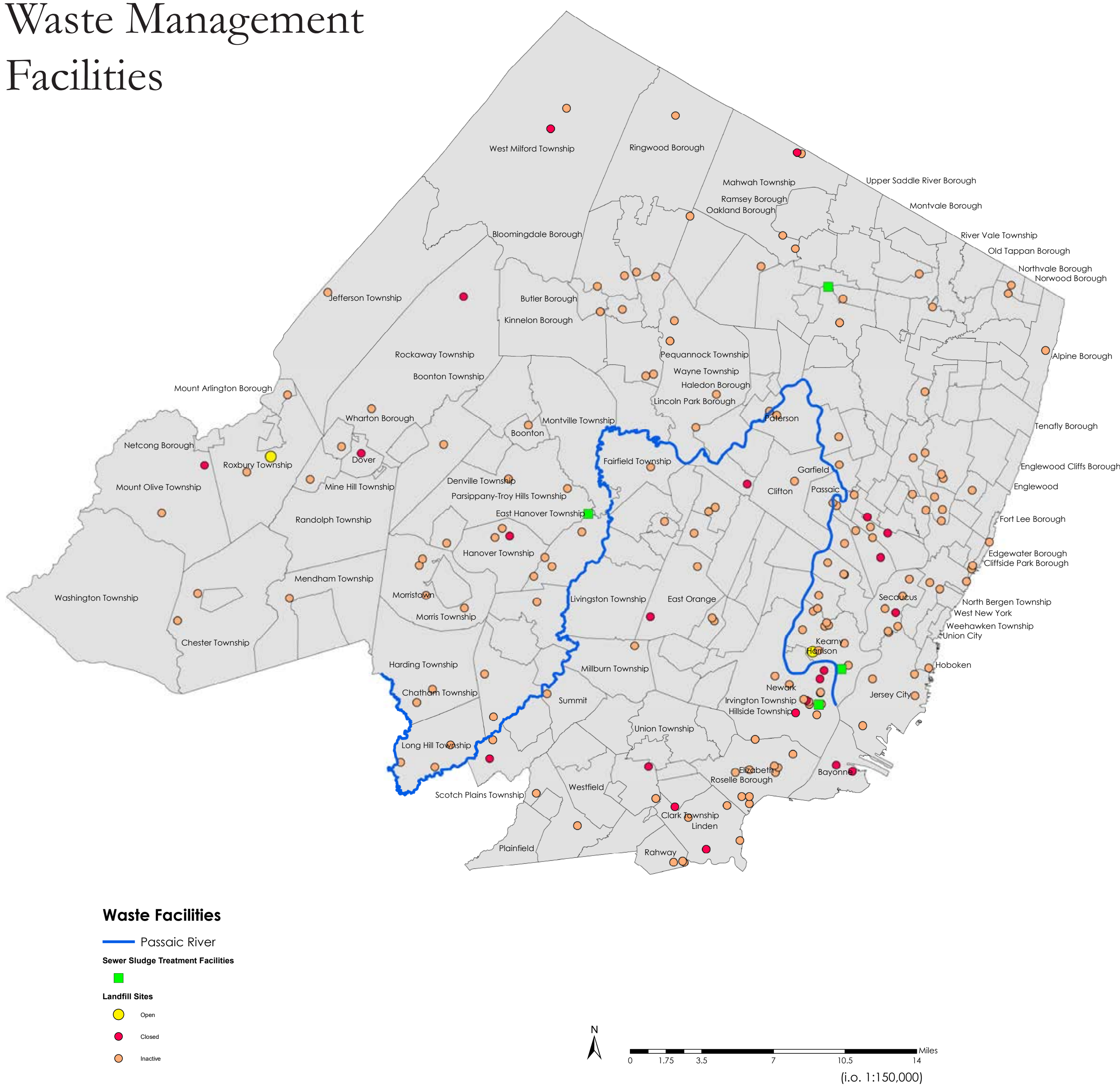
Wastewater Discharge Heatmap



Map Composition by: Eamon Epstein and Emily McGale, 9/24/17
Source: NJDEP

CSO outfalls are the exact locations where the wastewater overflow is released into the river. This heatmap is based off of the kernel density of all CSO outfall locations along the Passaic. The more heavily concentrated areas, marked by a more intense shade of red, indicate a higher likelihood of finding a CSO outfall within that area. From this diagramatic map it becomes clear that certain areas are experiencing the direct effects of CSO's in greater abundance than others, possibly directing the focus of interventions.

Waste Management Facilities



Map Composition by: Eamon Epstein and Emily McGale, 10/3/17

Credit: NJOGIS

This map is showing waste management facilities along the Passaic River. The sewer sludge treatment facilities are where sludge is dried and then used for fertilizer of capping landfills, and are colored in green. The closed landfills colored in red means that it was closed properly. The landfills that are no longer active, but were never properly closed are colored in orange. Finally, active landfills are colored in yellow. This map shows a very small number of active waste management facilities relative to those that are inactive.

Data inventory

Conclusion

The Passaic River is about 80 miles long, in northern New Jersey and was the backbone of the Industrial Revolution in the United States. Highly developed areas resulting from industry along the river lead to a steep drop in water quality. The Passaic River is considered one of the most polluted rivers in the U.S. Amongst the many factors contributing to the degradation of the Passaic River, impervious surface proved to be largely influential. Whether industrial, commercial, or high density residential, the character of the areas surrounding the river lead to high percentages of impervious surface. The impermeability of these areas caused high concentrations of stormwater runoff. In turn, this would result in the overflow of combined sewer systems.

The rise of industrialization meant a rise in population, further adding to the problem. A large portion of the areas studied had a high population density. This increase in the amount of waste that humans created needed to be addressed. Combined Sewer Outlet systems were created to be able to sustain the amount of waste. As of today, CSOs are outdated and overwhelmed. When the stormwater is too much the contaminated water of the river and the sewer waste are overflowing on the streets and even into homes. As a result of both issues, multiple interventions placed a focus on altering the landscape to provide greater permeability. From "green streets" to bioswales, collective efforts placed an emphasis on reducing the contaminated overflow of surface water draining into the Passaic.

Flooding is a frequent problem along the Passaic River impacting most sites of intervention. The result is uncontained and polluted stormwater runoff which can damage homes and hurt the environment. After making the inventory maps for flooding, the areas that experience the most and least flooding became clear. Higher risk flood zones were given priority when crafting the master plan. Efforts in these areas include the construction of canals to address the Oxbow Effect, where flooding occurs on the inside of river bends. Areas with moderate flooding were considered for smaller measures such as building up land to direct water into retention and detention systems. Areas with the least amount of flooding were given very basic treatments to mitigate flooding concerns in other areas. This includes designing green streets, vegetated swales, and rain gardens as ways to absorb and filter runoff before it continues downstream.

The demographics that were researched contributed to the site designs and overall understanding of not only the land, but the people that inhabited these spaces as well. These demographic types were a percent of children, median household income and population density contained within the 48 municipalities that PVSC is responsible for. Areas with lower median household income also correlated with areas of higher combined sewage overflows. The areas that were prone to flooding also had lower median household income. Though the density in many of the known flood zones did not appear to have the major impact that we had suspected, these areas were still being occupied. This was an important factor in our designing. Designs were not created solely for a space, but for a better quality of life for those within this space.

Factors such as combined sewer overflows, impervious surfaces, flood zones and demographics had the greatest influence on individual site designs. Taking into consideration these problematic areas and changing them into effective open/ remediation spaces was the most important goal. Implementing designs such as green corridors, retention basins, rain gardens and many other environmentally friendly interventions will help the projects achieve this. One single intervention might not make a huge impact, but providing many small ideas will help develop a solution to all the discussed problems.

Case Studies

Case Studies

For this chapter, students were given the task of researching and compiling a case study. This case study was an examination and presentation of a designed and planned area. These case studies were meant to give insights on how to solve problems and challenges associated with the task of planning the spaces surrounding the Passaic River. Students were given two options for how to go about researching the case studies.

1) Case studies of open space systems, which may include park masterplans on city, county, and state levels. They may be located in the US or abroad. What are the goals of these park systems? What makes a park system good? What is relevant information for developing a successful park system? What is needed to transform a number of individual parks into a cohesive system? What connects parks? What are core elements of a park system?

2) Research on Green Infrastructure Best Practices. This research gives the opportunity to explore a wide range of best practices concerning stormwater management, sewage water treatment, addressing CSOs, green streets, multiple use retention spaces, and so forth.

3.1 Central Park

New York, New York

Frederick Law Olmsted and Calvert Vaux

By: Nanik Song

Central Park lies on top of the bones of Seneca Village, what was once “the largest community of free African-American property owners in antebellum New York”. Its location was declared in 1853, with the destruction of the village following soon after in 1856. Any residents who refused to move out after the final notice sent in summer of 1856 were bludgeoned out by the police the following year.

In late 1920, homeless people began to settle in Central Park as the Great Depression hit. These people were kicked out at first, but eventually allowed to stay as the Depression continued and sympathies grew, creating the Central Park shantytown. It was shortlived, disappearing by April 1933 with the continuation of the reservoir landfill project.

The park was initially designed for the weathy; people of the middleclass were only capable of coming at certain times and days because of their working schedules. Concerts on Saturdays, and later also on Sundays by popular demand, attracted a more diverse crowd. As more programming options were offered, the park became more and more inclusive. Today, Central Park has a little something for everyone who, no matter class or identity.

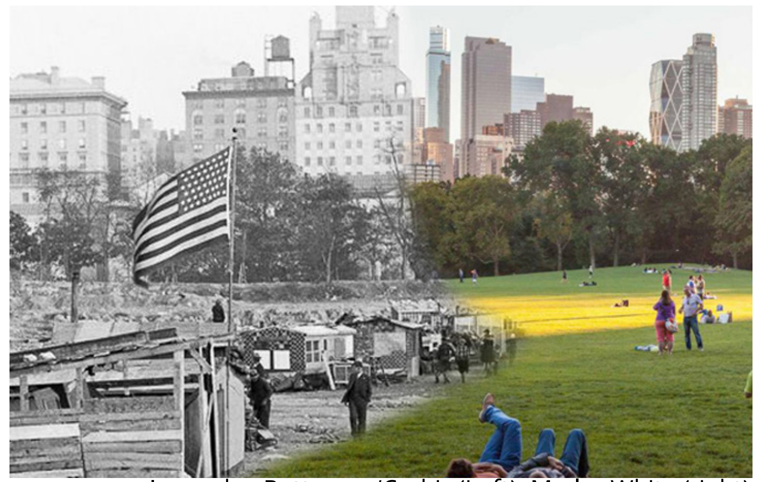


Image by: Bettmann/Corbis (Left), Marley White (right)

Image by: Marley White

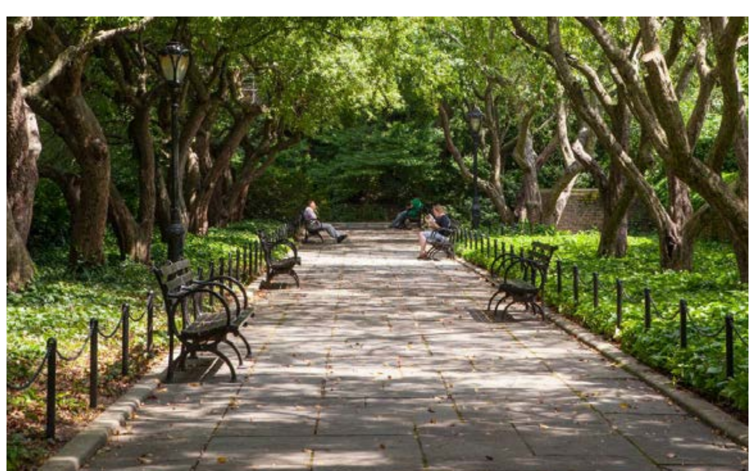


Image by: Marley White

Image by: Marley White

3.2 Bryant Park

New York, New York

Bryant Park Corporation

By: Tina Mao

Bryant Park located between Fifth and Sixth Avenue, and between 40th and 42nd Street in Midtown Manhattan. The park is managed by a non-profit private company responsible for maintaining the space. It is a landmark of environmental sustainability and has direct correlation between open space and land value.

Before Restoration, Bryant Park was known as “Needle Park” due to its poor design and lack of maintenance. Furthermore, the park was replete with illegal activity, and referred to as a magnet for “addicts, prostitutes, winos, and derelicts”. Police barricades became necessary at all of the park’s entrances after 9 o’clock at night. Additionally, tall, unkempt hedges, and a wrought-iron fence further blocked the view from the sidewalks; people have a difficult time trying to look across the park, making them feel uncomfortable.

Park rules also discouraged certain types of people from entering, even though it is supposedly open to the public. This did lead to a decline in crime rate within the park, but not because the offenders have been removed, but because they conducted their activates elsewhere.

After Restoration, it is known as a “Manhattan Landmark” by removing iron fences and shrubbery to make the space more physically and visually accessible. Entrances, ramps, stairs, and pavement were added while cutting through walkways and railing to configure free circulation. Besides increased accessibility and visibility, lighting and signage that indicating park rules and regulations were improved as well. Last but not least, increased presence of uniformed and unarmed security guards discourages crime and vandalism.

Image by: Townrealestate

Image by: Tina Mao

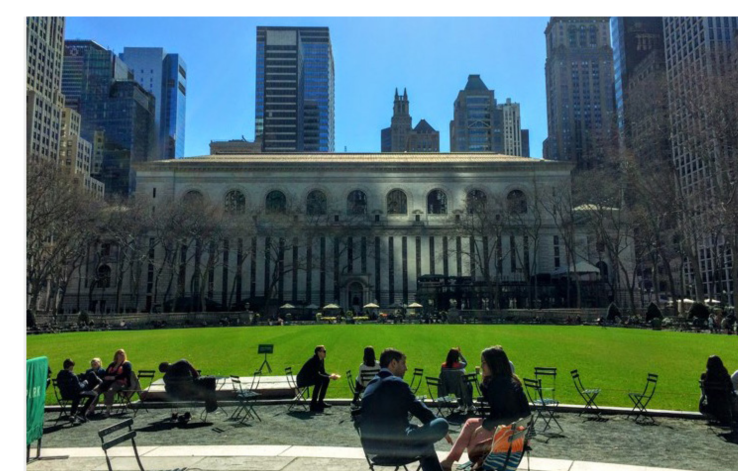


Image by: Tina Mao

3.3 Governers Island

Governers Island, New York Harbor, NYC

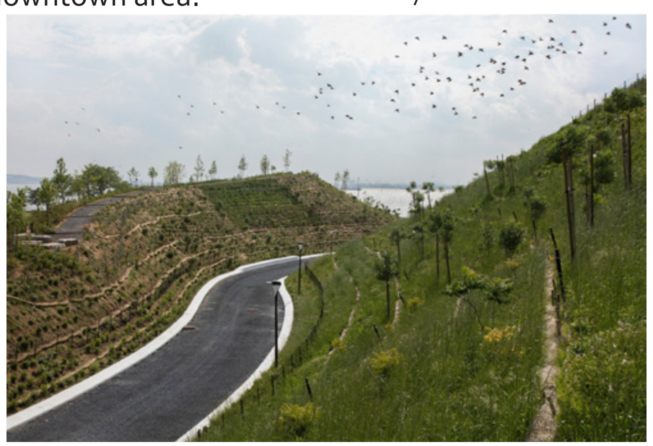
West 8

By: Wes Masco

Governers Island was a two phase project Done by West8 to reclaim part of the island as a multipurpose space to accomadate recreational needs of the people of the city and surrounding areas. A series of Hills ranging from 30 to 70 feet at the southern portion of the island were implelmented using reclaimed fill from demolished buildings and were built to protect the island from rising sea levels and ever increasing storms. These hills offer views of the City and Harbor like never before. Over 30 thousand plantings help hold together these new landforms and prevent erosion. Governers Island has become a landmark in New York City as is only a ferry ride away from the downtown area.

Photo by: George Steinmetz

Photo by: Richard Barnes



Phase 1 of the project implemented a network of winding paths and ballfields. The open program of the space gives the users the feeling of freedom.

Phase 2 of the project was the construction of the Hills which manipulate the topography to protect the island. They were hit hard during Hurricane Sandy but were 100% successful inppreventing damage.

Photo by: Andrew Moore

3.4 Chicago Botanical Garden

Glenco Illionis

Design by: Living Habitats

By: Alex Glasser

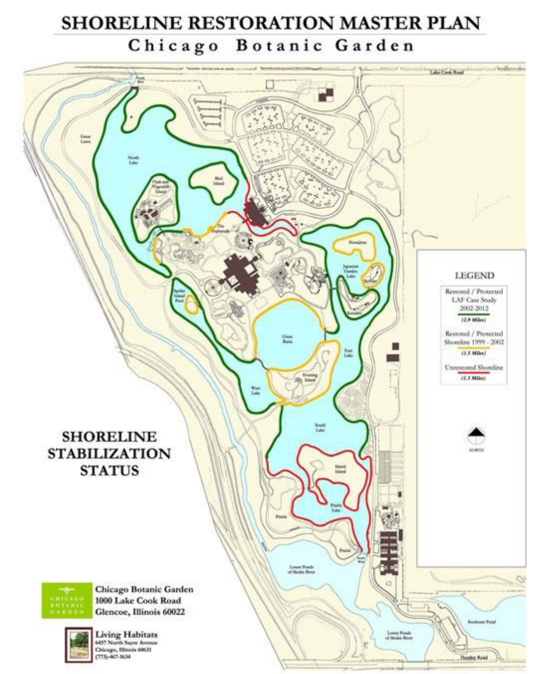


Photo By: Living Habitats

The Chicago Botanic Gardens Shoreline Restoration was put into place in order to respond to years of erosion and environmental decline along the banks of the lake. The project was completed in 2012, restoring 3 miles of the shorelines by increasing native habitat, while also increasing water quality. The design of the shorelines also took into account the wave actions and water levels that the lake has. The design allows for the fluctuation of the tide and waves up to 6 feet, which helps prevent erosion of the soils. The newly created habitat increased the plant and animal species richness, which is an educational mission the Chicago Botanic Garden wanted to teach to the public. The area was surrounded with many walking paths so that the public can get close to the newly native habitat and experience what the botanic gardens have to offer.

Photo By: Chicago Botanic Garden

Before the restoration, the shoreline had grass going up to the lake with a steep slope from years of erosion. The grass line did not provide any habitat and did not filter out any pollutants that went into the lake, causing water quality issues.

Photo By: Chicago Botanic Garden

After the restoration, the shorelines were planted with over 500,000 plants containing over 244 native species. This created new habitats for animals and increased the water quality of the lake.

3.5 Chicago Riverwalk

Chicago, Illinois
Hideo Sasaki
By: Monica Lee

Chicago Riverwalk, created by Hideo Sasaki was a movement to transform the Chicago River from a polluted, health hazard sewage drainage system into not only a clean waterway, but also a recreational, ecological, and economical amenity into the city. The Riverwalk's principal was to create an exceptional pedestrian experience along the South Bank of the Chicago River in the Main Branch. It is accomplished by expanding the Riverwalk between Franklin and Lake Streets and allowing under bridge connections. The Riverwalk brings people to the water, provides access for everyone, celebrates the history of downtown Chicago, creates unique places, finds new economic opportunities, as well as improves Riverwalk commercial functions. The Riverwalk is divided into five main sections, each providing a new program and design. The Riverwalk establishes a new green movement into the city.

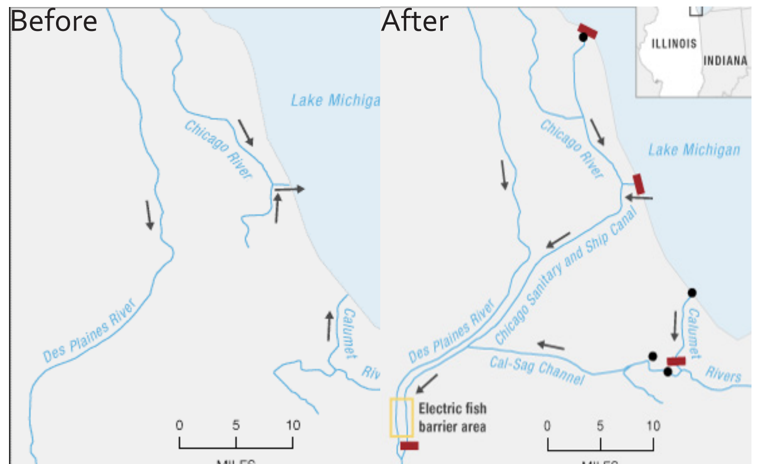



Image: Bobby's Bike Hike

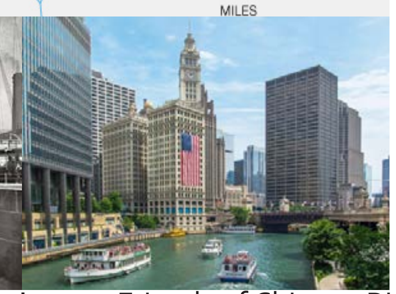


Image: Friends of Chicago River

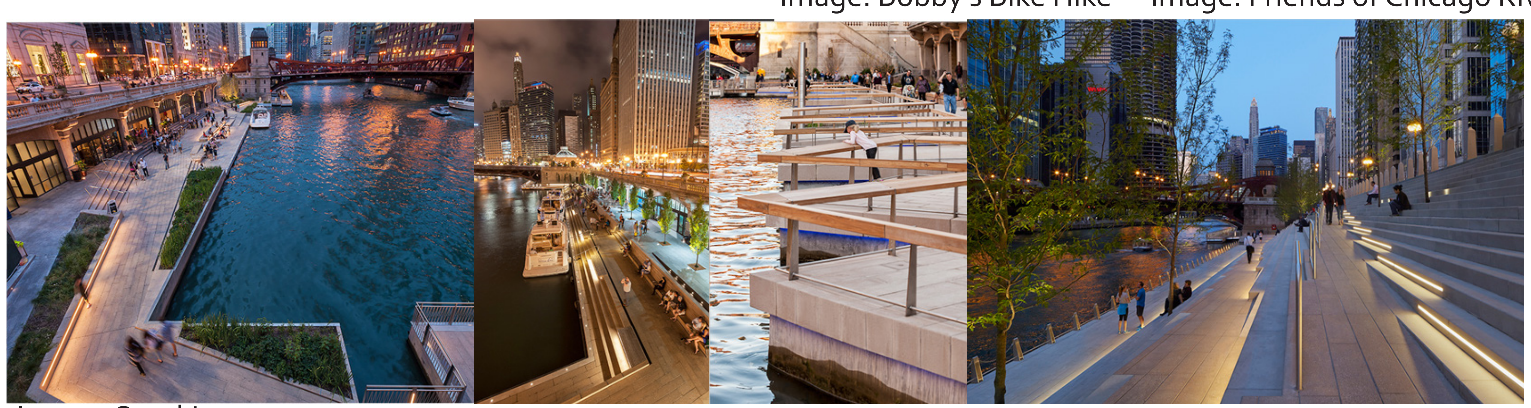


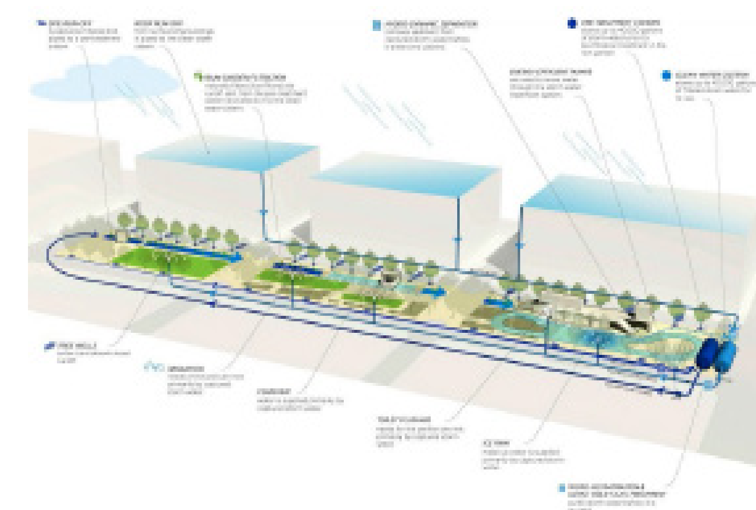
Image: Sasaki

5 Sections of Riverwalk: Jetty, Water Plaza, River Theater, Cover, and Marina.
Image: Sasaki

3.6 Canal Park

Washington D.C.
Olin Design
By: Emily Toth

Canal park, also known as the Navy Yard, is located approximately one mile southeast of the Capitol. Formerly a brownfield, the site of the park served as bus parking for the city school district. Today, Canal Park is a programmed space accessible to the community all year round. The site includes fountains to keep cool in the summer, an ice rink for the winter, a restaurant, and an open lawn, and a variety of other unique amenities. While this park thrives as a social open space, it also strives to be sustainable. A skim fountain works with underground cisterns to capture and filter stormwater runoff from nearby impervious surfaces. Other environmentally-friendly features include 6000 square feet of rain gardens, an electric car charging station and high albedo pavers that reflect light from the ground surface. Canal Park serves as a prime example of how even a small area can be transformed into a major asset to the community and the environment.



North End: Open lawn, Abstract cube pavilion. Middle: Skim fountain, Play area. South End: Restaurant, Ice Skate
Note: Photos provided by Landscape Performance Series

3.7 Rose Kennedy Greenway

Boston, Massachusetts

Perkins+Will

Anna Erickson

The Rose Kennedy Greenway is a 17 acre ribbon of parks that runs through the heart of Boston. Built over reclaimed land from what used to be an elevated highway, the greenway reconnects a previously severed community to its cultural spaces and the waterfront. It also provides important environmental benefits including improved air quality, caps for landfills, and increased open space.

When Boston's Central Artery was built in 1959, it was meant to relieve traffic. But it soon became clear that further amendments needed to be made. As early as 1970, solutions were proposed to put the highway underground with added tunnels to redirect traffic to and from the Logan Airport. After finally receiving federal funding, construction for the "Big Dig" began in 1991.

The Boston Central Artery Corridor Master Plan developed by Perkins+Will provided the framework for what should be done with the reclaimed land. It was decided that three quarters of the 27 acres of the highway would remain as open space, with 25% set aside for retail and commercial development.

One of the greenway's primary goals is to enhance pedestrian walkability. During the time of the highway, residents saw the space as a barrier, and expressed a strong desire to be able to cross the city freely. Because of that, the parks and promenades developed along that space are connected by pedestrian paths, bike trails, and road crossings.

The building of the greenway also helped with the revitalization of Boston's waterfronts. The material from the dig was instrumental in the creation of new greenspace, with 16 million cubic yards of dirt being used to fill and cap landfills throughout New England including a former city dump at Spectacle Island.

Boston has used the newly developed open space as a way to enhance the city's overall Greek Links plan to create a seamless network of greenway paths connected to every neighborhood.

Boston Central Artery Corridor Master Plan

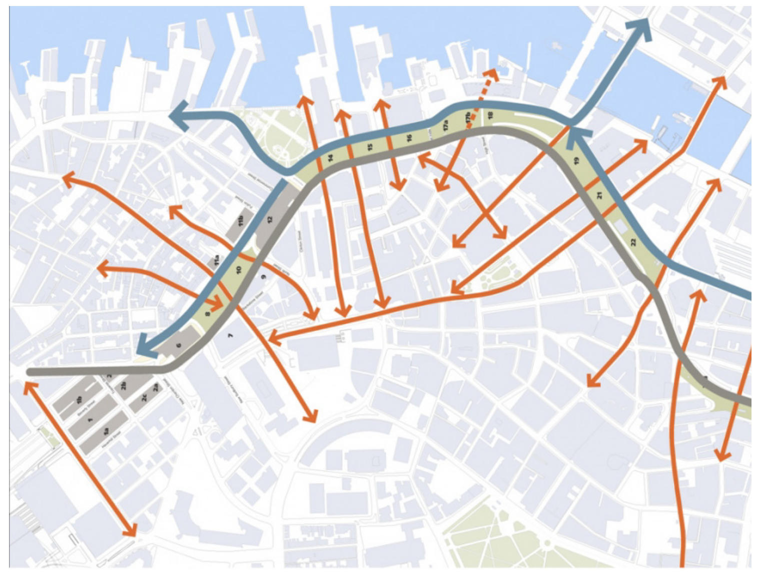


Image: Perkins+Will

Image: Boston Magazine

Image: Rose Kennedy Greenway

3.8 Cuyahoga Valley National Park

Peninsula, Ohio

National Park Service

Meng Guo

The Cuyahoga Valley National Park is located in the Northeast Ohio, and is administered by the NPS (National Park Service). It covers 32572 acres, and generally receives more than 2.2 millions recreational visits each year. A key feature of the park is the Cuyahoga River, which is one of the most polluted rivers in the world.

Fires have plagued the Cuyahoga River beginning in 1936, when a blow torch sparked the ignition of floating debris and oils. Afterwards, during the 1960s, the lower Cuyahoga River located in Cleveland was used for waste disposal, becoming choked with debris, oils, sludge, industrial wastes and sewage. On June 22, 1969, the Cuyahoga river caught fire and captured national attention. In 1988, the Ohio Environmental Protection Agency created the Remedial Action Plan for the AOC, and the Remedial Action Plan Stage I report was completed in 1992.

The purpose of Cuyahoga Valley National Park is to preserve and protect for public use and enjoyment the historic, scenic, natural, and recreational values of the Cuyahoga River and its valley. It also serves to maintain the necessary recreational open space in connection with the urban environment, and provides for many recreational and educational needs of the visiting public. Overall, the core value of Cuyahoga Valley National Park are collaboration, innovation, tenacity, renewal.

Until now, there have been more than 40 species of fish residing in the river's waters. Great blue herons are another river ecosystem resident that find the food and nest sites it needs along the Cuyahoga River. Now, fish that can only live in clean water, like steelhead trout and northern pike, have made their reappearance. After disappearing from the Cuyahoga County for 70 years, the nesting bald eagles have returned as well.

Cuyahoga Valley National Park Master Plan

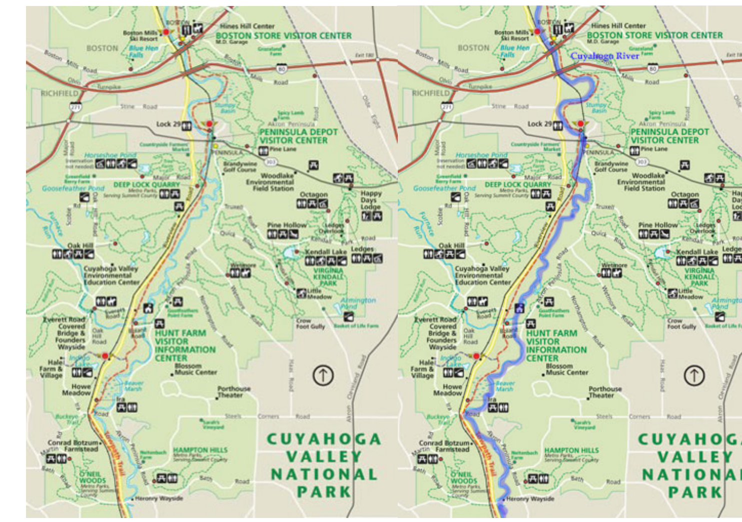


Image: National Park Service

Image: NPS/DJR

Image: National Geographic

3.9 Green Gutter Design

San Mateo County, CA
Nevue Ngan Associates
Sherwood Design Engineers
By: Grace Li

The implementation of green gutters is relatively new in the landscape architecture industry. The idea was proposed in the *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook* in the first edition that came out in January of 2009. It is a low cost option for roadways with 2 or more feet of excess land width between the travel lanes and the sidewalk zone. This "dead space" increases the efficiency of gutters in residential, commercial, and arterial street frontages which rely on length to be effective.

Green gutters are a combination of three different storm water management practices. These practices are curb extensions, which are spaces for plantings converted from strips of existing roadway, as well as linear forms with a conveyance function called swales,and flat-bottomed treatment areas with curbs on either side, called planters. There is an opening in the curb wall of the gutters to allow water to be retained and either infiltrate into the soil or flow through another opening into another gutter.

The major advantages of the gutters are that they create "green" streets with minimal investment, they are inexpensive to build, and they create a street environment that is safer for pedestrians. Of course, there is an aesthetic benefit provided as well. On the flip side, adequate length is necessary for the gutters to be fully effective, retaining a maximum of 3 inches of runoff, and they may decrease space available for the bike lane.

The defining reason for this concept not being utilized in San Mateo County, CA was because these gutters would not be able to satisfy the C.3 storm water treatment requirements. However, this is not an issue in areas of lesser quanitites of runoff.

Image by: Nevue Ngan Associates

Image by: Nevue Ngan Associates

Image by: Nevue Ngan Associates

3.10 Bay South Garden

Singapore
WilkinsonEyre, Atelier Ten and Atelier One
By: Wenjia Yan

Bay South Garden is one of the man-made parks that reaches the sustainability level in central Singapore. It is termed a "sustainable garden" because it was created using recycled material and uses renewable energy with no toxic release to the environment. The concept of Bay South Garden was inspired by the country's national flower, the Vanda 'Miss Joaquim'. The plan's design consists of a unique blend of nature, technology, environmental management and imagination. Its design includes two cooled conservatories, named the Flower Dome and Cloud Forest, two gardens known as Heritage Garden and World of Plants, two lakes, and a grove of Supertrees, which are cyclic systems of solar and water powered energy generation. In addition, the Garden has two open spaces, Meadow and Silver Leaf, which are used for outdoor events.

In addition to utilizing the energy generated by the Supertrees, the Bay South Garden sustains itself by burning its own bio-waste. The lakes in the Garden function as natural filtration systems for water from the Garden's catchments while simultaneously providing aquatic habitat for fish and dragonflies. Filter beds planted with aquatic reeds line each side of the lake system to filter any excess water run-off and reduces water flow while filtering out sediments. The aquatic plants and reed beds also help to absorb nutrients like nitrogen, which minimize algae growth.

Image by: Gardens By The Bay

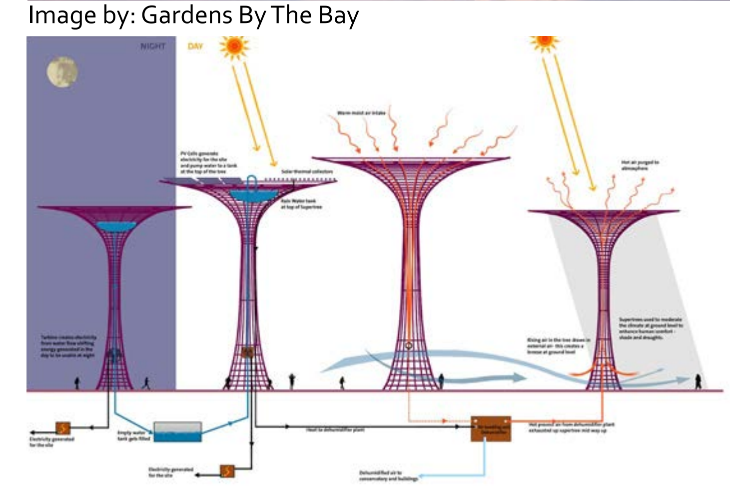


Image by: Gardens By The Bay

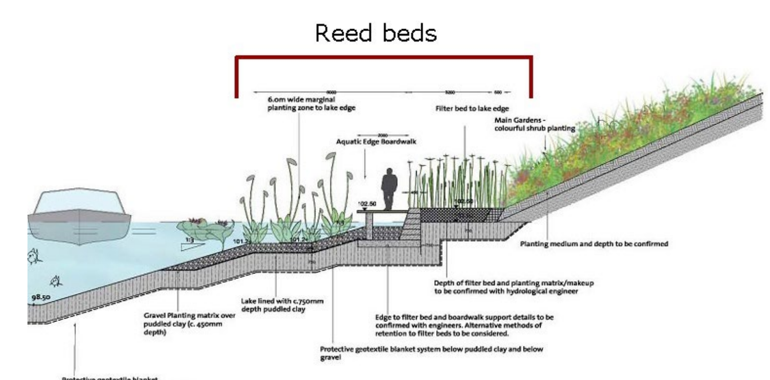


Image by: Gardens By The Bay

3.11 Shanghai Houtan Park

Shanghi, China

Turenscape

By: Shicheng Ma

Image by: Turenscape

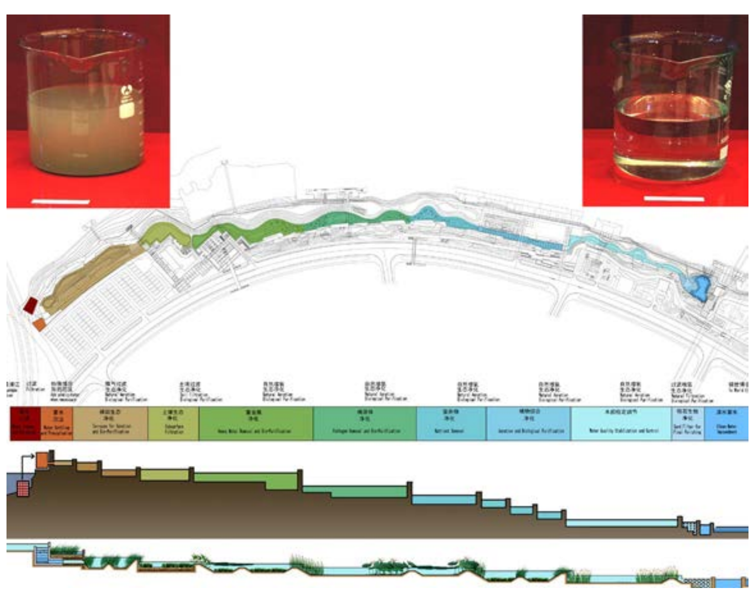


Image by: Turenscape

Houtan Park is built on a brownfield of a former industrial site and a regenerative living landscape on Shanghai's Huangpu riverfront. It is an open space system where green infrastructure is applied to water treatments, societal services and the ecosystem.The park's constructed wetland, ecological flood control, reclaimed industrial structures and materials, and urban agriculture are all integral parts of an overall restorative design strategy to treat polluted river water and recover the degraded waterfront of the river in an aesthetically pleasing way.

The success of Houtan Park shows that ideas of landscape architecture are capable of solving existing environmental issues in an aesthetically pleasing way. Landscape architecture not only provides more green to the area affected, but is also practical in how it functions to involve and incorporate the social context of its visitors. In short, the landscape is an impartible component to each community, and influences it in an inconspicuous yet essential way.

The center of Houtan Park, a linearly constructed wetland, is 1.7 kilometers long and 3-50 meters wide. It is designed to create a reinvigorated waterfront green infrastructure to serve as a living machine that treats contaminated water from the Huangpu River.

In this mechanism, cascades and terraces play key roles as a series of distillations to process the water that enters the system. They oxygenate the nutrient rich water, filter the nutrients within it, and reduce suspended sediments in the flow further with each distillation.

Along the way, the carefully selected wetland plants species included in the system are designed to absorb different pollutants from the water in order to purify it. These two components work together to help clean contaminated water.

Furthermore, the existing concrete floodwall was replaced to better allow native species to grow along the riverbank while simultaneously protecting the shoreline from erosion.

3.12 Tianjin Qiaoyuan Wetland Park

Tianjin City, China

Turenscape

By: Alexis Lo

Image by: Turenscape

Site Conditions:

The land was once rich with wetlands and salt marshes, but were destroyed by decades of urban development and infrastructure construction. After many years the site became abandoned, heavily polluted, flattened, and had accumulated poor soil conditions. It was the cities dumping grounds and where stagnant stormwater sat for days at a time.

Image by: Turenscape

Relation to The Passaic:

This heavily polluted site was transformed into an ecologically functional stormwater capturing system. Throughout the Passaic River, there is rampant flooding and contamination. Through this case study one can take away the progression of the land through a productive landscape design.

The Design:

The design goal for this project was to create a park that can provide a diversity of nature's services for the city and the surrounding urban residents, including: sustainability; native vegetation; environmental education about natural systems, stormwater management, and soil improvement. To capture the stormwater twenty-one pond cavities varying from 33-131 feet wide, and 3-16 feet deep were implemented.

Image by: Turenscape

Design Impact:

Through the use of select adaptive vegetation and best management practices, this landscape became a haven for wildlife and plant diversity. Improvements include: reduction in soil alkalinity and increased habitat value.Plants from the site sequester about 539 tons of carbon. Water quality was also improved.

3.13 Cheong-Gye-Cheon

Seoul, Korea

SeoAhn Total Landscape

By: Wooseok (Jacob) Choi

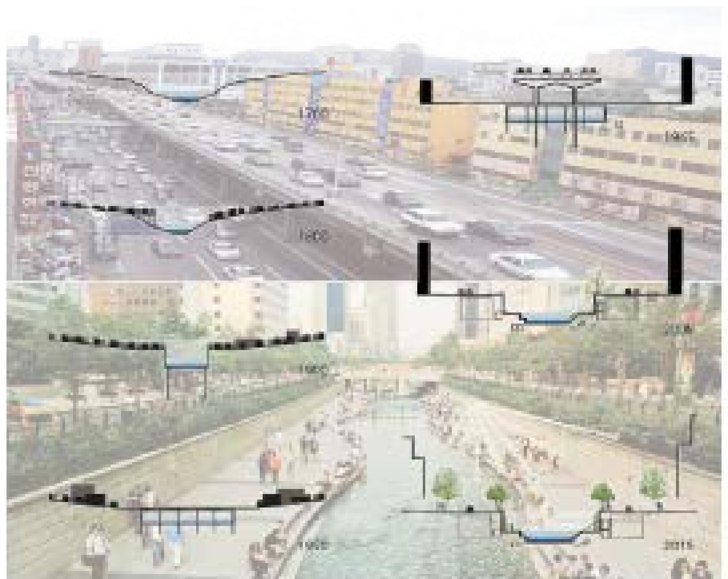


Photo by : Busquets, Landscapeperformance

As a result of this stream, the lost habitats were brought back to the nature and more wildlife species were found. Native willow swamps, shallows, and marshes were constructed in different locations along the restoration, creating habitats for fish, amphibians, insects, and birds. Also, the biotop structure has been used for environmental conservation. Furthermore, it reduced the urban heat island effect with temperature along the stream from 3.3 °C to 5.9 °C cooler than near areas. This allows the cooling effect of stream, increased vegetation, and reduction of air pollution.

Photo by: Matt Grant

Located in the center of Seoul, the capital of South Korea, CheongGyeCheon stream is 8.5 miles long, 65 ft to 280 ft wide, leading to Han River - the major river in Seoul. The government decided to remove the bridge and bring the stream back to the city for better ecosystem. It is designed with sections of stream to ensure maximum flood capacity and is built with embarkments to withstand the worst possible flood. This stream works as the infiltration system before going into the Han River. Along the upper reach of the stream, intercepting sewage lines are installed to collect rainwater and wastewater separately. Also, covering structures are used to prevent wastewater to flow into the stream during rainfall period.

Photo by : ICLEI

There are methods from this stream as a reference for Passaic River Valley. Biotops could be created by replacing granite with vegetated low-flow revetment to increase habitat area. Also, by installing spur dyke to deepen water and decrease veolocity, fish habitat in certain areas may be improved. Variations on the bottom of the river needs to be conserved in order to support invertebrates. Creating vegetated filter strips would reduce contaminants entering the stream from motorway run-offs. Furthermore, the isolation of the park from the roadways reduces the noise.

3.14 The River Isar

Munich, Germany

Irene Burkhardt & Winfried Jerney

By: Emily Otterbine

River arms and buildings along the Isar

Image by: Frédéric Rossano

Originally a wild river with a constantly changing riverbed, the Isar was forced into a fixed position ia construction in the nineteenth century. Issues with ooding came with the melting snow from the Alps which finally prompted the beginning of what was to be nown at the Isar-Plan.

In Germany, it is common to hold mandatory design competitions for anything being built for the public. his process was also used to choose a winning design or a section of the Isar which runs through Munich.

The jury, which was comprised of architects, andscape architects, city council members, engineers, ity planners, decided on a proposal by Irene Burkhardt. he design was a more technical solution that called for sculptural levee which kept the main river separate rom recreational areas. The second prize, by Winfried erney, presented a spontaneous and winding, almost entirely natural looking design, which gained much more popularity with citizens of the city. Objection to the winning design resulted in the decision that both the first and second prize winner would share the planning.

A look at the river now, and you can see a mixture of both designs. Flood protection measures included widening the riverbed, an increase in dike height, removal of silt deposition, and the building of "near natural" designs of the banks. There are now ramps made of rocks to replace sill beams that would have posed as a barrier for fish, new diversified rocky shoals and gravel bank structures instead of concrete, as well as blooming meadows, and islands with vegetation on them, and all is accessible to the public. A first glance of the river may appear completely natural, but underneath is a very technical and thought out design.

sar before: monotonous landscape

Image by: N. Mahida

Isar after: diversified bank structures

Image by: N. Mahida

3.15 River Rhine

Europe
Runs through 4 Countries
By: Emily McGale

The very long 760 mile Rhine river runs from the alps going through Switzerland France Germany and the Netherlands into the north sea. The river was mainly used to transport goods and connected many nations. To get an idea of the regions size, the population in 2009 was about 50 million people that were living along the river. (Cioc)

The four separate countries industrial revolutions starting as early as 1815 all had untreated industrial waste from chemical production, coal, steel production, and textile production, all being dumped into the river and it became very polluted. Not only industrial waste but residential waste and run off. For over 150 years the river was getting polluted. A big turning point in this rivers history was a 1986 chemical spill near Basel Switzerland that was 30 tons(BBC) of pesticides that entered the river. Millions of dead fish and eels had to be scooped out, some species were completely whipped out(BBC).

In 1950 there was a meeting for the start up of the International Commission for the Protection of the Rhine against Pollution (ICPR) they did have a rough start, the worst pollution was still to come in the 1960s it was measured at the worst its ever been. The commission wanted to make the international water protection legally binding. The counties joined together, had conventions protecting the river from pollution and chemicals, they set up measuring programs, analyses, and made laws to reduce discharges of waste. The international commissions and other stake holders are very successful. Clearly you can see I am in the dirty river!

This relates to the Passaic because it is a dirty river that is in the works of getting cleaner. The Passaic river is only 80 miles long and in one state. Four whole countries came together to make an international legally binding action to clean the river. With such huge problems it is easy to get overwhelmed and see no solution, with cases like this, what you thought was not possible is completely possible. We can take away that the only limits are the ones we put on ourselves.

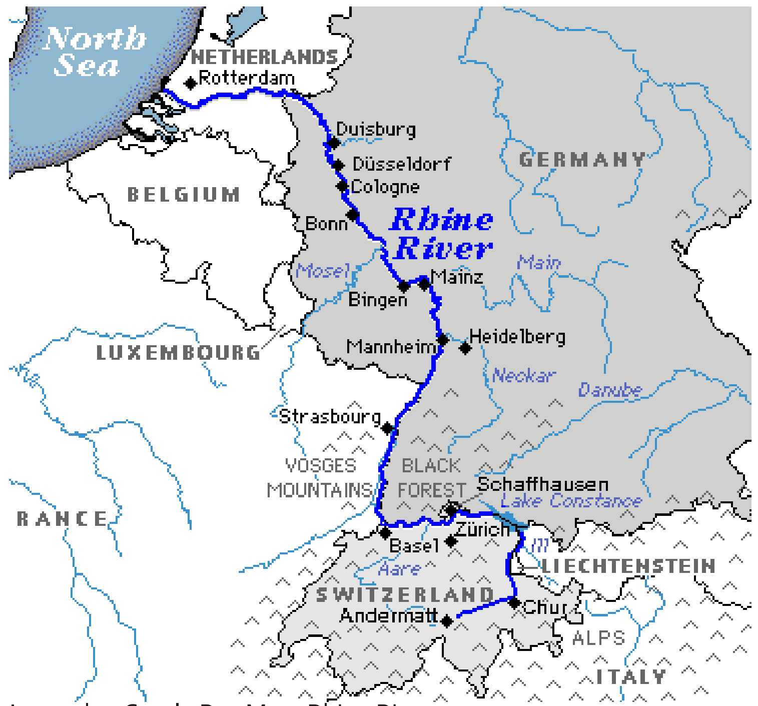


Image by: Carole Bos Map: Rhine River


Image by: Nicole Cohen

3.16 Lake Phoenix

Dortmund, Germany
Phoenix-See-Entwicklungsgesellschaft, Dortmandur Stadtwerk, Emschergenossenshaft, City of Dortmund
By: Devin Fields


Image by: Devin Fields

Lake Phoenix is a storm water retention basin created within a new development in the district of Horde in Dortmund, Germany. Phoenix, the development holding the retention basin, was created on land that has a long history of industrial production. The land was once occupied by a steel factory named Hermannshutte, which started production in 1843. After the devastation of WWII, the plant was remolded and expanded to be one of the most modern Oxygen steelworks of the continent in 1963. In the beginning of the 21st century, factory was shut down, and left vacant until Phoenix started development in September of 2006. The effects of the industrial history of the site leave the soil contaminated and the water polluted.

Phoenix's goal is to provide water-front upscale housing that is sustainable, all while paying homage to the history of the site. The sites shape is that of a typical retention basin: high topography surrounding a large pool of water, with any development on higher ground, and outlets where the water can rush downhill to the basin to be caught and managed. Lake Phoenix takes in 360,000 cubic meters of water and simultaneously works as a building block for the Emschergenossenshaft remediation of the Emscher River, which flows right through the development. The retention basin essentially takes in the river water, filters it and stores it until it eventually releases it back into the river. This helps slowly clean the Emscher River. The immediate area surrounding the lake provides an active and passive space for the local residents, where they can walk, bike, shop, eat, and relax. Lake Phoenix is also a great example of planning and design. The raised topography surrounding the lake not only helps with storm water flow, but also adds an aesthetic value of wealth and power for the local people living in the homes. Phoenix itself has many green infrastructure techniques implemented into the design, such as raingardens for storm water collection and filtration, gabion walls for permeability, soft borders for slowing storm water runoff, and of course, a large retention basin in the center.

3.17 Grorudparken

Oslo, Norway
LINK Landskap
By: Adam Fricke

Grorudparken is a recreational, water focused park located in Oslo, Norway. The park was designed by LINK Landskap, but the project itself was constructed and conducted by Oslo's Municipality's Department of Water and Sewerage, The Department of Recreation, The Planning Office, The Office of Cultural Heritage Management, and the District of Grorud. The park provides 119,000 square meters of space for athletics, play, social interactions, and youth programs. The demographics of the area consist of immigrants from Pakistan, Poland, Sweden and Somalia. The space acts as a corridor connecting Lillomark to Leirfossen and Hølakøkka. The central focus of the park is River Alna, which incorporates existing historical and cultural artifacts with fresh landscape experiences. Water structures flow throughout the entire design of the park. Phytoremediation components apply both aesthetically pleasing looks and environmental benefits.

Grorudparken contributed applicable knowledge for site interventions. Relating more to the class' overall goal and purpose for this project, Grorudparken is a hotspot for culturally diverse activities and social interactions to take place. Grorudparken successfully accomplishes what the studio has in mind for the Passaic Valley Region. With a focus being its river, water control, and

Photo By: Thomas Majewski

Grorudparken contains many of the storm water management, flood mitigation, and cleansing of runoff elements associated with the design groups' projects and interventions. CSOs are a result of an excess amount of rainwater runoff that infiltrate combined sewer systems. With that in mind, understanding the filtration and water management design throughout

Photo By: Tomasz Majewski

activities for a diverse population, Grorudparken was an exceptional study to gain insight on for furthering the design process.

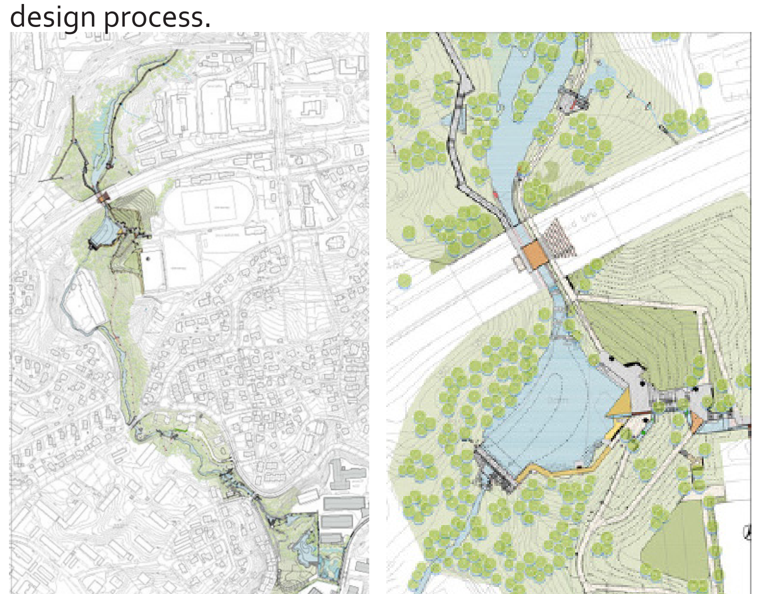


Photo By : © LINK Arkitektur

3.18 Water Re-Use Project

Sydney Park, Australia
Turf and Environ. Partnershp
By: Jason Cincotta

Sydney Park's Water Re-Use Project was on a 109 acre existing park in the center of Sydney, Australia. Completed in 2015, Sydney park received an incredible make-over to its water infrastructure. Formerly an industrial and waste disposal site, it had a variety of uses from brick making and manufacturing to gas storage. In 1948, clay brick-pits were formed and became a major municipal waste dump. With time, the pits filled up and were capped, then becoming a regional park in 1991.

Photo By: Ethan Rohloff

Photo By: drivenxdesign

This project was part of Sydney's Sustainable 2030 plan, and cashing in at around $11 million US dollars, it was the city's largest environmental project to date. It aims to filter ten percent of the cities water demand through capture and re-use in the park. The water infrastructure created a fresh face for the park, enhancing the recreational experience, revitalizing the waterscape and celebrating the connection between people and place.

The design was a fusion of disciplines; design, science, art, and ecology. Not only did it enhance amenities within the park, but also created new wildlife habitats while protecting and enhancing the existing ecosystem, as well as educating on the importance of water management and quality.

Plan and Photo By: Turf

Photo By: Simon Wood

The designers incorporated transformed wetlands, wildlife habitats and water celebration art. The wetlands contain four ponds that now capture and clean 340 Olympic-sized swimming pools per year. The wildlife is home to 22 wetland bird species, consisting of the highest population of native birds in the city. Lastly, the designers collaborated with artists, who developed terracotta pipe artwork within the water infrastructure that referenced the sites brickwork history.

3.19 Museum Park-Louvre Lens

Lens, France
Mosbach Paysagistes
Gisselle Peña

Plan View

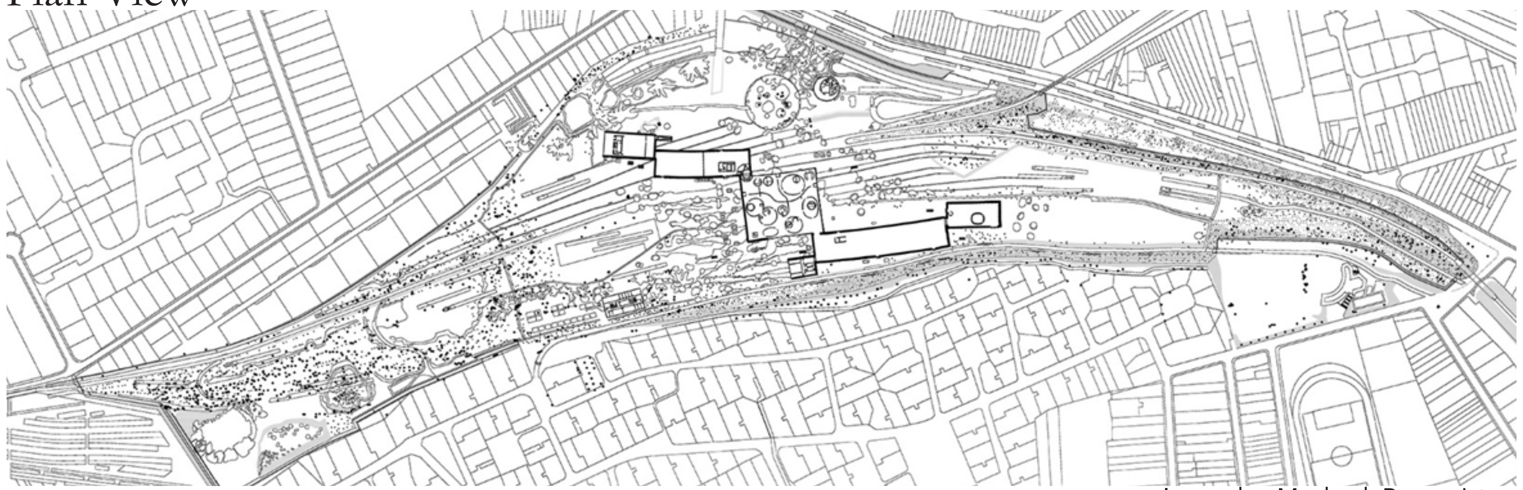


Image by: Mosbach Paysagistes

The Louvre Lens Museum Park is a 61 acre field located 200km North of Paris, France that used to be a big coal mine. Its history is an important aspect of understanding the surrounding landscape. Having been through two world wars and a coal mining industry has left a noticeable impact on the park itself. From it's varying topography to it's barren land, the Museum Park has been quite a challenge to accomplish. Connecting its unpleasant past to existing conditions all while drawing an audience to the museum is the Park's main goal.

Materials

Image by: Mosbach Paysagistes

The Louvre Park in Lens, France wanted to keep existing materials from the coal mining industry in order to remind guests of its past. Coal and charcoal textures remained the same while addition of new materials such as concrete, stone and greenery changed the landscape. The combination of old and new speaks volumes of the land's history and where it might go in the future.

Topography

Image by: Mosbach Paysagistes

The Louvre Park in Lens, France has very unique topography due to all the mining and digging that occured during the coal industry. The weight and pressure from these elements altered the land grading also led to the now winding paths which were used by workers who carried heavy machinery.

3.20 Villa D'Este

Tivoli, Italy
Pirro Ligorio
Diosmiry Rodriguez

The Fontana dell'Ovato ("Oval Fountain")

Image by: Joshua Bemporad

The land was acquired and construction was planned to begin at the end of 1550. Pirro Ligorio who painted frescoes for Villa d'Este estate was commissioned to lay out the gardens for the villa, with the assistance of Tommaso Chiruchi of Bologna. Tommaso was key to the overall construction of Villa d'Este because he was one of the most skilled hydraulic engineers of the sixteenth century. This is a perfect example of humans using different skills to create a better landscape.

The Fountain of Neptune

Image by: Joshua Bemporad

The fame and glory of the Villa d'Este was above all established by its extraordinary system of fountains. This consisted of 51 fountains and nymphaeums, 398 spouts, 364 water jets, 64 waterfalls and 220 basins. This is fed by 875 meters of canals, channels, cascades and sometimes rainwater. When visiting the site it is hard believe that it is all powered by water and gravity!

The Hundred Fountains

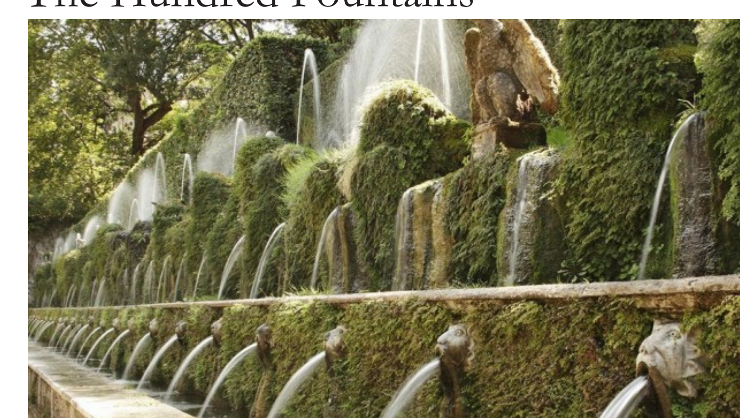


Image by: Joshua Bemporad

As architects we need to become more than what we are taught and diversify our minds to different possibilities. Gian Lorenzo Bernini (Genius Architect who designed St. Peter's Square at the Vatican) was a Sculptor, Painter, Architect and Engineer. He was able to create masterpieces because he didn't limit his mind to the thought of being simply an architect.

3.21 Renaissance Park

Chattanooga, Tennessee
Hargreaves Associates
By: Alex Ciorlian

Renaissance Park is considered to be an open space, waterfront redevelopment. Originally the site was previously known as a GE Roper Corporation factory that disturbed appliance manufacturing and an enameling facility. This caused the site to be contaminated and leach out semi-volatile organic compounds (SVOCs) and heavy metal contaminants into the groundwater and the Tennessee River. It was categorized as a brown-field. The area is now a open space park as well as an ecological preserve to help clean water outflows before going into the river after being completed in 2006. Renaissance Park provides social engagement, healthy lifestyles, an environmental education, leveraging ecosystem services of a preserved floodplain forest, and a constructed wetland that treats site storm water and increases floodplain storage capacity.

Image by: John Gollings, Hargreaves Associates

The construction process consisted of 34,000 cubic yds. of contaminated soils being excavated and placed in upland containment cells, safely sealed within the park's iconic landforms. A drainage system beneath the cells diverts any lingering leachate to the sanitary sewer. 18,000 cu yds. of concrete factory floor was salvaged, crushed, and reused on site as fill. Remediating 12,000 cubic yards of leaching soil containing commingled frit on site cost only $180,000. That's 75% less than the $720,000 estimated cost to haul the same volume of soil to a proper landfill. Preservation areas and native meadows installations reduce construction and maintenance costs, while iconic landforms safely and artistically enclose the contaminated soils. This park relates to the Passaic River Valley Project by connecting people to the water, conserving floodplain areas, reducing storm water volume.

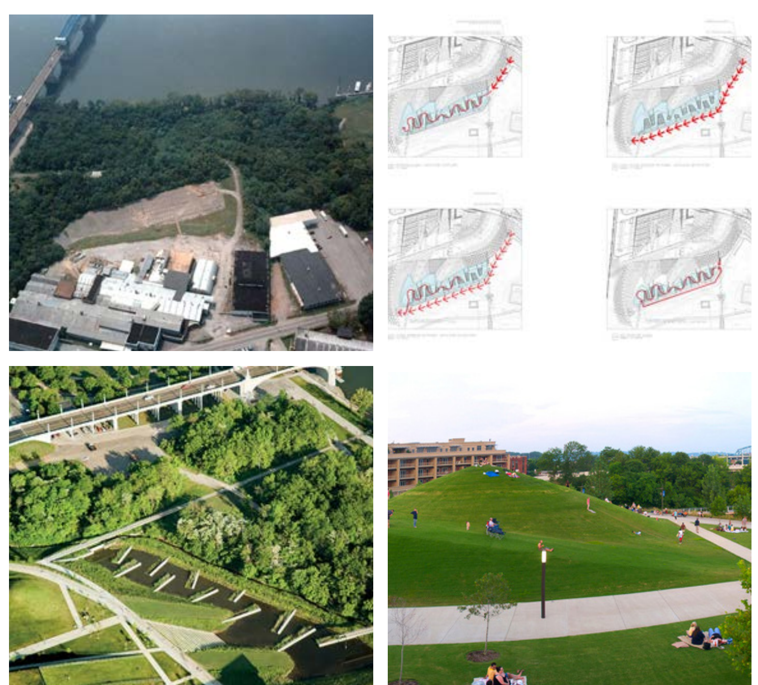


Image by: John Gollings, Hargreaves Associates

3.22 Park of Luna

Heerhugowaard-South, Netherlands
HOSPER
By: Eamon Epstein

Park of Luna, and City of Sun, are part of a large scale landscape design project aimed at sustainability and prominent water features. Undertaken by the landscape architecture firm HOSPER and the architects at DRFTWD Office, the park encompasses over 70 hectares of water surrounded the housing development within. The multiple subareas within the park each have distinct recreational areas and are connected through a series of trails and paths. The inner side of the recreational areas interact with the large body of water and the City of Sun, while the other side interacts with the surrounding landscape. The City of Sun includes 1,600 homes. Another main feature of the City of Sun is the installation of numerous solar panels with the intended goal of zero net emissions.

Image by: HOSPER

The recreational area of the park is divided into 3 main subareas, each with its own characteristics. The first is Druiplanden, which has a more urban character. Druiplanden includes instensive bank racreation, as well as amenities such as an ampitheatre and catering. The second is Subplan 4, which provides a transition between the urban and recreational areas. Subplan 4 includes outdoor living areas and spacious recreational routes. Finally there is Huygendjik, which provides a more "sheltered" atmosphere. Here one can find open grassland, nature banks, and space for activities such as walking and cycling. Several forms of water purification infrastructure are utilized in the park and incorporated with the recreational activities available. Examples include a water pumping station that can also be climbed to gain a better view of the park, as well as a natural flow water purification maze that greatly adds to the aesthetics of the park.

Image by: HOSPER

3.23 Johnson Park

Piscataway, NJ
Owned by Middlesex County
By: Robert Cook

Johnson Park is a 473 Acre county park along the bank of the Raritan river. It was donated to Middlesex County by Johnson and Johnson Pharmaceuticals in the 1920's. Located on the once bustling Raritan Landing port, used for trade in 18th-19th Centuries.

A Series of shallow Ponds were integrated into the Riverbed of the Raritan along the main road of the Park in the 1930s as a Works Projects Administration project. Recently a boardwalk was added to provide the ability to walk out further to view into the pond.

Johnson park is situated on a flood plain and nearly every time the river floods water covers the park. It is resiliant in that the park is never damaged from flooding and the wildlife and vegetation are seemingly indifferent to these flood events.

Photos taken by Robert Cook

Photos taken by Robert Cook

Map of Johnson Park from middlesexcountyparksnj.gov

3.24 Branch Brook Park

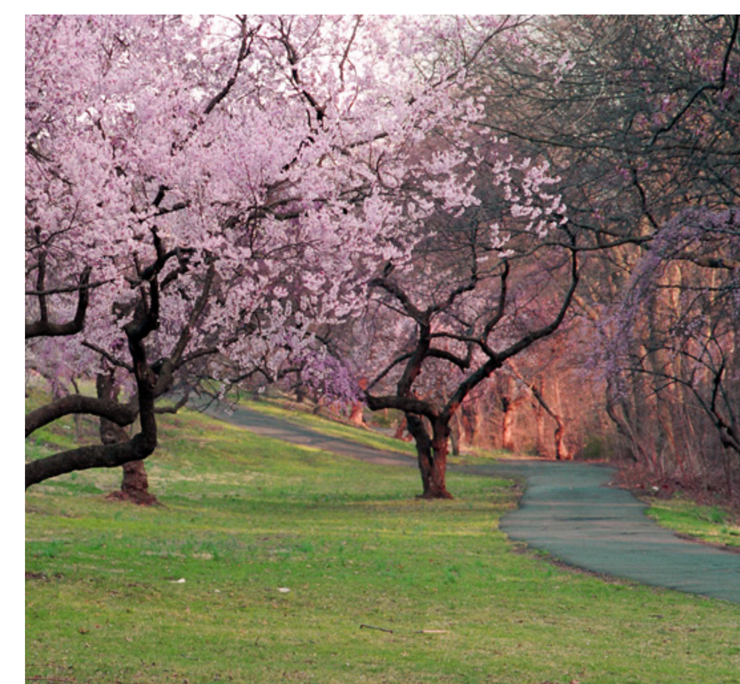
Newark, NJ
Frederick Law Olmstead
By: Summer Sprofera

Branch Brook Park consists of 360 acres in the city of Newark ,New Jersey. It is the largest public park in the city of Newark. A noted feature of the park is the beautiful cherry blossom trees. Branch Brook Park has over 4300 cherry blossom trees and more than 14 different varieties. This makes it the largest collection of cherry blossom trees in the United States. The annual cherry blossom festival brings over 20000 people from all over the world.

The commission hired the Olmstead Brothers in the 1900's for a redesign of the park. Mnay architectural significant structures exist there as well. They include bridges, buildings, gates and sculptures.

This park has undergone many changes from when I first visited in 2005. I have seen a restoration to many of the plants and a larger police presence which has brought more families to the park. The park also has a basketball court, rollerskating rink, playground, tennis court and baseball field.

