Rahway River Greenway Plan

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Prepared by:

Rutgers
Edward J. Bloustein School
of Planning and Public Policy

Fall 2008 Comprehensive Planning Studio

CREDITS AND ACKNOWLEDGEMENTS

Dennis Miranda
Executive Director, Rahway River Association

Fred Heyer and Susan Gruel
Studio Instructors

Kelly O'Brien
Studio Teaching Assistant

Fall 2008 Comprehensive Planning Studio Team Members
Peter Cutrera, Swena Gulati, Elmyra Jemison, Ashton Jones,
William LoSasso, Raja Murthy, Adam Szlachetka

Special Thanks

Ralph Albanier, Middlesex County Parks Director

Dr. Kirk R. Barrett, PE, PWS, Director, Passaic River Institute, Montclair State University

Mirah Becker, Middlesex County Planning Department

Scott Costello, Geographic Information Systems, CMX Engineering

Barbara Heskins Davis, PP, AICP, V.P., Programs, The Land Conservancy of New Jersey

Nelson Dittmar, Cranford Environmental Commission

Jennifer Duckworth, Milburn Environmental Commission

John P. DuPont, P.E., CME, P.P., Director of Municipal Engineering, Borough of Carteret

Caroline Ehrlich, Chief of Staff, Woodbridge Township,
Executive Director, Woodbridge Township Redevelopment Agency

Brandy Forbes, AICP, PP, Township Planner, Township of Edison

Marian Glenn, Chair, Summit Environmental Commission

Matt Mathan, Bureau Chief, County of Union, Bureau of GIS, Division of IT

Martin McHugh, NJDEP

Don Meisel, City Planner, City of Orange

Peter Pelissier, City of Rahway Administrator

Richard Rehmann, VP, Civil Solutions, a division of ARH

Lenore Slothower, AICP/PP, City of Rahway Planner

Joseph Timko, Assistant Engineer, Scotch Plains

Nick Tufaro, Middlesex County Planning Department

Alex Zakrewsky, Middlesex County Planning Department

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(left) Photosimulation by Kelly O'Brien ***(middle & right)*** Photos taken by Kelly O'Brien

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Rutgers, The State University of New Jersey

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A view of the Rahway River in Linden.

Executive Summary

The Rahway River currently lacks an interconnected greenway to connect people, protect natural environments, control flooding and attract tourism. Despite varied efforts on the part of the municipalities that lie within the River's watershed, there is no cohesive network of open green space spanning the River's 24 mile stretch. In the Fall of 2008, the Comprehensive Planning studio at the Bloustein School of Planning and Public Policy at Rutgers University endeavored to connect these varied plans and propose an updated, unified greenway network that stretches the entire 24 mile span of the Rahway River. The existing plans were closely examined and then synthesized in order to generate a backbone from which to build upon. Linkages were then proposed, illustrative examples created and policy recommendations offered. The result of that effort is this document.

This updated plan is divided into four (4) substantive sections.

Section 1, *The Rahway River and its Watershed*, provides a baseline of information on the current state of the Rahway River and identifies opportunities and obstacles that will impact a future greenway creation and implementation effort.

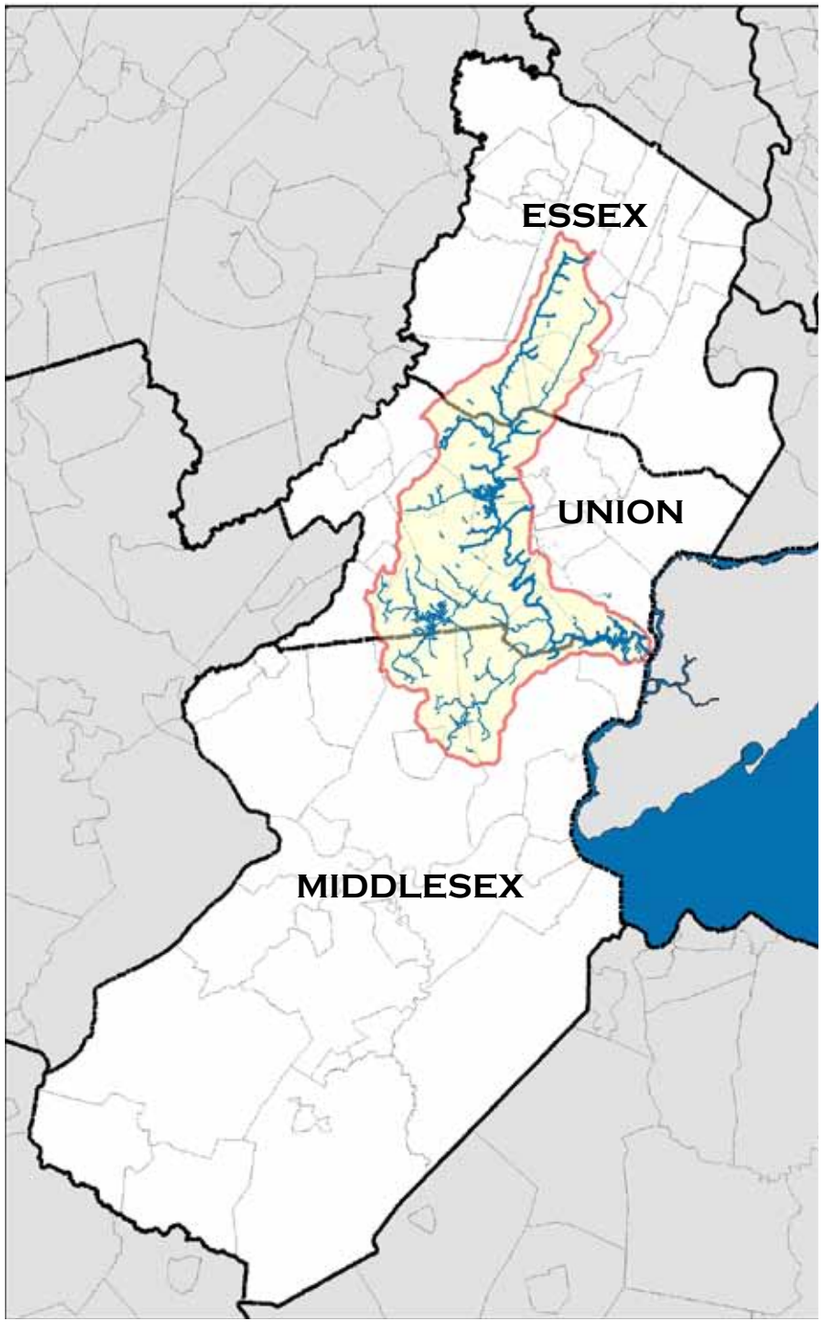
Section 2, *Recommendations,* offers design and policy suggestions for the creation, implementation and maintenance of a unified greenway network.

Section 3, *Greenway Case Studies,* offers four (4) illustrative design examples that offer linkage solutions where gaps currently exist.

Section 4, *Financing Sources*, offers potential finding sources to be explored in creating, implementing and maintaining a future unified Rahway River greenway.

While an interconnected greenway is currently lacking, there is still much to build upon. More than 10% of the land located within the Rahway River watershed is publicly-owned, offering great potential for future linkages to create a unified greenway. The Rahway River is accessible by multiple forms of transportation and, while public access is not universal, there are a great number of public access points along the River's 24 mile stretch. In addition, several parcels may be eligible for protection as historic sites, potentially providing funding for site acquisition and maintenance.

Figure E.1: View of the Rahway River from Riverside Park in Rahway. *(Source: Raja Waran)*



The land within the watershed is predominantly residential with concentrations of commercial, industrial and brownfields and greyfields interspersed, all of which offer both opportunities and obstacles of their own in creating one unified greenway along the Rahway River. Even though the Rahway River suffers from the effects of its past industrial use and neglect, the River and its watershed are still home to an abundance of flora and fauna, with habitats that support all types of wildlife. While invasive species and over-population of select species continue to be a problem, there is still time to act to bring the watershed back to a more natural state with a cooperative effort of community stakeholders across the watershed.

Many challenges exist as well in bringing this vision into fruition. The watershed is home to many contaminated sites and the River itself is severely polluted in several stretches – a consequence of its industrial past and present neglect. In addition, the River is prone to destructive flooding, a result of over-development within its watershed and a lack of green space within its watershed boundary to absorb storm runoff.

A summary of recommendations in creating, implementing and maintaining the greenway include: improve connectivity through improved way-finding signage, naturalize water channels and improve water quality, repair the River's riparian edge, exploit underutilized land to provide new public access, use the greenway as part of an economic development strategy, promote environmental responsibility through greenway construction and design materials, accommodate both pedestrian and bicyclist access, protect existing open space through national historic designation where possible, and complement the emerging East Coast Greenway where feasible.

Each case study in this plan focuses on a different site along the Rahway River where improved connectivity is possible. Different land use types were chosen for each example to illustrate the many possibilities that exist in increasing connectivity along the Rahway River, including a residential property, an existing commercial/greyfield site, a public park and a privately-owned landfill.

Finally, many potential funding sources were identified for exploration in creating a Rahway River greenway, including funds for construction, hazard mitigation, land acquisition and preservation, and environmental protection and rehabilitation.

The next stage in the creation of a Rahway River greenway is for the member municipalities, private and non-profit partners, and citizen stakeholders to take ownership of this plan while continually improving it to insure that the vision for a Rahway River Greenway is ultimately realized for the benefit of future generations.

Figure E.2: The map to the left highlights the Rahway River watershed in yellow.

Introduction

Project Background

In September 2008 the graduate Comprehensive Planning Studio at the Edward J. Bloustein School of Planning and Public Policy at Rutgers University undertook the task of evaluating the current status of the Rahway River greenway and proposing an updated plan. The plan contained in this document is aimed at creating an interconnected network of publicly accessible land that spans the entirety of the River's 24 mile stretch across northeastern New Jersey. Upon completion, the Rahway River greenway will provide open space for recreation and enjoying nature while simultaneously providing a myriad of environmental benefits for the River and its surrounding watershed.

Led by Fred Heyer and Susan Gruel and advised by Dennis Miranda of the Rahway River Association, the graduate students completed an extensive review of existing greenway plans, as well as existing land uses, environmental and historical conditions, wildlife inventories, flooding trends, transportation linkages, and public access constraints throughout the Rahway River watershed to develop a baseline understanding of the current state of the Rahway River. This was no small undertaking. Information was sparse, data was missing and the fragmented ownership of the parcels bordering the River threatened to derail the project at various points. With the assistance of many of the public and non-profit entities located within the watershed, as well as the research capabilities of the students, the necessary data was assembled to construct the inventory and establish the framework within which an update to the existing plan could take place.

Once obtained, this data was thoroughly analyzed to identify existing opportunities, as well as obstacles, in developing and implementing an updated greenway plan for the Rahway River. Following this, the team began to develop the design and policy recommendations aimed at creating a permanent greenway that are advanced in this document. Four (4) representative sites along the Rahway River where then chosen by the team, and these recommendations were applied to provide illustrative examples of the potential that exists in creating a Rahway River greenway, and to illustrate that the possibilities in creating the greenway are limited only by the imagination and will to implement this plan. Finally, potential financing vehicles have been identified to assist in implementing the recommendations set forth in this document and bringing this updated vision to fruition.

This plan does not exist in a static environment; it is intended to be a living document. As new information becomes available and additional parties join the greenway effort, this plan will evolve to reflect the individual and cooperative efforts and vision of municipal governments, non-profit partners and dedicated citizens.

Figure I.1: View of the Rahway River and the Linden landfill from Carteret. *(Source: Raja Waran)*

What is a Greenway?

Greenways are interconnected networks of parks, trails and open space that connect people and places while protecting water bodies and conserving wildlife from environmental and other human-based threats. Ranging from the Appalachian Train to small interconnected urban park systems, greenways improve the overall quality of life in communities by reconnecting people with a natural environment that has become increasingly inaccessible.

The benefits of greenways are numerous, and range from environmental and wildlife protection to recreation to the purely aesthetic. The vegetation within greenways, such as trees, shrubs and plants, acts as a natural filter, purifying rainwater and storm runoff of many non-point sources of pollution. This function helps insure that these pollutants don't end up in our natural water bodies, threatening fish and other aquatic life, and protecting humans as we use it for drinking water and recreation. In addition to filtering pollutants and preserving river health, greenway vegetation provides the habitat that is needed to support a wide variety of wildlife, supporting biodiversity and providing the framework for healthy ecosystems. These connected areas of green space are often the only suitable habitat for numerous species of wildlife and they provide a necessary buffer between the natural and built environments that allow wildlife to thrive in an increasingly urbanized state such as New Jersey.

Greenways are economically advantageous for communities as well, helping to prevent and control flooding during storms, saving homeowners and insurance companies from costly flood damage. Greenways also function to prevent rivers and streams from cresting during heavy rainstorms and causing flood damage to homes and businesses, preserving municipal funds that can be better spent on other worthwhile programs. In a state as developed as New Jersey, the ability to surround bodies of water with vegetation and pervious lands that are able to absorb storm runoff is of vital importance as current development patterns continue to cover land with impervious materials such as parking lots and roads. Further, greenways are an effective and increasingly popular way for communities to attract visitors and tourists, and they offer a refreshing escape from the built urban environment right within the heart of many municipalities. These natural assets, once realized, are vital instruments in creating communities that are economically, socially and environmentally sustainable.

Greenways also function as living laboratories where residents can congregate and learn about nature right in their own backyard. The walkways, bike paths, and observation points of greenways allow an opportunity for us to observe nature and wildlife in its unaltered state and to witness the biological processes that create a diverse ecological community. These natural amenities also offer an opportunity for schools to deepen the learning experience by getting students out of the classroom and into the field, providing students with the practical application of knowledge that creates a more worthwhile learning experience.

> **"Greenways allow us to treat land and water as a system, as interlocking pieces in a puzzle, not as isolated entities."**
>
> **- Ed McMahon,** Director, American Greenways Program

Finally, greenways offer an opportunity for us to observe, interact with, and simply enjoy nature and all that the natural environment has to offer. Providing ideal settings for jogging, biking, picnics, fishing, or even just a walk along the river, greenways offer an escape from the built environment and the hustle and bustle of the city. Since many of New Jersey's rivers have a past of industrial use and abuse, the creation of greenways on old industrial lands that are now brownfields provides an opportunity to return these lands to their natural state while simultaneously providing an economic and aesthetic benefit for the entire community.

Figure I.2: A pathway in Medwick Park in Carteret.

Rahway River at a Glance

Beginning in Essex County, the Rahway River consists of four (4) separate branches that finally converge in Rahway, NJ, where the River then flows as one waterway until it ultimately terminates into the Arthur Kill between mainland New Jersey and Staten Island. The Rahway River stretches for 24 miles across Essex, Union and Middlesex Counties in northeastern New Jersey, within the greater New York metropolitan region and through the most densely populated portion of the State of New Jersey. As one component part of the larger Arthur Kill watershed, the Rahway River watershed encompasses approximately 41 square miles while passing through 24 different municipalities.[1]

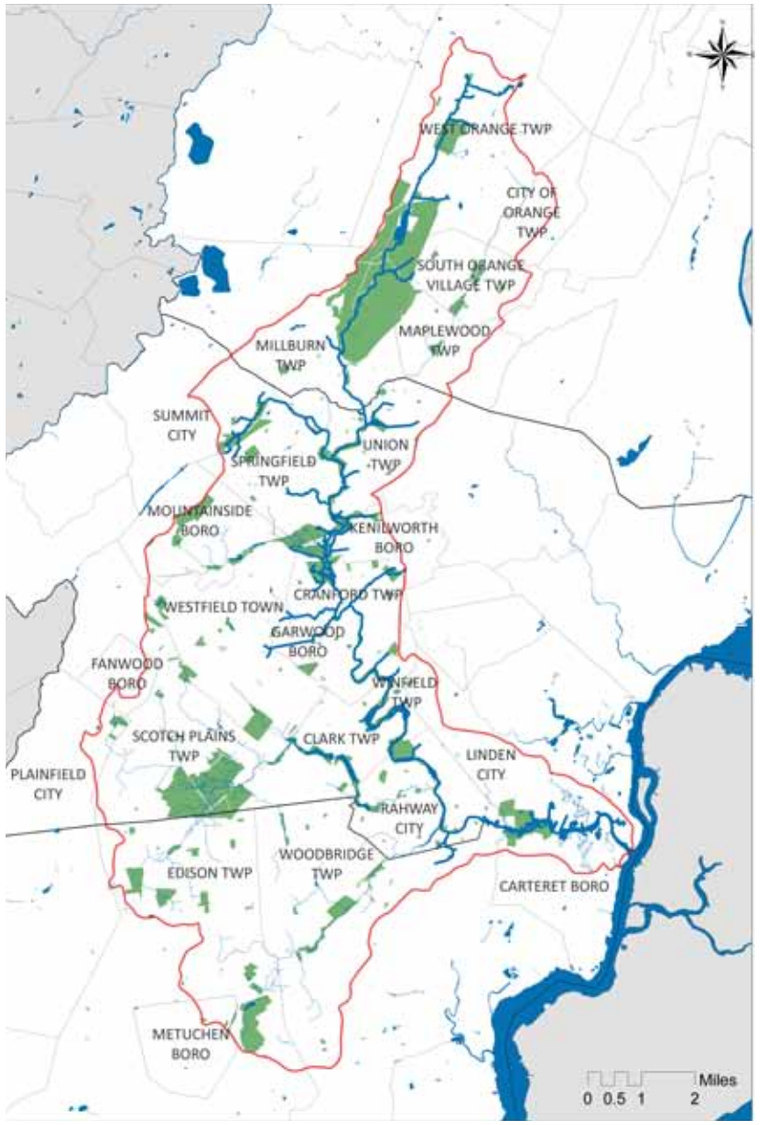


Figure I.3: Map of Rahway River Watershed and the municipalities encompassed within it.

The major branches of the Rahway River, with their originations, are as follows:

West Branch (Verona)

East Branch (West Orange / Montclair)

South Branch (Woodbridge)

Robinson's Branch (Scotch Plains)

The East Branch joins the West Branch in Springfield Township, forming the mainstem of the River. The South and Robinson's Branch then join the mainstem at the City of Rahway, where the River continues through Linden and Carteret as one unitary waterway, forming the boundary between Middlesex and Union Counties and ultimately emptying into the Arthur Kill. The upper portion (above the City of Rahway) consists of floodplains, woodlands and freshwater marshes, while the lower portion includes saltwater marshes and tidal flats.

Unfortunately, the Rahway River continues to suffer from the lingering effects of its industrial past, with polluted lands, sediments and water continuing to be a problem along various stretches of the River. Continued development within its watershed has also caused persistent problems, causing environmental degradation, pollution, erosion, habitat loss and frequent flooding.

Serving as the primary water source for the City of Rahway and as a source of water-related recreation for many regional residents, the Rahway River is an important natural asset within the region. Further, as a site of American Revolutionary battles, the River holds historical significance for the region as well as being part of New Jersey's living history.

Why a Rahway River Greenway?

Every river should have a greenway that protects its waters, provides scenic views and recreation, controls flooding, and provides habitat for wildlife. As mentioned, the Rahway River currently lacks a network of open space that is both publicly accessible and interconnected to allow for the free movement of people and wildlife along the 24 mile stretch of the River. The Rahway also continues to suffer from the effects of its industrial past and the over-development of its watershed, including habitat destruction, erosion, flooding, increased river temperatures, sediment and nutrient loadings, reduced dissolved oxygen levels and fishkills.[2] It is imperative that we act now to correct the effects of this past neglect and create a greenway as a beginning step in implementing sustainable development patterns across the State, using the Rahway River as a leading example. As the development pressures in New Jersey continue to intensify, and as available open space becomes even scarcer, it will become increasingly difficult to implement a greenway. We must act now to insure that this natural asset and the benefits it provides are not lost on us and future generations. It is only through a sustained preservation and implementation effort that the vision laid out in this plan will be realized.

There is considerable good news, however, in looking forward. There are already close to 5,000 acres of parkland in the Rahway River watershed, and most of the corridor in Essex and Union counties consists of public open space.[3] Meaningful protection of the Rahway River, however, cannot consist of *ad hoc* approaches and piecemeal plans that protect some portions of the River while leaving others unprotected and vulnerable. Rather, the entire Rahway must be protected to insure that the benefits of a greenway are available for all. This requires a comprehensive plan that lays out a bold vision with aggressive solutions that will weave the existing patchwork of open space, pathways and underutilized lands into a cohesive network of green space that capitalizes upon the natural assets of the River and protects the entirety of the River and its watershed. In addition, while this vision must be comprehensive, it must also be practical and able to be implemented.

This will involve a combination of strategies that include the preservation of current open space and the remediation of existing brownfields, as well as the clearing of underutilized lands in preparation for their return to their natural state as part of the greenway network. In addition, there will need to be considerable cooperation and collaboration with private parties to return inaccessible portions of the River to the public domain. Finally, creative financing agendas will have to be pursued to insure that the plan can be implemented and the greenway maintained. This update to existing plans takes into account these factors and offers what is hoped to be a realistic, comprehensive, and sound set of recommendations for finally implementing an interconnected Rahway River greenway.

Greenway Plan Breakdown

This document is divided into four (4) substantive sections, summarized below:

Section 1: The Rahway River and its Watershed
This section contains an overview of the existing conditions within the Rahway River watershed, including open space plans, ecological resources, historical and archaeological sites, contamination, land uses, transportation, flooding, and public access. This section outlines the various challenges and constraints that exist to the creation and implementation of a comprehensive greenway for the Rahway River.

Section 2: Recommendations
This section contains design and policy recommendations for the creation, implementation and maintenance of a interconnected Rahway River greenway. It contains strategies aimed at maintaining a healthy watershed, including improved water quality, land preservation, improved biodiversity, improved open space connectivity, economic development opportunities, public access opportunities, and cultural landscape preservation.

Section 3: Case Studies
This section contains four (4) detailed design examples of representative sites chosen along the River. They present potential strategies in connecting existing open space, constructing public facilities, and restoring public access to the River, as well as the criteria that were used in selecting these case study sites. These examples are not intended to be final, authoritative solutions, but rather illustrative examples of the possibilities that exist in creating a greenway regional cooperation and collective decision-making is utilized.

Section 4: Financing
This section contains potential funding sources that can be explored in implementing and maintaining the greenway plan proposed in this document, including funds for building and construction, environmental remediation, and land acquisition. The list is not exhaustive, but rather a sampling of programs and funding sources that can be patronized as a part of the larger implementation process.

Section 1 : The Rahway River and its Watershed

1.1 Summary of existing open space and plans along the Rahway River

Existing open space

In developing the recommendations contained herein, the graduate team researched existing planning documents, including master, recreation, redevelopment, park, greenway and open space plans in communities located within the Rahway River watershed. These plans were reviewed for assets to build upon in the creation of a singular integrated greenway network and gain insights into successful best practices from existing efforts. The results of this research are mixed. While there is ample open space within the member municipalities, and numerous attempts to maintain green spaces alongside or near the Rahway River, the existing open space is not connected into one cohesive greenway network. A summary of the existing state of affairs follows.

The Park system within the Rahway River watershed includes portions of 3 counties and 24 different municipalities, and the existing recreation and park systems within the watershed area encompass nearly 6,518 acres of land. Of these sites, approximately 107 acres are owned by the State of New Jersey, 4,830 are owned by the Counties, and 1,581 are owned by the Municipalities. Combined this represents 12.3% of total land area within the watershed. Fortunately, most of these sites are already open to the public and offer various active and passive recreational activities, including athletics, fishing and simply observing nature. Opportunities exist to create the greenway envisioned within this document by linking these open spaces with trails, paths, or pedestrian malls.

Out of 6,518 acres of recreation and open space, 2,804 (~ 43%) fall within the 100 or 500 year flood plain, reinforcing the importance of the proposed greenway to mitigate flooding, prevent property destruction, conserve valuable public and private funds.

Table 1.1, contained in the Appendix, contains a listing of the county parks that are located within the Rahway River watershed. Counties have identified areas to be preserved, conserved, or acquired for an open space park system to improve connectivity along the rivers and streams as well. These lands are listed in Tables 1.3 and 1.4 in the Appendix. A complete inventory of lands recommended by municipalities for acquisition in the creation of additional open is provided in Table 1.2 of the Appendix.

Existing Plans

A summary of the major existing plans and policies at the local, county, state, and regional level is located below.

County

Essex County

The first county park system in the United States was established in Essex County in 1895 to provide a balanced system of formal parks and natural reservations. The Olmsted influence is present in the County's parks and open spaces, including design features such as pathways, scenic viewpoints, water features, gardens, and street furniture. Essex County has established a trust fund to provide stable funding for improving and preserving open space as well. South Mountain Reservation, shared by Maplewood, West Orange and Millburn, is comprised of 2047 acres, offers 19 miles of hiking trails, 10 picnic areas and 27 miles of roads for recreation, and is the largest of Essex County's parks.

Union County

In 1921, the Olmsted firm was hired to establish a network of parks in Union County, and Rahway River Parkway is an example of this Olmsted legacy. According to the 2002 Union County Master Olan, a site greater than 10 acres may be developed and integrated with the existing park system. Greenway corridors - networks of landscaped parks and interconnecting parkways or thoroughfares - are consistent with the Olmsted plan, allowing this document to build upon the Olmsted vision. An initiative to create an open space trust fund which aims to purchase open space and historic properties was approved by Union County voters in November 2000. It is expected to generate close to $5 million annually which can be used in the assemblage of land and integration of it into the proposed greenway.

Figure 1.2: Greenbrook Park in Union County.

Figure 1.1:Illustration of "Union County Memorial Park", March 1919.