Photo taken by: Emily McGale



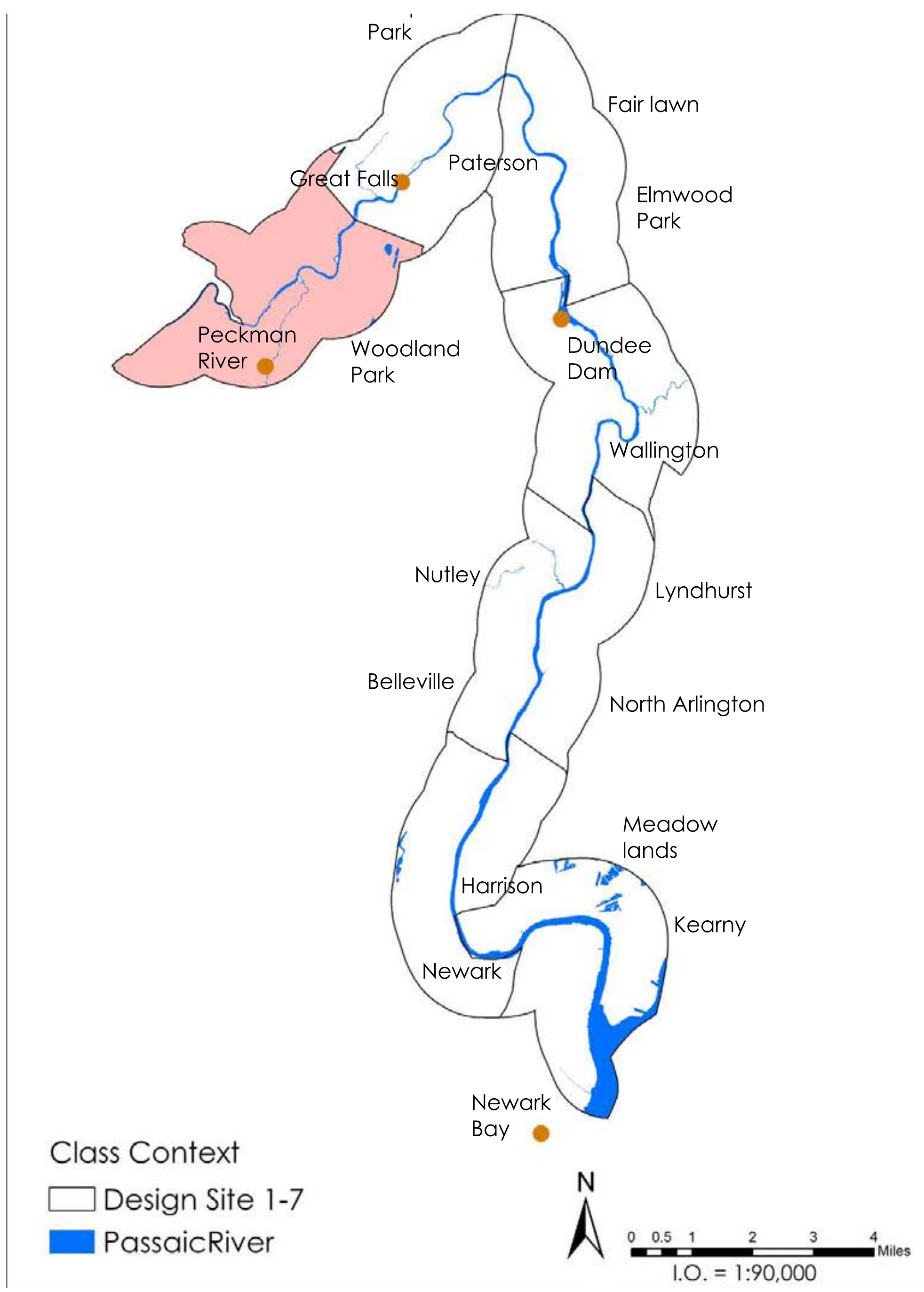
Photos from NJ Advance Media for NJ by STeve Starsky

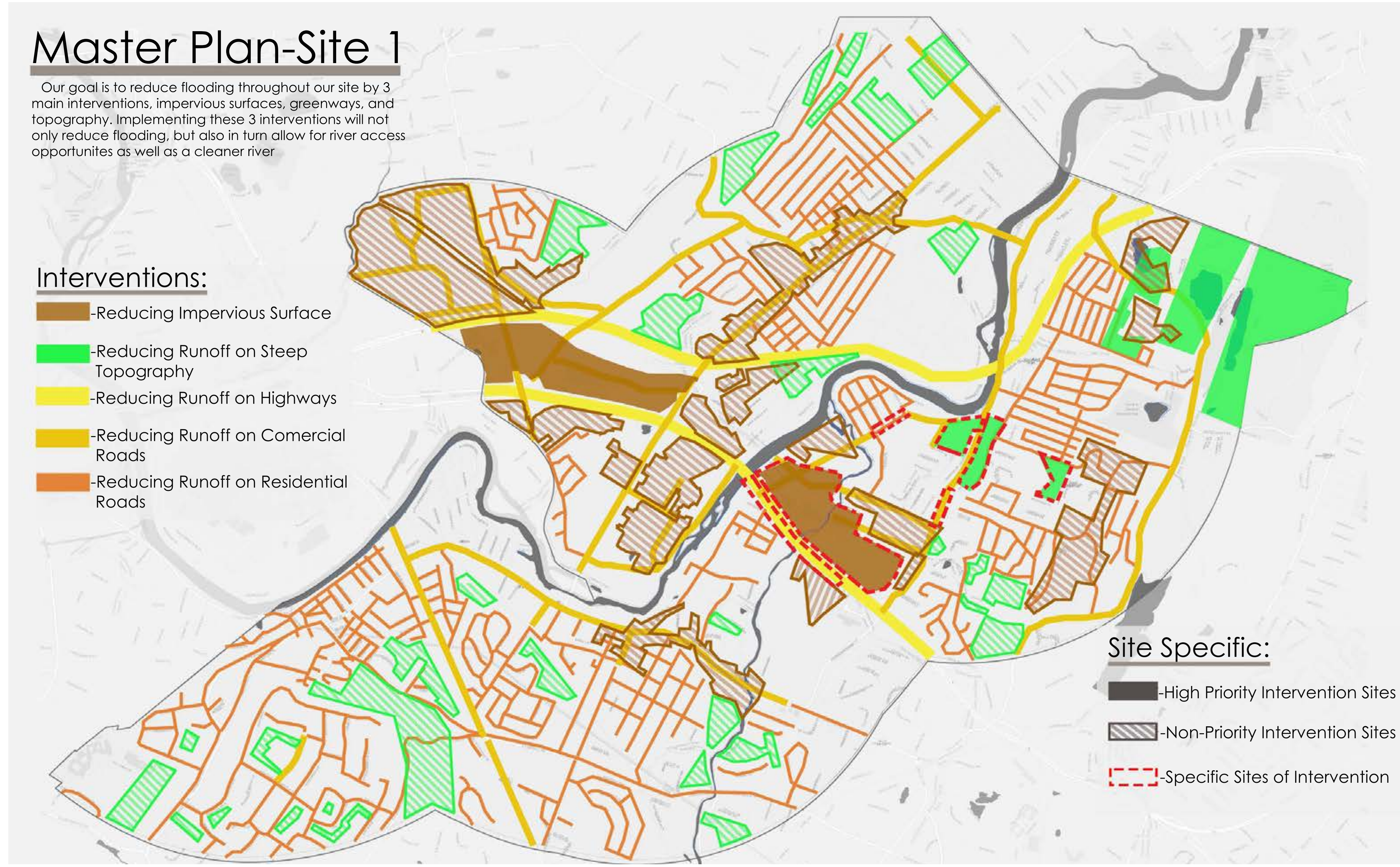
Intervention Sites

Site One

By: Monica Lee, Emily McGale, Summer Sprofera

Context map and Master Plan





As designers we have learned that the history of a site is incredibly important to keep us from making mere guesses and rather validated substantial decisions instead. It is important to not only know the land, but know the people, the area, and expectations of those you are designing for. This preparation was in mind for our site area in Woodland Park, Totowa, Little Falls and portions of North Caldwell and Cedar Grove. These municipalities are located in the northern hemisphere of New Jersey and inhabit both the Passaic River and the Peckman River.

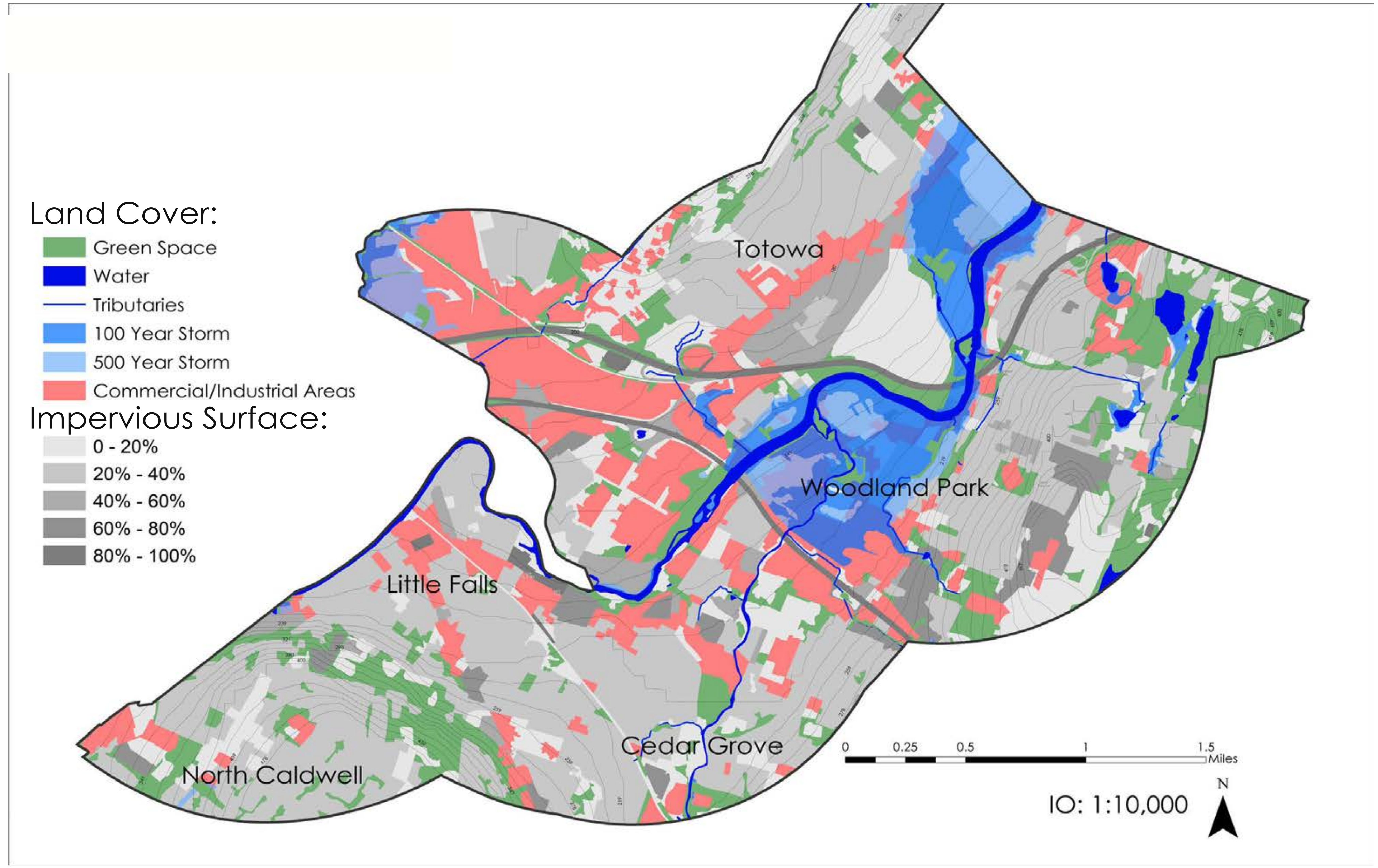
By starting with a diagramatic problem tree we organized our primary and secondary causes and our effects that correlated to our major problem in the center. With very little knowledge of the site, we proposed two major problems. Our first problem was the lack of an open system along the Passaic River and the second was the contamination on the banks of the Passaic River. We built our problem tree with causes and effects of both of these problems. We also did a history analysis of the designated sites and found a great foundation for building on our concept. One of our major developments in our history analysis was that flooding in specific zones of these sites had been going on for decades without much reconciliation.

Our collection of data using Geographic Information System maps showed massive flood zones in particular areas that were inhabited by a high number of people. These included the 100 year flood zone and the 500 year flood zone. With this information , along with our own research we found that the Peckman River also played a major role in the flooding in our site.

Using this new collected data we were able to revise our problem tree and decide that our major problem consisted of flooding on the banks of the Passaic River. The causes we found were high impervious surface areas, steep topography, along with runoff, lack of green space on the river and lack of green infrastructure on the roadways. With our problem clear now, we concluded that our solution was to increase green infrastructure to reduce flooding. We formed three major outlets of intervention to achieve this goal which included, an impervious surface intervention, steep topography and runoff intervention and green streets intervention.

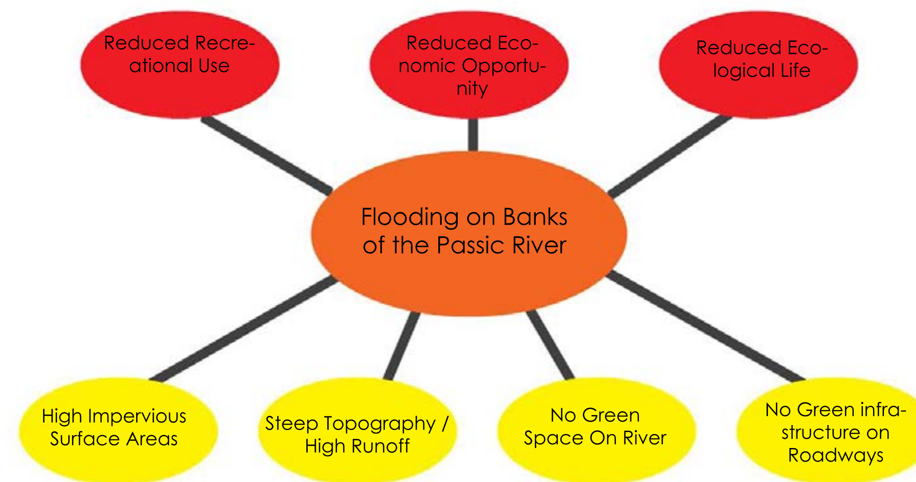
Relevent Conditions

While analyzing several conditions existing on our site we noticed a few important things that were vital to address and analyze more closer. First we noticed that the topography in this site can be very steep, but in some areas very shallow. Compared to the rest of the seven intervention sites, we noticed that our site particularly had the steepest slopes. For example, in one part of the site in a 0.2 mile distance our site dropped 60 feet. This is because Little Falls is located right near by. When we noticed this steep topography located in a wide range throughout our site, we knew we needed to look a little deeper into this. Researching furthermore, we noticed that not only is there steep topography, however this site is massively covered with impervious surface as well. The majority of our site had a range of 40-70% impervious surface. This existing condition is definitely concerning and can create a wide range of problems to not only our site, but the Passaic River as well. While looking deeper into why there was so much impervious surface throughout our site, we noticed that it was derived from two things: large commercial zones and a wide range of roads all throughout our site. Our site was mainly residential land use, because of this there are a lot of roads existing as well as a lot of commercial areas so the people living in those residential areas can shop. Furthermore we noticed one last thing that could be a big problem for not only access to the Passaic River, but the sanitary to the Passaic River itself. This was two large flood zones located right on the banks of the Passaic River. We knew right from seeing this existing condition that this was our biggest problem and we should certainly act upon it.

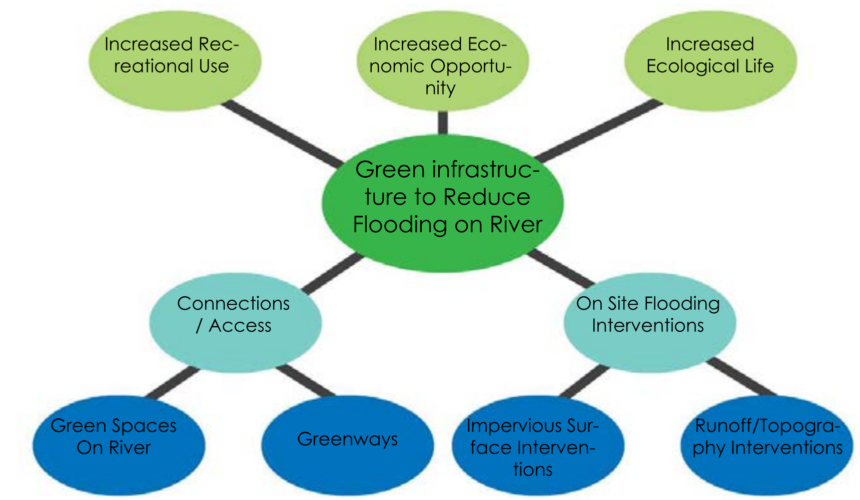


To create access to the Passaic River and dilute it, we knew we first needed to act upon these flood zones. We knew we needed to come up with interventions to reduce this flooding. From our previous analyzation, we concluded that the interventions we needed to implement was runoff from impervious surface as well as runoff from steep topography. Flooding on the river helped contributed to the making of these flood zones, but runoff had a big role too. We knew this because right around each of the flood zones consisted of steep topography sloping right into the flood zone. Also right by these flood zones were large commercial areas and large roadways with lots of impervious surface. If we acted upon reduced and filtering the runoff from greenways, impervious surface in commercial areas, and steep topography, we knew that this would play a domino affect and not only reduce the flood zone, but also make the Passaic River much more valuable. That is how we derived from the existing conditions map to choose the specific interventions we did.

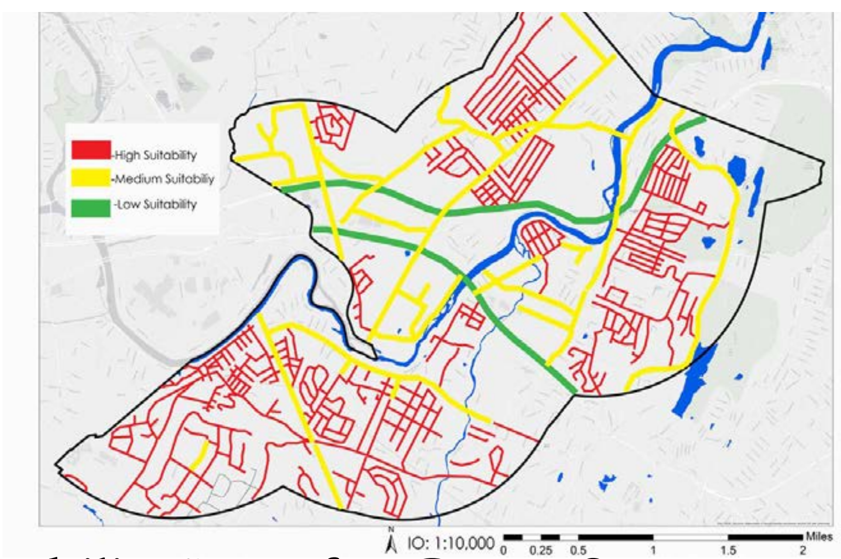
Suitability Maps and Problem Solution Trees



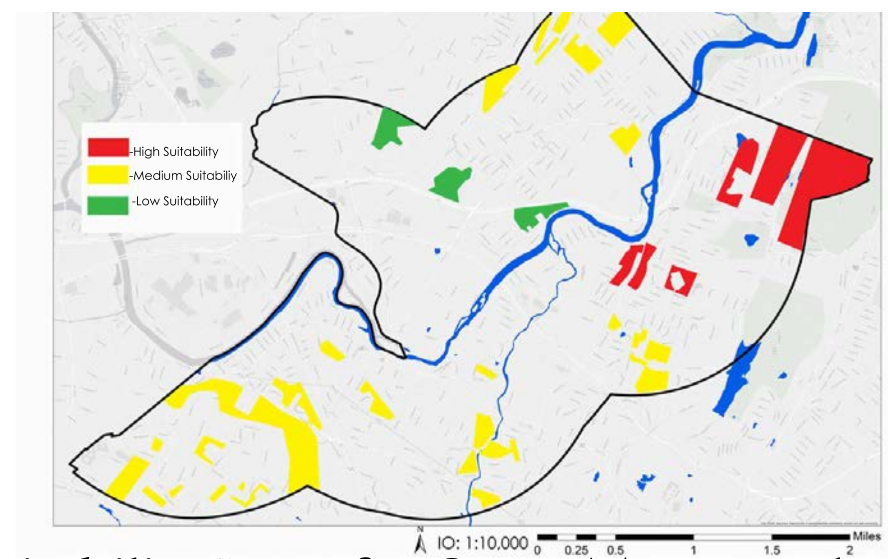
Problem Tree



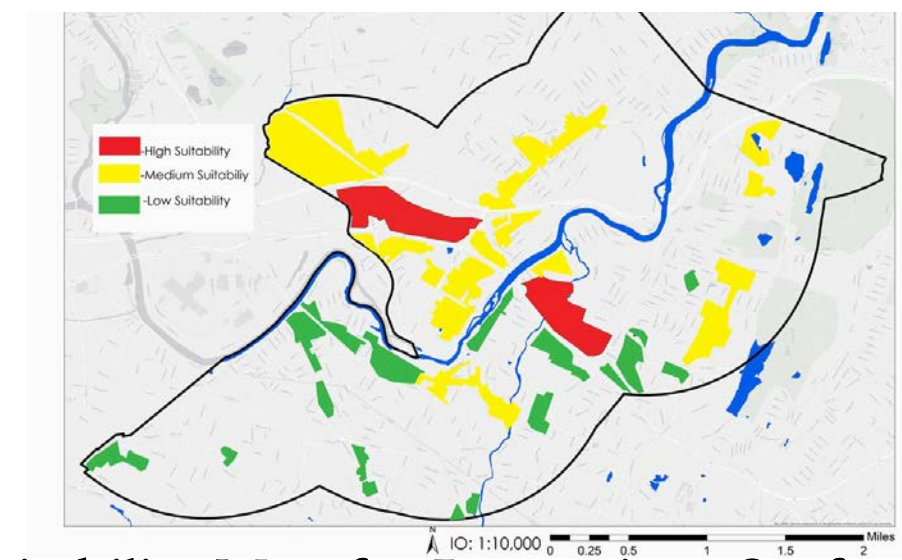
Solution Tree



Suitability Map for Green Streets



Suitability Map for Steep Topography



Suitability Map for Impervious Surface

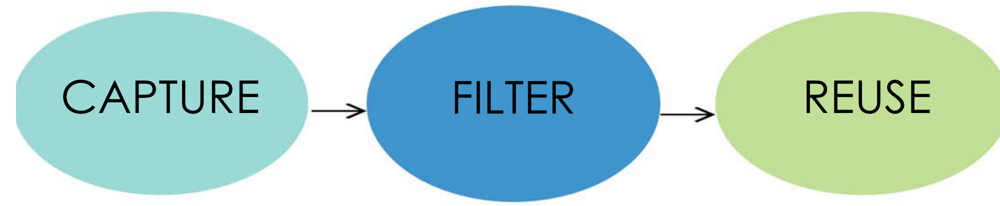
The type of roads that was highest suitable for intervention was residential roads. This is because residential roads covered the majority of this specific site. If intervention is implemented on residential roads, this would cause the most change, thus making it the most suitable. The type of roads with medium suitability is commercial roads. This is because commercial roads fill up more space than highways, but less than residential roads, thus making it the second most suitable because it would have the second largest effect. Highways are the lowest suitability since they take up the least amount of space in our site.

The topography zones with highest suitability is areas where topography is the steepest. The flood zones exist at the end of the slope where these steep topography sites are existing, so it is evident that the runoff from these steep topography places is one of the factors to the creation of these flood zones, making these sites the highest suitable for intervention. The sites with medium suitability are sites with medium topography. In these places, topography isn't too steep but also isn't shallow. The places with the lowest suitability for this intervention is places with the most shallow topography change. These places are also places with no flood zones nearby, not making these places much of a factor.

The places in this intervention that were the highest in suitability were places that had the greatest amount of impervious surface coverage. These places were mainly located in commercial in residential zones, were a mass area of parking lots were located. Interestingly, these places were also right by flood zones, so it was evident that the runoff from these sites was a factor to contribute to the flood zones, thus very suitable for intervention. The places with medium suitability were smaller commercial and parking areas that also had a lot of impervious surface, but not as much as the high suitable sites. These places should still have intervention implemented, but not as high as priority as the high suitable places. The places with the lowest suitability were places like schools, little shops, etc., that had some impervious surface from its parking lots.

Green Streets Intervention

Summer Sprofera

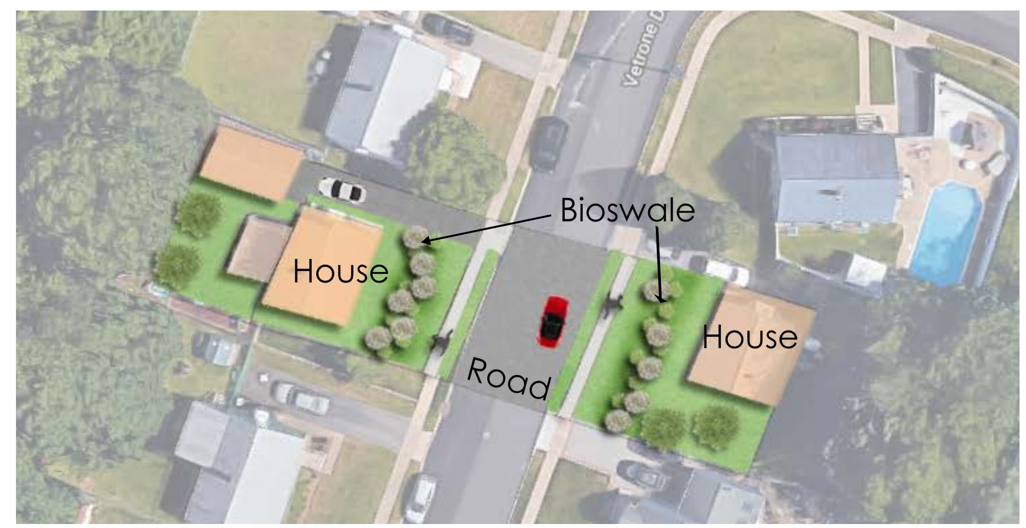


With our green street interventions we decided that three separate interventions would incorporate the most effect on the site. Small designs over a larger area of land would break down the impervious surface and include more plantings. We separated these designs into residential, highway and commercial that could be implicated in different areas along the site. These areas were categorized as such and another analysis was done where a high suitability would lie along with our other interventions. Different aspects were placed into these separate locations creating each with its own separate basis and design.

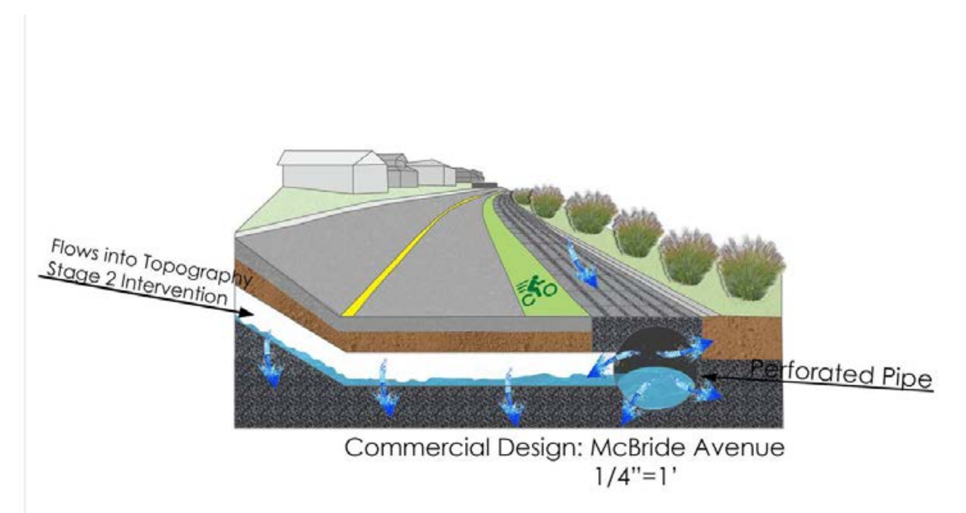
In the residential site the grass is sloped towards the road which does not allow the water enough time to go into the ground. With the proposed design, filling half of the lawn space with a bioswale and designated plantings, this will alleviate much of the runoff that ends up in the street and eventually into the stormdrains.

The commercial design which highlights McBride Avenue, has a bike lane along with a shoulder that consists of pavers and stone that allow the water to run into the perforated pipe below ground. The excess water that does not get filtered back into the ground will flow into our topological stage 2 intervention.

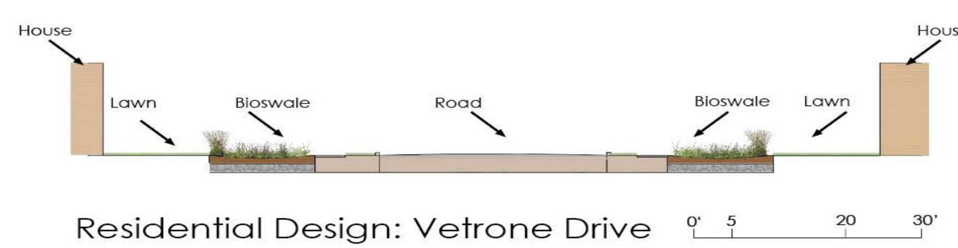
The highway design that uses Route 46 as its locational site has a swale with a perforated pipe in the median section that is currently just asphalt and a divider. The perforated pipe that runs along the site will collect water and filter it into the ground. Any excess water will be collected in the pipe and go into our topographical stage 2 intervention.



Plan of Residential Street



Commercial



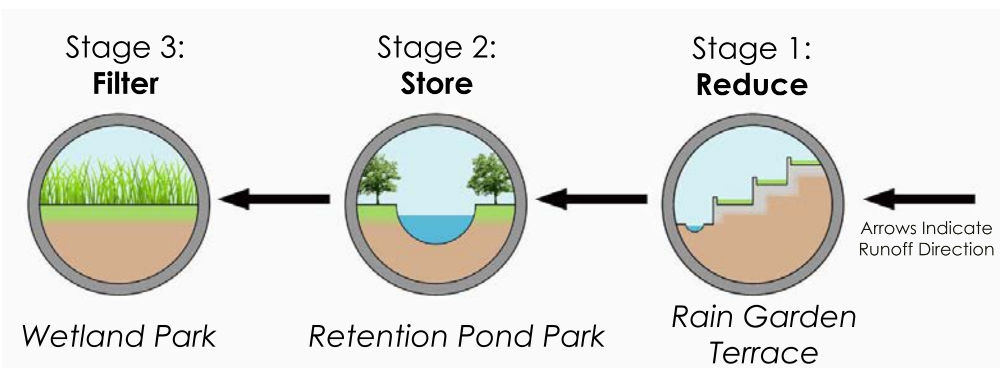
Residential Street

Highway Street

Steep Topography Runoff Intervention

Monica Lee

Concept



Stage 1: First stage reduces the amount of runoff at the beginning of the source thus impacting the amount flowing down the slope and eventually reaching the Passaic River

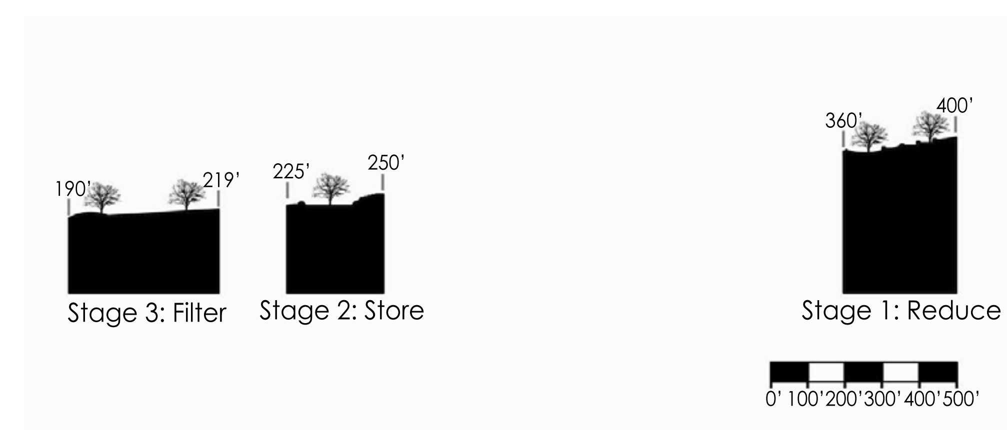
Stage 2: Second stage collects and stores runoff from a wide range to futher reduce the amount reaching into the Passaic River

Stage 3: Third stage collects the remaining runoff and filters it by a combination of wetlands and rain gardens to screen the runoff and make it cleaner before reaching the Passaic River

Master Plan

Existing Topography

Proposed Topography



Sidewell Friends School,
Washington DC
Photo by: Landscape Preformance Series

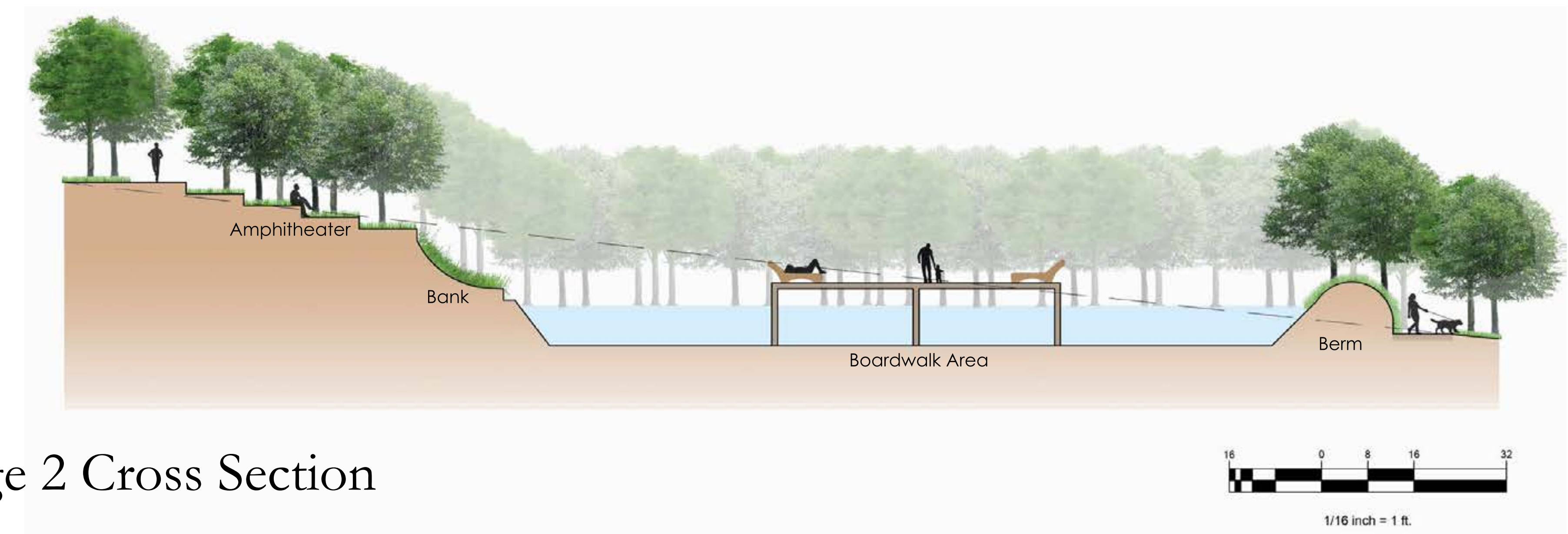
Wetland Park, Hong Kong
Photo by: DiscoverHongKong.com

Case Studies

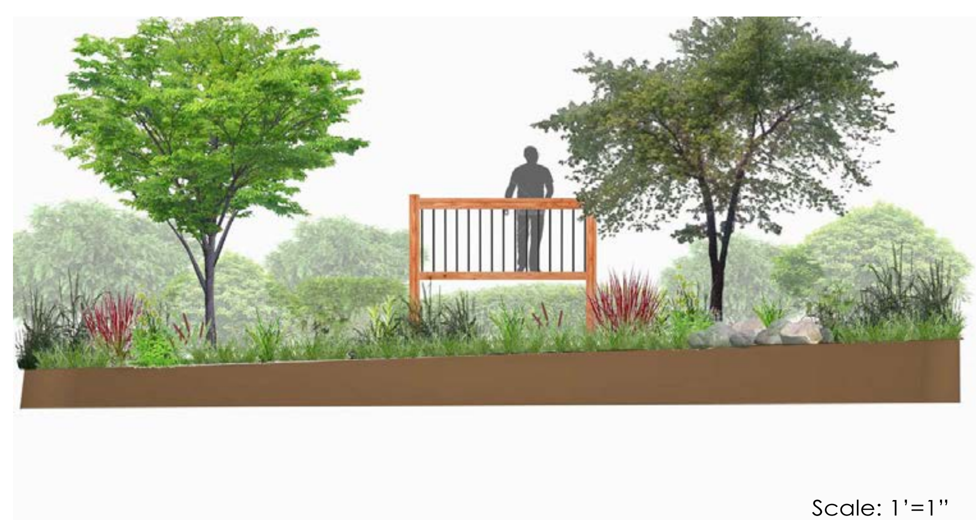
This intervention deals with the steep topography throughout our specific site. In addition, this specific site also has a lot of impervious surface too. In turn, these two existing conditions creates a problem with runoff. Currently, the runoff from the topography flows right from the mountains into the Passaic River with nothing but impervious surface in between. What we are implementing is runoff management strategies that not only reduce the amount of runoff that flows into the Passaic but also filters and temporary stores it for the neighborhood to engage with. If this implementation takes place, then the flood zone on the banks of the river will be massively reduced, and in turn not only makes the river a lot cleaner, but also creates access and brings people to the river, thus benefiting the river economically, ecologically, and recreationally.

The steep topography intervention deals with three different parts. Each part has a different function and program, however all together these three parts create a central main concept. This concept is to reduce and filter the water before reaching the Passaic River to help contribute cleaning up the pollution of the Passaic River. This intervention also contributes to reducing the flood zones that exist on the banks of the Passaic River. If these flood zones on the bank are reduced, then this creates spaces that could potentially create more access for people to the banks of the Passaic River. Out of all seven sites, this site has the steepest topography, and therefore this runoff from this topography should be addressed and reduced.

Stage 1 Cross Section



Stage 2 Cross Section



Stage 3 Cross Section

Stage 3 Perspective Sktech

Impervious Surface Intervention

Emily McGale

Our impervious surface intervention was designed to find the highest impervious sites to redesign and create a space that the water can be absorbed into the ground and alleviate much of the flooding. A categorized system was made from the relevant conditions map into low, medium and high suitability that would create the largest impact. Schools were evaluated as a low suitability area. We concluded though that it would have been a great teaching benefit to have used the school for a site but the area was just not conducive for our needs of space. Medium suitability was categorized as office buildings which addressed a large space and more beneficial for those that worked in the area. . A high suitability was the shopping plazas in our site, because these commercial sites provided the most benefits with space and had the largest impervious surfaces.

AREA OF SITE: 68 acres

IMPERVIOUS SURFACE: 55 acres

AREA OF PARKING: 13 acres

AREA OF BUILDINGS: 14 acres

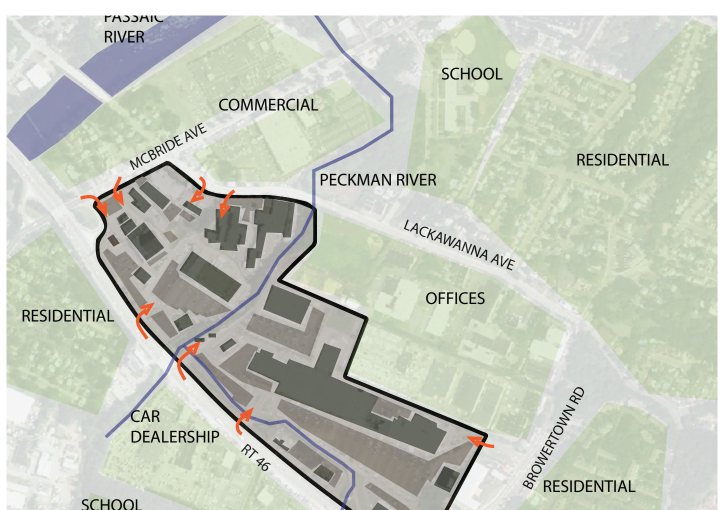
SITE BOUNDRY

ENTRY TO SITE

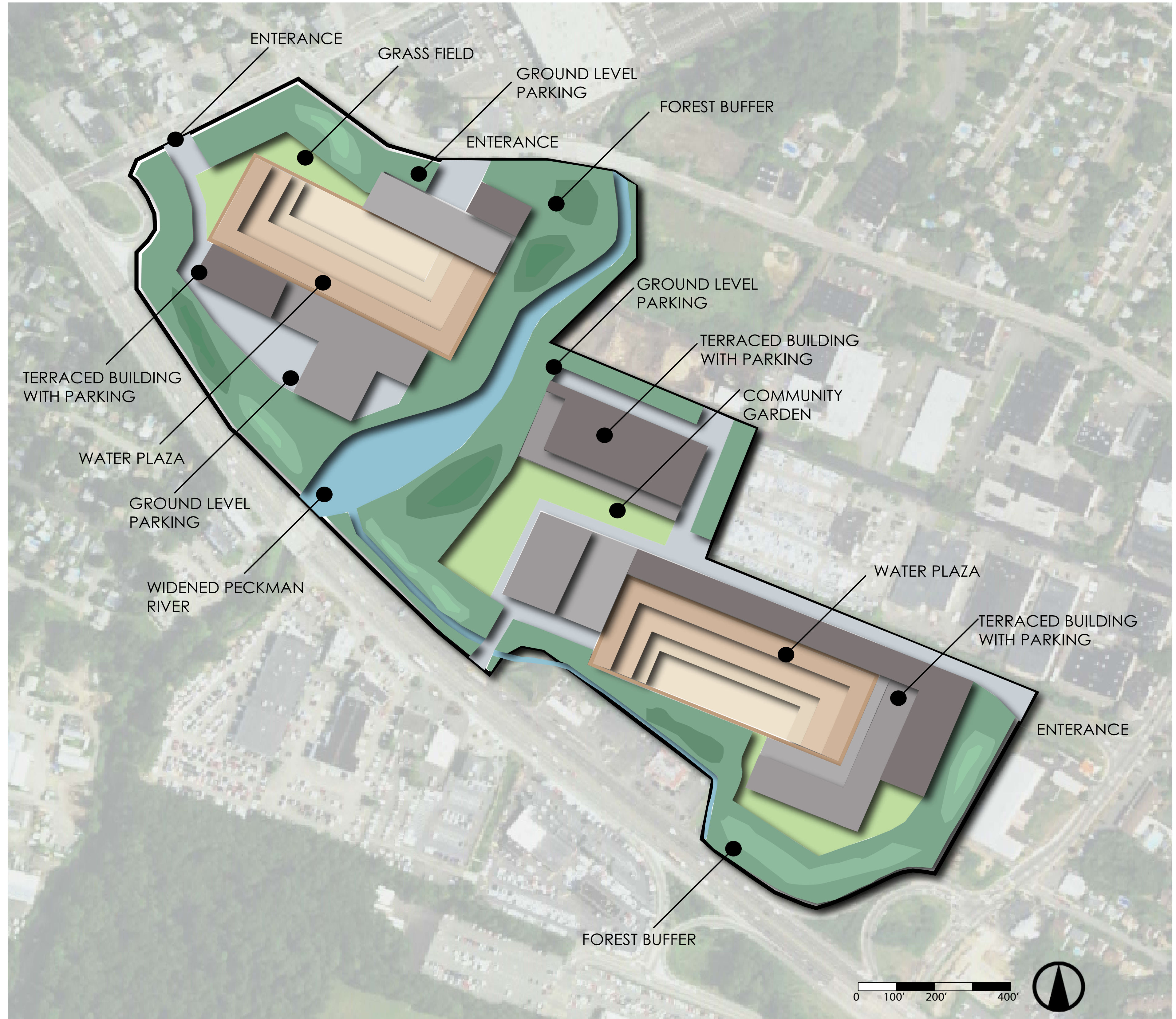
COMMERCIAL BUILDINGS

PARKING

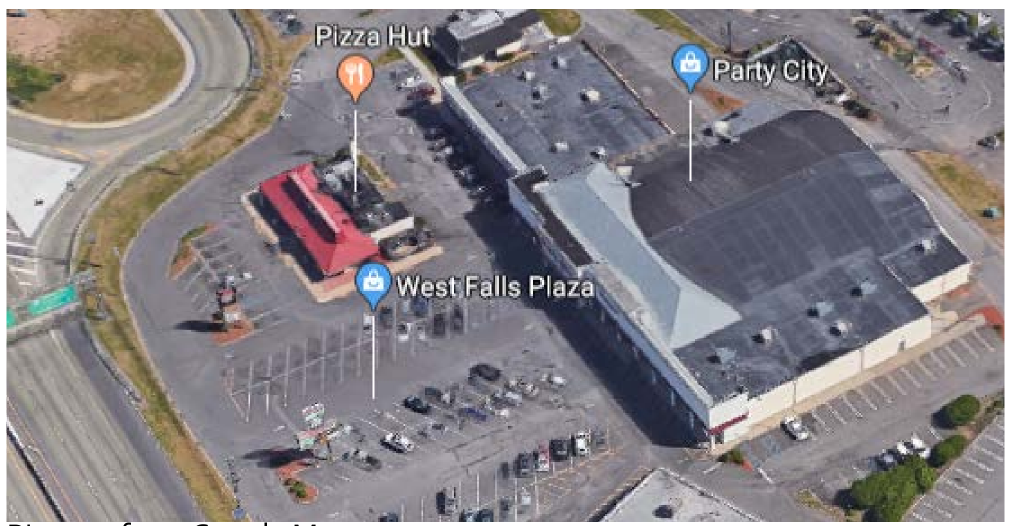
SURROUNDING AREA



Master Plan



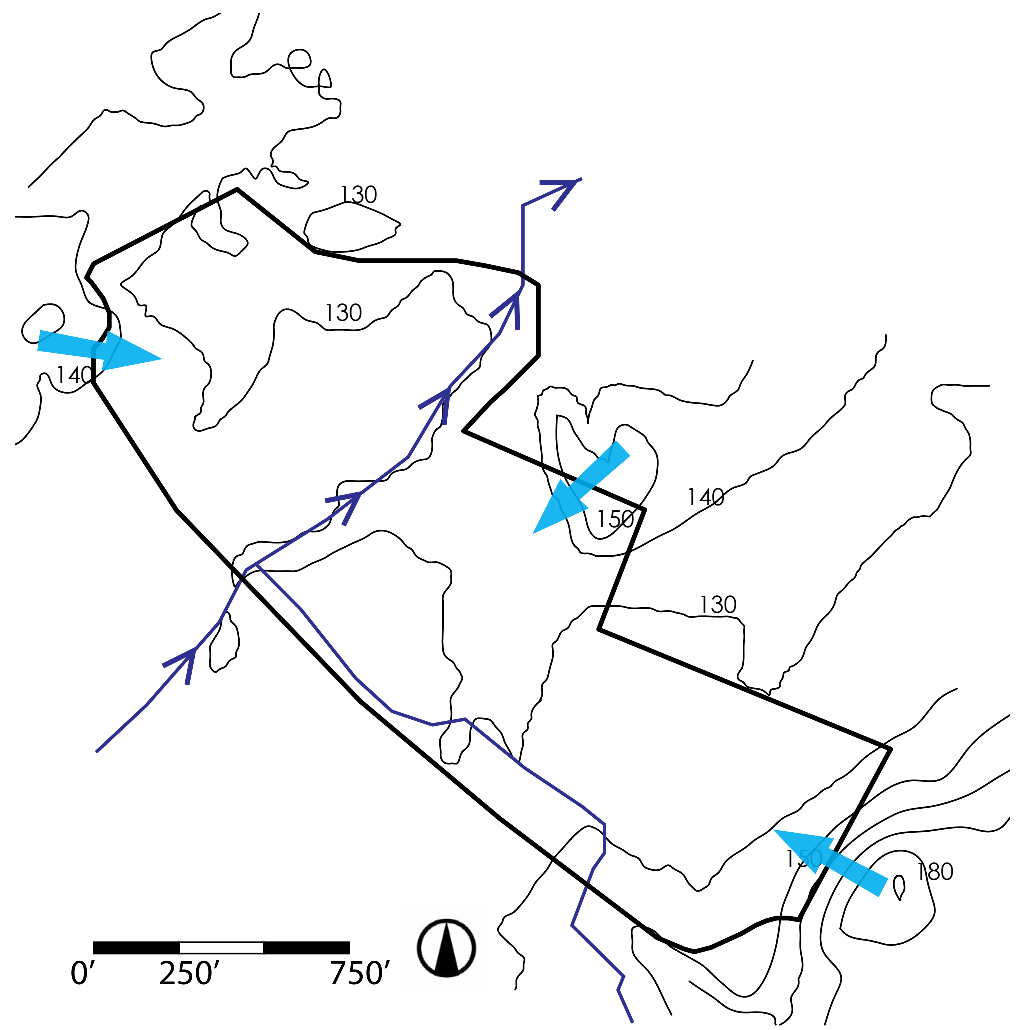
This commercial site was also chose based on ways to improve the water flow. The current flow of water in this space flows off of the building into the parking lot and then in the drainage. The amount of water that is not being filtered and absorbed into the ground is massive and when all shopping plazas are considered the amount only grows. The runoff brings pollution and flooding into the waterways and the surrounding area. With our other data considered we decided that a high suitability area to design would be one that includes the Peckman River. This site consists of a shopping plaza that is a mix of a grocery store, clothing store, restaurant and liquor stores.



Pictures from Google Maps


Pictures from Google Maps

Existing Contours and Water Flow



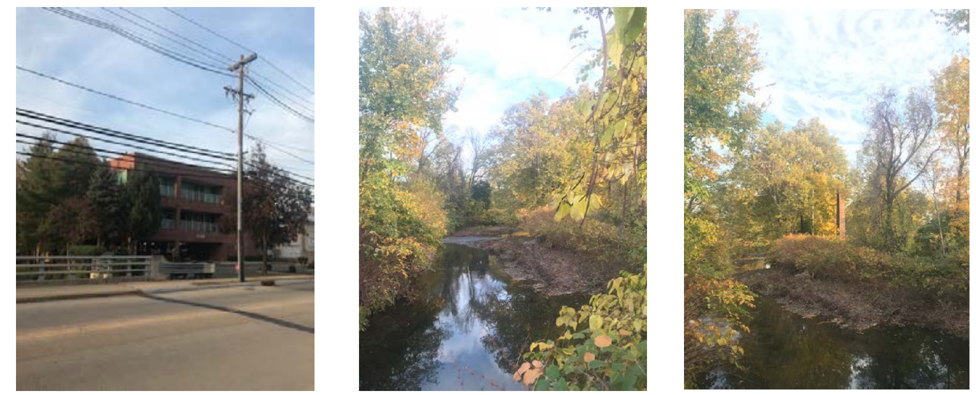
Case Studies


Picture taken by Emily McGale

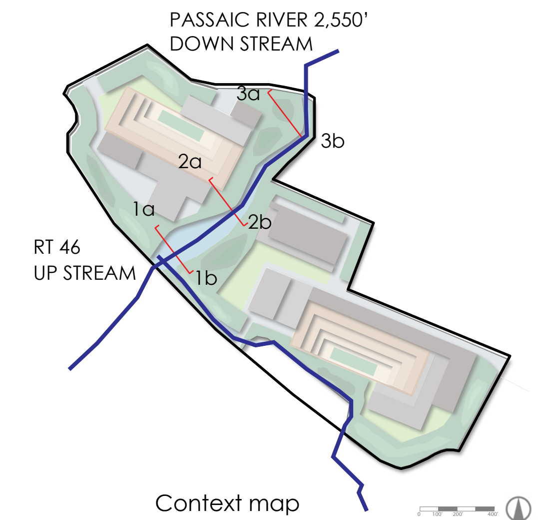

Picture from article WATERSQUARES by Florian Boer

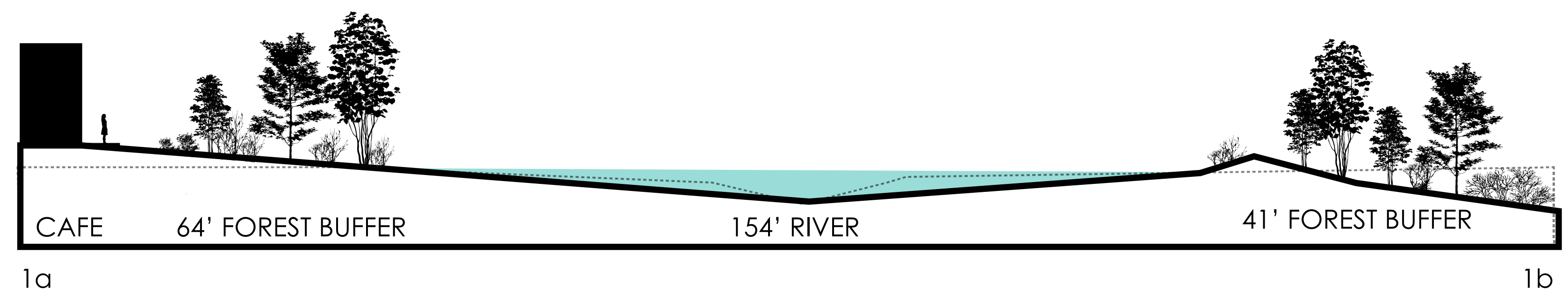
We questioned what the land use was before the major development. Knowing what the land was while designing the space and to keep in mind where it should be headed naturally. Restoration is not possible because that implies that it can go back to its original state. The alteration of the original landscape has been so drastic, we must only move forward. We needed to design something positive that will be a ripple effect to the immediate surrounding area. This is the post commercial landscape. The existing conditions include a lot of parking and lack of greenery. We decided to focus our attention to the vast areas of parking and the Peckman river which is a major source of flooding. The site is predominantly flat and the surrounding area is higher so the water runs toward the river. We did research to learn how Landscape Architects are incorporating flooding systems into their designs. A design that would fit the site and still be practical is the water plaza we researched in the Rotterdam Netherlands. This contemporary design will be placed in a plain outdated space. The entire space can be re organized with inspiration from the Ciaro festival mall shopping plaza, in Egypt. It consists of multi-level terraces and open buildings for shopping, lounging and eating. The parking could then be brought up to the roofs or level ground.

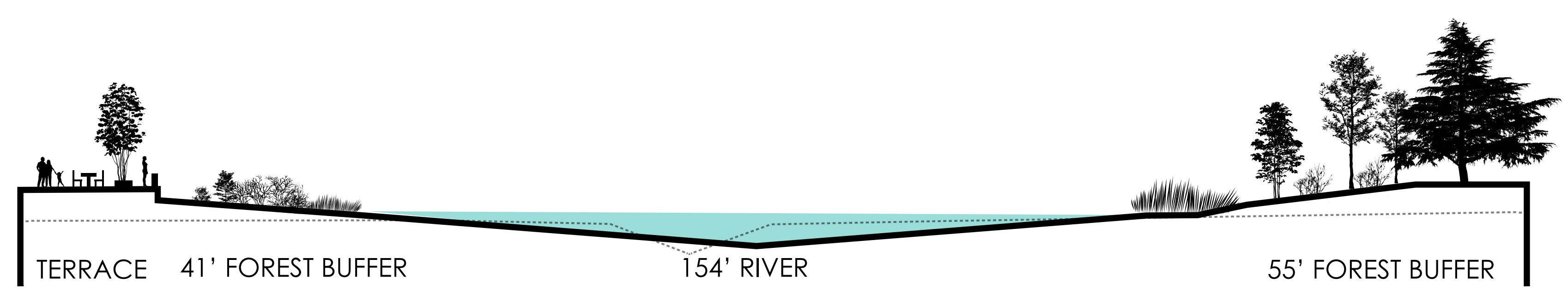
Sections Along the Peckman River

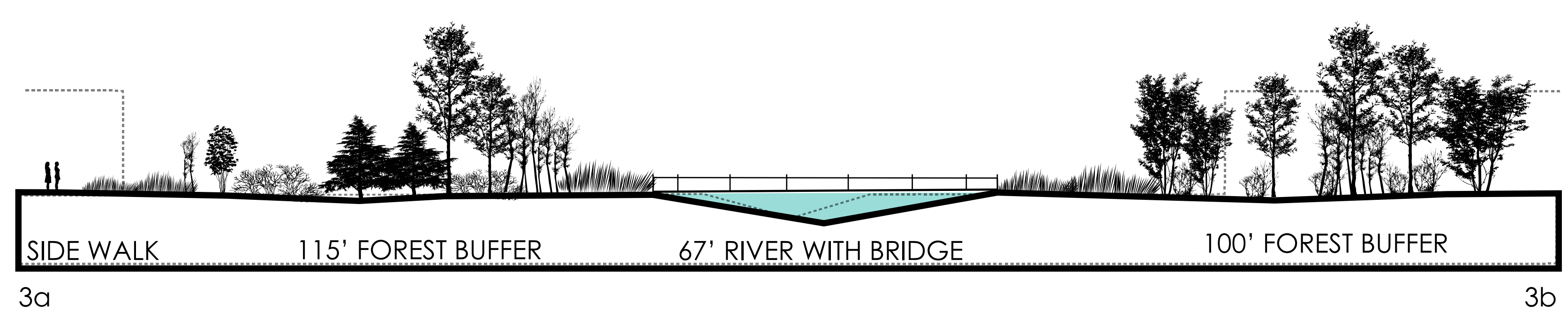


Existing site photos taken by Emily McGale Oct. 2017





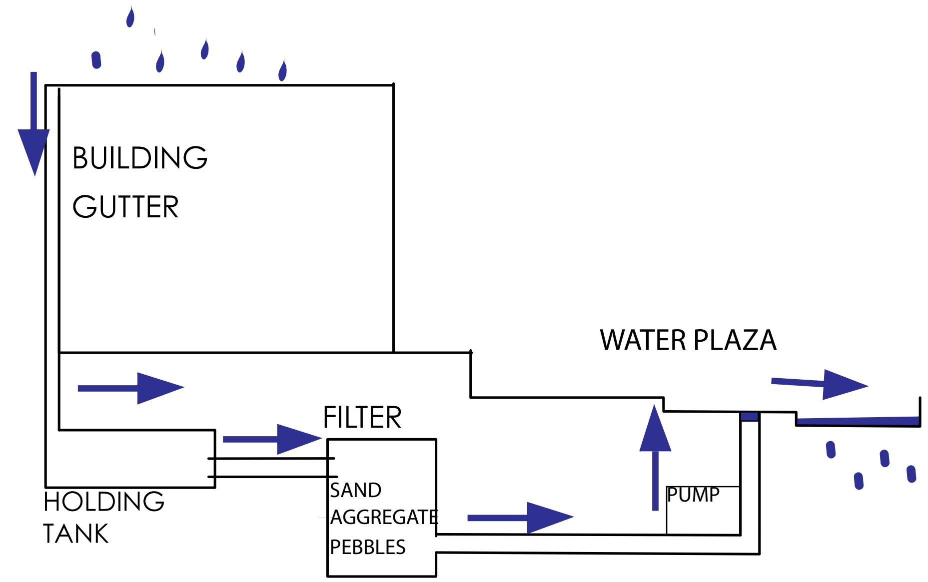




300' SECTIONS

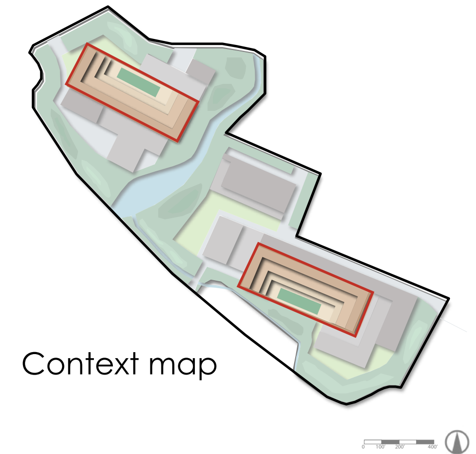
Tying these two concepts together, using the water plaza and open terraces a free forming space was created. A thick forest buffer is also being added to the edge of the site. The space can be more enclosed and can be a pleasant walking experience. Another benefit of the forest buffer is that it will catch rainwater and runoff and be absorbed into the ground. This will give habitat to wildlife and it will help with the de compaction of the surface slowly while creating a new ecosystem. This forest will have plants that grow naturally, encouraging the plants to thrive. Looking at the topography by the river and the natural flood way it was established that widening the river to meet the floodplain it would be beneficial to the site. Since the land is flat we were looking at how the land could be shaped to use and incorporate the old material and all the broken up surfaces and also be beneficial to the river. Building up the banks and then having a small dip to then level back out and create a buffer around the river will help regenerate the ecology. To make sure the water plaza will be effective in collecting the water from the impervious surface we calculated the square footage of the buildings and other impervious surfaces and calculated how many gallons is coming in from an average rain storm. The plaza needs to be big enough to handle this amount. The water plaza collects rain runoff and discharging it into the ground at a slower rate. The water is filtered before entering the plaza and will flow through a system of different level terraces that are still functional while holding water

Water Plaza Section and Water Levels

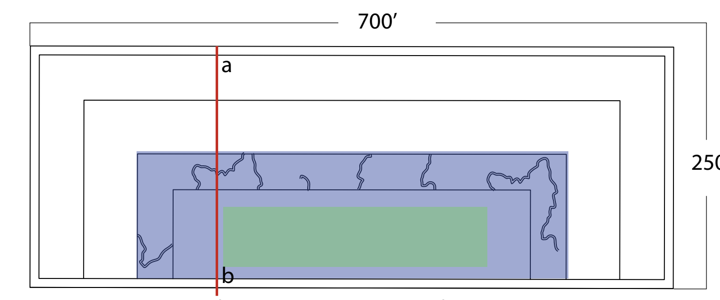


How water moves from the buildings to the water plaza

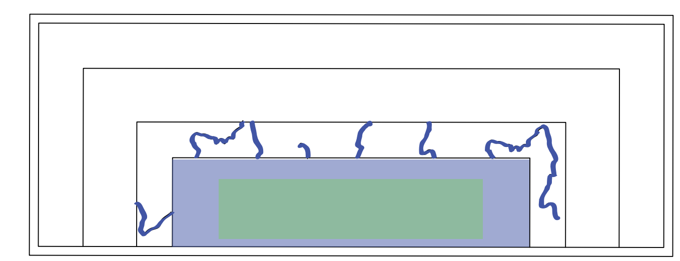
Planter in flood terrace



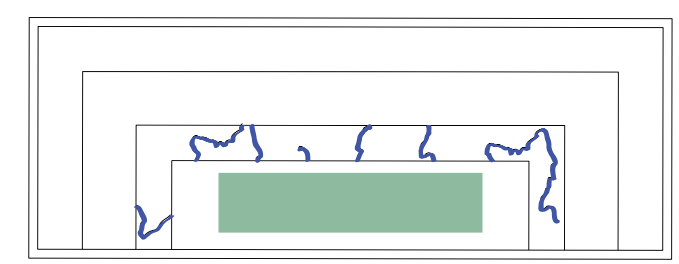
Context map



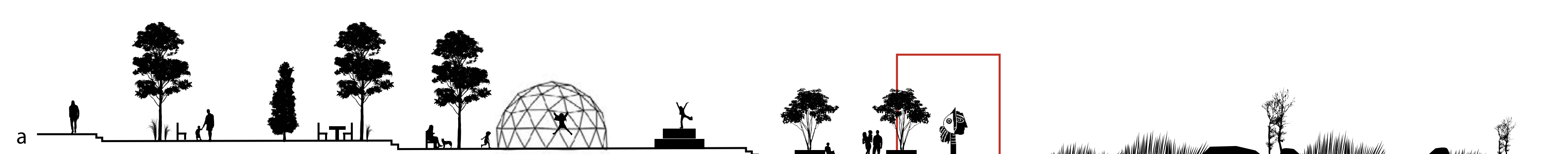
Water can over flow back on to the flood zone once the whole swamp terrace is at max capacity.



Water from the flood terrace moves to the swamp terrace which is 4' below grade and can fill up to 2'



Water fills in the flood terrace first. The terrace has an imbeded pattern that is 1' deep and 2' wide allowing the water run off to rush through.

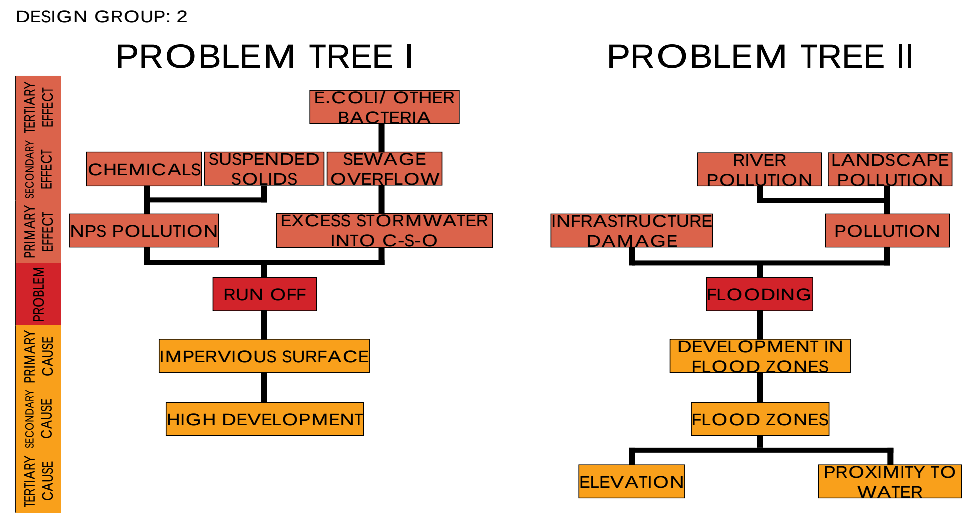


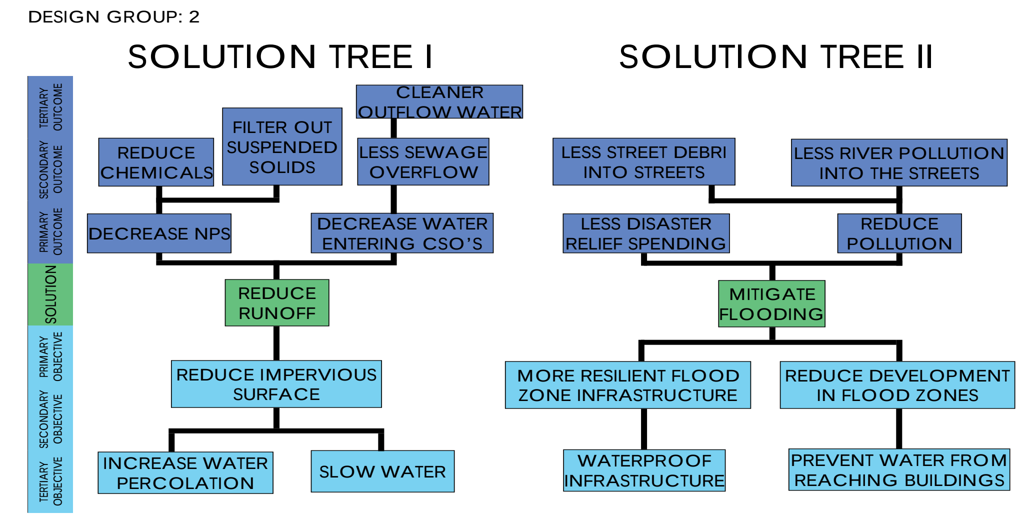
Site Two

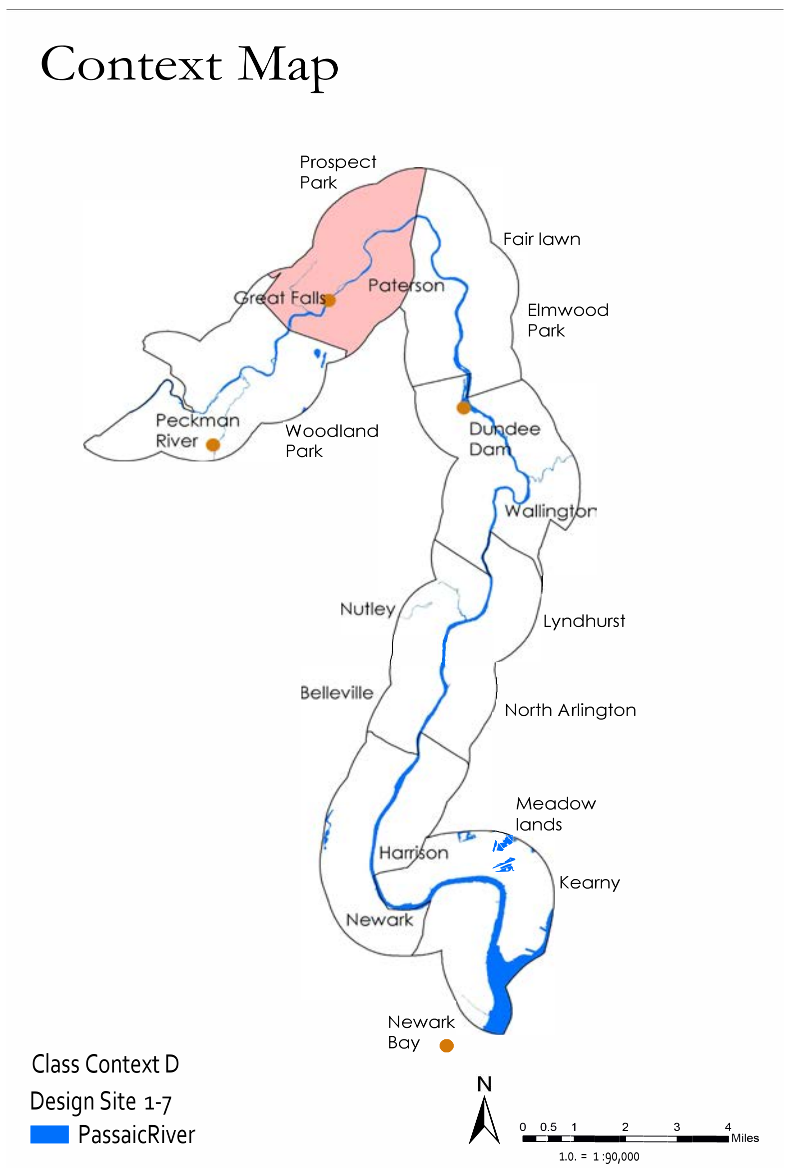
By: Jason Cincotta, Eamon Epstein, Devin Fields,Wes Masco

Context Map

The class originally broke down into seven design groups, each individual group having a specific zone of interest. Within our boundary were segments of three muniscipalitiesl; Paterson, Prospect Park and Hawthorne. Following analysis of the more general zone in question, we moved on to creating problem trees and continuing research on our focus area.