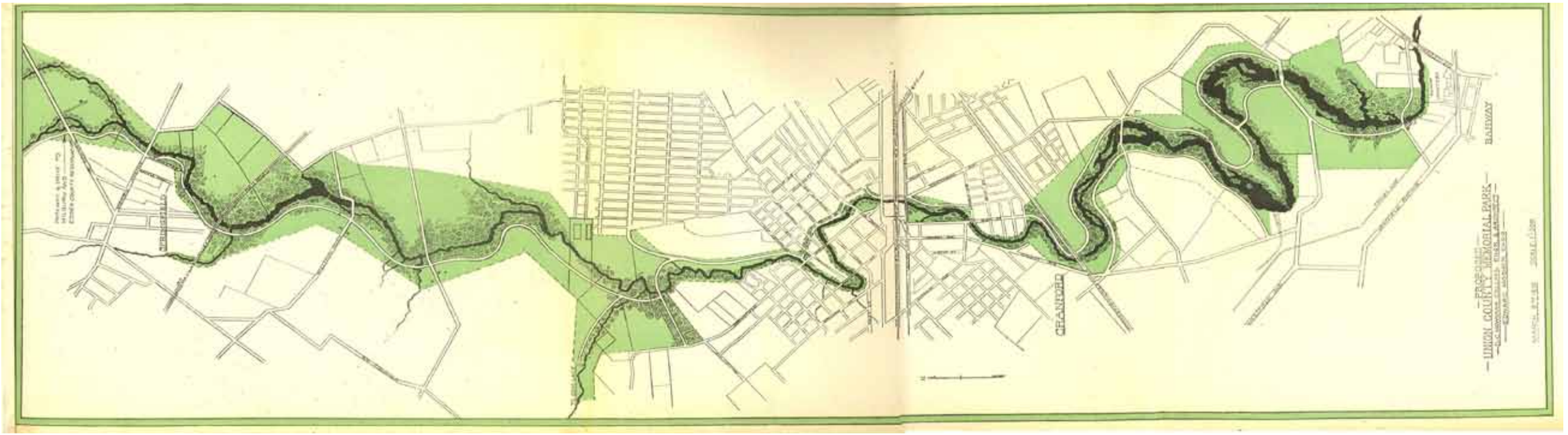
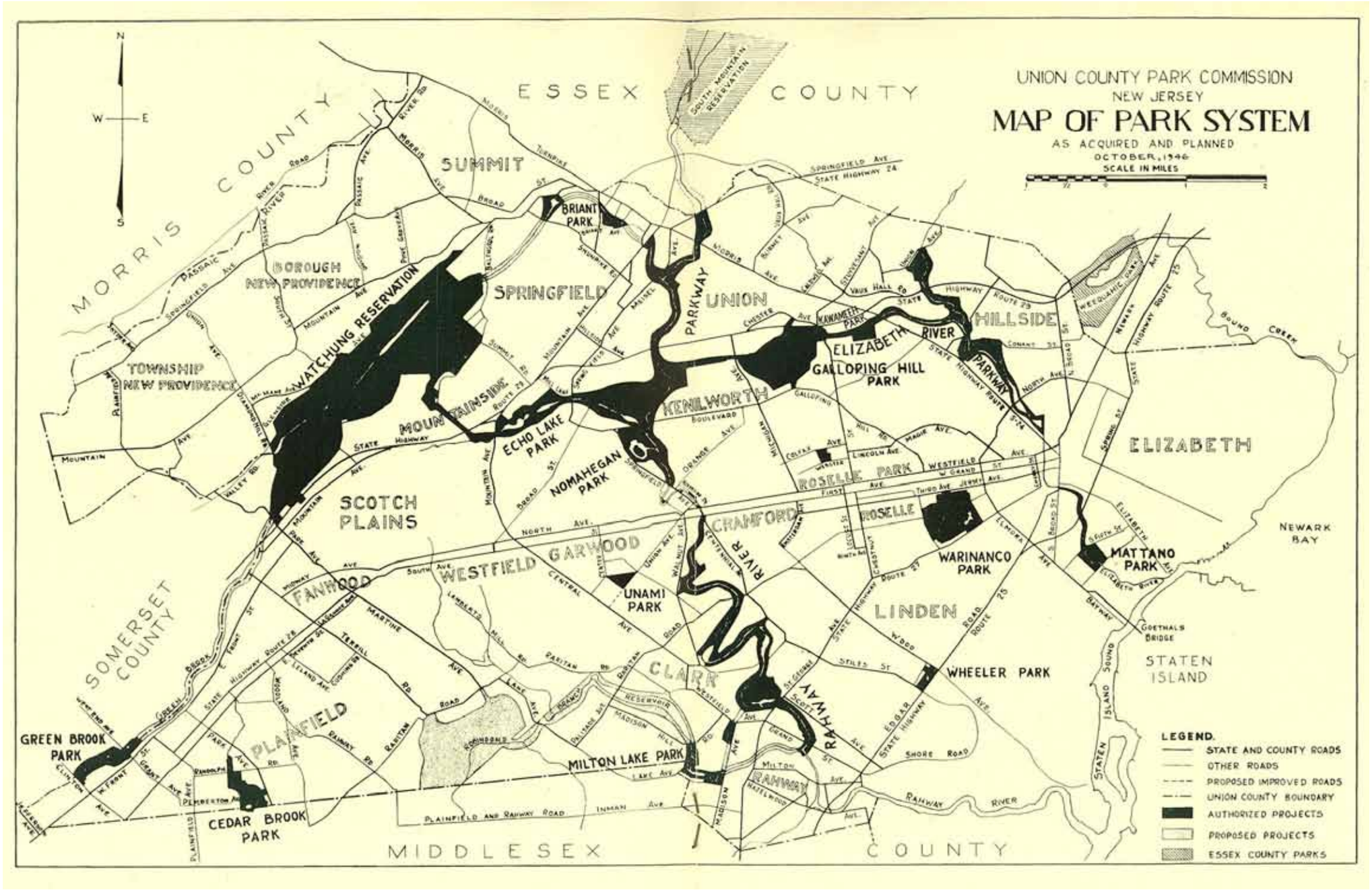


Figure 1.3: Map of the Union County park system from 1946.



Middlesex County

Middlesex County's *Open Space and Recreation Plan 2003* provides an inventory and history of the County's existing open space and recreation areas, and also offers plans for land acquisition and linkages to further connect the network. A handful of these proposals fall directly within our study area and greatly benefit our work.

Appendix E in particular, "Linkages," recommends that a "significant linkage of green space network be developed in the County." Its goals are to provide for both natural habitat linkages, expanded pedestrian pathways, and connecting County parks when possible. All of these goals line up with this study. Following a parcels of land highlighted in this Appendix that fall within our study area:

- *Woodbridge Creek Linkage (NE-1)*
  Links the Rahway River to the Arthur Kill along Woodbridge Creek. Includes a wetland protection preserve established in Woodbridge Township by the Woodbridge River Watch.
- *South Branch (of the Rahway River) Linkage (NE-2)*
  Links the proposed Middlesex Greenway to Roosevelt Park and Roosevelt Park to Merrill Park. Includes a proposal to use the state owned New Jersey Soldiers' Home property.

Regional

Published by the New Jersey Conservation Foundation in 1993, "Greenways to the Arthur Kill: A Greenway Plan for the Arthur Kill Tributaries" offers a comprehensive greenway plan for the entire Arthur Kill watershed, which includes the Rahway River watershed. This greenway plan provides vital ecological, geographic, and policy resources used as a foundation for this study. Its formulation, however, has not led to the construction of a greenway along the Rahway River. This documents attempts to build upon that work while laying the foundation for the implementation of the greenway proposed in this document.

State

According to the New Jersey State Plan, nearly the entire watershed area under study is designated as Metropolitan Planning Area 1, designated for growth by the New Jersey Office of Smart Growth), with the exceptions of the Watchung Reservation (designated under Parks and Natural Areas) and the South Mountain Reservation area (designated as Environmentally Sensitive Planning Area). Since growth is allowed, and anticipated in this area, it is vital that we act now and implement a greenway now to preserve open space while we still can, and to preserve it for the coming generations. The East Coast Greenway is a trail connecting the Appalachian Trail and other trails between Maine to Florida, and runs through the Rahway River watershed. This resource provides an opportunity for linkages to the proposed greenway in this document, linking the resource proposed in this document to this larger national treasure and attracting tourists.

Figure 1.4:

Municipal

Several municipalities within the Rahway watershed have greenway and open space plans which were consulted in the construction of this document. This plan aims to integrate vital details from these existing plans into one complementary vision for a singular greenway running parallel to the Rahway River.

Linden

Linden is in the process of creating the Linden City Greenway upon the 55-acre site of a closed landfill, which the City owns and operates, adjacent to the Rahway River. The landfill will be transformed to provide public access to the mix of forest and wetland resources around the landfill. The assemblage of the greenway will also arrange for 10 additional acres of adjacent land, in conjunction with a Natural Resource Damages Settlement with Merck through the NJDEP.

Rahway

In Rahway, The RBA Group prepared the Rahway River Greenway Concept Plan in 2005 for the Rahway River Association and the City of Rahway. This report provided a vision for a 1-1.5 mile stretch of the Rahway River corridor within the City of Rahway. Currently, the Concept Plan, funded through Green Acres, is achieving some of its goals. The Essex Street Park (across the River from the Rahway Library) is 50% complete. The CAFRA required public walkways were under construction and public access to the River via a boat launch is planned.

Carteret

The majority of Carteret's redevelopment efforts are focused on the edges of the Borough along the Rahway River, along the Woodbridge Township border and along the Arthur Kill. While not containing a greenway feature, Carteret's efforts do emphasize the creation of open spaces, such as golf courses and parks that can be woven into the proposed Rahway River greenway.

Maplewood

A map and proposal created for the Rahway River in Maplewood by the Land Conservancy of New Jersey provides for a naturalization of the rive, greater public access, and trail connections to the neighboring Reservation.

West Orange

The *West Orange Township Open Space and Recreation Plan* (West Orange Open Space Committee & Land Conservancy of New Jersey) inventories the existing open space within the municipality, as well as offers a proposal for pedestrian access and naturalization of the Rahway River within the Township's borders.

City of Orange Township

*Jefferson Avenue Art Walk (*Stephen Yablon Architects PLLC) is a proposal to create an 'urban village the Central Valley neighborhood" of the City of Orange Township. Focused on bringing commercial activity into the area, the plan looks to develop housing, utilize existing commercial structures for cultural and commercial purposes, and most importantly, naturalize and provide public access to the Rahway River within.

South Orange

South Orange has planned to rehabilitate the corridor of the East Branch of the Rahway River. As an extension of this plan, the Township has proposed a shared use trail along the East Branch that will serve as a spine for a Village-wide pedestrian and bicycle route that runs parallel to the River from the Maplewood to West Orange borders. In addition, South Orange has proposed to link all of its existing parks, which presents an opportunity for linkages to the greenway proposed in this document. Finally, the Township has proposed the restoration of embankments and the installation of a pedestrian path along the East Branch adjacent to Cameron Field.

In reviewing the municipal plans summarized above, several commonly occurring themes emerged that will be helpful in initiating a cooperative effort to implement the proposed Rahway River greenway. They include:

- Encourage conservation of areas inappropriate for development.
- Designate land for development of indoor and outdoor facilities as well as passive and active open space to meet the existing and future demand for recreation, preservation natural resources, and habitat.
- Efficiently utilize and improve the connectivity of the existing park system and propose a link by way of sidewalks, bicycle tracks, edge trail, historic areas and other resources.
- Improve the design of the existing parks and non-motorized access to park and natural areas
- Provide opportunities to access the river and interact with the natural ecosystem.
- Purchase or preserve the parcels and prohibit development of environmentally sensitive areas such as flood plains, water reserves, and wetlands.
- Promote public awareness through various communicative methods, such as information packets, brochures, municipal web site announcements, cable television, radio, and notices in municipal bills.
- Establish partnerships and coordinate with community groups, local government officials, and groups that support park system.
- Support policies and programs to promote health and welfare of the communities by encouraging walking, bicycling, outdoor recreation and other forms if physical exercise.

Plans presented by Heyer, Gruel & Associates PLLC and Rhodeside & Harwell discuss these goals.

Table 1.1: Plans referenced in report.

Entity	Title	Author	Year
Township of West Orange	Open Space and Recreation Plan	Land Conservancy of New Jersey and the Township of West Orange Open Space Committee and Land Conservancy	2005
City of Orange Township	Jefferson Avenue Art Walk	Stephen Yablon Architects PLLC	2006
South Orange	Open Space, Bicycle, Pedestrian, and Rahway River Plans	Heyer, Gruel & Associates	2007
South Orange	East Branch of the Rahway River: Master Plan	Rhodeside & Harwell	2007
Maplewood	Greenway/ Historic Sites Map	Land Conservancy of New Jersey	
Middlesex County	Open Space and Recreation Plan	CME Associates	2003
Essex County	Park, Recreation, and Open Space Master Plan	TM, Passaic River Coalition, & E. Timothy Marshall Associates	2003
Linden	Landfill Site - Linden, NJ Landscape Project	NJDEP	2006
Rahway	Rahway River Greenway Concept Plan	RBA Group	2005
West Orange	West Orange Township Open Space and Recreation Plan	West Orange Open Space Committee and the Land Conservancy of New Jersey	

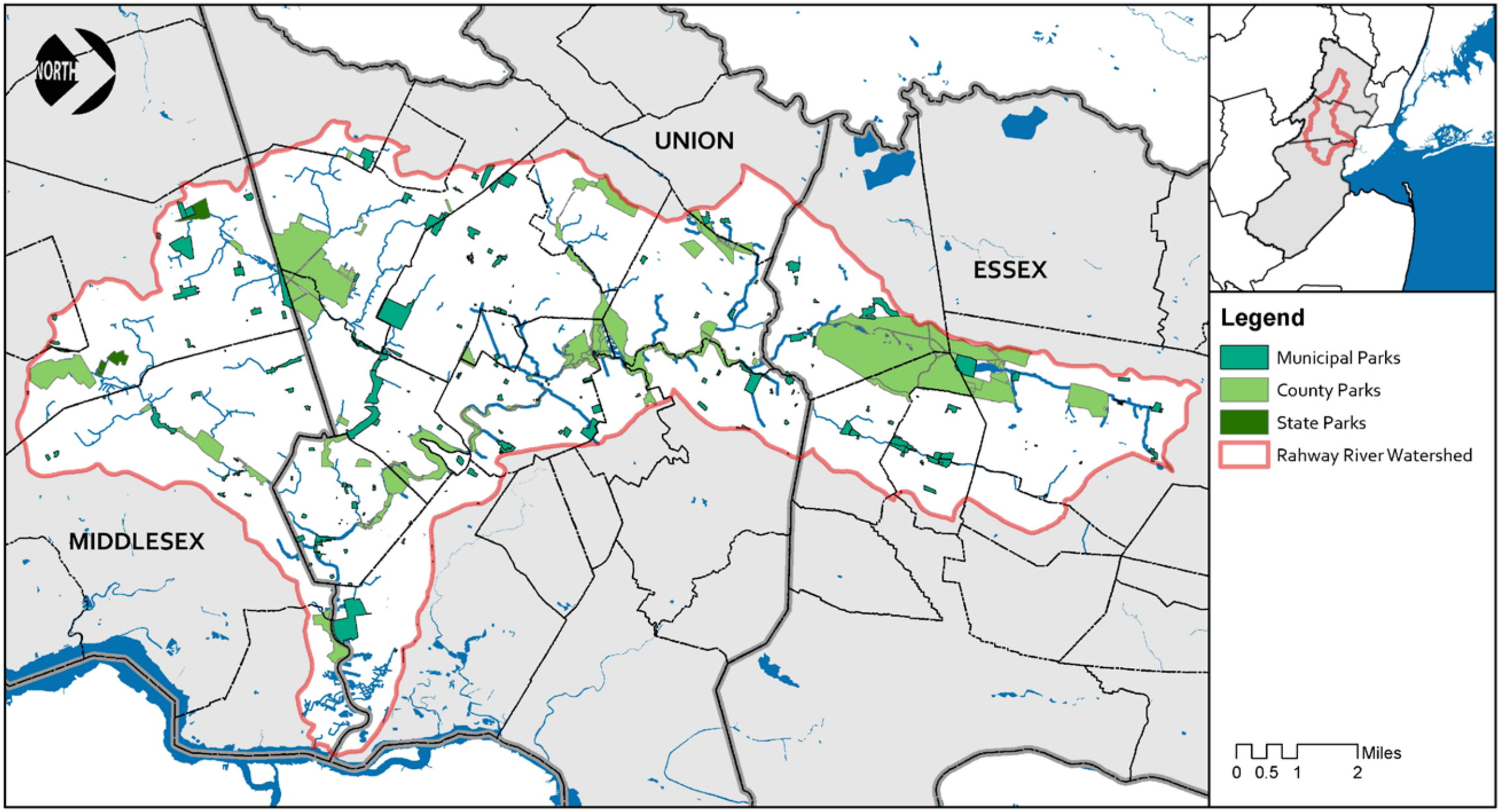


Figure 1.5: Map of existing State, County, and Municipal park lands.

1.2 Ecological Resources

Natural Resources

The Rahway River is 24 miles long and flows through Essex, Middlesex and Union Counties to its termination in the Arthur Kill between New Jersey and Staten Island. The highest point in the watershed is approximately 580 feet above sea level, located in the Watchung Mountains. Most of the watershed lies below 200 feet in elevation, with wide flat areas dropping gradually in elevation. Due to extensive development and destruction of riparian wetlands and floodplains, this highly urbanized watershed suffers from frequent flooding and is in dire need of repair and restoration.

Based on the 10 NJDEP biological monitoring sites located within the watershed aquatic life in the watershed is considered moderately impaired, with the Robinson Branch considered severely impaired. A 2006 report further indicates cause for alarm concerning NJ water bodies, stating that, "Less than 20% of the State's waters attain the general aquatic life use."

The upper reaches of the River (above the City of Rahway) are classified by the state as FW2-NT (freshwater non-trout), with designated acceptable for uses such as primary and secondary contact recreation, industrial water supply, public potable water supply after treatment, maintenance, migration and propagation of the natural and established biota. Although these classifications are based on NJDEP standards, the concentration of pathogen indicators indicates that much of the River is actually not supportive of the above activities.

The lower reaches of the River (below the City of Rahway) are designated SE2-SE3 (saline + estuarine) and are designated acceptable for secondary contact recreation, maintenance, migration and propagation (SE2 only) of the natural and established biota, but again do not meet the established standards for such uses.

Wildlife

Even with the environmental problems facing the Rahway River, life continues in and around the River. With some coordinated efforts, the Rahway can once again become part of the gem that the Olmstead brothers envisioned over 80 years ago. There are close to 5,000 acres of county parkland in the River's watershed, and much of the River's corridor in Essex and Union counties is public open space. The River is home to four anadromous fish species (those that spawn in freshwater and live in salt), including Alewife, Blueback Herring, Gizzard Shad, White Perch. It is also home to one specie of catadromous fish (those that spawn in salt water and live in freshwater), the American Eel (Anguilla rostrata). Other portions of the River are stocked with trout by the New Jersey Department of Environmental Protection for recreation. The lower portion of the River is tidal, extending up into the City of Rahway and consisting of salt marshes and tidal flats. The upper portion of River corridor consists of floodplains, woodlands and freshwater wetlands. The River's woodlands and wetlands provide much needed wildlife habitat in the region.

A survey conducted in 2005 and 2006 documented the presence of nearly 700 species of plants and animals within the River and riparian zone. After the Exxon oil spill of 1990, the Division of Fish, Game and Wild Life and the New Jersey Audubon Society (NJAS) documented heavy utilization of the River by nine heron species, as well, including great blue heron and yellow crowned night heron, both of which are state listed species.

Figure 1.6: Ducks enjoying the river in Cranford. *(Source: Kelly O'Brien)*

Common small mammals found in the watershed include raccoon, chipmunk, and possum. White-tailed dear were recorded in Lenape Park in Westfield by NJAS and probably occur at Ashbrook Swamp near the headwaters of the Robinson's Branch as well. Red fox inhabit both Ashbrook and Nomahegan Parks, and may also occur in larger parks in the Rahway River watershed. Numerous species of moles, shrews, bats, weasels, mice and rats would also be likely verified if inventoried.

The salt marshes and mudflats along the lower Rahway are high priority habitats and are the most extensive in the watershed and span four communities: Carteret Borough, the City of Linden, Woodbridge Township and the City of Rahway. Encompassing over 1,000 acres, this priority habitat contains 434 acres of salt marsh and 238 acres of brush and shrub lands. Over 1,500 gulls, many species of shorebirds, breeding clapper rail, egrets, ducks, plovers, hawks, pheasants, wintering northern harrier and marsh wrens utilize the site.

Figure 1.7: The lower section of the Rahway River in Carteret. *(Source: Raja Waran)*

Soils

The watershed lies mostly in New Jersey's Piedmont physiographic province, with the lower southeast corner overlapping into the inner coastal plain. The Piedmont has been worn mostly flat, with a few rounded hills and the Watchung Mountains in the west while the Inner coastal plain portion is nearly level, with only minor undulations.

The US Department of Agriculture (USDA) has inventoried Middlesex, Essex and Union County soils. Generally, the soils within the watershed comprise upland, poorly drained soils and modified (urban) soils. The poorly drained soils are seasonally wet, which supports some mixed woodlands, while the wettest soils allow only the most water tolerant tree species, such as pin oak and red maple. All major soils in the watershed have impervious pan or panlike layers that prevent drainage and are classified by the Middlesex County soil survey as inappropriate for development. In addition, much of the lands in the watershed are classified as urban, which means that considerable areas are filled and/or paved with cement, asphalt or other impervious surfaces. Mapped by New Jersey Geological Survey (NJGS), the watershed soils are a matrix of glacial till, estuarine deposits, river/floodplain deposits, swamp deposits, lake-bottom deposits and artificial fill (along the river's mouth).

Habitat Classifications

Wetlands provide habitat for reptiles, amphibians and fish. Painted turtles reside in freshwater stream corridors while diamondback terrapins dwell in saltwater reaches. Although north of its traditional habitat range, a slider turtle was sighted in Winfield Park. Green and wood frogs prefer the wetlands near open water, while the leopard frog lives in freshwater and brackish wetland near fields. Several varieties of shore birds feed on aquatic insects, small crustaceans and worms here.

There are both saltwater and freshwater wetlands, and the vegetation types are plentiful. Cordgrass grows in the most exposed section of estuarine emergent (indicates wetland planets that are submerged at the base but extend above water) wetlands (salt marsh). Saltmeadow hay lives beyond the Cordgrass, raised and shielded somewhat in less frequently flooded zones. Giant reed, sometimes considered an invasive species, is actually native to North America but has proliferated due to human modifications, such as pollution and marsh drainage, and drives out good marsh habitat.

Upland mixed oak forest, located in the drier parts of the watershed, signify habitats without standing water that still maintain adequate moisture. Upland mixed oak forest occurs in Essex County's South Mountain Reservation in upland areas at the headwaters of the Robinson Branch and in other locations throughout the watershed. Although there are other tree types in upland oak forests, three oak species (red oak, black oak and white oak) predominate. Other trees common to this forest type are scarlet oak, burr oak shagbark hickory, sugar maple, red maple, ash, beech and tulip poplar. Generally the understory consists of hop hornbeam, dogwood, ironwood and sassafras exist below the canopy and above a shrub layer (consisting of viburnum and spicebush). Upland Oak Forests depend on animals such as squirrels for seed dispersal and forest regeneration. Other inhabitants of this forest type include woodpeckers, blue jays and nuthatches; migrant warblers use the forest area in the fall and spring for migration and breeding.

Wildlife Issues and Invasive Species

The creation of a greenway along the Rahway River would be of great benefit to local wildlife. Further, such a greenway would fulfill the desires of the New Jersey Department of Fish and Wildlife, as documented in their New Jersey Wildlife Action Plan on January 23, 2008. The goals stated by the Wildlife Action Plan include both the restoration and reclamation of habitats and the creation of green "corridors" that will allow wildlife to disperse through developed regions. Many of these corridors contain streams and wetlands in an effort to preserve the waterways and provide habitats for aquatic species. The Rahway River greenway would act as such a corridor, if only for the aquatic species that live in the River.

Invasive species are a major problem in the Rahway River area. The fragmentation of native species habitat leaves areas open for invasive species to thrive. Such species, particularly *Phragmites australis* (Common Reed), are spreading explosively and having a negative impact on marsh-nesting birds. Other threatening invasive species that do considerable damage include the Asian longhorn beetle, gypsy moths, Japanese barberry, and non-native trout (which compete for resources with native trout). The creation of a greenway around the Rahway River will create areas where invasive species can be controlled and native species can be replenished.

The overpopulation of white-tailed deer and Canada geese also presents a problem to the Rahway River area. Both of these species feed on native vegetation but not on invasive species. Thus the damage to native plants populations is considerable. In addition, invasive species are then allowed to spread to the damaged areas.

Figure 1.8: Home owners with property along the river use visual scare devices to keep the nuisance geese away. The lifelike reflective predator eyes and markings confuse the birds. *(Source: Kelly O'Brien)*

1.3 Historical and Archaeological Sites

Existing Historical Resources

Preserving the historical and cultural resources adjacent to the River within the watershed is a goal of this greenway plan. According to the NJ Archaeological Map, the Rahway River watershed contains sensitive areas where there has been documentation of historical importance to American Indian tribes.

No properties adjacent to the Rahway River are currently on the state or national register. The following properties within the Central Railroad of New Jersey Main Line Corridor Historic District, a railroad right-of-way from Phillipsburg to Bayonne adjacent to the River in Essex, Middlesex, and Union Counties, however, are eligible for Historic Register nomination:

- Cranford Station, South Avenue
- Walnut Avenue Bridge
- Rahway River Bridge
- Centennial Avenue Bridge
- Cranford Junction Coach Yard
- Morses Creek Culvert
- Creek Bridge
- Lincoln Avenue Bridge

These properties are all components of this historic district and were given a Decision of Eligibility (DOE) in November 30, 2005, making them eligible for register listing as of 2007.
It is unclear whether there has been an effort to place the Central Railroad District on the list yet, but this plan recommends that the process be undertaken, as the improvement of these properties will improve the Rahway River greenway by preserving lands of great aesthetic value which will be maintained in the long-term. All of the associated bridges and culverts are publicly owned, which should facilitate the preservation process. Register listing does not limit the use of the property to greenway use, however, as it simply recognizes its significance and entitles access to preservation funds.

There are various organizations that should be consulted on the state level to assist with technical assistance and funding in historical and archaeological issues, including:

- NJ State Historic Preservation Office - Located within DEP, expertise in variety of fields essential to preserving historic resources, offer technical assistance for archaeology, cultural resource surveys, New Jersey and National Register nominations
- NJ Historic Trust - Non-profit preservation organization in NJ created by state law, affiliated with the Division of Community Affairs, Advances HP in NJ through education, stewardship, and financial investment Programs
- Preservation NJ - State-wide private membership-supported historic preservation organization in NJ, provides technical assistance and information to homeowners, municipalities, historic preservation commissions, nonprofit agencies, and other individuals and groups

Figure 1.9: Historic bridge *(Source: Raja Waran)*

1.4 Contamination

Known Contaminated Sites

A handful of New Jersey-based programs administered by the NJ DEP and the EPA document known contaminated parcels of land. Our effort has made note of all sites monitored by these programs that fall within the 300-foot buffer of the river. As such, some of the locations have not been remediated, while others are being addressed by various cleanup efforts. The appendix to the report contains a detailed listing of the sites. Figure 1.1, below, displays the contaminated sites described below.

The *NJDEP Known Contaminated Sites Shapefile* list dates from 2001 and contains sites and properties within the state where contamination of soil or ground water has been identified, or where there has been, or there is suspected to have been, a discharge of contamination. This includes sites where remediation is either currently under way, required but not yet initiated, or has been completed.[4]

In the late 1970s and early 1980s, the NJDEP developed the nation's first program dedicated to the cleanup of contaminated sites from industrial, commercial, and household activity that posed a danger to human health and the environment – the NJDEP Site Remediation Program. The passage of several key state laws followed facilitating these efforts.[5] The Site Remediation Program maintains a database of *Known Contaminated Sites (KCS-NJ Sites)* last updated in May 2008. There are three types: Active Sites, Pending Sites, and Closed sites.[6]

Finally, on the federal level, the Environmental Protection Agency's Region 2 encompasses New Jersey. The EPA administers the *Superfund* program, born from citizen reaction to pollution conditions in the 1980s. This initiative is designed to locate, investigate, and clean up the most hazardous sites nationwide.[7] There are three components to the Superfund program: *Resource Conservation and Recover Act (RCRA)* components address accidents at facilities that house hazardous wastes. The *National Priorities List (NPL)* is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation. Finally, the *Brownfields* component converts formal industrial and commercial facilities into areas of designed for community use.

Table 1.2: Known contaminated sites within the Rahway River watershed.

Type	Count
KCS-NJ Active Sites	511
KCS-NJ Pending Sites	63
EPA Superfund Sites	6

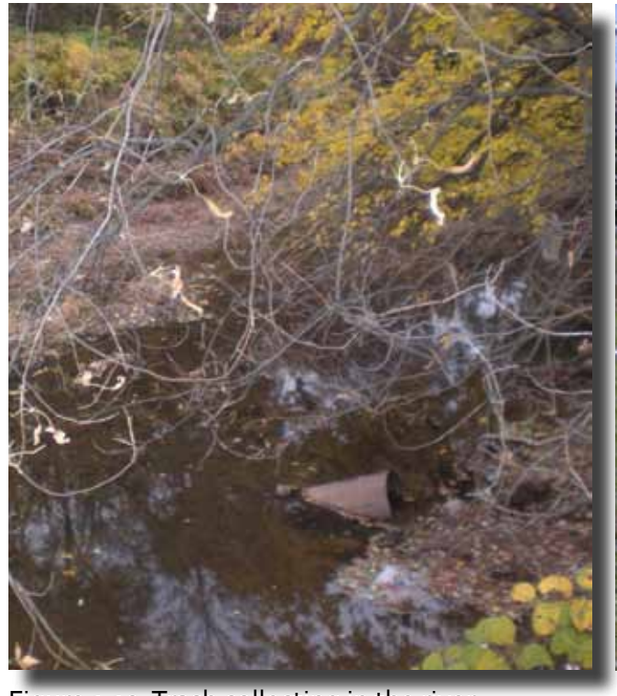


Figure 1.10: Trash collecting in the river. *(Source: Raja Waran)*

Figure 1.11: Playing fields closed off for remediation. *(Source: Raja Waran)*

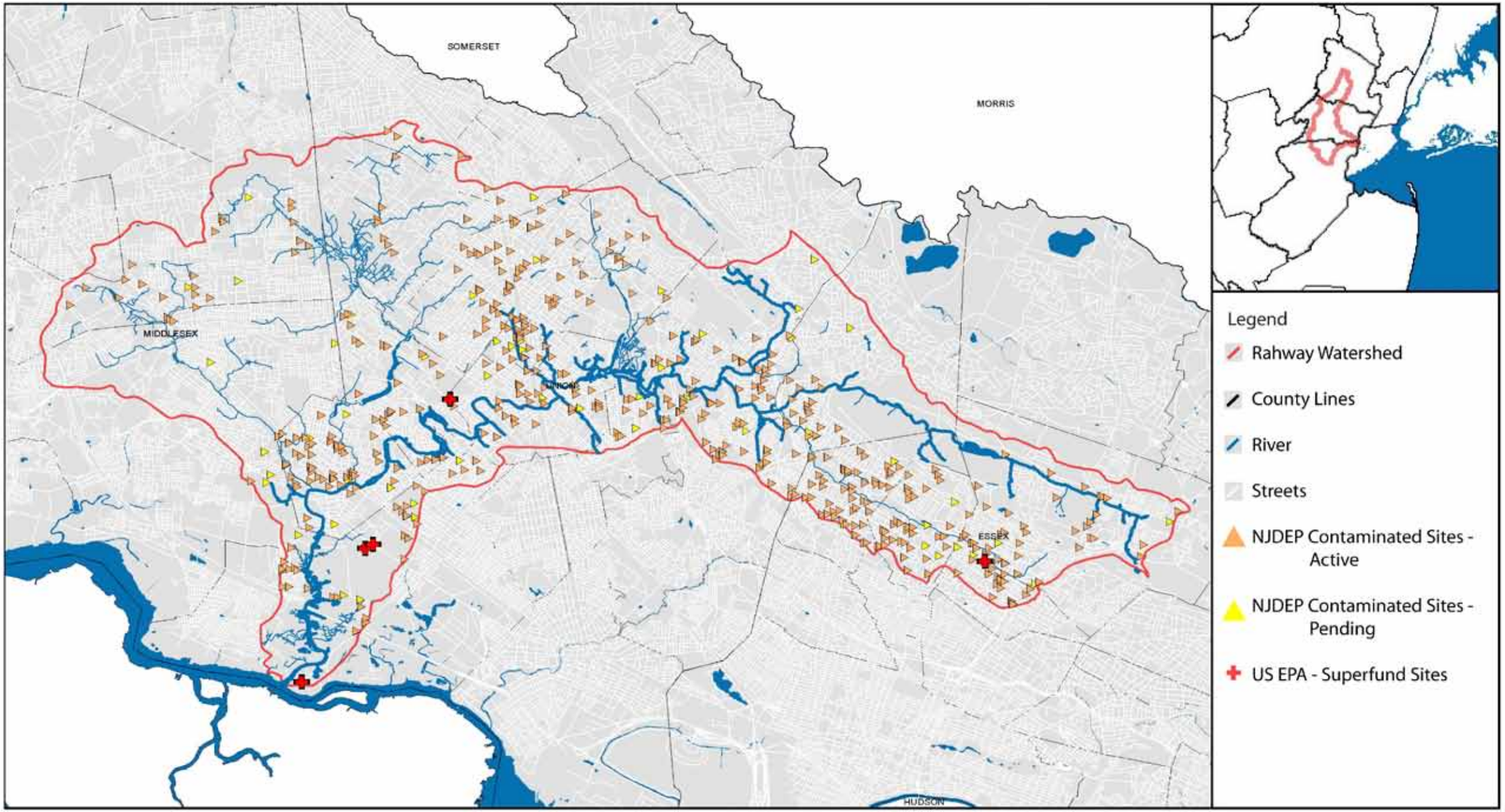


Figure 1.12: Map of Known Contaminated Sites within the study area

Industrial Site Recovery Act

Worth noting is the *Industrial Site Recovery Act (ISRA)* which imposes certain preconditions on the sale, transfer, or closure of "industrial establishments" involved in the generation, manufacture, refining, transportation, treatment, storage, handling or disposal of hazardous substances or wastes.[8] This program provides opportunities for the redevelopment and naturalization of closed industrial sites.

Under ISRA, owners and operators of industrial establishments must notify the NJDEP when they intend to close or sell ownership of their facilities. NJDEP then approves a remedial action plan or agreement as a precondition of closure or ownership transfer. The NJDEP can also recommend no action. Property owners and the operators of the industrial establishment are jointly liable for compliance with ISRA. The Legislature's intent in imposing a cleanup plan and requiring a funding source for the clean up can ensure that contaminated property is not abandoned to the State for cleanup.

All of the following four conditions must exist for a facility to be subject to ISRA:

- The facility has a subject North American Industry Classification System (NAICS) code as listed in N.J.A.C. 7:26 B - Appendix C subject to the specified exceptions and limitations;
- An applicable transaction (change in ownership or cessation of operation), as specified in ISRA;
- Operations of an industrial establishment must have been conducted after December 31, 1983; and
- Hazardous substances or hazardous wastes were on-site.[9]

Other Known Contaminated Sites

- There are also at least two (2) known cases of contaminated landfills being used in Rahway and Springfield.

- In April, 2007, the city of Linden and the state of New Jersey reached a $3 million settlement that led to the final closure of the Linden Landfill and initiated a program of stormwater control and surrounding wetland preservation. The Linden Landfill opened over 50 years ago, and ceased operations in January 2000. A plan was then created to control leakage and stormwater runoff - the city and its contractor did not follow the DEP guidelines, however, and a series of violations were handed down.

  The settlement required the city to properly close the landfill and enhance 50 acres of surrounding forest and wetlands that will contribute to a greenway. The city was required to pay $1 million in fines and commit an additional $1 million for greenway access projects. The NJ DEP agreed to provide $1 million in matching funds for greenway projects. Ten additional acres of wetlands preserved as part of this settlement will be made part of the greenway.[10]

- The NJ DEP filed a $6 million lawsuit on behalf of the borough of Carteret stemming from a Rahway riverfront improvement project, improperly using dredge material to built wetlands at Joseph Medwick County Park, that allegedly contaminated a Carteret public grade school's land. The suit argues that toxins such as lead and arsenic were found in the property. The Port Authority of New York & New Jersey was named in the suit for using the contaminated infill between 2005 and 2007.[11]

- There has also been concern over illegal dumping near the river in Union County Parks.[12]

Figure 1.13: View of the Linden Landfill from Carteret.
(Source: Raja Waran)

Notable Cleanup Efforts

The New Jersey government is not the only entity working to clean the Rahway River. On a local level, efforts such as *Clean Up Milburn* allows residents to take matters into their own hands.

Clean Up Millburn 2008 coordinated over 270 volunteers for participation in Rahway River Clean-up removing trash and litter from the South Mountain Reservation, Taylor Park, Gilbert Place, Vaux Hall Road Bridge, Gero Park and Old Short Hills Park. A range of local organizations were involved, from Girl Scout troops, school organizations, and religious groups. Another effort is planned for April 2009.

Efforts such as *Rahway River Appreciation Day in South Orange* have also brought together organizations and community members to get involved.[13]

The continued support and coordination of these local efforts are fundamental in the future health of the river.

Overall Water Conditions

The NJDEP's *DRAFT 2008 New Jersey Integrated Water Quality Monitoring and Assessment Report* is the current version of a report published every two years. The report describes the quality of New Jersey's water, and aims to provide tools for waters that do not attain their designated uses based on New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B). The standards establish designated uses, classify streams based on uses, designate antidegradation categories, and develop water quality criteria.[14] Following are the types of standards, and designations for the Rahway River where available.

Table 1.3: NJ Stream Classifications Relevant to the Rahway River[15]

Code	Type
FW1	Freshwaters kept in natural state (not subject to any man-made wastewater discharges)
FW2	All freshwaters not classified as FW1
PL	All waters within Pinelands Area
FW2-TP	Freshwaters suitable for trout spawning and nursery purposes
FW2-TM	Freshwaters suitable for the support of trout throughout the year
FW2-NT	Freshwaters not suitable for trout production and maintenance
SE2	Saline estuary waters with arbitrary uses defined by the State DEP. Less saline than SE3.
SE3	Saline estuary waters with arbitrary uses defined by the State DEP. More saline than SE1 & SE2.

Table 1.4: NJ Designated Uses[16]

Use	Code
Aquatic life (General)	All Waters
Aquatic life (Trout)	FW1 & 2, PL, classified as TP or TM
Primary contact recreation (activities that involve risk of water ingestion)	FW1 &2, PL
Secondary contact recreation (activities with minimal risk of water ingestion)	SE2, SE3
Drinking Water	FW2, PL
Agricultural Uses and Water Supply	FW2, PL
Industrial Water Supply	FW2
Fish Consumption	All Waters

Table 1.5: The Rahway River's Stream Classifications[17]

Branch	Code
South Branch	
(Rahway) - Source to Hazelwood Ave., Rahway	FW2-NT
(Rahway) - Hazelwood Ave. to mouth	SE2
Main Stem	
(Rahway) - Upstream of Pennsylvania Railroad bridge	FW2-NT
(Linden) - Penn. Railroad bridge to Route 1&9 crossing	SE2
(Carteret) - Route 1&9 crossing to mouth	SE3

The classification of the Rahway River allows all secondary contact recreation (e.g. boating and fishing), fish consumption, and the migration and maintenance of all natural and established aquatic life. Uses such as primary contact recreation (wading, swimming, and diving) are restricted to the South Brach from the source to Hazelwood Ave in Rahway and the Main Stem from its source to the Pennsylvania Railroad Bridge in Rahway. Likewise, those waters could be used as drinking water, industrial and agricultural water supplies, and the seasonal stocking of trout. The physical, chemical, or biological conditions of the Rahway River make it unsuitable for the year-round maintenance of trout.

While the Rahway River is classified for the uses listed above, the current water quality of the river makes many of those uses unacceptable in the areas in which they are classified. The term that the New Jersey Department of Environmental Protection uses to determine whether or not a particular use is acceptable is "attainment." A use is attained if the water quality of the stream is good enough to allow its performance. The following table lays out the use assessment results of water quality designations created by the NJDEP.[18]

Table 1.6: NJDEP Use Assesment Results

Use Assessment Result	Integrated Assessment	Sublist
Full Attainment	All designated uses are assessed AND all uses are attained. (Based on USEPA guidance, the Fish Consumption Use Assessment is not considered in this determination.)	Sublist 1
Attained	The designated use is assessed and attained BUT one or more designated uses in the assessment unit are not attained and/or there is insufficient information to determine if the use is attained.	Sublist 2
Insufficient Data	Insufficient data is available to determine if the use is attained.	Sublist 3
Not Attained	The designated use is not attained or is threatened; however, development of a TMDL is not required because a TMDL has been developed for the pollutant causing non-attainment.	Sublist 4A
Not Attained	The designated use is not attained or is threatened; however, development of a TMDL is not required because other enforceable pollution control requirements are reasonably expected to result in conformance with the applicable water quality standard(s) in the near future and the designated use will be attained. Examples of such requirements include nonpoint source pollution controls, lake restoration projects, NJPDES stormwater permits, and enforcement actions.	Sublist 4B
Not Attained	The designated use is not attained or is threatened; however, development of a TMDL is not required because non-attainment is caused by something other than a pollutant (e.g. "pollution" such as overland flow of stormwater, stream flow alterations, or habitat degradation).	Sublist 4C
Not Attained	The designated use is not attained or is threatened by a pollutant(s) and a TMDL is required.	Sublist 5

Table 1.7: The designated use attainment results for the Rahway River, broken down by sections.[19]

Name	Aquatic Life (General)	Aquatic Life (Trout)	Recreation	Drinking Water Supply	Ag Water Supply	Industrial Water Supply	Shellfish Harvest	Fish Consumption
Rahway River WB	Sublist 5	N/A	Sublist 4A	Sublist 5	Sublist 5	Sublist 2	N/A	Sublist 3
Rahway River EB	Sublist 5	N/A	Sublist 4A	Sublist 5	Sublist 5	Sublist 2	N/A	Sublist 3
Rahway River (Kenilworth Blvd to EB / WB)	Sublist 5	N/A	Sublist 4A	Sublist 3	Sublist 5	Sublist 2	N/A	Sublist 3
Rahway River (Robinsons Br to KenilworthBlvd)	Sublist 5	N/A	Sublist 4A	Sublist 5	Sublist 2	Sublist 5	N/A	Sublist 5
Robinsons Branch Rahway River (above Lake Ave)	Sublist 5	N/A	Sublist 4A	Sublist 2	Sublist 2	Sublist 2	N/A	Sublist 3
Robinsons Branch Rahway River (below Lake Ave)	Sublist 5	N/A	Sublist 4A	Sublist 5	Sublist 2	Sublist 2	N/A	Sublist 3
Rahway River SB	Sublist 5	N/A	Sublist 4A	Sublist 5	Sublist 5	Sublist 2	N/A	Sublist 5
Rahway River (below Robinsons Branch)	Sublist 2	N/A	Sublist 2	N/A	Sublist 3	Sublist 3	N/A	Sublist 5

Currently none of the designated uses for the Rahway River are fully attained. By definition (established by the NJDEP) these uses cannot be fully attained until all other uses are attained (i.e. all uses must be placed on "Sublist 2" for any to be placed on "Sublist 1"). Those uses that are on "Sublist 2" are defined as being met by the NJDEP (i.e. it is acceptable to use the river for this purpose). "Sublist 3" refers to those areas where there is not enough data to make an attainment determination. Those uses placed on "Sublist 4A" are not being met due to poor water quality but a total maximum daily load of the pollutant(s) has been calculated and quality is being monitored. Those uses placed on "Sublist 5" are not being met due to poor water quality but no total maximum daily load has been calculated (i.e. it is unknown how much of the pollutant(s) there actually is in the River).

Table 1.6 shows that, while some of the designated use attainment results are attained, nearly three-quarters of the applicable uses are not attained due to water contamination. Compared to other New Jersey streams, the Rahway River does not have a good attainment record. While it is similar to the average New Jersey waterway in the Industrial and Agricultural Water Supply uses, it does not retain comparability in other uses, particularly Aquatic Life and Recreational uses. Additionally, many of the pollutants that contaminate the river have direct human health impacts and are detrimental to the maintenance and propagation of natural and established wildlife. In fact, because of the contamination, the NJDEP has made a general fishing advisory suggesting that many of the fish caught from the Rahway River be consumed only in limited amounts.

Table 1.8: Consumption restrictions on fish caught in the Rahway River.[20]

Fish Species	FW2 Waters (Normal Individual)	FW2 Waters (High-Risk Individual)	SE2 and 3 Waters (Normal Individual)	SE2 and 3 Waters (High-Risk Individual)
Striped Bass	N/A	N/A	Four meals per year	Do not eat
American Eel	N/A	N/A	Do not eat	Do not eat
White Perch	N/A	N/A	Do not eat	Do not eat
White Catfish	N/A	N/A	One meal per year	Do not eat
Largemouth Bass	One meal per week	One meal per month	N/A	N/A
Smallmouth Bass	One meal per week	One meal per month	N/A	N/A
Chain Pickerel	One meal per week	One meal per month	N/A	N/A
Yellow Bullhead	No restrictions	One meal per month	N/A	N/A
Sunfish	No restrictions	One meal per month	N/A	N/A
Brown Bullhead	No restrictions	One meal per week	N/A	N/A

Table 1.5, located in the Appendix, displays what pollutants are affecting the water quality of the Rahway River, as well as the priority ranking assigned to it by the federal government, as per the Clean Water Act.[21]

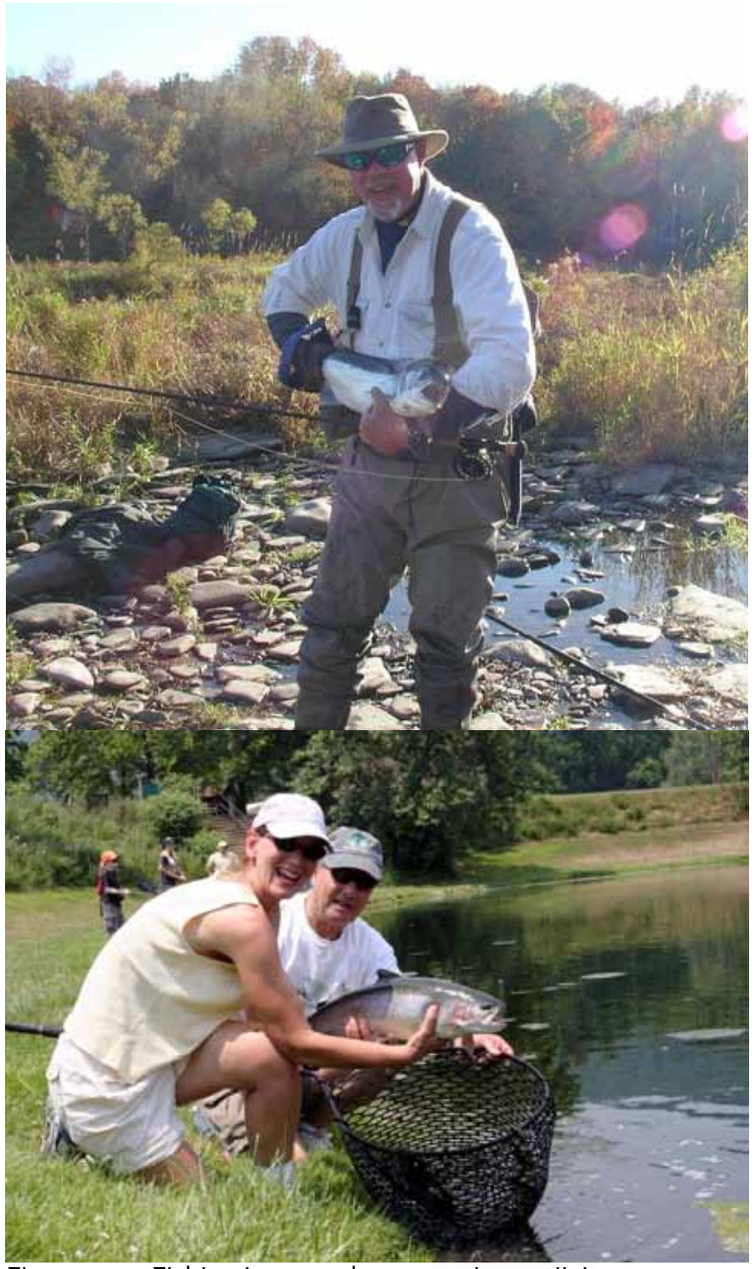


Figure 1.14: Fishing is a popular recreation actiivity.
(Source: http://www.cjtu.org/)

1.5 Land Uses

Residential

The Rahway River watershed is predominantly residential, comprising single-family, two-family and multi-family housing units. Residential land uses vary greatly by location along the River and within its watershed. Carteret makes up the lowest residential land use (~24%) within the watershed, while Millburn represents the highest (~67%). Generally the higher residential land use densities occur along the mouth of the River, near the Arthur Kill, in cities such as Rahway and Linden. Since the watershed is nearly fully built out, with little land to spare, new development mostly occurs as infill in the urban environment. Although infill development is considered a positive by many environmental planners, it is the challenging to complete and can cause environmental damage if done incorrectly.

Industrial

While the watershed does have an industrial past, today much of the industry is concentrated in the Rivers lower reaches, leaving many areas beautiful and unaffected today. The largest concentration of industrial land is in Linden and Carteret (~29% industrial), while West Orange only has .5% of land covered by industrial uses. Modern industrial activities along the River include petroleum-manufacturing operations, power plants, warehousing, truck distribution and research and development.

Commercial

Types of commercial development differ based on the amount of land they consume and the nature of the activity. Regional shopping centers with hundreds of parking spaces have replaced older traditional central business districts. The largest shopping complexes in the watershed, and possibly the area at large, are located in Woodbridge and Millburn Township (Menlo Park). With access to major highways such as the Garden State Parkway and New Jersey Turnpike, these large shopping centers have attracted business and spurred regional growth centers. Route 22 in Essex and Union Counties and Routes 27 and 28 in Linden and Westfield have become the major business corridors in the area, attracting new residential, office and strip developments.

Brownfields and Greyfields

Redevelopment in older industrial and commercial centers are often referred to as either "brownfields" or "greyfields," but collectively are called "infill." Brownfields are abandoned industrial sites, while greyfields are underutilized commercial sites. Under New Jersey's Brownfields Redevelopment Program, eight state taxes (including sales, business use and corporate taxes) can be used to reimburse developers for up to 75%t of the cost of cleaning up a contaminated property.

In New Jersey, there are thousands of these sites within both the state and within the watershed that are ripe for redevelopment. While much of the redevelopment occurring is itself conventional, automobile-oriented design, an increasing number of these projects use Traditional Neighborhood Design (TND) concepts and they are proving to be the key to breathing new life into older communities.

Carteret, for example, is in the middle of a $700 million redevelopment that will include homes, office complexes, a hotel and a waterfront park. Current plans would bring the borough $20 million in new tax revenue a year; while it currently takes in some $13 million.

In the years after World War II, Carteret was a thriving waterfront hub for the production of metals, chemicals, lumber and petroleum products. But the sites have long since transitioned to brownfields with the loss of an industrial presence. The last 20 years have seen several abortive attempts[22] to recharge Carteret's economy. Plans included the construction of telecommunication and data centers during the high-tech boom of the 1990s. More recent efforts hope to capitalize upon its location near New York City in the heart of the Northeast corridor.

Figure 1.15: Commercial uses along the river. *(Source: Raja Waran)*

1.6 Transportation and Linkages

Transportation to and from the greenway area is plentiful, with numerous street networks, bus stops, and rail stations serving the watershed. Much of the land in the proposed Rahway River greenway area is devoted to transportation as well. The New Jersey Turnpike, the Garden State Parkway and I-78 all cross into the greenway area. Other major highways that pass through the 300 foot greenway buffer include U.S. 1, 9, and 22, as well as state highways 35, 27, and 28. These highways are complemented by many arterials and countless neighborhood streets that all provide access into the greenway area.

Many commuter rail stations are within walking distance of the greenway area as well, including Rahway, Cranford, Millburn, Maplewood and South Orange. NJ Transit's Metropark Station also services the greenway area. In addition to the train stations, there are many bus stops in Rahway, Cranford, and South Orange, as well as other municipalities, within a five (5) minute walk of the greenway, including Routes 115, 62, 113, 59, 70, 92, 107, 114 and 117.

The master plans of the City of Orange, Edison Township, and other municipalities recommend accessibility to multi-modal transportation facilities and improving existing transit systems, as well. Edison's master plan also proposes to expand the program "rails to trails" on the existing railroad right-of-ways. In addition, it proposes to develop pedestrian corridors, a comprehensive sidewalk system, and pathways to link municipal and county recreational facilities, as well as to connect neighborhoods within the area. Several other master plans of the municipalities along the Rahway River, such as Woodbridge and Rahway, as well as the Union County Master Plan, encourage the creation of walkways and bicycle paths along the River. Unfortunately, they are unspecific about how this is to be accomplished.

Maplewood's master plan has a concise summary of the Bicycle Master Plan. South Orange Township's Bicycle and Pedestrian Circulation Plan identified corridors to improve connectivity among parks and to provide linkages within South Orange and points beyond. Other communities acknowledge the need to reduce traffic, yet fail to include plans for the creation of such trails.