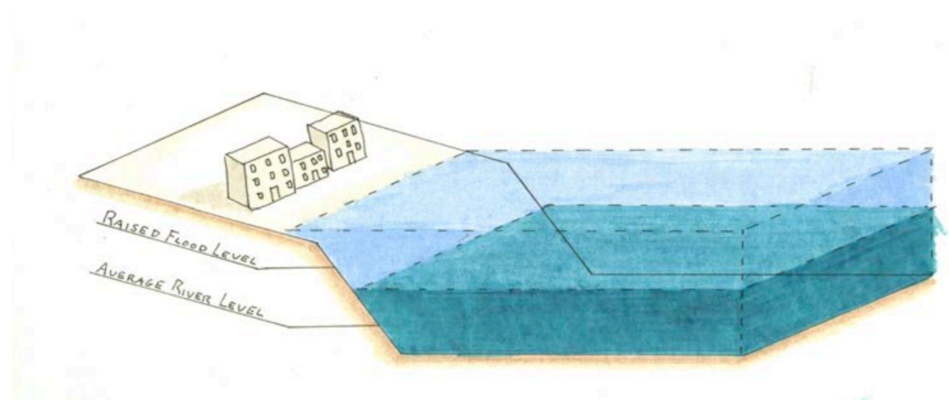




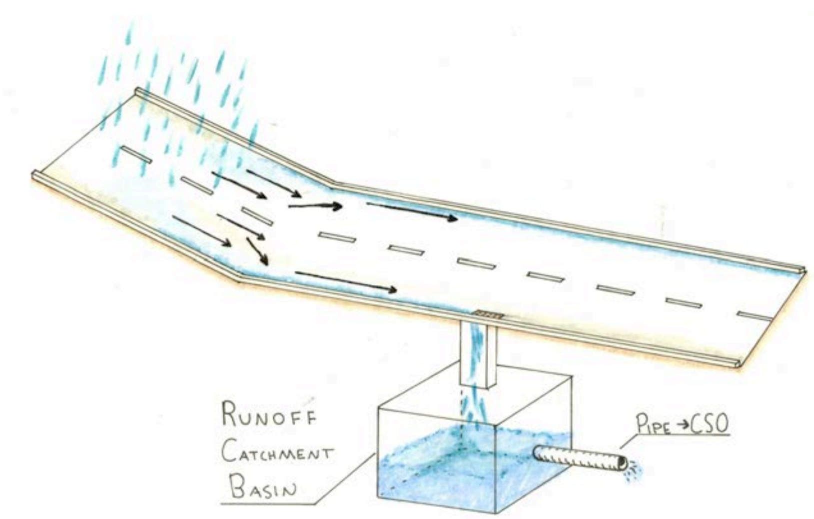
After conducting our initial reseach of our designated area along the Passaic. We decided our two main problems were stormwater runoff and flooding. Stormwater runoff is a problem in this area due to such high levels of impervious surfaces after many years of constant development. Runoff has many negative impacts both on the Passaic River and the surrounding land. Runoff can cause non-point source pollution which carries pollutants and disperses them throughout the landscape without knowing where they come from. Increased stormwater runoff also causes excess stormwater to flow into antiquated Combined Sewer Systems in the area. Our section of Paterson has about 14 total CSO outfalls. When these sewer systems overflow they can cause solid waste and bacteria such as E. Coli to flow into the river and onto the surrounding landscape causing serious health concerns. Another main problem of our area is flooding from the river. This is attributed to our areas generally low topography around the river as well as high development around the river as it was once a source of energy for manufacturers. Flooding causes a lot of property damage and also aids in spreading pollution.

Main Site Problems

Flooding



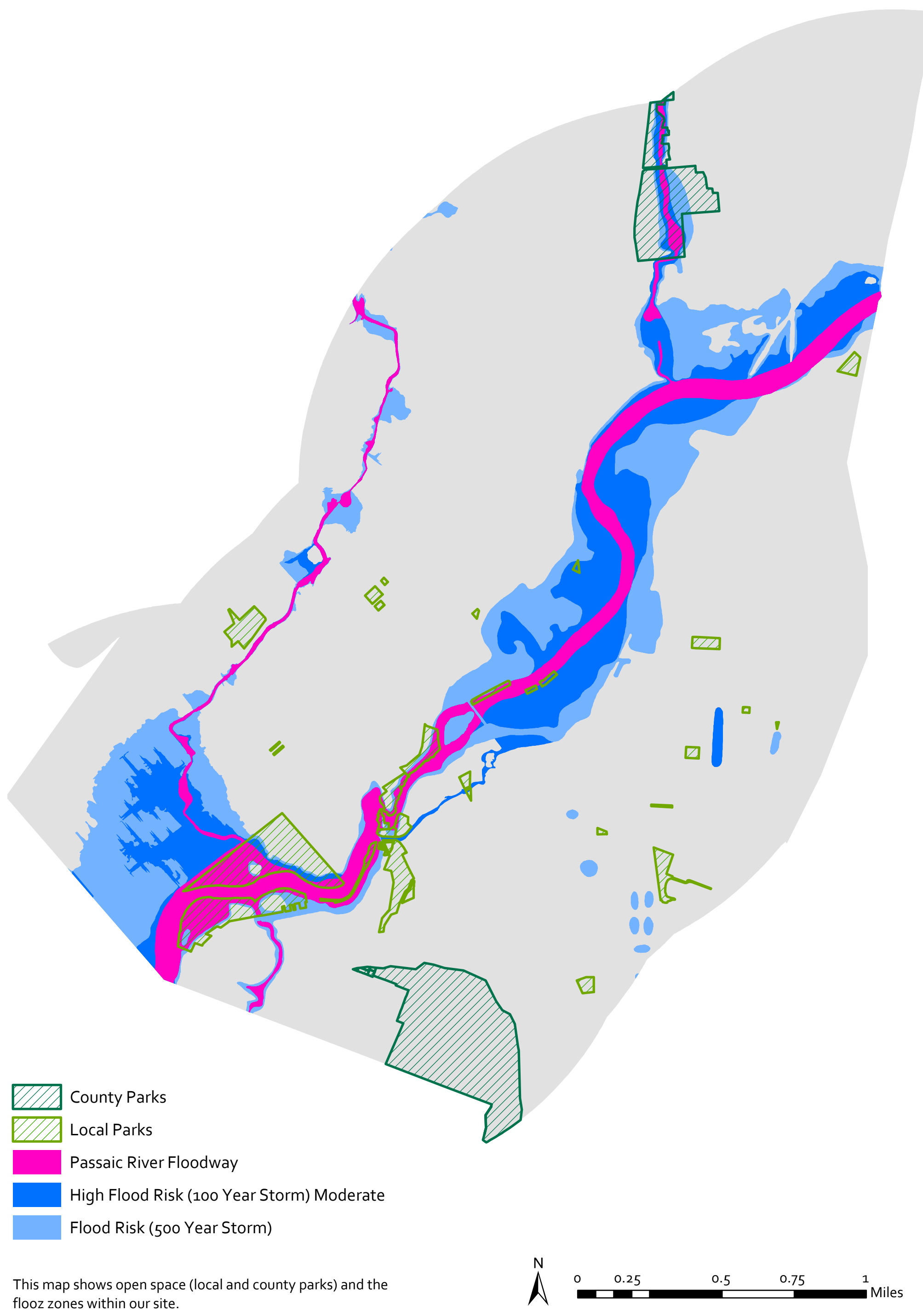
Runoff



Intervention Suitability Analysis

Open Space In Flood Zones

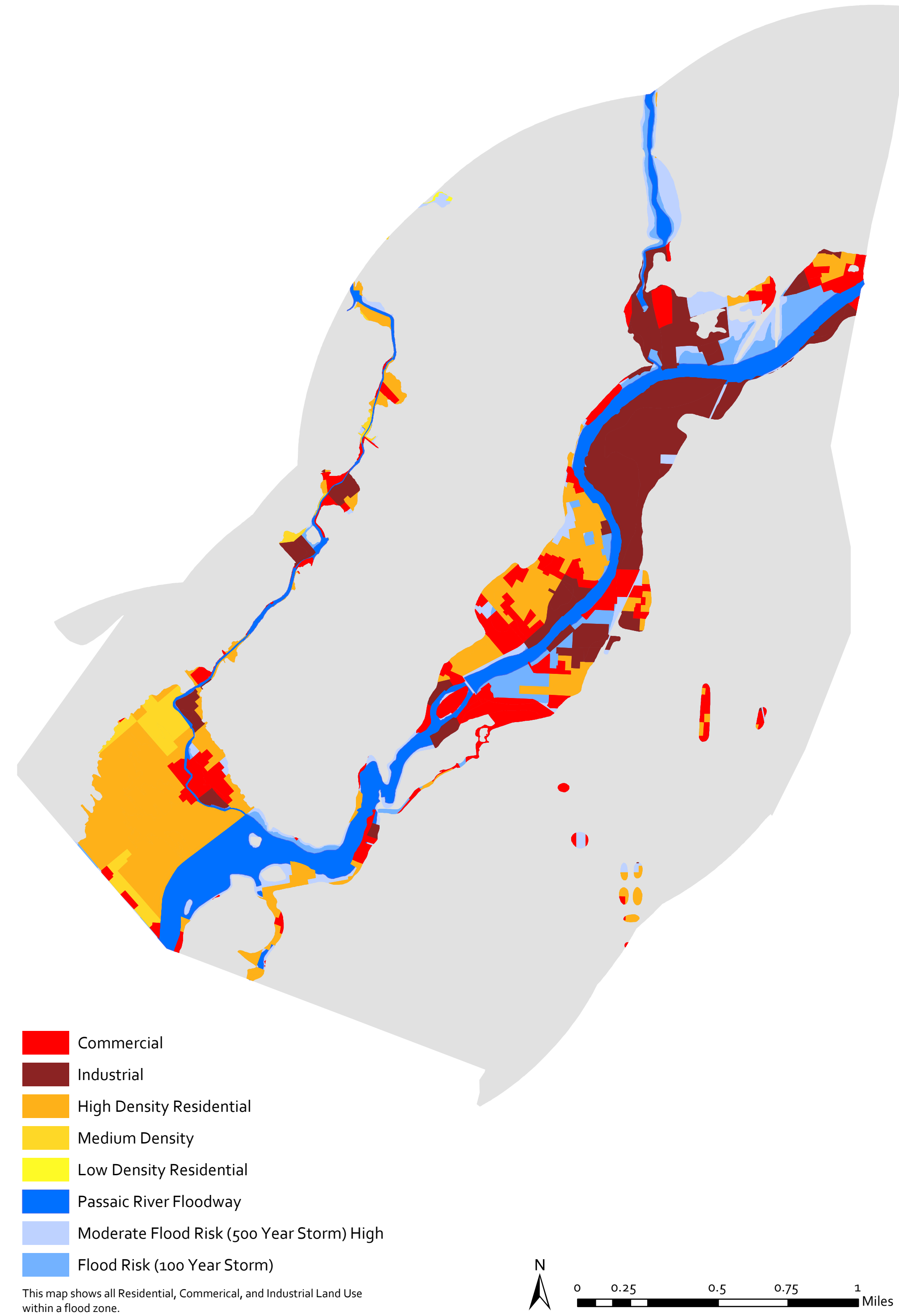
Used to develop park location suitability



This map shows open space in our site that is within a 100 and 500-year flood zone. These areas helped us determine which places needed flood protection and prevention. The lower run of the Passaic River, along with the northern section in this site are major areas that need protection from flood waters.

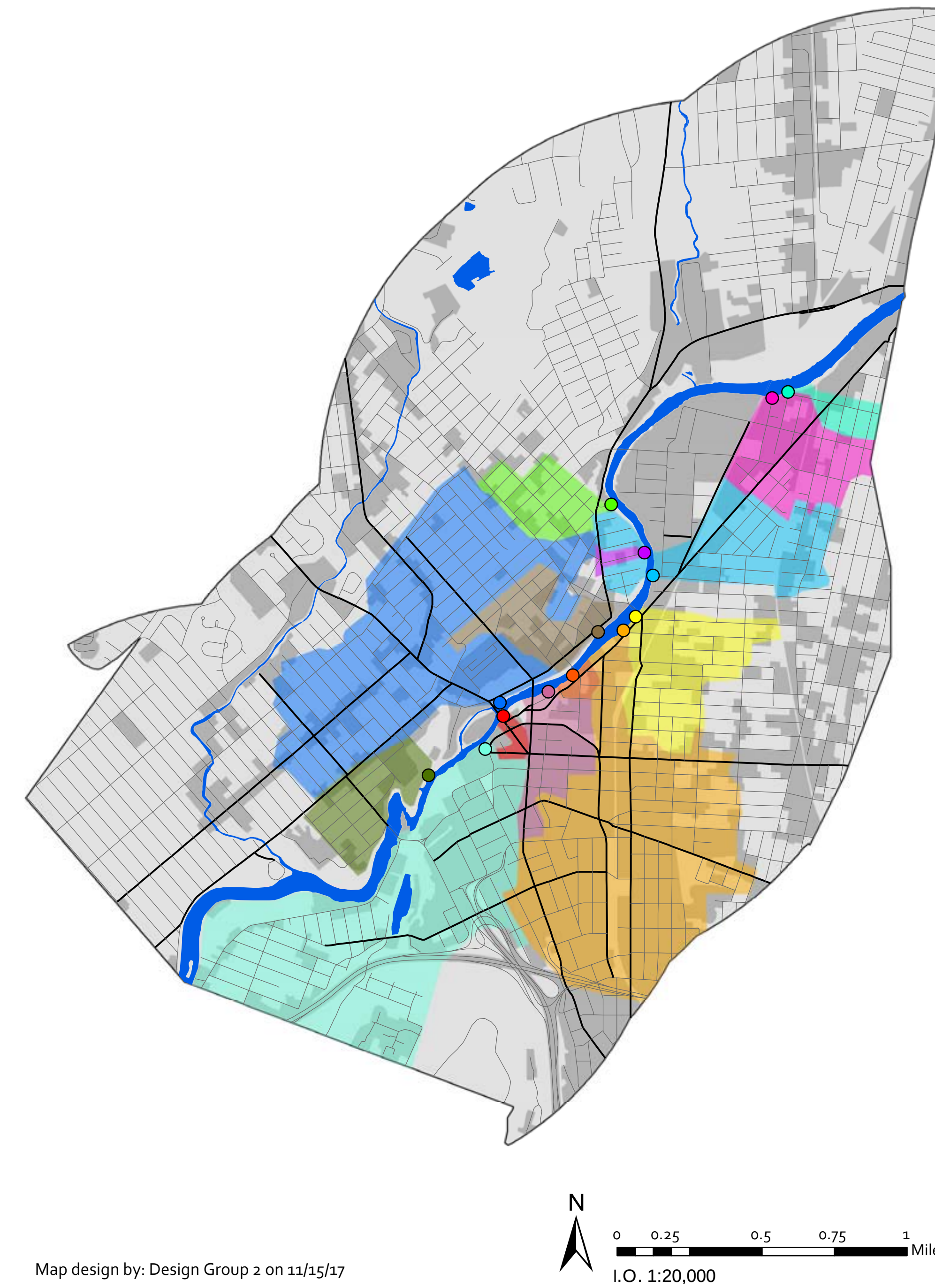
Highly Developed Land In A Flood Zone

Used to develop park location suitability



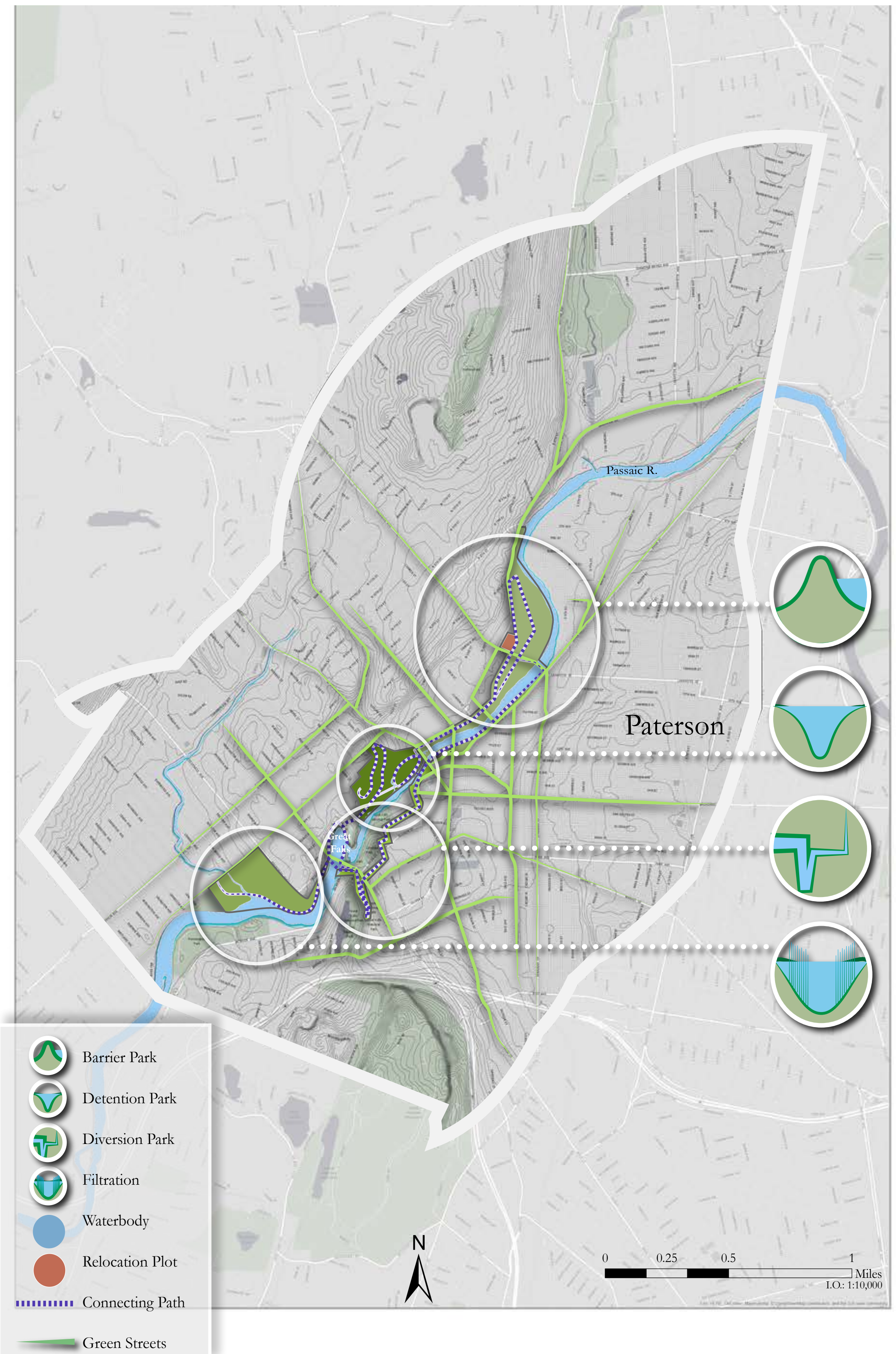
This map shows commercial, industrial, and residential land use within a 100 and 500-year storm flood zone. This maps main focus was to find areas where the three categories mentioned overlaped in this flood zone. Those areas would be where the focus of this site would be.

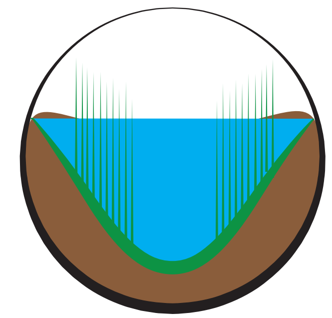
Green Streets Suitability Analysis



This map shows suitability for green steets within the intervention of the site. This was found by crossing referencing road data with high impervious surface (50% or more) CSO catchment areas. If most of a road runs through a single catchment area, that road was choosen for intervention.

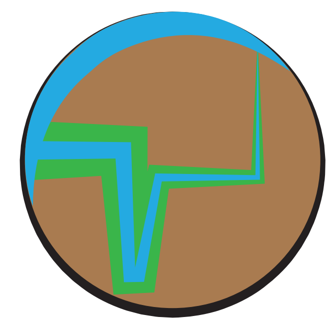
MASTER PLAN





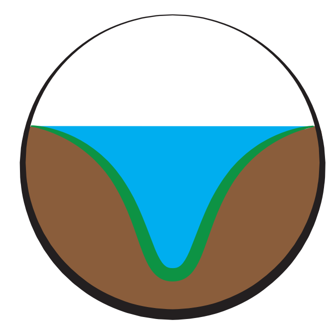
Wetland Park

Located at existing West Side Park and JFK High School sites, this design brings a fresh face to the park while implementing flood mitigation and water filtration techniques. It serves as an innovative park opportunity as well as a space for educational opportunities and recreation possibilities.



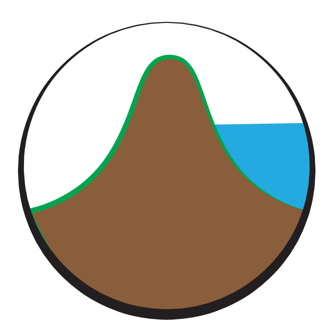
Diversion Park

This intervention utilizes the exisiting S.U.M. Raceway system that runs through Paterson New Jersey. There currently is no water running through these canals. This intervention would divert water into these raceways once again. A linear subsurface gravel wetland as well as dense wetland plantings will be implemented throughout these canals to aid in removing pollutants from the water. Stormwater runoff can also collect within these canals to ease combined sewer systems. People can enjoy the adjacent walking path as they walk through a district of rich industrial history.



Detention Park

An existing concrete island is converted into a detention basin. Detention basins divert and temporarily store river water to slow peak flow rate downstream. Outside of peak flow rate, detention basins can be used for recreation space.



Barrier Park

A system of green spaces, existing and proposed, located on both side of the Passaic River. These green spaces are raised 20 feet from the existing elevation and slope down to existing towards the river. These green space "barriers" block flood waters from the river during moderate to high storms.

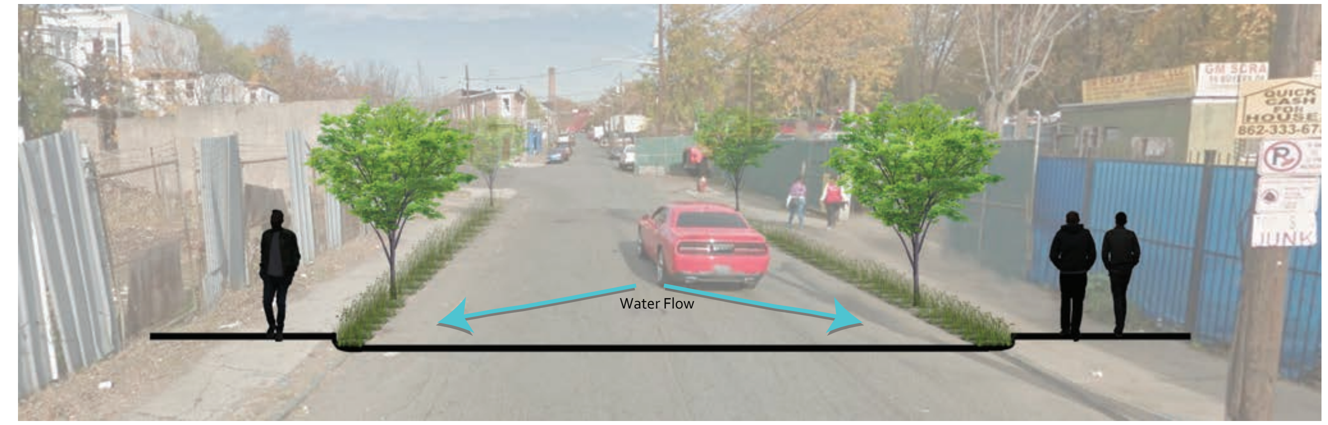
Our implementation of park systems will connect the fragemented green spaces of Paterson while remediating the polluted watersof the Passaic and protecting flood prone areas against rising storm waters. As well as capture stormwater runoff to lessen flow of stormwater into the antiquated Combined Sewer Systems in the surrounding areas.

GREEN STREETS

These **Green infrastructure** techniques can be implemented along roads to **catch stormwater** and prevent runoff from entering antiquated **Combined Sewer Systems.**

Small Streets: 36 to 50 feet wide

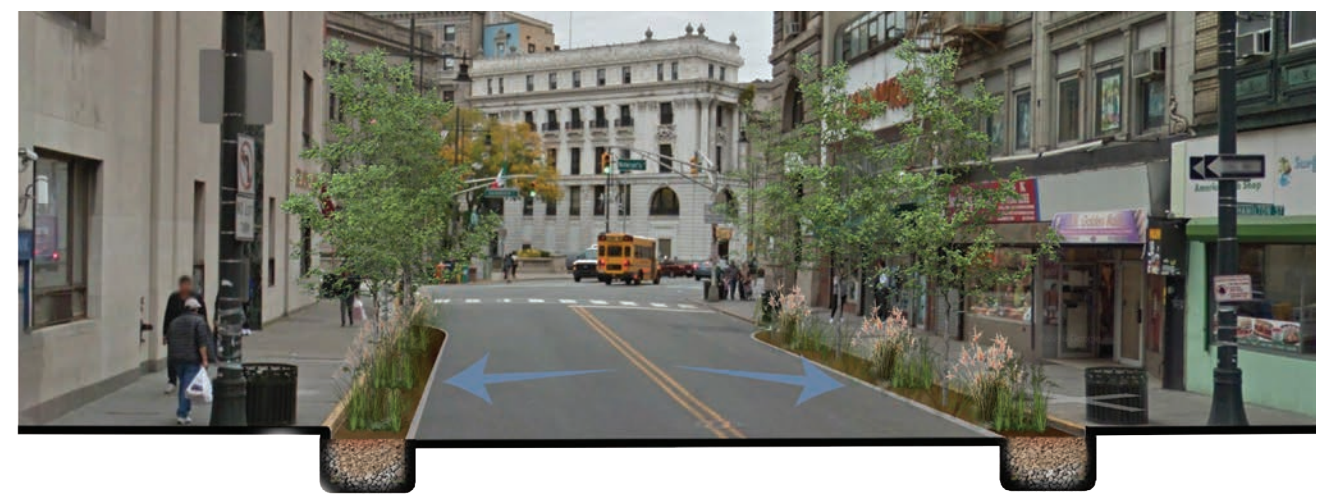
Wait Street: 36′
Goffle Road: 40′
E Main Street: 44′
Murray Avenue: 45′
Presidential Boulevard: 46′
Totawa Avenue: 47′
Main Street: 49′
Straight Street: 49′
Preakness Avenue: 50′
Paterson Street: 50′



A section perspective of Presidential Boulevard in Paterson New Jersey.
These 2 foot wide “**Green Gutters**” can be implemented on more narrow streets to maximize the storm water retention within a small area

Medium Streets: 51 to 65 feet wide

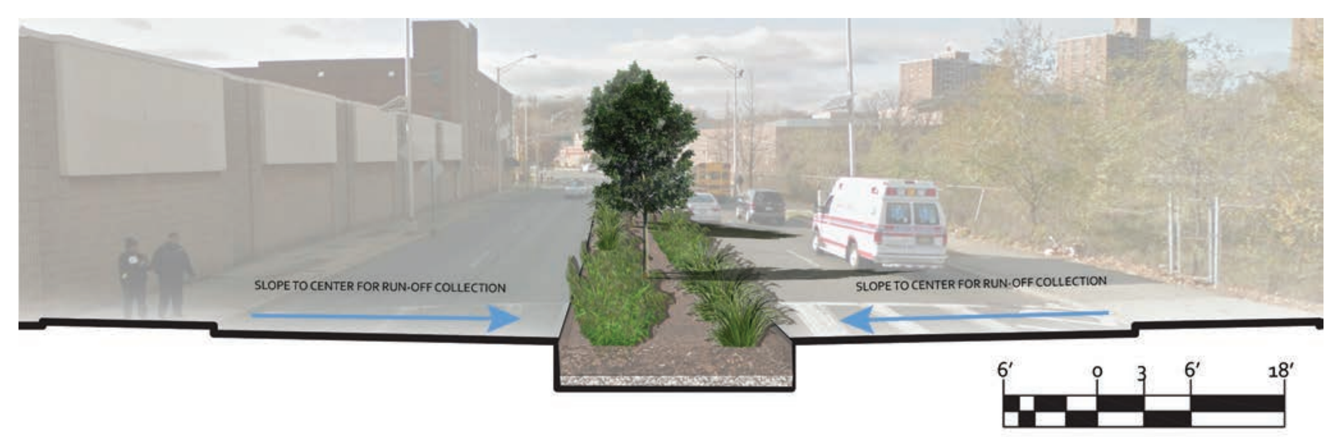
River Street: 55′
Belmont Avenue: 55′
Temple Street: 57′
Market Street: 56′
Wagaraw Road: 59′
W. Broadway: 60′
Grand Street: 64′



A section perspective of Market Street in Paterson New Jersey.
These 6 foot wide “**Roadside Bioswales**” can be implemented on medium to large streets to hold and retain stormwater runoff and lessen the amount of rainwater that ends up in Combined Sewer Systems

Large Streets: 66 to 80 feet wide

Union Avenue: 70′
Broadwy: 71′
Memorial Drive: 79′



Memorial Drive is a 79 foot wide four-lane road. A long stretch of 15 foot yellow line dividers serve as optimal location for a **bio-swale divider** to collect and clean run-off. Areas where turning lanes exist could have metal grates to continue the water storage swale.

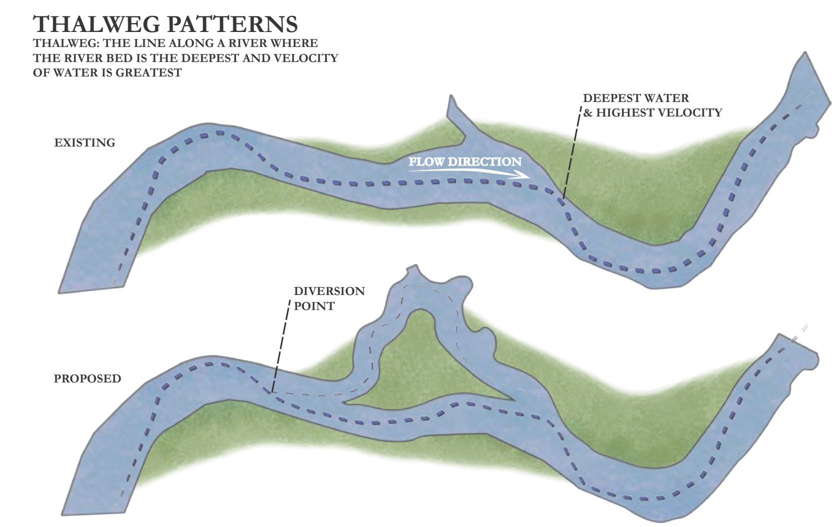
SITE A

WETLAND PARK

GOALS	PROPOSAL
MITIGATE FLOOD WATER	SPONGE ISLAND AND BANKS
RUNOFF STORAGE	GREEN ROOF CONNECTED TO WATER RETENTION SYSTEM
FILTER RIVER	RIVER DIVERSION

Figure one shows the site plan of this site. It sits within the existing West Side Park and JFK High School boundaries. Listed above are the main goals and plans for the site. The sole purpose of this design is to serve as a sponge - both filtering some of the diverted Passaic River as well as water coming from a nearby stream, as well as storage for run-off and flood water. Other additional benefits include public educational opportunities and continued recreational possibilities.

1 PLAN VIEW



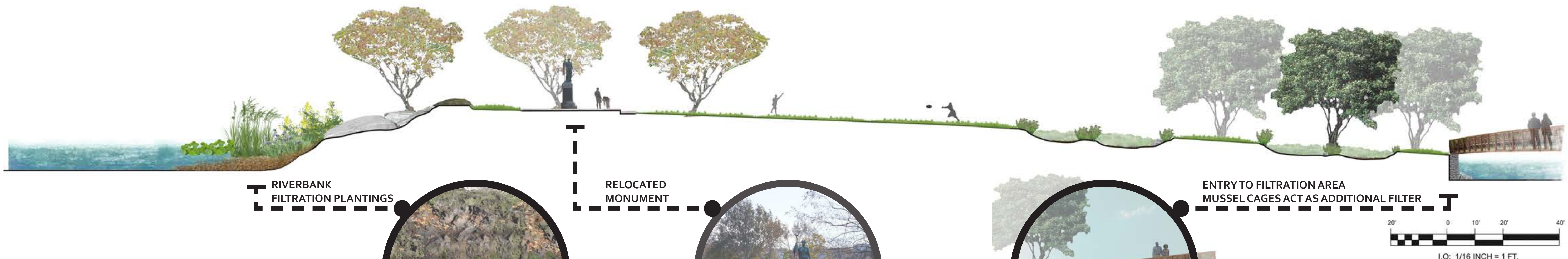
Shown above is a diagram of the Passaic River thalweg patterns running through my site. It shows the existing versus proposed, and was strategically analyzed to allow for one-third of the rivers water to separate from the main body at the diversion point.

Below is the general planting palette for this site, categorized into four parts, each designated for a specific function within the site. The most important plants involved are the marshland and emergent plants, for the aid to filtration and storage on the site.

PLANT PALETTE

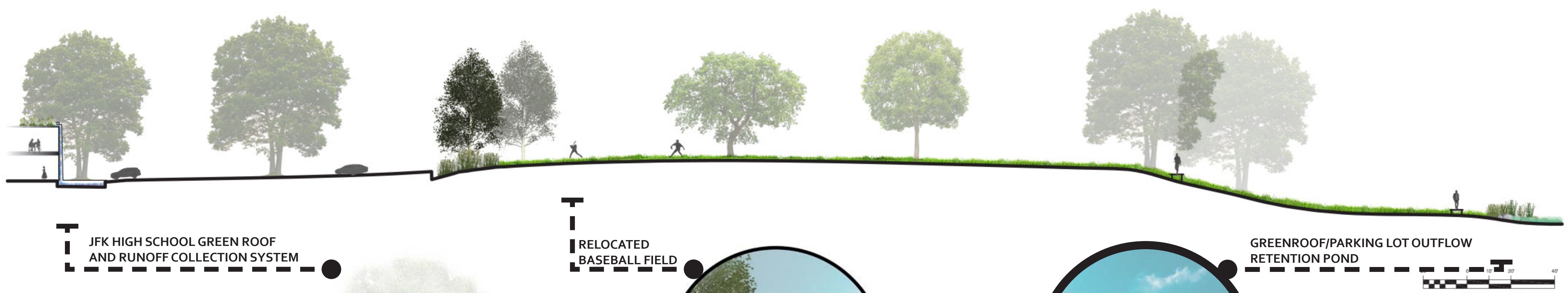
TREES FOR WELL DRAINED SOILS	TREES FOR WET SOILS	PLANTS FOR MARSHLANDS	EMERGENT PLANTS FOR SHALLOW WATERS
CARYA OVATA	SALIX NIGRA	HIBISCUS MOSCHEUTOS	TYPHA AUGUSTIFOLIA
OSTRYA VIRGINIANA	NYSSA SYLVATICA	SCIRPUS PUNGENS	SAGITTARIA LATIFOLIA

SECTIONS AND PERSPECTIVES




2 SECTION ELEVATION A-A’

This section and accompanying views are pieces of the built island. Within this cut from the diversion side to the outlet side, the filtration, storage and vegetation infrastructure are shown in relation to each other.



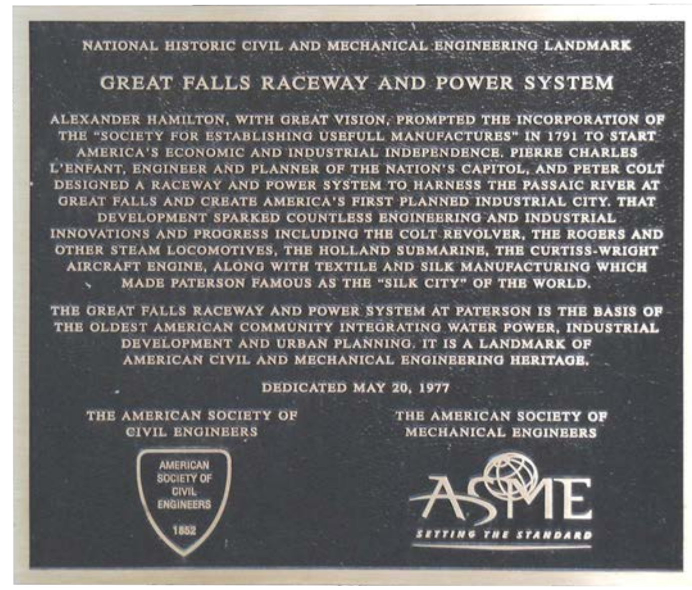

3 SECTION ELEVATION B-B’

Section two shows us the green roof drainage system from entry point, and the outflow area into the retention pond. Within each side, updated existing aspects such as the baseball field are seen.

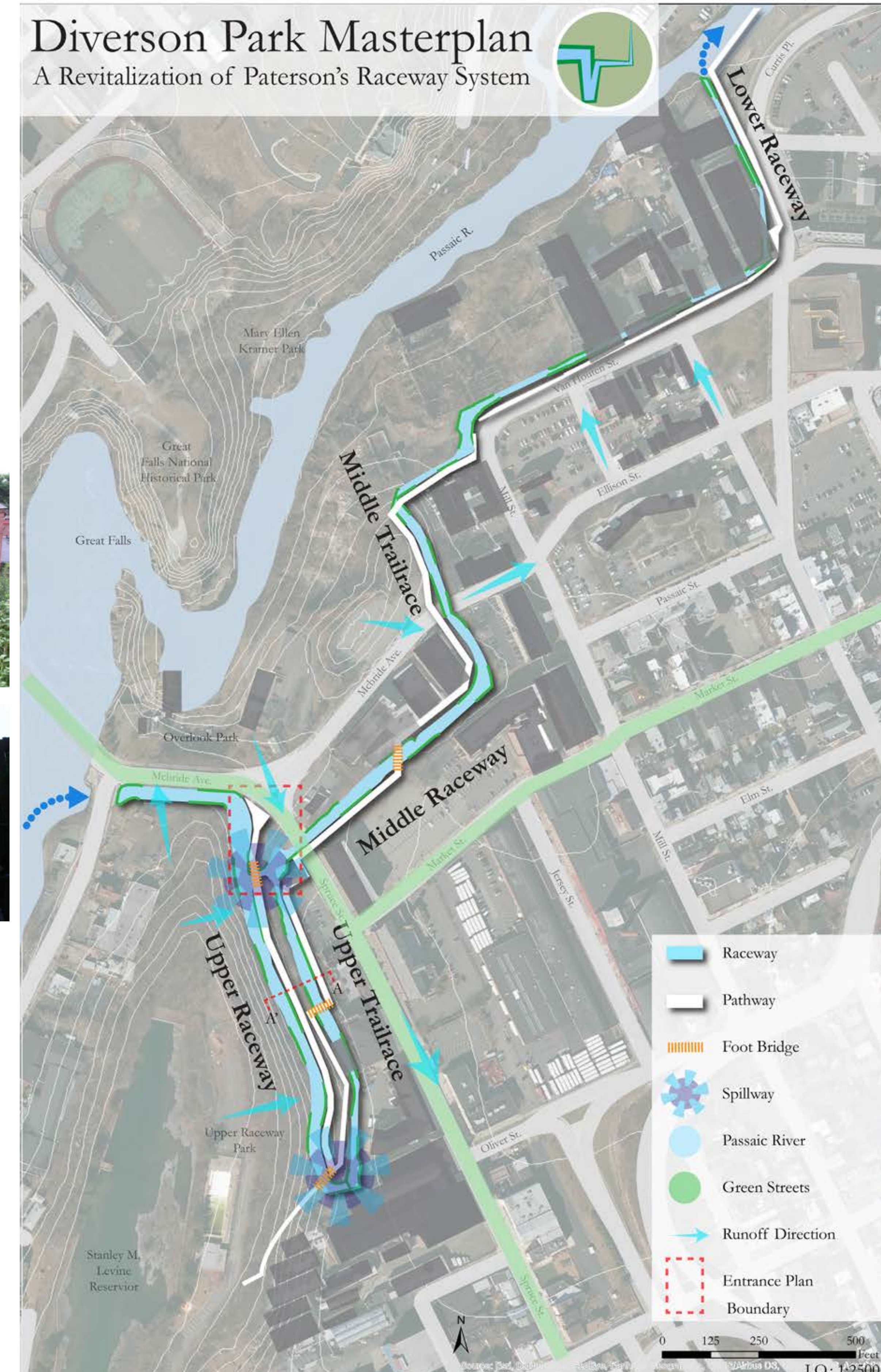
SITE B

DIVERSION PARK

The proposed revival of Paterson's Raceway System will see an improved entrance to the park as users are greeted by the sound of water flowing throw Paterson's great canal system once again. This renewed flow of water diverted from the Passaic River will be complimented by an innovative linear wetland system throughout the canals to help filter out unwanted pollutants. The adjacent racewalk offers a scenic trail stretching the full expanse of the racway network while paying homage to the rich industrial history of the area.



Existing Condition



Plant Palette

Salix Sepulcralis
Weeping Willow

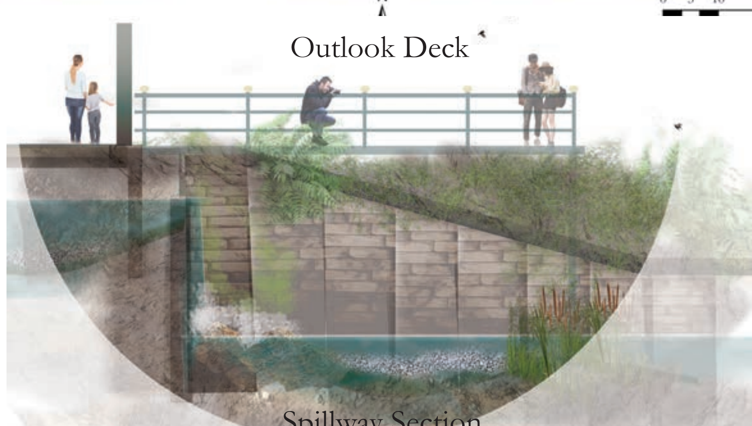
Phragmites Australis
Common Reed

Cyperaceae
Sedge

Cornus Florida
Flowering Dogwood

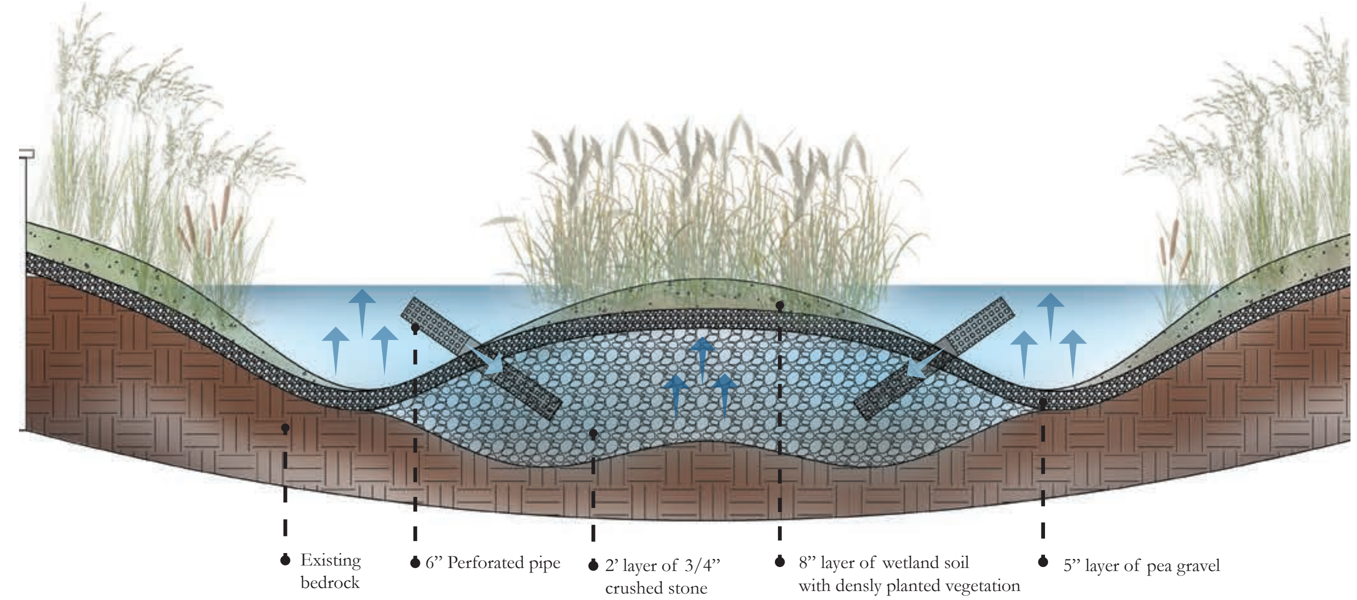
Typha
Cattail

Saurrus Cernuus
Lizard Tail

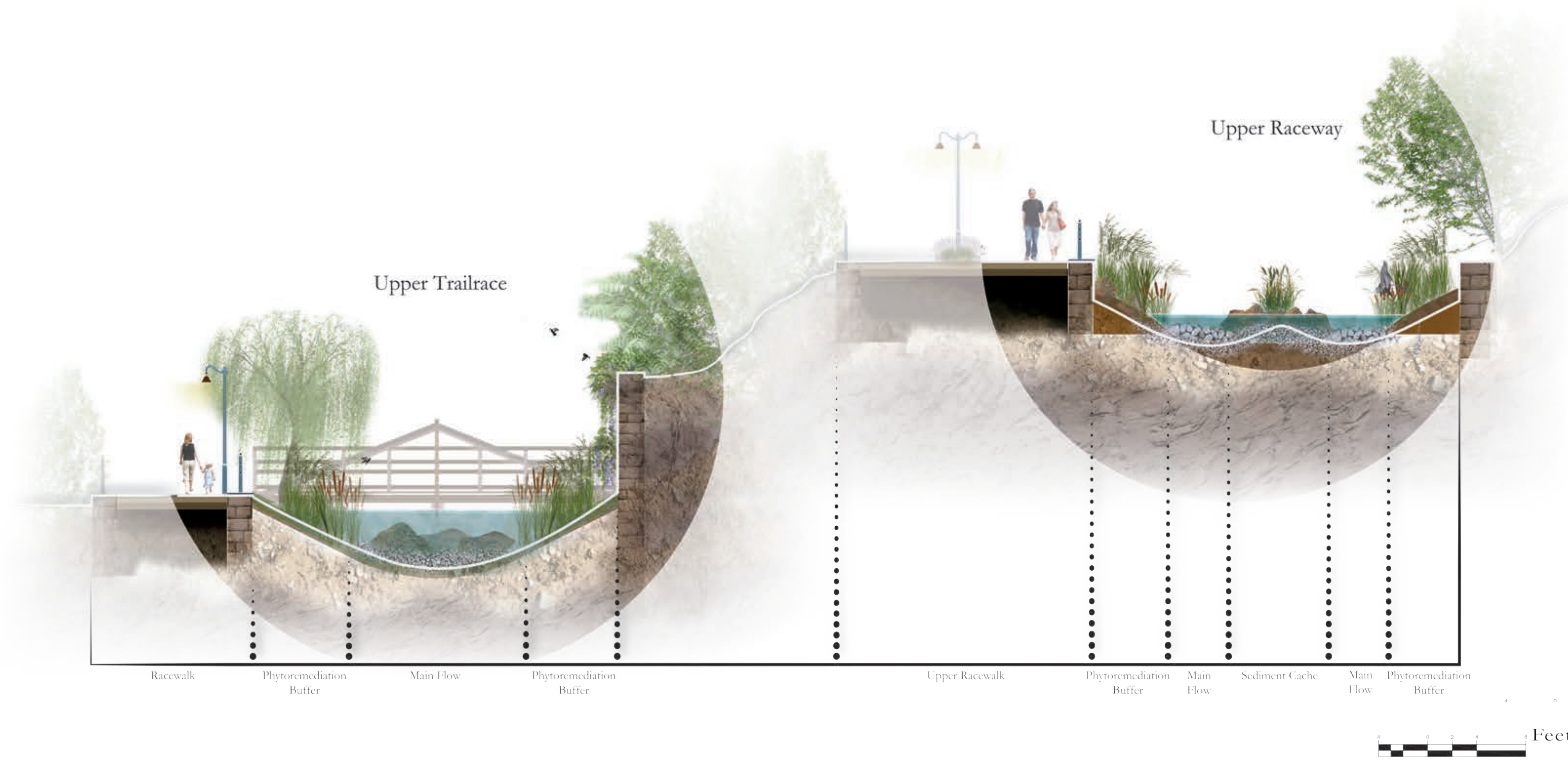


Subsurface Gravel Wetland Detail

(Within Raceway)



These Vegetated Subsurface Gravel Wetlands will be implemented within parts of the Raceways to aid in cleansing the water that is diverted from the Passaic. The water will enter the raceway where portions of it will then encounter these constructed landforms which remove up to 80% of total suspended solids. Water will percolate and flow through these gravel basins that will naturally line with a biofilm of algae and microbes over time. This biofilm will adhere to and intercept suspended solids in the water. The vegetation within the racway will have a similar pollutant absorbing effect. Plant species such as cattails, Fragmites, Sedge, and ragweed will help to regulate the pollutants in the water as well. The power to control flow into the raceways will allow for easy maintenance.



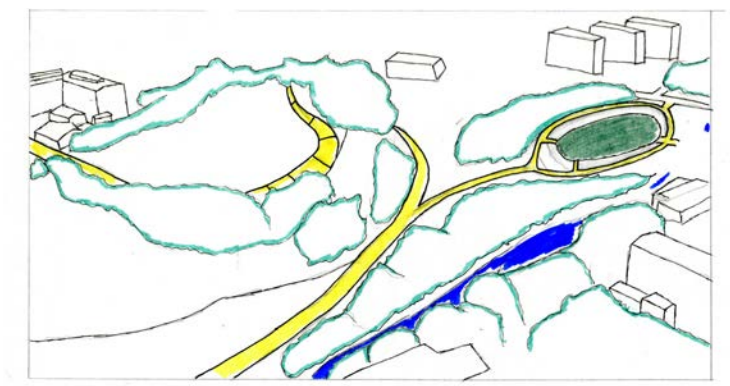
SITE C

DETENTION PARK

The plan view of the intervention highlights both the specific outlines of the areas to be developed, as well as the proximity of the two locations relative to one another.

Aerial View

Perspective Sketch



Detention Park converts a concrete island stuck in a fork of the Passaic River into a multifunctional flood mitigation and recreation asset. River flow is diverted into the park, while maintaining the original branched path flowing around the new park. During flood events, the peak discharge of the Passaic River will be partially channeled through the intake pipe at the beginning of the park, and will be slowed through the various levels of the basin until it is slowly re-released into the main body of the river. In between flooding events, the park serves as a large open space recreation area. The bottom level of the detention basin consists of an open grass field, which residents have the liberty to use for any activity they choose. The path leading up to the park continues around its outermost, highest elevated edge, alowing for a recreational route both during and between flood events.

Overlook Park sits atop a cliff previously home to a failed residential development, with close proximity to Detention Park. The same multi-use path leading to Detention Park also follows the curve of the cliff and leads pedestrian traffic through a wooded trail up to Overlook Park. As the dense forest clears visitors to the park are greeted by both a large lawn area sloping up to the cliff edge, as well as an observation walk along the edge. The observation walk provides a scenic view of the city of Paterson and provides a better persepective of the Detention Park as a whole.

Dry detention basins provide multiple uses for flood management, as well as public recreation. The process of flood management begins with an intake pipe that accepts river flow, releasing it into a sloping level of concrete rip rap. The rip rap spreads and slows the stream of water before reaching the sediment forebay, serving as a temporary storage site for the body of water that simultaneously removes some sediment pollution. As the forebay overflows water is passed through a second level of concrete rip rap before entering the lower level of the detention basin, consisting of permeable grass. The lower level gradually slopes downward toward the outlet pipe, which is smaller than the intake pipe as to ensure a slower flow of water re-entering the Passaic River. This system, while slowing the water, moves the flow through quickly enough to remain dry during periods of normal river flow. Thus, Detention Park becomes a large-scale recreation area for the majority of the year, adding much needed green space and continuing the open space system developing throughout this site.

Detention Basin Section

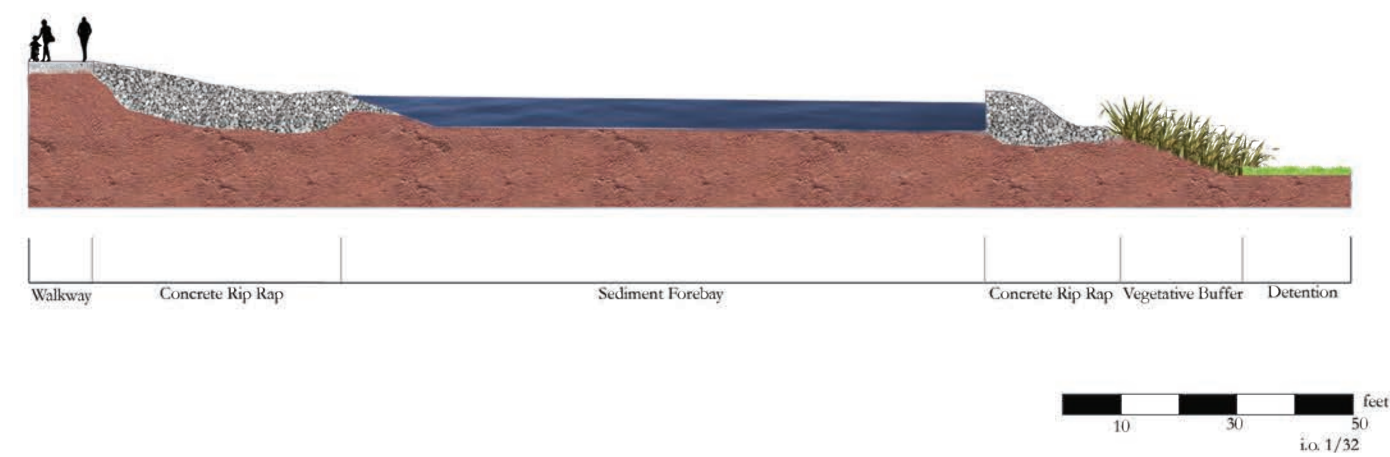
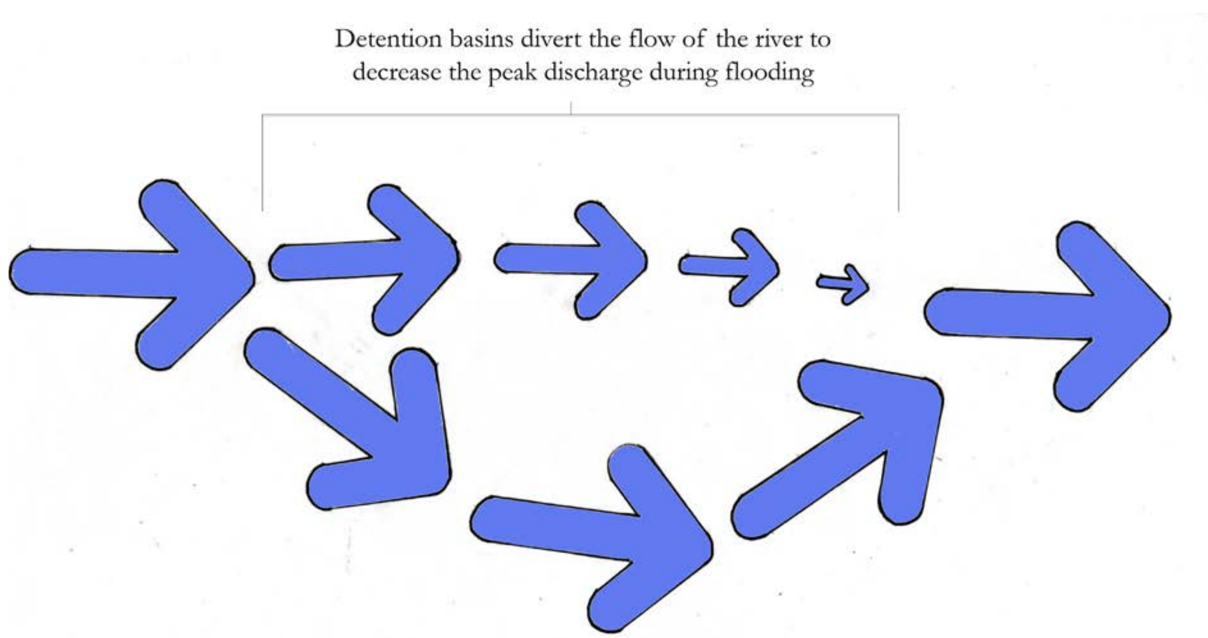
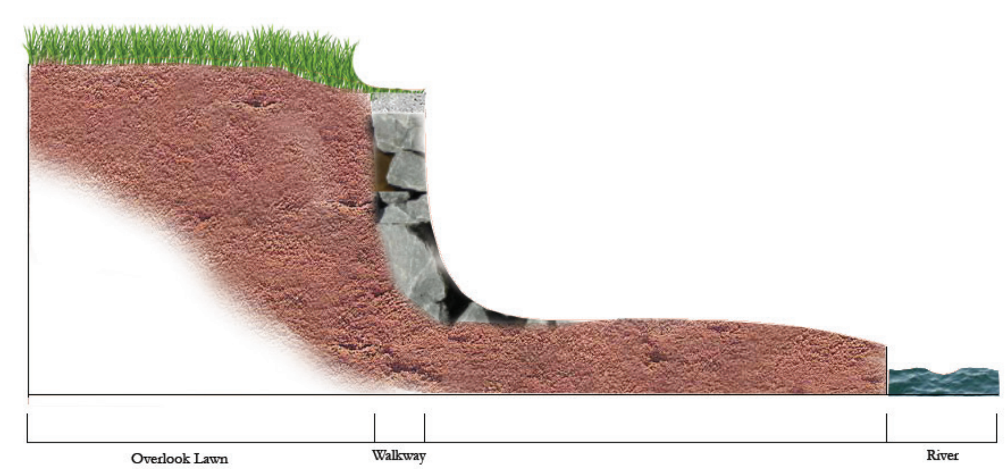


Diagram of Detention Basin

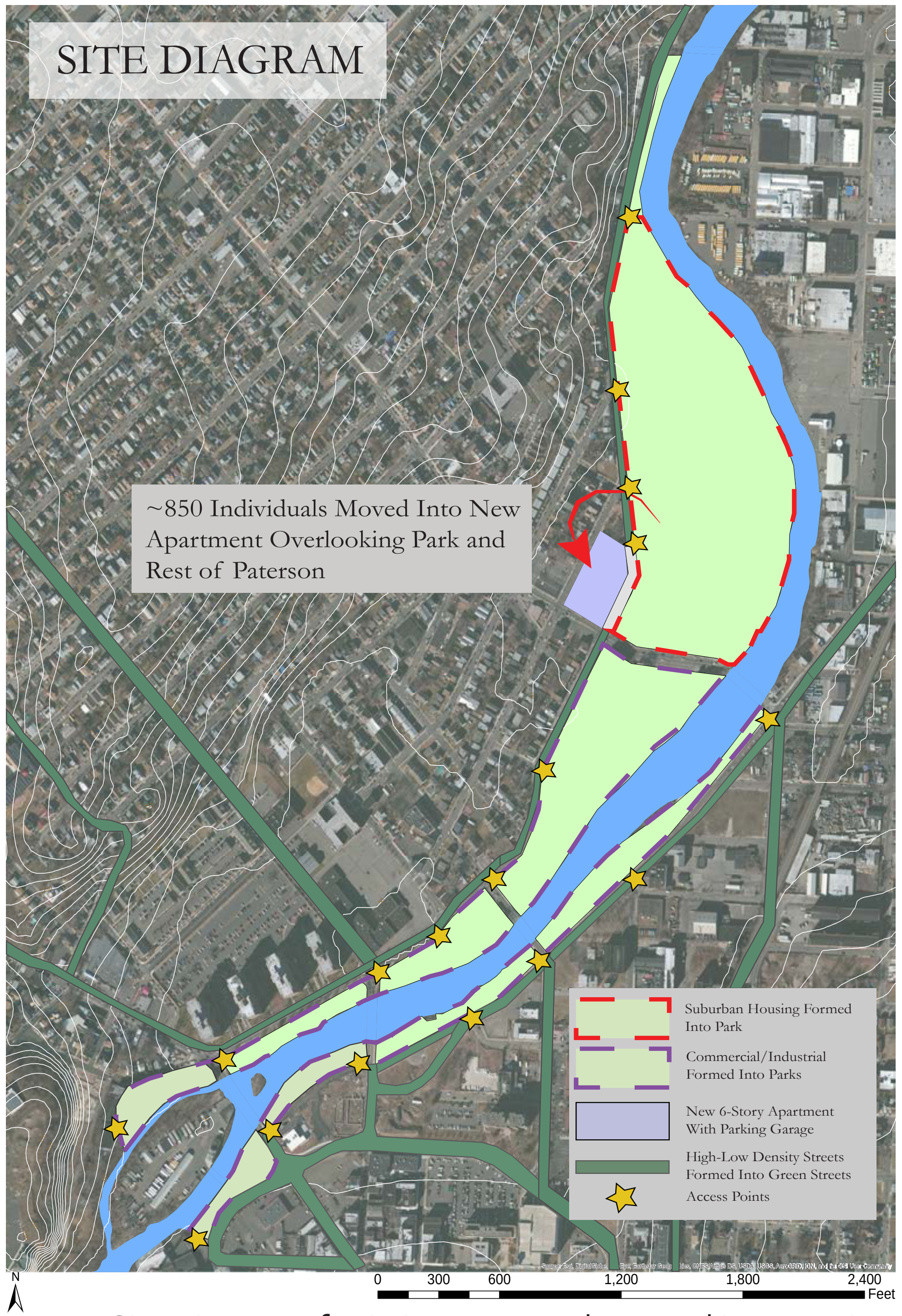


Overlook Section



SITE D

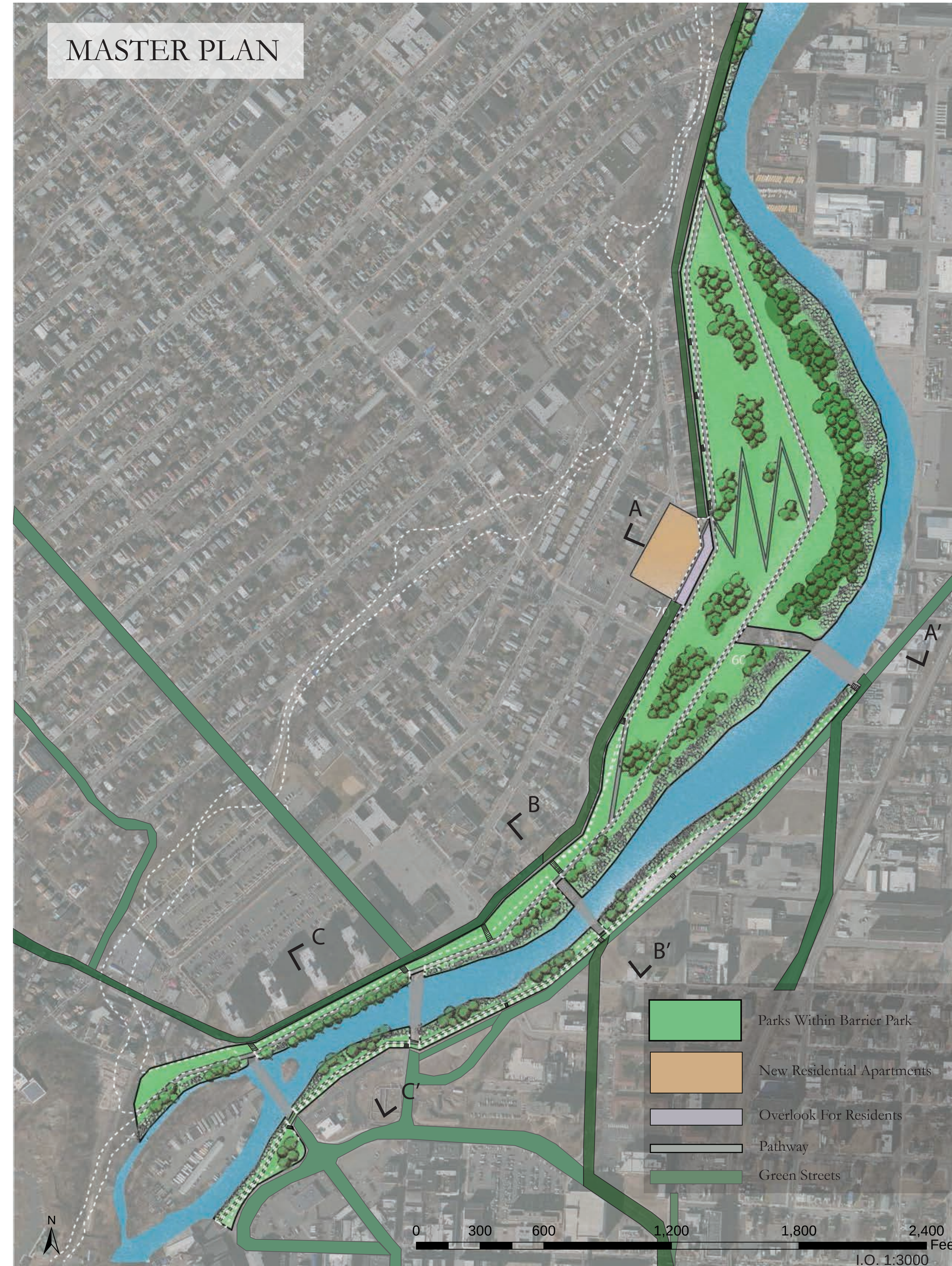
BARRIER PARK



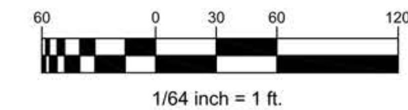
A Site Diagram of existing space and propsed interventions for the Barrier Park green space system. It delinates which areas are housing and commercial/industrial, where those residents will be moved, and the new green spaces and access points

The Barrier Park green space system is a series of small to large green spaces that act as barriers to block rising flood water from the Passaic River. The design consists of differing elevations, peaking at 20 feet above existing grade. It also consists of pathways at multiple elevations, dense soft border plantings, ada accesible ramp coming from the proposed residential apartments, and rip rap lining the edge of the green space to help prevent soil erosion. Around the parks are green street to slow down the storm water runoff.