There are concerns about the linkages and connectivity between the recreation and community facilities of various municipalities and counties in the Rahway River watershed area. Most of the parks and open space in the watershed area are not within walking distance of NJ transit stations. Townships need to encourage increased bus service to improve connections to municipal and county parks. Although many municipalities do not have on-road bicycle facilities, many existing parks along the Rahway River have bicycle and pedestrian trails available for public use. These are generally not contiguous, however, and do not connect the park system.

A transportation study may be a first step in addressing such concerns and making recommendations to improve accessibility, linkages, and connections to open spaces and maximize the efficiency of the exiting circulation system.

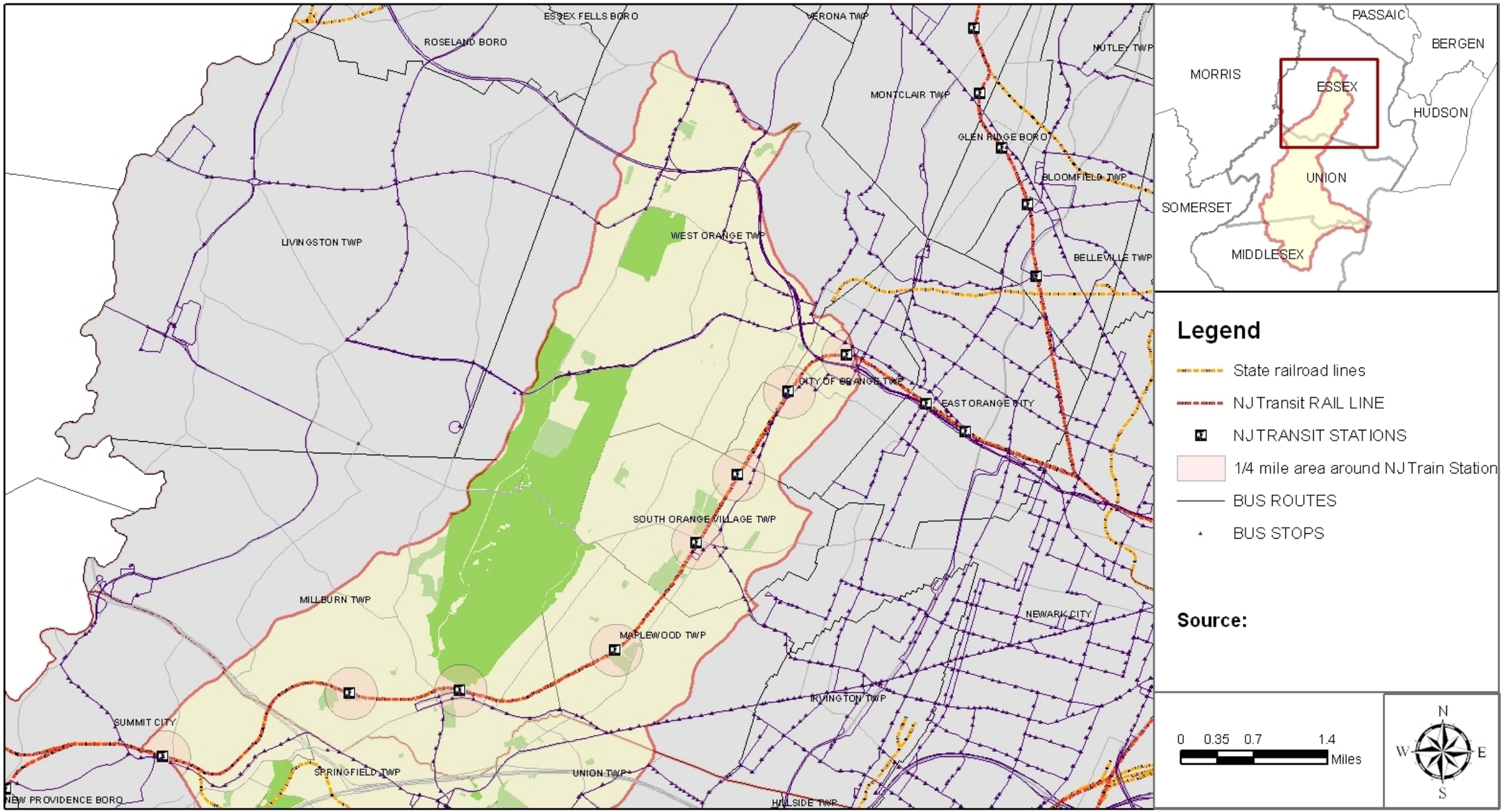


Figure 1.16: Transportation linkages, Essex County

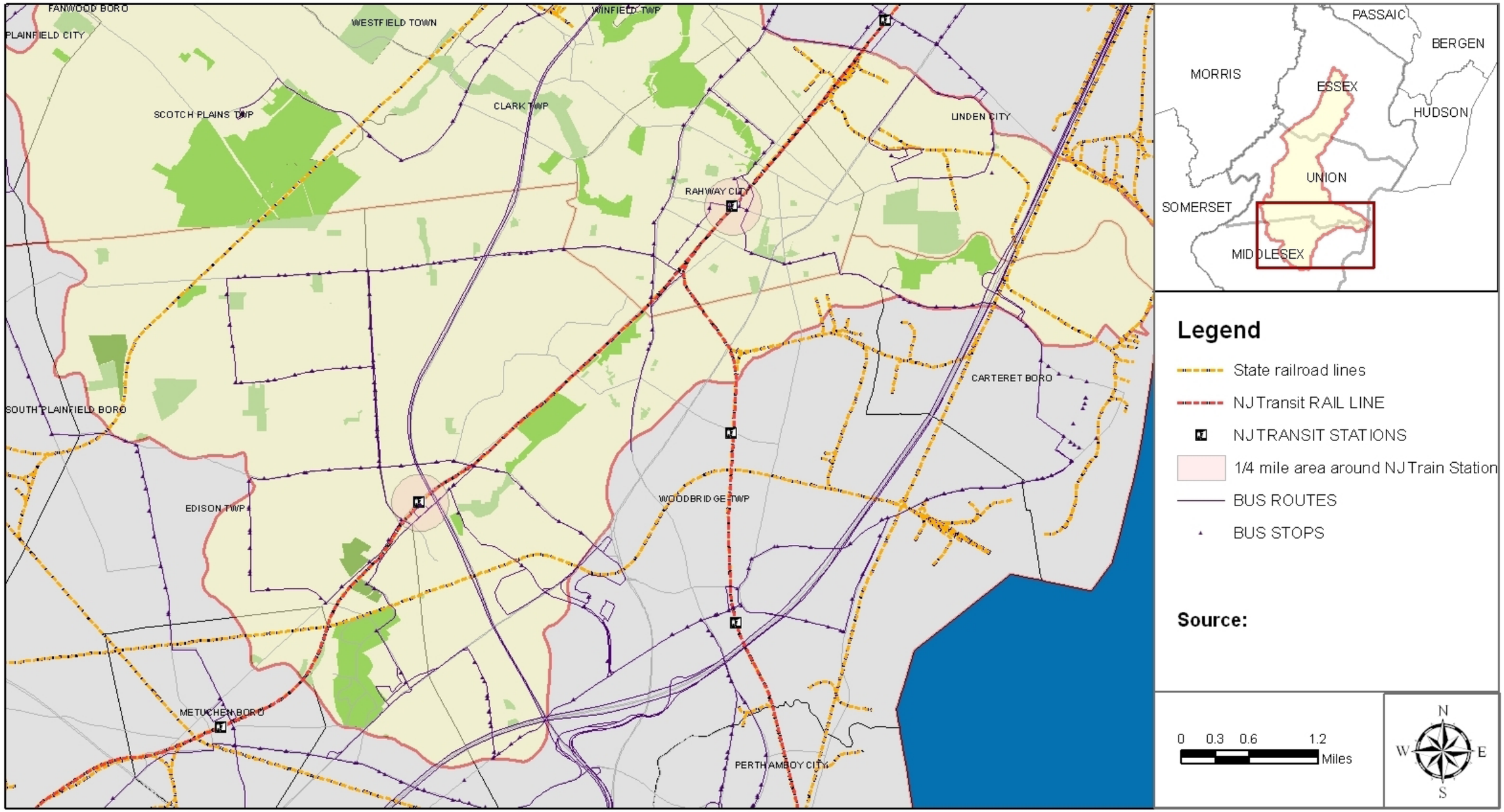


Figure 1.17: Transportation linkages, Middlesex County

Figure 1.18: Transportation linkages, Union County

1.7 Flooding

Flooding in the Rahway River watershed is largely due to the excessive rate of surface runoff and the cresting of the River during heavy storms. Out of 6,518 acres of recreation and open space, 2,804 fall within the 100 or 500 year flood plain, reinforcing the importance of the proposed greenway to mitigate flooding, prevent property destruction, conserve valuable public and private funds. One consequence of flooding is soil erosion, with an example of erosion along the Rahway in Cranford seen below in Figure 1.2, below.

The flooding along the riverbanks causes serious damage to vegetation, houses, businesses, physical infrastructure, erosion of river and stream banks, and erosion of tree roots in the riparian zone. Unfortunately, the widespread flooding is largely due to the lack of awareness of the dangers of building within a floodplain. For example, Union County and the Township of Cranford were declared federal disaster areas as a result of the storm and resulting flooding in April 2007, a result of past development within the floodplain. [23]

Figure 1.19: Rahway River bank erosion in Cranford, NJ *(Source: Kelly O'Brien)*

Flooding in the Rahway River watershed is due to heavy soil and impervious cover which does not allow water to permeate into the soil. During heavy storms, the heavy texture of the soil in certain areas impedes internal drainage, causing higher rates of surface runoff. This aggravates existing downstream flooding and erosion problems. During flooding, small particles suspended in the water are deposited on the riverbanks due to water overflow as well, resulting in fine-grained clayey soils which are impervious and have poor drainage quality. Therefore, it is important to have a comprehensive storm water master plan to maintain storm water infrastructure and funding mechanism. Common causes of flooding seen throughout municipal plans include:

- Heavy storms and inadequate drainage systems.
- River and streams carrying flows in excess of its transporting capacity within their banks. This may be due to obstruction of the natural flow of a river and water detaining by a dam, embankments or encroachments.
- Backwater effect in tributaries.
- Aggradations and sedimentation in the riverbed and deforestation in the river basin.

NJDEP regulates land use in flood plain areas through its stream encroachment permitting process, and activities in flood prone areas under the Flood Hazard Area Control Act. Various municipalities in New Jersey enacted a comprehensive Flood Damage Prevention Ordinance to regulate and designate new land uses in flood hazard areas as well.

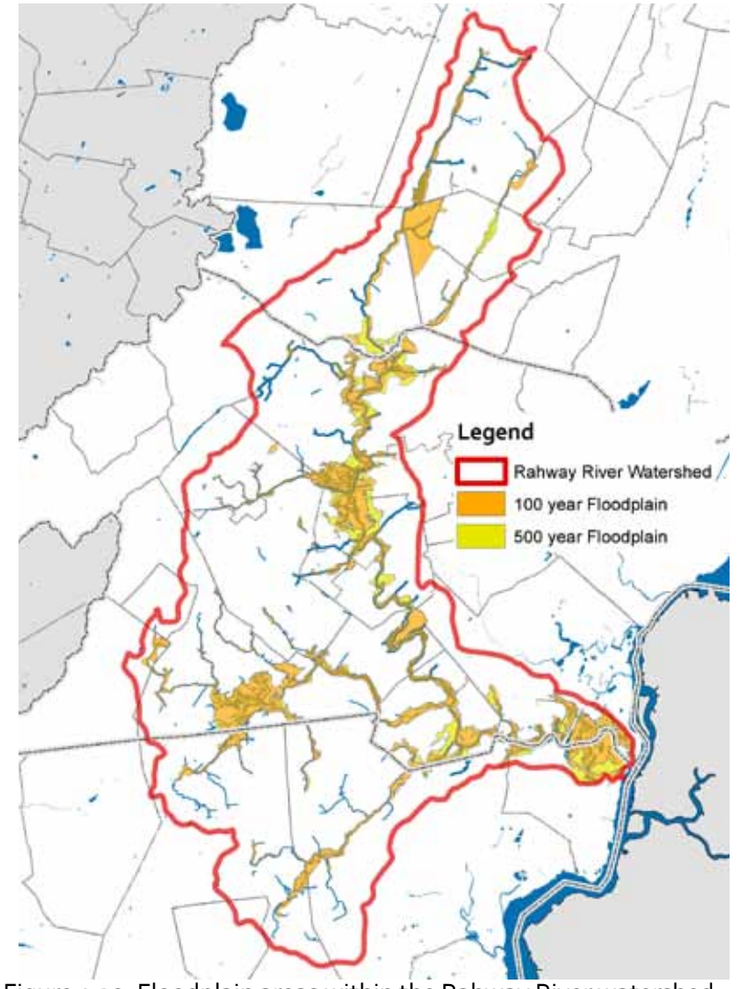


Figure 1.20: Floodplain areas within the Rahway River watershed

There are various ways to prevent flooding, summarized below:

- Embankments, floodwalls and draining channels can provide protection against floods.
- Provision of reservoirs to store excess river water.
- Land use planning and watershed management to deliver a controlled flow of river water downstream and preventing excessive runoff.
- Soil conservation by creating a green buffer along the river and its tributaries.
- Adopt retrofitting techniques (structural changes), such as elevation, barriers, dry flood proofing, and wet flood proofing.
- Wetlands play an important role in floodplain management. They act as a retention basin and absorb excess water runoff during heavy storms. They also help during droughts by releasing stored floodwaters.
- The Essex County Park, Recreation and Open Space Master Plan recommends to protect the areas with slope greater than 15 percent. Development in such areas may cause erosions and exacerbate flooding problems.
- The NJ State Development and Redevelopment Plan recommends use of nonstructural methods for floodplain management, including increased filtration.
- Prohibit development and conserve environmentally sensitive areas such as floodplains and wetlands.
- Statement of compliance with the Flood Hazard Area Control Act should be the part of development permit application.

NJDEP adopted new Flood Hazard Control Act rules on November 5, 2007 to regulate development in flood hazard areas and riparian zone adjacent to water surface. Zero-percent net-fill requirements will now apply to all non-tidal hazard areas. Riparian zones of 50, 150, 300 feet in width are proposed (depending on environmental resource to be protected) along each side of the water surface to preserve near stream vegetation. Certain upstream tributaries and Category One waters, receive 300 ft zone, whereas water courses which flows through the contaminated area, receives 150 ft zone.

New Jersey Statewide Flood Control Master Plan compiles data on flood histories, flood control efforts and areas with flood potential. An approved local mitigation plan is required by the local governments prior to the approval of local mitigation project grants to apply for the Pre-Disaster Mitigation funds. States are also required to have an approved Standard Mitigation plan. To maintain the eligibility for future PDM funding, the following conditions must be met:

- Property acquisition or relocation of hazard prone property for conversion to open space in perpetuity;
- Structural and non-structural retrofitting for flood hazards
- Minor structural hazard control or protection projects that may include vegetation management, and storm water management (e.g., culverts, floodgates, retention basins); and,
- Localized flood control projects, such as certain ring levees and floodwall systems, that are designed specifically to protect critical facilities and that do not constitute a section of a larger flood control system.

Mitigation Strategies as per 2008 State Hazard Mitigation Plan include:

- Expand and enhance flood warning and emergency communications systems to improve local and state capability to protect life.
- Effectively address flood plain management laws and regulations.
- Encourage municipal participation and public support in existing programs – FMA, PDM, HMGP to improve the structural integrity of vulnerable homes.
- Strengthen State and local building code enforcement to reduce flood loses and flood insurance claims.
- Promote Community Emergency Response Team training and education programs to enhance community ability to effectively respond to hazard events.
- Prioritize structural and non-structural retrofits for critical areas based on their vulnerability and enhance comprehensive GIS based repository.
- Utilize NJDEP Green Acres, Blue Acres and Flood Control acquisition funds to promote more acquisition of repetitive loss structures.
- Enhance community outreach and awareness.

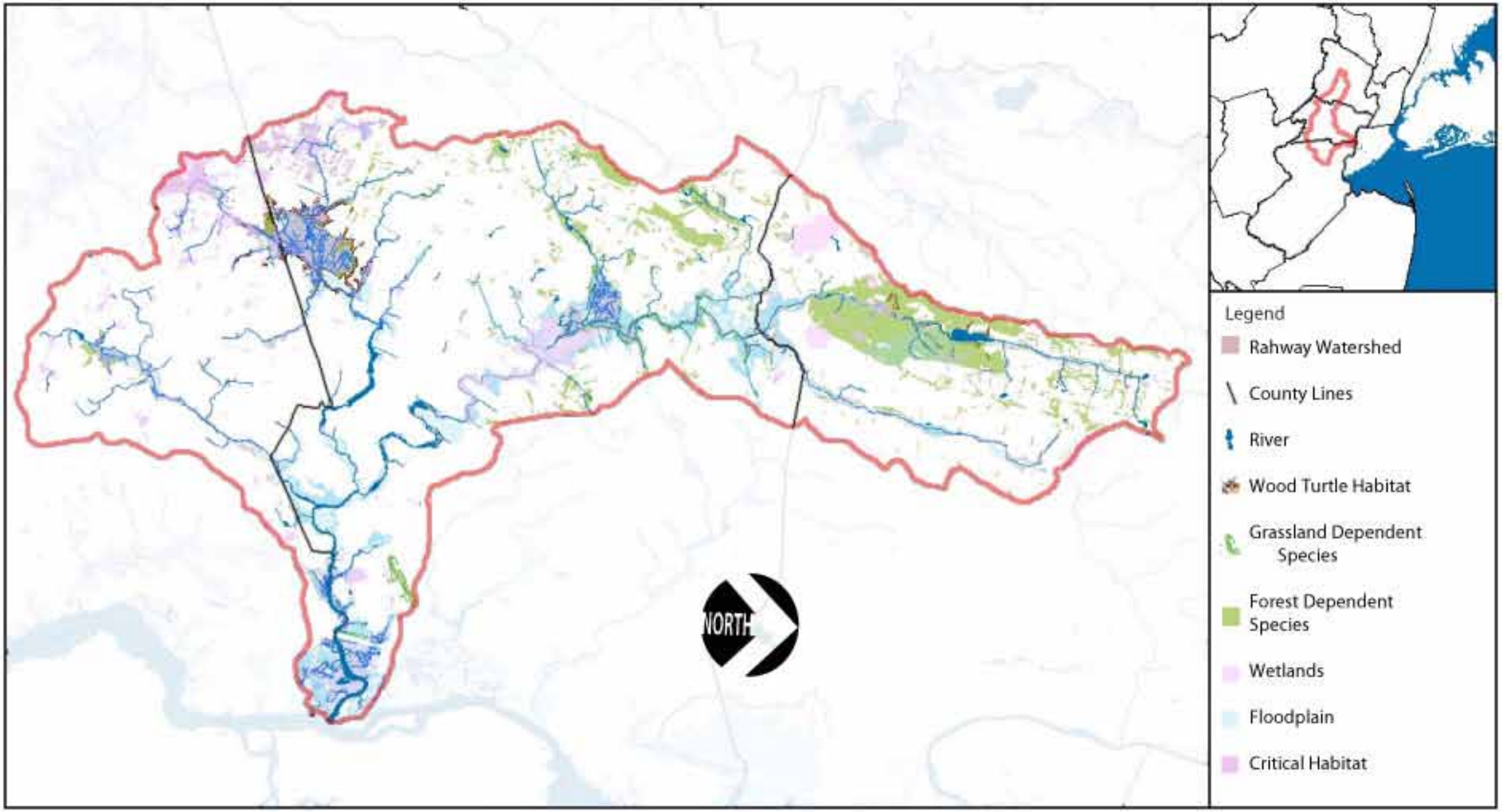


Figure 1.21: Environmental Conditions Map

1.8 Public Access

Access to waterways is a natural right of the public based on the Public Trust Doctrine dating back to Roman civil law and English Common Law adopted by the original 13 colonies. The rules adopted by NJDEP require unobstructed access to tidal waterways and their shores at all times, including visual and physical perpendicular and linear access. Particularly when Green Acres funds are utilized, public access requirements exist.

Public access to the Rahway River does exist in some places, including at one waterfall location at the South Mountain Reservation and at portions of the River's branches situated within municipal and county parkland. The Rahway River is, however, largely obstructed from public view for the most part, tucked away within industrial and residential backyards in large segments. In some sections, the River flows under a strip mall parking lot via a culvert. In others, River access is restricted due to large invasive species and contamination.

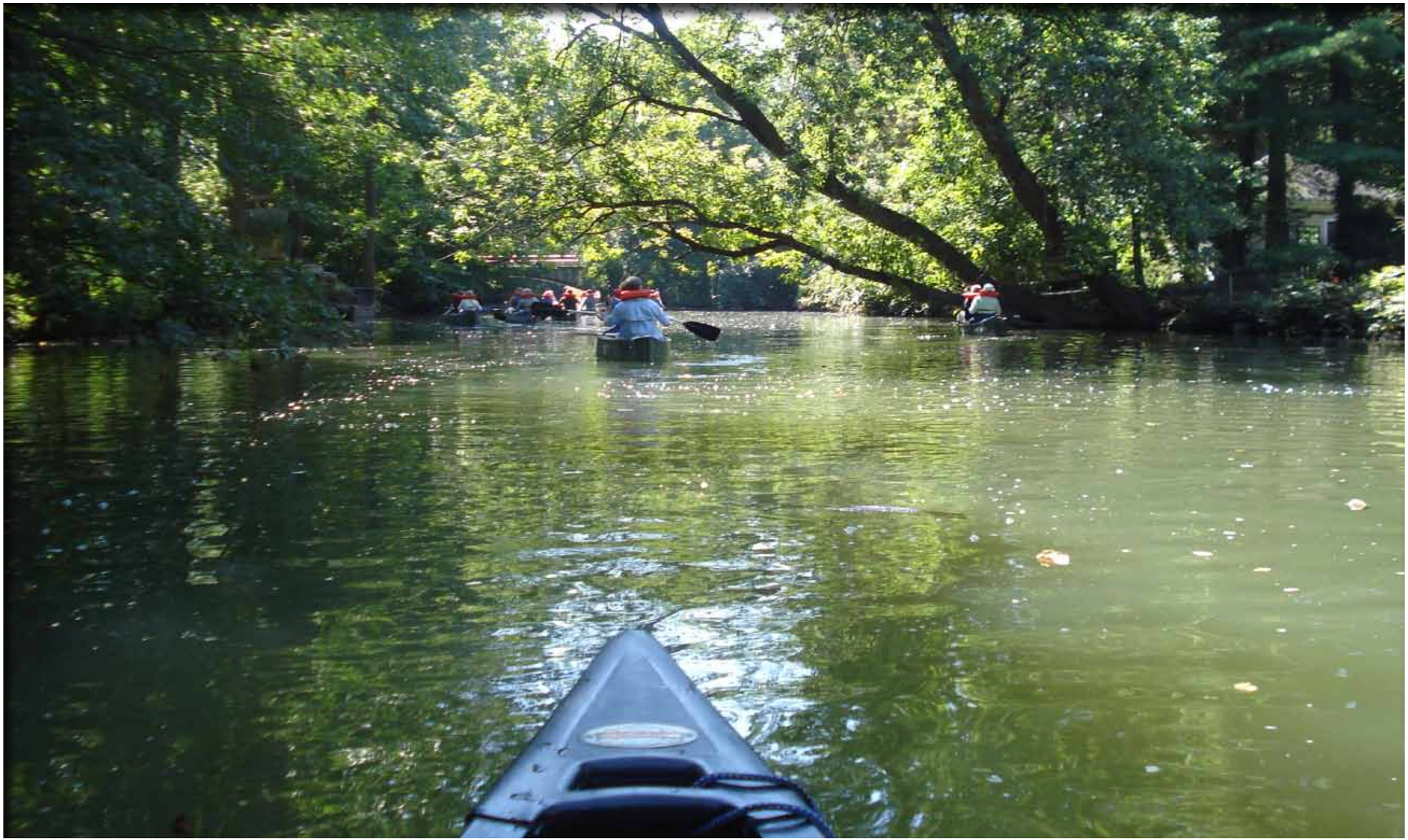
This greenway plan aims to restore the natural beauty of the Rahway River through effective clean up and regulatory mechanisms, as well as restoring public access to these locations. Much of the land surrounding the River, particularly in the eastern part, is privately-owned industrial or commercial land, posing a particular problem in establishing public access. Also, many of the green areas that exist along the River are inaccessible to the public because private residences must be crossed to reach them. It will be difficult to access these public lands surrounded by private property, and unfortunately these is limited land available for acquisition to fill the existing gaps in the greenway that exist since most of the total land area is already developed. Perhaps the largest obstacle in the creation of an interconnected, unified greenway is the need to obtain easements from private property owners to cross their land in order to reach a new greenway along the River due the restricted public access discussed above.

Historically, there has been an inability to manage the land along the bank of the River, causing concern for the species of plants and animals that live within the riparian corridor on the River's edge. The riparian rights held by private owners may limit the local government's ability to preserve the River's environmental quality, necessitating further research into mechanisms, legal and otherwise, available to provide unrestricted access to the public and governmental bodies for both greenway enjoyment and river maintenance. Even when under public control, land adjacent to the River must be prioritized for effective management, particularly because the Rahway River is used for drinking water. With the creation of a walkable, interconnected greenway along the edge of the River, greater awareness of the erosion problems facing the River's banks. This will hopefully lead to greater attention to maintaining the bank of the River, and sustainable land use practices in general.

Several locations that offer particular potential for establishing public access points to the River and its greenway include:

- Rahway Yacht Club (1706 Paterson St, Rahway, NJ)
- Best Western Riverview hotel parking lot (1747 Paterson St, Rahway, NJ)
- American Legion Post in Rahway (581 Maple Ave, Rahway, NJ)
- Home Depot shopping center in Woodbridge (77 St. Georges Ave, Woodbridge, NJ)
- Cranford's Riverside Inn (56 North Ave E, Cranford, NJ)
- McDonnell Park in Cranford
- Millburn's South Mountain Reservation
- The proposed South Orange Transit Village
- Several additional abandoned sites along the River

Figure 1.22: Boat dock in Rahway. *(Source: Raja Waran)*



(Source: Kelly O'Brien)

Section 2 : Recommendations

2.1 General Recommendations

These recommendations expand upon the research done in the Arthur Kill Greenway plan and aim to facilitate and complement the creation of a unified Rahway River greenway. The list is not exhaustive, but rather is an attempt to highlight several strategies that can be undertaken and implemented to complement the unified greenway network - physically, aesthetically and economically - as it is assembled. They are as follows:

1. Provide way-finding signage to ensure connectivity
2. Promote naturalization of water channels and improve water quality to reduce negative impacts
3. Repair riparian edge and perform erosion control to maintain stable land
4. Capitalize on paper streets and underutilized public land
5. Capitalize on economic development
6. Foster fishing opportunities in existing and new sites
7. Integrate energy-efficient and environmentally-friendly features
8. Balance bicycle and pedestrian opportunities
9. Intertwine par courses
10. Enact flood-control ordinances for protection
11. Establish National Historic Designation for recognition and conservation
12. Complement connections to East Coast Greenway where feasible

1. **Provide way-finding signage to ensure connectivity**

   Signage is important to maintaining connectivity of the greenway. One of the purposes of the greenway is to provide recreational and travel opportunities to the public at large. Signage is necessary if people are to recognize where such opportunities exist and take advantage of them.