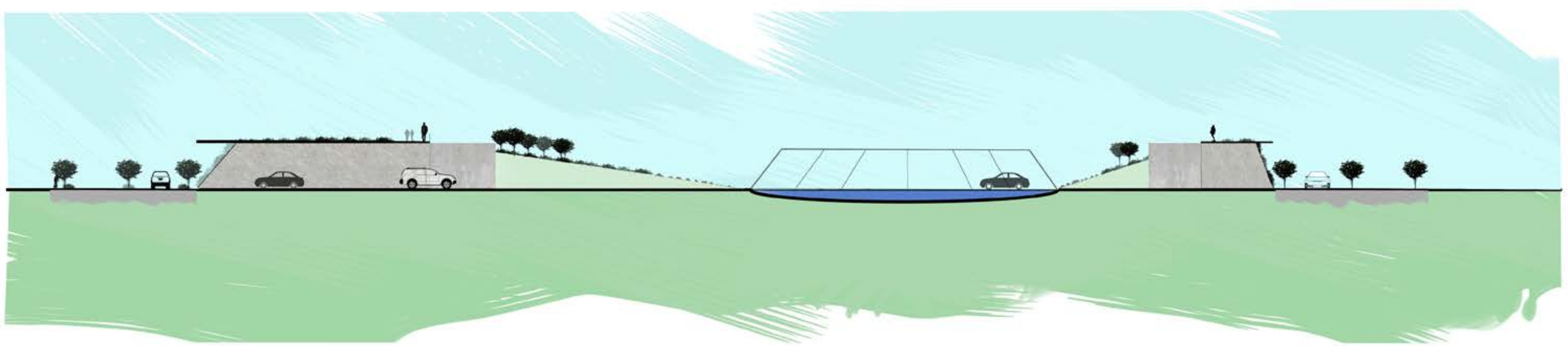
A perspective drawing of the interaction between the existing bridge, and the flood wall tunnel.



Section A-A'

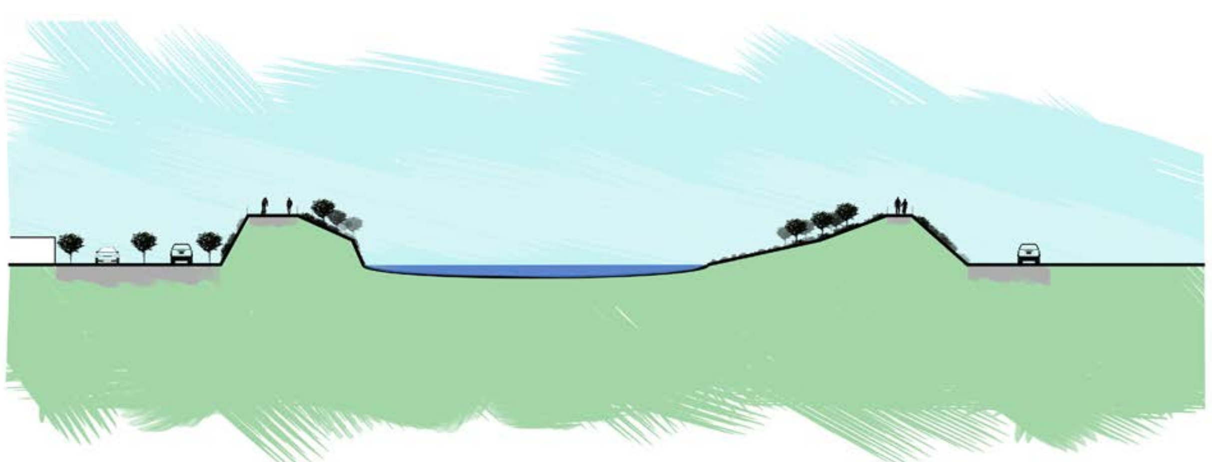


Section A-A' is a long section that cuts through the proposed residential apartments, the tunnel with terrace above, and the gradual slope that lowers itself into the Passaic River. This section of Barrier Park has two walkways, one 20 feet above existing grade and another 10 feet above. The lower path is expected to flood during intense storms.

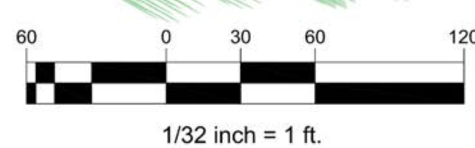


Section B-B'

Section B-B' is a section cut through a green street, flood wall tunnel, over an existing bridge, and over to the other flood wall tunnel on the other side of the Passaic River. This section shows how the roads were not raised or altered, but the green spaces were built around the existing roads. Also, the flood wall doors are there to be closed during intense storms.



Section C-C'

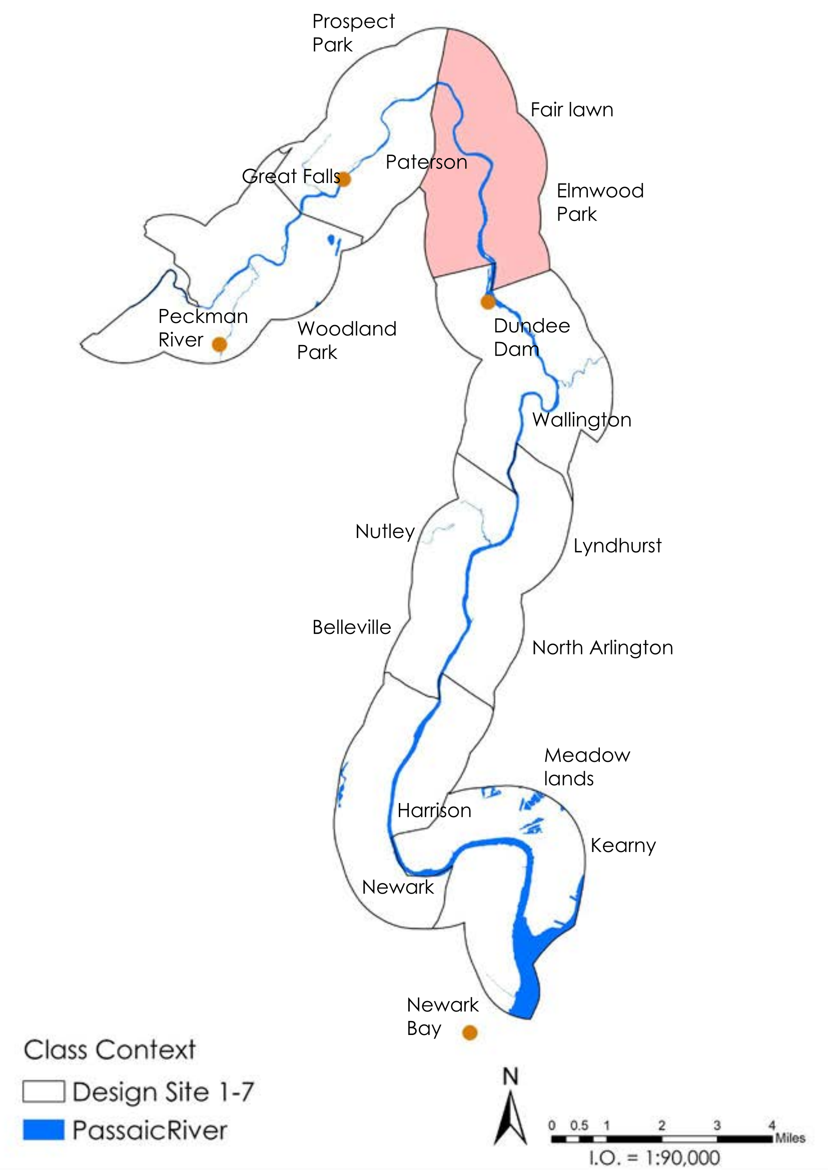


Section C-C' is a section cut through the more narrow section of the Barrier Park green space system. The cut runs through a green street, a green space, the river, and mirrors the other side. This section contrasts Section A-A' as the slope in this section is much steeper. Also, there is one walkway located at the highest elevation on both sides of the river.

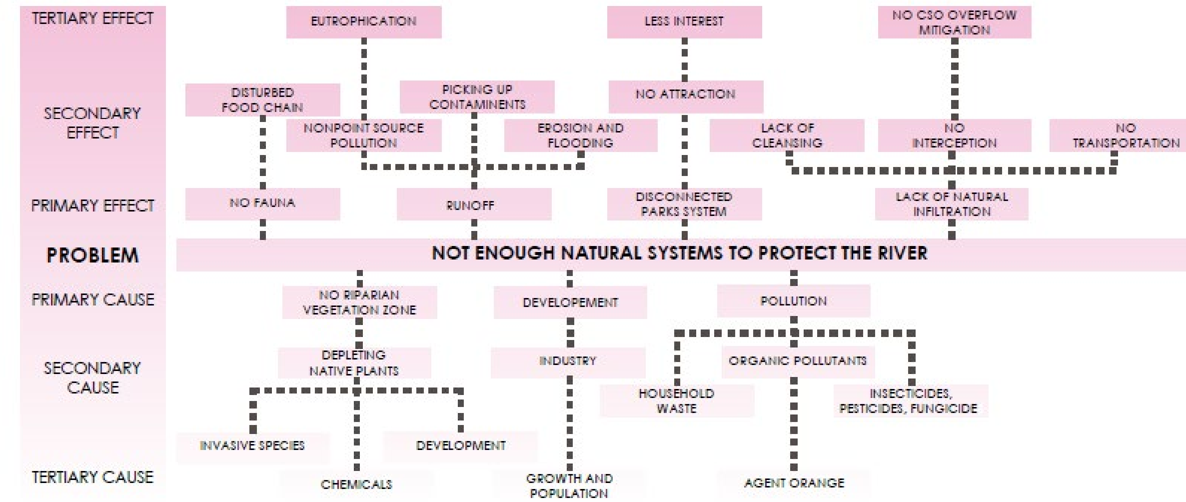
Site Three

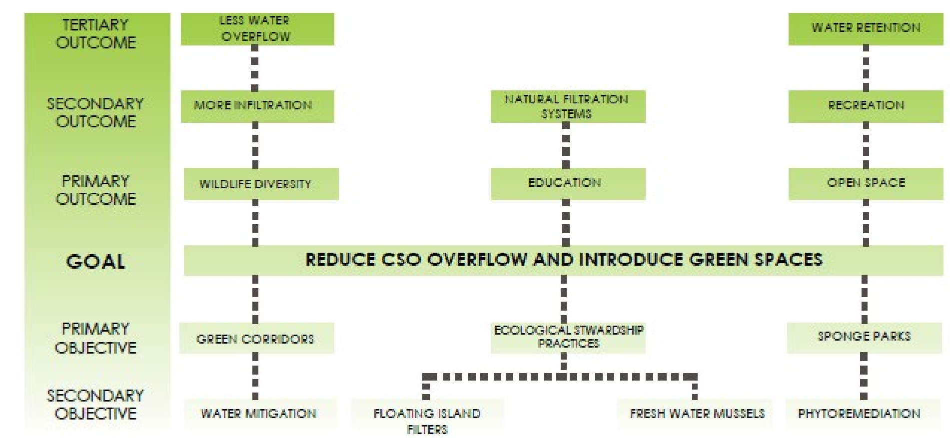
By: Alexis Lo, Emily Otterbine, Gisselle Pena, Emily Toth

Context Map



Problem and Solution Trees



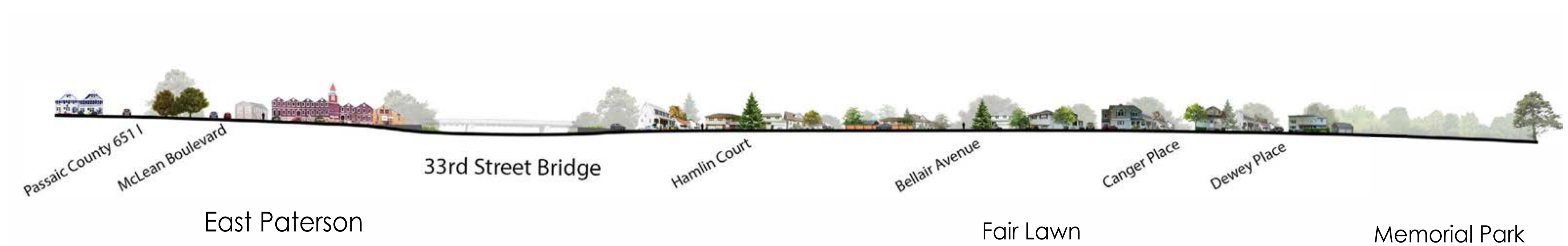


After inventory analysis of the sites in Fairlawn, Elmwood Park, and Paterson, it was apparent that there were not enough natural green systems to protect the Passaic River. The over development and pollution degraded the natural buffers that once lined the Passaic. To address this problem the goal was to reduce combined sewer overflow and introduce green spaces. Some of the site interventions include green corridors, flood parks, and green practices to improve the overall quality of the environment and river.

Goals and Intended Interventions

The goal of site three is to create a cohesive sustainable green system to manage CSO overflow and consumer/industrial waste. The objective is to restore natural systems along the Passaic River and improve environmental quality. Specific interventions create a network of green corridors on roadways where most runoff leads to CSOs while connecting proposed green spaces with the wsurrounding communities. A selection of contaminated areas will be addressed and transformed into sites for phytoremediation.

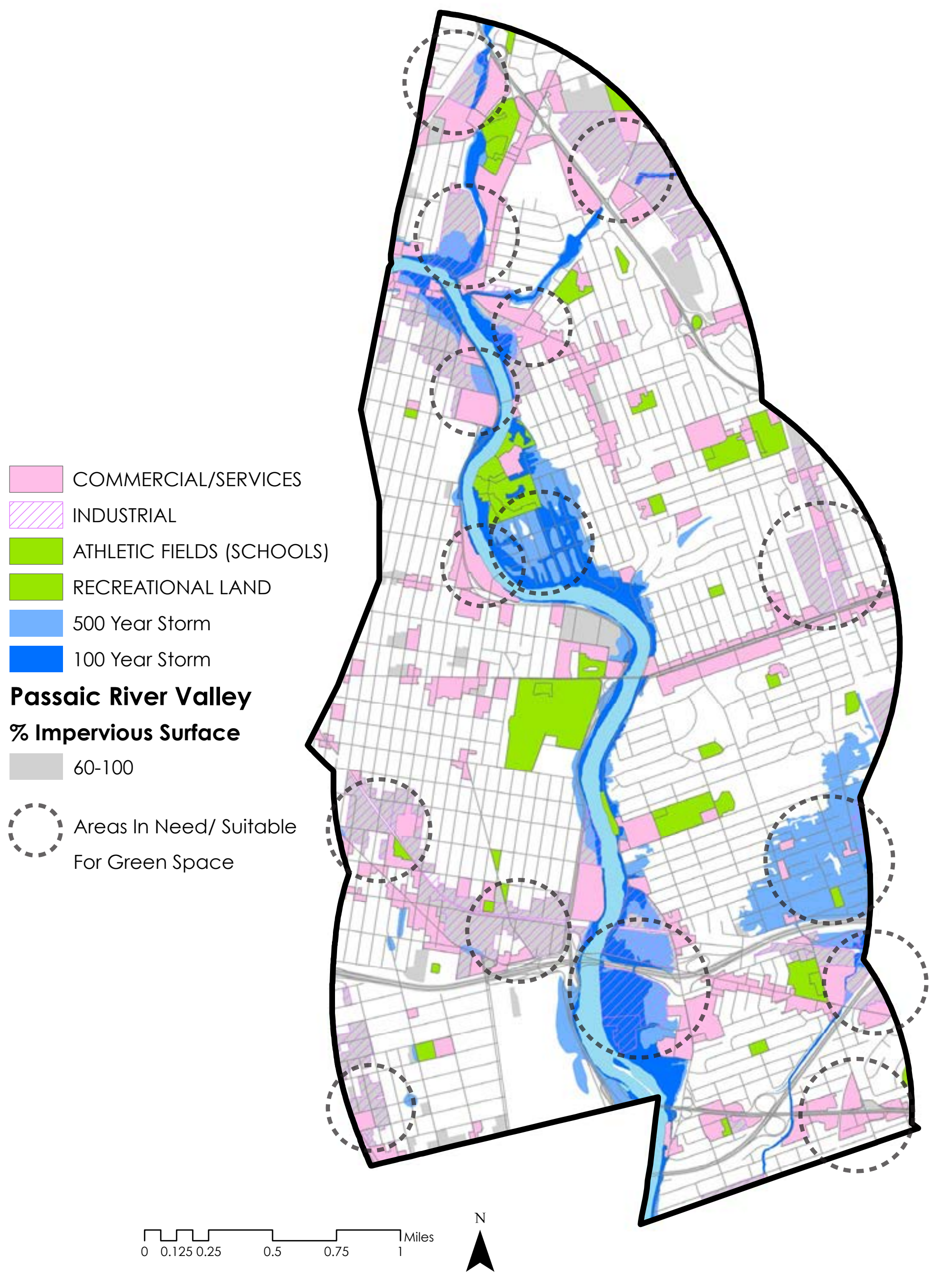
Existing Site Section



This existing section runs through Paterson, Fair Lawn and Memorial Park. The section shows the difference in impervious surface between the communities. On the Paterson side, there is less vegetation and trees paired with industrial and commercial buildings. While the Fair Lawn side appears to be more lush and green, the following impervious surface calculations will show high levels of impervious surface on the Fair Lawn side of the river.

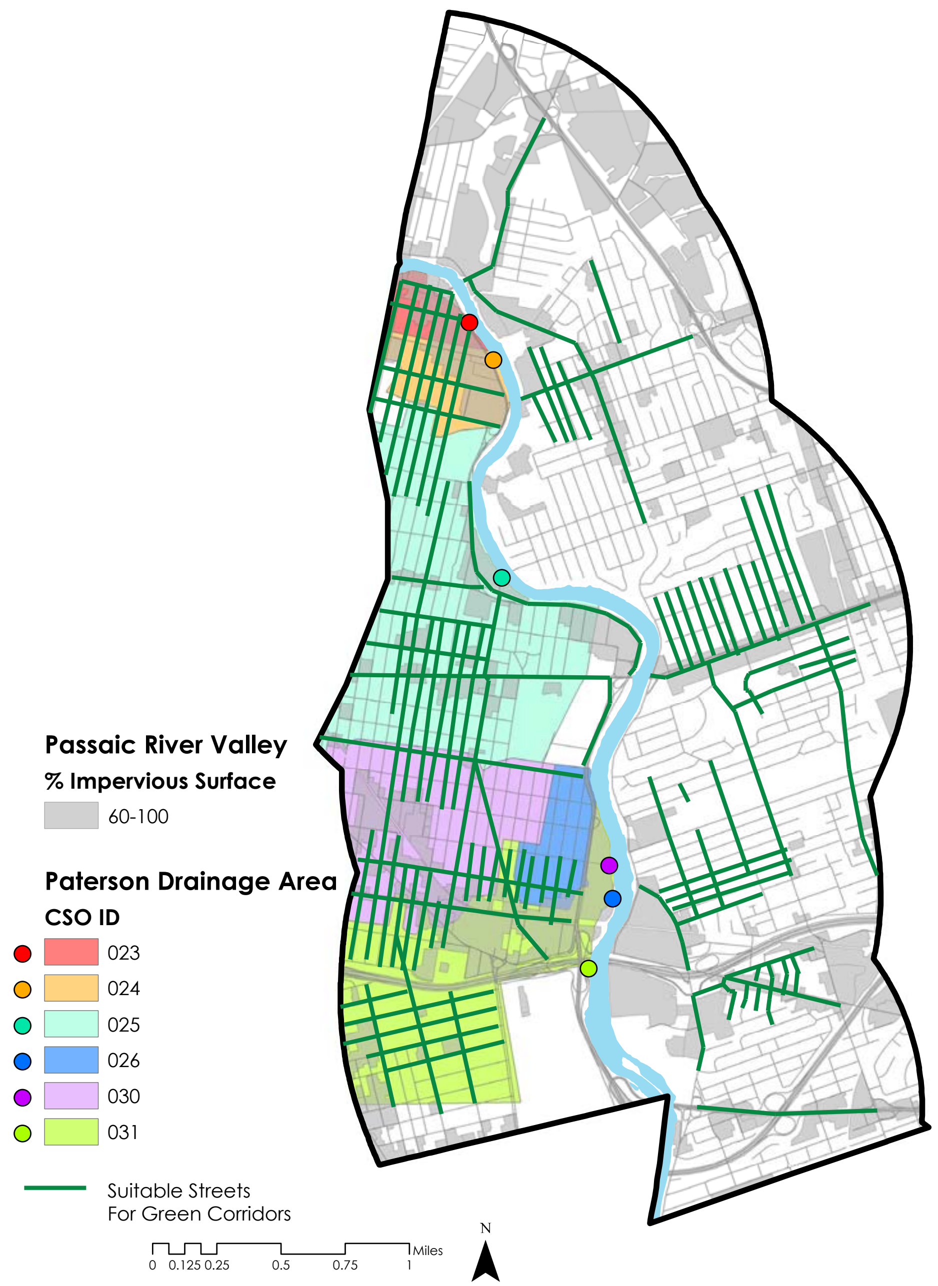
Suitability Maps

Need/Opportunity For Green Space



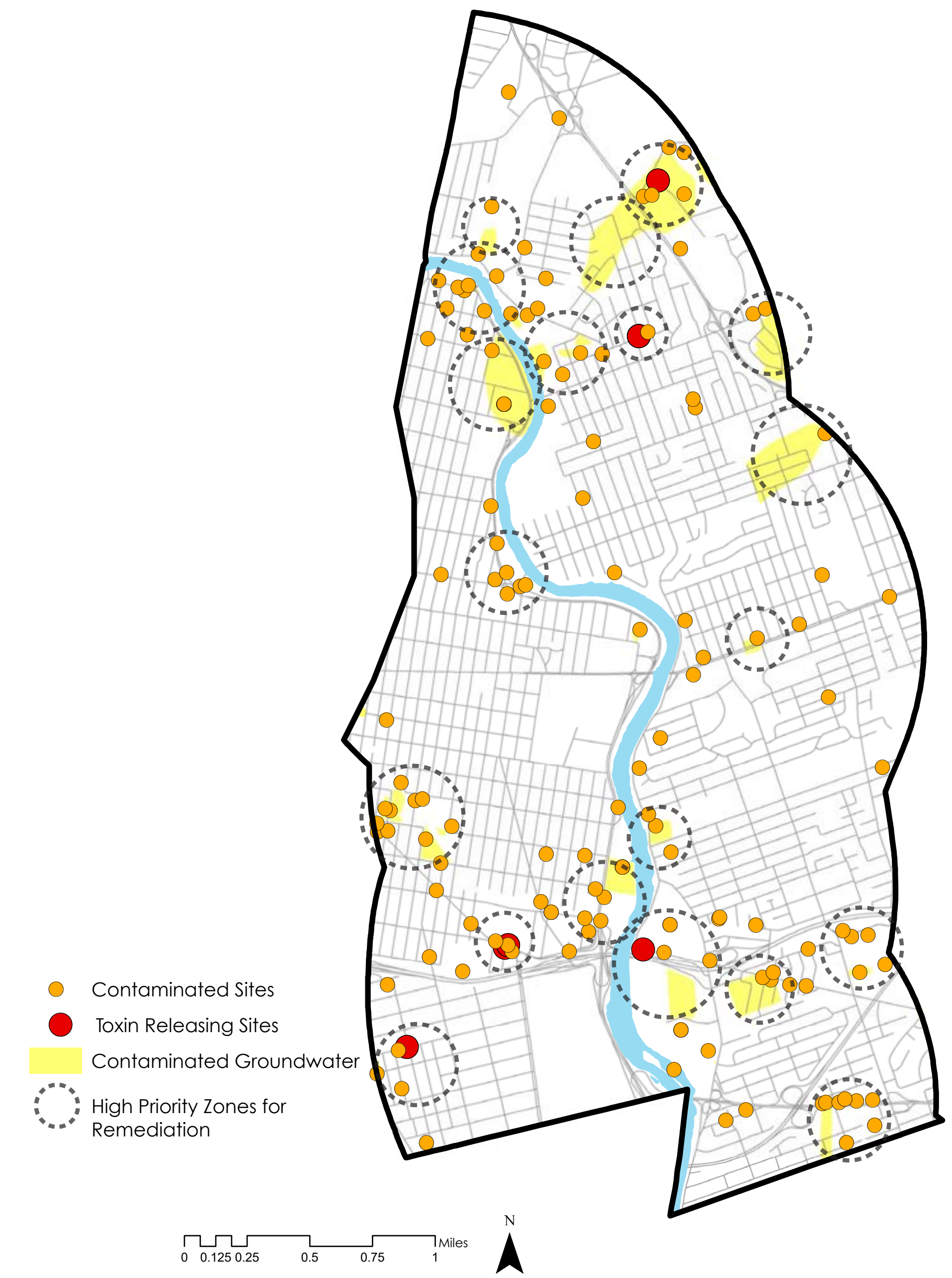
Areas most suitable for open/green space design include commercial, industrial parks, and flood-zone areas. An attempt is made to displace as little residents as possible. Homes located in flood zones are to be relocated and turned into park space. The areas that are in need of green space design take into consideration suitability as well as percentage of impervious surface.

Green Corridor



Suitability is based on 60% or more impervious surface area green corridors were placed in conjunction with their drainage area. Each drainage shed was required to have green corridors to minimize overflow of CSOs. Applications in Fair Lawn are to reduce sediment pollution as well as create a green network throughout the community.

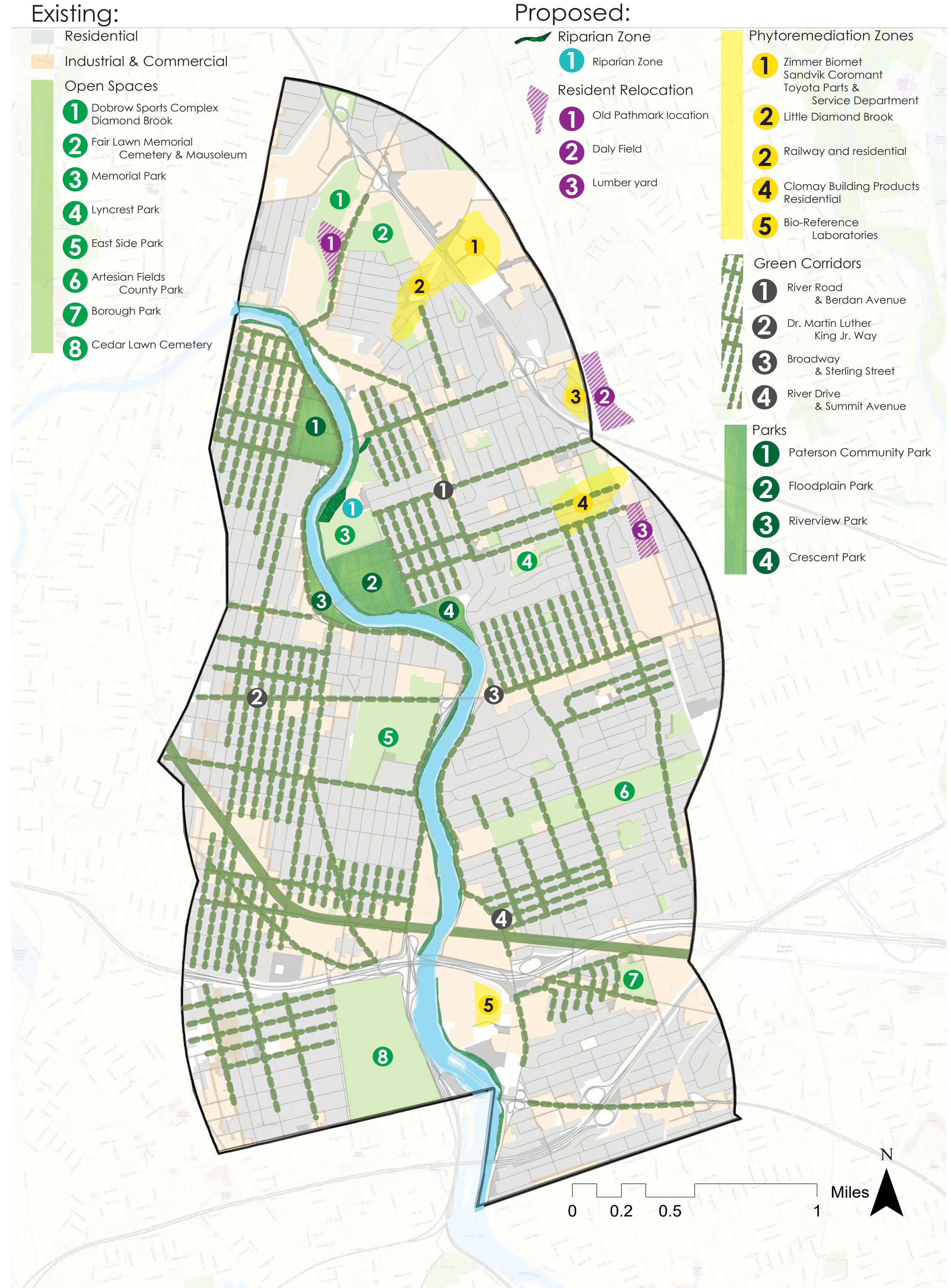
Remediation Zone



Suitability for high priority remediation zones include areas that have a variety, and or high concentration, of contaminants. All groundwater contamination areas will be addressed due to their close proximity and impacts on the aquifers.

Master Plan

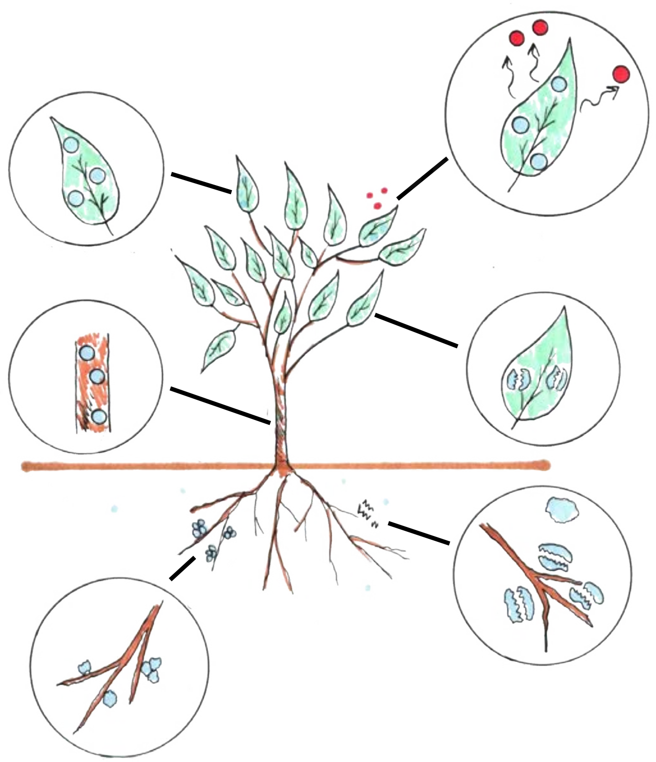
The main challenges that were identified by the site analysis were CSO overflow, flood zones and lacking natural systems. The proposed designs were created to help reduce the problematic areas in this site. After a series of calculations and surveying the results demonstrated that there was an overwhelming amount of impervious surface runoff and contamination in this site. Creating green spaces helped to reduce these challenges and provided a way to connect the community amongst the proposed interventions. The green corridors provide a way to connect residents to the river and the relative green spaces. The riparian zone provides a restorative feature to the Passaic River by filtering different contaminants, slowing down water runoff and trapping sediments. Its close proximity to the Memorial Middle School also provides educational opportunities. The riparian zone also helps direct the water into the Flood Plain park. The purpose of the Flood Plain park is to capture flood waters. It slows, absorbs and directs excess water through a series of basins that will use meadow plants to soak up sediments and contaminates. This park benefits areas downstream from most flooding and contaminates. Phytoremediation zones are implemented in areas that have a variety, and or high concentration, of contaminants. This masterplan portrays the ideas and solutions that were designed to address the challenges mentioned above.



Remediation Strategies

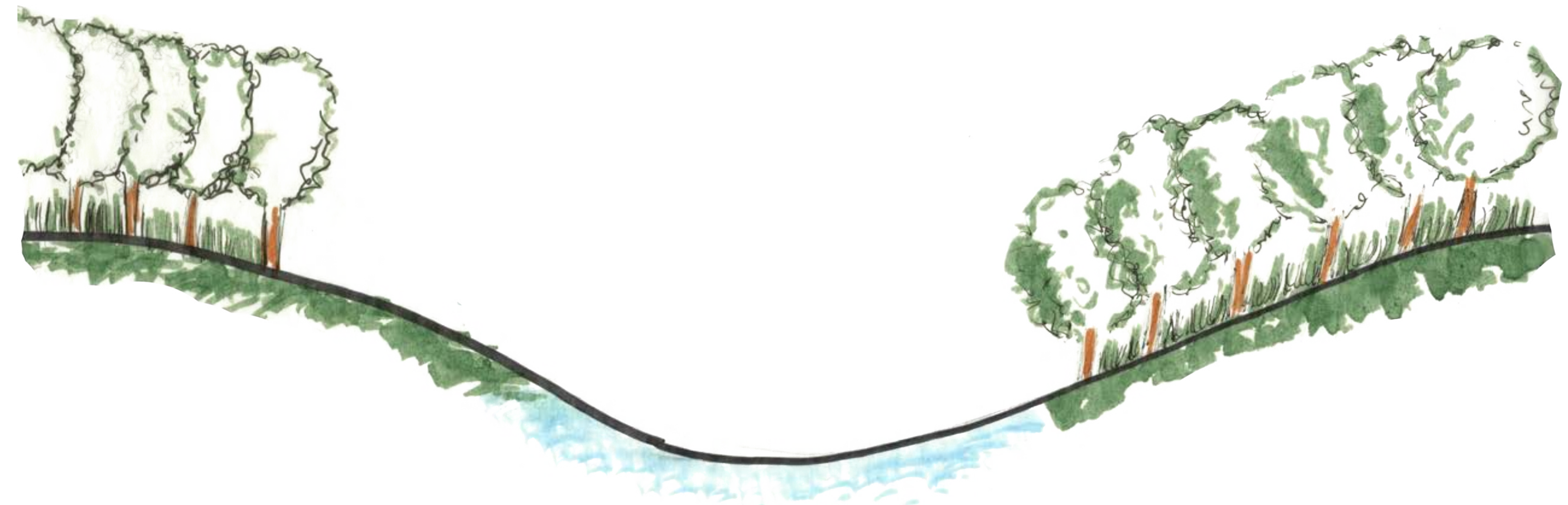
The proposed remediation strategies will help reduce CSO overflow, flood zones and pollution both in the soil and water. These strategies are all environmentally friendly and offer an aesthetic alternative to the typical grey infrastructure environment.

Phytoremediation



Phytoremediation is the technique of using specific plants to remove or break-down contaminants in the soil and groundwater. Phytoremediation can be broken into four subprocesses: Phytoextraction, Phytodegradation, Phytostabilization, and Phytovolatilization. Simplistic definitions are as followed. Phytoextraction is the process of plants removing and storing contaminants from the soil or water. Phytodegradation is the process of plants breaking down contaminants in the soil or water. Phytostabilization is the process of plants reducing the mobility of heavy metals in soil. Phytovolatilization is the process of plants uptaking and transpiring contaminants through leaves.

Constructed Riparian Zones

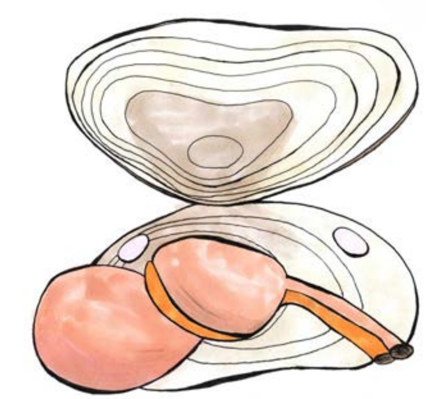


A riparian zone is a buffer area between a water body and inland. This area normally includes a variety of lush plants and trees due to water and nutrient availability. Although these water bodies already have a green space buffer, they are negatively impacted by development in that area. This development is almost always residential and or highway use. Restoring this elevated buffer near a body of water is essential because it helps filter water and soil, trap sediment and slow down water runoff. This can potentially reduce the challenges earlier presented. Riparian zones also provide corridors for wildlife to live and travel and the opportunity for educational practices.

Floating Island Filters

Floating Island Filters are made up of floating recycled material that holds adaptive and native vegetation. The vegetation sits above the material, while the roots extend down and filter the water. These filters are held near the shore to catch pollutants and debris.

Mussel Filtration



Mussels can be used as water filtration aids. The specific mussel that will be used is the freshwater pearl mussel (*Margaritifer margaritifera*). This species of mussel is native to North America and New England. Filter feeders such as these act to clarify water. The mussel has siphons, which are organs that organic particles enter through and clean water is pushed out.

Green Corridors

Emily Otterbine

The objective is to help mitigate and excess storm water runoff that would otherwise flood the CSO systems which lead to the Passaic, connect the community while simultaneously incorporating their own unique natural and open spaces and commercial or economic destinations, and finally, to design a series of models that will coordinate with characteristics of different roads by applying a point-based criteria to determine which applications would be most relative to each model.

With a lack of green corridors in the area, natural or constructed, the aim was to introduce an efficient system that would link not only the residents to open, green, and recreational spaces in the area but also reconnect habitats in order to support genetic and biodiversity in local plant and animal communities. Plantings with be the same as those used in the Flood Plain Park and the Riparian Zone in order to acheive the same effects of infiltration and filtration of storm water similar to those sites, as well as maintain cohesion between habitats.

Table of Roads

Municipality	Speed Limit	Lanes	Parking	Sidewalk buffer	Notes	CSO #	Score
Paterson							
1st & 2nd Ave	25mph	2-3	Yes	Yes	Near 2 bridges crossing Passaic, both one-ways	23	1
4th & 5th Ave	25mph	2	Yes	Yes		24	0
11th & 12th Ave	25mph	2	Yes	Yes		25	0
19th – 26th (north side of Paterson)	25mph	2	Yes	Yes		23,24, 25	0
20th Ave	25mph	2	Yes	Yes	Passes back side of MLK Elementary School	26, 30, 31	0
21st Ave	25mph	2	Yes	No, very rough pavement	East end runs between railroad and industrial	30, 31	2
26th – 33rd (near MLK Way & 10th)	25mph	2	Yes	Yes		25, 30	0
Broadway (ends at E. 33rd)	25mph	4	No	Yes	Jersey Barriers, crosses Passaic and cuts through East Side Park	25	2
Dr. Martin Luther King Jr. Way	25mph	2	Yes	Mostly, except for commercial areas		25	0
E. 33rd Ave	25mph	2	Yes	Yes	Crosses Passaic	25	0
26th – 42nd (near Market St & rail)	25mph	2	Yes	Yes, except certain industrial/commercial areas		26, 30, 31	0
Market St	25mph	2	Yes	Mostly, less towards river	Crosses Passaic near Columbus Highway	30, 31	0
McLean Blvd (Rte 20)	35-45mph	4	No	No sidewalks, buffers are medians and parks		23-31	6
Park Ave	25mph	2	Yes	Some, except for commercial areas	In East Side Historic District	25, 26, 30	0
Passaic County 651 I (aka 10th Ave)	25mph	2	Yes	Few buffers, wide sidewalks mostly commercial	Short road, begins at unnamed public baseball field, ends at merges into McLean	25	0
Railroad				No access	Crosses Passaic	25, 30, 31	
Vreeland Ave	35mph	2	Yes	Yes	Vreeland & 20th Triangle and Vreeland & 19th Triangle	30, 31	1
Alabama Ave	25mph	2	Yes	Yes		31	0
Maryland Ave	25mph	2	Yes	Yes	Ends at Cedar Lawn Cemetery	31	0
Florida Ave	25mph	2	Yes	Yes	Ends at Cedar Lawn Cemetery	31	0
Illinois Ave	25mph	2	Yes	Yes	Passes School 25, ends at Cedar Lawn Cemetery	31	0
Michigan Ave	25mph	2	Yes	Yes	Passes School 25, ends at Cedar Lawn Cemetery	31	0
Vernon Ave	25mph	2	Yes	Yes		31	0
Wabash Ave	25mph	2	Yes	Yes	Some commercial areas with wider sidewalks, less buffer	31	0
Trenton Ave	25mph	2	Yes	Yes	Passes School 25 playground	31	0
Fair Lawn							
1st – 6th St	25mph	2	Yes	Yes	Near Memorial Park		0
Bellair Ave	25mph	2	Yes	Yes	Passes Van River Ellis Christian School grounds and the center rec field, ends at Fair Lawn Rec Center fields		0
Morlot Ave	40mph	2	No	Yes	Passes Van Riper Ellis Christian School and Lyncrest Elementary School & Lyncrest Park		1
Berdan Ave	25mph	2	Yes	Yes	Connects Memorial Park to Fair Lawn High School and Fair Lawn Rec Center through mostly residential streets		0
Hopper Ave	25mph	2	Yes	Yes	Passes Forrest Elementary School, ends at Memorial Middle School		0
Parmelee Ave	25mph	2	Yes	No	Passes Westmoreland Elementary School & Park, and ends at Little Diamond Brook		2
River Dr	35mph	2-3	No	Yes in residential, some in commercial			3
Maple Ave	35mph	2-4	No	Yes	Cuts through Fair Lawn Memorial Cemetery & Mausoleum & Dobrow Sports Complex		3
Cyril Ave	25mph	2	Yes	Yes			0
Kenneth Ave	25mph	2	Yes	Yes			0
Lyncrest Ave	25mph	2	Yes	Yes			0
Summit Ave	25mph	2	Yes	Yes			0
17th St	25mph	2	Yes	Yes	Ends at center rec field, Fair Lawn High School, near Fair Lawn Rec Center, Memorial Playground.		0
Fair Lawn Ave	35mph	2-4	Yes	Yes, less commercial areas			2
Elmwood Park							
14th – 16th Ave	25mph	2	Yes	Yes	Passes/ends at Sixteenth Ave Elementary School		0
Florence Pl	25mph	2	Yes	Yes	Adjacent unnamed playground/field		0
Elizabeth Ave	25mph	2	Yes	Yes	Adjacent unnamed playground/field		0
Bellevue Ave	25mph	2	Yes	Yes			0
Rosedale Ave	25mph	2	Yes	Yes			0
Broadway	35mph	5	Yes	No	Medians, paved & grass		5
Orange Ave	25mph	2	Yes	Yes			0
Rosemont Ave	25mph	2	Yes	Yes			0
Parkview Ave	25mph	2	Yes	Yes			0
Sterling St	25mph	2	Yes	Yes			0
E. 54th St	35mph	2	Yes	Yes	Cuts through Artesian Fields County Park		1
Elm St	25mph	2	Yes	Yes	Cuts through Elmwood Park Memorial School grounds		0
Viviney St	25mph	2	Yes	Yes	Cuts through Elmwood Park Memorial School grounds		0
Speidel Ave	25mph	2	No	Yes	Adjacent to Artesian Fields County Park		1
Rte 46	50mph	4	No	No sidewalks, but some grass buffers	Shoulders		6
Market St	30mph	2	Yes	Few buffers, wide sidewalks	Passes St. Leo's School & Roman Catholic Church and Borough Park		0
Railroad				No access	Crosses Passaic		
Elmhurst St	25mph	2	Yes	Yes			0
Walnut St	25mph	2	Yes	Yes			0
Locust St	25mph	1	Yes	Yes1)	One-way		0
Mulberry St	25mph	2	No	Yes			0
River Dr	35-40mph	2-5	No	Yes in residential, some in commercial	Runs through commercial area, but also along Passaic & boat ramp		3
Lee St	25mph	2	Yes	Yes			0
Orchard St	25mph	2	Yes	Yes			0
Grove St	25mph	2	Yes	Yes	Part of street left open for Fire Dpt.		0
Summit Ave	25mph	2	Yes	Yes			0
Van Riper Ave	25mph	2	Yes	Yes			0
Chestnut St	25mph	2	Yes	Yes			0
Church St	25mph	2	Yes	Yes			0
Beech St	25mph	2	Yes	Yes			0
Pine St	25mph	2	Yes	Yes	Adjacent to Borough Park		0
Mola Blvd	35mph	4	No	Yes in residential, some commercial areas without buffer	Adjacent to Borough Park		3

Figure 1.0

All tables created in Microsoft Word 2016.

Streets listed in no particular order other than which town they are located in. Paterson roads include their corresponding CSO numbers. The notes column ncludes any parks, fields, and natural areas they pass or lead through as well as any important characteristics that coincide with urban land use.

Criteria and Models

Speeds	Lanes	Parking	Pedestrians	Scores
25-30mph = 0	1-2 = 0	Yes = 0	Yes = 0	0-1 = Model 1
35-40 = 1	2-4 = 1	No =1		2-4 = Model 2
45+ = 2	4+ = 2		No = 2	5+ = Model 3

Figure 1.1

Model 1 (99 streets total)		Model 2	Model 3
Paterson			
1st & 2nd Ave 4th & 5th Ave 11th & 12th Ave 19th- 26th Ave (North end of Paterson) 20th Ave 26th – 33rd Ave (near MLK& 10th) 26th – 42nd (near Market & rail) Wabash – Vernon Ave	Dr. MLK Jr. Way E. 33rd Ave Market St (Paterson & Elmwood Park) Park Ave Passaic County 651 I (10th Ave) Vreeland Ave Alabama – Michigan Ave		McLean (Rte 20)
Fair Lawn			
1st – 6th St 6 Bellair Ave Morlot Ave Berdan Ave Hopper Ave Cyril Ave – 17th St 5		Parmelee Ave Maple Ave Fair Lawn Ave River Dr	
Elmwood Park			
14th – 16th Ave 3 Florence Pl – Sterling St 8 E. 54th St Elm St Vevney St Speidel Ave Mola Blvd Market St Elmhurst St Walnut St Locust St	Mulberry St Lee St Orchard St Grove St Summit St Van Riper Ave Chestnut St Church St Beech St Pine St	River Dr Mola Blvd	Broadway (Elmwood Park) Rte 46

Figure 1.2

Figure 1.0 was produced based on information from the Green Corridor Suitability Analysis map. Roads that were located in the 60% or more impervious surface area were listed, as well as any roads that intersected or connected with these inital roads. The characteristics of the roads were added on to find similarities and differences between the vast list of roads in order to easily categorize them with the ultimate goal to create general models that will fit each category. In Paterson, it was important to choose roads from every CSO drainage shed to ensure the mitigation of run off to all CSO's on our site.

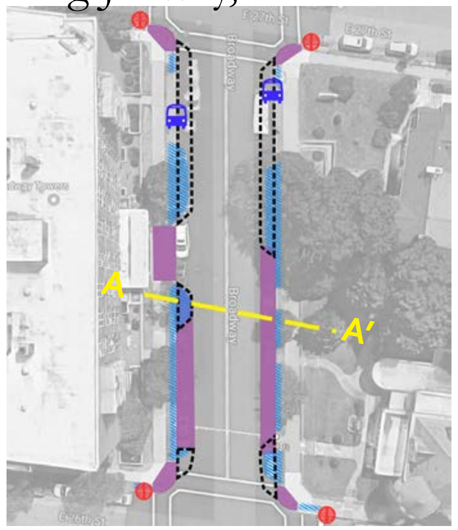
Figures 1.1 shows the points criteria used on the original table of roads, where the cells are color coded based on what their point score was for that specific road and characteristic.

Figure 1.2 is the final results, listing the roads be municipality and which model will be applied to them. Applications to roads depend on which model the roads falls under. General applications include curb extensions (of different varieties), bioretention cells and basins depending on area available, and porous pavers and surfaces where applicable.

Model 1:
Dr. Martin Luther King Jr. Way, Paterson

Applications:

- **Curb Extensions** — Pinch Points, Bus Bulbs, Gateways
- **Bio-retention** — Cells & Basins
- **Porous Pavement**
- Existing drains
- Bus stops

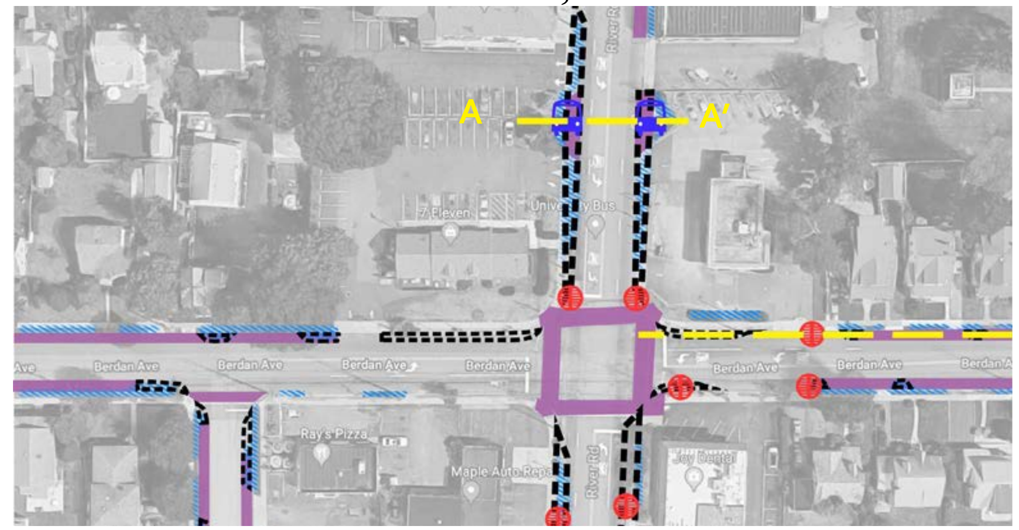


Implementation of pinch points and bump-outs where storm water could drain via stormwater inlet into a bio-retention cell that would both mitigate the amount of run off headed for the CSO systems while also providing a small amount of filter treatment to the water.

Installation of porous pavers in parking lanes and sections of sidewalk that may be susceptable to nearby impervious runoff or pooling water.

Retention cells adjacent to parking lanes will be covered by grates where they will be without plantings but layered with appropriate aggregates to encourage infiltration into the native soil.

Model 1 & 2 Intersecion:
Berdan Avenue & River Road, Elmwood Park



A moderately busy four-way intersection with commercial businesses, bus stops, and nearby residential neighborhoods presents many opportunities for parking bump-outs, corner curb extensions, and porous pavers.

River Road may be implemented with subtle curb extensions in its turn-only lanes while thru-traffic lanes may be slightly narrowed near the intersection to allow more space for curb extension that will taper off when met with a parking lane or another turn-only lane down the block. Bus stops will be widened into bus bulbs with pervious surfaces accompanied by basins.

Pedestrian crosswalks will also be paved with brightly colored permeable materials, and finally, existing grass sidewalk buffers will be transformed into bio-retention cells.

Model 3:
Broadway, Elmwood Park - Fair Lawn

Intervention is limited on these roads due to high speeds and heavy traffic leaving only room for subtle curb extensions with minimal plantings as to not obstruct emergency and breakdown lanes.

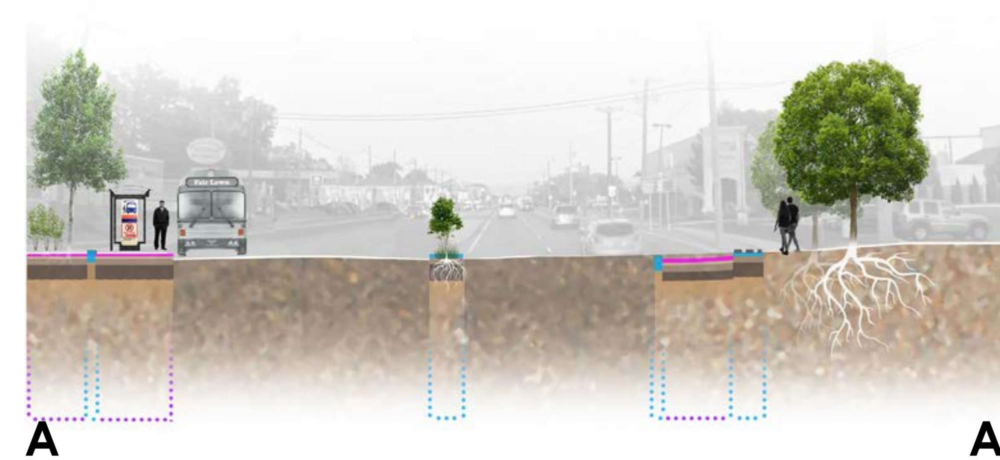
Grate-covered swales may be placed within narrow road areas such as rumble strips where grates may be corrugated to reproduce the sound effect of the strips, or near/beneath Jersey Barries where water is not efficiently drained.

Medians will become bio-retention basins where any of the nearby grated swales could drain from the road.

Parking lane pinch point with bio-retention gardens within

Porous pavement alongside a grated retention cell

Bus bulbs fitted with porous pavers accompanied by bio-retention gardens



Bus bulbs fitted with porous pavers and grated swales

Planted median

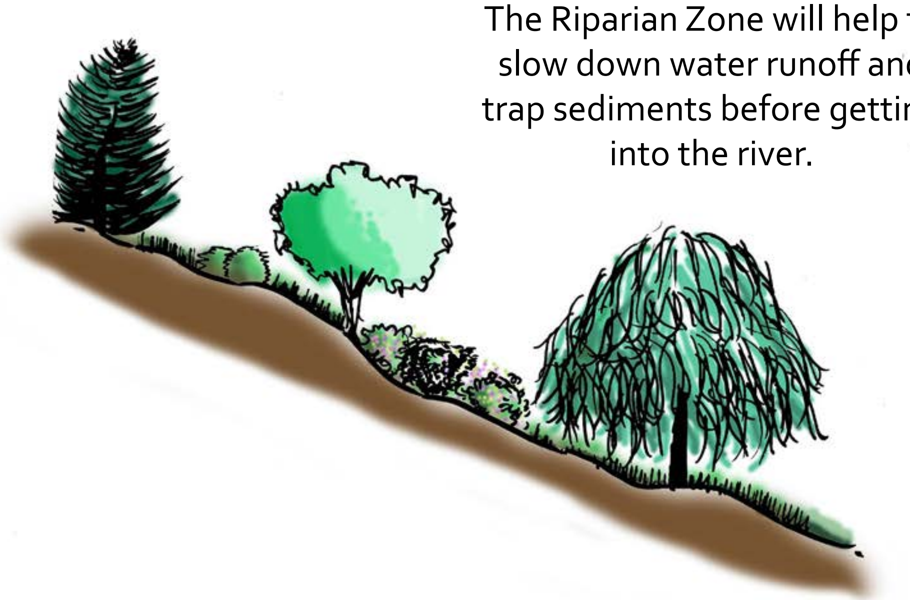
Porous pavement in between a grated retention cell and rumble strip swale

RIPARIAN ZONES
Gisselle Pena

The word 'ripa' in Latin actually means 'river bank,' making this an appropriate term to describe the riparian zones. Riparian zones are normally 50 to 300 ft. wide, allowing for plant diversity and soil conservation. Water bodies such as the Passaic River already have a natural buffer zone but these areas are negatively impacted by construction and development of highways, residential areas and other man made regions. Riparian zones are essential to any water body it surrounds because of its restoring and healing properties. Plants in this zone also tend to be more luscious and aesthetically pleasing because of readily available resources from the close-by water body. These plants provide soil and water filtration and help stabilize the surrounding soil during times of heavy rain. This particular riparian zone will work in conjunction with the proposed Flood Plain park in order to redirect storm water into the park, thereby solving the flood zone area near Fair Lawn Memorial Pool. This riparian zone will also offer educational opportunities for Memorial Middle School as it has a path that directs citizens through the site and into the Flood plain park and into the pool. These riparian interventions can be implemented along the entire river and can help to solve the flood zone areas and CSO overflow challenges.

CONCEPT DIAGRAM

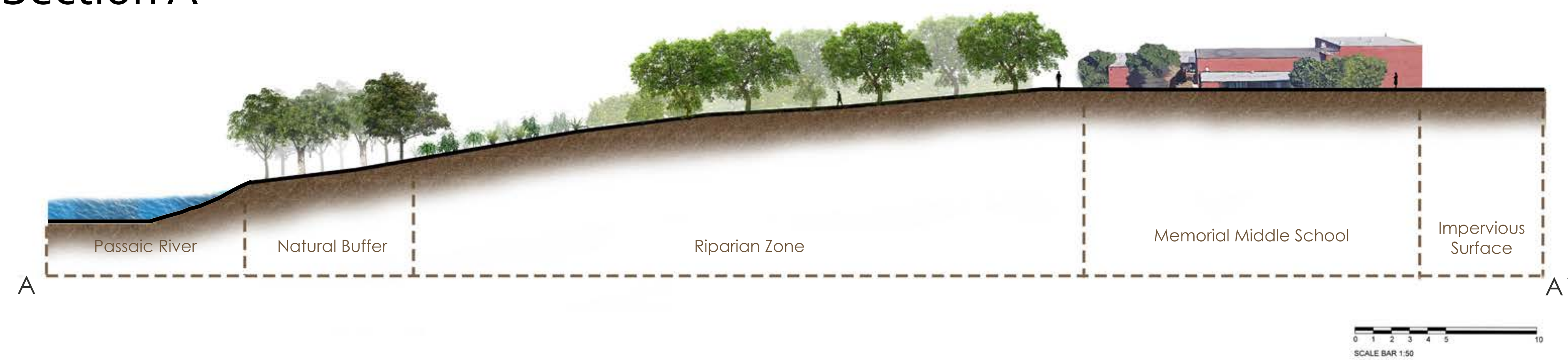
The Riparian Zone will help to slow down water runoff and trap sediments before getting into the river.



Riparian Zone Plan

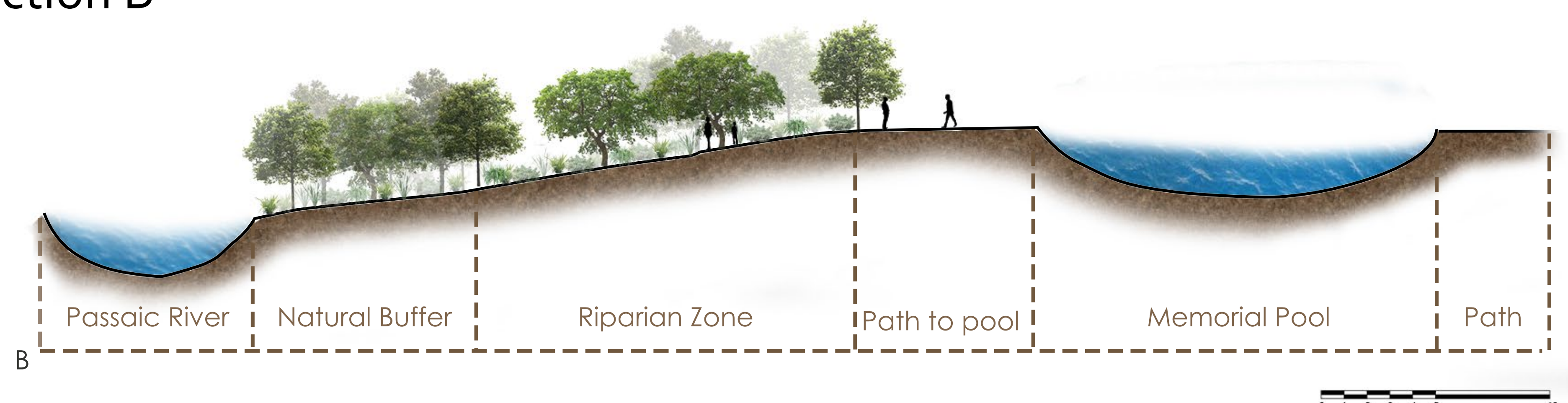
Sections

Section A



This section depicts the Passaic River and its natural buffer which is about 50 ft. wide. The proposed Riparian zone is about 175ft. long and provides a variety of trees and shrubs and herbaceous plants that will help slow down water run off into the river. Keeping the existing natural buffer near the river will help to stabilize the soil and offer filtration through its roots. The riparian zone also extends all the way to the Memorial Middle School which can provide educational opportunities and a possible field trip for students.

Section B



This section cuts directly into the riparian zone and Memorial Pool. It shows a hierarchy of plants and also an arranged allee along the path that would connect the riparian zone to the following Flood Plain park. Because the existing site is flat, the riparian zone would have to be regraded in order to redirect water back into the river and into the Flood Plain park.

Plant Palette

Thuja Plicata
Western Red Cedar
Native
Grows up to 14 ft. tall
Evergreen

Plantanus Racemosa
California Sycamore
Native
Grows up to 100ft. tall
Turns orange/brown in the fall

Spiraea Douglasii
Douglas Spirea
Native
Grows up to 6 ft. tall
Has a purple flower

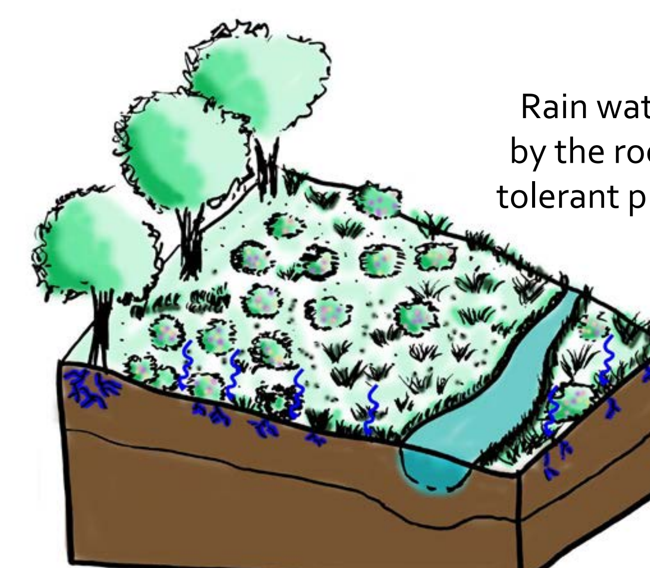
Salix Alba
Willow Tree
Non native
Grows up to 10 ft. tall
Turngs orange/brown in the fall

Clethra Alnifolia
Sweet Pepperbush
Native
Grows up to 4ft. tall
Has bright pink flower that attracts pollinator

Adiantum
Walking Fern
Native
Grows up to 3 ft. tall
Wet site tolerant

This plant palette provides different wet site tolerant species that would be appropriate for the Riparian Zone. Many of them also change color and provide an aesthetically pleasing view to the region.

Concept Diagram



Rain water will be absorbed by the roots of these wet site tolerant plants where filtration will occur.

Phytoremediation Zones

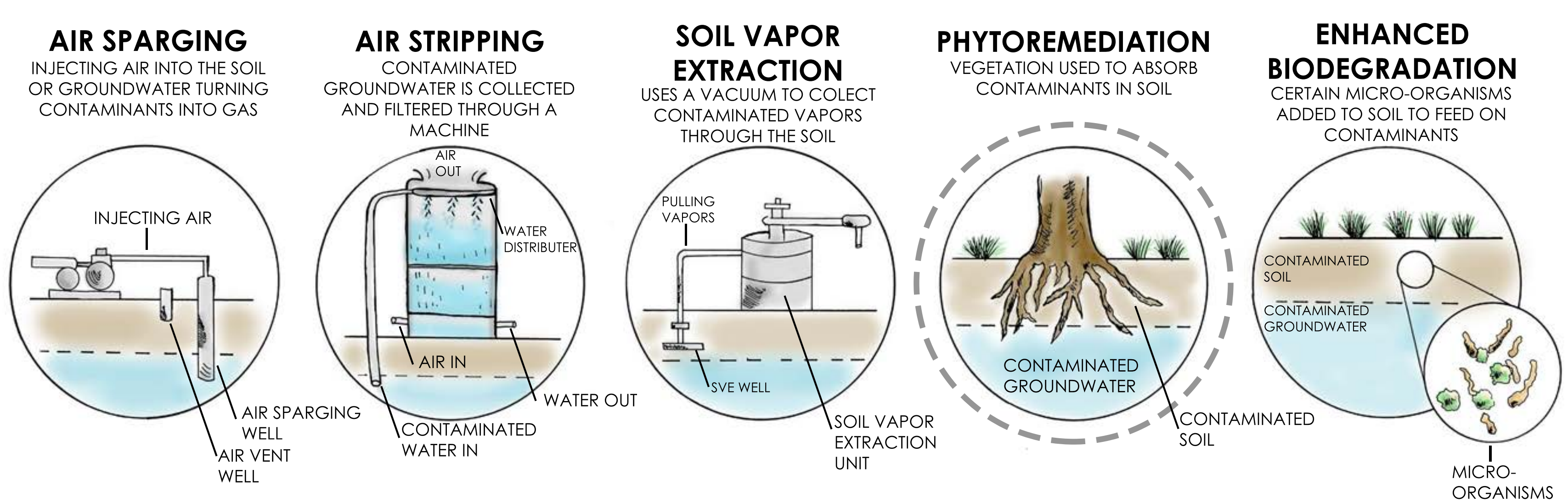
Alexis Lo

Currently, there are numerous contamination sites located within the areas of Paterson, Fair Lawn, and Elmwood Park. Contamination sites that were deemed suitable for remediation consist of areas with a variety and or high level of contaminants. All groundwater contamination areas within site three are to be addressed and eventually remediated due to their close proximity to the river and effect on surrounding aquafers. Groundwater pollutants can be any contaminant or substance that makes water unclean or unsuitable for use under the Department of Environmental Protection's sanctions. Sites to be remediated also focus on data of "contaminated sites". Contaminated sites are areas that contain substances at or under the surface level that are actually or potentially hazardous to health or the environment. The remediation of the various aforementioned contamination sites is paramount to the health and well-being of the river, land, and inhabitants of the area.

Through various remediation methods, groundwater and soil contamination can be cleaned and removed. This specific site intervention heavily focuses on phytoremediation as a tool to improve soil and water quality. Phytoremediation is the technique of using specific plants to remove or break-down contaminants in the soil and groundwater.

There are various types of phytoremediation. Phytoremediation can be regarded as a blanket term for the biological processes of plants remediating soil and groundwater. Four main sects of phytoremediation are used throughout Site Three. These subprocesses include: phytodegradation, phytoextraction, phytostabalization, and phytovolatilization. The following statements are simplistic definitions of these processes. Phytodegradation is the breakdown of contaminants; this process is commonly used for organic pollutants, however some plant species can break down inorganic pollutants. Phytoextraction is the process where plants remove dangerous contaminants from soil or water, mostly heavy metals, and are stored in the roots and shoots of the plant. Phytostabalization is the containment of contaminants within the soil surrounding the roots; this process is used in the presence of heavy metals and inorganic contaminants. Phytovolatilization is the process of plants volatilizing, or turning organic contaminants into vapors, through the vegetation; this process is very commonly used because of its transformation and removal, through evaporation, of the contaminants.

Various Groundwater and Soil Remediation Methods



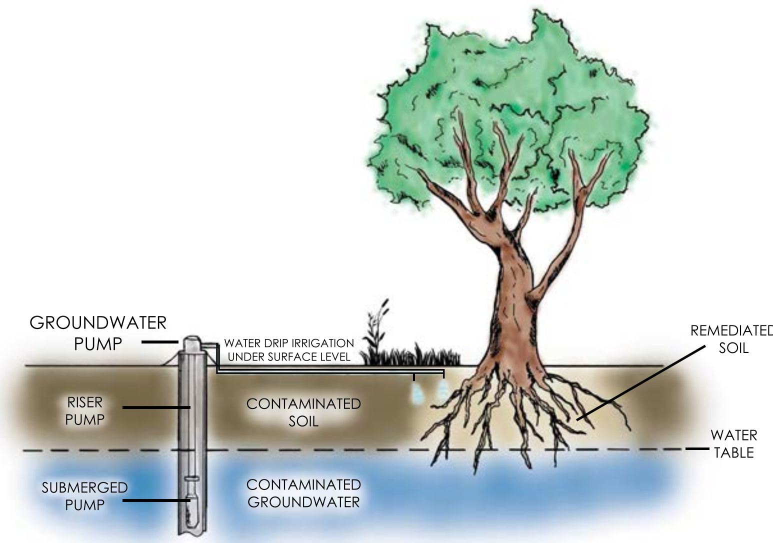
Focus Site

Bio-Reference Laboratories

This analysis map depicts the contamination data within the selected site specific phytoremediation zone. This area was chosen due to its close proximity to the river and various types of contamination. The remediation will be implemented within the contaminated ground water area. The building within this area is the Bio-Reference Laboratories.