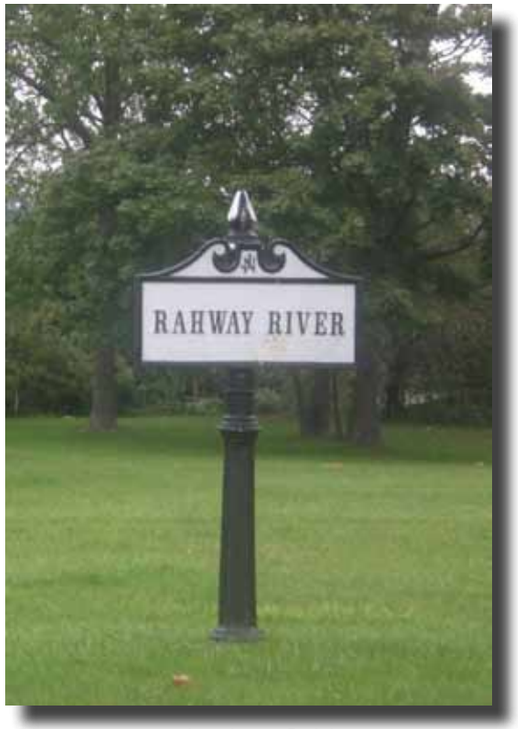


Figure 2.1: Easily identifiable sign in Rahway. *(Source: Raja Waran)*

Figure 2.2: A greenway sign in Minneapolis identifies the route the visitor is on as well as points out nearby attractions. *(Source: http://minneapolis.about.com/od/healthsportsrecreation/ss/midtowngreenway.htm)*

2. **Promote naturalization of water channels and improve water quality to reduce negative impacts**

   Development around the Rahway River has had a negative impact on its ecosystem. Assessment and remediation of these impacts and is critical. Vital wetlands and other habitats can be restored through conservation practices and policies. Additionally, altered land can be re-naturalized, enhancing the river's ecological characteristics. Improvement of the water quality can be realized through monitoring, remediation (particularly bioremediation), and regulation.

Figure 8. A steep concrete channel was replaced with a series of step-pool structures. This sequence of small pools (visible in the photo on the right) slows stream flow, disperses energy during storms, and provides a stable, naturally functioning channel with improved habitat. (Note the outflow pipe on the right-hand side of both photographs.)

Figure 2.3: Example of stream naturalization from EPA report, "Baltimore County Stream Restoration Improves Quality of Life".

3. **Repair riparian edge and perform erosion control to maintain stable land**

Along with re-naturalization, erosion control is important to maintaining the greenway. The loss of land into the river will reduce the public's enjoyment of the greenway and damage water quality.

Figure 2.4: Soil erosion along the river banks in Cranford threaten the stability of trees along the riparian edge.
(Source: Kelly O'Brien)

Figure 2.5: Examples of current measures in place to combat soil erosion and flooding issues.
(Source: Kelly O'Brien)

4. **Capitalize on paper streets and underutilized public land**

Many municipalities along the Rahway River own properties adjacent to or leading to the river. Often, these properties stand vacant and unused. These lands could be added to the greenway and turned into parkland, adding property to the greenway without having to purchase private properties. Paper streets (i.e. long strips of un-owned or municipal land) could be developed into access ways to the greenway.

Figure 2.6: The areas highlighted in yellow above are examples of paper streets.

5. **Capitalize on economic development**

Despite monies made available by federal, state, and municipal sources, there is difficulty in both funding greenway development and providing economic benefits to the region as a whole. By inviting public and private sponsorship of the greenway, the region can benefit greatly. Such sponsorship can take the form of sign placement and the support of activity programs that will educate the public about the Rahway River, its ecosystem, and information about local businesses. It is important that this method not be overused to the point of distraction from the natural beauty of the area.

6. **Foster fishing opportunities in existing and new sites**

Fishing is one of the most popular recreational activities allowed on the Rahway River and, while technically fishing is legally allowed on the entire length of the river, water quality and other problems prevent full use of the river for fishing purposes. Water quality should be checked, monitored, and remediated so that people who want to fish can do it anywhere on the Rahway River. Also, restocking programs should be expanded so that fishermen have access to a greater variety of fish in the river.

Figure 2.7: Notification in an area that has been stocked with fish. *(Source: Raja Waran)*

7. Integrate energy-efficient and environmentally-friendly features

One purpose of the greenway is to educate the public about the natural environment and its conservation. Thus, environmentally-friendly features are necessary to set an example as well as keep the greenway as clean as possible. For example: lighting, powered signage, and other features that require power are needed to enhance the public's enjoyment of the greenway. Instead of connecting these to the power grid, solar panels could be used to power them.

Figure 2.8: Solar energy should be used whenever possible. (Source: Sunseap, *www.sunseap.com/solar_park.htm)*

Figure 2.9: Arsenic-free preserved wood walkway. *(Source: www.austinwholesaledecking.com/pine/)*

8. Balance bicycle and pedestrian opportunities

The greenway allows both pedestrian and bicycle travel and must be suited to accommodate both. Pathways should be wide enough to allow pedestrians and bicyclists to pass each other and bike racks should be placed at scenic locations.

Figure 2.10: Example of a multi-use path clearly defined for users. *(Source: http://www.valleyconservation.org/bettermodels_2003.html)*

Figure 2.11: A paved multi-use trail in a wooded area along the Swannanoa River. *(Source: http://www.townofblackmountain.org/greenway5.htm)*

9. Intertwine par courses

Par courses are very cont-efficient and allow excellent recreational and exercise opportunities for the public. They are also a great way to take advantage of large, open spaces that people might not otherwise use.

Figure 2.12: Par courses along a pathway encourage fitness and give visitors an opportunity to stretch properly to avoid injury.
(Source: www.bakersfield.com/142/story/88832.html)

10. Enact flood-control ordinances for protection

While many municipalities have enacted flood-control regulations to protect the land surrounding the Rahway River, some have not and others are not properly enforcing those that they have enacted. It is important to the maintenance of the greenway that all current flood-control regulations be enforced by the involved municipalities or created by those municipalities that do not have them in place.

Figure 2.13: Flooding in Cranford after heavy rains made Eastman Street unusable.
(Source: Cranford Chronicle Jim Occi/Correspondent ; http://blog.nj.com/cranfordupdates/eastman%20flood.jpg)

11. Establish National Historic Designation for recognition and conservation

In some cases, properties that are needed to maintain connectivity in the greenway are at risk of being purchased by private entities. In order to keep and protect these lands, it has been suggested that some could be registered as National Historic sites due to their potential archaeological value.

Figure 2.14: Example of a historic event in the Rahway River Watershed. Plan of the Battle at Springfield.
(Source: http://freepages.history.rootsweb.ancestry.com/~wcarr1/Lossing1/14-08.gif)

12. Complement connections to East Coast Greenway where feasible

It is important for the Rahway River Greenway to connect to other greenways where possible, so that the public could access any of them if desired. The East Coast Greenway is one such greenway that should connect to the Rahway River Greenway.

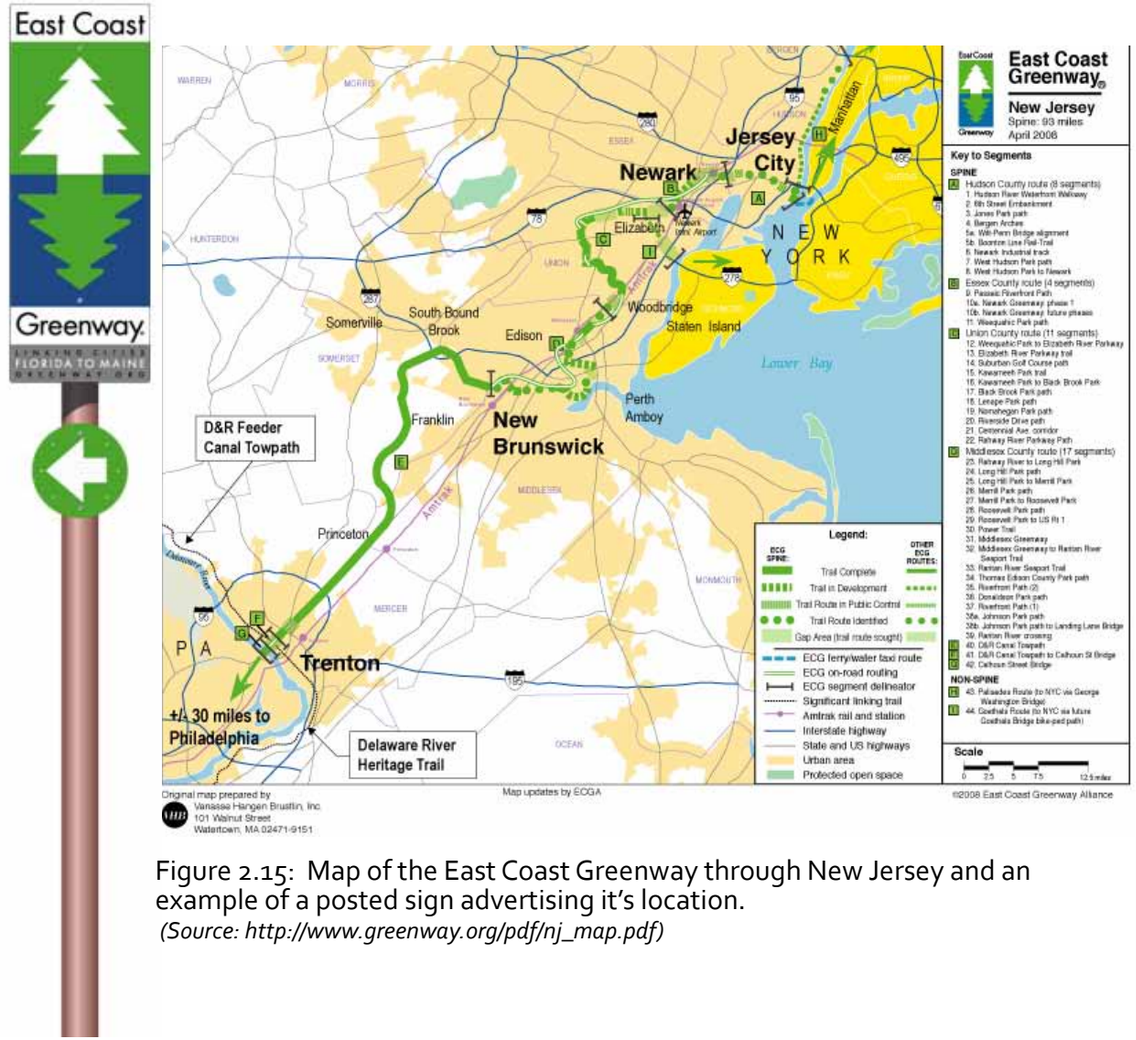


Figure 2.15: Map of the East Coast Greenway through New Jersey and an example of a posted sign advertising it's location.
(Source: http://www.greenway.org/pdf/nj_map.pdf)

2.2 Greenway Design Guidelines

Path Widths

In considering how to design the greenway there are many issues that need to be considered. Due to its location in a very urbanized area, the greenway will be composed of on and off street facilities with shared use paths for pedestrians, bicyclists, and other recreational seekers. Although facility standards for two-way shared use paths recommend that widths be at least 10 feet, in many instances the desired 10 feet will not be attainable. Other critical measurements that also may not always be attainable include:

- 8 feet may be used where bicycle traffic is expected to be low at all times, pedestrian use is only occasional, sightlines are good, passing opportunities are provided, and maintenance vehicles will not destroy the edge of the trail,
- 12 feet is recommended where substantial use by bicycles, joggers, skaters, and pedestrians is expected, and where grades are steep,
- 2 feet of graded area should be maintained adjacent to both sides of the path,
- 3 feet of clear distance should be maintained between the edge of the trail and trees, poles, walls, fences, guardrails or other lateral obstructions,
- 8 feet of vertical clearance to obstructions should be maintained; rising to 10 feet in tunnels and where maintenance and emergency vehicles must operate.

Considering the urban location of this greenway ADA standards must be applied when possible, while appropriate lighting and benches must be considered for safety and comfort.

Figure 2.16: Aldridge Creek Greenway.
(Source: www.hsvcity.com/gis/greenways/images/ald3.JPG)

Figure 2.17: Greenway in Vinton, VA.
(Source: www.town.vinton.va.us/images/greenway.jpg)

Path Surface

The type of surface that will be provided is an important consideration in design. Factors such as weather conditions and soil types can affect the choice of asphalt, concrete, or crushed rock. Other considerations of surface material include, terrain, climate, design life, maintenance, cost, and product availability. Soft surface materials include earth, grass, bark and wood decking. Generally these materials are low cost, but require substantial maintenance and are not suitable for many of the recreational activities today's trails and paths are used for. Hard surface materials include stone, brick, concrete porous pavement and asphalt. These materials, specifically concrete and asphalt provide years of service with low maintenance. Table 2.1 illustrates some of the advantages and disadvantages of various trail surfaces.

Table 2.1: Trail Surface Comparison

Surface Material	Advantages	Disadvantages
Soil Cement	Uses natural materials, more durable than native soils, smoother surface, low cost.	Surface wears unevenly, not a stable all-weather surface, erodes, difficult to achieve correct mix.
Granular Stone	Soft but firm surface, natural material, moderate costs, smooth surface, accommodates multiple use.	Surface can rut or erode with heavy rainfall, regular maintenance to keep consistent surface, replenishing stones may be a long-term expense, not for steep slopes.
Asphalt	Hard surface, supports most types of use, all weather, does not erode, accommodates most users simultaneously, low maintenance.	High installation cost, costly to repair, not a natural surface, freeze/thaw can crack surface, heavy construction vehicles need access.
Concrete	Hardest surface, easy to form to site conditions, supports multiple use, lowest maintenance, resists freeze/thaw, best cold weather surface.	High installation cost, costly to repair, not a natural looking surface, construction vehicles will need access to the trail corridor.
Native Soil	Natural material, lowest cost, low maintenance, can be altered for future improvements, easiest for volunteers to build and maintain.	Dusty, ruts when wet, not an all-weather surface, can be uneven and bumpy, limited use, not accessible.
Woodchips	Soft, spongy surface - good for walking, moderate cost, natural material.	Decomposes under high temperature and moisture, requires constant replenishment not typically accessible, limited availability.
Recycled Materials	Good use of recyclable materials, surface can vary depending on materials.	High purchase and installation cost, life expectancy unknown.

Lighting

Shared use paths in urban and suburban areas often serve travel needs both day and night. Fixed source lighting improves visibility along trails and at intersections, and is critical for lighting tunnels and underpasses. Solar Powered lighting will undoubtly be very important along the Rahway River Greenway because installing electric power would be cost prohibitive over 24 miles. The AASHTO guide recommends using average maintained illumination levels of between 5 and 22 lux with the surrounding environment and location determining the appropriate illumination.

Maintenance

A certain amount of damage, intentional and accidental, can be expected on heavily used trails that are open to the public. Damaged items, if not promptly removed or repaired, stimulate more damage. The greenway must be inspected regularly and problem areas must be identified early. While most municipalities do not have the resources to maintain or patrol such a greenway many of these standard maintenance and upkeep functions will need to be undertaken by volunteers or nonprofits. Two great examples of nonprofit trail maintenance organizations are the Appalachian Trail Conservancy and the Green Mountain Club.

Cost

Table 2.1: General Trail Construction Estimates

Trail width	Trail Surfaces	Obstacles	Cost per mile
3-4 foot	Natural	Soft soil and light to no vegetation Large rocks or heavy vegetation or wet soil	$8,000 $13,200
10 foot	Crushed aggregate w/ 4 inch depth	Soft soil and light to no vegetation Large rocks or heavy vegetation or wet soil	$37,000 $48,000
10 foot	Asphalt	Soft soil and light to no vegetation Large rocks or heavy vegetation or wet soil	$125,000 $300,000
10 foot	Concrete	Soft soil and light to no vegetation Large rocks or heavy vegetation or wet soil	$188,000 $600,000

Trail Design and Construction Standards from Northern Bonneville Shoreline Trail

Figure 2.18: Examples of light fixtures; traditional, solar, and emergency. *(Sources: left - http://northmetro.blogspot.com/2007/09/for-september-7th.html; middle - www.sunseap.com/images/solar-park-light.jpg; right - www.strikeind.com/Code%20Blue.htm)*

Greenways Signs

A greenways signage is almost as important as the greenway itself. Signage allows users to find trailheads, feel connected to the place and have a sense of location and destination. Signage should be placed at intersections with all streets, major trail intersections and all railheads. Signage should be uniform in design and should provide key information, such as distance to key locations, educational information and information related to permitted uses. Trailhead markers should be placed at main collection points, parking lots and at the intersection of other major trail systems such as East Coast Greenway. Primary trailhead markers shall have a system-wide map, directional signs naming the greenway with mileage and community or neighborhood information.

Benches and Tables

Any good park or public space needs gathering spaces. People must have spaces to gather and providing resting places along a greenway is critical to its usage. Tables and benches allow greenway participants to enjoy the greenways natural environment in a relaxed manner. The more activities that are located on the trail, the more use it will receive and as a result the community will become more invested in its upkeep and maintenance.

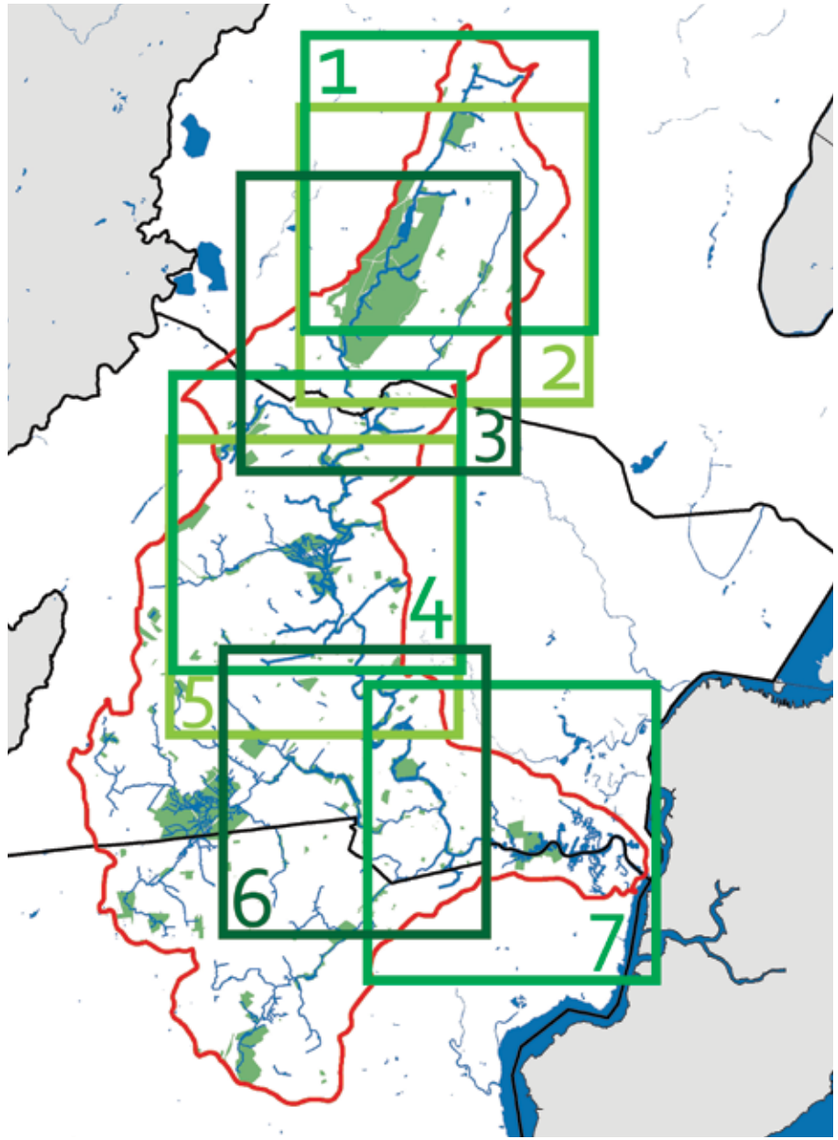
Figure 2.19: Examples of different styles of signage to advertise the greenway; upper left - Interpretive Sign on the Midtown Greenway, Minneapolis ; lower left - Kiosk in Brunswick, ME; lower right - Post sign for the Midtown Greenway, Minneapolis
(Sources: UL - minneapolis.about.com/.../midtowngreenway_3.htm; LL - http://www.greenway.org/support/sponsor/milesponsors ; LR - photo by Micah Taylor, http://2knitwits.blogspot.com/2008/08/riding-bike-in-minneapolis.html)

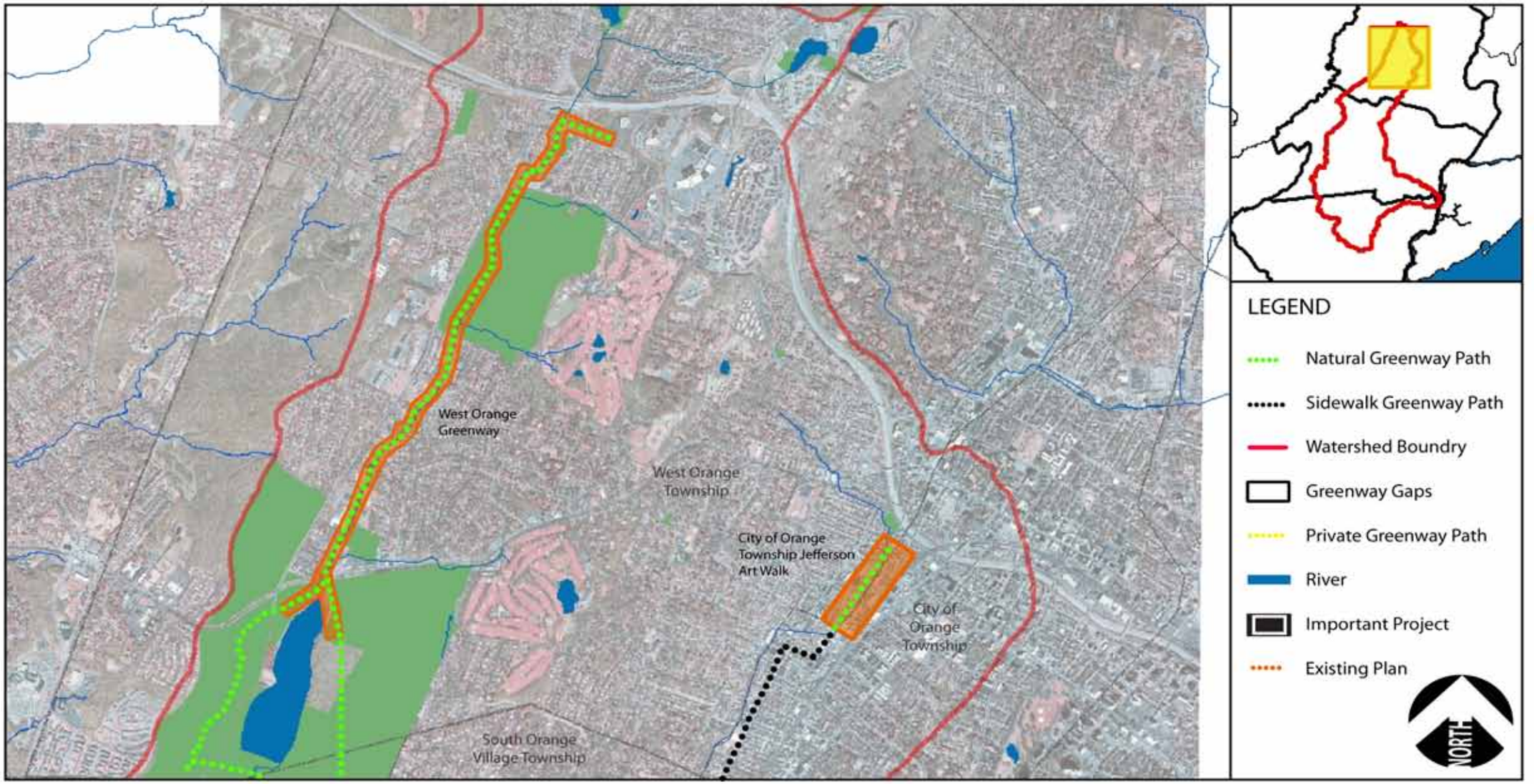
Federal Art Project display at the "Own Your Own Home Show", 1938.

Section 3 : Greenway Case Studies

The greenway proposal recognizes the existing municipal and county efforts to revitalize the Rahway River's waterfront, and offers suggestions to fill the gaps in between these plans to create a unified whole. As the study area is large, there are seven maps zoomed into the river, moving from north to south. The colors used deserve further explanation.

- The dotted line in *light green* represents the greenway where access is directly adjacent to the river, and will move along publicly owned landed. This designation can represent access in an existing plan, in our proposed plan, or simply through publicly owned land.
- The dotted line in *black* represents areas where access to the waterfront is simply unavailable at this point and time – the "greenway" will be required to connect in these locations by pedestrians using the sidewalk.
- The dotted line in *yellow* represents the greenway where the only possible connection is through private property. The recommendations in these instances will be described as they arise.
- Boxes in *black* highlight gaps in the greenway where the natural greenway path, nor a sidewalk connection will suffice. The challenges of these locations are discussed as they arise.
- Boxes in *white* highlight important, unique study areas – a further explanation will be included in these areas.
- Finally, boxes and dotted lines in *orange* represent existing municipal and county plans surrounding the Rahway River. Our maps simply outline the existing proposed plans.





Rahway River Greenway
Part 1

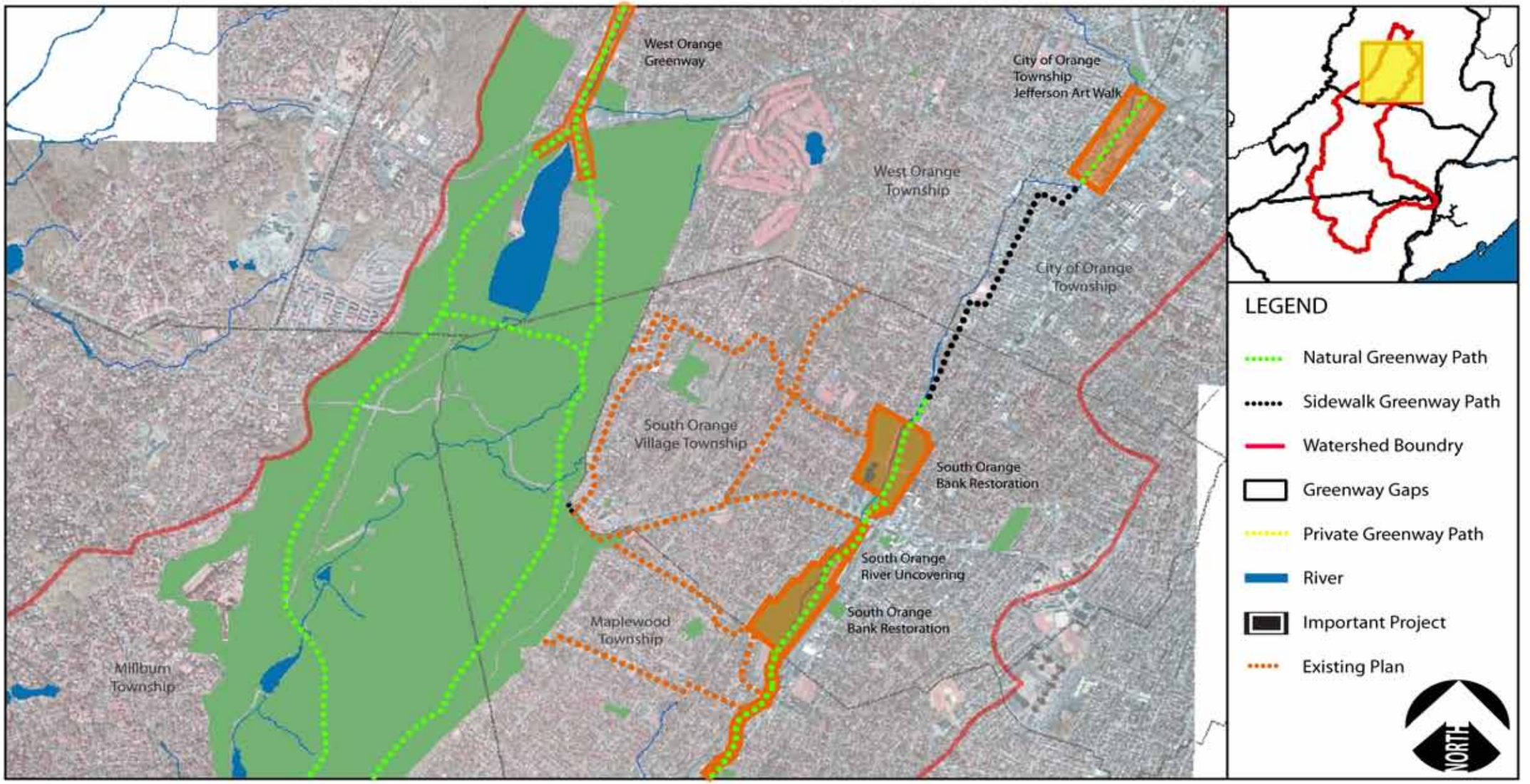
PART 1

The northernmost portion of the Watershed begins our site analyses. The vertical orange strip in the center represents an existing greenway proposal from West Orange: the *Township of West Orange Open Space and Recreation Plan* (West Orange Open Space Committee & Morris Land Conservancy). The planned greenway stretches south from US 280, past Byrne Gold Course, into the South Mountain Reservation. Once reaching the Reservation, a natural path could continue uninterrupted from the West Orange plan into the park.

To the East of this area is the proposed *Jefferson Art Walk* proposal (Stephen Yablon Architects) in the Central Valley neighborhood of the City of Orange Township – an effort to revitalize the area's economy through developing its cultural assets, and to "open the east branch of the Rahway River as a pedestrian greenway into the neighborhood." The plan clearly points out its goal to reopen the stream for pedestrian use.

Directly south of this plan, stretching to the bottom of this first analysis, is already developed privately owned residential lots. Naturalizing or creating public access to the waterfront of this branch at this point is not feasible – the black dotted line represents where the "greenway" would be forced to continue along public sidewalks until reaching the next portion of our study.

Both plans are excellent example of two municipalities that have designs in place to naturalize the river where it is primarily covered by the man-made landscape.



Rahway River Greenway
Part 2

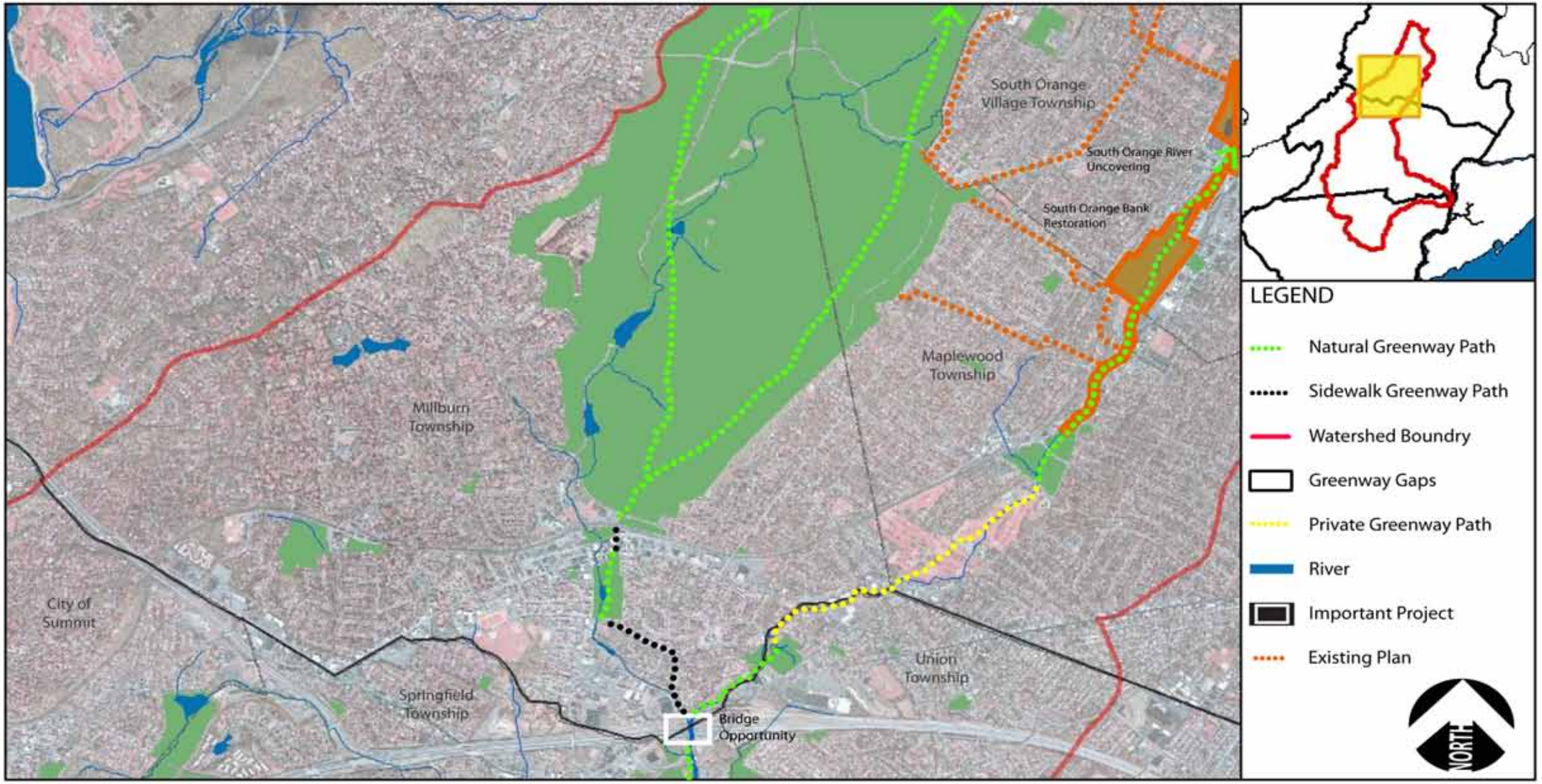
PART 2

The Western portion of this image represents utilizing existing trails through the South Mountain Reservation, or creating new trails if necessary to continue the greenway. Appropriate, yet minimal signage, would ensure that users are aware that they are still on the greenway as it continues through the Reservation.

To the East (the right) highlights, first, in orange, the *Open Space, Bicycle, Pedestrian, and Rahway River Plans for South Orange* (Heyer, Gruel & Associates). This plan includes two riverbank restorations, and an effort to uncover part of the river. Further, the project also involves bike and pedestrian paths linking the greenway to the Reservation. The river at this point is described as having great potential, but "underused because it is not community friendly or aesthetically pleasing: its massive concrete walls are an eyesore to most who visit the river area." The plan would include masking the concrete retaining walls, replacing chain link fencing, a new pedestrian bridge, and re-landscaped river banks and adjacent parkland. Further, the "gentle meandering nature" of the river would be restored as it had originally been straightened to increase its flow.

Directly connected to this to the South is the greenway plan for Maplewood (Land Conservancy of New Jersey). This complimentary effort also includes greening the riverbanks for public use, and creating pedestrian and bike connections to the Reservation. This proposal is also highlighted in orange.

Thus far, the entire greenway has already been designed by four different municipalities. Particularly notable is the complimentary efforts to naturalize the waterfront in an urban setting.



Rahway River Greenway Part 3

PART 3

This portion illustrates one of the biggest challenges to the greenway. First, no existing municipal or county plans exist in this area. Despite the restoration and daylighting projects to the North, significant barriers exist to the South of the Reservation.

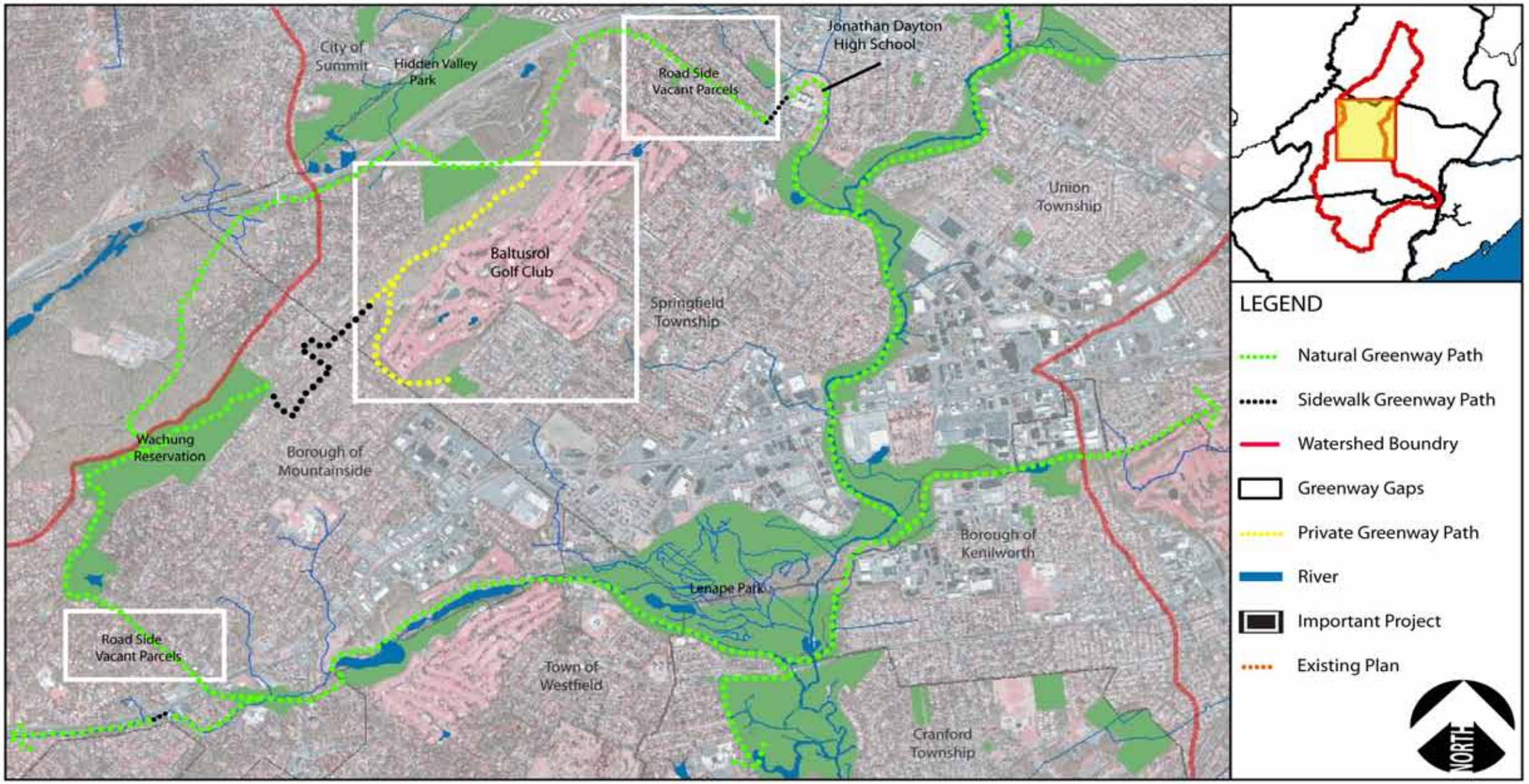
Although there is currently a "greenway" from I-78 north up through the Maplewood Country Club into the Townships center, none of it is publicly accessible. About 1.2 miles of land or easements would need to be purchased in order to allow for pedestrian access. This portion is highlighted in yellow.

Next, the presence of I-78 at the juncture of Springfield and Millburn townships at the county line presents an impenetrable crossing for pedestrians. I-78 currently crosses the river, but provides no opportunity for pedestrian access underneath. See Figure3.2. A pedestrian trail crossing over I-78 is the only option at this location. Although it would require a large capitol expenditure, there are examples in the East Coast of trail crossings over federal highways. The Chester Valley trail over I-76 in King of Prussia PA, and the D and R canal over Route 1. Federal transit funds could be utilized for projects of this nature. Below are images of similar crossings:

Again, the path highlighted in black represents privately owned residential lots where pedestrian access on the existing sidewalk is the only feasible option at this point. Signage, again, could guide pedestrians to naturalized areas.

Figure 3.2: Route 78 at Exit 49B where the river flows under the roadway.
(Source: http://maps.live.com)

Figure 3.3: Examples of Pedestrian Crossings over major roadways *(Sources: L - http://www.uscoles.com/bikepix/chatsbridgel.jpg; R- http://maps.live.com)*



Rahway River Greenway Part 4

PART 4

This portion offers some great insight into the future of the greenway – analysis of the site has revealed an opportunity for a greenway "loop." While this loop would not follow the river entirely, it would still serve an excellent civic function within the watershed.

First, the trail could work through parkland north to Jonathan Dayton High School. At school is a gap in this proposed greenway loop connecter. This sidewalk stretches along Mountainside Drive for only 1/8th of a mile – but then users could reconnect to the greenway.

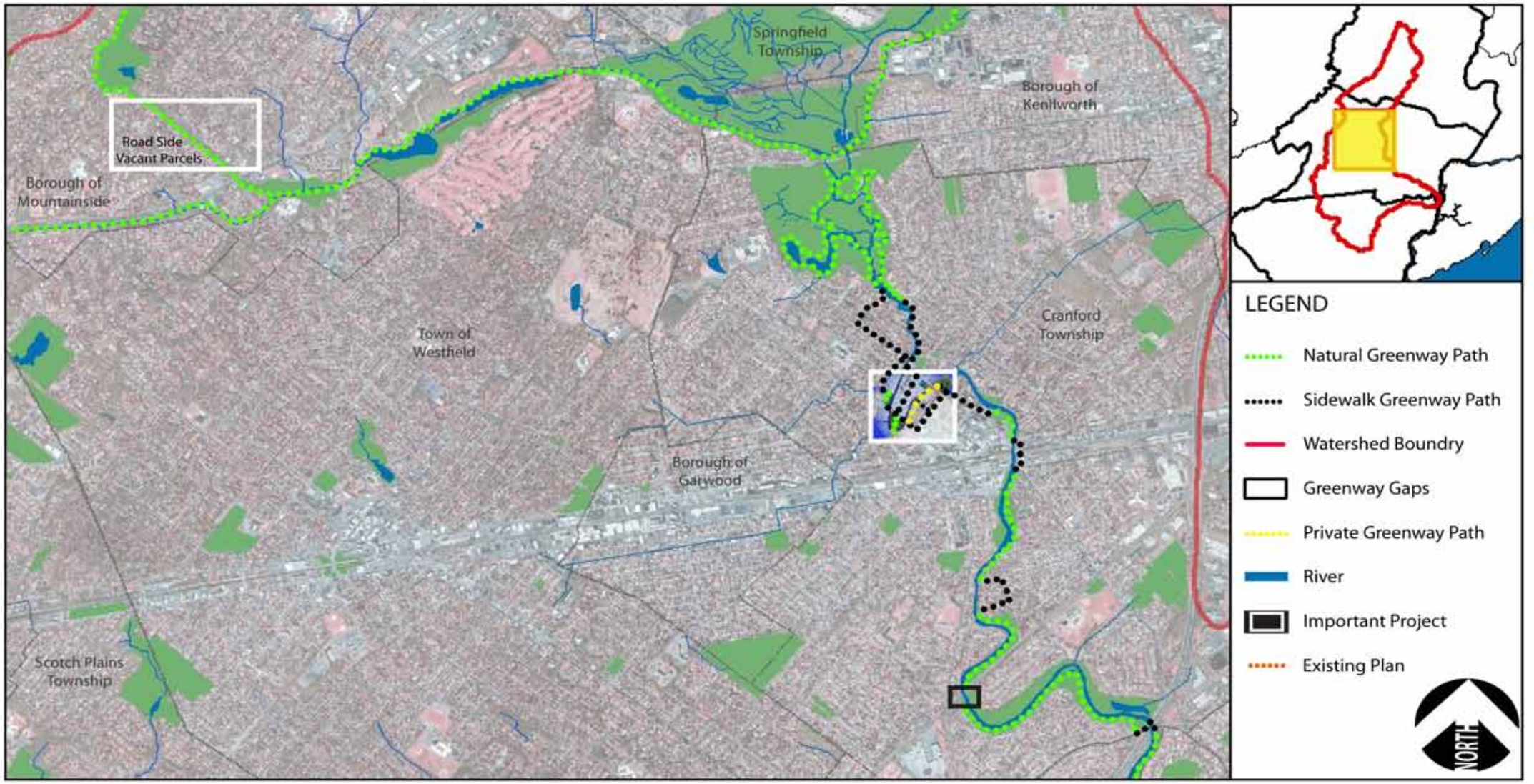
The following will be described in steps:

- Moving north, old railroad right of way (owned by NJDOT) could be utilized until reaching I-78.
- At I-78, one can head west along the interstate right of way until reaching Houdaille Quarry Park (Union County).
- From the park pedestrians can again head west along the interstate right of way until reaching Watchung Reservation.
- Next, one can head south, parallel to New Providence Road (Union County) on a stretch of public land.
- Then, head east back towards Lenape Park along existing road right of way (NJDOT) and parkland (Echo Lake Park).

This Loop would provide about a 10 mile hike and create a unique opportunity: all of the mentioned land is publicly owned (NJDOT, Union County, and various townships) and would require only communication among owners.

Beyond this proposal, the plan could be taken further. With some sort of land acquisition or agreement with the Baltusrol Country Club, as indicated in yellow, there could be some trial connectors to various smaller parks (e.g., Township of Springfield Tennis Courts), and residential neighborhoods to provide easy recreational access for surrounding populations.

Figure 3.4: Aerials of the roadside vacant parcels highlighted on the map on page 60. *(Source: http://maps.live.com)*



Rahway River Greenway Part 5

PART 5

This portion of the future greenway has almost taken care of itself as excellent green infrastructure already exists. First, the existing Olmstead Lenape and Nomahegan Parks are historic jewels in the greenway.

Following is a handful of locations, highlighted in black, that are simply inaccessible to the public as residential lots line the river. Sidewalk access is required.

Towards the south is the continuation of the Union County Park system and the existing Rahway River Parkway.

In the very south, highlighted in white, is a location where railroad tracks cross the park. The tracks completely intersect it, reducing pedestrian access to the other side. This crossing may require an elevated crossing, similar to that proposed in PART 3.

Figure 3.5: An aerial view of the obstructed portion due to train tracks. *(Source: http://maps.live.com)*

RESIDENTIAL FLOODPLAIN CASE STUDY

The Site

The site is a residential area in Cranford Township surrounding McConnell Park. Predominantly single family homes with some apartment complexes in the northeastern section of the study area. This area is located on a big bend in the river and thus is prone to flooding. This area does provide river access in numerous parks and the Cranford canoe club is located in the study area as well. Most homes along this stretch of river are very close to the water, but there is one area of interest in relation to water proximity.

The Proposal

Due to the developed nature of this area it would be difficult to justify a path natural path along the lengths of the river. For most of this area we use the case study as an illustration to the fact that a greenway does not have to be natural and in many cases it is quite impossible to provide a natural path.

In Cranford we propose that the greenway follow existing sidewalks but be clearly marked. Along the sidewalk could be information plaques taking about the river, natural process and the local history of the river. All of these interactive means will help to alert people that even though they are not along the river it is there, existing in there presences and should be cared for. There is one section of road that seems to be under utilized and would provide a great staging area for active recreational users of the river.

We are proposing a potential small parking area in another park located just north and west of McConnell Park. In the Illustration there is a path proposed along the river for a stretch through private backyards. Although there is a good 200 feet between the rivers edge and the houses located on the properties, we acknowledge the difficulty of this proposal and only if there is political will, will the path be constructed.

One other important aspect of this proposal is the floodplain as indicated in blue/white. Cranford Township has a flood plan ordinance that requires special permits and permission to build in this flood area, which should be a model to other municipalities in the Greenway area that experience strong flooding issues.

Figure 3.6: Canoeing the river is a popular activity. The Cranford Canoe Club seen above is an excellent opporutnity for the public to access the water. *(Source: photos taken by Kelly O'Brien)*

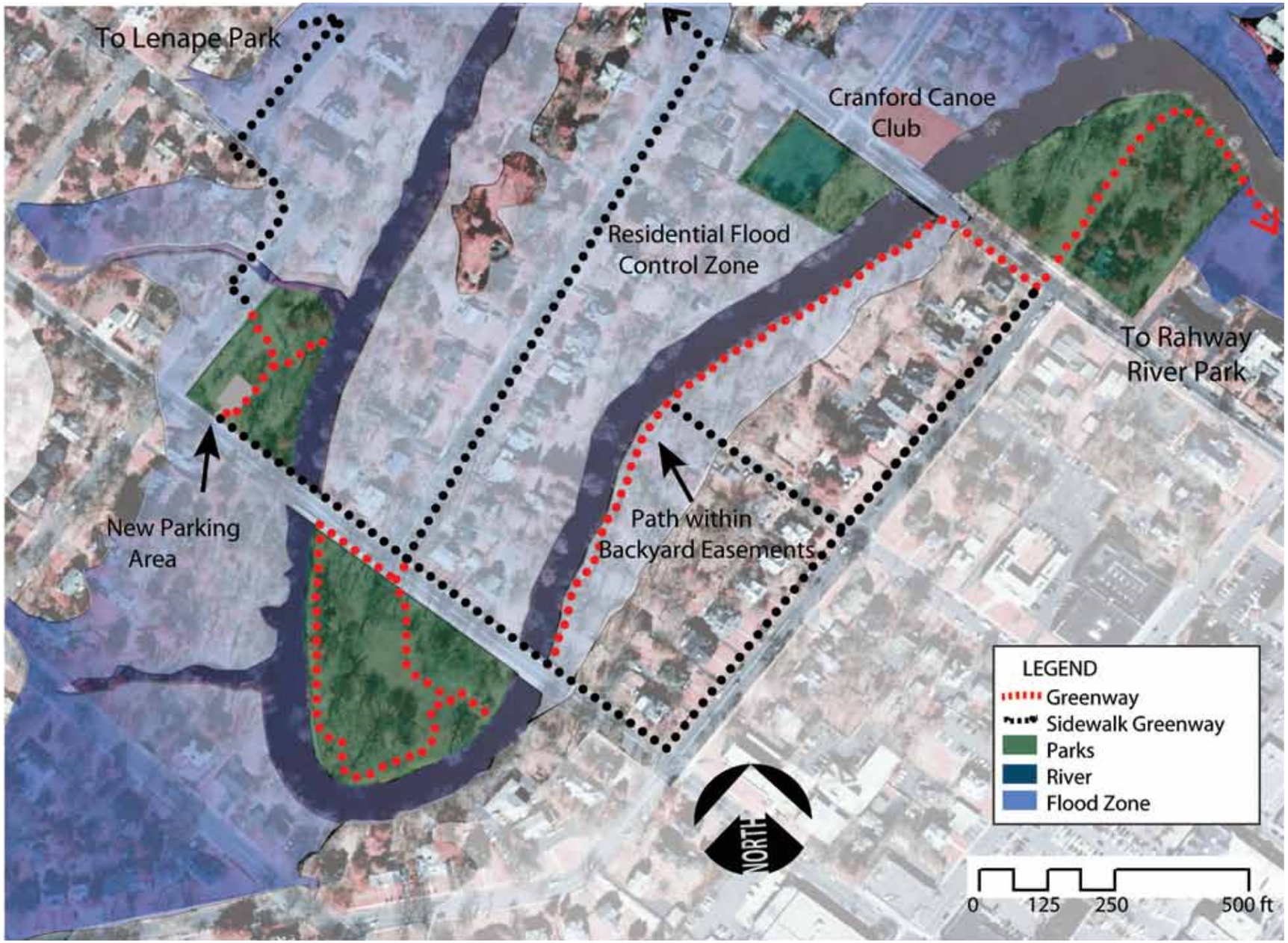
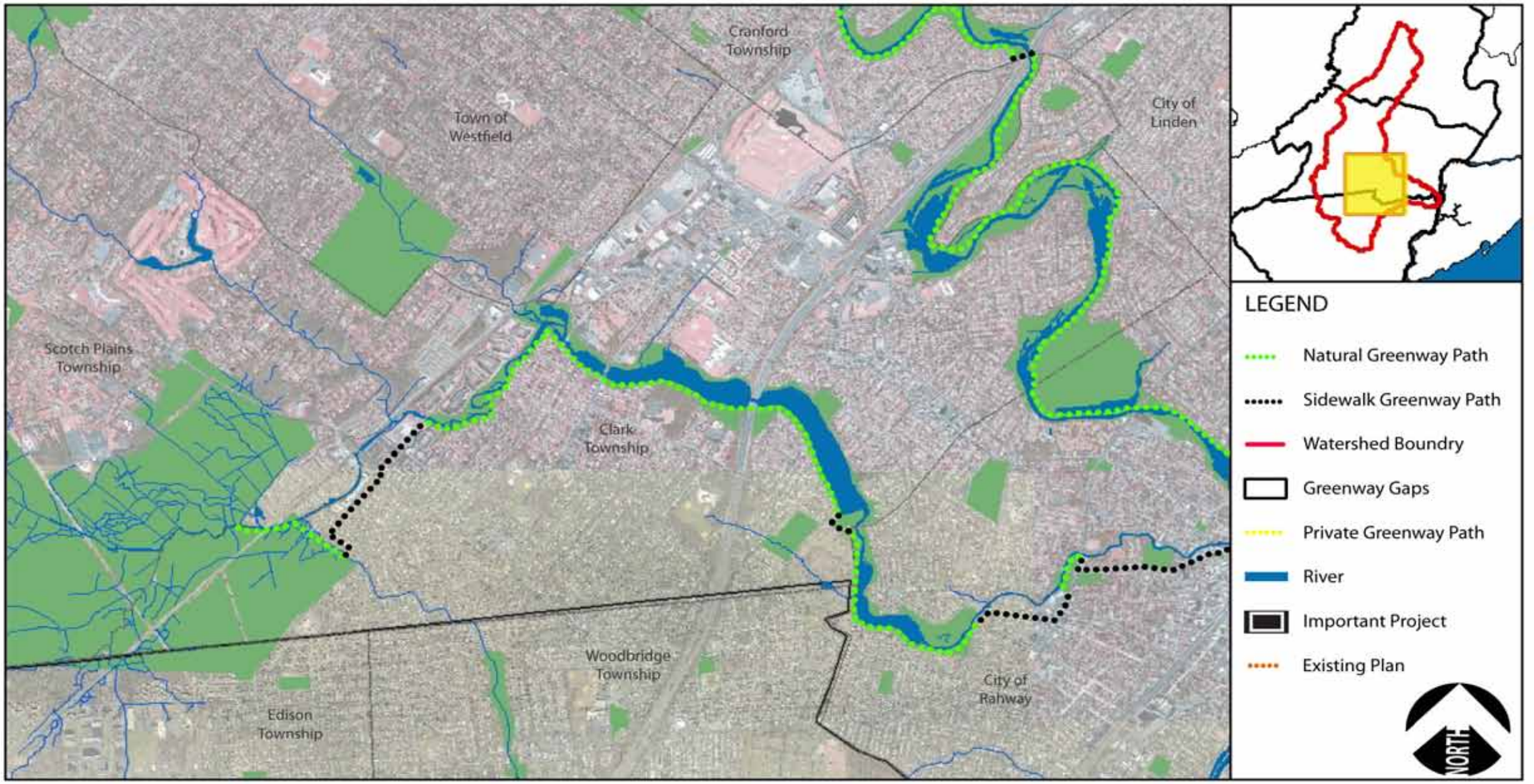