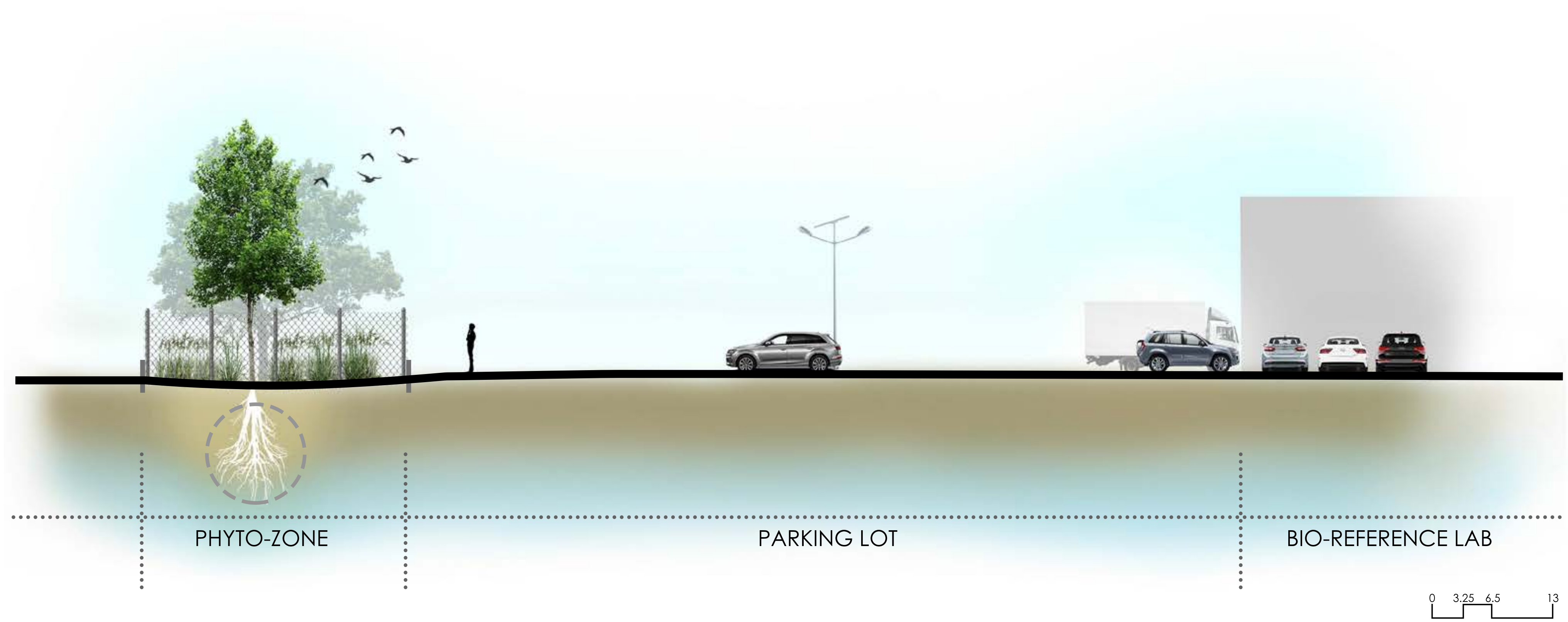
Bio-Reference Lab Plan

Bio-Reference Lab Diagram



This site will still be functional for the current users of the building. The groundwater contamination is located beneath the entire parking lot and building. To collect and "filter" stormwater throughout the site without removing the existing structures, a groundwater pump system has been created to fit this specific site. This system could theoretically be applied to multiple sites as long as the parameters fit within this site's context. The pump would move contaminated water upwards to a set of irrigation lines that would bring the water directly to the roots of the plants within the phytoremediation zone. These irrigation lines will be below the surface level so it will not be a direct threat to the surrounding people.

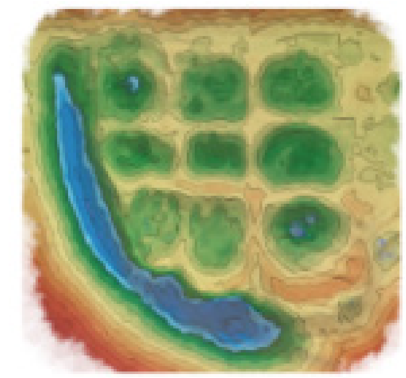
Bio-Reference Lab Section



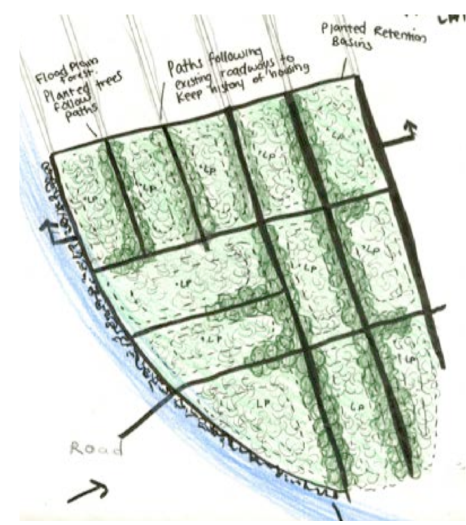
This plan depicts the implementation of phytoremediation zones within the bio-reference laboratory site parking lot, located in Elmwood Park, New Jersey. At the north end of the plan, an "orchard" type layout of Willow and Poplar trees are to be planted within an eight foot fence. The fence is put in place to prevent contact with the contaminated vegetation. As time progresses and the sites contamination levels decrease, the fence will be able to be removed. The fence should be treated as an initial precaution, the foliage usually does not retain toxins and pollutants, rather it is volatilized; inorganic contaminants are typically stored in the roots and shoots, or contained within the soil around the roots. All of the water on site will drain to the east side of the parking lot into a bio-swale that will lead to the northern phytoremediation zone. The west side phytoremediation strip is a secondary remediation zone, due to the narrow area of the parking lot, the fenced area is only able to contain seven trees. The median vegetative area will be planted with herbaceous phytoremediation plants.

Flood Plain Park

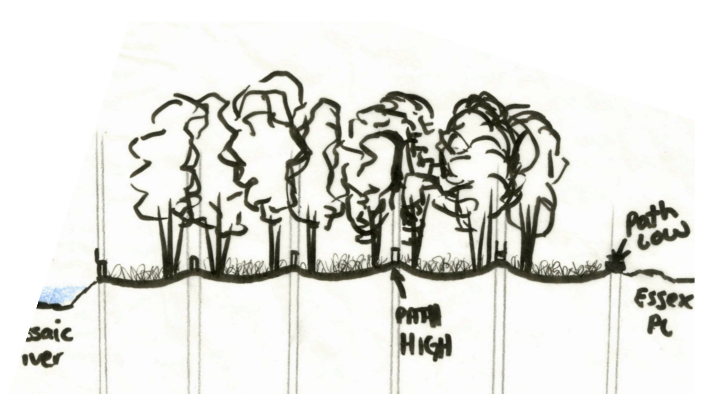
Emily Toth



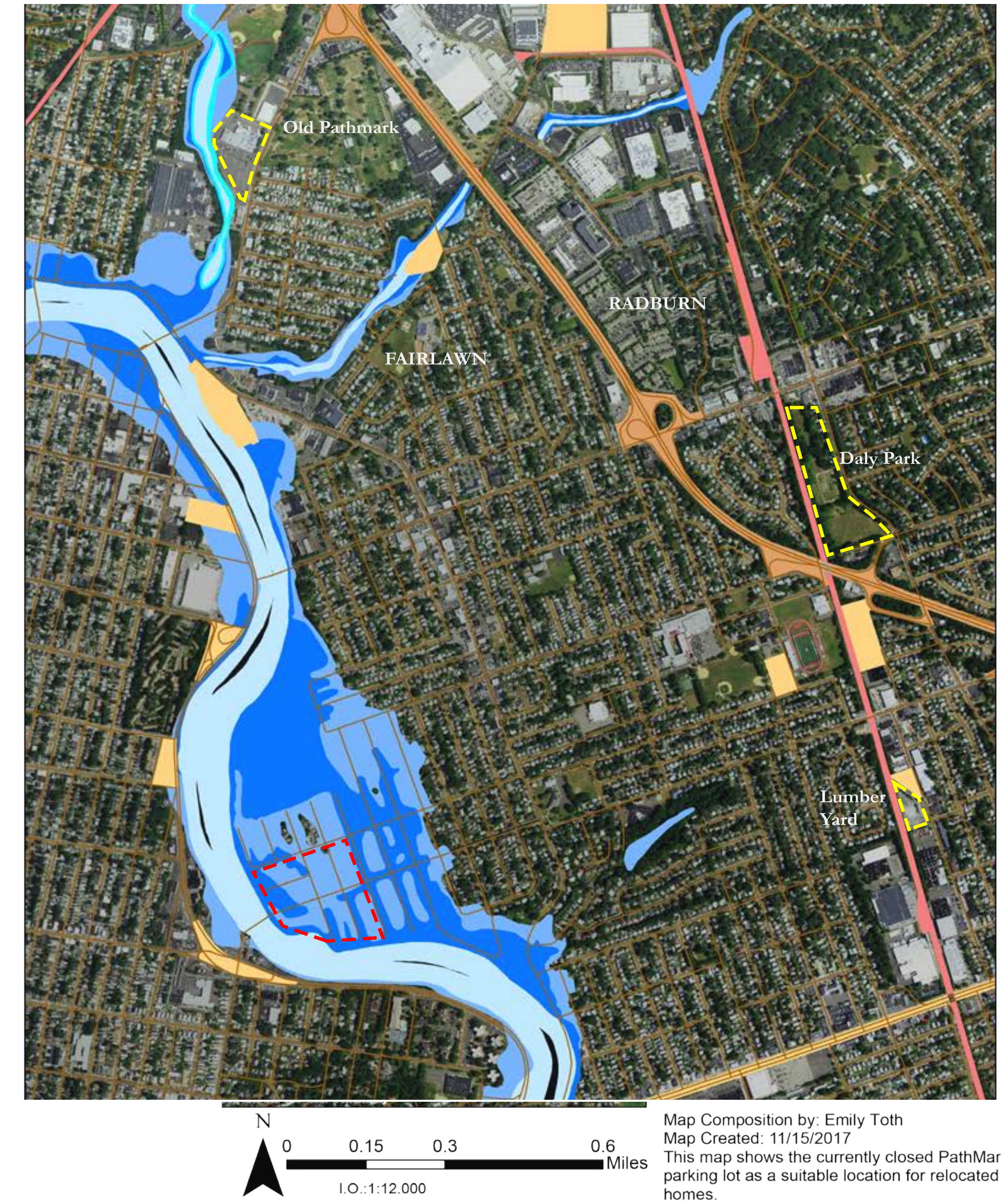
This sandbox model shows the topography of the land. The green shows lows elevations, while yellow and red show higher elevations



Early Stage concept drawing for the site. Walking Paths mimic the existing neighborhood layout that once existed.



Concept drawing of a section view showing the relationship between detention basins and walking paths are wave-like.



Flood Plain Park is located just south of Memorial Pool in Fair Lawn, NJ. The existing site is built-out with residential uses. However, the site sits in a flood plain, placing residents at risk of property damage during severe storms. Flood Plain Park seeks to mitigate this risk by replacing the existing residential uses with a new system of paths, basins, and vegetation. Residents of the existing neighborhood would be relocated to three potential housing sites with far less risk of flooding. The park would assume the footprint of the neighborhood. Existing roads become trails; existing homes become detention basic meadows; and one road will remain to connect the park to the nearby Memorial Pool and Memorial Middle School. The function of the park is to capture water in basins, filter it, and release it back into the Passaic River as flood waters recede. As a visitor walks along the park's boardwalks, they will see the topography of the land and how it moves with a wavelike motion between basins, reflecting the movement of water that once flooded the neighborhood. A stream cuts through the basins as well, emphasizing the new pattern of water movement throughout the site. Alone, this park has an incredible capacity to absorb water and protect adjacent neighborhoods from the damaging effects of flooding. This is just one location capable of supporting this type of park. Flood Plain Park provides a model of the development of other parks in flood zones along the river. When the water levels of the river rise, excess water enters the park's basins through the sluice gates located under the pathways. Each basin acts as a filter to clear out the sediments while slowing the movement of water. As the water travels through the whole park, it passes through a leveled filtration system. The same water that enters the basins as polluted runoff is able to reenter the river in a far cleaner state.

This flood map shows the intervention site for the proposed Flood Plain Park as well as three possible relocation areas for residents currently in floodplains. The first site is a path mark building that was shutdown. This space can be transformed to provide either single family or multi- family homes. The second site available is known as Daly Field. It is currently private property, that passed development of 165- unit development for affordable housing. The third location is a lumber yard, with in walking distance of a train station. Through programs such as Blue Acres and Green Acres, homeowners at risk of experiencing flooding may volunteer their homes. Once all homes are acquired, the entire site may become an open space for the community. The diagram above gives the options to people who would like to relocate near by to their existing home.

Photo from California Academy of Sciences

Silver Maple
Acer saccharinum
Spread: 30-50' Height: 50-70'
Sun Preference: Full to Partial Sun/Shade
Soil Tolerance: Moist, Well-drained soil, Wet soil
Drought tolerance: Tolerant
Foliage: Green
Fall Color: Yellow

Picture from: Virginia Tech Dept. of Forest Resources and Environmental Conservation

Pin Oak
Quercus palustris
Spread: 40' Height: 70'
Sun Preference: Full to Partial Sun
Soil Tolerance: Clay; Loam; Sand; Acidic; Extended flooding; Well-drained
Drought tolerance: Moderate
Foliage: Green
Fall Color: Copper; Red

Photo by Luis Fernandez

Thornless Honeylocust
Gleditsia triacanthos f. inermis
Spread: 30-70' Height: 30-70'
Sun Preference: Full Sun
Soil Tolerance: Clay; Loam; Sand; Acidic; Occasionally wet;
Drought tolerance: Tolerant
Foliage: Green
Fall Color: Copper

Photo from New Moon Nursery

Obedient Plant
Physostegia virginiana
Spread: 24-36" Height: 48"
Sun Preference: Full Sun
Soil Tolerance: Moist, Acidic, Well-drained soils
Season of Interest: June-December
Foliage: Green
Bloom Color: Pink

Photo from gardeninacity

Brown-Eyed Susan
Rudbeckia triloba
Spread: 18-24" Height: 18-36"
Sun Preference: Full Sun; Half Sun/Shade
Soil Tolerance: Dry, Moist
Season of Interest: June, July, August, September, October
Foliage: Green
Bloom Color: Yellow

Photo by Kevin Klein

Ironweed
Veronia fasciculata
Spread: 12" Height: 48-72"
Sun Preference: Full Sun
Soil Tolerance: Moist, Regular, Dry
Season of Interest: August, September
Foliage: Dark Green
Bloom Color: Red, Purple

Photo by yardflower

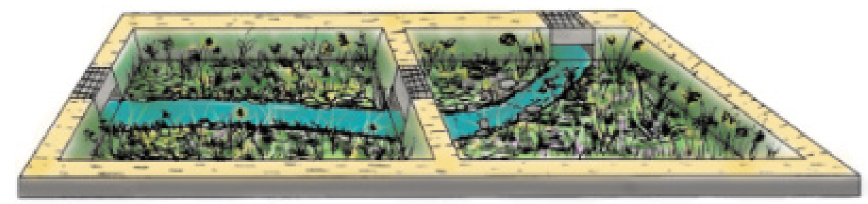
Indiangrass
Sorghastrum nutans
Spread: 24-36" Height: 36-60"
Sun Preference: Full Sun
Soil Tolerance: Sand, Loam, Clay
Dry, Medium, Moist
Season of Interest: August, September
Foliage: Green
Bloom Color: Green, Tan

Photo by Bibrmann

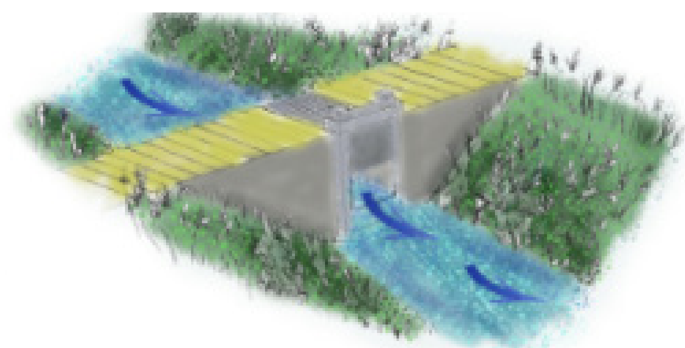
Common Rush
Juncus effusus
Spread: 2-4' Height: 2-4'
Sun Preference: Full Sun
Soil Tolerance: Clay; Loam; Sand; Acidic; Occasionally wet; Alkaline; Well-drained
Season of Interest: Fall, Summer, Spring, Winter
Foliage: Green
Bloom Color: Yellowish,

Photo by Eden Brothers

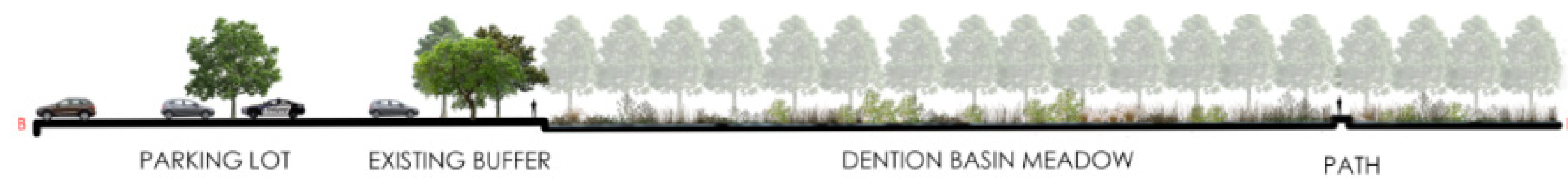
Birdsfoot Trefoil
Lotus corniculatus L.
Height:2-24"
Sun Preference: Full Sun
Soil Tolerance: Fertile soil, drought tolerant
Season of Interest: May-August
Foliage: Green
Bloom Color: Yellow



Flood Basins are a depth of 4' from the trails. The stream bed is a depth of 1'. The basins include wetland meadow plants that can survive flooding as well as tolerate drought conditions.



Sluice gate: Control the flow and speed of water through the flood basins.



Site Four

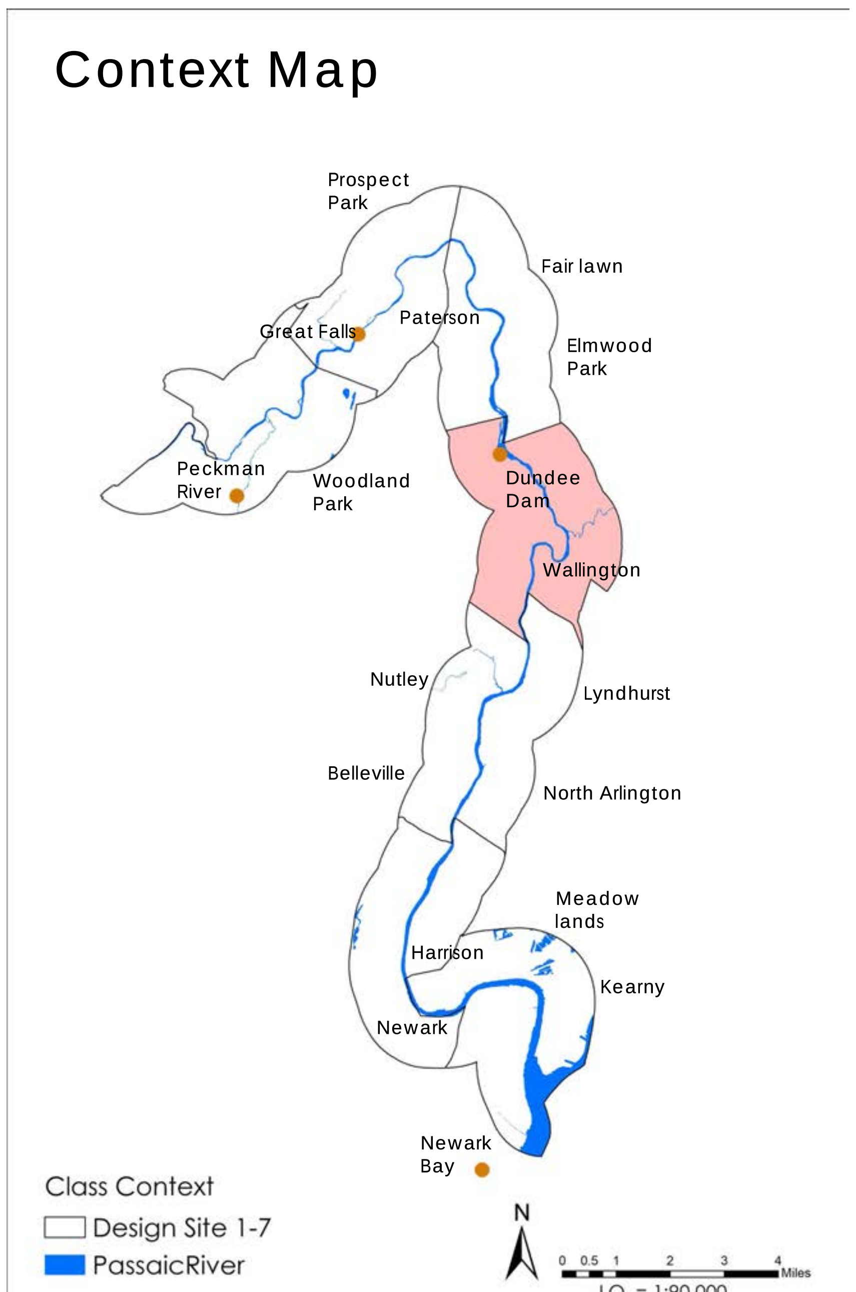
By: Alex Glasser, Wenjia Yan, Robert Cook

Photo taken by Nanik Song

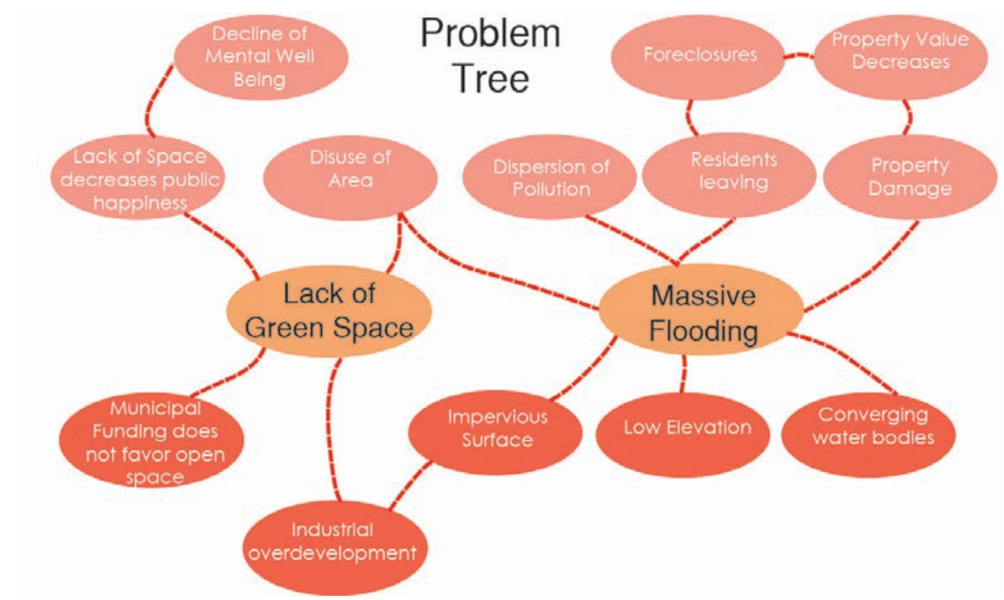
Site 4 Intervention

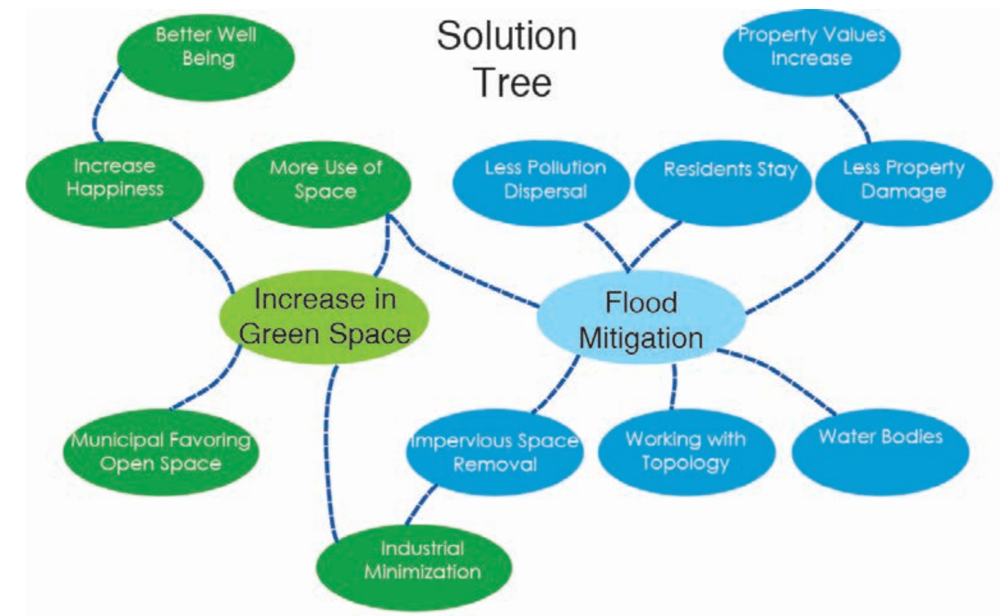
Goal-

"To remediate floodwaters within the town of Wallington New Jersey, by providing a flood resilient system to increase creative and social interaction within the community."



The area of focus is on the town of Wallington. Wallington borders the Passaic and is South of the Dunndee Dam. The Passaic River and Saddle River converge just North of the town and contribute to major flooding events.





Problem Tree

The problem tree names massive flooding and lack of green space as the two major problems being faced at site 4 in the town of Wallington. The convergence of the Passaic River and the Saddle River, low elevation and impervious surfaces are reasons why the town of Wallington is flooded so often. The town of Wallington is 1.6 square miles and has a fairly dense population. The flooding experienced here damages properties and has increased the rate of foreclosed homes significantly.

Solution Tree

To address the problems, flooding needs to be corrected. Green space needs to be added, and topography adjusted. These actions will be effective in reducing flooding. This will lead to less property damage, and less foreclosed residences. One of the main focuses will be removal of impermeable surfaces in order to create new green spaces with community engagement in mind.

Suitability Analysis

Data collection for suitability analysis consisted of population density maps, flood data, existing green space locations, Bergen county parcels data, and residence foreclosure/for sale data.

At first glance of Figure 2, the town of Wallington is experiencing a flooding problem. The majority of the town is situated in a 100 and 500 year flood zone. When we compare the data from Figure 4 with the data from Figure 2, it is noticable that there is a correlation between the flooding and forclosed houses. Using this data, the site intervention zone was created.

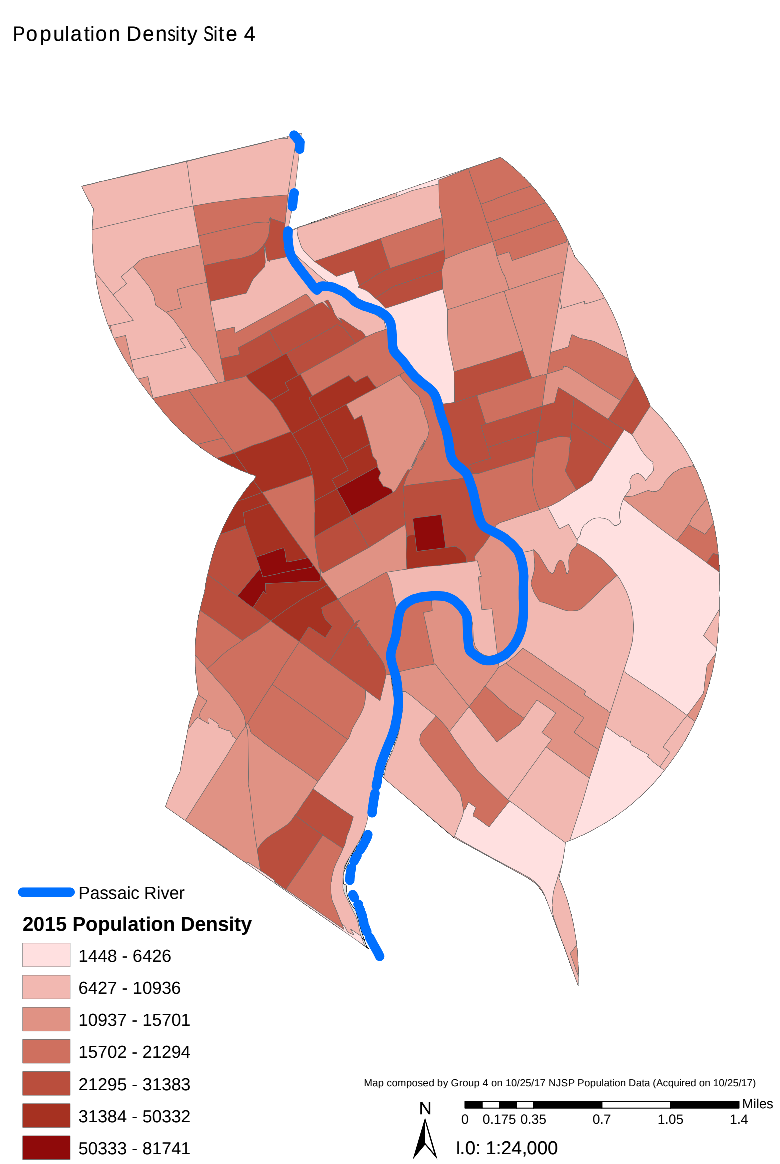


Figure 1. Map provided by: Bergen County Census Data
This map shows the population density of site 4.

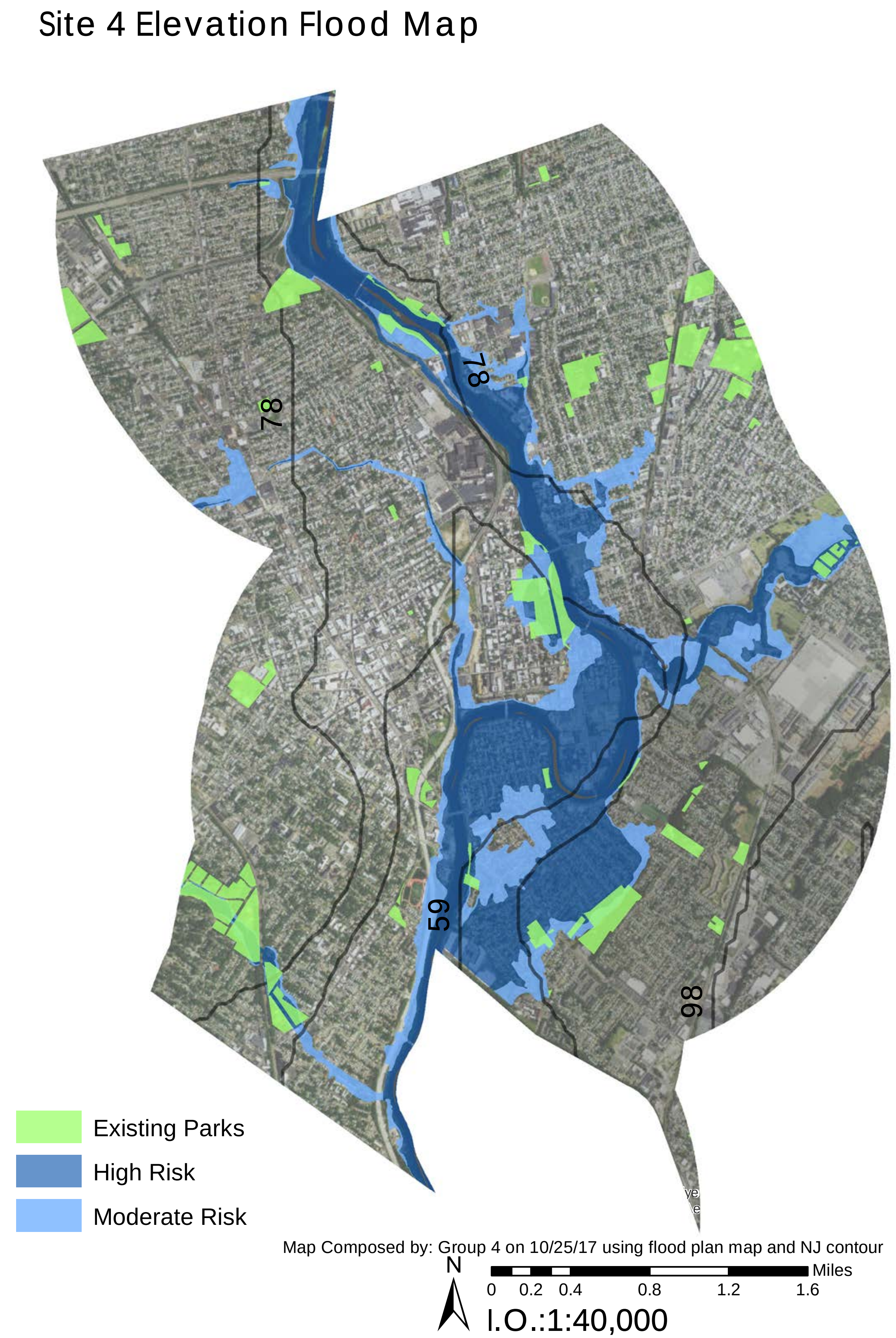


Figure 2. Data provided by: Federal Emergency Management Agency and Bergen County Parcels data and Census.
This map shows the Existing Parks, High Risk (500 year flood data), and Moderate Risk (100 year flood data). The town of Wallington is located in the bottom portion of the map and experiences the worst flood events in the area.

Suitability Analysis Continued.

The urban land use of site 4 is primarily residential and industrial as noted in Figure 3. The area has small amounts of green space scattered throughout the area. By using this data along with the flood data, imperious surfaces is the main cause of flooding within the Site 4. By incorporationg more green space, the risk of flooding will decrease, preventing flood damages.

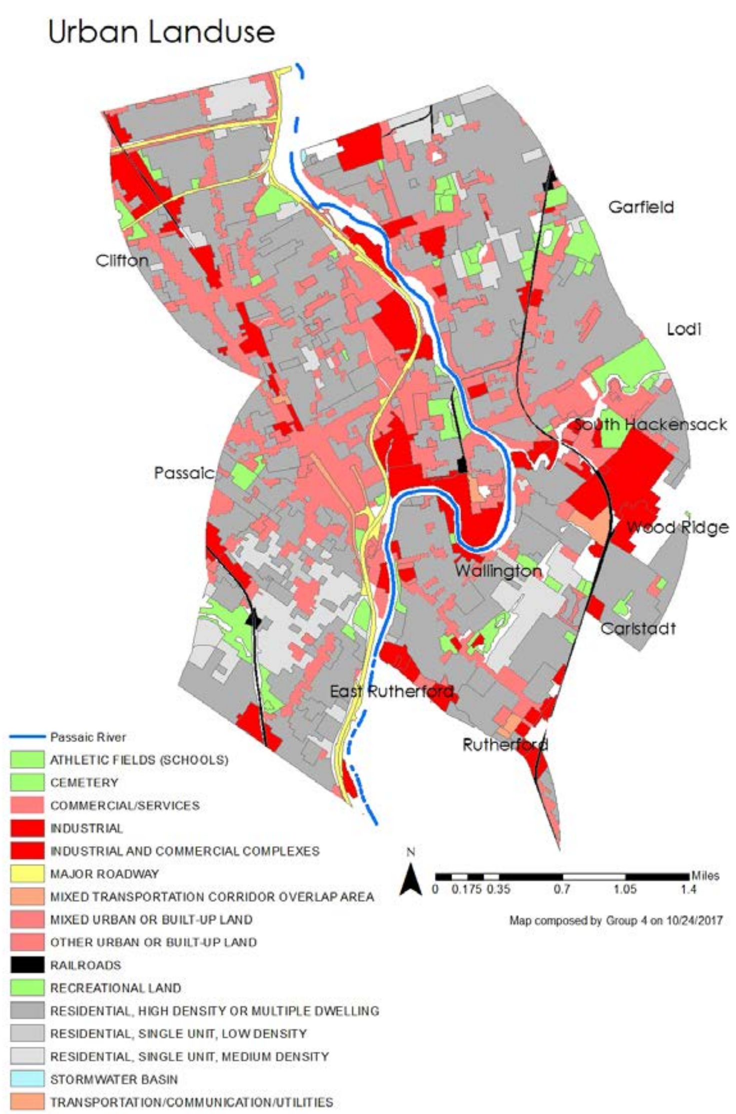


Figure 3. Data provided by NJ Department of Environmental Protection
This map shows the Urban land use of Site 4. Wallington (central), is mostly residential high density or multiple dwelling and residential single unit medium density.

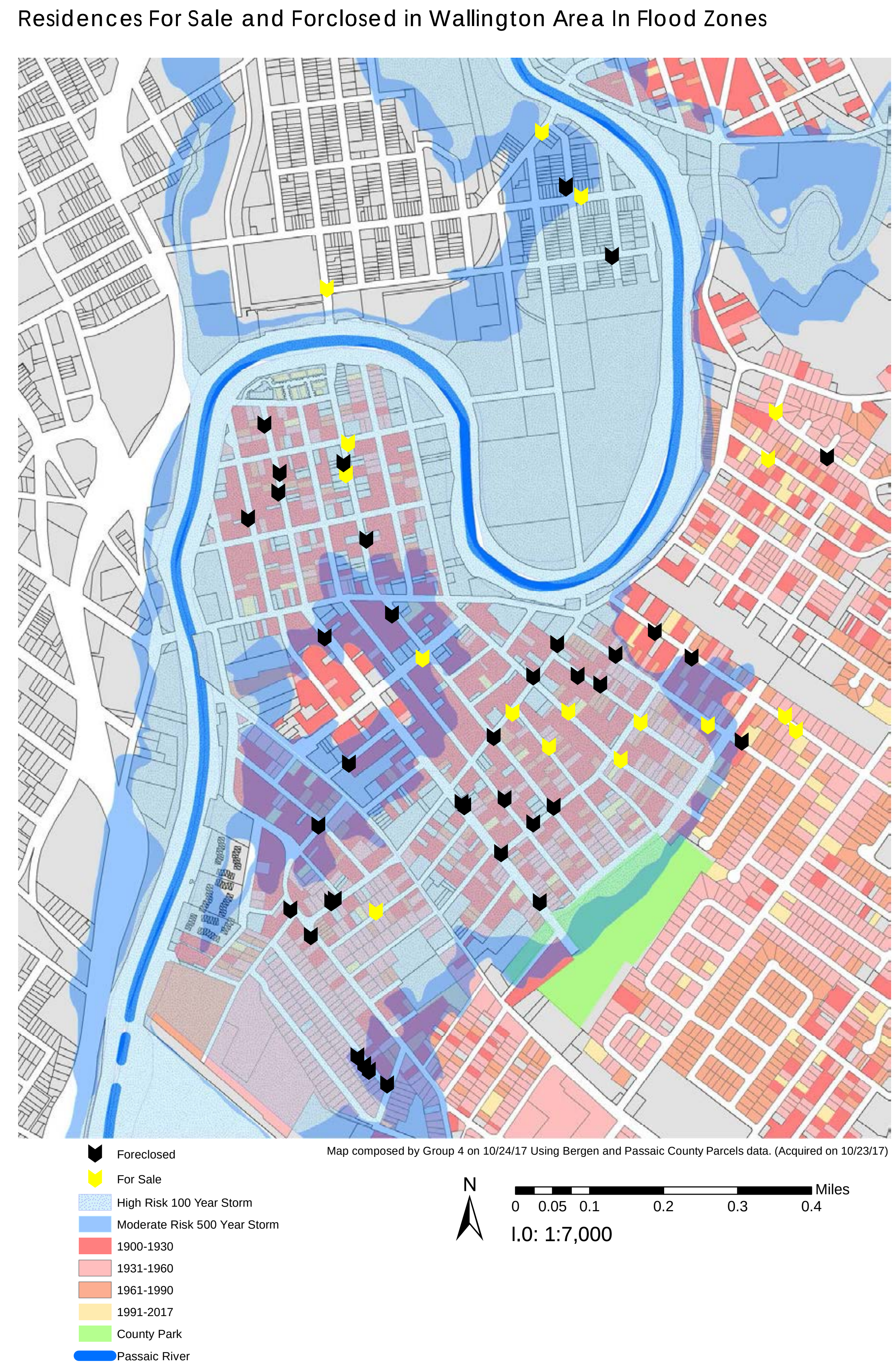


Figure 4. Data provided by: Begen County Parcels and Census Data and Federal Emergency Management Agency.
This suitability map shows the overlay of residences for sale and residences that are foreclosed and the High Risk and Moderate Risk flood data.
Age of homes is also provided. There is a direct correlation of the amount of foreclosed and for sale residences with where in the High risk and moderate risk flood zones they are located.

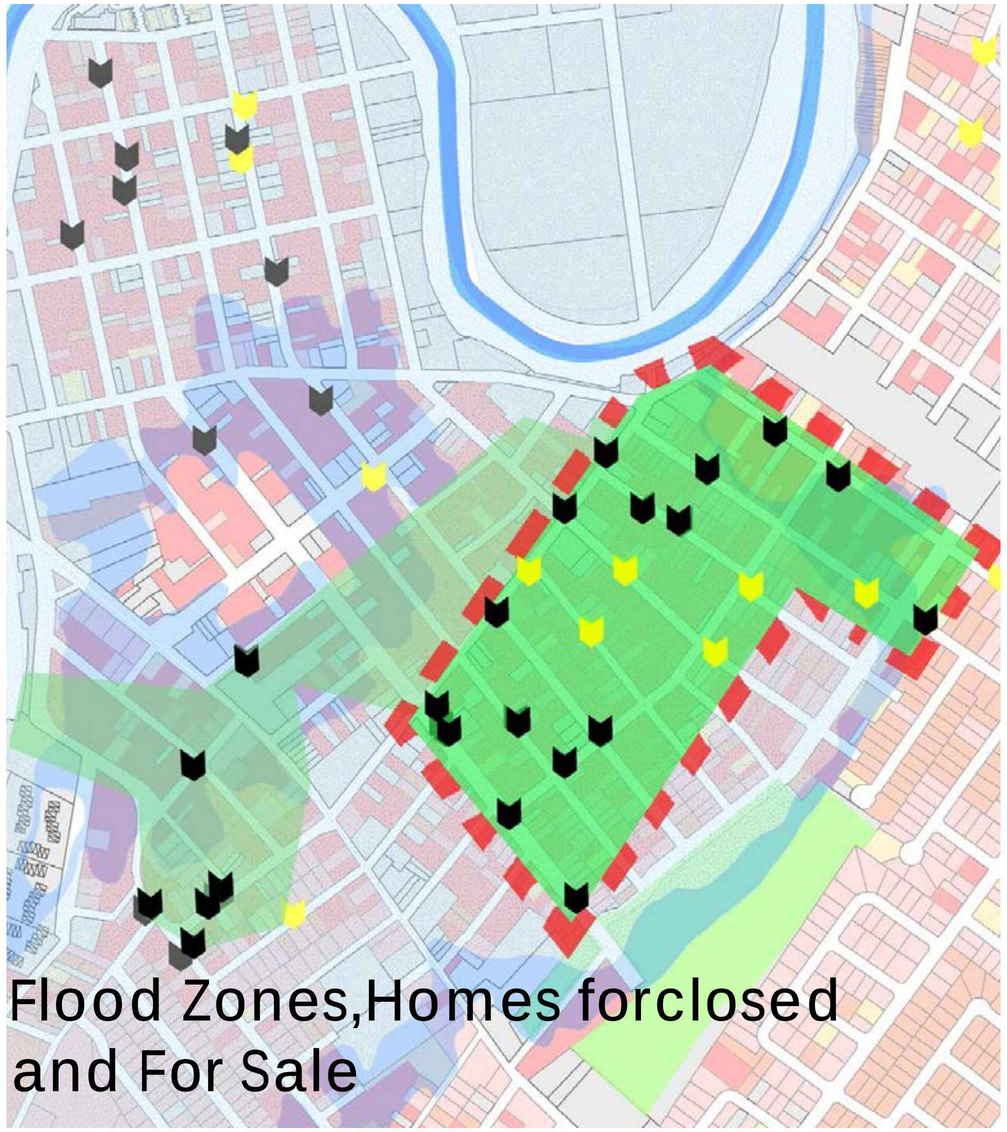


Figure 5. An outline of the trend in location of flood zones and residences that are foreclosed and for sale.

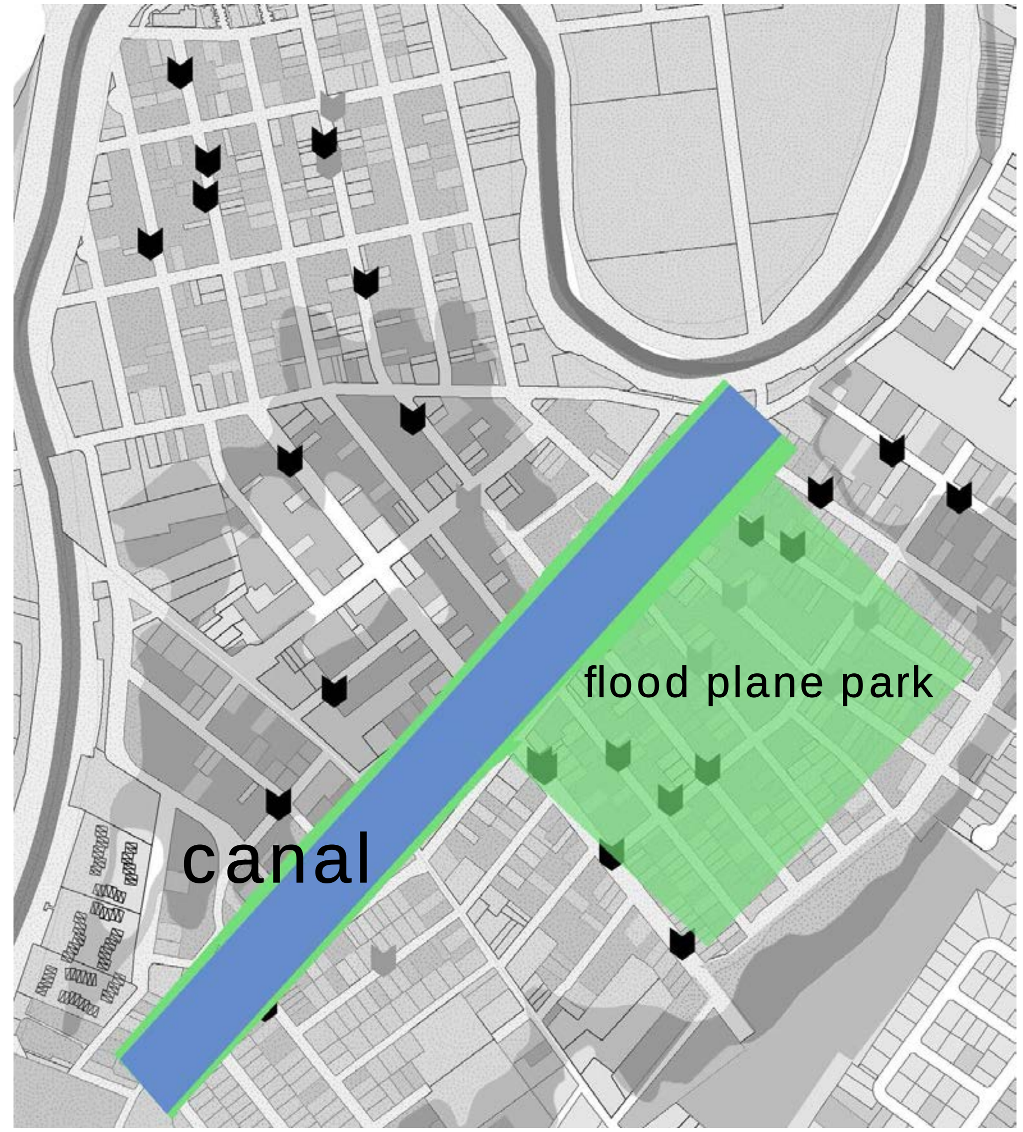


Figure 6. Diagram of general intervention of site, shown with canal and flood plain area.

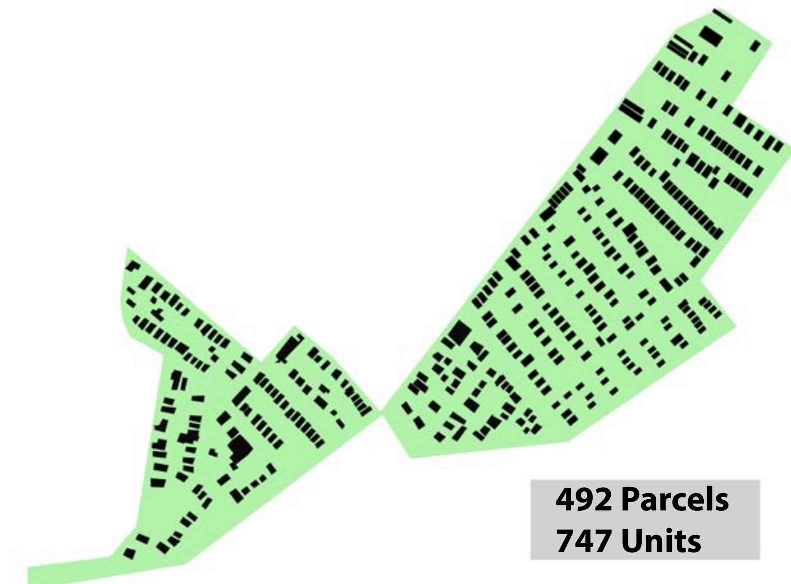


Figure 7. Figure Ground of site, and estimated units and parcels that will be disturbed.

After the site analysis was completed, the shape of the intervention area was roughly defined. In figure 5, it is represented by the red dashed outline. This would be the location for any potential intervention because of the higher rate of foreclosed and for sale residences in the area. When surveying residences outside of the town of Wallington and its flood areas, the frequency of foreclosed residences was a lot less. The ages of the homes in figure 4 may also play a part in removal of homes for intervention. Removal of homes in the town of Wallington may take many years and a plan on this scale may take many years to accomplish. By using Green Acres and Blue Acres programs, residences will slowly be bought out.

As progress was made with the site intervention area, the idea of including a canal emerged, and the flood plain area took place. One of the main goals of the intervention was to add flood resilience to the town. A flood plain park is a perfect candidate for the area because it would make the area able to recover from the large amount of floodwaters that move through the town. A flood plain park works well for this area because when it is not in use as a flood defense system it will be used for public enjoyment and entertainment. Having this system in place along with the canal, the town will be able to control the water levels and decrease the flooding damages to properties. Another benefit that this concept offers is the limitation of these floodwaters into the sewer systems, which is a concern for the PVSC.

The final shape of the middle park and the lower park. (Above Figure 7) Unit density and parcel calculations showed how much of a disturbance this intervention would cause. To find these numbers, a ratio of how many units to parcels was constructed and an estimation on how many units would be disturbed, was reached. Figure 7 is a figure ground illustrating the residential homes that will be removed to make the flood plain.

Another challenge of removing so many residences and units, is finding where to displace them or move them somewhere else. To do this, design group 4 calculated three different possible unit density options.

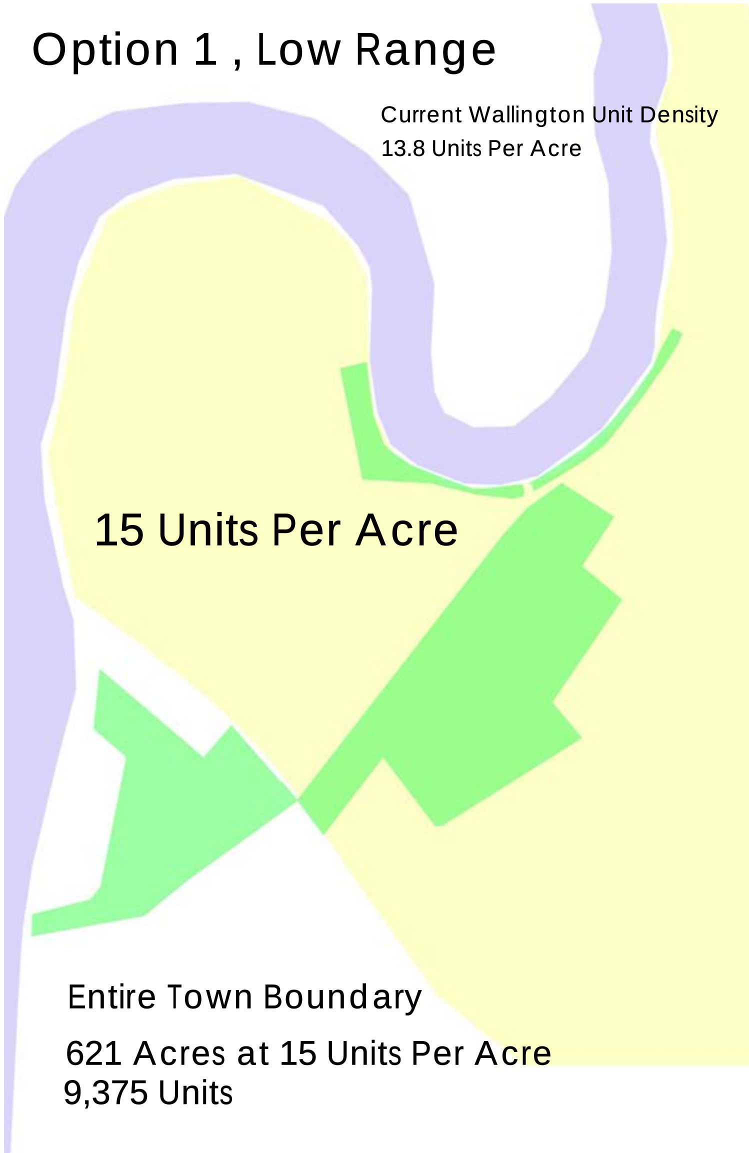


Figure 10. Shows option 1, Low range, which spreads the unit density throuought the town by averaging. The exisitng Unit Density is 13.8 which would become 15 per acre.

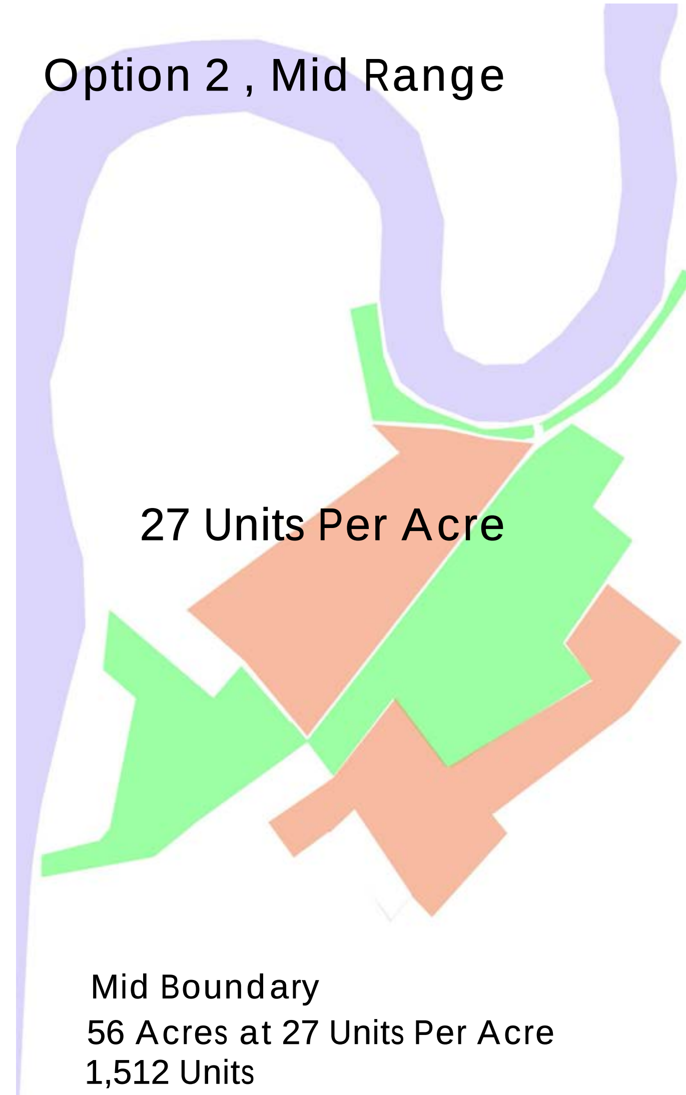


Figure 11. Shows option 2, Mid range, which increases the unit density to 27 units per acre. This is the option illustrated in the master plan and includes a mix of higher density dwellings as well as lower single unit residences.

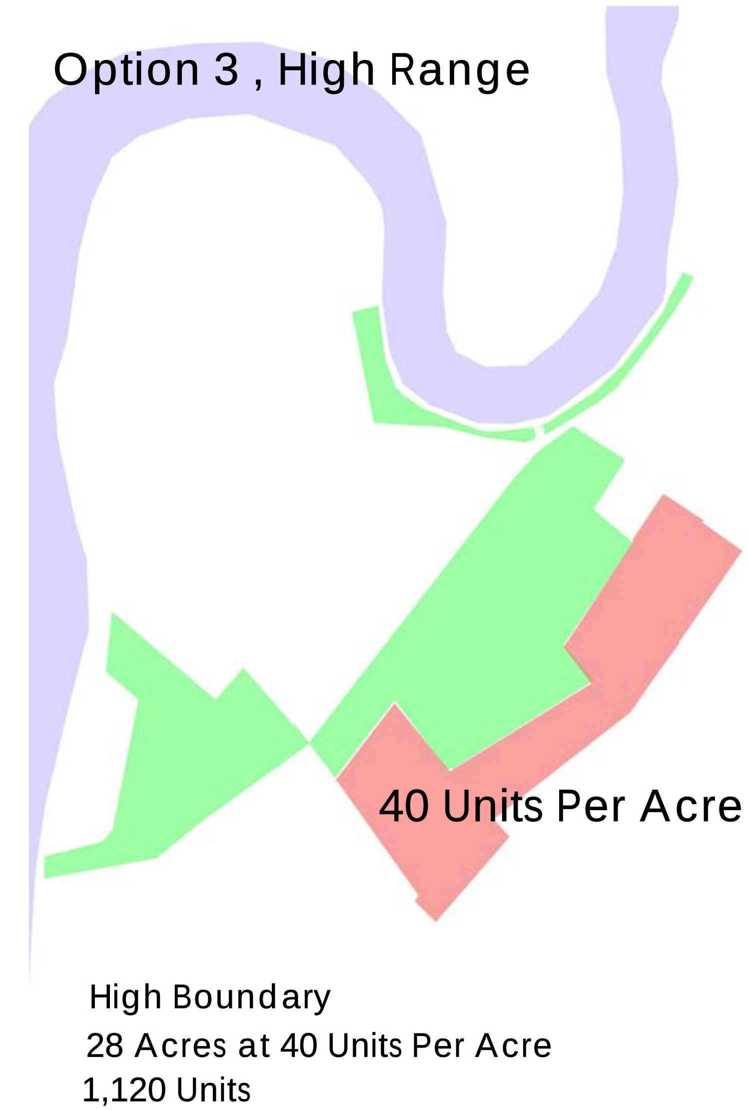


Figure 13. Shows option 3, High Range, which increases the unit density to 40 units per acre. This option would most likely be unwanted within the community.

The current unit density of the town of Wallington is 13.8 units per acre. A residence can have more than one living space so the average was made using the ratio described on the last page. These options illustrate the possible locations of where residences and units could be displaced.

Low Range

The low range spreads the unit density throughout the entire town. This option would cause the less disturbance to the area and the town as a whole. It would not be a significant noticable change. However, bumping the unit density up at locations spread throughout town may be difficult to do.

Mid Range

The mid range option is the option that was chosen to be represented in the master plan because it was estimated that it would alter the urban fabric for the better around the intervention area. The building up of the orange zones in Figure 11 would lead to more usage in the park, yet not change the way that the residents carry out day to day life.

High Range

The high range option changes the unit density to 40 units per acre. This would most likely be an unwanted alteration to the urban fabric and would be large midrises on one side of the park. The most agressive answer would probably be met with opposition by the town members of Wallington.

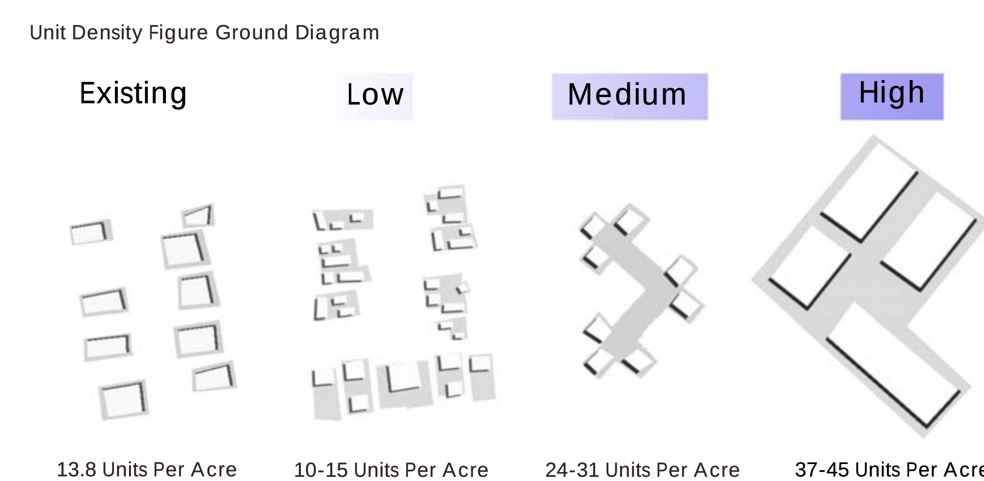
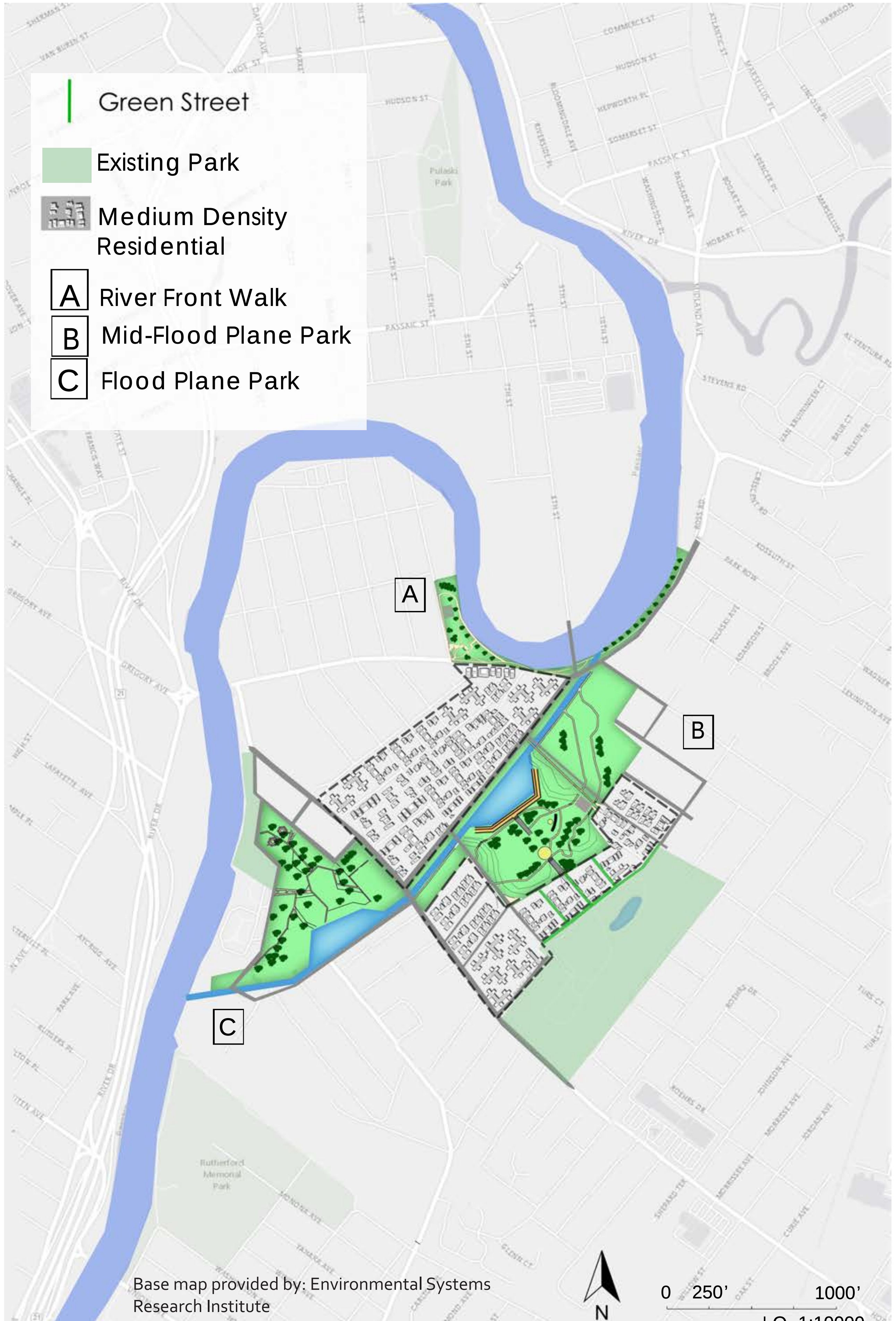


Figure 14. Unit density figure ground diagram. This illustrates the shape, footprint and size of what these options might look like.



Master Plan

The main design focus was to mitigate the flood waters by channeling the water through the use of a canal and adding flood plain parks. The Passaic Rivers natural path is through Wallington. This canal allows the Passaic to flow through the town in a controlled way. The implementation of the concept will reduce the flooding and divert the water away from residential areas.

The series of parks would act as flood plain zones during 100- 500 year flood events. Aside from functioning as a tool for storm water mitigation, they will also provide residents of the town with more needed green space. The park designs allows a continuous movement from one park to another and act as connectors for pedestrians to move throughout the town.

Parks B and C will be equipped with spillways that allow the movement of water into the parks when water levels in the canal rise. The amount of water let into the canal will be controlled by a weir at the beginning of the canal located in Park A. Community programming is a very important aspect for the design and each park has a unique approach of incorporating a social programing event.

Due to the aggressive nature of this intervention, the surrounding neighborhoods will go through a change of pace. The canal intervention, along with the increase in unit density will form a hub of lofts and shops along the canal. Green connecting streets will collect storm water and recycle the storm water within the buildings. These green practices will further the reduction of water that goes into storm water systems, and CSO outflows.

Site A: Wallington Riverront Walk

Site A is situated along the bank of the Passaic River. On the Master plan, there are currently two small existing parks. One located on the upper right side of the map and one on the upper left side of the map. The design intent of this intervention is to connect the two parks, create community involvement and mitigate flooding.

With the use of a riverfront walk, the two existing parks will become one. The walk will be adjacent to the Passaic River, which will create beautiful sightlines to the water's edge. To connect to the community, the design provides social programing with the use of a small pocket park. This pocket park, consists of multiple gathering spaces for community events as well as a small playground for neighborhood kids to play in.

Due to Wallington being on the curve of the river, erosion and flooding is a huge issue. A boulder bulkhead will help prevent the erosion of the banks, and create a barrier to help prevent flooding. At the mouth of the canal, there is a pedestrian foot bridge that is also a weir. This helps control the fluctuation of water able to go into the canal.

Site Intervention A.

Base map provided by: Environmental Systems Research Institute

1. Pedestrians are able to walk under 8th St. Bridge and have an uninterupted riverfront walk from one side of the park to the other.

2. The pedestrian bridge over the canal showcases the weir that controls the flow of water from the Passaic River into the canal.

3. Riverfront walk with views of the Passaic River.

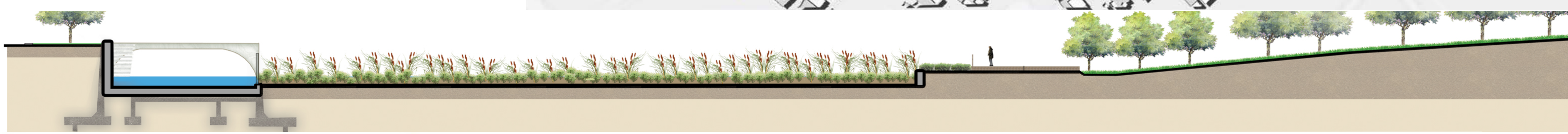
Site B: Wallington Mid Flood Plain Park

The intervention of site B is located along Locust Ave and continues until Paterson Ave. Samuel Nelkins park, is a county park nearby.

Currently this site is entirely residential housing. These homes are in moderate to high risk flood zones. In removing these residences, the area will become the flood plain park. This area will contain the floodwaters with its bowl shaped topography, and slowly release the water during a flooding event.

The park will boast a spillway and a decking area that allows visitors to enjoy the artificially created wetland habitat area that will be naturally resilient to flooding. All other vegetation and plants will be resilient to flooding, as well as the furnishings and materials used. Low maintenance furnishings and plants are key in a flood plain park due to the possibility of constant inundation and months with ought attention.

The canal-spillway-floodplain combination will be able to lessen the blows of flood events and prevent damage to residential housing by removing it from the picture.



(Above) Section of canal during 500 year flood event. (Right) Perspective looking down canal from Paterson Ave.

Site C: Wallington Lower Flood Plain Park

The purpose of the Lower Flood Plain Park design is to contain excess overspill water from the canals currently in place to protect residential areas during floods.

This concept is based on removing the buildings within the affected area and replacing the current paths with new ones that preserve the tree pattern already in place. This space will then be differentiated into big spaces for large amounts of people, and small spaces for more privacy based on the tree density of the area.

The park that is already in existence will be connected so that the paths align with each other, but the original park will remain open, while the new space will be an enclosed space to relax in. In order to keep harmony with the population, there will be a playground installed for children to play in. There will also be a skateboarding park for older teens to hang out in located further away from the more populated areas so that the sounds will not disturb the residents. For greater convenience for the people, the welcoming park is located next to the parking lot in the eastern area of the park, so that more people may have access to it. This area will allow for activities such as festivals while also providing space for mobile stalls.

A. Private Gathering Space
B. Kids Playground
C. Welcoming Plaza
D. Parking Lot
E. Open Space Plaza
F. Spillover
G. Skatepark
H. Existing Trees

Stormwater Management

The storm water management system is a design intervention for connecting the Mid Flood Plain Park to an existing park. It reduces storm water runoff through the application of permeable pavement allows water to pass through and be absorbed by the ground beneath it, and the porous asphalt connected to a pipe replacement enables a greater capacity to store and convey storm water. The roadside rain gardens and sidewalk trees assist in reducing excess runoff. The buildings have the additional systems to redirect water from green roofs to be stored for later reuse in cisterns.

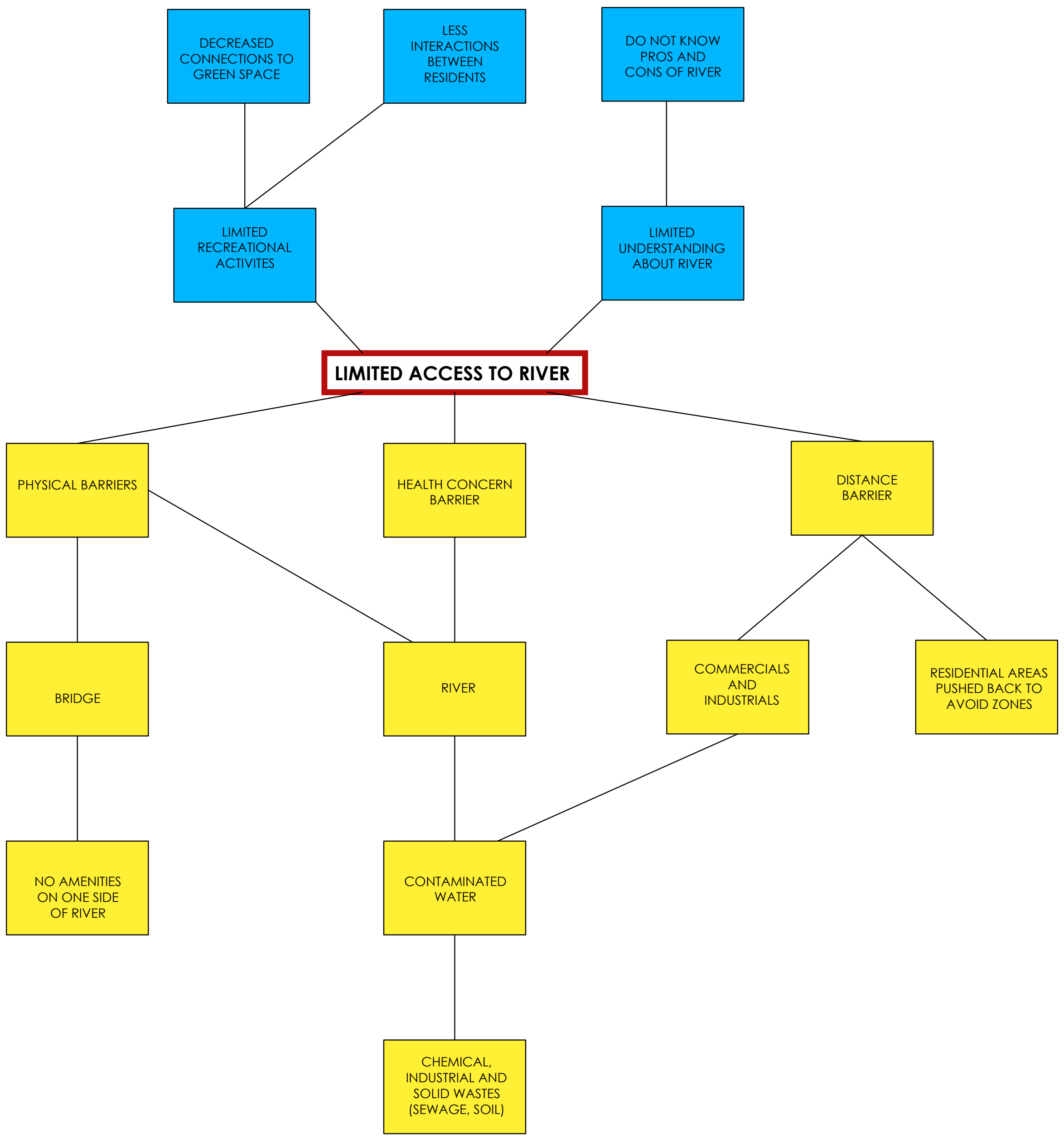
Open Space Plaza With Flower Planting Bed

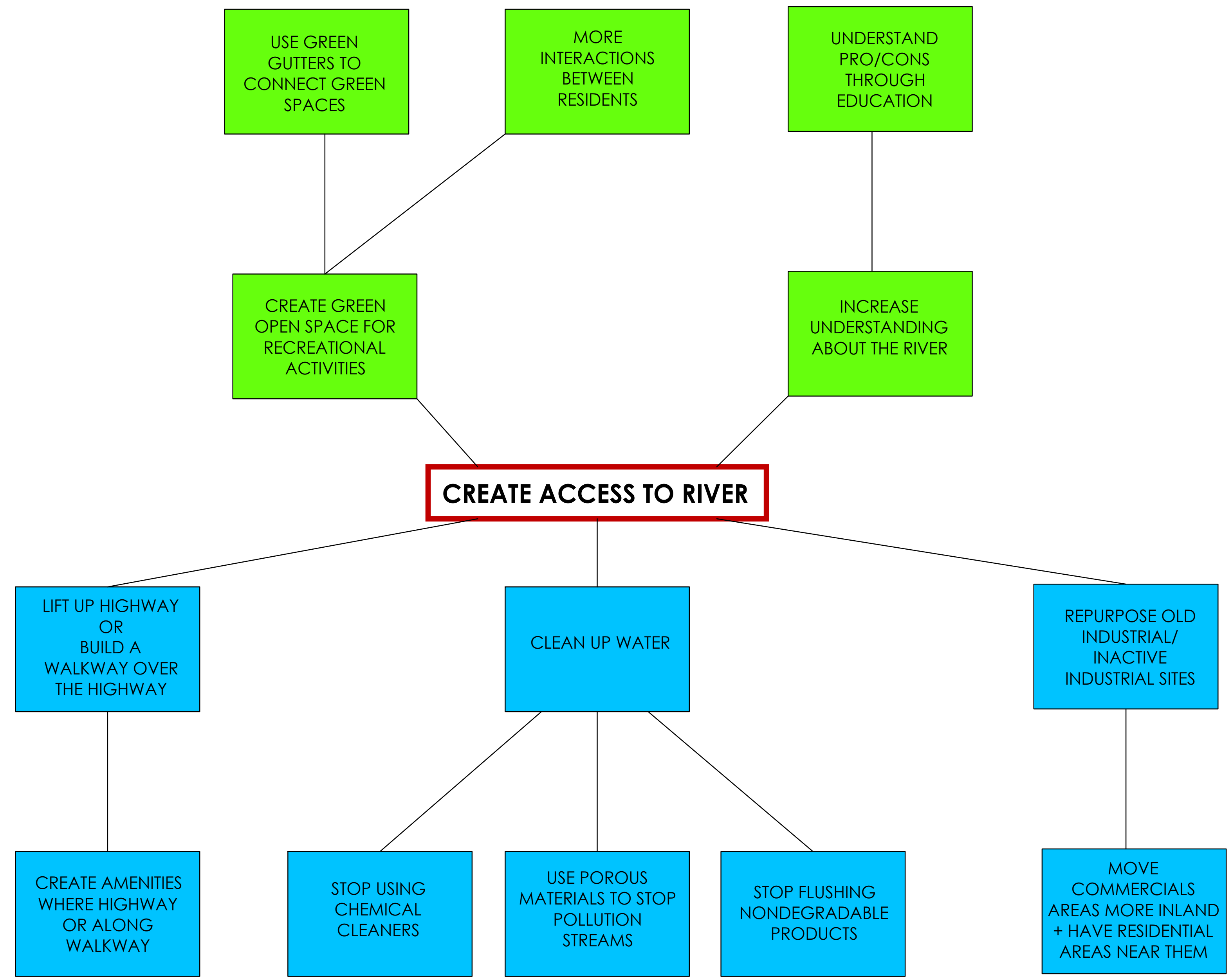
Site Five

By: Meng Guo, Shicheng Ma, Tina Mao, Grace Li

Photograph by:Corey Best

Problem/Solution Treee





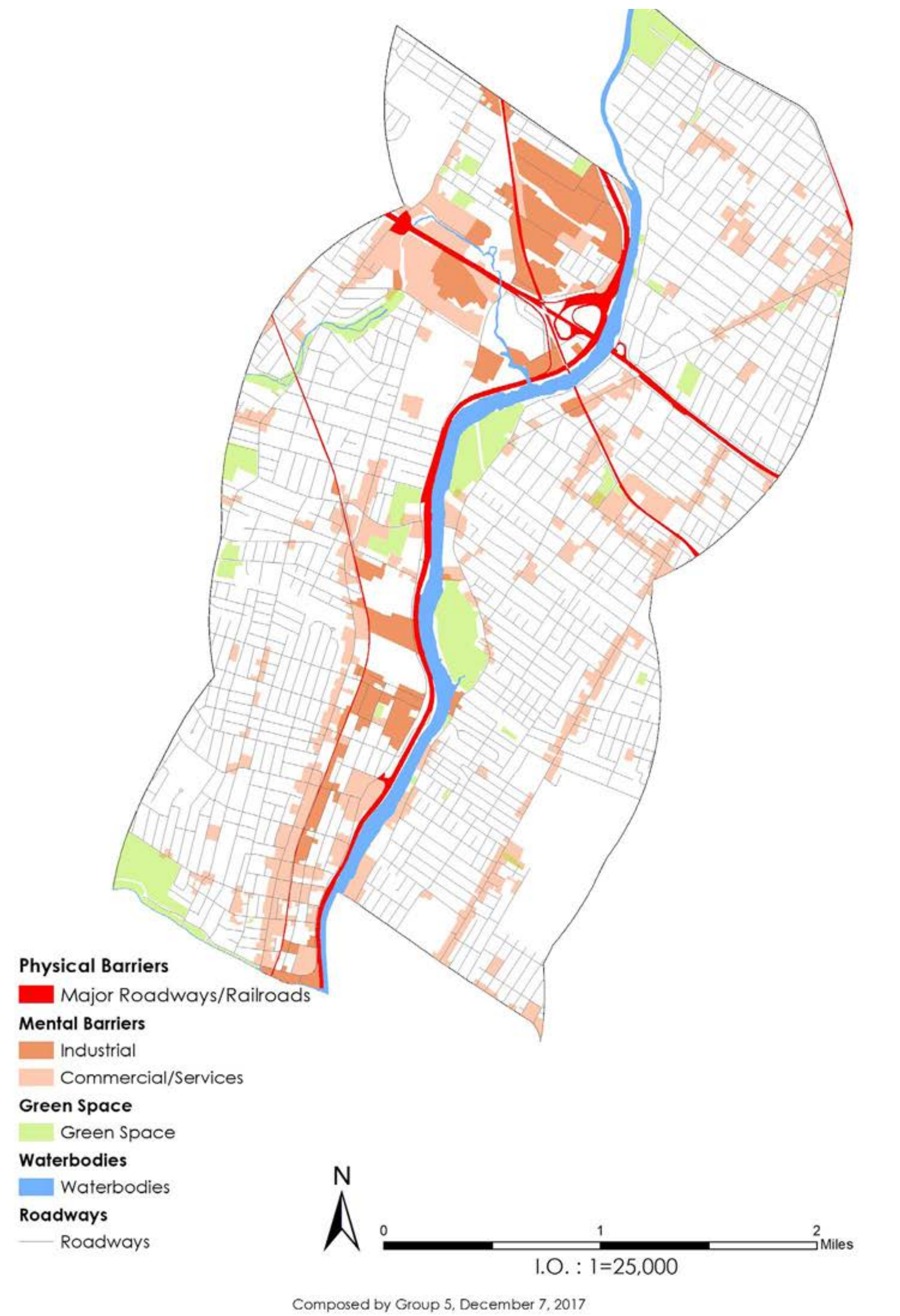
After researching and visitng certain locations within the site, several problems were found. Even though the common theme of pollutants in the river is a major problem, this area faced a bigger problem with limited access to the river. The limitations were caused by physical barriers, such as Route 21 and bridges, health concern barriers, such as contaminated waters, and distance barriers, which may deter local residents from going to river. To deal with the major problem at hand, which was the blockage by Route 21, the group decided to either lift up the highway or build a walkway over it. As there is no where to go on the other side of the river or invite residents to the river, a boardwalk or open space system can be implemented.

Suitability Maps

Flood Zone

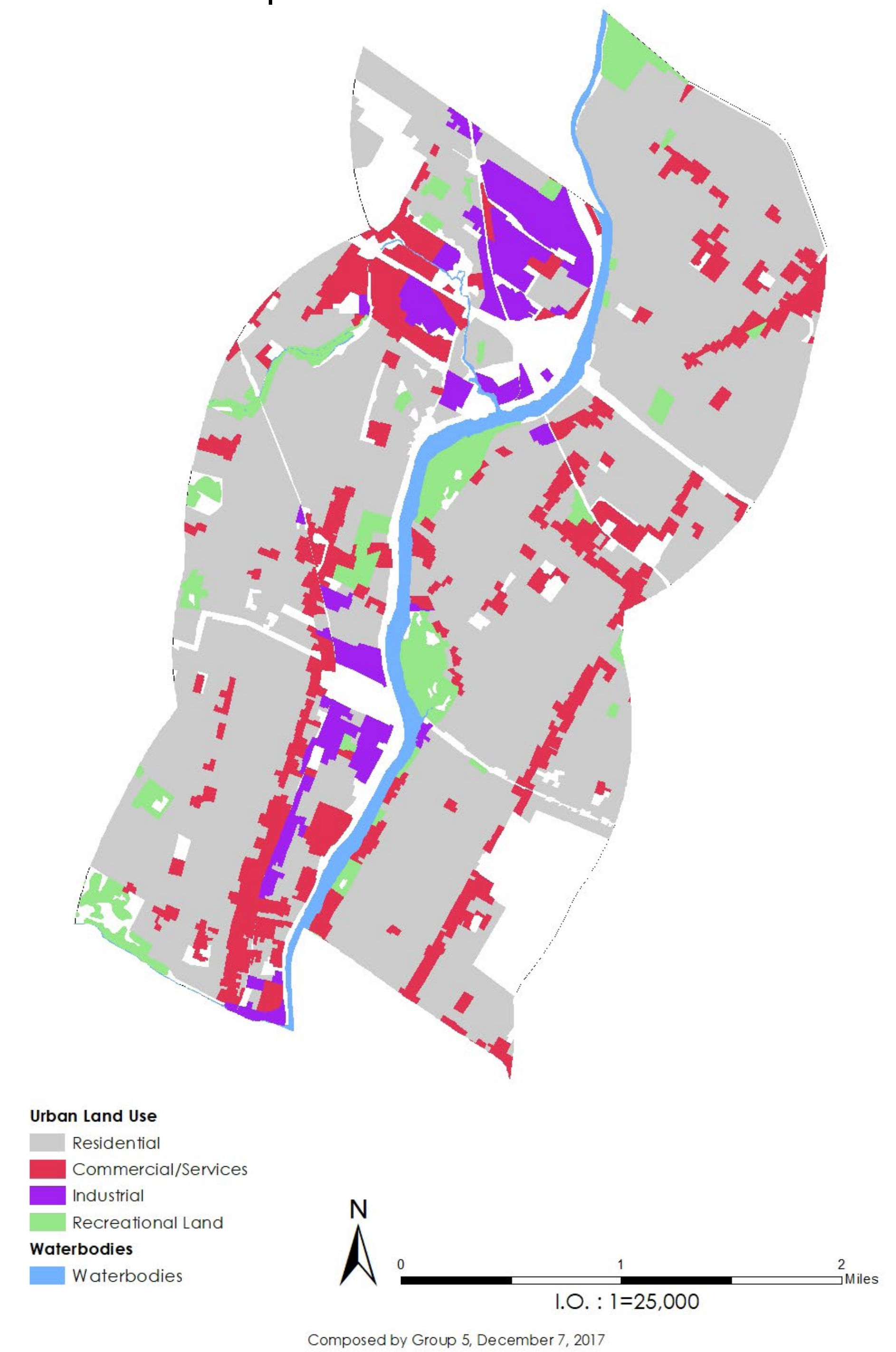
There are several flood zones along the river in the site. The major flooding areas are dealt with by the existing open spaces on the right side of the river, where there is no highway or barrier to block it. Even though the highway acts as a flood barrier, there are still times where floodwaters are able to creep in.

Barriers to the River Front



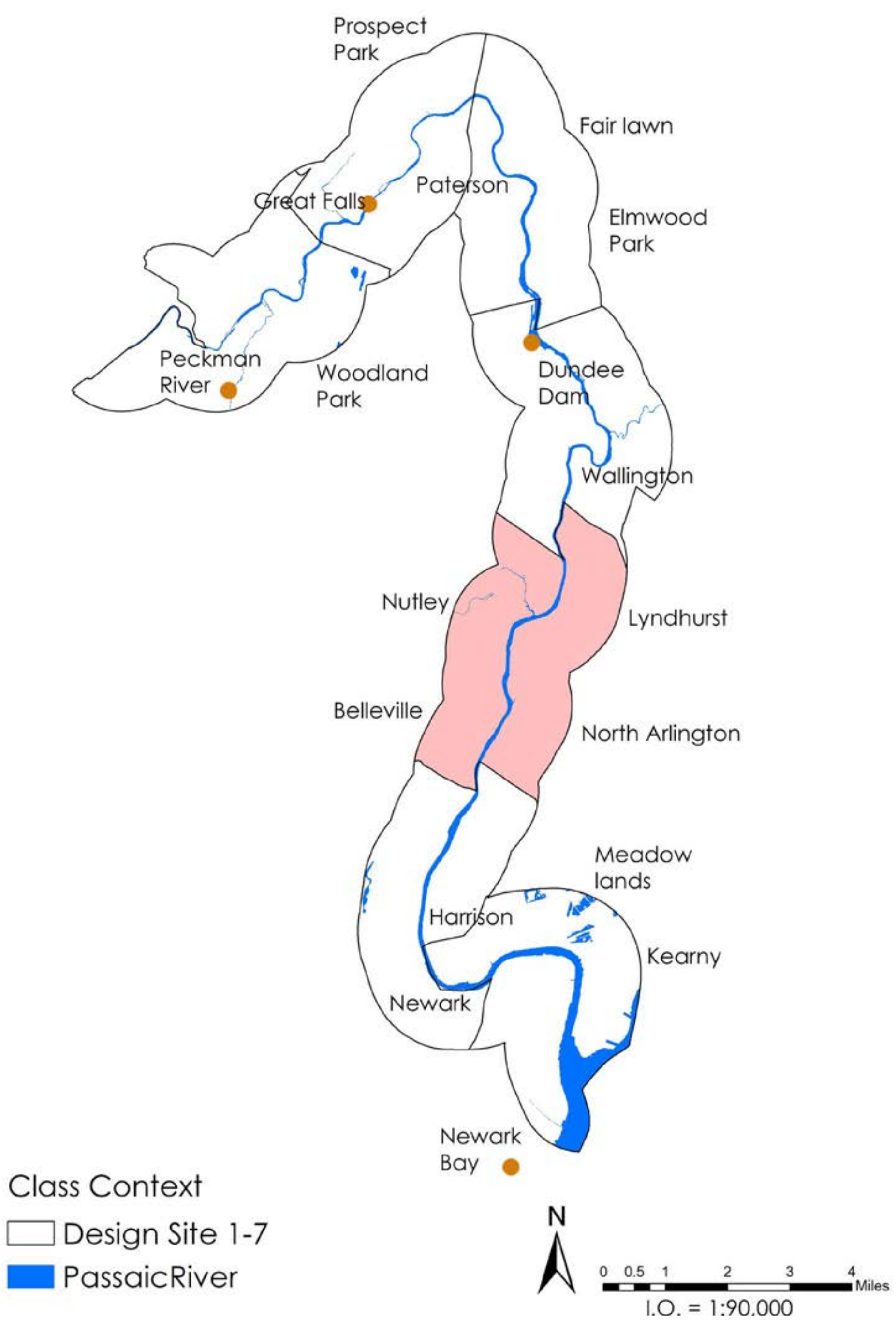
This map shows the relationship between physical barriers, mental barriers, and green space. The physical barriers are solid structures that prevent residents from going past to access the river. The mental barriers, such as abandoned railroads, are perceived as negative barriers that cannot be easily overcome.

Land Use Map



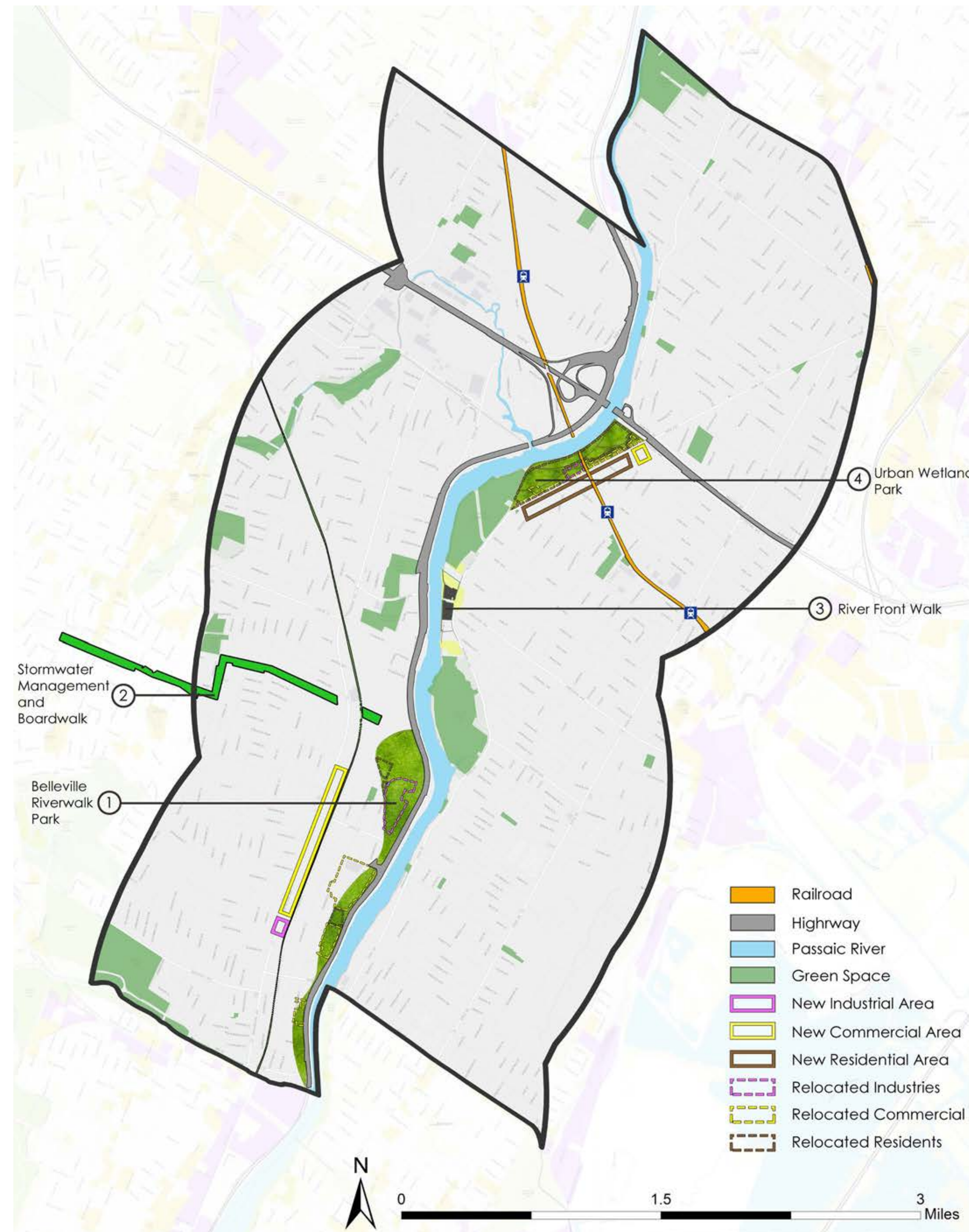
This map shows where the residential, commerical, industrial and recreational land use areas are in the site. This will later determine whether or not anything needs to be moved when paired with the flood map.

Context Map



The goals of the design group are to decrease stormwater and flooding in residential areas and increase accessibility and availability of green open spaces for local residents. The site was split into four design intervention areas, the Belleville Riverwalk Park, the Stormwater Management and Boardwalk area, the Riverfront Walk, and the Urban Wetland Park. The order of the areas within the site start from downstream going upstream.

Master Plan



Belleville Riverwalk Park

By: Shicheng Ma

Perspective 1

Perspective 1: A trail runs through the entire Belleville Riverwalk Park for bikers and pedestrians alike, providing an ideal route to follow as they see the sights once denied to them.

Master Plan

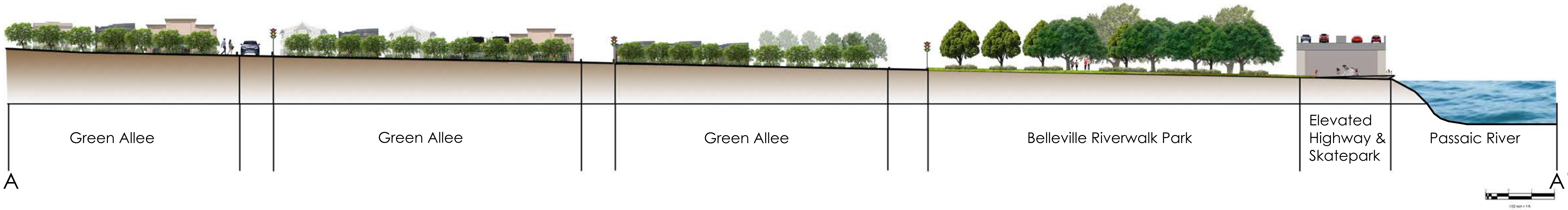
The Belleville Riverwalk Park is located on the western side of the Passaic River in Belleville. The main purpose of its design is to uncover the riverfront that was once blocked by Route 21 by elevating the highway 20 feet.

The park was built over a flood zone, with the original residents relocated to a safer area further inland to the proposed apartments located near the Bergen train station. The newly renovated area will also serve to help restrain the overflowing water though the use of a retaining wall, while simultaneously making the riverfront visible. The area the park is located in was not originally very attractive to visitors due to its light industrialization and low profit organizations. As a result, there is not much interest in the area. The establishment of this park will strive to change this fact.

The park itself is a dynamic park which cannot be enjoyed to its fullest extent while one remains stationary. There are beautiful allees that lead into the park itself and help to liven the community around it. In the brightly illuminated space underneath the highway, there are recreational areas such as a skateboard park that help make the area more welcoming to visitors.

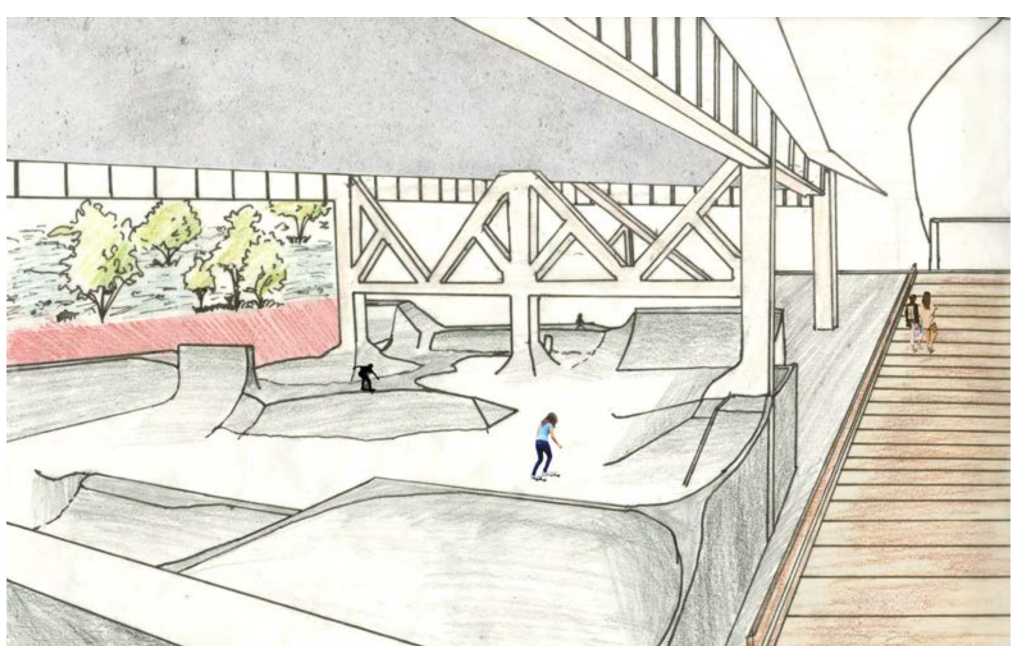
Over time, the park will attract more and more people, which will then create a ripple effect that helps to influence its surroundings. The placement of the allees are specifically designed to facillitate this process by stretching outwards to the nearby area. The boardwalk also helps to reach out to the community while appealing to a greater population, and the parking lot located near one end of the park allows for a more convenient journey.

Cross Section



Elevated Highway

Perspective 2



Cross section: The cross section stretches along Academy Street in Belleville from Valley Street to Passaic riverfront. It shows how the green allee is implemented as a guide to the Belleville Riverwalk Park, leading visitors to see the riverfront view and how it helps to create a transition from the community to the park.

Elevated highway diagram: This diagram displays the tunnels formed under the elevated highway that people may use to cross and access the boardwalk on the other side. A few trees from the park are visble behind it.

Perspective 2: This perspective gives a conceptual image of the skateboard park that will be built in one of the tunnels under the highway. The long strip of lighting on the edge of the highway illuminates the area in place of the natural light that is blocked by it.

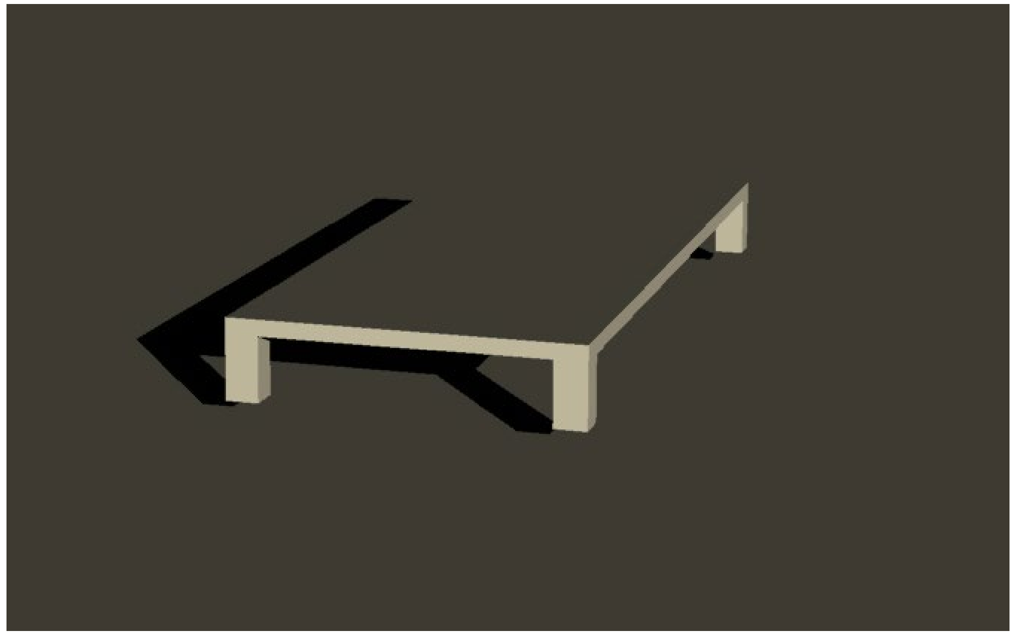
Stormwater Management and Boardwalk
by Grace Li

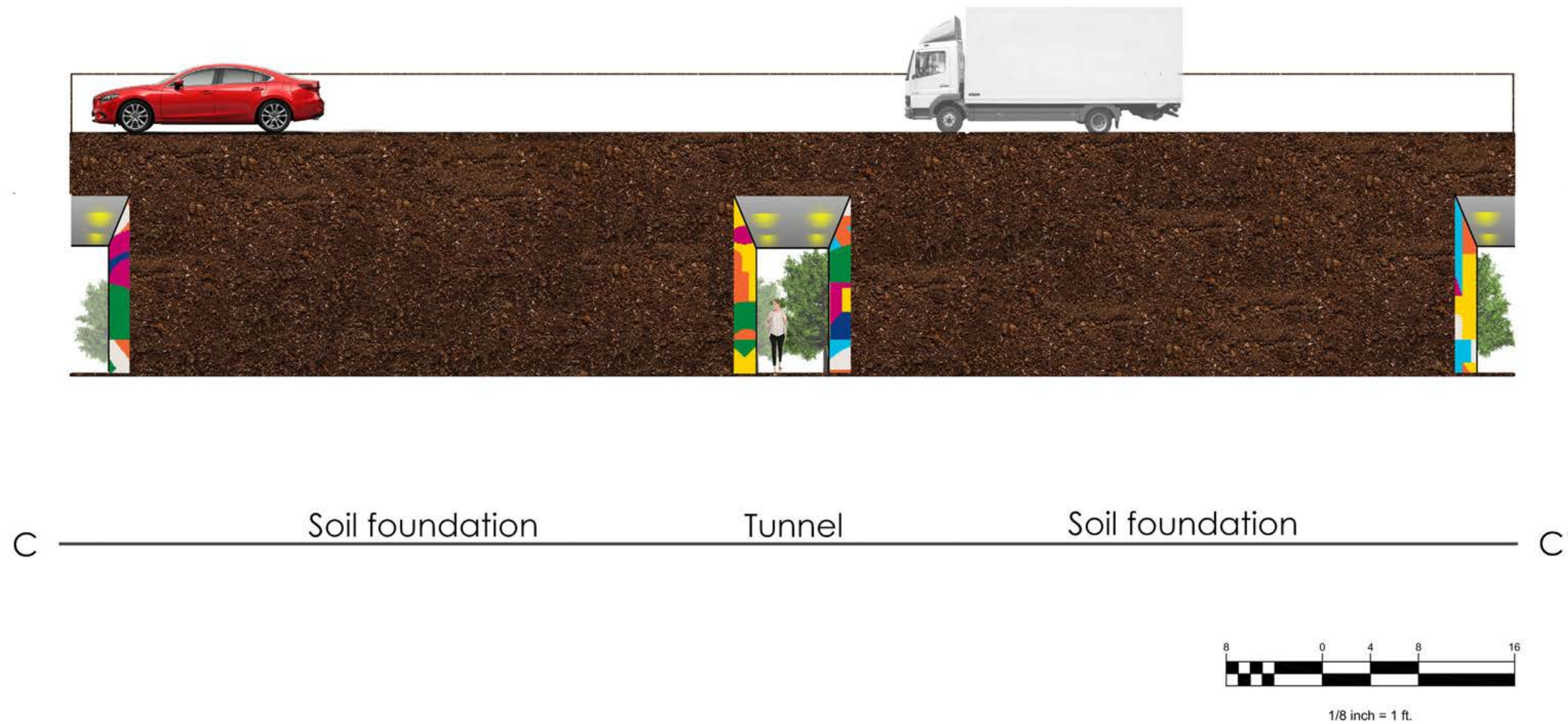
Master Plan

Green Gutters and Meadow

The sections show two ways in which stormwater runoff can be reduced and managed. The master plan includes green gutters which are formed by combining three stormwater management practices: curb extensions, swales, and planters. The gutters retain no more than 3 inches of runoff; therefore, they rely on their length to be efficient at reducing and capturing stormwater. The master plan also includes a meadow which is within a power strip, making it suitable for an ecological meadow that would bring back habitat and slow down stormwater runoff as well. Section A cuts through both the green gutter streets as well as the meadow, showing the spatial relationship between the two interventions. Section B only cuts through the green gutter streets, but displays the meadow in the background to show depth perception.

Elevated Highway





Above is a model of Route 21 after raising it up by 20 feet to provide access to the Passaic River. This model shows how there would be little to no light under the highway, making it a dark and uninviting place. Before making this model, it was assumed that raising the highway would be enough to provide a safe and inviting walkway to the boardwalk on the other side of the highway. As the focus was to increase access for local residents to get to the river, a boardwalk was incorporarted at the other side of the highway. After finding out that it would be completely dark under the highway, a new plan was developed that would provide a walkway for people to access the boardwalk that would be long and bright to invite people to travel through. By incorporating a retaining wall where there were no tunnels, the amount of floodwater that would normally pass through is restricted, causing the amount to decrease. The retaining walls would also include some green plantings that border it in order to reduce erosion by the water over time. Lights are used to brighten the tunnel up in order to make the dark tunnels more welcoming, and murals were added to encourage people to walk through.

Riverfront Walk

by Tina Mao

The goals of the Riverfront Walk are to reduce parking space in order to create a green connection, increase and create accessibility and availability of green open spaces for local residents, and make walkable paths between green spaces for pedestrians.

Figure 1

The site will be located between two green spaces, one referred to as the Riverside County Park. The original goals were to create a connection between the two green spaces and decrease flooding. However, since the site already has a bulkhead, which is a wall along the side of the river, the flooding problem has already been solved. As it is still an active commercial area with a certain amount of residents, the goals have been updated to focus on building a relationship between the green spaces and the residents.

The riverfront walk will be divided into two parts by the Park Avenue Bridge. Since the bridge has been around for over a hundred years, it has a historical value so there is not much that can be changed. To implement the walkway, parking space must be reduced from around 150 parking spaces to 120 parking spaces for each parking lot. Pedestrians will walk along the path and eventually reach an intersection between the bridge and the major road, Riverside Avenue. From there, they would have to cross the road to get to the other half of the walkway. To draw pedestrians in, the site will include locations of interest such as a sports club, shops, bars, and restaurants.

Figure 1

Figure 2

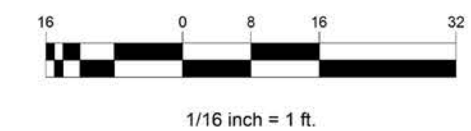
Figure 2

This perspective displays the riverfront walk with the bulkhead along the side of the river. It also has a seating area with plantings so people can relax and take a break while enjoying the view. Each seating area has space in-between each other, as well as some green space between the path and the lots, so a person's car can remain within eyesight even if the trees create a sense of privacy.

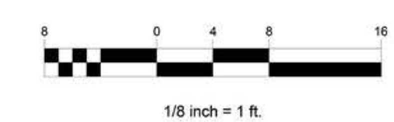
Figure 3

Figure 3

The bridge is known as Avondale Bridge, Park Avenue Bridge, De Jessa Memorial Bridge, and Kingsland Avenue Bridge. It connects the towns of Lyndhurst in Bergen County and Nutley in Essex County. It opened in 1905 and has over a hundred years of history. The bridge is a swing bridge, or moveable bridge, for both vehicular and pedestrian traffic.



Section A to A' shows the riverfront walk and Park Avenue Bridge



Section B to B' displays what would occur from the river to the major road, Riverside Avenue

Urban Wetland Park
by Meng Guo

Master Plan

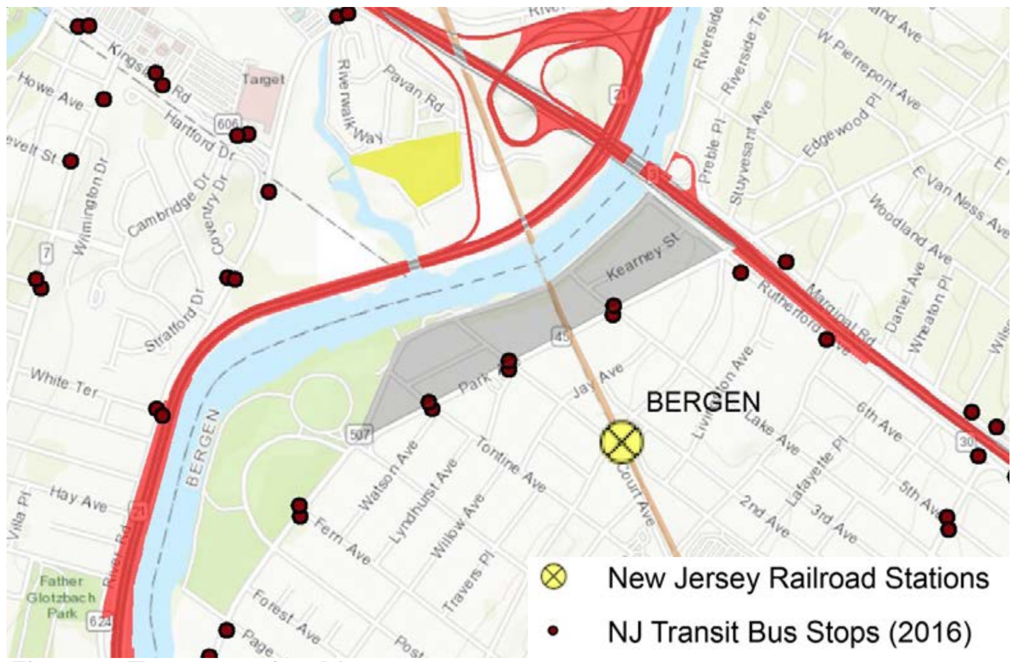


Figure. 1 Transpotation Map

According to the Master Plan, the site of the wetland park was originally a residential district, however due to the area being a flooding zone this was deemed hazardous. As a result, the residential area will be moved inland, with the wetlands taking up the majority of the original space. This park is crucial because despite its smaller size than the original hazard zone, its ability to absorb water is much greater, making it the ideal barrier to halt the flow. Since there is less space the new buildings must have greater height to suit the higher population density, so the living areas will be converted into apartment buildings.

Figure.1 Transportation Map. This diagram shows the train stop that is located in the site location. As a transit hub, this area provides people with close access to public transportation, thus resulting in an increase in population density. As the train stop is out of the flood zone, it prowvides a safer area for residents to move to.

Figure. 2 Prespective. This is the viewer's perspective of the wetland and Passaic River. The existing green space is on the left of the bridge, while the wetland park is on the right. The stumps lining both sides of the bridge are three feet tall, and can be used as a bench, while simultaneously serving their function to act as a barrier separating the bridge from the wetland.

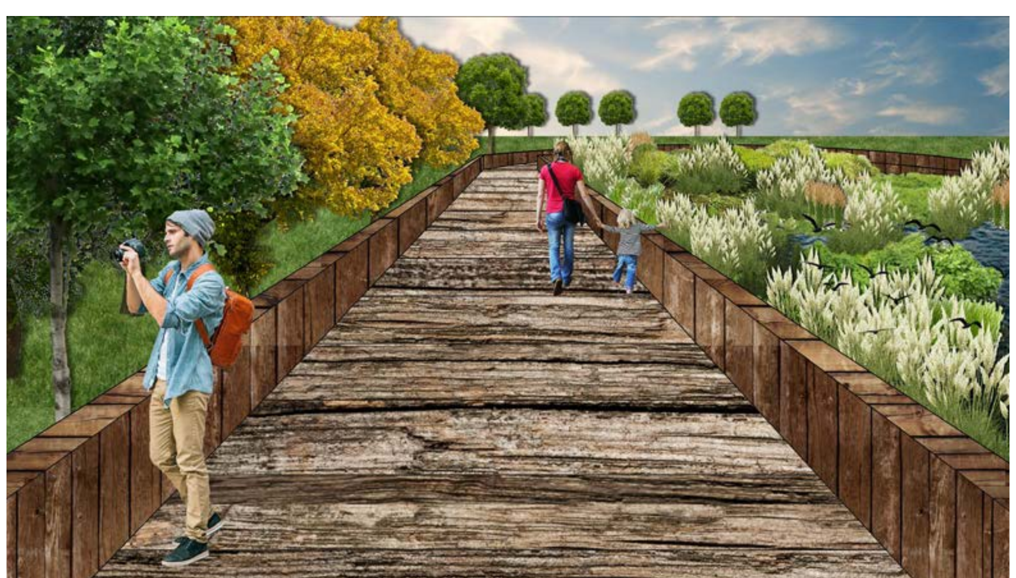
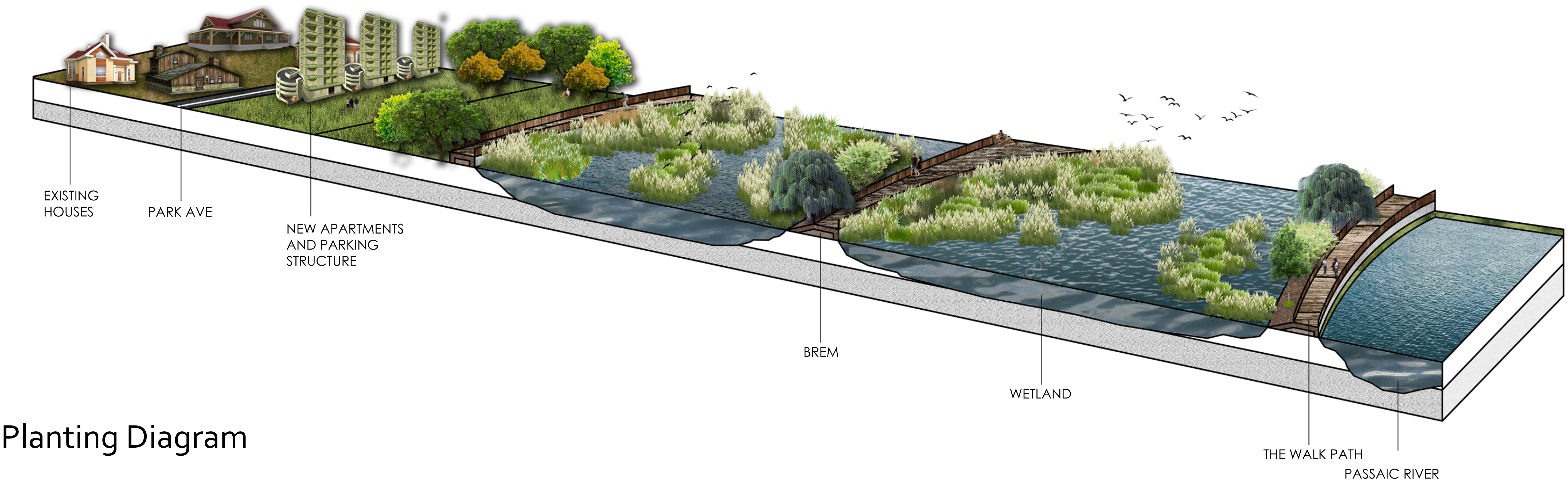
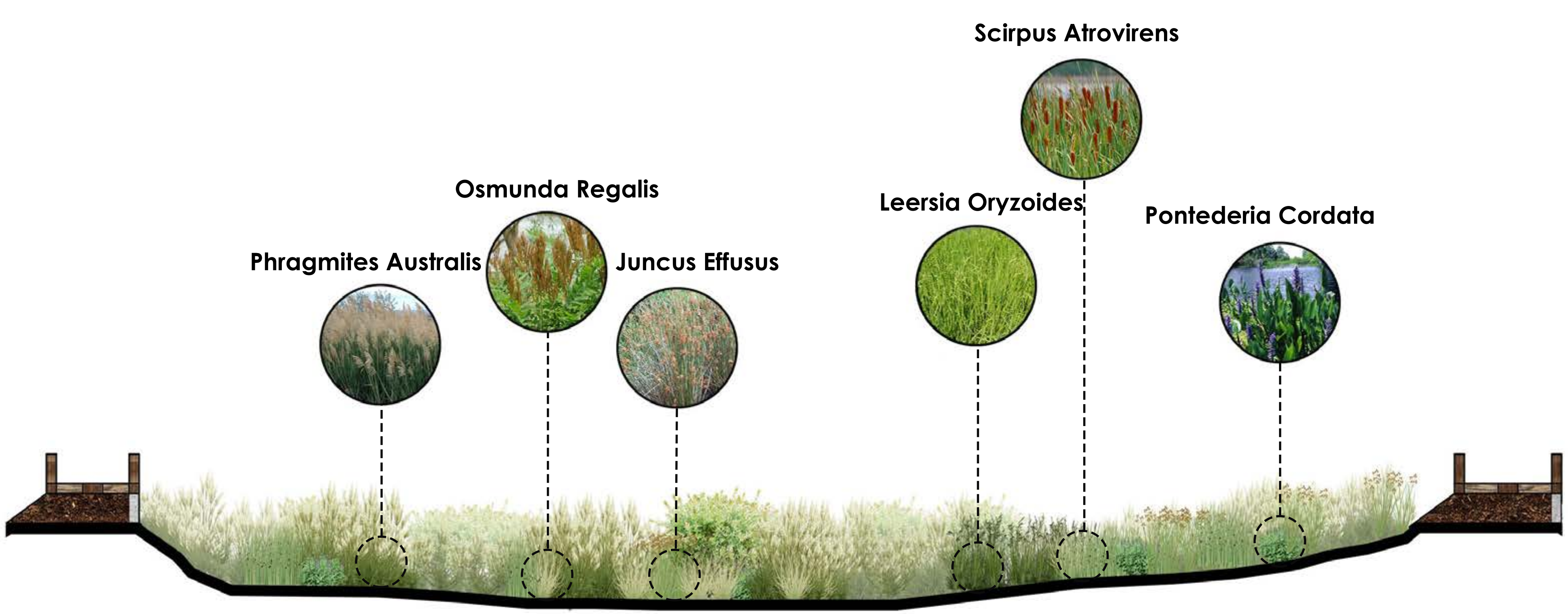


Figure. 2 Perspective

Axonometric Diagram



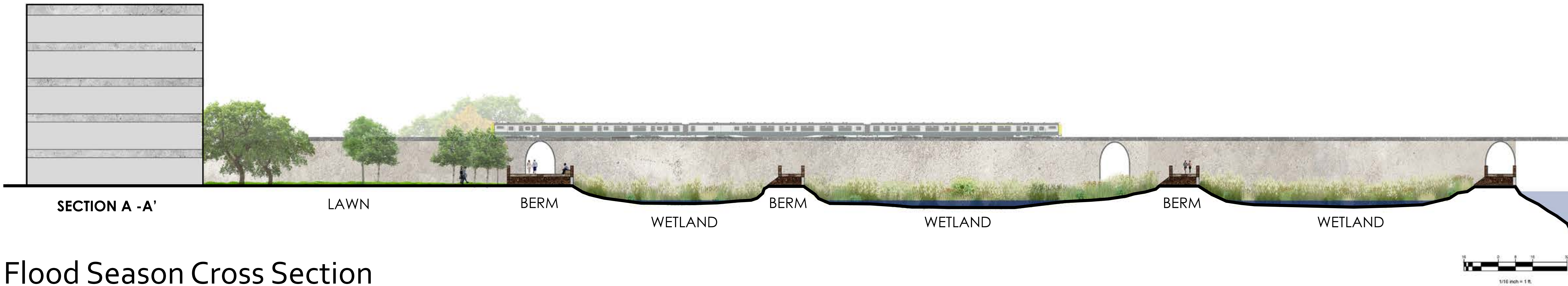
Planting Diagram



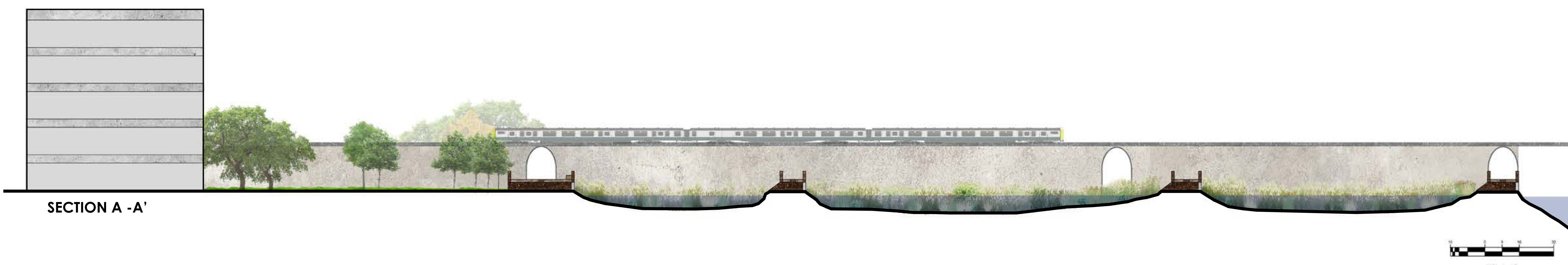
This diagram is an axon that displays the series of layers that make up the wetlands and new residential area. The progression of different materials in each section shows how overflowing water is filtered in the flooding season. The side view makes the alternating berm and wetlands sections show the different ways in which this is accomplished. The berms act as a physical barrier, while the wetlands act as a sponge to store it. (Above)

The planting diagram shows the plant species present in the urban freshwater marsh section of the wetlands area. (Left)

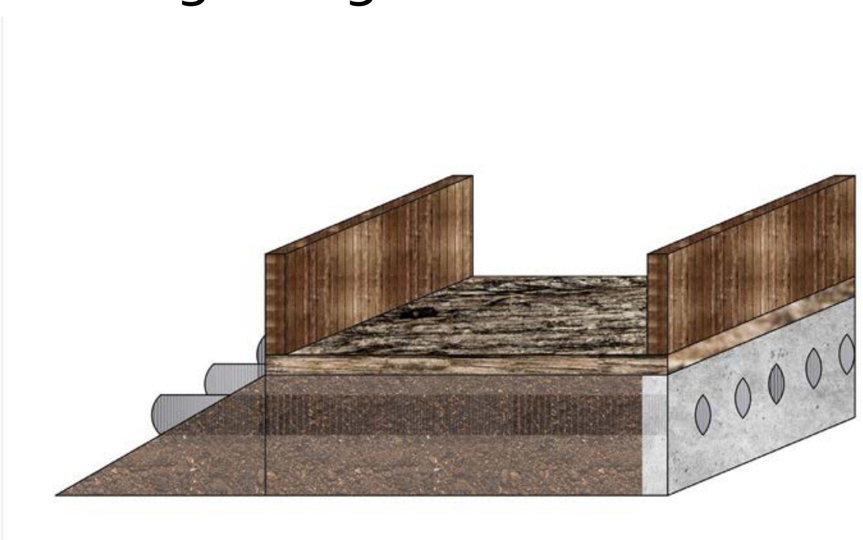
Drought Season Cross Section



Flood Season Cross Section

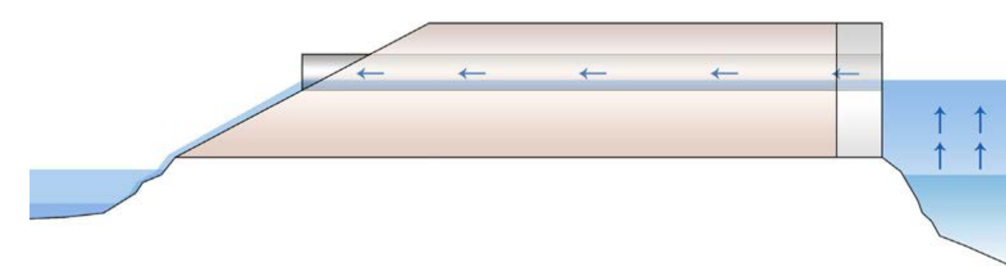


Drainage Diagrams



The drainage system is to be implemented under the berm, which is between the Passaic River and the proposed wetland closest to the River. The pipes pass through the berm, so when the water rises up to the level of the pipes, the resulting overflow can then flow into the wetland (right).

The concrete is used to keep the pipes in place and prevent soil erosion. Without the pipes, the concrete blockw would push the increased floodwater to unblocked areas. Therefore, the pipes will direct the floodwaters into the wetlands. (left)

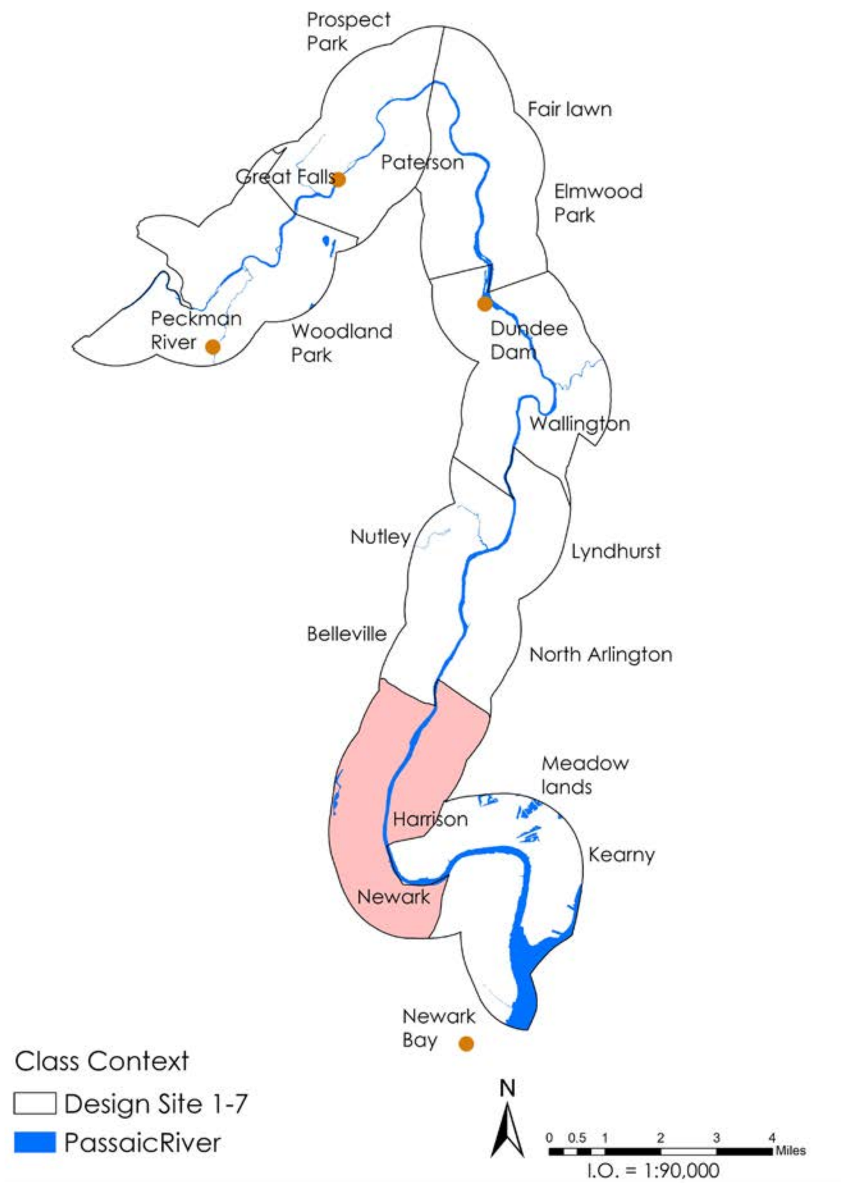


Site Six

By:Wooseok (Jacob) Choi, Alex Ciorlian, Adam Fricke

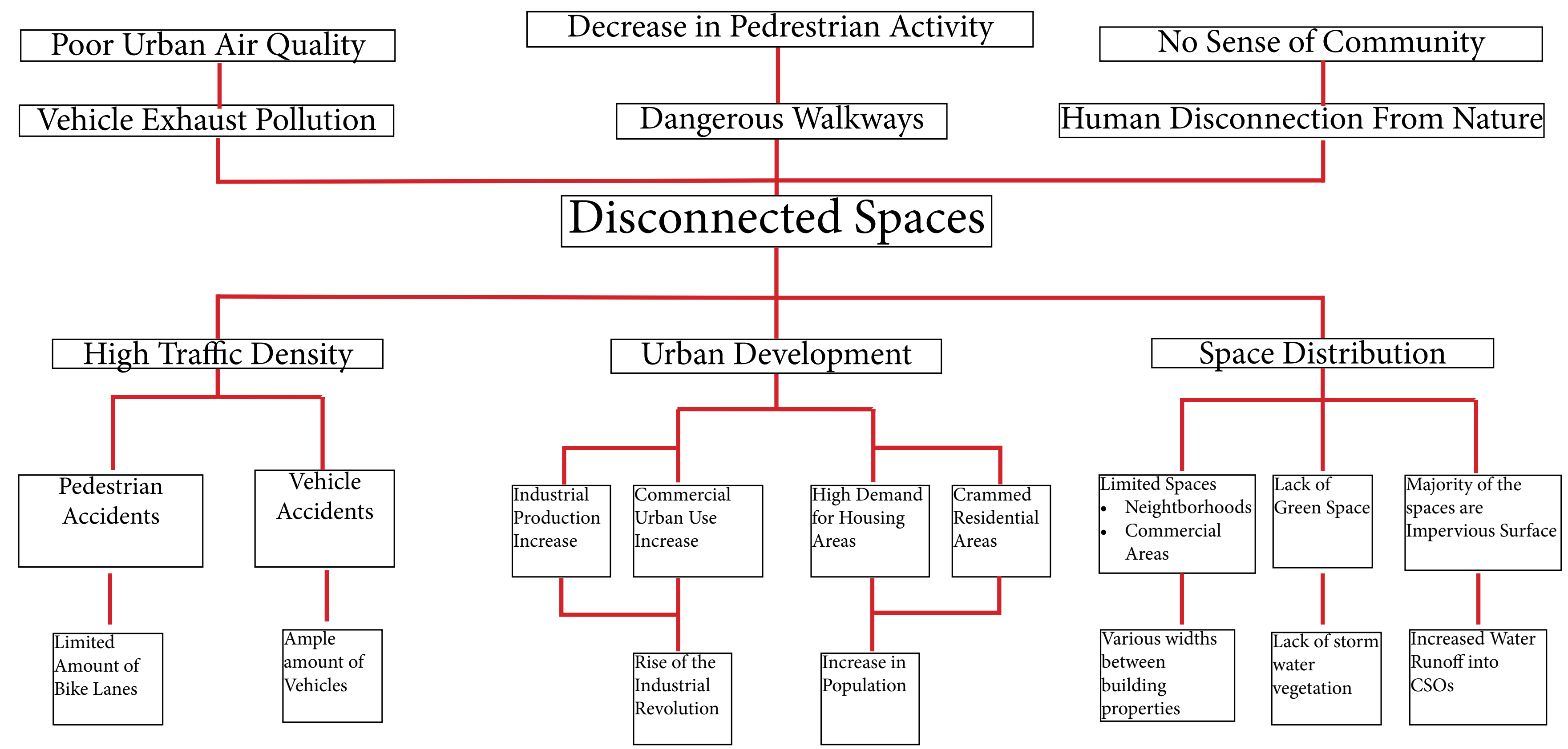
Photograph By: RDg Planning Design

Context Map

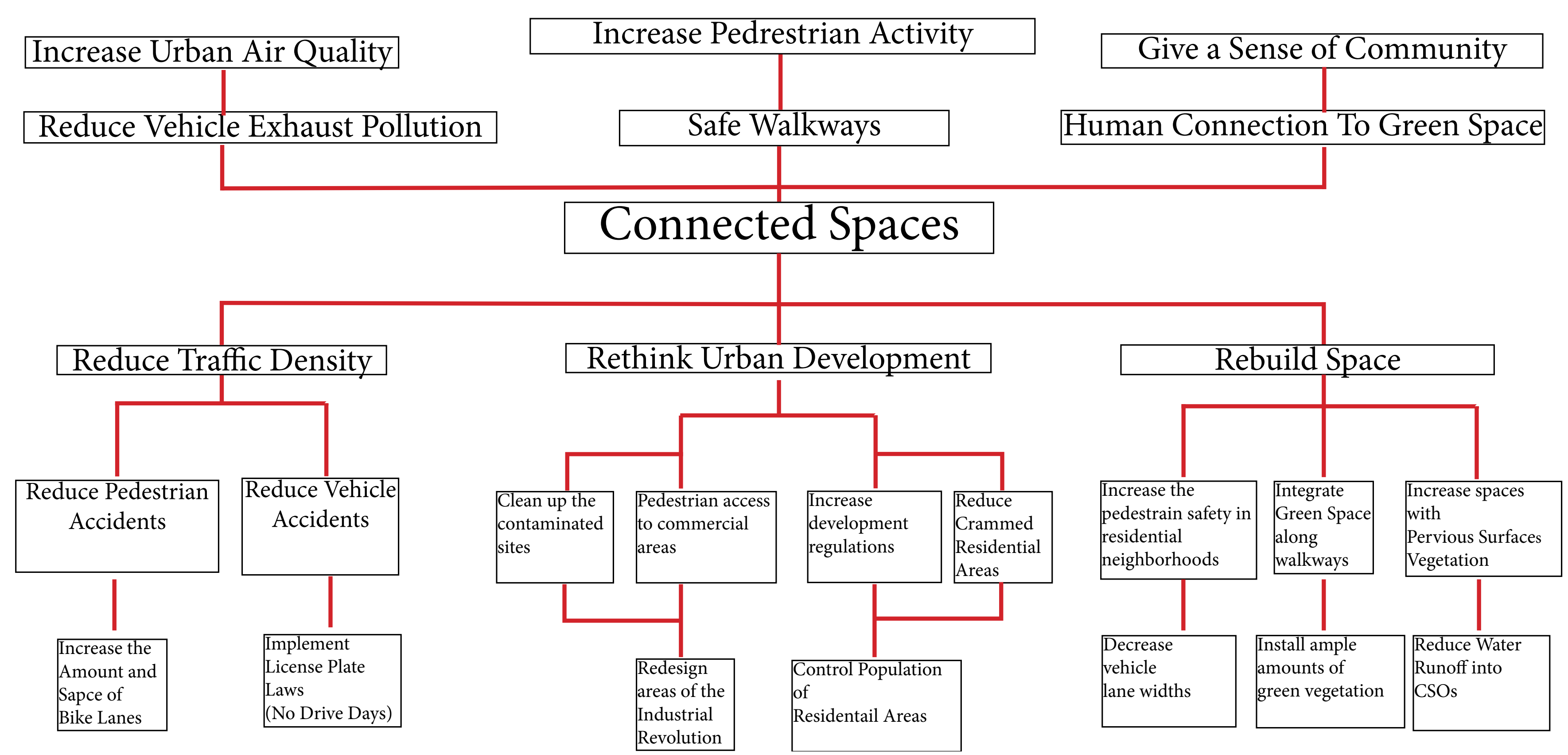


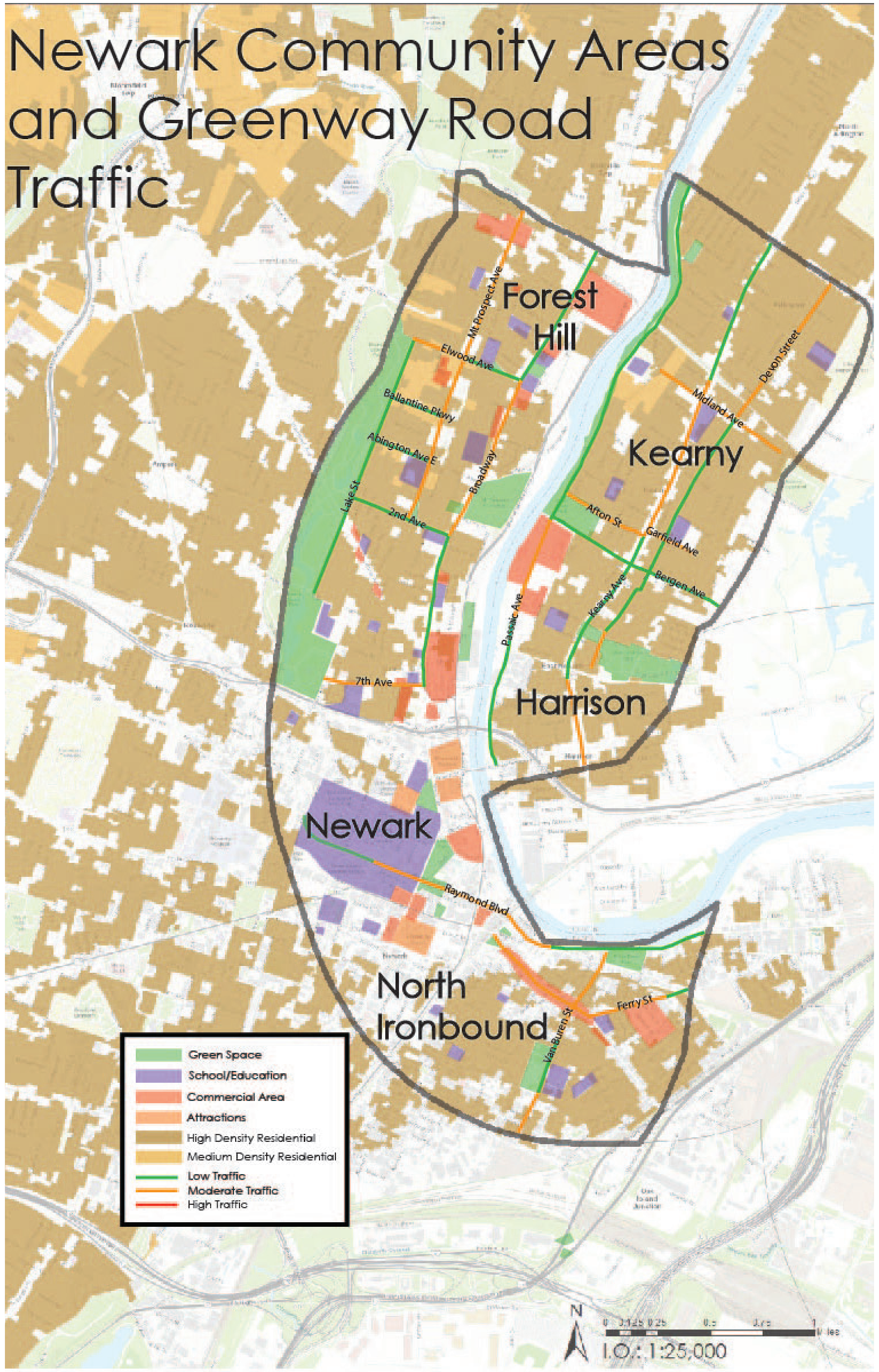
The goal of the site design is to connect existing and potential green space and use these connected paths for residents to travel and interact with the green spaces of Newark. Greenways can be created out of existing roads, unused railways, and trails. The plan is to connect these paths to focal points throughout the site such as schools, attractions, and commercial areas. Throughout these greenways, stormwater management systems will be installed such as rain gardens and bioswales. These installations will help reduce the amount of stormwater flow into the combined sewer systems and increase green infrastructure. The design focus is to increase safe pedestrian activity through reducing high traffic density, rethinking development, and redesigning streetscapes by adding more vegetation and bike lanes. The site contains areas of green space such as the parks and fields. The streetscape contain very little green vegetation besides street trees in decent condition. Implementing green infrastructure adds more green space for pedestrians to walk along and admire nature reconnecting to the urban environment. With proper maintenance and care, these greenways will flourish the entire site.