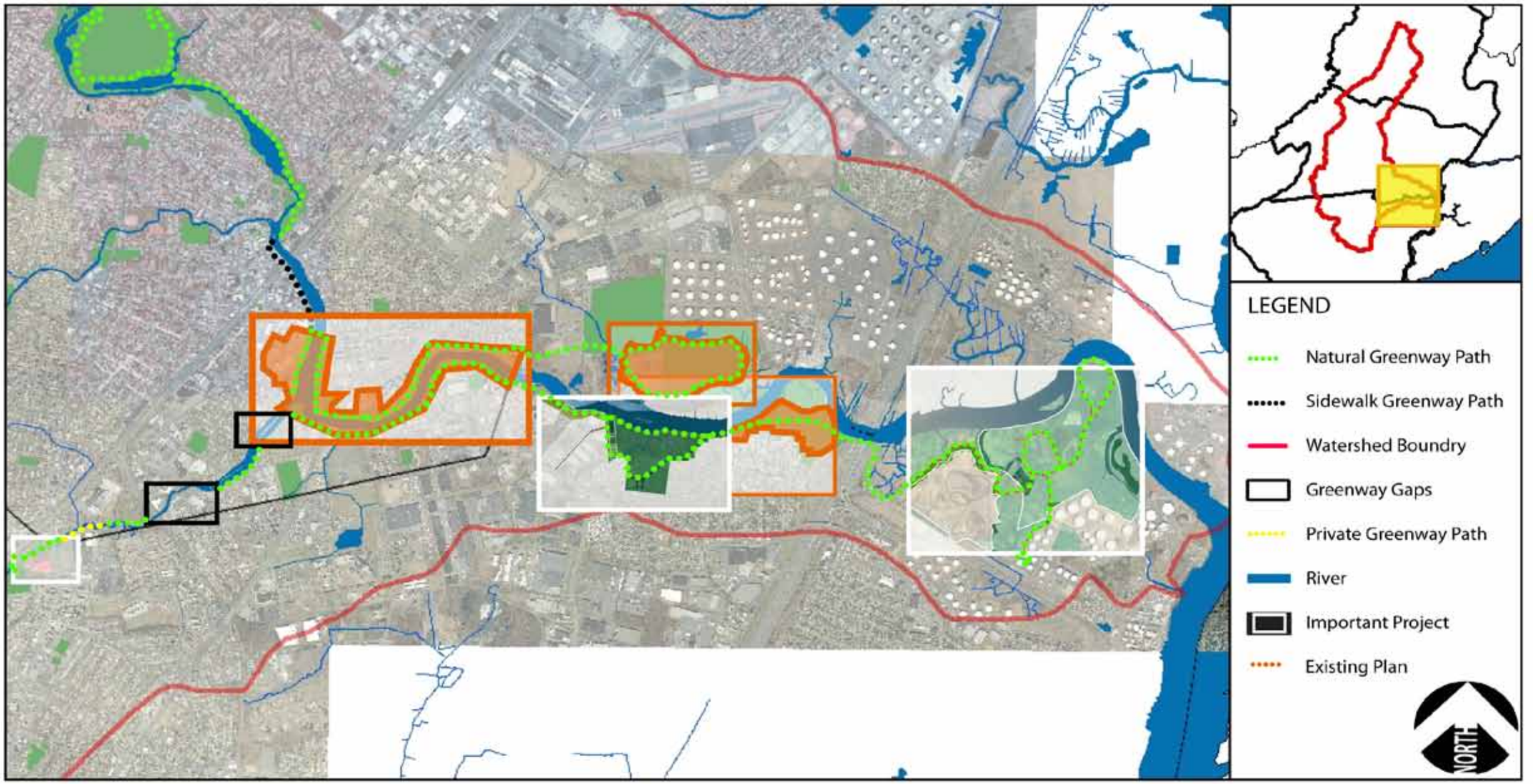
Figure 3.7: The map illustrates the proposed pathways of the Rahway River Greenway connecting park lands and surrounding residential communities.



Rahway River Greenway Part 6

PART 6

This portion is very similar to PART 5 – an extensive park system exists. Only a handful of residential lots, requiring sidewalk access for pedestrians, breaks up the path.



Rahway River Greenway
Part 7

PART 7

This final portion is the most complicated and contains the majority of our recommendations. This is a heavily built-up, industrial and urban area with limited park area, limited river access, and few natural areas.

Moving from West to East towards the mouth of the river, we first have our most extensive case study recommendation at the site of the Home Depot at the Woodbridge and Rahway border. (See Pages 70-71)

The next two areas highlighted in black are considered gaps in the proposal. They are heavily industrialized areas with limited space for pedestrian access.

The first, westernmost orange portion is the Rahway River Greenway Concept Plan developed by RBA Associates, in collaboration with the Rahway River Association and the City of Rahway, in 2005. Stakeholder meetings assisted in the drafting of this plan, which covers 1 ½ miles – from Elizabeth Avenue to Wall Street in Rahway.

The plan proposes design guidelines for the greenway, and notably inventories and focuses upon existing publicly owned property along the waterfront that could be used for a greenway. In particular, parcels that could be utilized include existing green space adjacent to the Rahway Library and Community Center and directly on the waterfront, the existing Riverfront Park, and property owned by the NJDOT as part of a roadway right of way on the southern banks.

Only for a short distance is sidewalk access required, highlighted in black, directly north of the Concept Plan, until the existing park system begins and moves to the north. This plan highlights the wealth of existing public property already existing along the river, and abuts almost directly to our next case study, and two other existing plans from different sources.

The second case study, boxed in white on the southern bank, involves Joseph Medwick Park. (See Pages 72-73) It should be noted that the entire park features a conceptual design plan by Najarian Associates to redevelop the park. Directly across the river, a landscape project has been designed for the Linden Landfill – a project of the New Jersey Department of Environmental Preservation.

Heading east from the park, existing service roadways existing that could take pedestrians underneath the overpass of the New Jersey Turnpike to our last case study - the site of a redevelopment project by the Borough of Carteret. (See pages 74-75)

COMMERCIAL/ GREYFIELD CASE STUDY (Woodbridge, NJ)

The Site

The 13.5 acre site lies in Woodbridge Township. There is a shopping mall, a school and residential area around the site. The river is piped under the parking lot. There is an unoccupied accessory building (A) and two small boxes of under-utilized fast food establishments (B and C) on a large area in north. Most importantly, there is a very large, under-utilized parking lot. There is also a shared parking area in the south, between the commercial building and the Merrill County Park.

The Proposal

There is an opportunity to naturalize the section of the river, which is piped under the parking lot, and redirect it closer to the north. A major goal of the plan is to provide recreational activities, which can be accomplished by removing the under-utilized buildings in the north to create a park (approx 1.7 acres) and a playground.

A green buffer of approximately 50 feet, and a pathway and pedestrian bridge over the river can be proposed to improve the connection between the existing and the proposed park. This will also provide access to the river.

The reduced parking space (approx 200) due to the proposed green buffer can be compensated by removing the unoccupied accessory building (approx 9,000 sq ft) in the south. The parking area in the south can be reconfigured for more efficient use and to improve the parking access around the exiting commercial building structure.

Parking requirements – "The Low Impact Development Parking Space Ratios provided by the NJDEP indicate that ratios at shopping centers shall be less than 4.5 spaces per 1,000 square feet GFA. Therefore, this requirement should also be reduced to comply with the NJDEP's recommendation." (Source: Storm water Management Plan 2005, Township of Woodbridge)

The Funding

Listed below are a few sources of funding that can be utilized to redevelop this site :

New Jersey Environmental Infrastructure Financing Program
New Jersey Open Space Program
Recreational Trails Program administered under SAFETEA-LU

Figure 3.8: A view of the river flowing under the existing parking lot. *(Source: Photo taken by Raja Waran)*

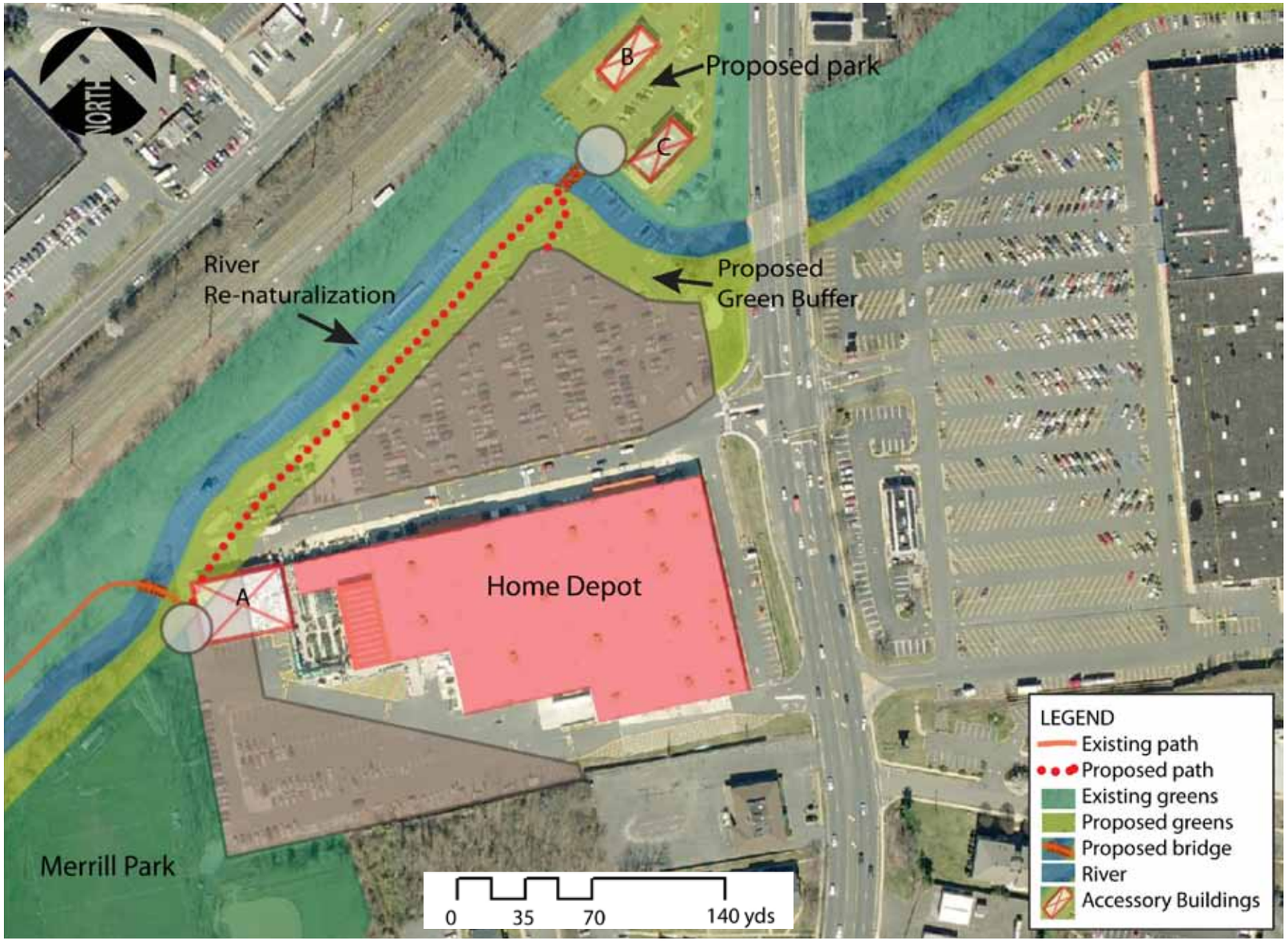


Figure 3.9: The map above illustrates the proposed area for daylighting the river and the path connecting to Merrill Park.

Figure 3.10: The images above are examples of types of bridges that could be used to span the newly daylighted river. *(Sources: top - http://www.hatleygardens.com/japanese_garden-hatley.html ; bottom - http://www.glamorganwalks.com/Bridge_over_river.jpg)*

JOSEPH MEDWICK PARK CASE STUDY (Woodbridge, NJ)

The Site

The proposal focuses on creating pedestrian access along the waterfront at Joseph Medwick Park in Woodbridge. This case study focuses on a portion of the area not addressed by the *Najarian Associates* plan.

The park lies near the banks of the Rahway River, adjacent to US 95. The existing park includes recreational areas, pathways, and parking, yet wetland/ marsh areas separate the public from the waterfront. Vacant publicly and privately owned property lies on the waterfront on each side of the parkland. A 66" outfall pipeline owned by the Rahway Valley Sewerage Authority hugs the waterfront.

Moving West to East / Left to Right, there are two adjacent privately owned parcels of land that front the river's edge.

Running north and south, adjacent to the second private parcel is an unutilized paper street that reaches directly to the waterfront and connects to the existing street and cul-de-sac.

At the southern end of the paper street is a privately owned lot that is currently fenced off and appears to also be a storage area for refuse.

The Proposal

Moving West to East:

The first parcel highlighted is owned by the Rahway Valley Sewer Authority – this parcel should be utilized for public access and a boat launch for active use. Adjacent to this parcel is a portion of an apparent junkyard owned by *75 Randolph LLC,* on the waterfront. Lastly is waterfront property owned by the Township of Woodbridge for a utility easement.

These three areas are zoned "M-1." These three parcels can create waterfront connectivity for the greenway, and to expand the footprint of the existing park by being incorporated into a waterfront easement.

Directly to the south is an unutilized paper street, owned by the county – these are prefect opportunities for public access to the park – either by driving into the cul-de-sac, or walking through the park. Further, the southernmost highlighted parcel is a fenced-off parcel that appears to be an illegal dumping ground for industrial waste, owned by *James & Anna Searle* – this parcel should also be incorporated into the public realm.

Lastly, an elevated, wooden walkway can be placed on top of the pipeline running along the waterfront. This unique approach to utilizing the existing pipeline will allow pedestrians access through the wetland without disturbing it, permit a view of the water itself, and connect the eastern portion of the park to the newly utilized lots on the western side.

Figure 3.11 The image on the left shows the existing conditions and the location of the outfall pipeline. The image on the right shows the proposed boardwalk over the existing pipeline. *(Source: Photo by Raja Waran, Photosim by Kelly O'Brien)*

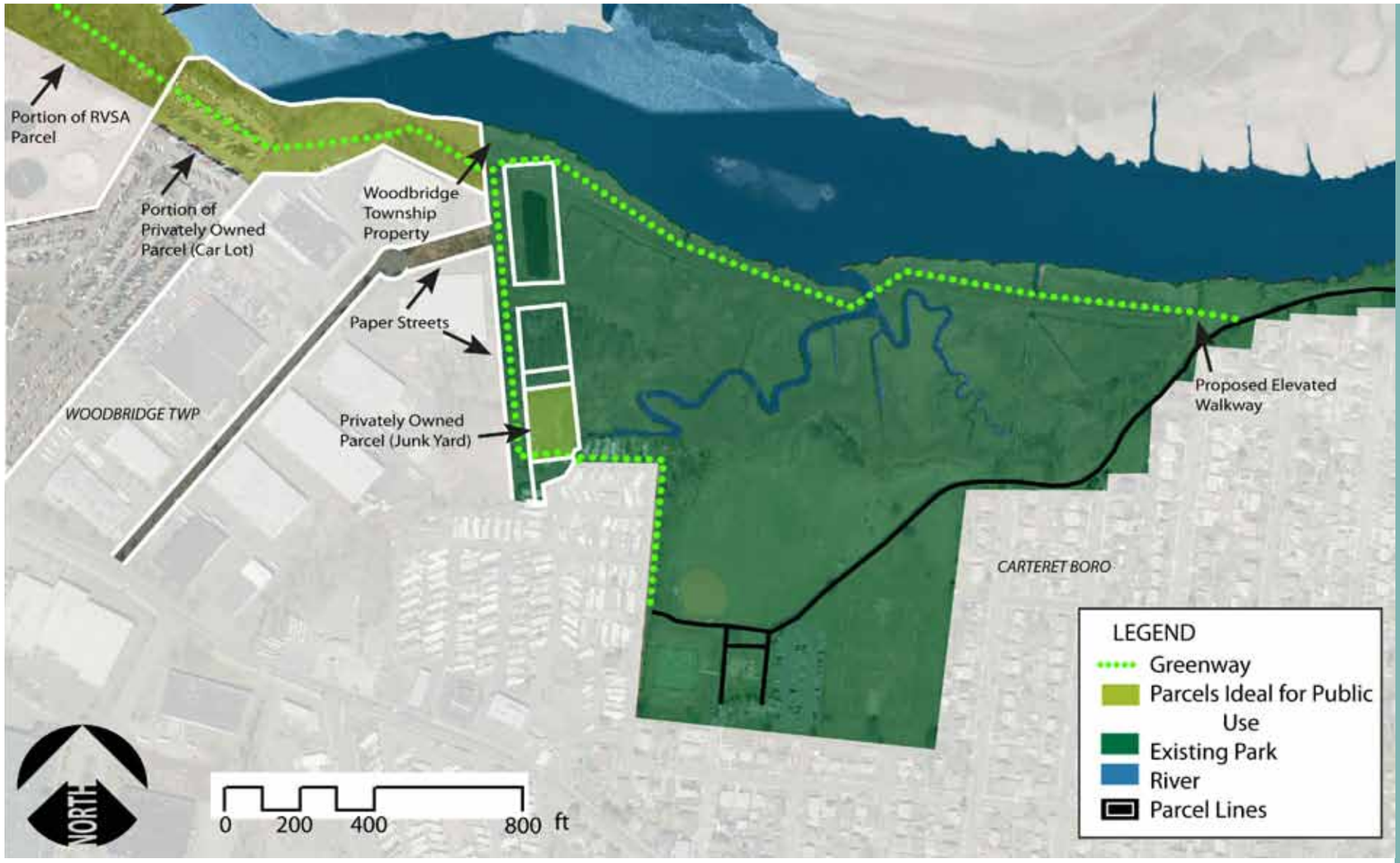


Figure 3.12 The map above illustrates the proposed pathways of the Rahway River Greenway and how it connects to existing trails in Medwick Park.

Figure 3.13 The images above are from Riverside Park in Rahway. The existing boardwalk allows visitors to enjoy the sights and sounds of the river without disturbing the natural wetlands.
(Source: Photos by Raja Waran)

REDEVELOPED LANDFILL CASE STUDY (Carteret, NJ)

The Site:

This 137 acre site is located in the township of Carteret at the near the mouth of the river. Portions of the site used to be a landfill but have recently been built over. Currently in the south central portion of the case study area, a multi-bay truck distribution facility has been constructed, but seems to be completely underutilized. Adjacent to the site are some oil storage facilities owned by Sunoco. These two built up areas are adjacent to the river and wetlands and were built on what were surely wetlands at some point in time. These wetlands, although dirty, provide critical breeding habitat to the migratory birds of the area.

The Proposal:

What this case study is proposing is some sort solution to the phase II development that is proposed for the second half of the site. This phase II section will destroy what remained of this critical environment and there for some sort of protection should be aggressively followed. On the site there are what appears to be old truck paths meandering around the wetlands. What we propose is to turn some if not all of these paths into nature trails. These trails would not just be for strolling and relaxing but there would be a major environmental education component. This case study envisions wooden viewing decks at certain key areas that present a learning lesson about the natural environment. Also since these wetlands have been so degraded due to toxic and polluting material we envision some education relating to the function of wetlands and their natural cleaning abilities. As for whatever ultimately is proposed for this phase II development site, if phase I lies empty, an alternative use must be considered and outright land acquisition is a viable option. If this natural vision is ever realized a trail connection could be established under the NJ turnpike for connection to Joseph Medwick Park and ultimately the rest of the greenway to the north. This site is so important in that it is the beginning of the greenway and where the Rahway River ends its XX mile journey from the north.

Figure 3.14 The image on above shows the existing gravel path and its proximity to the river and its wetlands. *(Source: Photo by RajaWaran)*

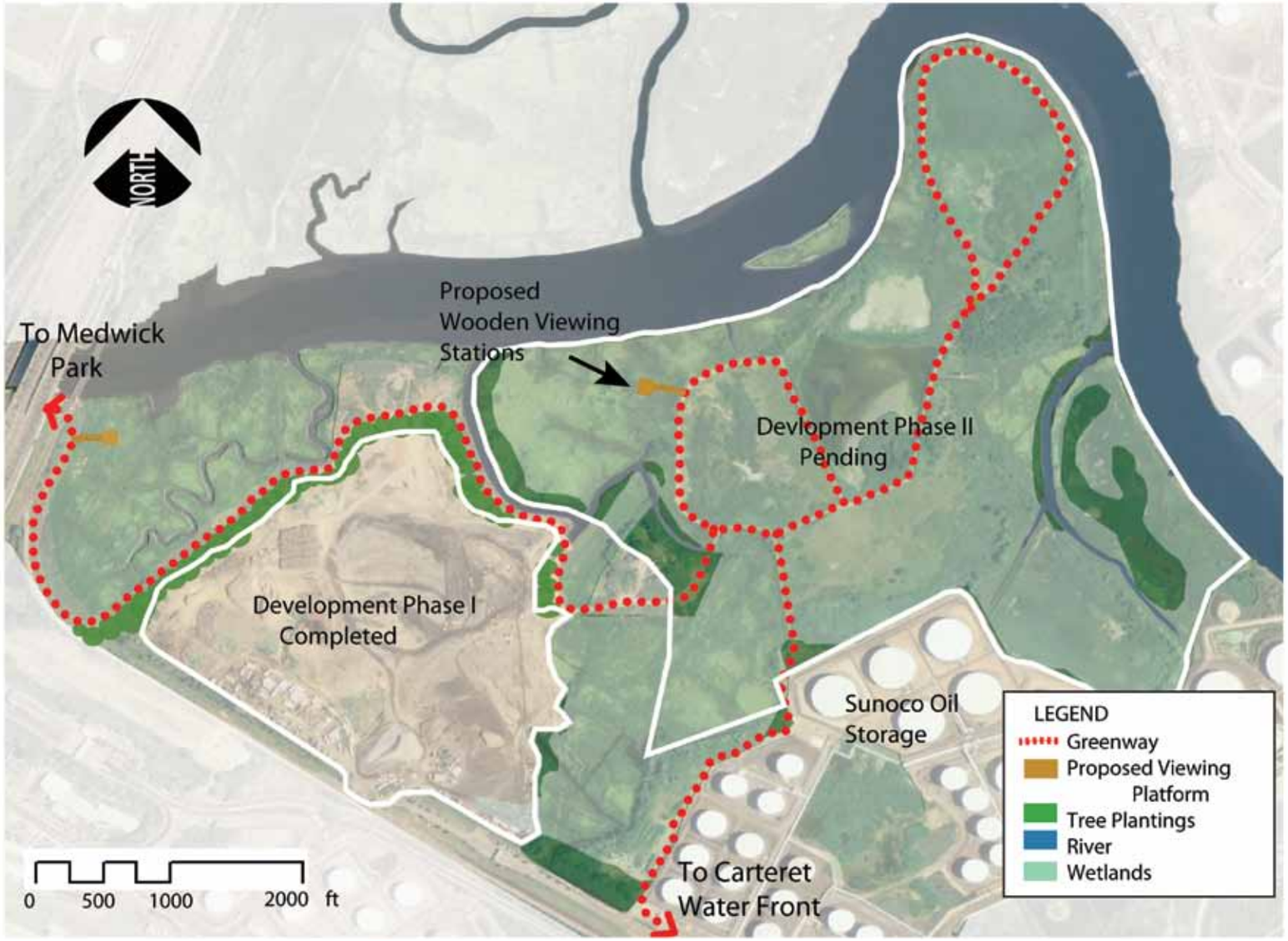


Figure 3.15: The map above illustrates the use of existing gravel paths through the wetlands for the Greenway.