Problem Tree



Solution Tree





Forest Hill

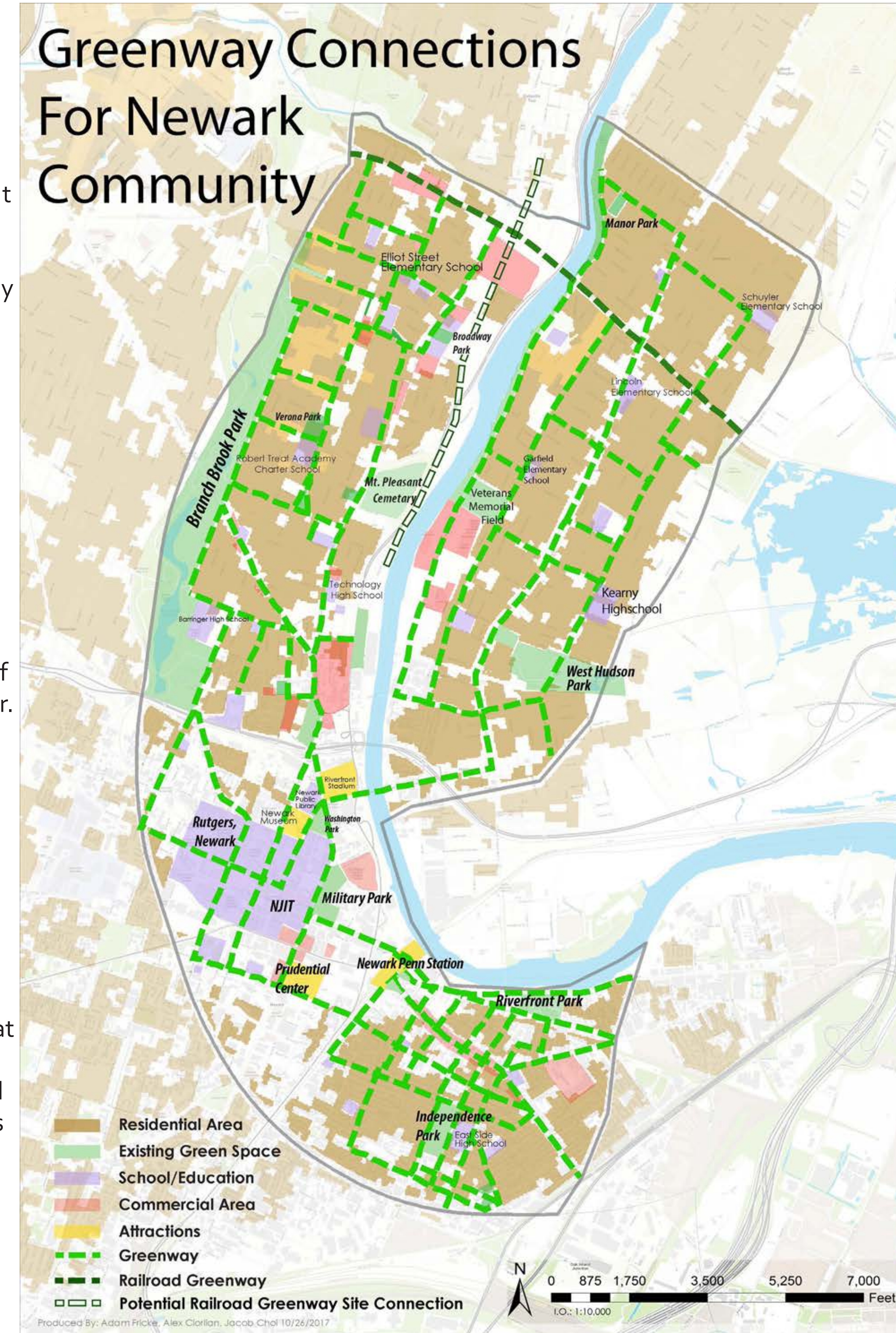
Forest Hill is an unincorporated community and residential neighborhood located within Newark, Essex County. It is bounded by Branch Brook Park from the west, by both Summer and Mt. Prospect Avenues form the east, and by Bloomdield Ave from the south.

Kearny

Kearny is a high residential area with many schools located. As a residential area, most streets are narrow, with some hills right next to the school areas. Also, there is an abandoned railway that is now covered with myriad of trees, yet this area is restricted to enter. This leads to the bridge that connects Kearny and Forest Hill.

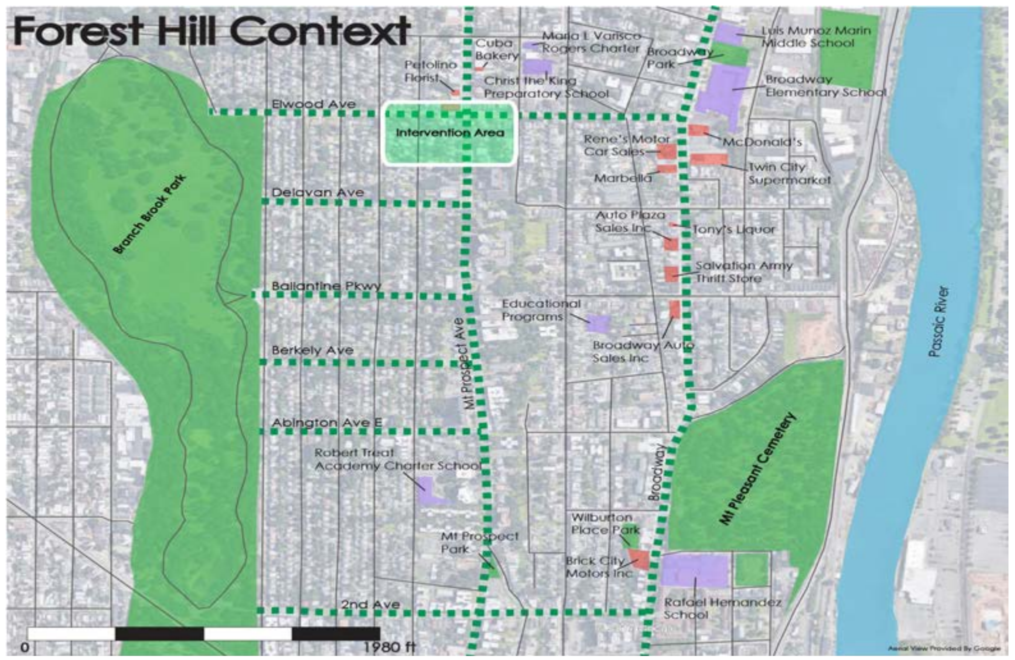
Ironbound

Historically, Ironbound recieved its reputation from the old, large metalworking industry and railyard that is now Riverbank and Riverfront Park. It is an unincorporated community and neighborhood within the city Newark's East Ward. It is a large working-class, close-knit, multi-ethnic community covering approximately four square miles.

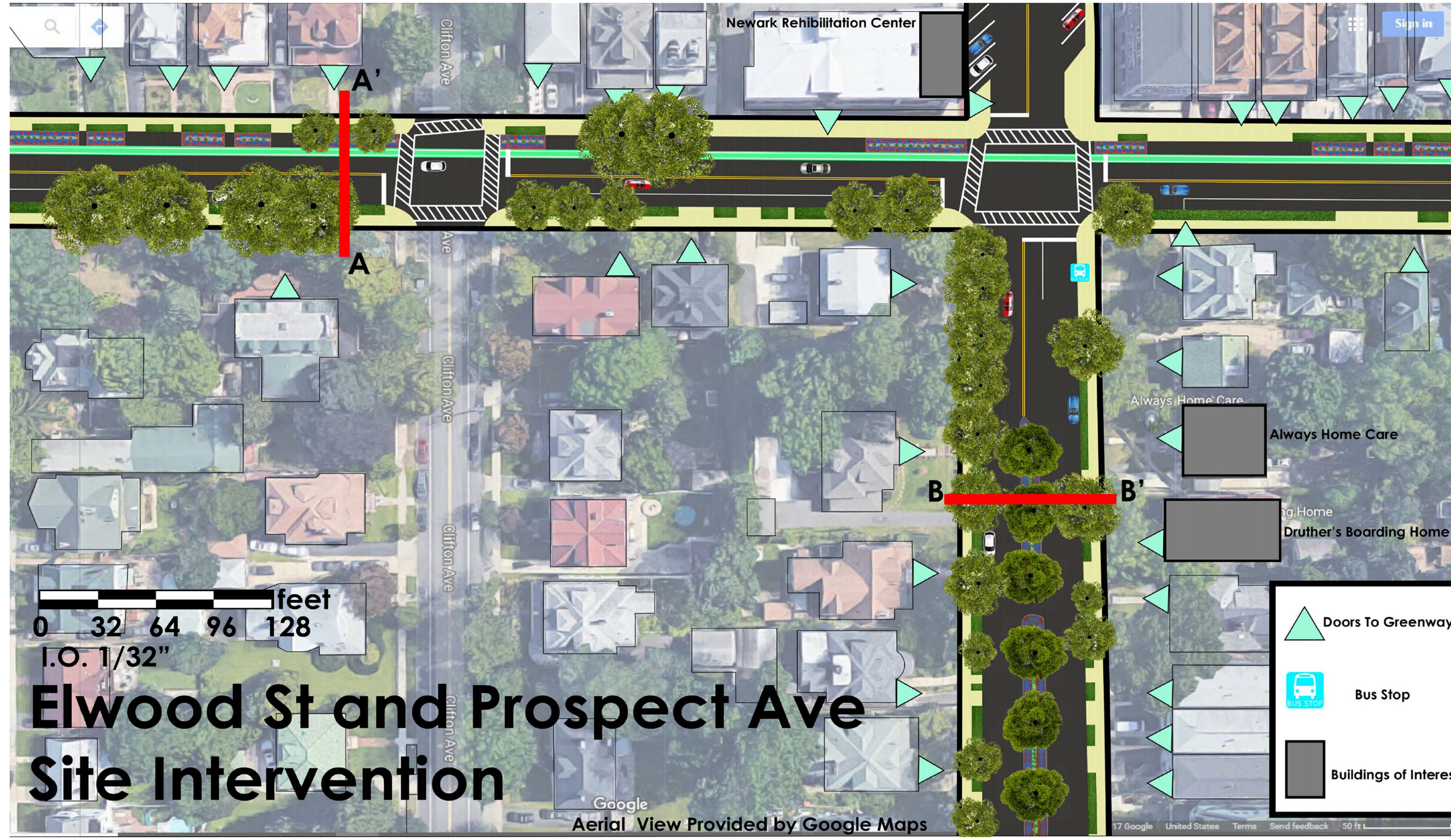


Forest Hill, Newark Intervention

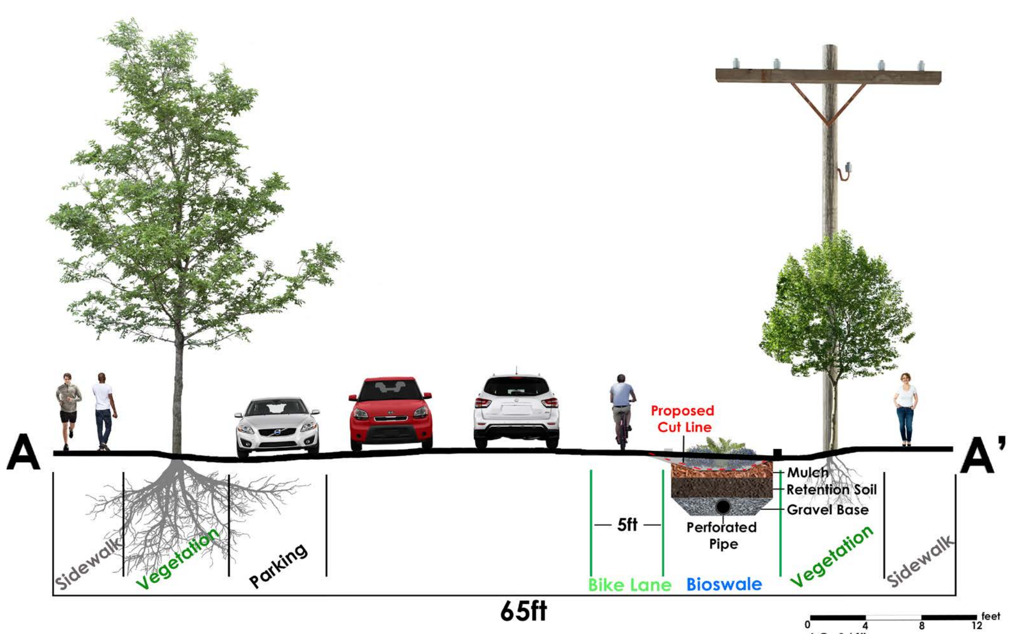
Adam Fricke



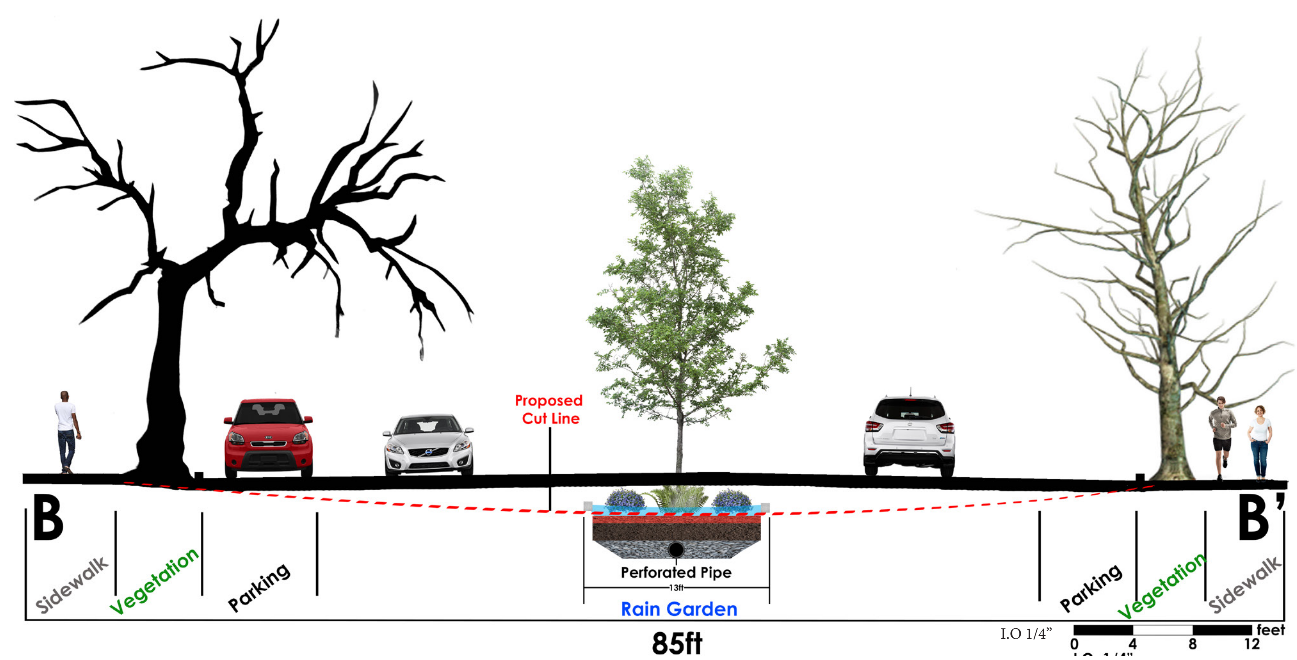
Context map of the Forest Hill area containing: potential greenways, existing green space, commericial areas, and community education areas.



Plan view of Elwood Ave and Prospect Ave intersection intervention.



From each end of the sidewalk Elwood Avenue is 65 feet in width. The streets parallel to it also have widths of about 65 feet. Keeping this in mind, the design intervention for implementin bioswales and a bike lane can be incorporated for more than one raod that lead to Branch Brook Park.



Mount Prospect Ave is an 85 foot long main road that runs vertically through the Forest Hill area. It intersects many of the roads that have potential for becoming greenways. For this area, the painted meridian strip can be used as a place for raingardens to accumulate runoff water.

Bioswale and Rain Garden Diagram

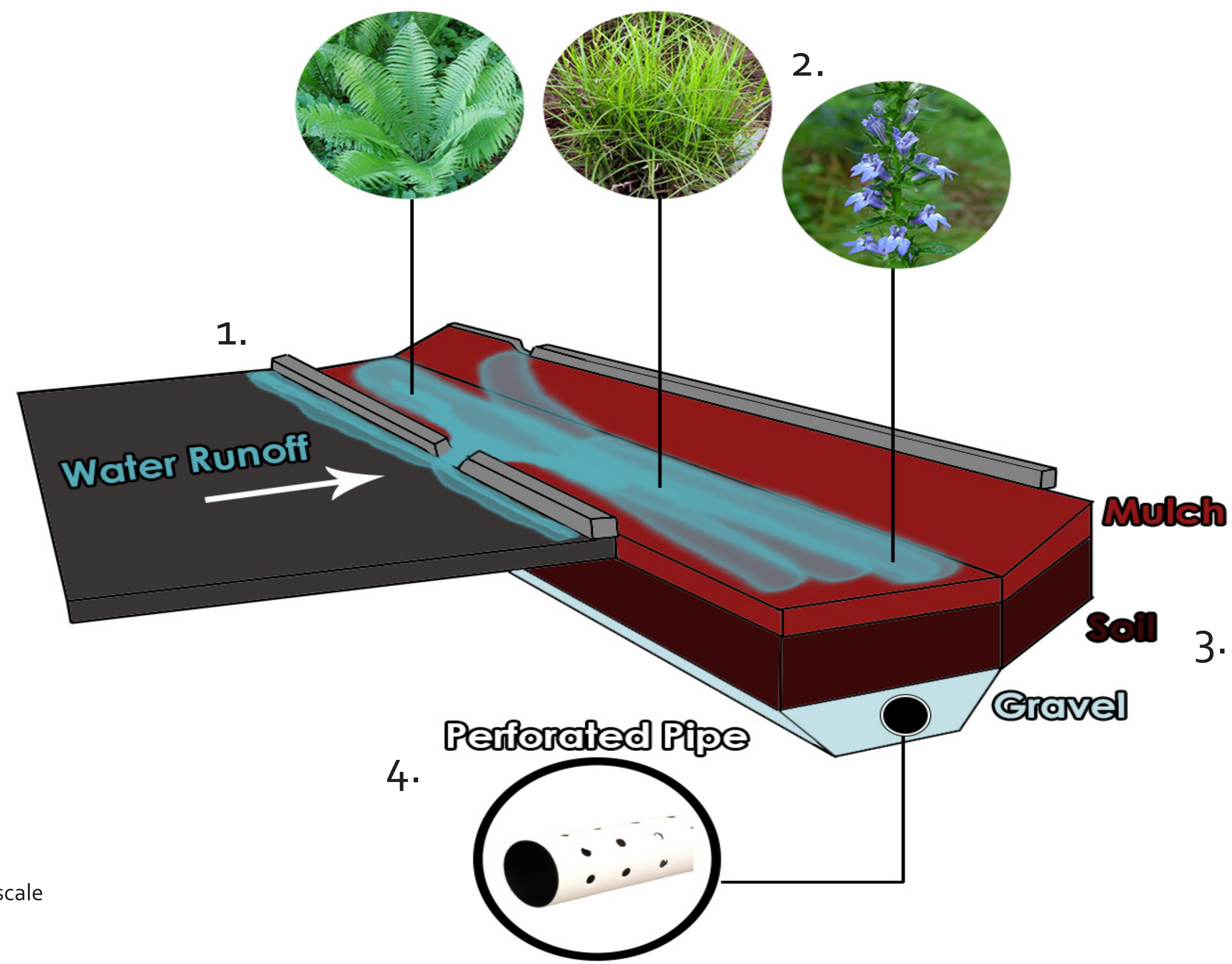


Diagram not to scale

1. Water Runoff

Areas around Newark shed large volumes of runoff water because of the amount of impervious surfaces in the area. Water that makes its way to the roads will infiltrate the system through openings in the curbs of the design. The water then will gather into a layer of plantings and mulch. From there, the phytoremediation process begins and contaminates in the water will attach and filter through the plantings in place.

2. Plantings

The plantings within the bioswale and rain garden systems will contain native water-tolerant plants that can handle the conditions of a stressful urban setting. They can range from perennials, ferns & sedges, and shrubs. Some plantings in mind to fill the swale are Lady Ferns (*Athyrium filix-femina*), Drooping Sedge (*Carex pendula*) Blue Lobelias (*Lobelia siphilitica*), Cardinal flowers (*Lobelia cardinalis*), and Dwarf Fothergillas (*Fothergilla gardenii*). These plants are important for the phytoremediation process and revitalization of green life in Newark.

3. Structural Layers

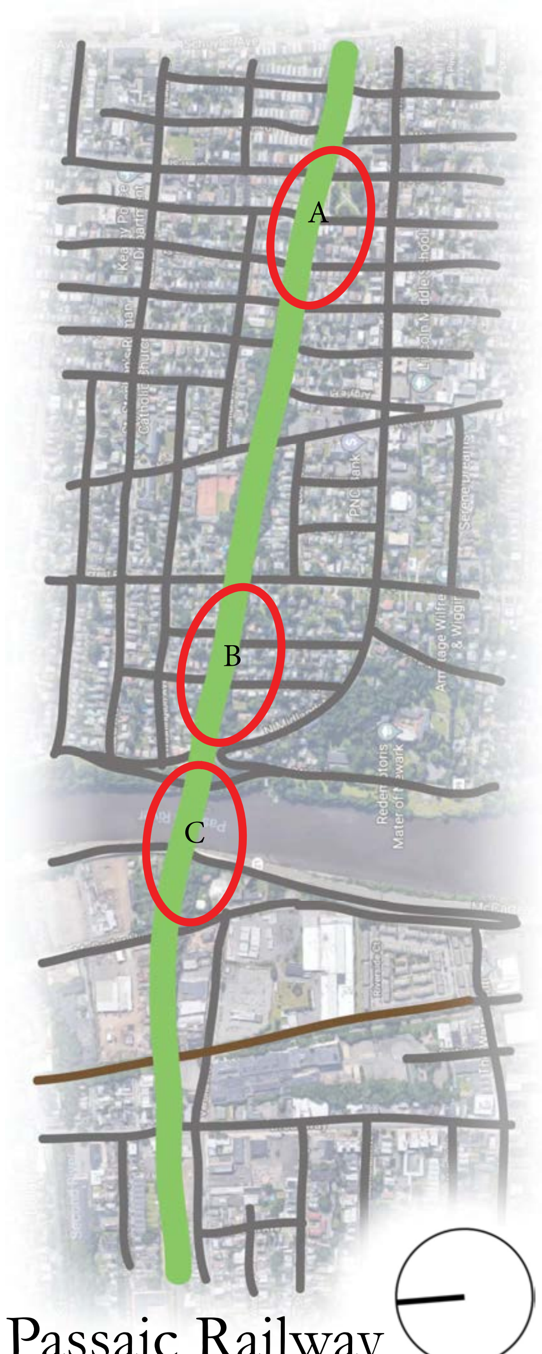
Mulch is the first layer of the system used to protect against germination and erosion control. Underneath this layer of mulch is retention soil. A native soil used for retention purposes will hold the runoff water to nurture the plants and act as a storage. As the water slowly drains through the soil, it enters a gravel layer. This layer provides an area for water to permeate through and also allows groundwater to flow through the channel. Once the runoff has passed through these three layers it enters the final stage of the system.

4. Perforated Pipe

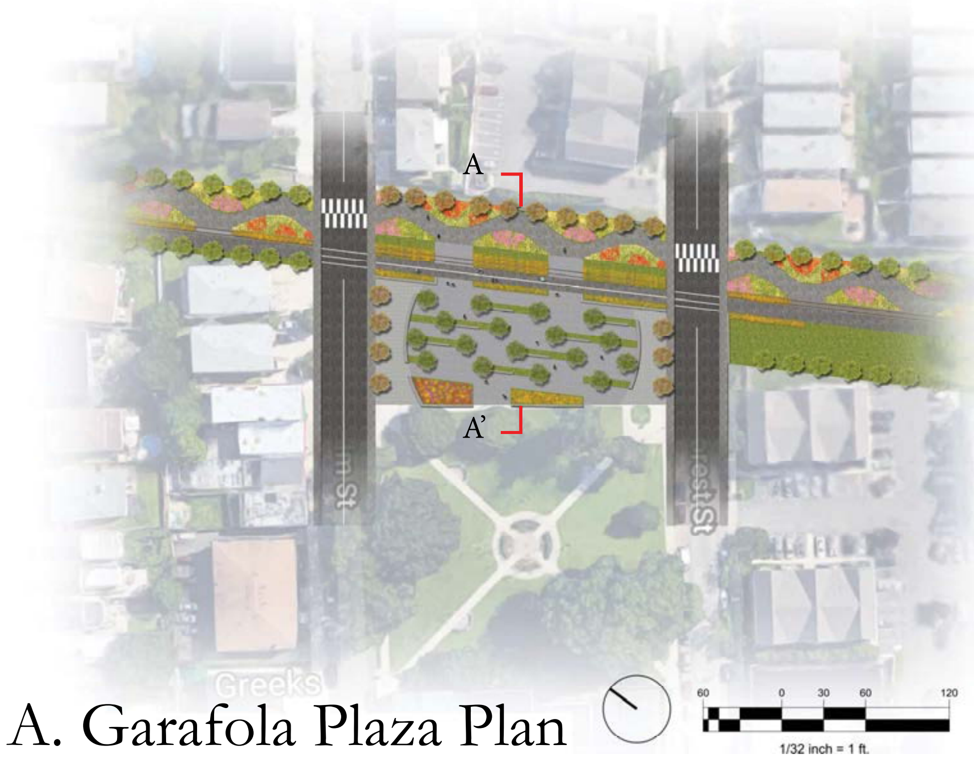
A perforated pipe allows water to enter and exit through the holes drilled throughout the pipe. This allows the pipe to serve two important purposes for managing water. Firstly, the pipe can drain water into specified areas within the design or for off-site areas. Secondly, water that travels through the pipe can be redistributed into other islands throughout the streets. This is beneficial for areas that do not get much runoff compared to other areas because the water can be better distributed.

Passaic Railroad Walkway

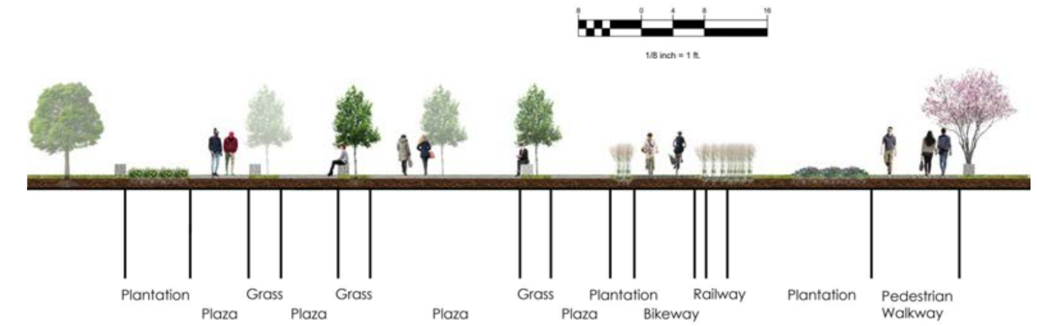
Along the Passaic River, through Kearny to Forest Hill regions across the bridge, there is an abandoned railroad that is currently covered with trees and forests. The bridge is completely closed, the forest is prohibited for close neighbors to enter, and some parts of the open space only remain as dearth.
By renovating this abandoned railroad into railroad walkways and bikeways, people could get across the river, connecting the Branch Brook Park and Kearny residential area, or even further to Newark city.



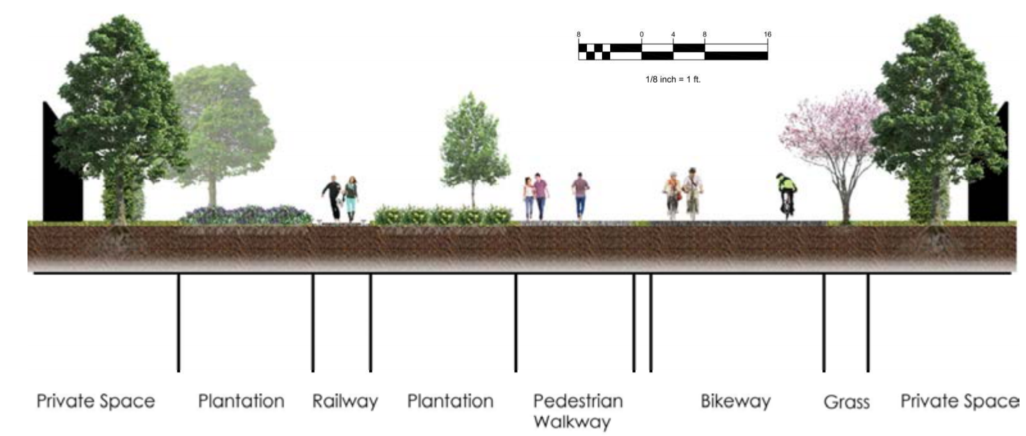
Passaic Railway



A. Garafola Plaza Plan



A. Garafola Plaza Section A-A'

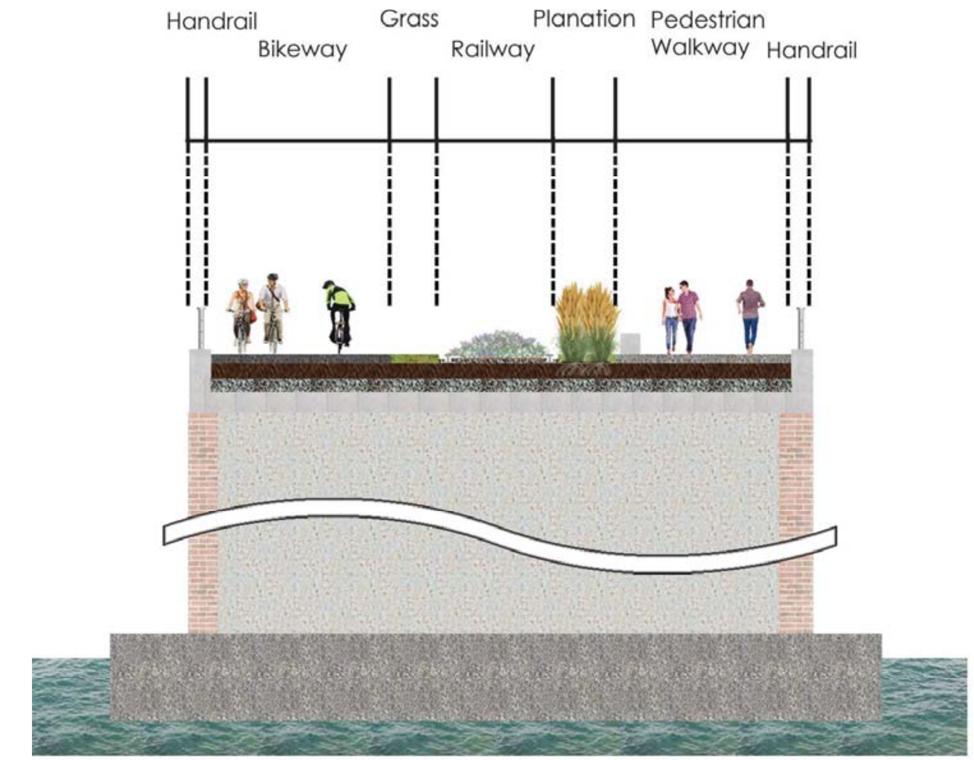


B. Passaic Railway Section B-B'

B. Passaic Railway Plan

Wooseok (Jacob) Choi

C. Passaic Railway Bridge Plan

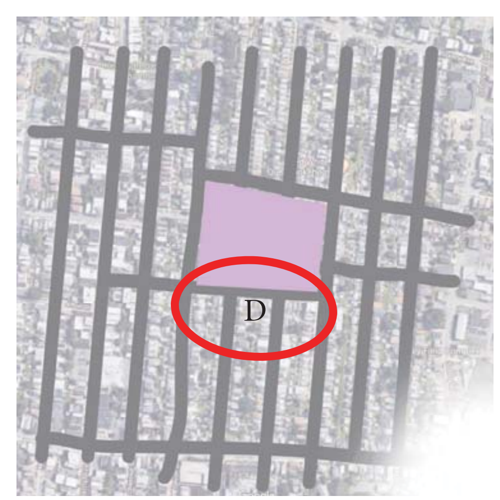


C. Passaic Railway Section

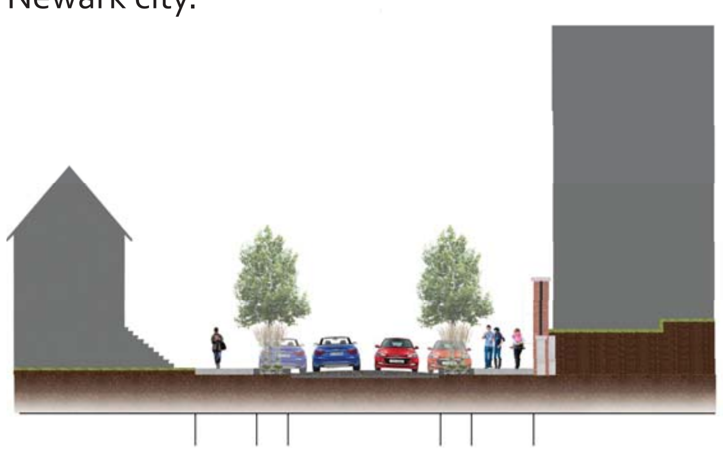
1/4 inch = 1 ft.

Garfield Avenue 55’ Street

Along the Passaic River, through Kearny to Forest Hill regions across the bridge, there is an abandoned railroad that is currently covered with trees and forests. The bridge is completely closed, the forest is prohibitted for close neighbors to enter, and some parts of the open space only remain as dearth.
By renovating this abandoned railroad into railroad walkways and bikeways, people could get across the river, connecting the Branch Brook Park and Kearny residential area, or even further to Newark city.



Garfield Avenue



1/8 inch = 1 ft.

D. Garfield Avenue Section D-D’

D. Garfield Avenue Plan

1/64 inch = 1 ft.

Wooseok (Jacob) Choi

Raymond Boulevard

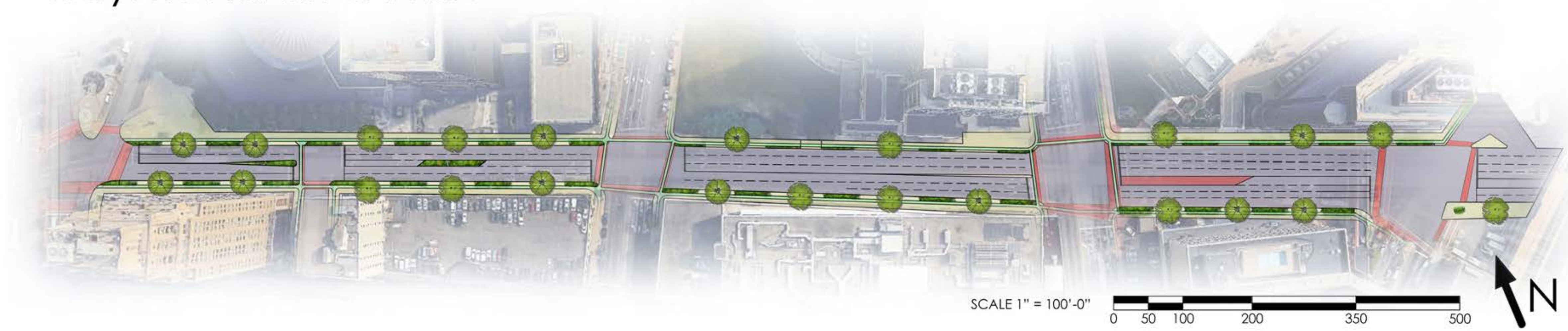
Site Design Intervention

Alex Ciorlian

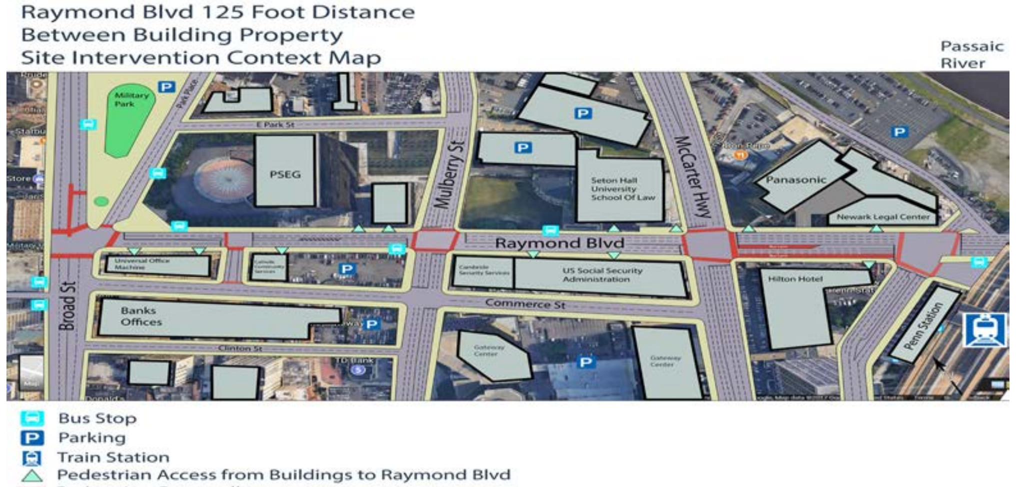
Raymond Boulevard is a high traffic street that is located near the major transportation hub Newark Penn Station. According to NJ Transit, the hub hosts almost 30,000 commuters a day. These commuters travel to and from Newark as well as to New York City. The site intervention is to help provide a safe and acessible mode of transportation for pedestrians to the hub and office buildings along Raymond Blvd. In addition to the design, a secondary intent is to provide a stormwater management system with rain gardens and bioswales along the street while adding more green elements to the streetscape.

Ferry Street is located in a high commercial area with stores, restaurants, and businesses lined up all along the street. Van Buren Street goes through the street which leads to Riverfront and Independence Park. The goal of the design is to implement better stormwater management systems by taking advantage of the existing street "bump-outs". Using the bump-outs as a guideline, rain gardens and bioswales are installed in the existing parking spots. Parking is reduced as green infrastructure is increased.

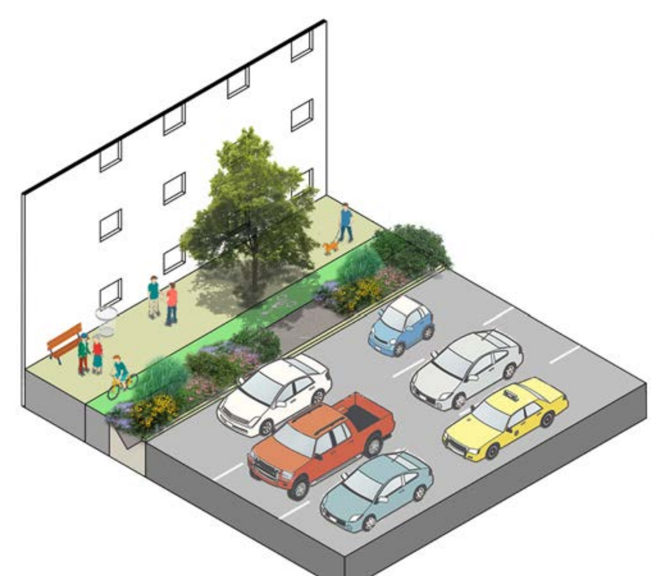
Raymond Blvd Plan



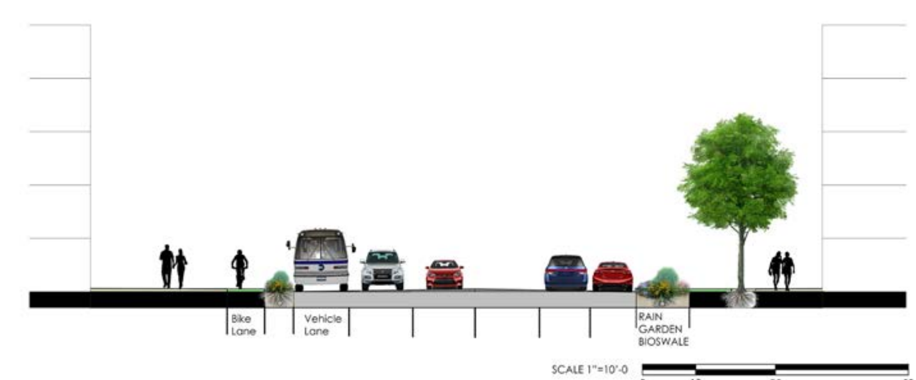
Raymond Blvd 125 Foot Distance Between Building Property Site Intervention Context Map



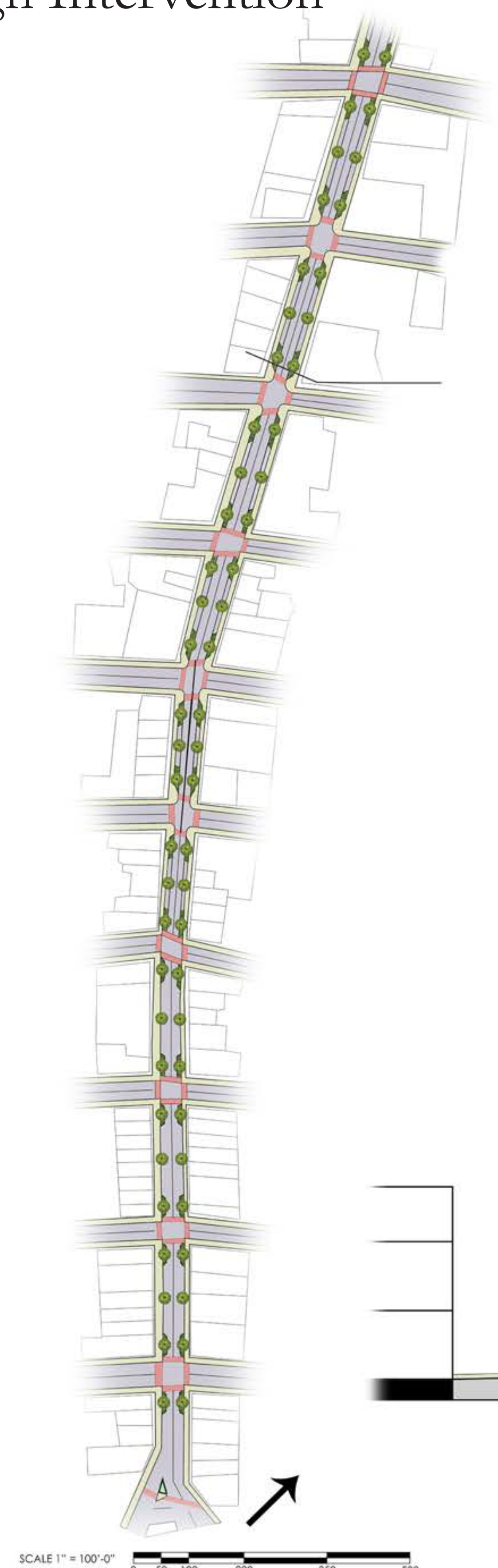
Axonometric Perspective



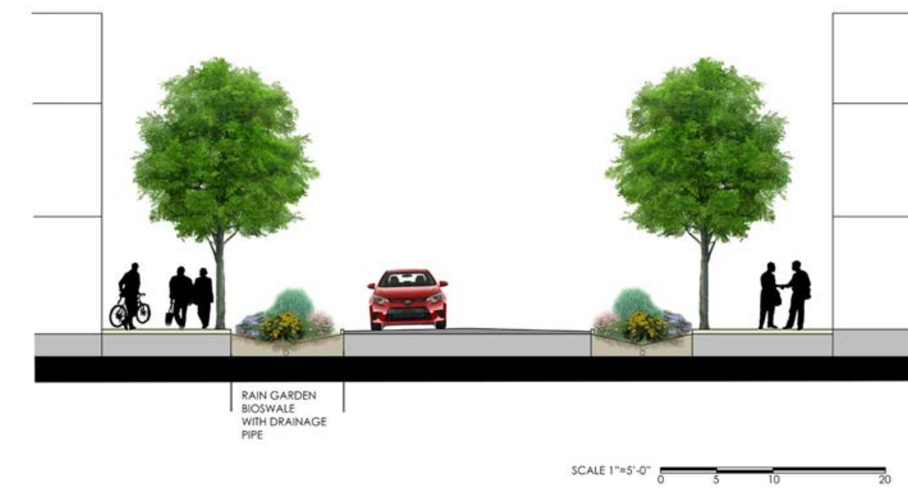
Street Section



Ferry Street
Site Design Intervention
Alex Ciorlian

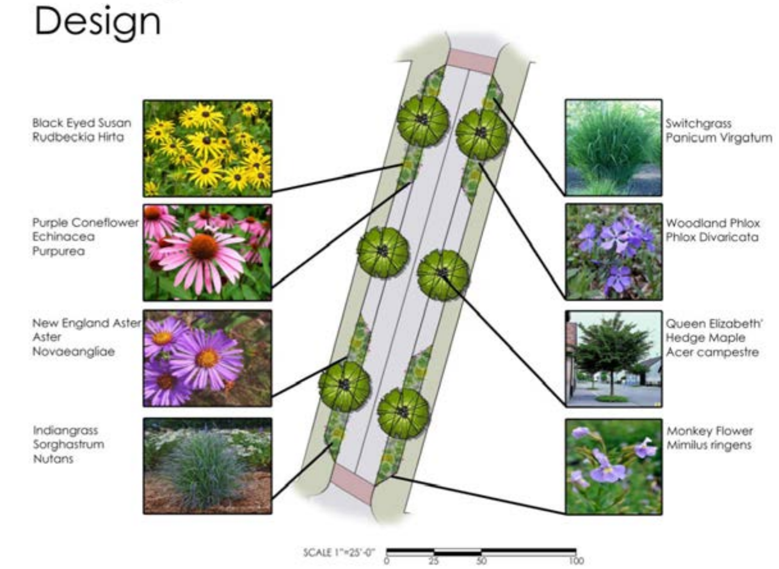


Ferry Street 65 Foot Distance Between Building Property Site Intervention Context Map

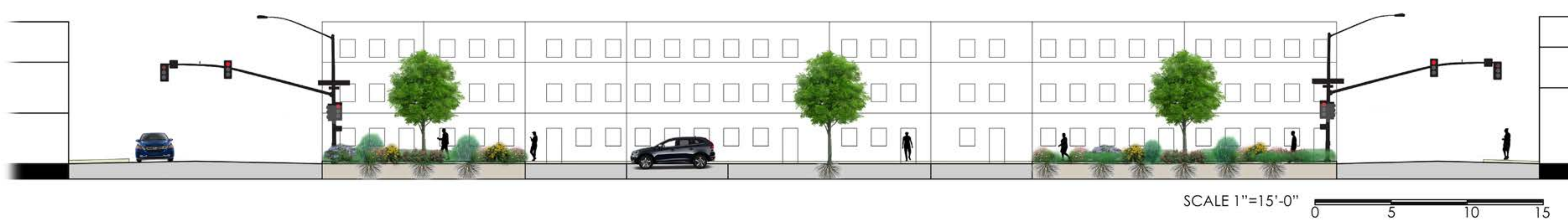


Street Section

Planting Design



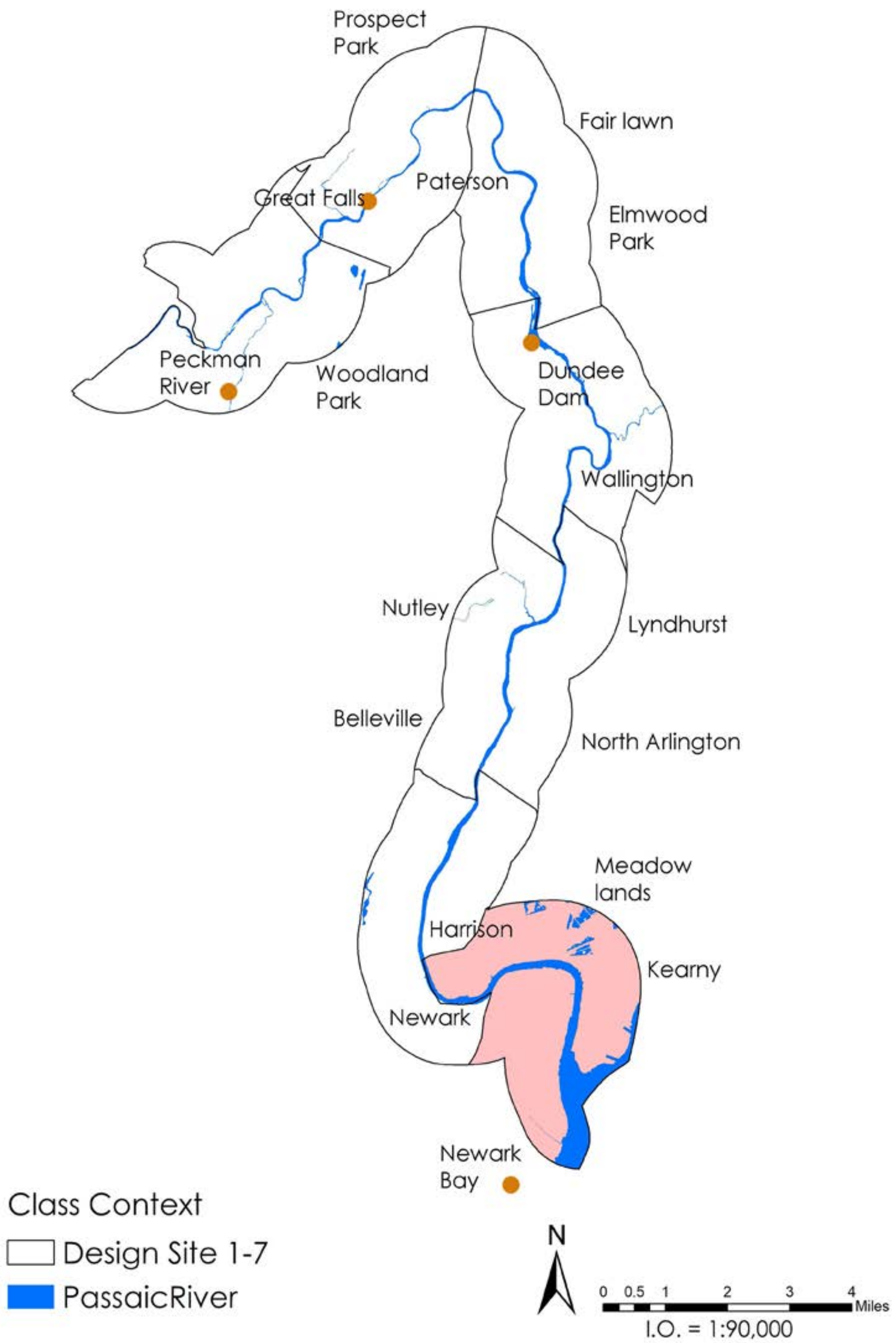
Street Section



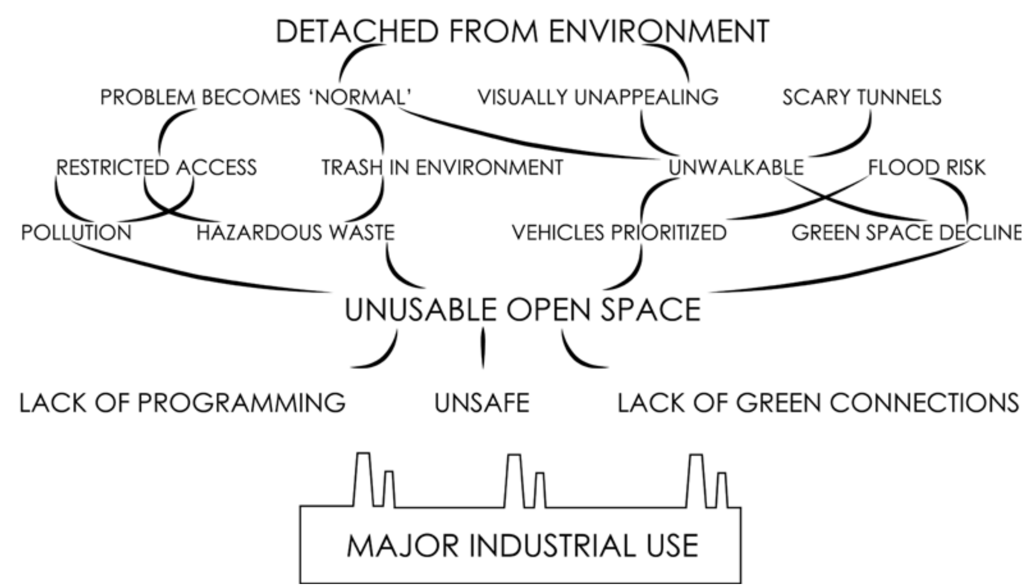
Site Seven

By: Anna Erickson, Diosmiry Rodriguez, Nanik Song

Context Map



Problem Tree

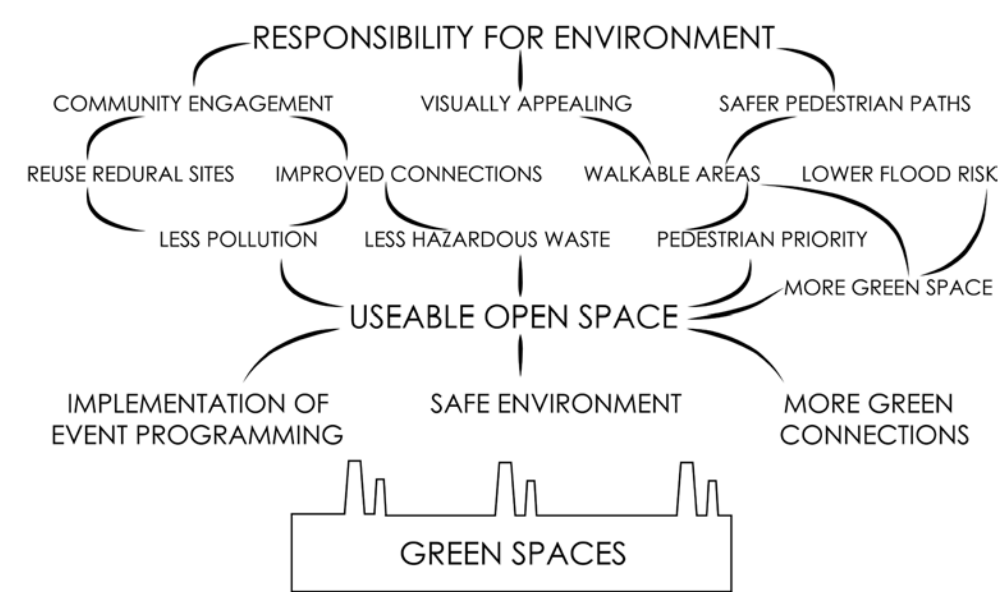


Site Seven is located at the end of the Passaic River. Its conditions consist of tidal zone (meaning salt water), high levels of contamination, and lots of impervious area. It contains portions of the Meadowlands as well as the Newark Bay, and near the Newark Liberty Airport, which introduces its own challenges into the mix.

Site Seven also contains the former location of the infamous Diamond Alkali industry, known for being one of the main producers of Agent Orange, as well as the byproduct that now contaminates much of the area, dioxin.

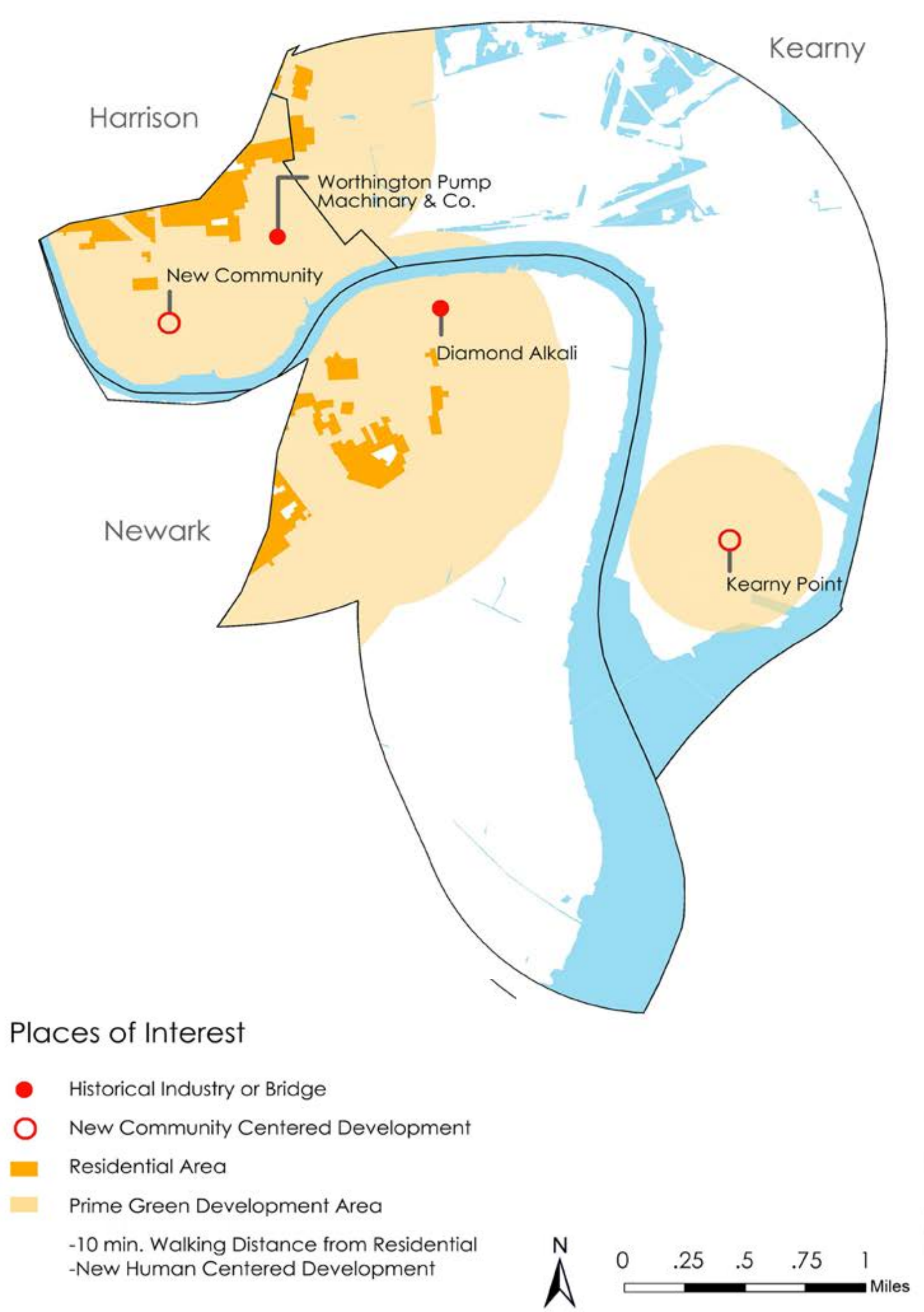
Today the area is undergoing remediation; Diamond Alkali has been closed down and capped, with new businesses moving into its former location. Newark, Harrison, and Kearny are undergoing redevelopment, transitioning from older infrastructure to more sustainable and modern cities.

Solution Tree

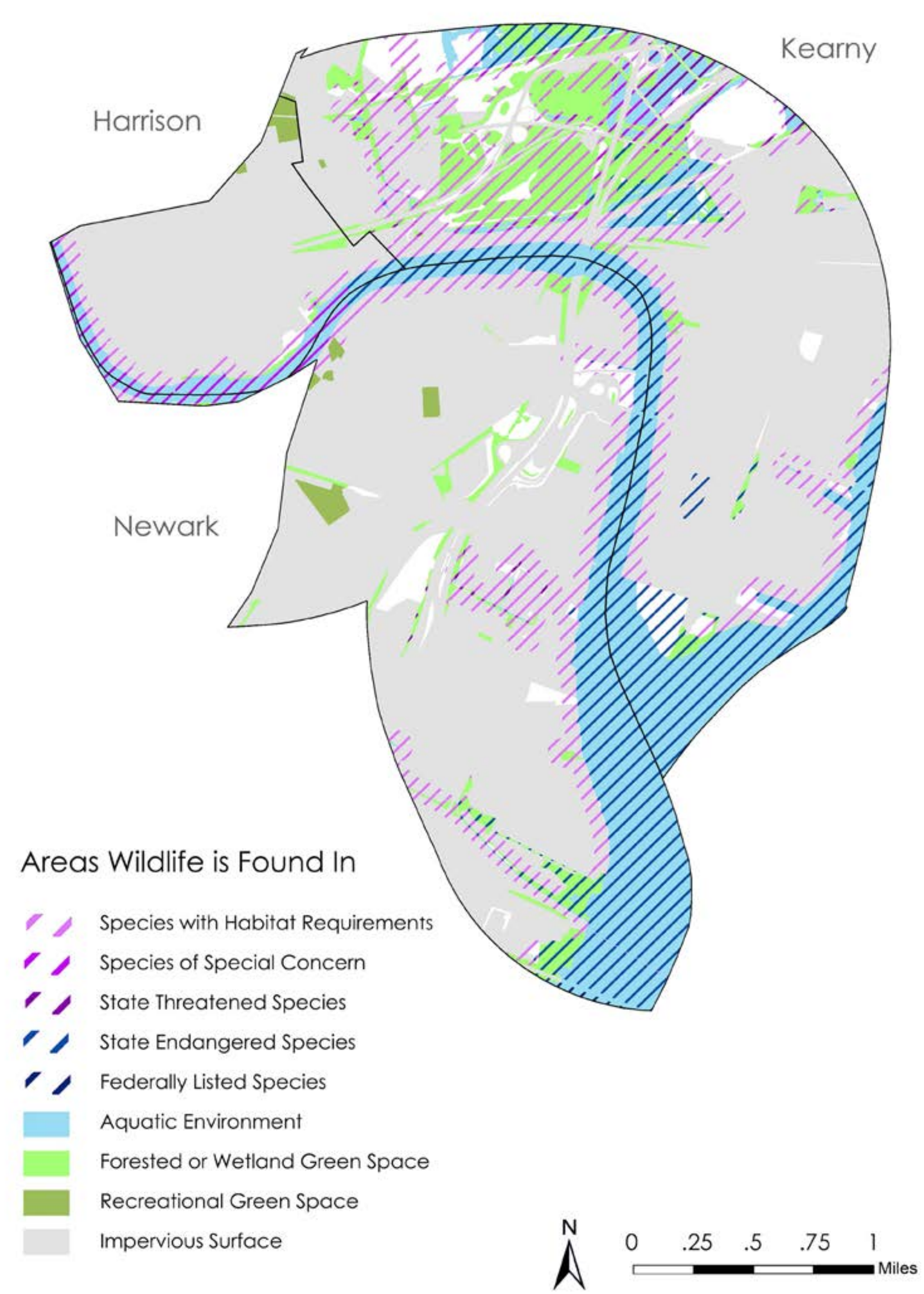


The problems that we focused on were the noticeable detachment from environment and unusable open space, as well as the large amounts of impervious surface, which only exacerbates the issue of flooding in an area that is already topographically vulnerable. In order to reconnect residents with public spaces and engage them in storm water management practices, it is important to make these solutions not only visible, but appealing for people at all levels, from households to businesses. Habitat considerations are also important so as to make sure the design is focused on everyone in the community- not just the people, but also the plants and animals who we share the space with. Sustainable infrastructure should also be embedded into the framework of the cities whenever and wherever the opportunity presents itself.