Figure 3.16: The images above are examples of simple boat launches that could be added in key locations.

(Sources: top - http://farm1.static.flickr.com/47/133929187_cfefaof89d.jpg?v=o; bottom - http://ci.owosso.mi.us/images/Pic-CanoeLaunch.JPG)

Table 3.1: Suggested Properties to be Utilized and/or Acquired

County	Municipality	Description	Owner	Public/ Private	Block-Lot	Map	County	Municipality	Description	Owner	Public/ Private	Block-Lot	Map
Essex	Maplewood	Country Club	Maplewood Country Club	Private	No Available Information	Part 3	Union	Mountainside Borough	New Providence Rd	Union County	Public	15F-9	Part 4
Middlesex	Woodbridge	Home Depot	Raritan Enterprises LLC % Home Depot	Private	415-10	Part 7	Union	Mountainside Borough	New Providence Rd	Union County	Public	15H-9	Part 4
Middlesex	Woodbridge	Vacant Land	Township of Woodbridge	Public	921.01-1	Part 7	Union	Mountainside Borough	New Providence Rd	Union County	Public	1.50E+00	Part 4
Middlesex	Woodbridge	Paper Street	Township of Woodbridge	Public	No Available Information	Part 7	Union	Springfield	Country Club	Baltusrol Country Club	Private	1605-1	Part 4
Middlesex	Woodbridge	Junk Lot	James & Anna Searle	Private	921.01-06	Part 7	Union	Springfield Twp	Old Rail Right of Way	Union County		No Available Information	Part 4
Middlesex	Woodbridge	Sewer Pipeline	Rahway Valley Sewerage Authority	Easement	No Available Information	Part 7	Union	Springfield Twp	I-78 Right of Way	No Available Information	Public	Near Mountainside Reservation	Part 4
Middlesex	Carteret	Landfill		Private	No Available Information	Part 7	Union	Springfield Twp	Vacant Land	NJ DOT	Public	1601-4	Part 4
Union	City of Rahway	Waterfront Vacant Land	Rahway Valley Sewerage Authority	Public	918.01-1	Part 7	Union	Springfield Twp	Woods	NJ DOT	Public	3201-1	Part 4
Union	City of Rahway	Waterfront Junk Yard	75 Randolph LLC	Private	919.05-1.01	Part 7	Union	Springfield Twp/ Union Twp	Vacant Land	No Available Information	Public	Near I-78 and the fork of the East and West Branch	Part 4
Union	City of Rahway	Woods	API Foils INC	Private	276-10	Part 7	Union	Union Twp	Industrial	Giordano I % Stephen Giordano	Private	4701-1	Part 3
Union	City of Rahway	Woods	Alwisa Systems LLC	Private	276-8	Part 7	Union	Union Twp	Industrial	Isabelle Realty % Cushman-Wakefield	Private	4701-02	Part 3
Union	City of Rahway	Vacant land	City of Rahway		292-12	Part 7	Union	Union Twp	Industrial	Cuzzo JJ-MP-Jackovino J-A	Private	4701-4	Part 3
Union	City of Rahway	Vacant Land	Agape Family Worship Center INC	Private	298-1	Part 7	Union	Union Twp	Commercial	Brownmill LLC	Private	4801-01	Part 3

Section 4 : Funding Sources

Building and Construction Assistance

There are a number of financing options for developing open space and green space along the Rahway River waterway. Summarized below is a brief description and funding dollars available for disbursement (if available) for federal, state and non-profit financing programs.

Federal Financing

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law by President George W. Bush in 2003 and is set to expire in 2009. This legislation guaranteed funding for highways, highway safety, and public transportation totaling $244.1 billion (U.S. Department of Transportation, Federal Highway Administration). SAFETEA-LU builds upon the progress made by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21). According to the FHA Office of Legislation and Intergovernmental Affairs, under the umbrella of SAFETEA-LU are many programs with financing available to develop highways, promote safety and build alternative transportation systems (Source: Federal Highway Administration SAFETEA-LU Summary Information - http://www.fhwa.dot.gov/safetealu/summary.htm)

Safe Routes to School is one of the programs financed by SAFETEA-LU under the auspices of "Safety". This new program will enable and encourage primary and secondary school children to walk and bicycle to school. Both infrastructure-related and behavioral projects will be geared toward providing a safe, appealing environment for walking and biking that will improve the quality of children's lives and support national health objectives by reducing traffic, fuel consumption, and air pollution in the vicinity of schools (U.S. Department of Transportation, Federal Highway Administration).

SAFETEA-LU's Recreational Trails Program has a total of $370 million provided through 2009 allocated to develop and maintain trails for recreational purposes that include pedestrian, equestrian, bicycling and non-motorized snow activities as well as off-road motorized vehicle activities. New eligibilities are provided, including construction and maintenance equipment, real estate costs, educational program costs, State administration costs, and assessment of trail conditions.

The Recreational Trails Program is also administered under SAFETEA-LU. It is a grant program designed to be competitive; therefore, only projects that meet certain criteria may be funded: maintenance and restoration of existing trails, development or rehabilitation of trailside and trailhead facilities and linkages, acquisition of necessary easements, associated administrative costs, new trails and educational programs. At least 30 percent of all funds must be used for non-motorized trails, and since 1995 this program has helped construct more than 100 miles of trail. (Source: Recreational Trails Program website - http://www.fhwa.dot.gov/environment/rectrails/)

The Transportation Enhancements Program projects "expand travel choices and enhance the transportation experience by improving the cultural, historic, aesthetic and environmental aspects of our transportation infrastructure." This program may be the best option to obtain federal dollars for building a green way that includes trails and transportation access. (Transportation Enhancement Activities - http://www.fhwa.dot.gov/environment/te/)

Federal Emergency Management Agency (FEMA) offers pre-disaster financing to implement cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program (NFIP). In 2007, there was $31 million available in a nationwide competition. According to FEMA, there are numerous programs available:

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP).

The Pre-Disaster Mitigation (PDM) Program is available to provide funds to states, territories, Indian Tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. This program is a nationwide competition with $100 million available in fiscal year 2007.

The Repetitive Flood Claims is a pre disaster program designed to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that have had one or more claim payment(s) for flood damages. The nationwide competition for this program is $10 million.

The Hazard Mitigation Grant Program (HMGP) is a post-disaster program that provides funds to States, territories, Indian Tribal governments, and communities to significantly reduce or permanently eliminate future risk to lives and property from natural hazards. HMGP funds projects in accordance with priorities identified in State, Tribal or local hazard mitigation plans, and enables mitigation measures to be implemented during the recovery from a disaster. If a state has a FEMA-approved Standard State Mitigation plan, HMGP funds are available based on up to 15% for amounts not more than $2 billion.

State Financing

The Garden State Preservation Trust leverages this $98 million in constitutionally dedicated funds to issue bonds. Today, New Jersey has the largest preservation program in the nation for a geographic area of this size. It is financed with Garden State Preservation Trust funds through three partnering agencies: The Green Acres Program, a division of the Department of Environmental Protection to preserve natural lands and recreational parks. The Farmland Preservation Program, administered by the independent State Agriculture Development Committee to acquire the development rights on privately owned farmland. Historic Preservation is administered by the independent New Jersey Historic Trust to provide matching grants to save important historic buildings.

The Garden State Preservation Trust Fund Account (Trust Fund) which will receive $98 million annually for ten years. From fiscal year 2010 through and including fiscal year 2029, debt service on the bonds shall be satisfied by funds deposited into the trust fund from the general fund. These funds will not exceed $98 million during a fiscal year. The bill will allow projects funded under the Trust Fund to begin immediately by allowing $90 million to be appropriated through the appropriations act for fiscal year 2000.

The New Jersey Open Space Program makes funding available to the thirteen (13) counties and fifty three (53) municipalities that have passed a tax assessment on property owners to help purchase land in their community for use in open space planning. These municipalities and counties collect 1 to 5 cents on each $100 of assessed property value. State law requires that the money go to a dedicated trust fund for open space and parks, farmland development easements and historic preservation. Because of differences of assessed property value and county tax amount, the funding amounts will vary.

Non-transportation Federal Funding and Assistance

The Land and Water Conservation Fund is a 50/50 matching grant program is administered by state agencies in cooperation with the National Park Service. Program funds are intended for the acquisition and development of outdoor recreation areas. According to the National Park Service, trails are one priority of this program.

The Department of Housing and Urban Development operates the Community Development Block Grant (CDBG) program, a flexible and innovative program that provides communities with resources to address a wide range of unique community development needs such as building construction and open space preservation. Since 1974, the CDBG program has provided annual grants on a formula basis to 1180 general units of local government and states (HUD Website – http://www.hud.gov).

A program of the US Forest Service, Urban and Community Forestry, "provides technical, financial, research and educational services to local government, nonprofit organizations community groups, educational institutions, and tribal governments." Trails and greenways are a key part of the program, according to their website (Source: http://www.fs.fed.us/ucf/)

The National Coastal Wetlands Conservation Grant Program was established by Title III of P.L. 101-646, Coastal Wetlands Planning, Protection and Restoration Act of 1990. Under the Program, the U.S. Fish and Wildlife Service provides matching grants to States (except Louisiana) for acquisition, restoration, management or enhancement of coastal wetlands. Louisiana is funded separately. About $183 million in grant monies have been awarded to 25 coastal States and one U.S. Territory and to acquire, protect or restore over 250,000 acres of coastal wetland ecosystems. Between $13 million and $17 million in grants are awarded annually through a competitive process. Funding for the program comes from taxes on fishing equipment and motorboat and small engine fuels. All states provide 50 percent of the total costs of a project, but if a state has established and maintained a special fund to acquire coastal wetlands, other natural areas and/or open spaces, the Federal share may be increased to 75%. All territories and commonwealths are not required to share the costs of projects except for Puerto Rico. Grants awarded under the National Coastal Wetlands Conservation Grant Program cannot exceed $1 million for an individual project. (Source: US Fish and Wildlife Website - http://www.lacoast.gov/cwppra/national.htm)

Economic Recovery Programs 2009

New Jersey Environmental Infrastructure Trust & NJ DEP

This funding is being put in place in expectation of upcoming federal stimulus funding of various environmental infrastructure projects.

New Jersey is projected to receive $262 millon to finance clean water projects and $22 million for water supply projects. Stormwater management, water supply, and nonpoint pollution control programs are eligible. A blend of grants and loans are considered. The timeframe is short – more information is available at www.njeit.org

APPENDIX

Table 1.1: County-owned parkland within Rahway River watershed

Name	Acreage	Location	Sports and Recreation Activities	Scenic	Ecological Resources
Essex County Parks					
Monte Irvin Orange Park	47.63	Orange	Football and soccer fields,Softball fields, Playground Lighted Basketball court, Jogging Path,		Fishing Pond
South Mountain Reservation	2047.14	West Orange	Richard J. Codey Arena — contains two indoor ice skating rinks. The NJ Devils training facilities are located here. The arena is also used for various special events. Ten picnic areas, nineteen miles of hiking and walking trails Twenty-seven miles of carriage roads for jogging, horseback riding, & cross-country skiing. Girl Scout camp., Archery range	Rahway River runs through the valley into several ponds and the Orange Reservoir. Hemlock Falls. Largest parkland in Essex County Washington Rock Lookout Historic Site.	Turtle Back Zoo. Fishing at Diamond Mill Pond. Various wildlife, including deer.
Eagle Rock Reservation	408.33	West Orange	The "Old Casino" located at the edge of the cliff, now converted into the Highlawn Pavilion restaurant, noted for its excellent cuisine and spectacular view. Bridle paths / horseback riding, Hiking trails, Picnic area, Softball diamond,	Unrivaled view of the New York City skyline from the George Washington Bridge to the Verrazano Bridge. September 11, 2001, Memorial. Sculpture and plaza commemorate the location where hundreds viewed the 9/11 tragedy.	Habitat to a wide range of flora and fauna Predominantly a red oak forest, with a unique red maple wetland in the northern section of the tract.

Table 1.1: County-owned parkland within Rahway River watershed (continued)

Name	Acreage	Location	Sports and Recreation Activities	Scenic	Ecological Resources
Union County Parks					
Madison Avenue Park		Rahway			
Miltan Lake Park		Rahway/Clark			
Rahway River Park		Clark and Rahway	Parcourse and Tennis court		
Sperry Park		Cranford	Riverside Drive		
Peter J. Esposito Park		Clark			
Middlesex County					
Medwick Park	82	Carteret	1 Baseball Field, 1 Roller Hockey Rink 1 Soccer Field, 2 Playgrounds 2 Reservable Picnic Groves, 1 Open Picnic Grove Walk/Bikeways		
Merrill Par	179	Woodbridge	Tennis Courts , Soccer Field Basketball Courts, Baseball Fields Softball Fields, Football Field 7 Reservable Picnic Groves, 2 Open Picnic Groves 3 Playgrounds Woodbridge Township Progressive Playground		Animal Haven
Roosevelt Park	217	Edison	Level Playing Fields, 4 Basketball Courts Ice Skating Rink, 1 Softball Field 7 Tennis courts (lights), 3 Playgrounds 6 Reservable Picnic Groves, 1 Open Picnic Grove Bike/Walkways Stephen J. Capestro Theater Eight acre lake and home of Plays-in-the-Park	Veterans Memorial	Lake/Fishing

Table 1.2: Proposed acquisition sites, 1991 (NJDEP)

City	Name	Block	Lot	Assessed Value	Acreage
Carteret	American Cyanamid	9.03	21	$380,000	15.22
		10	8	$105,000	4.2
		10	9	$102,000	4.1
		10	10	$114,000	6.8
		10	12	$283,500	11.3
		10	13	$208,000	8.9
		10	14	$188,000	15.26
		10	15	$36,000	3
		10	16	$107,500	4.1
		10	17	$94,000	3.7
		10	18	$55,700	2.2
		10	19	$72,300	2.8
		10	20	$121,600	4.8
		10	21	$132,500	5.3
		10	25	No Data	5.04
		11.01	10	$134,900	5.3
		11.01	11	$367,000	14.6
		11.01	12	$192,300	7.6
		11.01	13	$135,700	5.4
		11.01	14	$84,300	3.3
		11.01	28	$62,500	2
	American Transport	10	1	$2,500,000	2
		10	2	Included above	9.89
		10	4	$200,000	8.2
		10	7	Included above	2.6
	Borough of Carteret	10	11	$47,000	4.7
		11.01	6	$29,500	1.18
		11.01	7	$168,800	6.75
		11.01	9	$29,200	1.17
		11.01	19	$182,500	7.3
		11.01	46	$90,000	3.6
		11.01	47	$62,500	2.5
Carteret	Borough of Carteret	11.01	48	$95,000	3.8
		11.01	50.01	$100,000	2.9
		11.01	53	$95,000	3.8
		11.01	54	$60,000	2.4
	Cranbrook Associates	11.01	50	$100,000	4
	General American Transport Corp	10	22	$51,000	2.04
		11.01	3	$18,700	0.07
		11.01	4	$17,200	5.4
		11.01	5	$191,800	7.6
	Middlesex Landfill Corp	11.01	49	$75,000	3
	National State Corp	11.01	27	$380,000	15.2
Linden	American Terminal Co.	587	15.04	$710,000	7.1
	Buckeye Pipeline	581	16.02	$139,000	6.9
	Cities Service	581	67	No Data	116.8
	Cities Service Corp.	587	18	$83,100	2.7
	City of Linden	581	1.02	$520,000	2.6
		581	17	$4,947,000	34.4
		581	10	$682,000	6.6
	Colonial Pipeline	587	17	$126,000	4.2
	EFC Land Development inc, Northville	587	15.01	$310,500	8.88
	Exxon	581	11.03	$18,664,000	192.7
	George Sacks Inc.	587	16	$1,700,000	87.2
	Merck	581	18	$1,780,500	22.5
	Mobile Oil Corp.	587	19	$3,770,400	64.83
Rahway	Dorbett, Inc.	338	9	$720,400	
	J. Bhutt Inc.	338	4	$239,300	1
	J. Swierad	353	1	$32,500	127 x 154
	Krishna Corp.	338	3	$349,100	1.43
	Paul Urban	338	10	$90,100	227 x 229
	Rahway Boat Club	355	15	$9,000	174 x 272
	Rahway Yacht Club	338	6	$71,100	171 x 157
	T. Royalcheck	353	2	$44,400	271 x 154

Table 1.3: Potential acquisition sites, Union County. (Union County Master Plan, 2002)

Municipality	Site	Block & Lot	Acreage
Clark	Shwartz Farm/Terminal Road & Old Raritan Road	57, Lot 1 & 2	4.07
	Esposito Farm/Maidson Hill Road	40, lot 25 & 27	12.84
	Greenhouses/Lake Avenue	28.01, lot 13	4
Cranford	Springfield & Brookside	151, lot 14	5.55
	39A Myrtle Street	555, lot 7	1.95
	75 Rod Smith Place	555, lot 19	2.6
Kenilworth	Wilshire Drive	62, lot 1	5.82
	N. 7th Avenue	6 , lot 1.01, 1.03	31
	901 Kenilworth Blvd	179, lot 7.01	6.55
	Market Street	127, lot 1	3.02
Plainfield	Peterson Farm/Cushing Road	922, lot 55, 6	5.7
Springfield	924 Schaeffermorth Place	3601, lot 6	10.7
	Skylark Frive	2602, lot 36	5.223
	Sayre House & Maquire Property/Old Coach Road	2601, lot 1,2,3,4	5.34
	Greenhouses/Lake Avenue	2501, lot 55	11.85
	Danato & Stockwell prperties/Providence Road	4901,lot 2,3	10
	Elizabethtown Water Company/Jerusalem Road	4401, lot 13	16
	Midd;esex Water Company/Lamberts Road	13701, lot5	15
	Clarls Lane	15601, lot1	9.8
	Lamberts Mill Road	13501, lot 20.01, 21.01	44.1
	1892, 1900,08,14,20 Lake Avenue	12701, lot 67	6.9
	Sevell Property/1600 Cooper Road	12201, lot 3, 27, 20	22.5
	Greenhouses/Terrill Road	12001, lot 4	10.8
Summit	Columbia Cleaners Inc/29 Chatham Road	202, lot 14	1
	NJ American Pacel		62.66
	Duke-Holt Property/Gelnside Ave		5.34
Union	Elizabeth Water Company	2802, lot 4	32.1
	Route 22	3402, lot 8	10
	Rahway Valley	3503, lot 1	10
	Morris Avenue & North Avenue Parcel	102, lot 2	3.1
Westfield	St. Helens RC Church/Rahway Avenue	5402, lot 35	10.66
	Meridian Partnership/Lambert Rd	5402, lot 41	5
	Greenhouses/Springfield Avenue	1905, lot 13	6.55

Table 1.4: Recommended Middlesex County Open Space Acquisition sites as requested by municipalities. (Middlesex County Open Space and Recreation Plan, 2003)

Municipality	Site	Block & Lot	Acreage
Edison	Sharma Property	415, lot 20-A3	22.58
	Raritan Arsenal	395, lot 3-B, 37	
	Dismal Swamp Greenway Expansion	681, lot 1-5	
	Ashok Swamp	412, lot 3-N	13.4
	Middlesex Greenway	815, lot 1-13	
	Oakerest swim Club	412, lot 3-C2, 3-C5	
	Inmand Golf range	412, lot 3-CC	
	Baldwin property	945 , lot A1	3.72
Metuchen		109, lot 1	2.68
		43, lot 1, 2,3	
		37, lot 5.05, 5.03, 8, 13, 14, 15.01	
Carteret		5.02, lot 1.01	30.576
Woodbridge	Pin Oak Road	1020 A, lot 1C,1D,1E,1F	
		938-941,lots ?	
		953-956, lots?	
		963A, 963B, lots?	
		473S, lot8	1.2
		473U, lot1	3.25
		473T, lot2	0.23
	Port Reading		217.73

Table 1.5: Pollutants affecting water quality in the Rahway River

Name	Parameter	Priority Ranking
Rahway River WB	Phosphorus	Medium
	Sulfate	Medium
	Total Dissolved Solids	Low
Rahway River EB	Total Dissolved Solids	Low
Rahway R (Kenilworth Blvd to EB / WB)	Arsenic	Medium
	Phosphorus	Medium
	Total Dissolved Solids	Low
Rahway R(Robinsons Br to KenilworthBlvd)	Arsenic	Medium
	Mercury	Medium
	Phosphorus	Medium
	Total Suspended Solids	Low
Robinsons Br Rahway R (above Lake Ave)	Phosphorus	Medium
	Arsenic	Medium
	Phosphorus	Medium
Rahway River SB	Dioxin	Medium
	PCB	Low
	Phosphorus	Medium
	Total Dissolved Solids	Low
Rahway River (below Robinsons Branch)	Benzo(a)Pyrene	Low
	Chlordane	Medium
	DDD	Medium
	DDE	Medium
	DDT	Medium
	Dieldrin	Medium
	Dioxin	Medium
	Mercury	Medium
	PCB	Low

Table 1.6: Trail Surface Comparison (NJDOT)

Surface Material	Advantages	Disadvantages
Soil Cement	Uses natural materials, more durable than native soils, smoother surface, low cost.	Surface wears unevenly, not a stable all-weather surface, erodes, difficult to achieve correct mix.
Granular Stone	Soft but firm surface, natural material, moderate costs, smooth surface, accommodates multiple use.	Surface can rut or erode with heavy rainfall, regular maintenance to keep consistent surface, replenishing stones may be a long-term expense, not for steep slopes.
Asphalt	Hard surface, supports most types of use, all weather, does not erode, accommodates most users simultaneously, low maintenance.	High installation cost, costly to repair, not a natural surface, freeze/thaw can crack surface, heavy construction vehicles need access.
Concrete	Hardest surface, easy to form to site conditions, supports multiple use, lowest maintenance, resists freeze/thaw, best cold weather surface.	High installation cost, costly to repair, not a natural looking surface, construction vehicles will need access to the trail corridor.
Native Soil	Natural material, lowest cost, low maintenance, can be altered for future improvements, easiest for volunteers to build and maintain.	Dusty, ruts when wet, not an all-weather surface, can be uneven and bumpy, limited use, not accessible.
Woodchips	Soft, spongy surface - good for walking, moderate cost, natural material.	Decomposes under high temperature and moisture, requires constant replenishment not typically accessible, limited availability.
Recycled Materials	Good use of recyclable materials, surface can vary depending on materials.	High purchase and installation cost, life expectancy unknown.

Table 1.7: Mapping Data Sources

1. Union County
2. Middlesex County
3. Essex County
4. Township of Woodbridge
5. Township of South Orange
6. Borough of Carteret
7. City of Orange
8. New Jersey Department of Community Affairs
9. New Jersey Department of Environment Protection
10. New Jersey Geological Survey
11. Green Acres
12. RBA Group
13. Trust for Public Lands
14. Land Conservancy of New Jersey
15. New Jersey Conservation Foundation
16. East Coast Greenway
17. The Grant F. Walton Center for Remote Sensing and Spatial Analysis
18. New Jersey Conservation Foundation
19. Land Conservancy of New Jersey
20. Trust for Public Lands
21. Passaic River Institute
22. CMX Engineering
23. Federal Emergency Management Agency

Table 1.8: References

1. Greenways to the Arthur Kill
2. EPA watershed doc
3. Rahway River Association http://www.rahwayriver.org/fact_sheet.htm
4. www.state.nj.us/dep/gis/stateshp.html#KCSL
   "Note: There are some sites found in the 'official' KSCNJ list that do not exist in the GIS version. There were about 50 sites which either had poor address descriptions and could not be located accurately or are 'sites' which actually describe a case covering several locations and cannot be expressed by a single point. These problem sites were intentionally left off."
5. www.state.nj.us/dep/srp/
6. www.nj.gov/dep/srp/kcsnj/
7. www.epa.gov/region02/cleanup/sites/
8. ISRA Website
9. http://www.nj.gov/dep/srp/isra/isragide.htm
10. Landfill Settlement Protects New Jersey Wetlands, May 3, 2007
11. N.J. sues Port Authority for clean-up costs of Rahway riverfront, Judy Peet, The Star-Ledger, December 15, 2008
12. http://www.rahwayriver.org/Dumping.htm
13. http://pages.csam.montclair.edu/~barrettki/rahway/
14. www.state.nj.us/dep/wms/bwqsa/generalinfo.htm
15. New Jersey Department of Environmental Protection, New Jersey Surface Water Quality Standards Fact Sheet, June 2008, p. 2-11.
16. New Jersey Department of Environmental Protection, New Jersey Surface Water Quality Standards Fact Sheet, June 2008, p. 28-30.
17. NJDEP, Surface Water Quality Standards, www.state.nj.us/dep/wms/bwqsa/swqsdocs.html
18. New Jersey Department of Environmental Protection, New Jersey Integrated Water Quality Monitoring and Assessment Report, 2008 Draft, p. 63
19. New Jersey Department of Environmental Protection, New Jersey Integrated Water Quality Monitoring and Assessment Report, 2008 Draft, Appendix A
20. New Jersey Department of Environmental Protection fishing advisories website, http://www.state.nj.us/dep/dsr/fishadvisories/statewide.htm
21. New Jersey Department of Environmental Protection, New Jersey Integrated Water Quality Monitoring and Assessment Report, 2008 Draft, Appendix B
22. Njtransit.com
23. US Army Corps of Engineers study report
24. Copyright 1999 by the American Association of State Highway and Transportation Officials.
25. Trail Design and Construction Standards from Northern Bonneville Shoreline Trail; http://www.americantrails.org/resources/trailbuilding/index.html
27. Recreational trail design and construction Univ of Minnisota extension; http://www.extension.umn.edu/distribution/naturalresources/DD6371.html#obstacle7
28. 1999 AASHTO Guide for the Development of Bicycle Facilities.
29. Primer on Designing Facilities ; http://www.bicyclinginfo.org/bikecost/primer.cfm