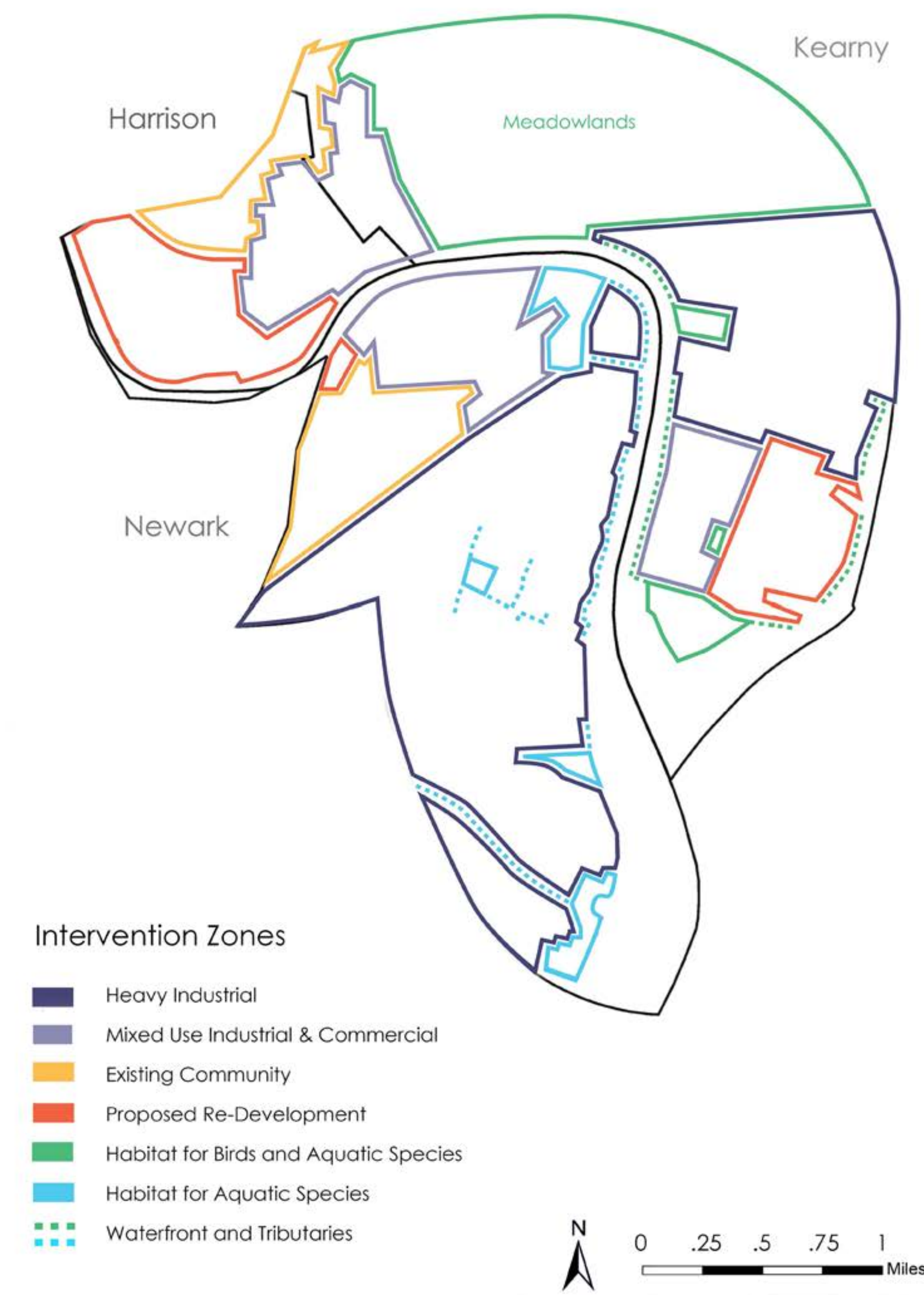
Places in Range of Pedestrian Walkablity



Risk Level of Wildlife in Habitat Areas



Suitability Assessment for Intervention Type



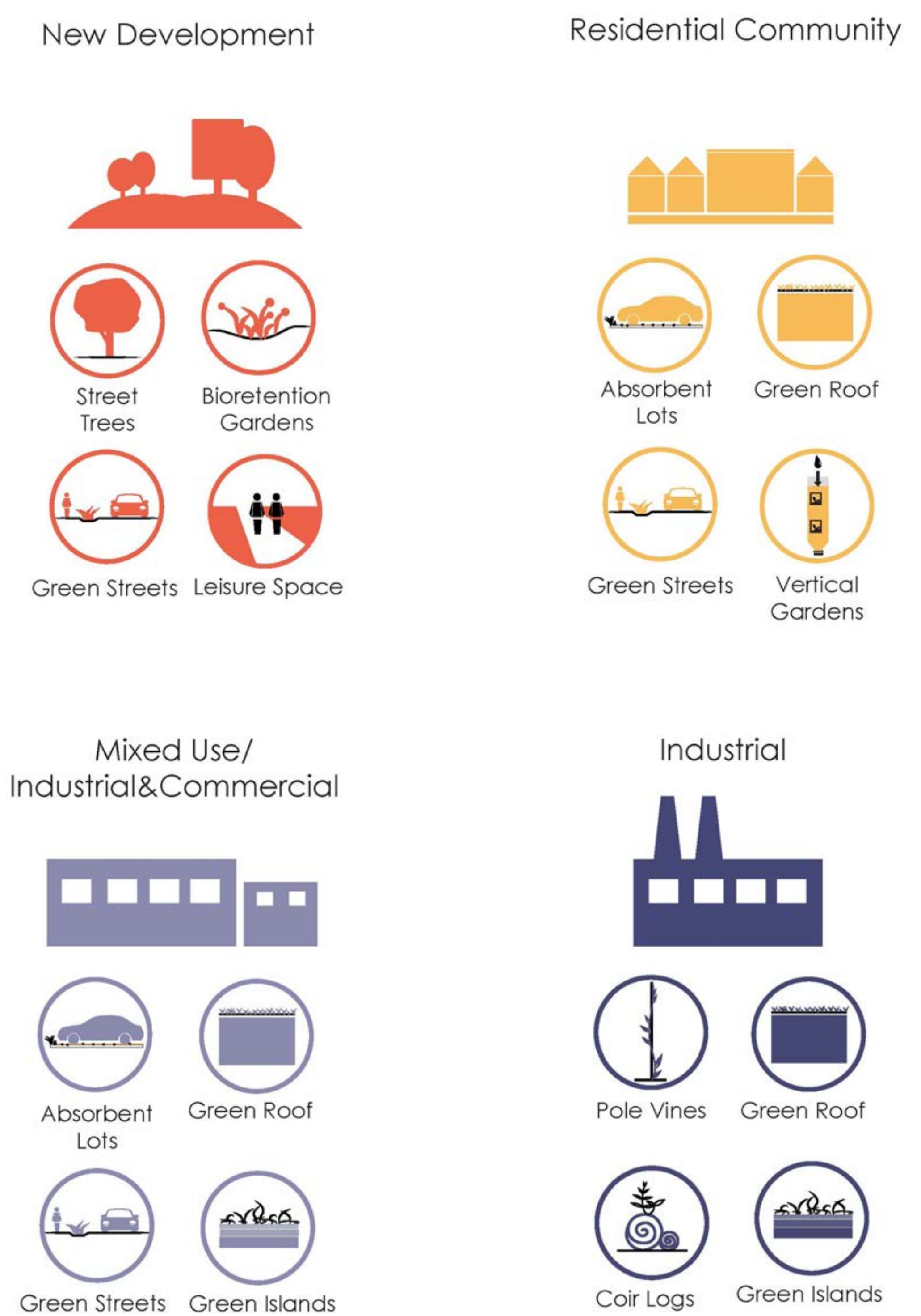
We first located our residential areas and gathering spaces on a large scale. Kearny Point is a developing business center with a waterfront park, and the new community in Harrison will feature a park as well. Residents live mainly to the north-west and a half mile buffer around these areas show a 10 minute walking distance where pedestrian safety and ease of transport is most important.

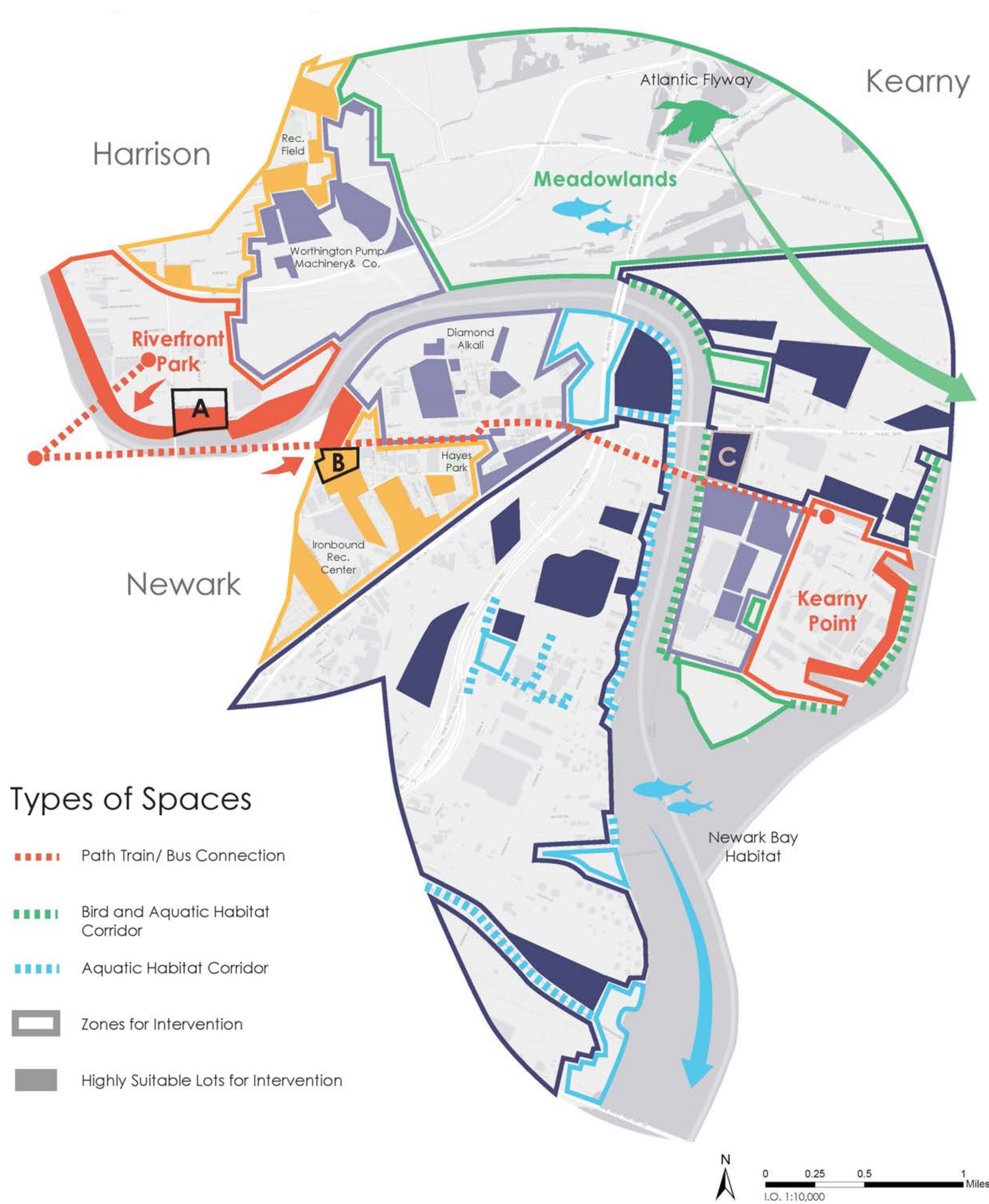
Our wildlife intervention's goals are to help protect endangered species habitat, as well as improve the existing habitat quality. Most of the known wildlife in site seven rely on aquatic ecosystems, either living within the water or resting along the banks. There are residential species as well as migratory ones, and the Meadowlands serve as an important stopover on the Atlantic Flyway.

The site has been broken into various types of intervention after comparison of the pedestrian and wildlife suitability analyses. It is important to have interventions specific to each zone, as each area has its own challenges. A solution suitable for an industrial area may not be well-suited for a residential area, and vise-versa. It is important to keep in mind the spirit of the community in design.

Site 7 Master Plan

Reconnecting People to the River; An Urban Approach





Site Seven introduces a number of difficulties into design, not the least of which was the question of how much space we want to change. We wanted to keep the alteration of the space's usage to a minimum, and thereby create less disturbance to the existing structure of the social and economic structure of the community. At the same time, we believe in the importance of cohabitation with wildlife. For this reason, we intend to improve the conditions of areas wildlife frequent, such as the Atlantic Flyway and Newark Bay habitat.

For this purpose, we created corridors between habitat and industrial zones, as well as separated the human-oriented intervention from the wildlife-based intervention. There is the Meadowlands Conservation Trust, which is dedicated to conserving the quality of the ecological community in its current jurisdiction, mainly focusing on the Hackensack River watershed area. As their goals align with our own, it would be optimal for them to spread further south and into Newark Bay.

To avoid conflicts with the airport in Newark, we have also focused on making the eastern side of the river more desirable for avians. The Passaic River in general will undergo habitat improvements to make it a more viable space for aquatic communities.

We have broken up the rest of the site into 4 different categories of intervention; new development, existing residential, mixed use, and industrial.

For the new development area, we have placed more emphasis on storm water remediation. By building it into the framework of the city, it becomes easier to handle large storm surges, and lessens the amount of non-point pollution produced.

Residential communities benefit from rain water disconnection incentives to improve storm water management in older locations where it may not be feasible to build new infrastructure. We have also enhanced pedestrian walkability and connectivity to parks and green spaces.

Industrial regions are highly impermeable, and so benefit most from more greenery, and a wider variety of plants. The inclusion of more diverse plants serve multiple functions, such as increased transpiration to help handle storm water, as well as providing food and habitat for wildlife.

Mixed use areas are combinations of these interventions, and therefore use a mix of the described interventions.

Sustainable Green Roof
Image: Green Roof Kinnard Primary School - C Bauder

Vertical Container Gardening
Image: Prof. Dr. Willem Van Cotthem (University of Ghent, Belgium)

Urban Plants Growing in between Paving
Image: Nanik Song

Site A

New Development Intervention

By: Diosmiry Rodriguez

Goals:

1. Reduce CSO overflow

2. Enhance the aesthetic value of existing pedestrian streets to allow coonectivity to future proposed waterfront

Intervention:

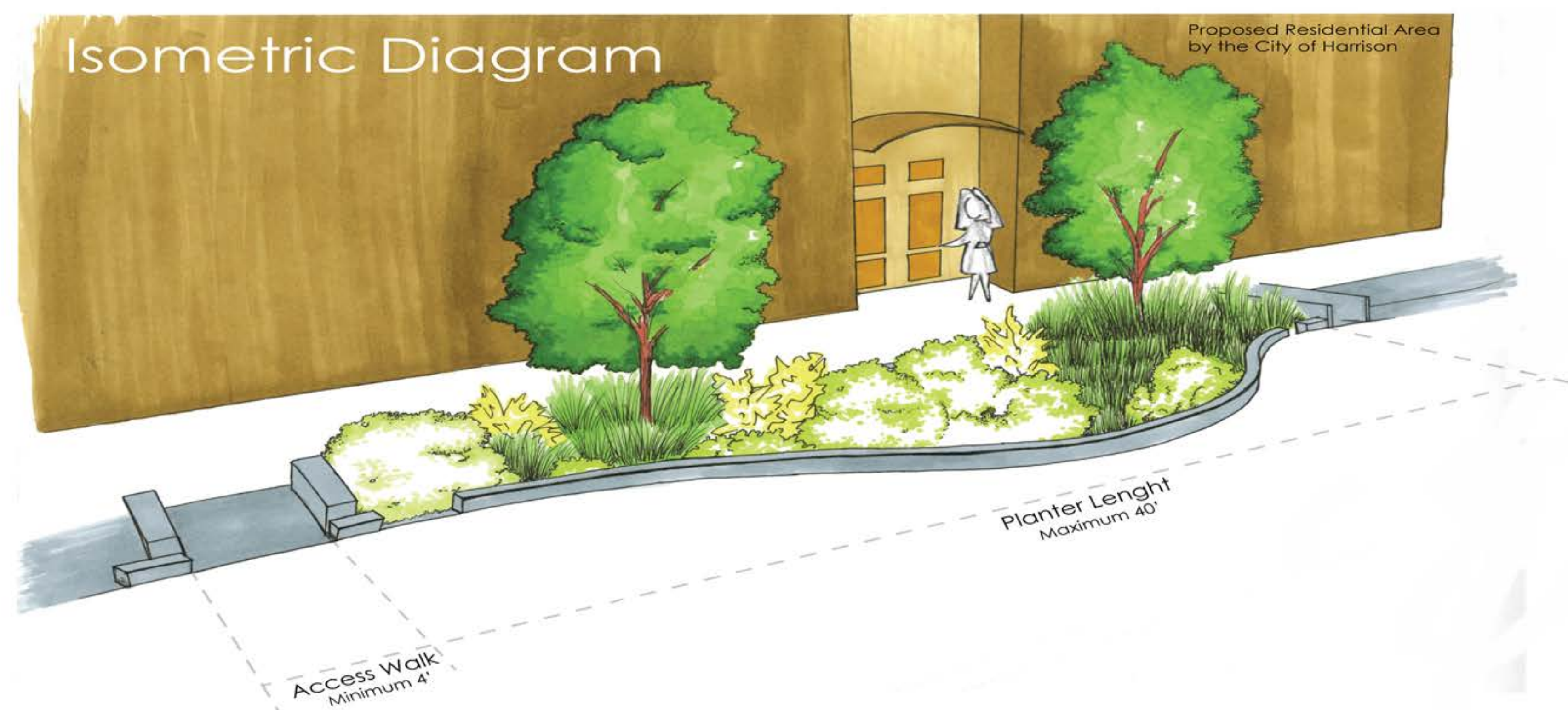
1. Reduce the amount of stormwater runoff going into the CSOs with Bioretentions and plant materials.

2. Create Bioswale bumpout that is environmentally valuable to the site and aestheically pleasing view for the pedestrants who are either residing in the area or visiting.

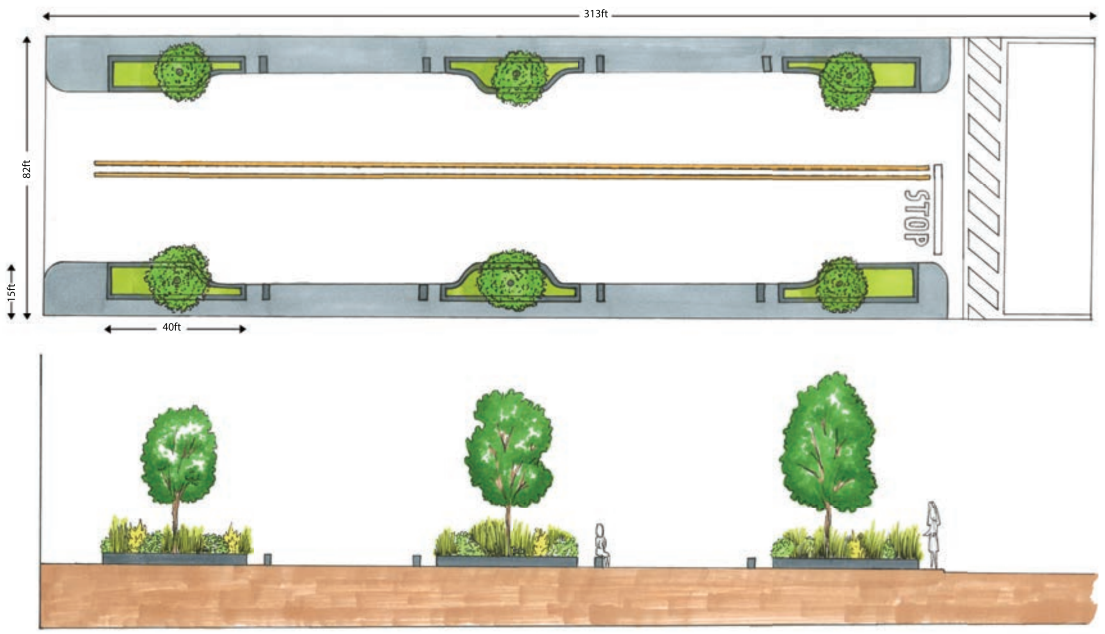
Site A focuses on new development intervention. In this site, the city puts most of its attention on the Red Bull Arena and the construction of the new residential areas, but one major thing is being left out. Streets. Streets are being negleted and the amount of impervious surface they take up is vast. Site A Plan proposes to create “greener streets” that addresses not only the aesthetic value of the area but also the stormwater runoff.

Green Street Bumpouts are a perfect addition to break through the impervious surface and create a great amount of space dedicated to bioretentions and plants.

A bioretention system consists of a soil bed planted with suitable non-invasive (preferably native species) vegetation. Stormwater runoff entering the bioretention system is filtered through the soil planting bed before being conveyed into a cistern. Once it is full, the excess water will release the water into an existing sewer system. Vegetation in the soil planting bed provides uptake of pollutants and runoff. It also helps maintain the pores and associated infiltration rates of the soil in the bed. Deep-rooted native plants are preferred for infiltration and reduced maintenance.



Plan View and Section Cut



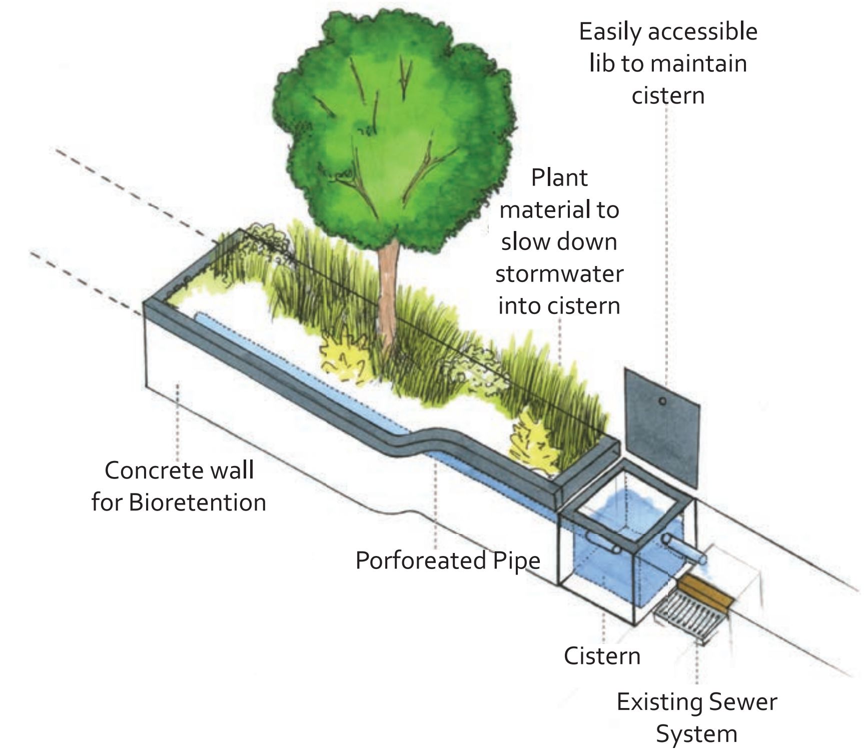
Pete Higgins Blvd

Proposed Main Green Street

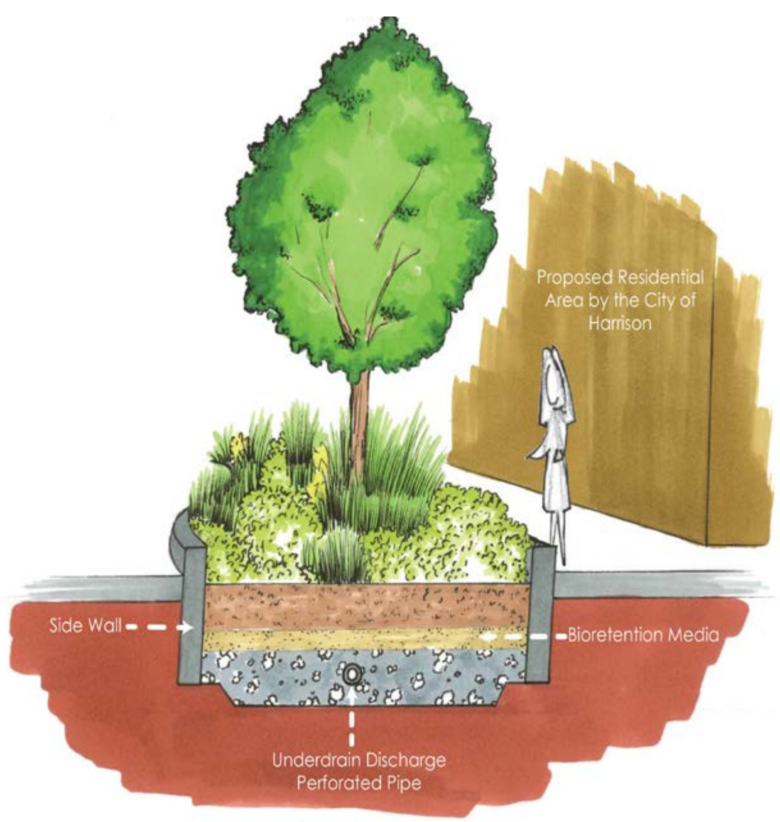
Pete Higgins Blvd

The above diagram provides a clear view of spacing and layout of the proposed bioretentions. The planting adds aesthetic value that establishes a unique sense of place (especially when featuring plants native to the area). It encourages environmental stewardship and community pride. It also provides a host of additional environmental benefits such as habitat for micro-wildlife and native plant varieties, improving air quality, reducing energy use, mitigating and reducing storm water runoff.

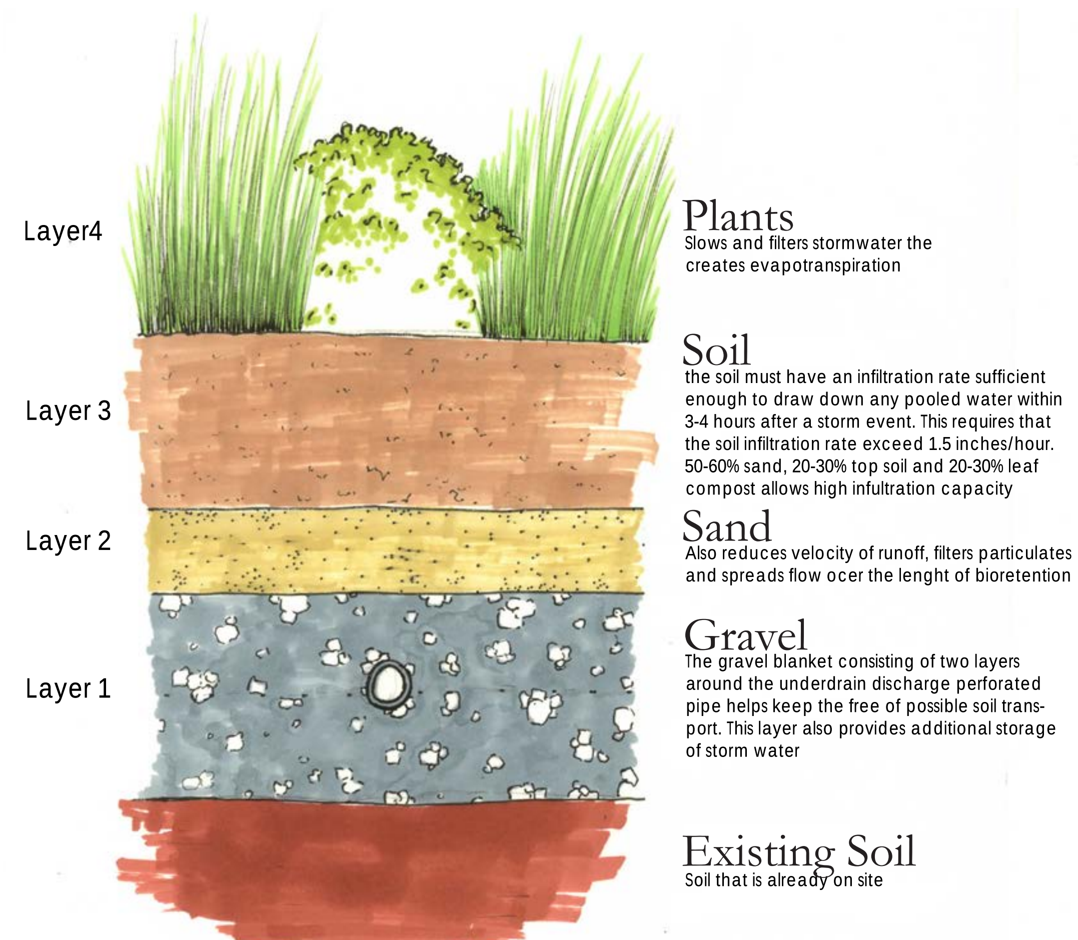
Axonometric Cistern Detail



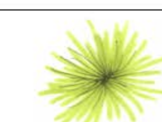
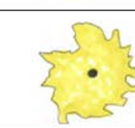
Bioretention Sectional Diagram



Bioretention Layers Diagram



Plant Inventory

	Little Bluestem (Schizachyrium Scoparium)	Height: 2.00 to 4.00 feet Spread: 1.50 to 2.00 feet Bloom Time: August-February Blood Description: Purplish Bronze Tolerate: Deer, Drought, Erosion, Dry Soil, Shallow-Rocky Soils, Wet Soils, Air Pollution and Salt Water
	Dallas Blue Switch Grass (Panicum Virgatum)	Height: 4.00 to 6.00 feet Spread: 2.00 to 3.00 feet Bloom Time: September-February Blood Description: Purple Tinge Tolerate: Drought, Erosion, Dry Soil, Wet Soils, Air Pollution and Salt Water
	Golden Fleece (Solidago Sphacelata)	Height: 1.00 to 1.50 feet Spread: 1.00 to 1.50 feet Bloom Time: August to September Blood Description: Yellow Tolerate: Deer, Drought, Erosion, Clay Soil, Dry Soil, and Shallow-Rocky Soil
	Blue Star Amsonia (Amsonia Hubrectii)	Height: 2.00 to 3.00 feet Spread: 2.00 to 3.00 feet Bloom Time: April-May Blood Description: Powdery Blue Tolerate: Deer, Wet Soil, and Salt Water
	River Birch (Betula Nigra)	Height: 40.00 to 70.00 feet Spread: 40.00 to 70.00 feet Bloom Time: April-May Blood Description: Brown (Male) Tolerate: Deer, Wet Soil, Low Salt Water, Clay Soil, Air Pollution, and Drought

Site B
Residential Intervention

By: Anna Erickson

Goals:

1. Connect people to parks and the waterfront.

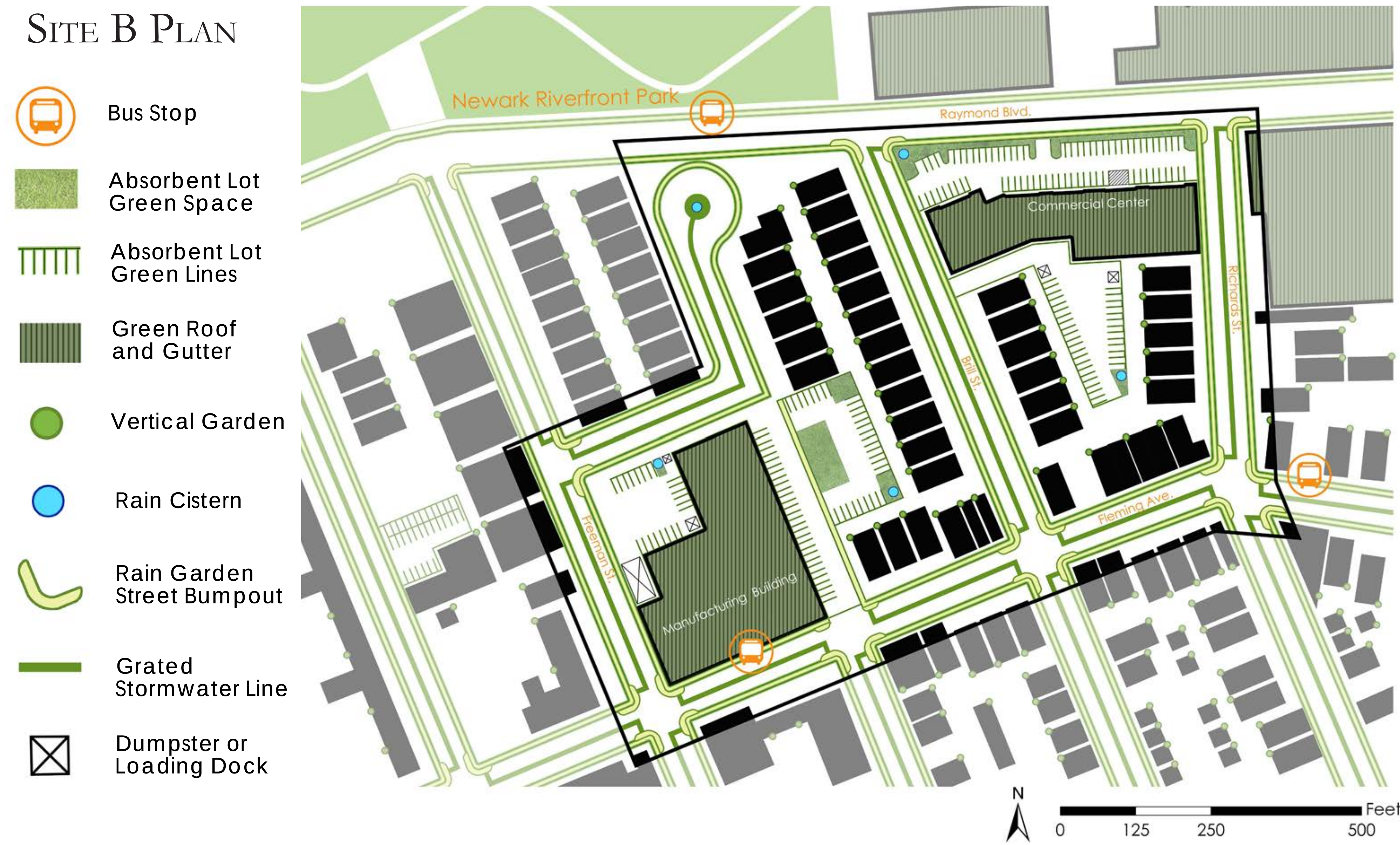
2. Incorporate urban wildlife within the city.

3. Reduce CSO overflow.

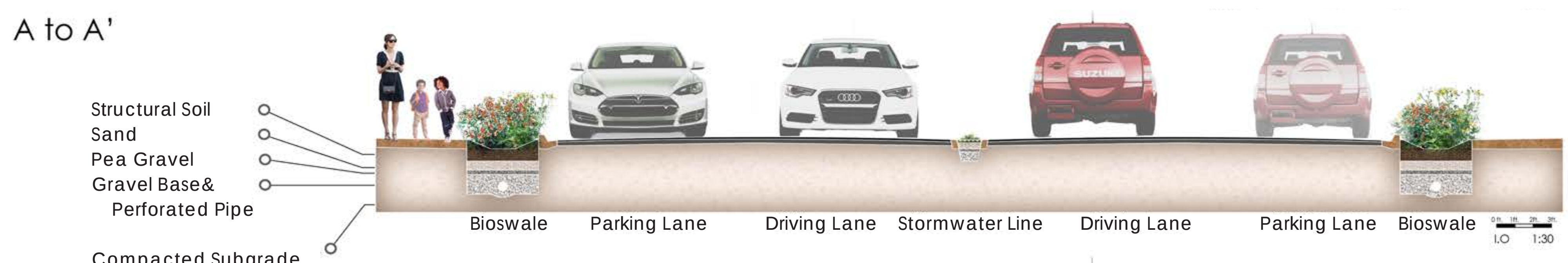
The residential interventions in Site 7 are categorized by the need to create a pedestrian friendly environment in an area of the city that borders on industrial territory. This part of Newark in Site B is also being faced with the interesting dynamic of being a community built on old infrastructure that is in the midst of seeing new change. The conglomeration of more recently developed parks and housing units in combination of with long standing manufacturing and industrial facilities leaves the area lacking a complete feel.

To remedy this, green streets featuring grated storm water lines that slow and divert run-off into rain garden bumpouts create a cohesive green network that makes pedestrian crossing safer while controlling storm water. With an abundance of parking lots, this area of town has an extremely high degree of impervious surface, but this can be mitigated with the concept of absorbent lots. By turning all potential unused space into areas that can slow rainwater, peak run-off rates can be reduced. Rainwater disconnection incentives should be offered to make homeowners and business owners excited and aware of storm water management in their community. By making use of green roofs, gutter gardens, rain cisterns, and rain gardens, property owners can be offered tax rebates for their part in making the community a more sustainable place. To increase awareness among the next generation, vertical gardens can be purchased as premade units to attach to a fence or a downspout, or they can be made out of recyclable water bottles. Community outreach events led by schools, churches, or the parks system can use the opportunity to bring families together and spread a message about storm water in the community.

Site B Plan

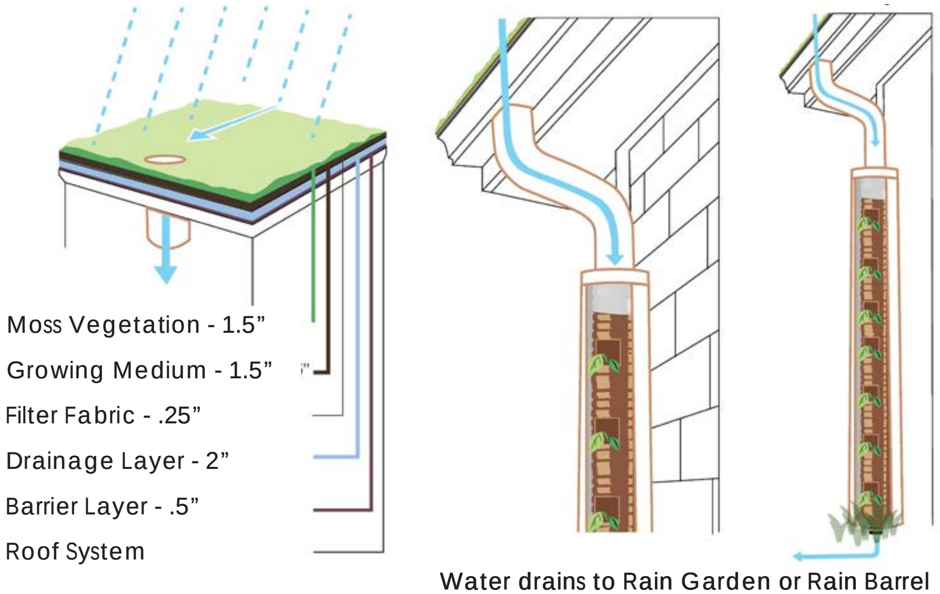


Fleming Ave. Street Sections



Grated stormwater lines slope down to intersection and carry water into stormwater bumpout.

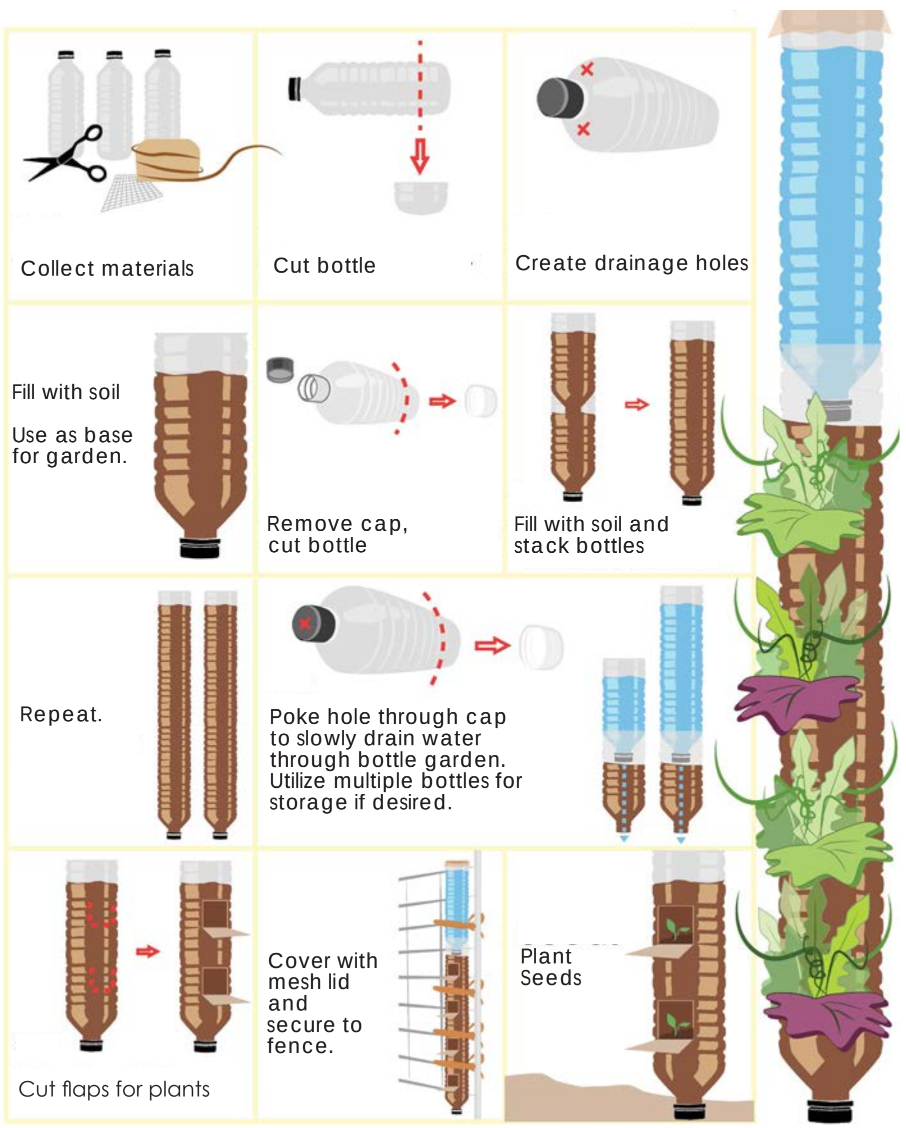
Green Roof and Gutter Garden



Fleming Ave. Street view

Grated green lines support low growing vegetation that can survive in compacted soil along roadways such as Carpetweed and Purslane. These stormwater diversion strips take the place of traditional painted road markings where high speed traffic is low. Colored grates maintain the symbology of the lines while allowing them to be driven over without compressing root structures. Collected water drains into a rain garden at the end of every intersection.

Vertical Community or Home Garden

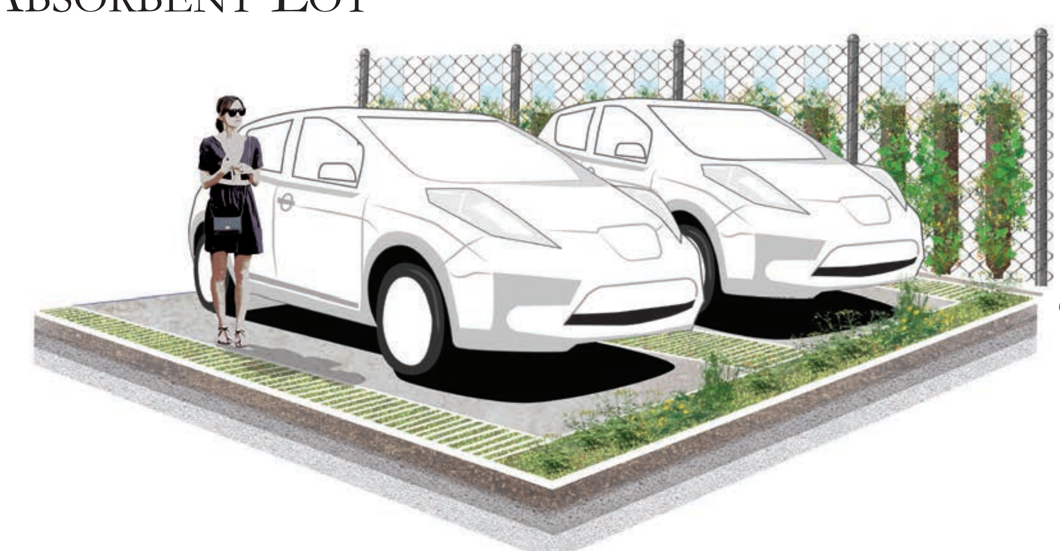


Gutter Gardens on Building Side

A lightweight moss greenroof drains excess water into a prefabricated vertical garden made of metal or plastic. Ratio of water storage space to vegetated garden space can vary as desired.

Water from vertical gardens drains into a bed of stones that flows into a rain cistern. A pump mechanism can irrigate vertical gardens during periods of drought.

Absorbent Lot



Absorbent lots feature grated green lines bounding either side and the front of each parking space. Concrete reinforcements at the edge of each line create a boundary between the stormwater infiltration strip and the asphalt parking space. Grates cover the two side lines for walkability while taller species such as sweet clover and birdsfoot trefoil dominate the front planting.

Site C
Industrial Intervention
By Nanik Song

Goals:

1. Increase Transpiration Rates within Industrial Areas
2. Promote Polyculture and Urban Plants
3. Provide Food and Shelter/Habitat for Wildlife
4. Stabilize Banks via Assisted Succession
5. Reduce Erosion and Decrease Sediment Contamination
6. Serve Ecological Functions

Interventions:

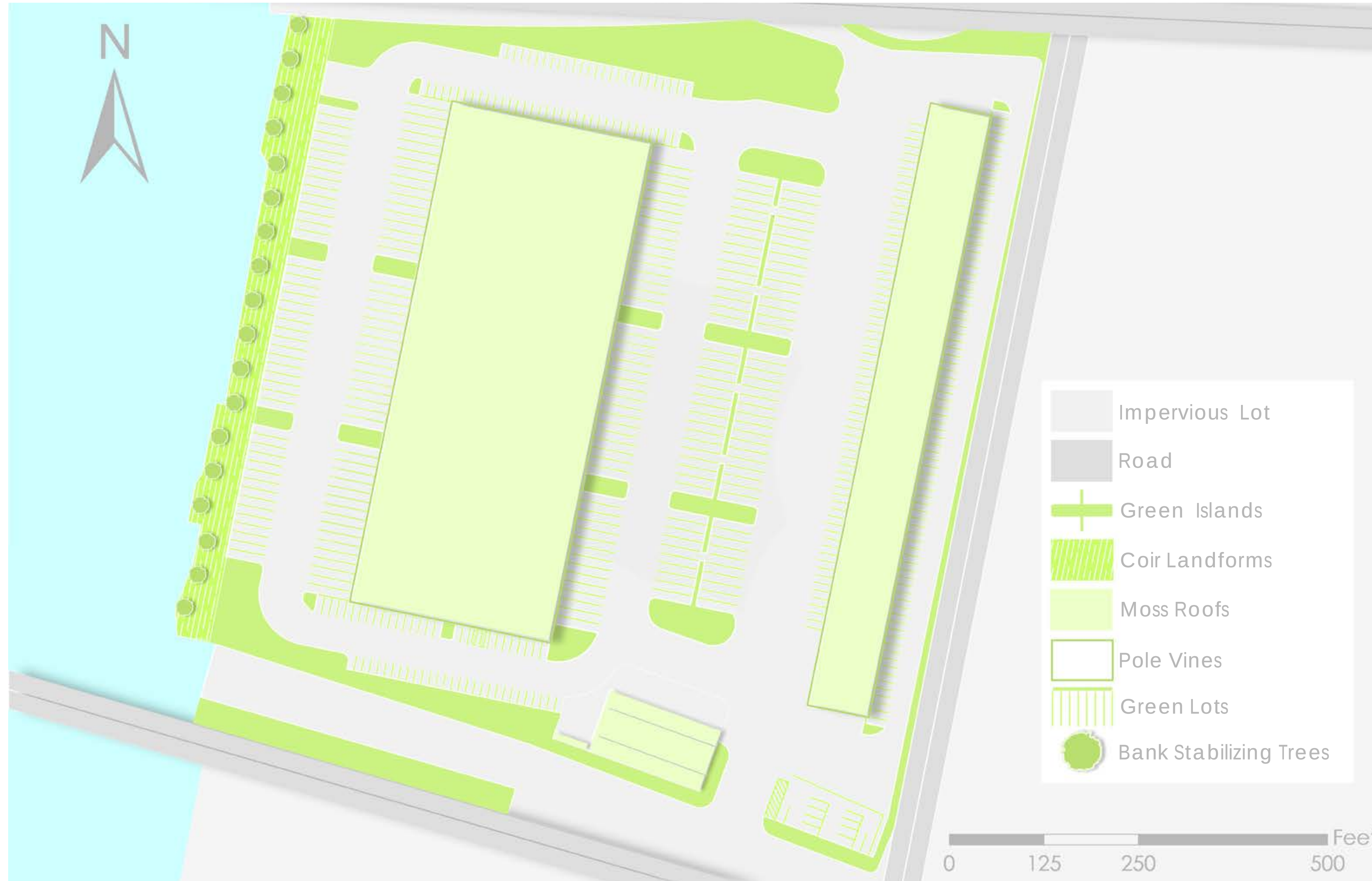
1. Parking Lots → Absorbant/Green Lots
2. Roofs → Lightweight Moss Roof
3. Building Facades → Vine Poles
4. Parking Lot Medians → Green Islands
5. Riverside → Coir Landforms

Site C can be simply summarized as a large parking lot. With a large building in the center, an immense amount of impervious space, and very little greenery (which is primarily characterized by grass), it serves as a pretty good example of what to expect in (light) industrial areas.

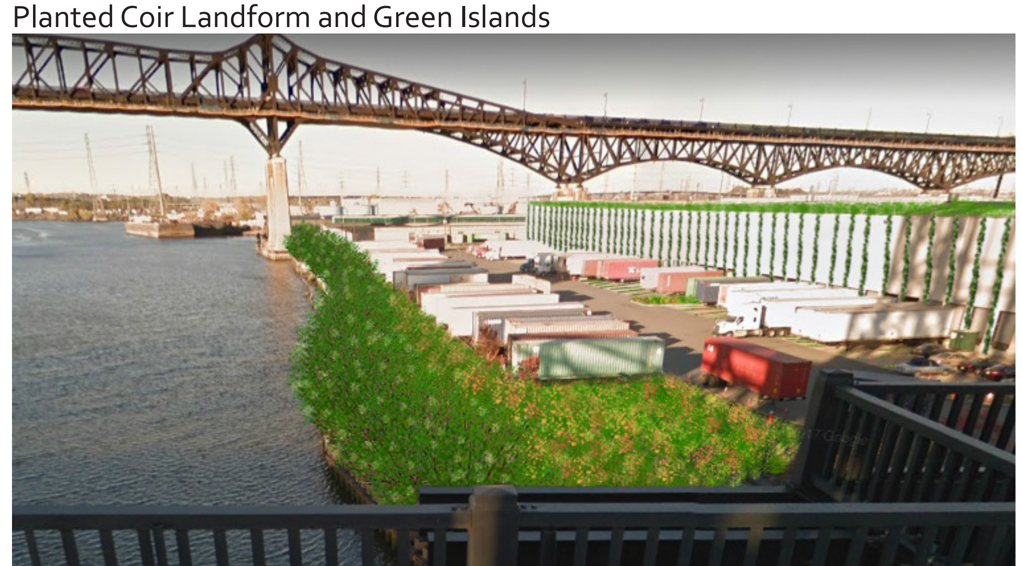
Site C has become an example of ecological design in industrial areas by taking advantage of what opportunities there are in the area.

While one may not be able to reclaim parking spots, there is the possibility to take advantage of small spaces, such as the painted lines between each parking spot, transforming them into lanes that hold water and increase transpiration rates, or by creating vertical structures that can increase surface area, thus productivity and opportunities, and running plants along the length, inviting resources for the wildlife in the area.

By rethinking space, we create opportunity. By rethinking design, we transform space.



Planted Coir Landform and Green Islands



Vine Poles and Green Islands

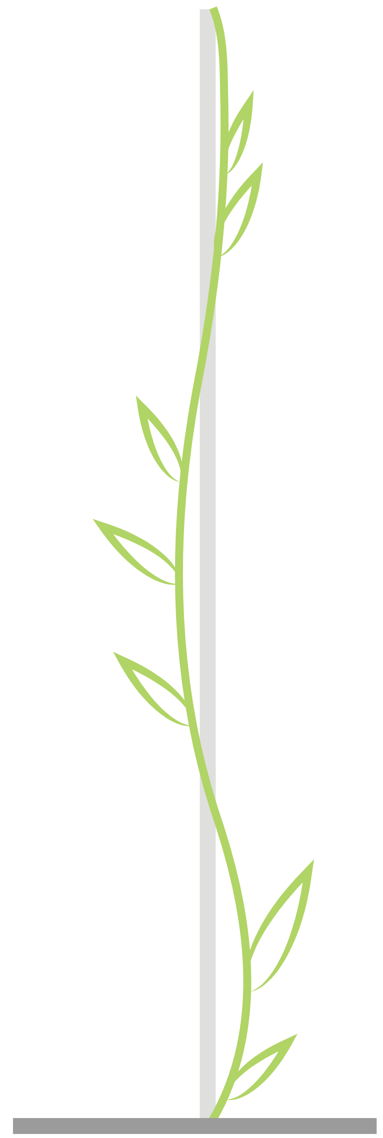
Urban Plants and Design

Urban plants have been long overlooked in the world of landscape architecture. Their ability to thrive in urban landscapes, while desirable, is often overshadowed by the public perception of these survivor specialists as weeds. It's easy to see why, what with them growing in the cracks of sidewalks, in parking lots, along railroads; they often appear where they're not invited, and rarely wanted. But that is the beauty of urban plants.

Their tenacity and determination to survive in places where few other plants will is admirable, and exactly what we need for a place that is as heavily disturbed as the industrial areas in Site 7. Adventurers and pioneers, they provide necessary ecological services, such as food and shelter for wildlife, erosion control, and water regulation, where it's desperately needed.

Urban plants are the breath of life in industrialized areas.

Vine Poles



With such few potential areas of intervention available in the existing conditions, we turn to the possibilities offered by creating new surface- in this case, vertical poles that offer more plant-able surface area.

By using a steel pole with texturing or nodules for tendrils to grip onto we are able to utilize vines in areas they would not otherwise be welcome or capable of thriving. By selecting vines with minimal to no branching habit, we also reduce the need for maintenance, both for the plant/pole and for the existing building.

Green Islands

While there is not much greenery in the area, what little there is all seems to be monotonous grass. Instead of using monoculture, which is a sign of an unhealthy ecosystem, we will propagate polyculture by using a variety of urban plants, which will provide ecological services such as food and shelter for wildlife, erosion control, and transpiration. Because these green islands are planned for industrial areas with little to no human involvement planned for the area, these plants should be selected solely for their ecological function and ability to survive in urban environments.

Coir Landforms - Assisted Succession

Step 1: Placement
Form undulating landforms, preferably no more than 6" high

Step 2: Run-off
Sediments carried by run-off gets trapped in coir

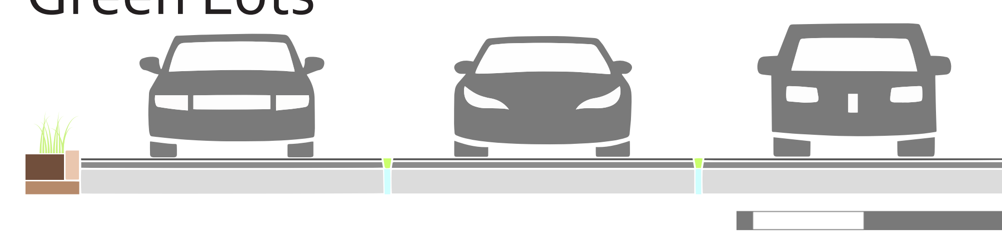
Step 3: Sediment Build-up
Sediments form a layer of soil

Step 4: Colonization
Coir landforms become colonized

Coir is useful for a variety of purposes. Great at water-retention, slow to degrade, and a natural, renewable resource, coir has been rising in popularity over the years. And with so many uses, it would be remiss to ignore its capabilities here.

Coir landforms are created by the placement of coir logs stacked on top of each other along the riverside. Even from the first stage of placement, the logs begin to assist the banks by decreasing the amount of erosion. But as they stay there, they also start to pick up sediments in their fibers, washed into them by run-off. Eventually, this sediment builds up into a layer of soil, deep enough that seeds might find their way there, and eventually take root. As plants start to colonize the coir, it begins to function in its own right as a community, providing ecological functions for the plants, animals, water, soil, etc. around it.

Green Lots



While there is not much opportunity for intervention in the parking lots, there is the possibility of turning the painted lines into planted lines, or green lots. This would require the lines to be dug into trenches, filled with a light layer of soil/sediment, and then planted with low-growing, sturdy vegetation. The asphalt below the planted margin may be permeable, serve as a detention basin, or be a continuation of the surrounding context.

Conclusion

Developing landscape architecture solutions that address stormwater runoff and contribute to the clean up of the Passaic River and its immediate surroundings was no easy task. Students discovered that not every solution is the best solution for a given area. Students also learned how much work goes into designing and planning for densely populated areas. The linear progression of this report only shows the final products of what the students did. The amount of additional research and concepts that were explored throughout the process of the studio is not displayed. In the future, the students hope to implement the strategies they learned in this studio into upcoming classes, possible careers, and everyday life. The final lesson the students learned is how dire of an environmental issue the Passaic River truly is.

The pollution in the river is extremely worse in the downstream area. The lower portion of the river is an EPA Superfund site, and the rest is highly polluted from industrial waste, sewage, and other pollutants. The work displayed in this report is a way to inform communities of the situation they are surrounded with and to introduce possible solutions. Each town in this project area, especially the towns with existing Combined Sewer Overflows (CSOs), should be informed about the effects that they have on the river. The ideas and designs presented aspire to influence designers, engineers, and any persons to make changes and spread word of the environmental crisis surrounding these waterways. The loss of a major water and habitat source like the Passaic River is detrimental to the hydrology and ecology of the surrounding area.

We are delighted to share the ideas and concepts in this report with the Passaic Valley Sewerage Commission (PVSC) who acted as client for the studio class. This one semester-long junior design studio has shown the need for further investigation, planning and design work. However, we hope that PVSC may find our inventory, analysis, designs, and concepts helpful for the long term control plan. Although developed as an educational exercise by Rutgers University, we hope that the results can guide some decision making in the future.

Ultimately as a society, a change must happen. The new norms must become sustainable and conservation minded. These problems are so large that they can be immobilizing. Problems such as flooding, limited access, and contamination are complex; however, even the smallest components can make a huge difference in reducing the severity of the problem. Our interventions may consist of diminutive components covering minute areas such as rain gardens, detention basins, or greenways covering small residential, commercial or industrial zones. However, these components are connected and intertwining creating a common task that eventually solves a mast problem.

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Data Dictionary

File Name	Short Description	Origin	Date Collected	Scale	Citation	Processing History	Notes
Topography and Hydrology							
New Jersey Municipalities	municipal boundaries in New jersey	NJOGIS					This layer was developed to produce the most accurate delineation of municipal boundaries achievable from existing data sources
USA Rivers and Streams	Presents linear water features of the United States	ESRI, National atlas of the U.S, U.S Geological Survey	2/7/17		Esri	Main rivers clipped to Passaic	This dataset was created to provide consistent line casing for road features in basemaps
DGS00-3 Topographic Elevation Contours for New Jersey	Topographic elevation contour lines for New Jersey	NJGWS		1:100,000	N.J. Dept. Environmental Protection Division of Science & Research N. J. Geological Survey		
An interdisciplinary investigation of ecological history and enviromental restoration objective in an urba nlandscape	an analysis of the degradtion history of the lower passaic river		september 2005				
Flood Zones							
floodway	floodway data	FEMA's National Flood Hazard Layer	25 September 2017	1:50000	FEMA's National Flood Hazard Layer		
100 year storm	1% chance of storm	FEMA's National Flood Hazard Layer	25 September 2017	1:50000	FEMA's National Flood Hazard Layer		
500 year storm	.2% chance of storm	FEMA's National Flood Hazard Layer	25 September 2017	1:50000	FEMA's National Flood Hazard Layer		
Open Space and Ecology							
New_Jersey_Counties	county boundary						
Municipalities_PassaicRiverValley	municipality boundary PVSC						
NHDStreams2002.gdb	stream line feature						
NHDWaterbody_2002	waterbodies						
2012 Land UseLand Cover Wetlands	Wetlands in NJ	NJ OGIS					
2012 Impervious Surface Estimation in New Jersey	Impervious Surface in NJ	NJ OGIS					
PassaicRiver150ftBuffer	150 ft buffer shapefile	NHDStreams2002.gdb					
wetland_munis_buffer	Wetland in 150ft Buffer - MUNIs						
WetlandinBufferbyCounty	Wetland in 150ft Buffer - COUNTY						
Municipalities_PassaicRiverValley	municipality boundary PVSC						
NHDStreams2002.gdb	stream line feature						
NHDWaterbody_2002	waterbodies						
PADUS1_4Fee_Easements_NJ	different kinds of open space	USGS Protected Areas Database of the United States (PAD-US)					
njgolf	golf courses	NJ OGIS					
County Open Space	county parks	NJ OGIS					
State Open Space	state parks	NJ OGIS					

File Name	Short Description	Origin	Date Collected	Scale	Citation	Processing History	Notes
Local_Parks_and_Rec	local parks (from Padus)	USGS Protected Areas Database of the United States (PAD-US)					
Municipalities_PassaicRiverValley	municipality boundary PVSC						
NHDStreams2002.gdb	stream line feature						
NHDWaterbody_2002	waterbodies						
piedmont	Species Based Habitat Piedmont Region endangered habitat ranking	Nj DEP Bureau of GIS					
Demographics							
Pop_Den_2015	Population Density (2015)	R:\331_fall 2017 Regional Studio Passaic River\ClassData\Demographics\CensusNJ.gdb	03 Oct. 2017				
NJ_BG_CENSUS_ESRI	Within this shapefile is data showing both Household Income Levels (MEDHINC_CY) and Levels of Children Ages 0 - 14 in a field I created named (PooAo_14)	S:\GISdata\cesus	19 Sept. 2017				
NJMUN	Muniscipal boundary our class is working with created by Devin Fields, used to clip the census data file	ArcGIS Online	26 Sept. 2017				
Passaic	Segment of Passaic River within Boundary	ArcGIS Online	26 Sept. 2017				
Government							
NJ Municipalities	Municipalities of NJ	Jersey City Division of Planning	2010				
Addresses Historic Sites	Historic Sites Of NJ		2017				
EPA Waste Water Programs	Waste Water EPA	EPA					
EPA Hazardous Waste Sites	Hazardous Waste	EPA					
Federal Registry Service	EPA Sites	EPA	2015				
Sustainable NJ Registry Data	Ranks of Sustainable NJ		2017				
Development							
Land_lu_2012_hu02030101_103	Lower Hudson Subbasin LULC	NJDEP	2012	1:294,961	NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information System (BGIS)		
Land_lu_2012_hu02030104	SandyHook-StatenIsland_LULC	NJDEP	2012	1:294,150	NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information System (BGIS)	Roads data buffered by 20ft and dissolved	This dataset was created to provide consistent line casing for road features in basemaps
USA Rivers and Streams	Presents linear water features of the United States	ESRI, National atlas of the U.S, U.S Geological Survey	2/7/2017	1:30,085,102	Esri, National Atlas of the United States and the Unites States Geological Survery		
New Jersey Municipalities	outline of all municipalities in nj	NJOGIS	2/22/2017	1:1,246,907	New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems	Roads clipped to city boundary	

File Name	Short Description	Origin	Date Collected	Scale	Citation	Processing History	Notes
Passenger Railroad Lines in New Jersey	A layer delineating right-of-way centerlines for rail, light rail, and subway service lines operated by New Jersey Transit and connecting commuter lines. Data set is intended only for general planning and mapping use. Single lines represent approximate right-of-way centerlines, not track centerlines	NJOGIS	2/22/2017	1:1,091,318	NJ TRANSIT - GIS-Transportation	Data clipped to city boundary	
Industrial							
PVSC_Municipalities	Muncipalities that PVSC services	ArcGIS online (Program)	42685				
NJ State Boundary	Jersey State Boundary	ArcGIS online (Program)	42788				
PassaicRiverGCS	Passaic River	ArcGIS online (Web)	42647				
2012_Land_UseLand_Cover_in_New_Jersey	LULC For Jersey	NJOGIS	42051				
New Jersey Municipalities		ArcGIS online (Program)	42788				
Contaminated Sites	Contaminated Sites	NJOGIS	42852				
Brownfield Sites	NJ Brownfield Development Area Outline	NJOGIS	42765				
Pollution							
New Jersey Municipalities	municipal boundaries in New jersey	NJOGIS					
Passaic River Line File	Presents linear water features of Passaic River	ESRI, National atlas of the U.S, U.S Geological Survey	10/4/2016				
Passaic River Historic Sampling	Chemical camples collected along the lower Passaic River throughout years	MaryJo.Watson_CES	6/22/2017				
TRI_2016_NJ	Toxics Release Inventory (TRI) Program	EPA(Environmental Protection Agency)	8/23/2017				
NJDEP 2012 Land Use/Land Cover Update 2/17/15	The 2012 Land Use/Land Cover dataset of New Jersey	NJDEP	2/17/2015				
Diamond Alkali Co. Superfund Site	The location of Diamond Alkali Co. in New Jersey that disposed chemicals in the river.	EPA(Environmental Protection Agency)					
Waste Management							
WasteManagement_CSO_Passaic.lyr	Locations of all CSO outfalls along the Passaic River	NJDEP	2016	Unknown	NJ Department of Environmental Protection, Bureau of GIS	Locations clipped to points along Passaic River	
WasteManagement_Landfill Sites.lyr	Locations of all active, inactive, and closed landfills in NJ	NJOGIS	2014	Unknown	NJ Office of Geographic Information Systems	Locations clipped to areas within Sewer Service Area	
WasteManagement_SSA_clip.lyr	Color coded layer of the areas of land each firm that comprises the Sewer Service Area controls	NJOGIS	2014	Unknown	NJ Office of Geographic Information Systems	SSA clipped to municipality map in areas within Bergen, Essex, Hudson, Morris, Passaic, Somerset, and Union Counties	
PassaicRiver.lyr	General path of the Passaic River	Drew Spatial Data Center	2016	Unknown	Drew Spatial Data Center		
Design Group 2							
Group2_Site	Border of region of focus for Design Group 2 interventions	David Smith	2017	Unknown			Outlines based on National Hydrography Dataset
DrainageAreas_Group2	Distinct areas that drain into specific CSO's	Daniel Van Abs	2014	Unknown	Rutgers School of Environmental and Biological Sciences- Department of Human Ecology	Clipped to Group2_Site layer.	

File Name	Short Description	Origin	Date Collected	Scale	Citation	Processing History	Notes
Design Group 4							
NHDstream_2002	provide stream information for regulators, planners, and others interested in hydrography data	NJDEP	2010	1:24,000	NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information System (BGIS) John Bocchino: NJDEP, Metadata Compilier	Main rivers clipped to bergen	This Dataset was created to provide reference the major streams in our site
UrbanLU	The data set will provide information for regulators, planners, and others interested in LU/LC changes, and allow them to quantify those changes over time using GIS.	NJDEP	2012	N/A	NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information System (BGIS)	Urban LU clipped to Bergen County	This data provides refernce to the Urban Landuse of bergen county
Municipalities of New Jersey, New Jersey State Plane NAD83	To provide basic jurisdictional information. This data set was developed to produce the most accurate delineation of municipal boundaries achievable from existing data sources.		N/A	N/A	Bergen County		
ParcelsBergen	Parcels are a key framework data set for Bergen County's GIS spatial data network which serves the Bergen County information management system.	OGIS	2013	N/A	New Jersey Meadowlands Commission, Meadowlands Environmental Research Institute	Parcels Information clipped to Wallington Area	This information was used to figurwe out ages of Parcels
100 and 500 Year Strom	To provide information for flooding for the 100 and 500 year storm	FEMA		N/A		Clipped to Site 4 interventiion zone	This information was used to make figure out the major flooding areas within Wallington.